



March 2010

INAC BAKER CREEK GRAYLING PROJECT

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Submitted to:

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REPORT



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Acknowledgements

This project was funded by Indian and Northern Affairs Canada (INAC), Giant Mine Remediation Project and Department of Fisheries and Oceans (DFO). We wish to thank Bill Coedy (INAC Contaminants and Remediation Directorate) for his efforts in providing logistical support and advice during the 2009 Baker Creek performance monitoring project. The encouragement, and editorial reviews provided by Jim O'Neil and Serge Metikosh (Golder Associates Ltd., Edmonton and Calgary) are gratefully acknowledged. Thanks also to Ernest Watson and Morag McPherson (DFO, Winnipeg and Yellowknife) for providing direction on this project. We wish to thank SRK Consulting and Northwest Hydraulic Consultants for their expertise and efforts in physically restoring Baker Creek to productive fish habitat.

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Developmental Stages of Arctic Grayling in Baker Creek



ACRONYMS and DEFINITIONS

Term	Definition
Authorization	Authorization for the harmful alteration disruption or destruction (HADD) of fish habitat issued pursuant to subsection 35(2) of the <i>Fisheries Act</i>
Benthos	General term referring to bottom-dwelling organisms (e.g., worms, snails, clams, crustaceans, insects) living on or within the sediments of lakes and streams. Benthic invertebrates are also referred to as "benthic macroinvertebrates" because of their large size, with some species reaching a few centimetres in length.
BHP	Broken Hills Proprietary – Ekati Mine
CPUE	Catch-per-unit-effort
Coregonids	Family of fishes including ciscoes, whitefish, smelt and inconnu.
DFO	Fisheries and Oceans Canada
Discharge	Outflow of water, measured at Martin Lake outfall (does not include mine effluent discharge).
Embeddedness	The degree to which gravel-sized and larger particles are surrounded or enclosed by finer-sized particles.
Embryo	Developmental stage extending from egg fertilization to the moment of hatching.
Endogenous feeding	A type of nutrient acquisition during fish ontogeny, usually from yolk but also from a maternal-embryonic exchange.
Exogenous feeding	Nutrient acquisition during fish ontogeny by food taken in through the mouth and digested in the intestine.
HADD	Harmful Alteration, Disruption or Destruction
Gastrula	In embryology, a postblastula stage in which an archenteron (primitive gut or gastrocoele) forms by invagination of cells through a blastopore, and in which germ layers appear and the embryonic axis is formed.
Glide	Shallow stream reach with a maximum depth that is 5% or less of the average width with a water velocity of less than 0.2 m/s and without surface turbulence.
Golder	Golder Associates Ltd.
INAC	Indian and Northern Affairs Canada
Invertebrate	As used in this report, the term "invertebrate" collectively refers to both zooplankton and benthos.
Juvenile	Phase of development when fins are differentiated and the temporary organs of the larval stage are replaced by definitive organs.
MMER	Metal Mining Effluent Regulations
Mesolarva	Phase of larval development characterized by presence of forming fins, reduced or absent yolk sac.
Metalarva	A larval phase in which the full complement of distinct principal rays in the median fish and pelvic fin buds or fins are apparent.
Morula	A stage in egg development where the blastomere forms a mulberry-like cluster.
NHC	Northwest Hydraulic Consultants
Ontogeny	The development from embryo to adult fish.
Oviparous	Production of eggs that hatch and develop outside the body.
Pool	Aquatic habitat in a stream with a gradient less <1% that is normally wider and deeper the habitat above and below it .



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Term	Definition
Protolarva	Phase of larval development, post-hatching, characterized by absence of fin spines and rays and prominent yolk sac.
Reach	A length of stream that is chosen to represent a uniform set of physical, chemical, and biological conditions; the principal sampling unit for study purposes.
Riffle	A shallow part of the stream where water flows swiftly over completely or partially submerged obstructions to produce surface agitation (i.e. a broken water surface) generally composed of coarser bottom materials than other channel types, and often form a step in the bed and water surface profile.
Run	Swiftly flowing stream reach with a gradient greater than 4%, little or no surface agitation, waves or turbulence, no major flow obstructions, approximately uniform flow, substrates of variable particle size and water surface slope roughly parallel to the overall stream gradient.
Thalweg	Path of a stream that follows the deepest part of the channel
Transect	A line across the stream, perpendicular to the flow, along which measurements are taken; allows systematic measurement of morphological and flow characteristics from bank to bank. Unlike a cross section, no attempt is made to determine elevation points along the line.
UTM	Universal Transverse Mercator
YOY	Young-of the-year
Zooplankton	Microscopic animals that float, drift or swim weakly. For this Project, zooplankton includes four major taxonomic groups: Cladocera (cladocerans); Calanoida (calanoids); Cyclopoida (cyclopoids); and Rotifera (rotifers). Cyclopoid and calanoid copepods are considered separately because of taxonomic differences, but also because Calanoids are almost exclusively planktonic, while cyclopoids are dominated by littoral species (Wetzel 2001).

Fish/habitat definitions based on the on-line Dictionary of Ichthyology (<http://www.briancoad.com/Dictionary/Introduction.htm>) and Armantrout 1998.



UNITS

Unit	Definition
%	percent
<	less than
>	greater than
°C	degrees Celsius
µS/cm	microSiemens per second
cm	centimetres
fish/sec	fish per second
µm	micron
m	metre
mm	millimetre
m/s	metres per second
m ²	square metres
m ³ /s	cubic meters per second
mL	millilitre
mg/L	milligrams per litre



1.0 INTRODUCTION

1.1 Background

Baker Creek originates from a network of small lakes northwest of the City of Yellowknife and flows south into Yellowknife Bay on Great Slave Lake (Figure 1). The lower reaches of Baker Creek originally flowed through the Mill Pond of the Giant Mine site on the east side of the Ingraham Trail, Highway 4. The Mill Pond and runoff from adjacent areas are contaminated from historical mining activities which has affected sediment and water quality in Baker Creek. Water quality in the stream is also affected by treated effluent from the Giant Mine, which is discharged seasonally (July to September) into lower Baker Creek.

In summer 2006, a portion of Baker Creek known as 'Reach 4' was realigned to the west side of Ingraham Trail. The primary objectives of the Reach 4 realignment were to isolate the contaminated Mill Pond from Baker Creek, thereby eliminating a source of ongoing contamination and to prevent seepage loss from Baker Creek into areas of the mine itself. Secondary objectives of the realignment were to provide a stable flood conveyance channel, maintain or improve fish passage, and provide spawning and rearing habitat for native fish species.

An Authorization for Works or Undertakings Affecting Fish Habitat (YK-06-0063); Authorization for the harmful alteration, disruption or destruction (HADD) of fish habitat resulting from the realignment of Baker Creek was issued by Fisheries and Oceans Canada (DFO) pursuant to Section 35(2) of the *Fisheries Act* in 2006. The Authorization required Indian and Northern Affairs Canada (INAC), the agency supervising reclamation activities at Giant Mine, to reconstruct a reach of Baker Creek. The intent was to provide suitable spawning, rearing and overwintering habitat for Arctic Grayling (*Thymallus arcticus*) as compensation for habitat losses incurred from the realignment.

1.2 Construction Summary

In fall 2006, seven riffles were constructed in the new Baker Creek channel. Five were constructed (50 m intervals) in the upstream portion of Reach 4, and two wider units were constructed 80 m and 160 m downstream of the fifth riffle. The surface complexity (bed material) and slope of the downstream face of the riffles were designed to allow upstream fish passage over a wide range of flows. For a more detailed summary of construction work undertaken at Baker Creek, see Golder Associates Ltd [Golder] 2006).



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Figure 1: Sampling Locations on Baker Creek, NWT, Spring/Summer 2009



1.3 Fish Monitoring Plan

As required under Section 5.0 of the Authorization, INAC and Northwest Hydraulic Consultants (NHC) submitted a Monitoring Plan in January 2007. Golder was then contracted by DFO and INAC to design and implement the fish monitoring component of the Monitoring Plan.

Section 5.2.2 of the Authorization requires monitoring of Reach 4 for three consecutive years. Year 3 of the three-year monitoring program was carried out in 2009. This document presents the findings of the 2009 fish monitoring program on Baker Creek, and constitutes the third of three annual reports.

In addition to meeting the requirements of the *Fisheries Act* Authorization, INAC (at the request of DFO) agreed to expand the monitoring plan to include some science-based objectives on adfluvial Arctic Grayling in the Yellowknife area. The science-based objectives changed in scope during the three year monitoring period. These changes are reflected in the 2009 work plan which is listed below.

Objectives

The objectives of the fish monitoring survey in 2009 were as follows:

- 1) Characterize biological attributes (size, age, sex and maturity) of Arctic Grayling and estimate the abundance of Arctic Grayling and Longnose Sucker spawners in Reach 4;
- 2) Locate and characterize habitat at Arctic Grayling and Longnose Sucker spawning/egg deposition sites in Reach 4 (including velocity, substrate size, and embeddedness);
- 3) Determine Walleye presence/absence in Reach 4;
- 4) Determine Arctic Grayling young-of-the-year (YOY) size by larval stage in Reach 4;
- 5) Determine Arctic Grayling YOY habitat and food resources in Reach 4;
- 6) Determine Arctic Grayling YOY outmigration density and timing from Baker Creek; and,
- 7) Collection of a sediment sample and YOY Arctic Grayling to be archived for future chemical analyses.

2.0 METHODS

2.1 Study Timing

Preliminary inspections of the stream were carried out between 2 May and 13 May, 2009 to determine the status of spring melt in the area. Fish surveys at Baker Creek commenced on 14 May, 2009 and continued until 20 July, 2009. During this period, the stream was visited almost daily to determine fish presence/absence and habitat use. Sampling was undertaken in Reach 4, and in the lower section of Baker Creek (Reach 0 and Reach 1) downstream of the Ingraham Trail (Highway 4) culvert (Figure 1). Reach 3 was also visited in 2009 as spawning fish were observed in one area of the reach in 2008 and 2009. Reach 5 and 6 were not part of the study.



Sampling included capture and observations of migrating adults, eggs, larvae, as well as collection of habitat data at sites occupied by the various life stages. Sampling dates and data are presented in Appendix A. Appendix B contains a journal-style documentation of stream observations and fish diversity. Appendix C is a detailed account of YOY Arctic Grayling development prior to and during outmigration in Baker Creek.

2.2 Adult/Spawning Fish Sampling

Adult fish were observed congregating in a pool immediately downstream of the Highway 4 culvert (referred to as 'Culvert Pool'). Sampling of upstream migrating adults was carried out in the Culvert Pool and upstream in Reach 4. As in 2007 and 2008, the adult Arctic Grayling accessed Reach 4 in mid-May to early June. In 2009, however, freshet was prolonged and this resulted in reduced fish passage at the Highway 4 culvert; some individual Arctic Grayling remained in Reach 1 and spawned below the culvert.

To achieve objectives 1 (biological attributes and abundance) and 3 (Walleye presence/absence), surveys and sampling of adult fish were undertaken in Reaches 0, 1, and 4. Methods included shore-based observations, seine netting, and angling.

Shore-based visual observations were made in Reach 0, 1, and 4 to document the presence and activities of adult fish. To accomplish this, two observers walked upstream in tandem, both positioned on the same side of the channel (other side could not be walked due to rock face), and recorded the number of adult Arctic Grayling observed. This method of enumeration was carried out on each visit to Reach 4.

Snorkelling and underwater photography were used to describe the various habitats and their use by fish occupying Reaches 0, 1, and 4. For the enumeration of fish, the swimmer would enter the water at the uppermost portion of the reach and passively drift downstream. All adult-sized fish were counted, while numbers of young-of-year, juvenile large-bodied fish, and small-bodied fish were estimated. The presence of the various life stages of the fish species inhabiting the area was documented almost daily during the spawning period. Underwater photographs were taken with a Nikon D40 digital camera placed in an Ikelite underwater housing using a Nikkor 12-to 24-mm wide-angle lens.

Northern Pike and Longnose Suckers were tagged with floy tags in 2007 to determine their presence and frequency of occurrence in Reach 4 (Golder 2008a). If Floy-tagged fish were encountered while snorkelling in 2009, they were photographed and the sighting was noted.

A seine net (15 m long x 2 m wide; 10-mm mesh; 1 m collection bag of 5-mm mesh) was used to capture large-bodied fish in the pool downstream of the culvert on 2 June, 5 June and 4 July, 2009. A smaller seine net (10 m long x 1.5 m wide; 3-mm mesh; with no collection bag) was used on several occasions between 20 June and 19 July 2009 to collect young-of-year, juveniles, and adults of the small-bodied fish species. Methods of setting and deploying nets were standardized over the repetitive sampling events. Sampling involved hauling the seine net downstream and across the channel, starting from the upstream end of the pool (see photographs in Appendix B). The sampled area (7 m X 20 m = 140 m²) included almost the entire area (7m x 20 m) of swift and most of the slack water habitat in the pool.

Angling for adult Arctic Grayling was carried out after spawning was complete, to avoid any adverse effects on spawning fish. In Reach 1, angling occurred on 31 May and 6 and 7 June 2009; in Reach 4, angling occurred on



16, 17, and 18 June 2009 in areas of adult congregations. Electrofishing and gill nets were not employed to reduce the risk of harming spawning fish.

Captured fish were placed in a tub filled with fresh water, and were processed immediately. The fork length (mm) was recorded; however, when large sample sizes of non-target fish were encountered (e.g. YOY Longnose Suckers), only a subset of the catch was measured. Girth (mm) was measured on adult Arctic Grayling, where possible; it was not measured on all fish so as to reduce handling time of fish. Scales and the leading edge pectoral fin rays (excised at the junction with the latero-ventral body surface) were collected from each adult Arctic Grayling captured. Although most fish were released, otoliths were removed from accidental mortalities to facilitate age determination. Age structures were submitted to Jon Tost of North Shore Environmental Services for analysis. For these sacrificed fish, stomachs and gonads were removed. Stomachs and a subsample of gonads were preserved in 70% ethanol. Stomach contents were noted for prey type (eggs, fish and/or insects). Preserved gonads were archived for future examination; frozen gonads were archived for possible future chemical analysis. If a floy tag was found on a fish, the tag number was recorded.

Of the total capture, fourteen YOY and eight adult Arctic Grayling were retained and frozen for future chemical analyses for contaminant levels (Objective 7 of the study).

2.3 Egg Sampling and Habitat Description

2.3.1 Egg Sampling

Egg sites were found based on the observations of the adult spawning and by examining each 'glide' area in Reach 4. Eggs in Reach 1 and Reach 4 were sampled by kick-netting, which involved wading in the stream, gently disturbing the gravel substrate, and capturing drifting eggs in a dip net positioned immediately downstream. Sampling was done almost daily from 26 May to 9 June at each egg site (Figure 2). Egg diameter was measured (mm) individually with a Fisher Scientific Electronic Digital Caliper. Measurements were made on three to 16 eggs from each deposition site for each sampling date. The eggs were photographed using a Nikon D200 digital camera with a Nikkor 105-mm VR Micro lens. Following enumeration, measurement and species identification, eggs were returned to the original collection sites. Photographs were reviewed by Golder personnel, and an independent expert, Martin Hochleithner, Aquatech Ltd., to identify the eggs according to fish species and stage of development.

2.3.2 Egg Habitat

The locations of the main egg deposition sites were mapped (Figure 2) and photographed. The following habitat measurements were recorded at the egg deposition sites (which included a 1 m² area around the site):

- water velocity (measured with a Marsh McBirney meter; bottom, middle and surface of the water column);
- substrate size (diameter of 30 randomly selected rocks to provide an average of substrate size typical of an egg deposition site; to the nearest mm);
- wet width (m)
- sediment deposition (embeddedness); and
- water depth (cm).



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Figure 2: Location of Egg Site Sampling, Baker Creek, 2009



The degree to which the substrate in an area is covered in sediment is referred to as 'embeddedness'. To document the extent and distribution of deposition, embeddedness was measured in five areas in Reach 4 (Figure 3). The method used was the United States Fish and Wildlife Service Upper Colorado River Method as described in Sylte and Fishenich (2002) and the measurement of depth to embeddedness as described by Osmundson and Scheer (1998). The method quantifies embeddedness by measuring the distance from the top of the rocks on the bed surface down to the top of the layer of fines in which the rock are embedded. Measurements were taken at twenty locations at each of the five sampling areas (10 locations 1 m from shore and 1 m apart on both side of the stream) (see visual representation on Figure 3). For consistency, the same person did each measurement. At each of the twenty locations, five types of measurements were made:

- 1) water velocity (measured with a Marsh McBirney meter; bottom, middle and surface of the water column);
- 2) water depth (cm);
- 3) substrate size of five particles (cm)
- 4) top of substrate to fines layer (cm); and,
- 5) embedded height (cm).

Embedded height was measured by laying one hand flat on top of the cobble surface layer, holding the other hand perpendicular to the first and extending a finger down between the thumb and forefinger of the hand placed flat on the substrate. The index finger was then pressed down until it reached the layer of embeddedness (i.e., the point where more than moderate force is necessary to push the finger deeper into the substrate). A mean embedded height for each of the five areas in Reach 4 was then calculated.

The area (m^2) of the habitat used for spawning and egg deposition was calculated by multiplying the wetted width of the stream at each location by the distance from the tail of the upstream pool to the head of the downstream riffle (the area of the glide).



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Figure 3: Location of Embeddedness Measurements in Reach 4, Baker Creek, 2009



2.4 Young-of-Year Sampling and Habitat Description

2.4.1 Young-Of-Year Sampling

To achieve objectives 4 (larval size and stage), 5 (habitat) and 6 (outmigration timing), surveys and sampling of YOY fish were undertaken from 14 June 2009, immediately following emergence, until 20 July 2009, when outmigration was complete. Three methods were used to capture, observe and identify YOY fish in Baker Creek: visual observations (via snorkelling and shoreline observations), seine netting and dip netting. Methods for seine netting were as described in Section 2.2. Dip nets were used intermittently when YOY were seen.

Snorkelling was done frequently during the period that larval fish were present in Reach 4. During each sampling event, a diver would enter at the upstream end of Reach 4 and then swim downstream through the entire reach. Visual observations and underwater photography were used to document the distribution and relative densities of larval fish in various habitats.

Larval fish were photographed, measured (to nearest mm) and released. A subset of fish of each larval stage (approximately twelve per stage) was collected and preserved in 10% buffered formalin for morphological assessment. Each specimen was examined under a low-power stereo microscope and close-up photographs were taken with a Nikon D200 digital SLR and Nikkor 105 micro lens. Photographs were reviewed by Golder personnel and Martin Hochleitner, an independent expert specializing in the rearing of Arctic Grayling and whitefish. Structural attributes (e.g., fin-folds, presence/absences of fins, fin rays, presence/absence of scales, presence/absence of the yolk sac) and pigment distribution were noted and based on the descriptions in Snyder (1998), the developmental stage (protolarva, mesolarva, and metalarva/juvenile) of each specimen was determined.

To document the morphological characteristics typical of each larval stage for Arctic Grayling in Baker Creek, hand-drawn illustrations were made (Appendix C). Variation in pigment patterns was observed but specimens considered “most typical” as representing a size category were chosen for illustration.

2.4.2 Young-Of-Year Habitat

The habitats occupied by larvae were described by measuring water depth (cm) and water velocity (m/s); the locations were mapped. Depth (m) and velocity (m/s) measurements (surface, mid and bottom) were made at 0.5 m intervals from the right upstream bank to the left upstream bank along six transects. Transects were focussed on the areas of Arctic Grayling mesolarvae congregations in Reach 1, 3 and 4 (Figure 4). Depth and velocity measurements were repeated two weeks later at three of the transects in Reach 4 when the larvae were a larger size (Transect 1, 2, and 3).



Figure 4: Location of YOY Habitat/Feeding Transects, Baker Creek, 2009



2.4.3 Outmigration

YOY Arctic Grayling densities and the timing of out-migration from Reach 4 were recorded from 26 June to 19 July, 2009. Because of the late spring, YOY outmigration had the potential to overlap with discharge of treated mine water, which commenced 7 July. Seine nets were set at two locations: one at the downstream end of Reach 4 (Station 1), and the other (Station 2) 50 m downstream at the culvert in Reach 1 (Figure 5). A single seine net spanning the width of the stream was set nightly for 200 seconds at each station. Nets were set three to six times per evening prior to discharge (26 June to July 6) at Station 1 and nets were set nine times at each station during discharge (July 7 to July 19).

For each fish captured, species and fork length (mm) was recorded; a subset of individuals was weighed (g). Water temperature (°C), depth (cm), wetted width (m), and velocity [meters per second (m/s)] were also recorded each day at each station; the physical data from the stream may be found in Golder 2009b and is not repeated here.

Additional seine net hauls were performed intermittently at the Baker Creek 'breakwater' (Figure 1) to determine if YOY were leaving Baker Creek and entering Great Slave Lake in July. Fish capture data from the mouth of Baker Creek was not included in the CPUE analysis undertaken for Station 1 and Station 2; this data was only used to qualitatively examine fish presence and out-migration to Great Slave Lake.

2.5 Food Items in Reach 4

Invertebrates were sampled in the water column (zooplankton) and in the stream bed (benthos) of the 'Giant Pool' Reach 4 (Figure 6) to collect a 'snapshot' of the food resources in the stream for adult and YOY Grayling. Invertebrate sampling was completed when YOY fish had already emerged from the substrate and were actively feeding (exogenous feeding instead of using the yolk sac) as well as when adult Arctic Grayling were feeding in Reach 4 post-spawning.

2.5.1 Zooplankton

Four replicate plankton samples were collected from Reach 4 on 30 June, 2009 (Figure 6). Each replicate sample was collected from the same mid-stream location at the pool-riffle interface (Figure 6), using a 76 µm Nitex® mesh plankton net with a detachable sampling bucket. The solid-frame net was anchored in the stream and suspended horizontally by the current with the opening facing upstream; the net was set for approximately 15 minutes for each replicate sample. The net was placed at a depth which allowed coverage of the entire water column. Sampling depth was 41.3 cm and water velocity ranged from 0.12 to 0.14 m/s at the mid-column opening of the plankton net. Replicate samples were transferred into a single 250-mL white Nalgene® bottles and preserved in 10% buffered formalin. The composite sample was kept cool, but not frozen, and sent to Golder, Edmonton for taxonomic analysis (species identification to lowest taxonomic level possible) and estimation of abundance.



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Figure 5: Sampling Stations for Capturing Out-migrating YOY Fishes, Baker Creek, 2009



Figure 6: Locations of Habitat Measurements, Baker Creek, 2009



2.5.2 Benthos

Two methods were used to sample benthos in Reach 4: dip net (riffle/glide areas) and Ekman dredge (depositional areas). On 26 June, 2009, dip nets were used to sample benthos in a shallow riffle area near Riffle 2 (Figure 6). The sampler disturbed the substrate allowing the debris to float downstream into a fine-mesh dip net. The area of the stream sampled was approximately 0.6 m². Contents from the dip net were combined into one composite sample by transferring material to a single 500-mL Nalgene® bottle and preserved with 10% buffered formalin.

On 1 July 2009, a standard 6-inch Ekman grab (sampling area = 0.0232 m²) was used to sample benthos in depositional habitat within the lower section of 'Giant Pool' near Riffle 2 (Figure 6). Water depth in this area was 0.67 m. Two grab samples were collected and sieved through a 500-µm mesh screen to remove clay and fine sediments. The remaining detritus and invertebrates were combined into one composite sample by transferring material to a single 500-mL Nalgene® bottle and preserved in 10% buffered formalin. An additional grab sample of sediment was taken in the same area and frozen/archived for future sediment quality analysis.

Benthos samples were kept cool, but not frozen, and sent to Dr. Jack Zloty, Ph.D. in Summerland, British Columbia for taxonomic analysis (to lowest taxonomic level possible) and estimation of abundance.

2.6 Stream conditions

Water temperatures (°C) were measured regularly with a thermometer from 6 May to 19 July, 2009. A temperature data logger that measured water temperature on an hourly basis (i.e. 24 readings per day) was installed in Reach 4 on 28 May, 2009.

Stream discharge data (m³/s) for Station #07SB013, located at the outflow of Martin Lake about 5 km upstream, was obtained from Environment Canada for the period January through September 2009 (Environment Canada 2009). A range of water quality measurements including dissolved oxygen (DO) concentration (mg/L), DO percent saturation (%), and pH were taken in the field with an YSI multi-probe meter. Measurements were taken after the peak of the spring freshet (5 June), and in early-summer (30 June) before treated effluent from the Giant Mine was released into the stream. The measurements were taken in the mid-section of Reach 4 downstream of Riffle 5 (Figure 6) at a depth of about 0.35 m. Water quality is monitored during discharge by the Giant Mine staff and as such additional sampling was not done during this program.

Water quality samples for laboratory analyses were collected in Reach 4 on 5 June and 30 June, 2009. On both occasions, a surface water sample, a field blank, and a travel blank were submitted to ALS Laboratory Group in Yellowknife for analysis. Analytical parameters included physical parameters, anions, nutrients, cyanides, total metals, and dissolved metals. This suite of parameters is similar to the water quality tests done by the Giant Mine, as required under the Metal Mining Effluent Regulations (MMER). The methods and detection limits for parameters and the data validation procedures were consistent with the Standard Operating Procedures for the Giant Mine (INAC 2008).



2.7 Data analysis

Catch-per-unit-effort (CPUE) for adults was calculated for seine nets used below the culvert on Reach 1. Because the sampled area for individual seine net hauls below the culvert was approximately equal, the CPUE was reported as number of fish captured per haul. During outmigration of fish, a seine net was set in a fixed location for 200 seconds at a time. CPUE for fixed stations was calculated as the number of fish captured per minute.

Length-frequency histograms were constructed for the most abundant large-bodied fish captured. Snorkelling observations of large-bodied fish were plotted with water temperature. Plankton and benthic invertebrate data were summarized as presence/absence for each major taxonomic group and abundance per area sampled.

3.0 RESULTS

3.1 Summary of Fish Captured and Observed in Baker Creek

An estimated total of 1416 fish representing twelve species were captured in Baker Creek in spring and summer 2009 (Table 1); the total catch was not quantified and only a subset of fish were processed if the catch of fish was sometimes too numerous to process (e.g. YOY Longnose Sucker) or the catch was dominated by a non-target species (e.g., Emerald Shiner) Table A-1 and Table A-2 in Appendix A, contains the length, and sex (when possible to determine externally) data for fish captured and measured.

Two fish with floy tags were observed in 2009: a Northern Pike captured in Reach 1 and a Longnose Sucker in Reach 4. Of the large-bodied species that were captured downstream of the culvert, Northern Pike and Longnose Sucker had the highest catch rate (Table 1).

3.2 Reach 0 and Reach 1

3.2.1 Arctic Grayling

Twenty-four Arctic Grayling were captured downstream of the culvert (Reach 1) prior to their upstream migration (Table 1). Adult Grayling captured in Reach 1 ranged from 300 to 440 mm in length and were between four and eleven years of age with a mean age of approximately 7 years (Table 2). Most the fish captured were adult males.

Eight fish captured in Reach 1 were retained for internal examination and otolith collection (two found dead and six sacrificed). The gonads of five of the eight fish were tentatively identified to be in the 'resting stage' (not confirmed with histology and thus noted as a tentative identification). The presence of fish with gonads in the 'resting stage' suggests that individual Arctic Grayling may not spawn annually in this creek.

The total number of Arctic Grayling observed in Reach 1 between 20 May and 20 June 2009 varied from one to 30 (see Reach 1 in Table 3). Spawning was observed below the culvert in Reach 1 (Figure 7); fertilized Arctic Grayling eggs were also found in this location, confirming spawning observations.



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Table 1 Number of Fish Captured and Catch-Per-Unit-Effort in Baker Creek, 2009

Objective	Location and Sampling Dates	Method and Capture Effort	Species	Number of Fish Captured	CPUE (# fish/haul)	Fish Observed During Shoreline Observation or Through Snorkelling
Capture of Migrating Adults (Objective 3)	Reach 1 (June 2, 5, 19 July 4)	Dip net ,5 angling sessions (no fish captured) and 8 seine hauls ^(a)	Longnose sucker	29	3.6	Numerous throughout area, several fish with 2007 floy tags observed
			Northern pike	29	3.6	Numerous in slower waters in Reach 1
			White sucker	7	0.9	Many others observed while snorkelling
			Lake whitefish	13	1.6	Many observed while snorkelling (See Appendix A, Table A-12 for count)
			Walleye	1	0.1	Numerous seen in Reach 1, below the culvert; see Appendix A, Table A-12 for details
			Sucker spp	3	--	Numerous juvenile suckers seen near breakwater, few captured in dip net to measure length of individuals
			Burbot	1	--	Burbot observed dead on shore and measured, no other burbot observed
			Arctic Grayling	24	(c)	Many observed while snorkelling (see Table 3 and Appendix A, Table A-12 for counts)
Subtotal –Reach 1				107	--	
Capture of Migrating Adults (Objective 1)	Reach 4 (June 16 and June 17)	Angling	Arctic Grayling	4 ^(b)	(c)	Minimum of 1 seen daily to a maximum of 23 (see Table 2 for detail)
		By hand	Northern pike	1	--	3 observed and 1 juvenile captured by hand
Subtotal – Reach 4				5	--	
Capture of Outmigrating YOY and Small-Bodied Fish (Objective 6)	Reach 1 and Reach 4 (June 26 to July 17, 2009)	Fixed seine stations and active seining	Sucker spp.	401++	--	Large numbers of YOY captured during outmigration (Appendix A, Table A-2); only a subset (n=119) were recorded as there were too many to accurately count and to minimize mortality.
			Northern pike	4	--	YOY captured at seining station in Reach 1
			Arctic Grayling	656	--	See Table 3 for observations; Catch data recorded in Appendix A, Table A-2
			Ninespine stickleback	63	--	Many seen in Reach 0 and Reach 1; 1 captured in Reach 4
			Emerald shiner	114	--	Large numbers seen in lower Reach 1; 4 captured at 'breakwater', 110 captured in Reach 1
			Whitefish spp ^(f)	48	--	--
			Lake chub	3	--	Several seen at end of Breakwater, captured but not measured
			Spottail shiner	15	--	Hundreds observed near end of Breakwater but none observed in culvert area
Subtotal – Reach 0, 1 and 4				1304++		Numerous fish of various species; one slimy sculpin observed in Reach 1; Arctic Grayling YOY present in high numbers
Grand Total			All Species	1416++	--	

Notes: CPUE = catch-per-unit-effort; # = number; YOY = young-of-year; spp. = species plural; -- = not available.

(a) Each seine haul covered an area of approximately 140 m²; therefore, the unit of effort is one haul.

(b) This includes angling of 3 fish and dip net of one dead Arctic Grayling retrieved in Reach 4 on May 20, 2009.

(c) Not available, angling effort not quantified because angling duration not recorded.

(d) Portion of the seine net used to carefully 'scoop' small-sized fish to prevent damage to fish.

(e) Number of fish captured and measured is noted here; remaining catch was released without measuring (i.e., not target species).

(f) Whitefish species indicated a species in the Coregoninae subfamily (e.g., round or Lake Whitefish or cisco form)



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Table 2 Size and Age of Adult Arctic Grayling Captured in Baker Creek, 2009

Site	Date	Fork Length (mm) ^a	Maturity ^b	Sex	Age	Age Structure Collected ^c	Live Release?	Sampling Method
Reach 1	06-June-09	389	resting	female	7	scales and leading edge fin ray, otoliths	no	Angling
Reach 1	06-June-09	427	resting	female	9-10	scales and leading edge fin ray, otoliths	no	Angling
Reach 1	06-June-09	351	resting	male	7-8	scales and leading edge fin ray, otoliths	no	Angling
Reach 1	06-June-09	382	resting	male	8-10	leading edge fin ray, otoliths	no	Angling
Reach 1	09-June-09	408	no	male	6	scales and leading edge fin ray	no	Found dead
Reach 1	06-June-09	414	unknown	male	7	leading edge fin ray	no	Angling
Reach 1	06-June-09	372	unknown	unknown	6-7	scales and leading edge fin ray, otoliths	no	Angling
Reach 1	06-June-09	391	resting	unknown	6-7	scales and leading edge fin ray, otoliths	no	Angling
Reach 1	07-June-09	300	unknown	female	5	leading edge fin ray	yes	Angling
Reach 1	16-June-09	335	unknown	male	4	leading edge fin ray	yes	Angling
Reach 1	18-June-09	360	unknown	male	4	leading edge fin ray	yes	Angling
Reach 1	06-June-09	361	unknown	male	9	leading edge fin ray	yes	Angling
Reach 1	06-June-09	363	unknown	male	8	leading edge fin ray	yes	Angling
Reach 1	06-June-09	378	unknown	male	8	leading edge fin ray	yes	Angling
Reach 1	16-June-09	385	unknown	male	7	leading edge fin ray	yes	Angling
Reach 1	06-June-09	392	unknown	male	9	leading edge fin ray	yes	Angling
Reach 1	06-June-09	401	unknown	male	8	leading edge fin ray	yes	Angling
Reach 1	06-June-09	411	unknown	male	6	leading edge fin ray	yes	Angling
Reach 1	07-June-09	440	unknown	male	11	leading edge fin ray	yes	Angling
Reach 1	31-May-09	310	unknown	unknown	7	leading edge fin ray	yes	angling
Reach 1	06-June-09	338	unknown	unknown	4	leading edge fin ray	yes	Angling
Reach 1	03-June-09	356	unknown	unknown	4	leading edge fin ray	yes	Angling
Reach 1	31-May-09	380	unknown	unknown	8	leading edge fin ray	yes	Angling
Reach 1	06-June-09	381	unknown	unknown	8	leading edge fin ray	yes	Angling
Reach 4	16-June-09	360	unknown	male	7	leading edge fin ray	yes	Angling
Reach 4	17-June-09	342	unknown	male	4	leading edge fin ray	yes	Angling
Reach 4	17-June-09	415	unknown	male	10	leading edge fin ray	yes	Angling
Reach 4	20-May-09	~390	ripe	male	7-9	scales and leading edge fin ray, otoliths	no	Found dead

^a: mm = millimetres; b: State of maturity are estimates only based on field dissections; histology was not done to confirm maturity.

^c For some fish, more than one age structure was collected to compare the age estimation from various structures. There appears to be agreement between fin rays and otoliths while scales tend to slightly underestimate age; full data on the comparison is available upon request.

Note: Length and weight data from this table are also presented in Appendix A, Table A-I and is summarized here for ease of reference.



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Table 3 Adult Arctic Grayling and Longnose Sucker Observations at Baker Creek in Spring and Summer, 2009

Date	Reach 1		Reach 2		Reach 3		Reach 4		Total Count by Day	
	ARGR	LNSC	ARGR	LNSC	ARGR	LNSC	ARGR	LNSC	ARGR	LNSC
May 20, 2009	3	Too Numerous to count	-	-	-	-	2	-	5	-
May 21, 2009	6		-	-	-	-	8	-	14	-
May 22, 2009	4		-	-	-	-	4	-	8	-
May 24, 2009	3		-	-	-	-	3	-	6	-
May 25, 2009	3		-	-	-	-	7	-	10	-
May 26, 2009	-		-	-	-	-	7	-	7	-
May 27, 2009	-		-	-	-	-	8	-	8	-
May 28, 2009	4		-	-	-	-	1	-	5	-
May 29, 2009	2		-	-	-	-	-	-	2	-
May 31, 2009	8		-	-	-	-	-	-	8	-
June 1, 2009	1		-	-	-	-	6	-	7	-
June 2, 2009	6		-	-	-	-	-	-	6	-
June 3, 2009	7		-	-	-	-	-	-	7	-
June 4, 2009	4		-	-	-	-	-	-	4	-
June 5, 2009	-		-	-	-	-	23	7	23	7
June 6, 2009	25		-	-	-	-	-	-	25	-
June 7, 2009	14		-	-	-	-	-	-	14	-
June 8, 2009	16		-	-	-	-	5	10	21	10
June 9, 2009	30		-	-	-	-	13	21	43	21
June 10, 2009	30		8	22	30	22	21	14	89	58
June 14, 2009	1		-	-	-	-	-	-	1	-
June 16, 2009	-		-	-	-	-	10	-	10	-
June 18, 2009	-		-	-	-	-	7	-	7	-
June 20, 2009	2		-	-	-	-	-	-	2	-

Note – this data is also presented in Appendix A, Table A-12 and is summarized here for ease of reference; - = snorkeling not done; ARGR = Arctic Grayling; LNSC = Longnose Sucker



Figure 7: Spawning Locations, Reaches 1, 3, and 4, Baker Creek, 2009



3.2.2 White Sucker and Longnose Sucker

Seven White Suckers were captured in Baker Creek during the 2009 survey (Table 1). The average length of White Suckers was 424 mm (Figure 8; Appendix A, Table A-1). Capture period for White Sucker overlapped with that of Longnose Sucker.

Longnose Suckers were abundant in Reach 0 and Reach 1. They were too numerous to accurately count during snorkel surveys; no further attempts to enumerate the total number of adults with alternate methods was made as this was not a key objective of the study. Adult Longnose Suckers were captured from 2 June to 4 July, 2009. A total of 29 adult Longnose Suckers were captured downstream of the culvert (Table 1); numerous individuals were in spawning condition (milt and eggs were easily extruded). The mean length of captured adult Longnose Suckers was 462 mm (see length- frequency histogram in Figure 8; Appendix A, Table A-1). By 14 June, 2009, most adults appeared to have out-migrated from the creek, although some remained in the pool and run downstream of the culvert in Reach 1. Peak of Longnose Sucker spawning activity downstream of the culvert likely occurred during the period 31 May to 7 June, at water temperatures between 8 and 10°C (Appendix A, Table A-5).

YOY and juvenile suckers were observed and captured downstream of the culvert in 2009. A total of 118 individuals (115 YOY and three juveniles) were captured and they ranged in size from 11 to 51 mm (Appendix A, Table A-1 and A-2). Suckers could not be identified to species level without further examination.

3.2.3 Northern Pike

Twenty-nine adult Northern Pike were captured downstream of the culvert. The mean size of adult pike was 424 mm; individuals ranged in size from 350 to 680 mm (Figure 8; Appendix A, Table A-1). Four YOY northern pike (31 to 58 mm) were captured downstream of the culvert.

3.2.4 Lake Whitefish

Thirteen Lake Whitefish were captured from the pool downstream of the culvert between 2 June and 19 June, 2009 (Table 1). The mean size of Lake Whitefish was 372 mm; individuals ranged from 335 to 410 mm in length (Figure 8; Appendix A, Table A-1). Numerous Lake Whitefish were observed during daily snorkelling surveys between 29 May and 12 June, 2009; water temperature during these sampling events varied from 8° to 15.5°C (Figure 9). Peak numbers of Lake Whitefish were observed on 9 and 10 June (Appendix A, Table A-12); water temperature ranged from 14.2 to 15.5°C on these dates.

Large numbers of juvenile coregonids, possibly more than one species, were observed and captured in Reach 0 at the end of the breakwater on several occasions during July, 2009. Between 11, and 17 July, 42 coregonids were captured in Reach 0 while three were captured from Reach 1 on 8 July, 2009 (Appendix A, Table A-1).



Figure 8: Length-Frequency Histograms of Large-Bodied Fishes, Baker Creek, 2009



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Figure 9: Snorkelling Observations on Species Abundance in Baker Creek, 2009



3.2.5 Walleye

In 2009, walleye were observed during snorkelling. They were holding below the culvert throughout Reach 1 (Appendix A, Table A-12). Walleye were first recorded on 28 May, 2009 followed by daily sightings until 10 June. Water temperatures during the period when walleye were observed in Reach 1 ranged from 7.2 to 15.5°C (Figure 9). The peak number of Walleye observed in a single day was nine; they were seen on 6 June, 2009 in or flowing water below the Culvert Pool when water temperature was approximately 10°C. On 12 June, 2009, it appeared as if almost all large-bodied fish out-migrated from Reach 1. However, on 4 July, 2009, when the water temperature was 19°C, a single Walleye was observed in the Culvert Pool. This individual was 381 mm in fork length.

3.2.6 Burbot

One Burbot (340 mm total length) was found dead near the shore in Reach 1. No other Burbot were observed in 2009.

3.2.7 Small-bodied fish

Ninespine Stickleback

Large numbers of Ninespine Sticklebacks were observed frequently in the pool downstream of the culvert or in the 'breakwater' area. Between 7 June and 13 July, 2009, 62 adult and juvenile Ninespine Stickleback were captured downstream of the culvert; fish ranged in length from 25 to 58 mm (Appendix A, Table A-1).

Emerald Shiner and Spottail Shiner

On 20 June, 2009, 110 Emerald Shiners were captured between Reach 0 and Reach 1. Captured Emerald Shiner ranged in size from 48 to 96 mm (Appendix A, Table A-1). On the basis of snorkelling observations, Emerald Shiners did not reside in the pool downstream of the culvert as observed in 2008, rather, they remained further downstream toward Reach 0.

Large numbers of Spottail Shiners were seen in the vegetated areas near the 'breakwater' at the confluence with Great Slave Lake. A small, representative sample of Spottail Shiners was measured (n=15) and individuals ranged in size from 28 to 78 mm (Appendix A, Table A-1). Only a few Spottail Shiners were observed immediately downstream of the culvert or in Culvert Pool.

Lake Chub

On 17 July, 2009, three Lake Chub were captured by seine net at the mouth of Baker Creek; they were photographed and released.

3.3 Reach 4 – Arctic Grayling

3.3.1 Size and Age of Adult Captures

In 2009, three adult Arctic Grayling were captured by angling in Reach 4. These individuals were 342 mm, 360 mm, and 415 mm in length ranging from four to 10 years (Table 2). The fish may have been spent (post-spawning) males but this was not confirmed by histology as the fish were released. The remains of an Arctic Grayling were found on the shore in Reach 4 on 20 May, 2009; it was presumed that the fish had been captured



by a predator as only part of the fish was found. The fish was dissected and found to be an 8 year-old adult male, approximately 390 mm in length.

3.3.2 Timing of spawning

Arctic Grayling exhibited pre-spawning behaviour and spawning activities in Reach 4 from 19 May through 25 May, 2009, (see Figure 10 for relative distribution of fish throughout reach). On 26 May, 2009, numerous Arctic Grayling eggs were found in the upper portion of Reach 4. The developmental stage of the eggs suggested that they were deposited on 24 and 25 May, 2009. Unlike 2008, Arctic Grayling in 2009 spawned after peak freshet; discharge varied from 2.8 to 2.1 m³/s during this period (see Figure 17 on page 43).

3.3.3 Density of fish

The number of spawning fish counted in Reach 4 varied from one to eight during the observed spawning period (Table 3). Numerous fish were seen in Reach 4 after May 25 but were not exhibiting spawning behaviours; the highest number of adult Arctic Grayling observed in Reach 4 was 23 (seen on 6 June 2009).

3.3.4 Post-spawning Residency

Some Arctic Grayling remained in Reach 4 after spawning (see observations for June 2009 in Table 3). Snorkelling observations revealed large numbers of adult Arctic Grayling in Reach 1, Reach 3 and Reach 4 after the known spawning dates. Highest numbers of Arctic Grayling were observed in Baker Creek (Reach 1, 3, and 4) between 5 June and 10 June, 2009 (Table 3).

3.3.5 Egg sampling

In 2009, Arctic Grayling eggs were obtained from seven areas in Reach 4 (Figure 11). The eggs were consistently found above riffles in glide habitat. Two of these sites (5 and 6) contained both Longnose Sucker and Arctic Grayling eggs. In 2009, eggs were not observed in glide habitat above Riffle 1C or Riffle 7. Riffle 7 was 'run' habitat in 2009 and was not present as an area of fast-flow; this change in stream profile is possibly due to permafrost slumping, which is common in the area. Eggs were also observed in one location in Reach 3 (see Figure 7 for area where spawning was observed in Reach 3). Reach 3 is not a focus area for this study but the results are reported here for the sake of completeness (see Appendix A, Table A-7 for egg size data). It is not known if Reach 3 is used annually for spawning.

Eggs were measured several times throughout their developmental stages at several egg deposition sites (n= 93 Arctic Grayling eggs and 44 Longnose Sucker eggs). Arctic Grayling egg size varied from 3.32 to 4.91 mm in diameter and sucker eggs ranged from 2.45 to 3.34 mm in diameter (Appendix A, Table A-4; see photograph in Appendix B, 28 May, 2009). This represents the size range from fertilization to hatch in Baker Creek for both species (based on sizes reported in Vincent (1962) and Watling and Brown (1955)).



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Figure 10: Distribution of Spawning Arctic Grayling and Longnose Suckers in Reach 4, Baker Creek, 2009



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Figure 11: Areas of Egg Deposition for Arctic Grayling and Longnose Suckers in Reach 4, Baker Creek, 2009



3.3.6 Egg habitat

Arctic Grayling eggs were usually found in areas of small or large gravel (defined as 2 to 64 mm in size) and small cobble (defined as 64-128 mm) (Appendix A, Table A-7). Egg sites had water depths ranging from 26 to 59 cm with bottom water velocities ranging from 0.03 to 1.79 m/s (Appendix A, Table A-4). No eggs were observed to be covered by sediment; the mean embedded height in various areas of Reach 4 is presented in Table 4 and raw data is presented in Appendix A, Table A-6.

Table 4 Embedded Height at five locations in Reach 4

Location	Description of Area in Reach 4	Mean Embedded Height (cm) ^a
1	Top of Reach 4	0.25
2	Giant Pool	1.94
3	Spawning hole	0.49
4	Big Run	1.52
5	Lower canyon	1.32

a Defined in Sylte and Fischenich 2007

3.3.7 Egg Hatching

Surveys for eggs and YOY were done almost daily from late May to mid July. Arctic Grayling protolarvae were first observed on 14 June. Based on the state of development of the protolarvae, the date of hatching was approximately 12 June to 13 June, 2009, when daily stream water temperature was around 15°C (Appendix A Table A-5). For several days following initial emergence (post-hatching but prior to free swimming), Arctic Grayling eggs continued to be found throughout Reach 4. Compared to previous years, the timing of emergence appeared protracted.

3.3.8 Larval Emergence

Mass emergence appeared to take place from 12 June, 2009 and continued for several days. A newly hatched 13 mm specimen was captured and measured on 19 June, 2009, suggesting emergence occurred continuously over the period of one week (captured in Reach 1). Larvae at this stage were 'protolarvae' meaning free-swimming embryos. They were observed in large numbers along the shoreline of Reach 4 (Figure 12). Fish were holding throughout the water column, and were actively swimming using whirling tail movements. These protolarvae were 12.7-16 mm in length (Appendix A, Table A-2; see Appendix C for detailed descriptions and illustrations).



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Figure 12: Distribution of Arctic Grayling Protolarvae after Emergence in Reach 4, Baker Creek, 2009



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3.3.9 YOY Rearing

On the basis of measurements of YOY, 14 to 18 June, 2009 marked the transition phase between protolarvae and mesolarvae for most Arctic Grayling (Table 5). At this stage, Arctic Grayling YOY were observed swimming actively and feeding throughout the water column, in areas of low velocity (Figure 13).

The bulk of mesolarvae development occurred from 15 June to 26 June, 2009. However, two individuals of 16 mm were captured and measured as late as 30 June (Appendix A, Table A-2). While most of the mesolarvae were holding in water ranging from 11 to 21 cm depth (Appendix A, Table A-3), some were seen to hold at various depths in water as deep as 42 cm. At this stage, an obvious association with areas of cover, such as gravel and boulder, was observed. No other cover types were observed in Baker Creek, although one dead willow branch was seen near Riffle 2 and formed some type of 'woody debris' type cover.

At approximately 25 to 27 mm, Arctic Grayling YOY had fully-formed fin structures yet retained some degree of a fin-fold. At this size, Arctic Grayling were able to reside in different habitat types throughout Reach 4 (Figure 13).

Table 5 Mean Length of YOY Grayling in Baker Creek, 2009

Date	Mean Fork Length of Grayling (mm)		Stage of Development ^(a)
	Reach 4	Reach 1	
June 15, 2009	15.57	-	Proto to mesolarvae
June 17, 2009	17.46	-	Mesolarvae
June 18, 2009	19.11	-	Mesolarvae
June 19, 2009	-	17.61	Mesolarvae
June 20, 2009	20.31	-	Mesolarvae
June 22, 2009	23.13	-	Mesolarvae
June 24, 2009	26.78	25.00	Mesolarvae
June 26, 2009	28.38	-	Metalarvae
June 27, 2009	30.33	-	Metalarvae
June 28, 2009	32.21	-	Metalarvae
June 29, 2009	32.63	-	Metalarvae
June 30, 2009	16.58	-	Mesolarvae
July 1, 2009	36.93	-	Metalarvae
July 3, 2009	36.68	-	Metalarvae
July 5, 2009	-	41.38	Juvenile
July 6, 2009	40.5	37.90	Juvenile
July 7, 2009	47.63	-	Juvenile
July 8, 2009	54.00	43.39	Juvenile
July 11, 2009	-	45.80	Juvenile
July 13, 2009	-	43.00	Juvenile
July 16, 2009	-	36.43	Metalarvae
July 17, 2009	-	39.50	Juvenile
July 19, 2009	-	45.65	Juvenile

Note: mm = millimeters, - = no fish measured

a Raw data is presented in Appendix A, Table A-2 and is summarized here for ease of reference. Protolarvae = phase of larval development, post-hatching, characterized by absence of fin spines and rays and prominent yolk sac; Mesolarvae = phase of larval development characterized by presence of forming fins and reduced or absent yolk sac; Metalarvae = phase of larval development where distinct rays and pectoral fin buds are visible; Juvenile = phase of development when fins are differentiated and the temporary organs of the larval stage are replaced by definitive organs.



Figure 13: Distribution of Arctic Grayling Mesolarvae in Reach 4, Baker Creek, 2009



3.3.10 YOY Habitat Use

Starting 19 June, 2009, many YOY Arctic Grayling had transformed from protolarvae to mesolarvae and began showing strong associations to structure and cover such as boulders, woody debris, and surface foam. Physical measurements at 0.5m intervals across the stream in areas of larval concentration were summarized in Table 6 and raw data is located in Appendix A, Table A-3. During their mesolarval stage, YOY Arctic Grayling showed a tendency to avoid areas of high flow and preferred shallow waters (6-33 cm), though some YOY were seen as deep as 76 cm (Appendix A, Table A-3). In areas of slow flow, mesolarvae remained in water 10-40 cm but were clustered near the surface.

By early July, most Arctic Grayling were metalarvae (early juveniles) or juveniles. At this stage, they avoided areas of stagnant water and took up residence in the fastest flowing portions throughout Reach 4. Typically, juveniles were concentrated below riffles and throughout the runs, however, almost all areas of the stream seemed to provide favourable habitat as long as there was some current (Figure 14).

Table 6 Depth and velocity at YOY habitat locations

Date	Reach	Location	Depth range (cm)	Velocity (surface)		Velocity (middle)		Velocity (bottom)	
				min	max	min	max	min	max
June 19, 2009	Reach 4	Transect 1	16 to 42	0	1.89	0	1.67	0.01	1.2
June 25, 2009	Reach 4		6 to 55	0	1.71	0	1.61	0	0.6
June 19, 2009	Reach 4	Transect 2	11 to 90	0.01	0.24	0.01	0.25	0	0.21
June 25, 2009	Reach 4		10 to 91	0	0.48	0	0.36	0	0.2
June 19, 2009	Reach 4	Transect 3	12 to 51	0.1	0.41	0.02	0.32	0.11	0.3
June 25, 2009	Reach 4		12 to 51	0	0.38	0	0.35	0	0.3
June 20, 2009	Reach 3	Transect 5	13.5 to 37	0	1.13	0	1.05	0	0.83
June 20, 2009	Reach 1	Transect 6	43 to 48	0.52	0.7	0.39	0.62	0.21	0.43
June 22, 2009	Reach 4	Transect 4	12 to 79	0	0.3	0	0.36	0	0.21

See Figure 4 for transect locations.



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Figure 14: Distribution of Juvenile Arctic Grayling in Reach 4, Baker Creek, 2009



3.3.11 YOY Outmigration

Total catch and size of fishes during outmigration

Seven hundred fifty eight (758) fish were captured at Station 1 (Reach 4) and Station 2 (Reach 1) of Baker Creek from 26 June to 19 July, 2009. The majority of fish captured were YOY Arctic Grayling (357) and YOY Longnose Suckers (401). In addition, four additional species were captured: YOY Northern Pike (n=4), coracoids (likely cisco or whitefish) (n=5), Ninespine Stickleback (n=3) and Spottail Shiner (n=1). The sizes of captured fish are reported in Appendix A, Table A-1 (Adult and Juvenile) and Table A-2 (YOY); only a subset (n=119) of Longnose Suckers were measured to reduce mortality due to handling. Only target fish (Arctic Grayling and Longnose Sucker) are included in further analysis of outmigration. Fish which were captured at the breakwater were considered previously out-migrated from Baker Creek and were not included in the total of out-migrants.

Arctic Grayling YOY captured during outmigration from Baker Creek at Stations 1 and 2 ranged in size from 19.7 to 65 mm (mean 33.5 mm). During the outmigration, Arctic Grayling YOY were generally in an advanced stage of development; all fins and fin rays were fully formed and, as such, were termed 'juvenile' from a developmental perspective, however, some mesolarvae and metalarvae (early juveniles) were captured at Station 1. Longnose Suckers ranged from 15 to 28 mm in length (mean 22 mm). On the basis of visual appearance of the YOY Longnose Suckers, fish were in the mesolarval stage when they outmigrated from Reach 4.

Summary of Timing of outmigration

The CPUE of fish ranged from 0 fish per minute to approximately six fish per minute with maximum catch rates on 27 June (before discharge) and 13 July (during discharge) (Figure 15; Golder 2009b). Since CPUE can be used as a measure of relative abundance, it appears peak of the outmigration of all fish from Baker Creek was late June and again in mid-July 2009. Water temperature ranged from 16.5 to 21° C from 26 June to 19 July (Appendix A, Table A-5). Details on water depth and velocity can be found in Golder 2009b. No mortality of YOY fish was observed during the study dates.

Arctic Grayling

The outmigration of Arctic Grayling YOY was observed between 26 June and 13 July 2009. Peak outmigration of Arctic Grayling occurred prior to discharge (7 July, 2009). Most YOY Arctic Grayling were captured prior to discharge; only fifteen were captured after start of discharge between 7 July and 13 July, 2009. Water temperature during the start of outmigration was between 16.5 to 21.5 °C (Appendix A, Table A-5) and discharge varied from 0.2 m³/s to 3.6 m³/s in Spring 2009 (Figure 16). On 8 July, outmigration was considered complete from Reach 4 and on 13 July, the last YOY Arctic Grayling was captured in Baker Creek at Station 2 in Reach 1. No effluent from Giant Mine was released during the time of spawning, emergence, but effluent discharge overlapped with the end of the YOY Arctic Grayling outmigration.

The outmigrating Arctic Grayling were observed swimming in low velocity areas, but the bulk of downstream movement appeared to take place in the center (thalweg) of the stream where velocities were higher (0.46 m/s). During midday, schools of YOY Arctic Grayling were sometimes observed swimming downstream, at the surface.



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Figure 15: Outmigration of YOY Arctic Grayling and Longnose Sucker, Baker Creek, 2009



Figure 16: Historic Flows in Baker Creek (2001 to present)



Longnose Sucker

The outmigration of Longnose Sucker YOY was observed between 8 July and 17 July, 2009. Peak outmigration of Longnose Sucker appeared to occur during the period of treated effluent discharge. Water temperature during the start of outmigration was between 18 to 19.5 °C and the discharge rate dropped from 0.8 to 0.5 m³/s. Outmigration peaked on 13 July, 2009, when hundreds of YOY were captured and only subsets of each catch per seine could be processed. On July 16, 2009, outmigration was considered complete from Reach 4 and on July 19, 2009 the last YOY Longnose Sucker was captured in Baker Creek at Station 2 in Reach 1.

3.4 Food items in Reach 4

Twelve genera zooplankton taxa were collected in Reach 4 of Baker Creek (Table 7). The taxa present consisted primarily of cladocerans and cyclopoid copepods, Total zooplankton abundance was low (5.77 organism per m³) (Appendix A, Table A-8). However, the abundance data cannot be considered representative of the biomass available to fish over the period of larval growth because sampling only occurred on one occasion.

Table 7 Zooplankton Community Composition from One Location in Baker Creek, Reach 4, Spring 2009

Major Taxonomic Group	Taxa
Cladocera	<i>Ceriodaphnia</i> sp.
	<i>Chydorus sphaericus</i>
	<i>Alona</i> sp.
	<i>Acroperus harpae</i>
	<i>Pleuroxus</i> sp.
Calanoida	<i>Heterocope septentrionalis</i>
Cyclopoida	<i>Cyclops capillatus</i>
	<i>Diacyclops bicuspidatus thomasi</i>
Rotifera	<i>Notholoca</i> sp.
	<i>Brachionus</i> sp.
	<i>Conochilus</i> sp. colony
	<i>Keratella hiemalis</i>

Six different organisms were identified in the 'Giant Pool' (depositional) and twenty-one different organisms were identified in the riffle area in Reach 4 (erosional) (Table 8). Dip-net and Ekman samples are not directly comparable because the total sampling areas were different. In addition, differences in community composition would be expected because of habitat differences (i.e., erosional versus depositional).



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Table 8 Benthos Community Composition in Baker Creek Reach 4, Spring 2009

Major Taxonomic Group	Common Name	Family	Genus/Species	Baker Creek	
				Riffle	Giant pool
				Dip net	Ekman grab
Hydrozoa	hydra	Hydridae	<i>Hydra</i>	-	X
Oligochaeta	worms	Naididae	<i>Stylaria lacustris</i>	-	X
		Tubificidae		X	-
Amphipoda	side swimmers	Gammaridae	<i>Gammarus lacustris</i>	-	X
Gastropoda	snails	Planorbidae	<i>Gyraulus</i> sp.	X	X
Ephemeroptera	mayflies	Baetidae	<i>Baetis</i> sp.	X	X
		Heptageniidae (d)	-	-	X
		Heptageniidae	<i>Maccaffertium terminatum</i>	-	X
		Leptophlebiidae (d)	<i>Paraleptophlebia</i> ?	-	X
		Leptophlebiidae	<i>Leptophlebia</i> sp.	-	X
Trichoptera	caddisflies	Leptoceridae	<i>Oecetis</i> sp.	X	-
		Polycentropodidae	<i>Neureclipsis</i> sp.	-	X
		Polycentropodidae	<i>Polycentropus</i> sp.	-	X
Diptera	flies	Ceratopogonidae	<i>Bezzia</i> sp.	-	X
		Ceratopogonidae	<i>Probezzia</i> sp.	X	-
		Simuliidae	<i>Simulium</i> sp.	-	X
		Tabanidae	<i>Chrysops</i> sp.	X	-
		Chironomidae	<i>Larsia</i> sp.	-	X
		Chironomidae	<i>Nilotanyus</i> sp.	-	X
		Chironomidae	<i>Thienemannimyia</i> gr.	-	X
		Chironomidae	<i>Parachironomus</i> sp.	-	X
		Chironomidae	<i>Micropsectra</i> sp.	-	X
		Chironomidae	<i>Brillia</i> sp.	-	X
		Chironomidae	<i>Cricotopus/Orthocladius</i> sp.	-	X
		Chironomidae	<i>Nanocladius</i> sp.	-	X
		Chironomidae	<i>Parakiefferiella</i> sp.	-	X

X = present, - = absent



Observations of Adult Feeding

As in previous years, adult Arctic Grayling did not appear to be actively feeding prior or during spawning. However, within days after spawning was finished, individuals took up position below riffles and fed on invertebrates. Arctic Grayling fed from the surface and also along the bottom.

Observations of YOY Feeding

Mesolarvae and older YOY appeared to feed on plankton in the drift. Macroinvertebrates were also observed in Baker Creek, particularly Ephemeropteran (mayfly) nymphs and small-sized adults from the Family Baetidae. In late June and early July, blackfly larvae were seen attached to almost all rock substrate in the fast flowing portions of Baker Creek. When dislodged from the rock surface they were fed upon by YOY Arctic Grayling.

3.5 Reach 4-Other Fish Species

3.5.1 Longnose Sucker

Adults

Adult Longnose Suckers began entering Baker Creek on 25 May, 2009; water temperature reached 7.9°C on these dates. As in previous years, the spawning run extended into Reach 4. No attempts to capture Longnose Suckers were made in Reach 4 but holding and spawning fish were easily observed.

Longnose sucker spawning in 2009 was observed at the 'lower canyon riffle' in Reach 4 (Figure 10). Peak spawning activity in Reach 4 was observed between 9 June to 11 June, 2009 (Table 3); daily mean water temperature was approximately 14 to 15°C. In addition to spawning fish, other Longnose Suckers were observed holding in the 'overwintering pool' upstream of 'Giant Pool' (eight individuals observed on 9 June, 2009 and two on 10 June, 2009), which is further upstream in Reach 4 than observed in previous years.

YOY

Compared with Arctic Grayling YOY, the Longnose Sucker protolarvae were difficult to observe due to their small size. Attempts made to capture young suckers proved successful and a subset was measured regularly throughout the study period and released. Sizes of YOY suckers varied from 12 to 28 mm (Appendix A, Table A-2); they could not be identified to species due to their small size, but because adult Longnose Suckers were observed spawning and eggs were observed it is assumed they were Longnose Sucker YOY. The highest densities of YOY suckers were seen on 13 July, 2009 during their out-migration but large concentrations were regularly observed during snorkelling observations in late June and early July, 2009. Most were surface-oriented following hatching and sought out shallow areas with minimal flow velocity (Appendix A, Table A-3).

3.5.2 White Sucker

No White Suckers were observed in Reach 4 in 2009.

3.5.3 Lake Whitefish and other coregonids

During an 8 June, 2009, snorkel survey in Reach 4, a single adult Lake Whitefish was observed in 'Giant Pool' and two were observed in Reach 3.



Two unidentified individuals were captured during the outmigration survey at Station 1 in Reach 4 (Figure 5). It is presumed that they are type of whitefish or cisco (family Coregonidae) but the specific species was not identified. The fish were preserved for possible future identification.

3.5.4 Northern pike

Northern Pike were observed on several occasions in Reach 4. On 9 June 2009, a large individual was repeatedly observed in the 'overwintering pool' in upper Reach 4 above Giant Pool. On 22 June, 2009, a 158 mm individual was captured by hand in Reach 4. On 30 June 2009, two small individuals (~200 mm) were observed in mid Reach 4.

3.5.5 Small-Bodied Fish Species

One larval Ninespine Stickleback (6 mm fork length; Appendix A, Table A-1) was captured by seine net on 13 July 2009 at Station 1 in Reach 4 (Figure 5). No sculpins, cyprinids, or trout-perch were captured or observed in Reach 4 in 2009.

3.6 Stream conditions

Water quality measurements were recorded at mid-Reach 4 on two occasions: after the peak of the spring freshet (5 June), and in mid-summer (30 June) prior to the release of treated effluent from the Giant Mine into the creek (Table 9). Water temperature in Baker Creek was recorded using a data logger placed in Reach 4 from 25 May through 12 July, but the data proved irretrievable when being downloaded. Water temperature, taken with a hand-held thermometer, ranged from 0.5 C in early May to 21.5 C on 24 June (Appendix A, Table A-5; Figure 9). Water quality parameters were similar to previous years of the study.

Table 9 Field Water Quality Parameters, Baker Creek, 2009

Water Quality Parameter	June 5	June 30
Reach	4	4
DO (mg/L)	8.74	9.2
pH	7.8	7.7
Temperature (°C)	8.74	17.99
Depth (m)	0.19	0.14

Notes: DO = dissolved oxygen, mg/L = milligrams per litre, $\mu\text{S}/\text{cm}$ = micro Siemens per centimetre, °C = degrees Celsius, m = meter, NTU = Nephelometric Turbidity Units, - = no data.

Discharge in Baker Creek varied from $<0.2 \text{ m}^3/\text{s}$ at the start of the survey in early May, to $3.6 \text{ m}^3/\text{s}$ on 18 May 2009 (Environment Canada 2009; Figure 16). The range of spring flows and the date of peak freshet (late-May) is similar to the historical flow patterns for the stream (Figure 16). The 2009 peak daily discharge ($3.6 \text{ m}^3/\text{s}$) was greater than the peak recorded in 2007 ($2.3 \text{ m}^3/\text{s}$) or 2008 ($1.7 \text{ m}^3/\text{s}$). This discharge does not include mine effluent flows, which are released in July.

Water quality in Reach 4 in early June 2009 (Appendix A, Table A-10) was similar to that reported in 2008 and 2007 (Golder Associates 2008a), and to that reported for the upper reaches of Baker Creek unaffected by effluent discharge (INAC 2007). Total dissolved solids and total suspended solids were not elevated relative to previous years of the study, and were low in general (Appendix A, Table A-10). The water quality in Baker Creek during the spring was below the Canadian Water Quality Guidelines for the Protection Aquatic Life (CCME



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1999, 2007), except for arsenic and copper, which were slightly above guidelines. Detection limits for cadmium and selenium are not adequate to determine if concentrations are below guidelines.



4.0 DISCUSSION AND CONCLUSION

Twelve species of fish were documented in Reach 4 and in Reach 1 downstream of the culvert during the Spring and Summer 2009 Baker Creek study. The species assemblage included: Arctic Grayling, Longnose Sucker, White Sucker, Northern Pike, Lake Whitefish, Walleye, Burbot, and five small-bodied species (Emerald Shiner, Spottail Shiner, Lake Chub, Ninespine Stickleback, and Slimy Sculpin). YOY coregonids that could not be identified to species level were also captured. The use of the system by each species is discussed in the following section, with the exception of Burbot (i.e., this species occurred sporadically in study area and only a single individual was observed). The success of the 2009 program in achieving the study objectives is also discussed. This is followed by a review of the achievements of the program over the period 2007-2009.

4.1 Arctic Grayling

Observations in year 3 of the Reach 4 Monitoring Plan confirmed that, to date, the re-construction of Reach 4 on Baker Creek provides useable habitat for Arctic Grayling spawning, egg incubation and rearing of early life-stages (Figures 10, 11, 12, 13 and 14).

In 2009, adult Arctic Grayling were present in Reach 4 by late-May. Most adults had out-migrated by mid June but some YOY remained until early July. The confirmed date of first-arrival of Arctic Grayling in Reach 4 was 19 May. This timing coincides with ice breakup on Great Slave Lake and corresponds with results by other investigators who studied Arctic Grayling within the Great Slave Lake basin (Bishop 1971, Rawson 1951). The timing of spawning was approximately 20 May to 25 May, 2009, based on the developmental stage of eggs retrieved on 26 May when water temperatures were approximately 8°C (Appendix A, Table A-5). While spawning occurred over one week later in 2009 than in 2008, it was still within the known spawning times and temperatures for Arctic Grayling at similar latitudes in the southern Mackenzie Valley in the Northwest Territories (Stewart et al. 2007). Figure 17 shows a schematic of Arctic Grayling spawning times and general life history in Baker Creek.

Twenty-eight adult Arctic Grayling from Baker Creek (Reach 1 and 4) were captured and processed in 2009. They ranged from 300 to 440 mm in length (Appendix A, Table A-1). Stomach contents of preserved specimens revealed that Ninespine Sticklebacks were the primary food source in Reach 1, along with Sucker *spp.* eggs. Aquatic invertebrates made up a smaller portion of their diet. Stomach contents from Arctic Grayling captured in Reach 4 were not preserved so the diet in this reach remains undetermined.

The Baker Creek Arctic Grayling were 4 to 11 years in age (based on otolith, pelvic fin ray and scale age determination) (Table 2). The largest fish captured was 440 mm in length and age-10. Bishop (1971) examined a Great Slave Lake stock of Arctic Grayling from Providence Creek and found that individuals in the 6-to 9- year age classes made up 93.5 percent of the run. This coincides with the 2009 ageing results from Baker Creek where 7- to 9-year individuals were most frequent (Table 2).

Based on the small number of spawning adult Arctic Grayling captured in Baker Creek, it is possible, that these fish may represent a remnant stock if homing fidelity is as high as reported by Kristiansen and Doving (1996). It is also plausible that the original Baker Creek Arctic Grayling stock has been so 'depleted' that it now consists of strays from a larger population originating elsewhere in Yellowknife Bay. This assumes that the 'original' stock a size was large and was reduced through the years of Giant Mine operation; anecdotal information from local



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anglers suggest that pre-mining Arctic Grayling and Walleye were found in large numbers in Baker Creek and this changed during mining operations.

Spawning was successful and widespread in Reach 4; eggs were observed in all glides containing gravel-cobble substrate. In 2009, the range of substrate size and the overall size (i.e., larger-sized material) used during the spawning period was similar to that of 2008. Arctic Grayling eggs were present throughout areas with moderate velocity and small to medium-sized substrate. Almost all of the eggs that were observed appeared viable.

Upon hatching, yolk-sac protolarvae spend three to five days in the substrate prior to emergence (Kratt and Smith 1977, Stewart et al. 2007). Larval Arctic Grayling were observed throughout Reach 4 in shallow, slow moving areas. As they increased in size, they began dispersing throughout Baker Creek. YOY were observed in large numbers throughout Reach 3 and surprisingly, some were seen swimming upstream throughout Reach 5 (Figure 1). The mean length of Arctic Grayling YOY at emergence varies among systems but generally ranges between 7 to 15 mm (Northcote 1995). In Baker Creek, protolarval YOY ranged in size from 12.7 to 14 mm. Based on the size-at-hatching reported in the literature, it is likely that individuals measured in Baker Creek in 2009 were already a few days old. As in previous years, recently emerged YOY did not associate with any particular type of substrate. Similar to our findings, Vascotto (1970) observed recently emerged individuals in shallow, slow moving water, including shallow riffles. Lee (1985) found protolarvae in the current using rocks as velocity barriers.

During outmigration sampling (26 June to 13 July, 2009) at Stations 1 (Reach 4) and 2 (Reach 1), the size of YOY Arctic Grayling ranged from 19.7 to 65 mm. The size range was wider than reported by Jones and Tonn (2004) for YOY in BHP's artificial stream (i.e., ranged from 32 to 52 mm).



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Figure 17: Schematic Diagram of Adult and YOY Arctic Grayling and Longnose Sucker Movement, Baker Creek, 2009



4.2 Longnose and White Sucker

As in 2007 and 2008, Longnose Suckers used Reach 1, downstream of the culvert and Reach 4 for spawning. In late May 2009, Longnose Suckers were observed spawning throughout Reach 1. Spawning in Reach 4 was limited to a single riffle. While in 2008, the earlier freshet and subsequent reduced flow rates during Longnose Sucker spawning could have allowed many fish to migrate upstream. Increased flows over a prolonged period in 2009, likely posed a temporary barrier to upstream movement.

During the 2009 surveys, Longnose Suckers (floy tagged in 2007) were observed on numerous occasions while snorkelling downstream of the culvert, confirming some degree of site fidelity by adult spawners.

Fewer White Suckers were captured in 2009 (7 fish) than in 2008 (13 fish). However, large numbers were observed during daily snorkelling observations throughout Reach 1. Despite the increased sightings of White Suckers, Baker Creek is predominantly used by spawning Longnose Suckers.

4.3 Northern Pike

Northern Pike are thought to spawn at the mouth of Baker Creek where shallows with abundant flooded aquatic vegetation provide suitable habitat for egg deposition (Golder 2008a, 2009b). Many of the Northern Pike holding in Reach 1 were ripe; ripe females were captured as late as 2 June and 5 June, 2009. Why Northern Pike would hold in such swift waters prior to spawning and why they would spawn so late in the season remains unknown. Northern Pike may also use the habitat downstream of the culvert for feeding. Northern Pike were seen in Reach 4 swimming upstream; it is not known if these individuals were migrants from Great Slave Lake or residents of Baker Creek. While Reach 4 does not offer suitable habitat for Northern Pike, much of the watershed downstream and upstream of the reconstructed area offers prime habitat.

4.4 Lake Whitefish

Adult Lake Whitefish were frequently captured or observed in Reach 1 downstream of the culvert. Daily mean temperatures never exceeded the tolerance range of this species. Benthic organisms and aquatic insects were observed while snorkelling downstream of the culvert, indicating this area could provide feeding habitat for adult Lake Whitefish. Also, Whitefish were observed dislodging small pebbles and gravel substrate and feeding on exposed Longnose Sucker eggs. The presence of numerous spawning fish would provide Whitefish with a lipid-rich dietary source. Lake Whitefish were not observed after 12 June except on rare occasions. The reason for their departure was likely increasing water temperatures. Unlike previous years, in 2009 large numbers of juvenile coregonids were observed and captured in Reach 0 at the end of the breakwater. The presence of such large concentrations may indicate that the area provides critical habitat for juvenile age classes.

One Lake Whitefish was observed in Reach 4 on 8 June. Based on observations in all three years of the study, it seems that Lake Whitefish from downstream of the culvert may make periodic forays into upper Baker Creek, possibly for feeding.

4.5 Walleye

Traditional Knowledge obtained from Yellowknife Dene First Nation elders (Yellowknives Dene First Nation 1997), and anecdotal information from local anglers, suggests Walleye were present in the Baker Creek in the past and may have spawned in the stream. Walleye were not observed or captured during the 2007 and 2008 spring netting and snorkeling at Baker Creek, or in two years of summer electrofishing and netting in the mouth



of Baker Creek for fish health studies (Golder 2008a, 2008b, 2009) or in past fresh surveys of the creek (Dillon 2002). It is unknown if chemical/physical barriers (e.g., the mine effluent or historical culvert height), local overfishing, or other factors restricted Walleye from Baker Creek. The results of the 2009 survey indicate that a small number of adult walleye enter Baker Creek. Based on water temperatures at the time of their capture and the extended duration of their residency, these fish may have entered Reach 1 for spawning purposes. However, spawning behaviour was not observed and Walleye were generally alone rather than in pairs or groups. The single walleye captured in Reach by seining was present well after spawning would have been completed (based on water temperature), suggesting that the stream may offer early summer feeding habitat for adults as well as spring spawning habitat. There is no evidence that Walleye are present in Baker Creek on an annual basis; the flow and temperature regimes during the spring are likely determining factors. Sampling carried out in 2009 was the first attempt to locate Walleye in the system using active sampling methods (combination of seining, and daily snorkelling). It is possible that a repeat of such efforts may yield similar results on an annual basis.

4.6 Small-Bodied Species

Snorkelling in 2009 revealed concentrations of Ninespine Stickleback in areas of turbulent flow directly downstream of the culvert in Reach 1. The lower portion of Baker Creek, downstream of the culvert, offers a variety of habitats for small-bodied fish, and Ninespine Stickleback use the area for spawning, foraging, spawning and as a likely nursery for YOY. With the exception of one YOY individual captured in Reach 4, all Ninespine Sticklebacks were captured or observed in Reach 0 or Reach 1. It is not known if this species is present in Baker Creek upstream of Reach 4.

Emerald Shiners, Lake Chub, and Spottail Shiner used habitats near the mouth of the creek. Habitat preferences were apparent with Emerald Shiners periodically venturing into faster waters with rock substrate while Lake Chub and Spottail Shiners remained in the slack waters with fine sediment substrate and abundant aquatic vegetation.

While small-bodied species were present throughout Reach 1, enormous concentrations of YOY and juveniles were regularly observed in Reach 0 at the Baker Creek-Yellowknife Bay confluence. This site combined slow current, areas of silt and gravel substrate, and aquatic vegetation and provided nursery habitat for wide range of species.

4.7 Food Availability in Reach 4

Past studies of benthic invertebrates in the creek (i.e., Falk et al 1973; Moore et al. 1978; Dillon 1998, 2002a, 2002b; Golder 2008b) are not directly comparable because of differences in sampling methods, timing, location and taxonomic resolution. The results from most of these surveys indicate Chironomidae and Oligochaeta were the predominant taxa within the downstream portion of Baker Creek. Dillon (2002a) reported low numbers of benthic invertebrates, but sampling was completed in mid-October under early winter conditions. Dillon (2002b) also reported low benthic invertebrate abundance in Baker Creek, but observed Ephemeroptera, Trichoptera, and Chironomidae, which would provide good fish forage.

Juvenile and adult Arctic Grayling are opportunistic sight predators (Stewart et al. 2007, Bishop 1967). Unlike Reach 1 where fish eggs and small-bodied fish are the primary prey items for adult Arctic Grayling, terrestrial and aquatic originating seasonally available macroinvertebrates are the likely food source for adult and juvenile



Arctic Grayling in Reach 4. Jones et al. (2003) found that YOY Arctic Grayling in tundra lake-outlet streams in the Northwest Territories barrens consumed a combination of Chironomidae and Simuliidae.

The presence of a stable food source is critical for the survival of YOY Arctic Grayling. Newly hatched Arctic Grayling feed on zooplankton but as they grow, small insects begin to make up a large portion of their diet (e.g., Chironomidae and Simuliidae); (Jones et al. 2003). These prey items were available in Baker Creek during the YOY growth period prior to outmigration. During outmigration, the Arctic Grayling were likely feeding on a variety of invertebrates throughout the water column.

The availability and abundance of food items for both YOY and adult Arctic Grayling in Reach 4 is strongly linked to the productivity of Baker Pond in Reach 6 and the wetland habitat in Reach 5 (Figure 1). A detailed study of that reach of stream has never been carried out. Jones et al. (2003) noted that production capacity of Arctic Grayling in streams was largely dependent on in-stream invertebrate production, regardless of the contribution of lake-derived microcrustacea to the in the drift.

Factors that may increase food availability in Baker Creek over time for the various fish life-stages include temperature, flow, and habitat changes upstream, nutrients, water quality and growth of riparian vegetation. Aquatic plants along the stream bank could help regulate water temperature or provide habitat for terrestrial insects consumed by Arctic Grayling (SRK 2009).

4.8 Stream Conditions

Maximum daily water temperature in Baker Creek in 2009 was 21.5°C. Because the temperature logger installed in Baker Creek had mechanical problems, and hourly temperature data could not be downloaded, the daily temperatures were taken using a hand held thermometer. Therefore, higher temperatures may have occurred for periods but went unrecorded. The known lethal temperature limit for juvenile Grayling is 24.5°C (LaPierre and Carlson 1973), and at temperatures above 22.5°C, young Grayling can be stressed and growth rates can be negatively affected (Sandrine et al. 2006). Adult Arctic Grayling become physiologically stressed when water temperatures reach 17.2°C (Wojcik 1955). In 2009, adult Arctic Grayling remained in Baker Creek until the end of June at which time they left the system. Although water temperatures reached approximately 21.5°C, the outmigration was likely more correlated with food availability and/or their developmental stage, rather than temperature. This tentative conclusion was reached because there was a general decrease in temperature during the final days of the adult Arctic Grayling residency in Reach 4. Based on the 2009 data, water temperature did not stress or threaten the survival of YOY and adult Grayling in Baker Creek.

In 2009, freshet occurred later and was more protracted than in 2008. This resulted in some adult Arctic Grayling migrating upstream prior to peak freshet. During high flows, adult Arctic Grayling were seen trying unsuccessfully to negotiate the culvert. As discharge decreased, a second wave of migrating adults apparently made their way to Reach 3 and Reach 4. In early July 2009, Baker Creek stream flow was supplemented with treated effluent from the mine. Discharge increased at this time; however, this occurred towards the end of YOY Arctic Grayling outmigration but entirely overlapped with YOY Longnose Suckers outmigration.



4.9 Substrate Composition at Arctic Grayling Spawning Sites

As in previous survey years, continual monitoring of substrate composition was considered essential. Substrate provides the micro-habitat conditions needed by many fish and invertebrate species (including cover and spawning habitat). Major fluctuations in runoff can affect sedimentation rates, and these processes are often reflected in the size composition of the substrate.

The goal of substrate characterization was to describe the dominant streambed material, the variability in the mixture of material that makes up the substrate, and to provide baseline data for measuring change in substrate composition as Reach 4 matures.

Embeddedness refers to the accumulation of fine sediment around coarse substrates on the surface of a streambed. This parameter provides a measure of the degree to which larger substrate is covered with finer particles, and is a useful tool to assess quantity and suitability of fish spawning and macroinvertebrate habitat. Embeddedness can adversely affect permeability and inter-particle dissolved oxygen which in turn, reduces spawning success and stream productivity (Cordone and Kelly 1961).

Embeddedness was calculated at Arctic Grayling egg deposition sites in Baker Creek. Currently, silt deposition in Baker Creek at almost all egg sites is negligible to low, although higher levels of accumulation were noted in the slower portions of runs and deep holes throughout Reach 4.

Baker Creek lies on a zone of discontinuous permafrost. Reach 4 has been identified as having over 20% permafrost and/or ground ice (SRK 2009). Slight shifting of the stream bed was likely due to the changing ice conditions underground. As of 2009, Reach 4 had experienced a loss of 118.8 m² of spawning habitat. This loss was due to the transformation of the lower most riffle/run spawning area into a slow run/pool environment. Although spawning area measurements in 2009 did not include all the glides assessed in 2008 it appears that the only significant loss of spawning habitat was associated with disappearance of the large lowermost riffle/run spawning habitat.



4.10 Achievement of 2009 Study Objectives

The 2009 study objectives, and the activities carried out to meet them are summarized in Table 10.

Table 10 Summary of Study Objectives and Results, Reach 4, Spring and Summer 2009

Objective #	Objective	Objective Achieved	Result
1	Characterize biological attributes of Arctic Grayling and estimate the abundance of Arctic Grayling and Longnose Sucker spawners in Reach 4;	✓	More information obtained on Arctic Grayling spawning and spawning periodicity. Crude estimate of abundance based on snorkeling and shore-based observations
2	Locate and characterize habitat at Arctic Grayling and Longnose Sucker spawning/egg deposition sites in Reach 4	✓	Spawning habitat similar to areas used in previous years. Detailed embeddedness measurements taken for most of Reach 4.
3	Determine Walleye presence/absence in Reach 4	✓	Walleye presence confirmed in Reach 1. No walleye seen in Reach 4.
4	Determine Arctic Grayling young-of-the-year (YOY) size by larval stage in Reach 4	✓	YOY sampled during the course of their development in Reach 4. Size range obtained by measurements of many individuals during each developmental stage
5	Determine Arctic Grayling YOY habitat and food availability in Reach 4	✓	YOY habitat determined at 6 transects. Food availability was determined on a presence/absence species basis
6	Determine Arctic Grayling YOY outmigration density and timing.	✓	Baseline information obtained for both YOY Grayling and YOY Longnose Suckers. YOY Arctic Grayling almost completely out-migrated by time of effluent discharge
7	Collection and archive of sediment and YOY Arctic Grayling	✓	Eight adult and 7 YOY Arctic Grayling were collected from Reach 4; 7 YOY were collected from Reach 0; 1 sediment sample was collected from the pool near Riffle 2.



4.11 Key Findings of Study Program (2007-2009)

A summary of data qualifying and quantifying the habitats that proved successful for adult Arctic Grayling and Longnose sucker reproduction in 2009 was generated (Table 11).

Table 11 Summary of Life Stage and Habitat Utilization for Arctic Grayling in Reach 4, 2007 to 2009 inclusive

Life Stage	Habitat Characteristics				Substrate	Velocity	Figure
	Glide	Riffle	Run	Pool			
Egg	✓				Eggs deposited in interstitial spaces of substrate measuring 2-5 cm in 2007 and 0.5-18 cm in 2008 and 1 to 30 cm in 2009	Egg sites are in areas with moderate bottom velocities (0.27-0.96 m/s in 2007 and 0.26-0.7 m/s in 2008 and 0.03 to 1.79 m/s in 2009)	Figure 11
Emergence/Protolarvae	✓ near shore		✓	✓	Upon emergence, larval Arctic Grayling remain in gravel for 2-4 days. Protolarvae are associated with silt but this may be an artifact of holding in slow flow areas.	Protolarvae seek out slowest flows and prefer areas with zero or negligible current (0-0.2 m/s)	Figure 12
Mesolarvae	✓		✓	✓	This stage highly associated with gravel substrate and boulders	Mesolarvae prefer water velocities ranging from 0.10 to 0.15 m/s	Figure 13
Juvenile		✓	✓		Juveniles are restricted to flowing waters and appear to be feeding on prey items in the drift. Avoidance of slack water.	Downstream of and in riffles where velocities range from 0.35-0.68 m/s in 2007 and 0.87 to 3.19 m/s in 2008	Figure 14
Adults	✓ spawners		✓ Post-spawn	✓ Post-spawn	Spawners seek out areas with medium to large gravel with good intergravel space in which eggs can settle	Spawners prefer areas of moderate flow above riffles	Figure 10

Notes: cm = centimetre; m/s = metres per second; ✓ = present in area.

During the three field seasons of this survey, Reach 4 was found to be successfully used by all life stages of Arctic Grayling and Longnose suckers. In the two years where spawning site availability was measured, there was over 135m² of available habitat where substrate and velocities were favourable for spawning, despite the loss of an entire glide/riffle interface.

In all years of the study, egg incubation and emergence was successful with a seemingly high survival rate of YOY during the critical period (when internal nutrient reserves are extirpated and exogenous feeding begins). The success of Reach 4 as a spawning site and nursery grounds for YOY Grayling and Longnose suckers is likely based on a combination of hydrological and environmental conditions.

The outmigration of Arctic Grayling from Baker Creek during 2007 and 2008 occurred primarily in late June (Figure 17) before treated effluent from the Giant Mine was discharged. However, in 2009 cold spring temperatures delayed spawning and the later out-migration of YOY Grayling slightly overlapped with effluent discharge. The outmigration of YOY Longnose suckers was first investigated in 2009 and revealed that peak outmigration occurred during discharge of treated effluent.

In 2007, adult Arctic Grayling spawned and then migrated downstream to Great Slave Lake shortly afterwards (i.e., late May). In contrast, during 2008 and 2009, Arctic Grayling remained in Reach 4 well after spawning was



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complete. In 2008, the numbers of adult Arctic Grayling decreased after 19 May to less than five individuals, but peaked again at approximately twenty fish in early June. In 2009, the highest number of Grayling observed in Reach 4 occurred when 23 were observed on 5 June. On that day, water temperature was 8.7 °C and likely was the end of the spawning period.

In 2008, adult Arctic Grayling inhabited Reach 4 until approximately 11 June. Feeding activity of adults was carefully noted by snorkelling and shore based observations. Prior to spawning, Arctic Grayling appeared to only feed incidentally, if at all and never actively pursued prey items. After spawning, individuals moved from the glides into the riffles or upper runs, where they actively pursued prey in the drift and from the surface. In 2009, adult Arctic Grayling were seen actively feeding in Baker Creek until mid June but had apparently out-migrated en masse by 20 June, 2009.

Arctic Grayling feeding behaviour in Reach 1 was extensively observed in 2009. Primary food items found in the stomachs of preserved specimens consisted of ninespine sticklebacks, aquatic invertebrates and sucker eggs.

Reach 1 below the culvert (Reach 1) was documented as a spawning site by large-bodied fish as well as serving as a staging area for migrating species traveling upstream to Reach 3 and 4 (Golder 2008a, Golder 2009a). While glides typically required by Arctic Grayling for spawning are of limited availability, some Grayling spawning was observed in 2009. However, the large areas of riffles and runs that typify Reach 1 provide ideal spawning habitat for Longnose and White Suckers. The presence of small-bodied fish throughout Reach 1 also provides feeding habitat for predators such as Northern Pike and possibly walleye. Walleye were not observed during the 2007 and 2008 field season. However, in 2009, the regularity of Walleye observations throughout Reach 1 would suggest a small remnant population uses Baker Creek.

As of 2009, Reach 4 had experienced a loss of 118.8 m² of spawning habitat. This loss was due to the transformation of the lower most riffle/run spawning area into a slow run/pool environment. Although spawning area measurements in 2009 did not include all the glides assessed in 2008 it appears that the only significant loss of spawning habitat was associated with disappearance of the large lowermost riffle/run spawning habitat.

Though not a requirement of this study, the vegetation on the shores of Reach 4 was observed and photographed. Plant growth appears limited (see June 20, 2009 photograph in Appendix B) and overhead cover is non-existent. The lack of cover for fish may be a problem in future if stream temperatures rise or water levels drop.

The three years of The Monitoring Plan demonstrated that the fish habitat compensation works implemented in 2006 functioned as intended; providing spawning and rearing habitat for fish (Fisheries Authorization YK-06-0063, Section 5). While the newly created habitat in Reach 4 can be considered successful, the loss of an entire glide/riffle interface in lower Reach 4 is cause for concern. With a loss of a significant portion of Reach 4 spawning habitat for Arctic Grayling and suckers, the remaining areas used for various life stages of adults and YOY require ongoing monitoring.



5.0 RECOMMENDATIONS

Based on the findings of the three-year (2007-2009) fisheries program in Baker Creek, the following recommendation is made:

- 1) Annual monitoring of habitat conditions with particular reference to documentation of changes in the availability and quality of Arctic Grayling spawning areas such as occurred at the lowermost riffle/glide interface in Reach 4 (Riffle 7).

Additional science-based initiatives in relation to Baker Creek and Arctic Grayling are possible and will be discussed under separate cover with INAC and DFO.



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Report Signature Page

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APPENDIX A

Raw Data



APPENDIX B

Photo Journal



APPENDIX C

Developmental Stages of Arctic Grayling in Baker Creek

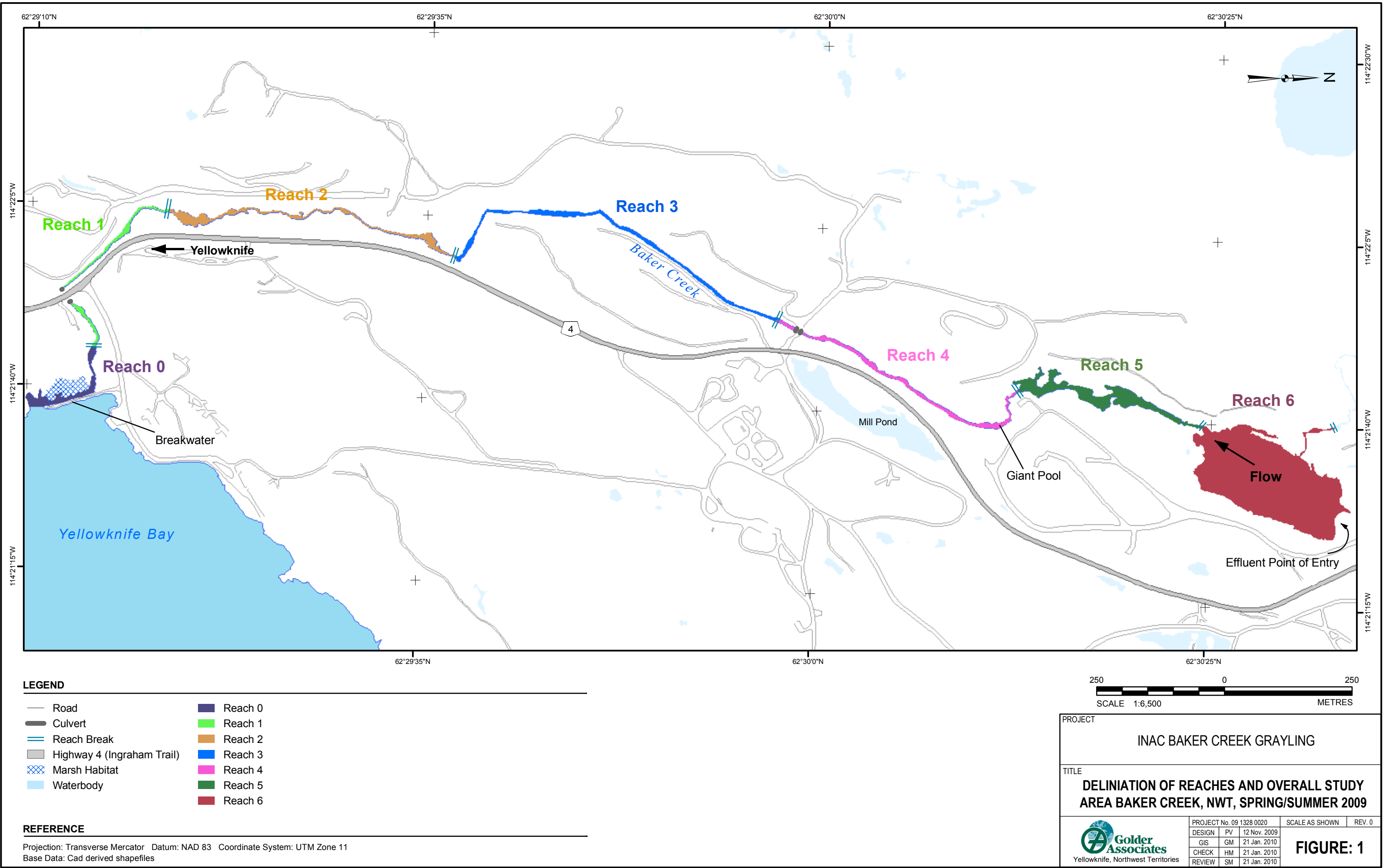
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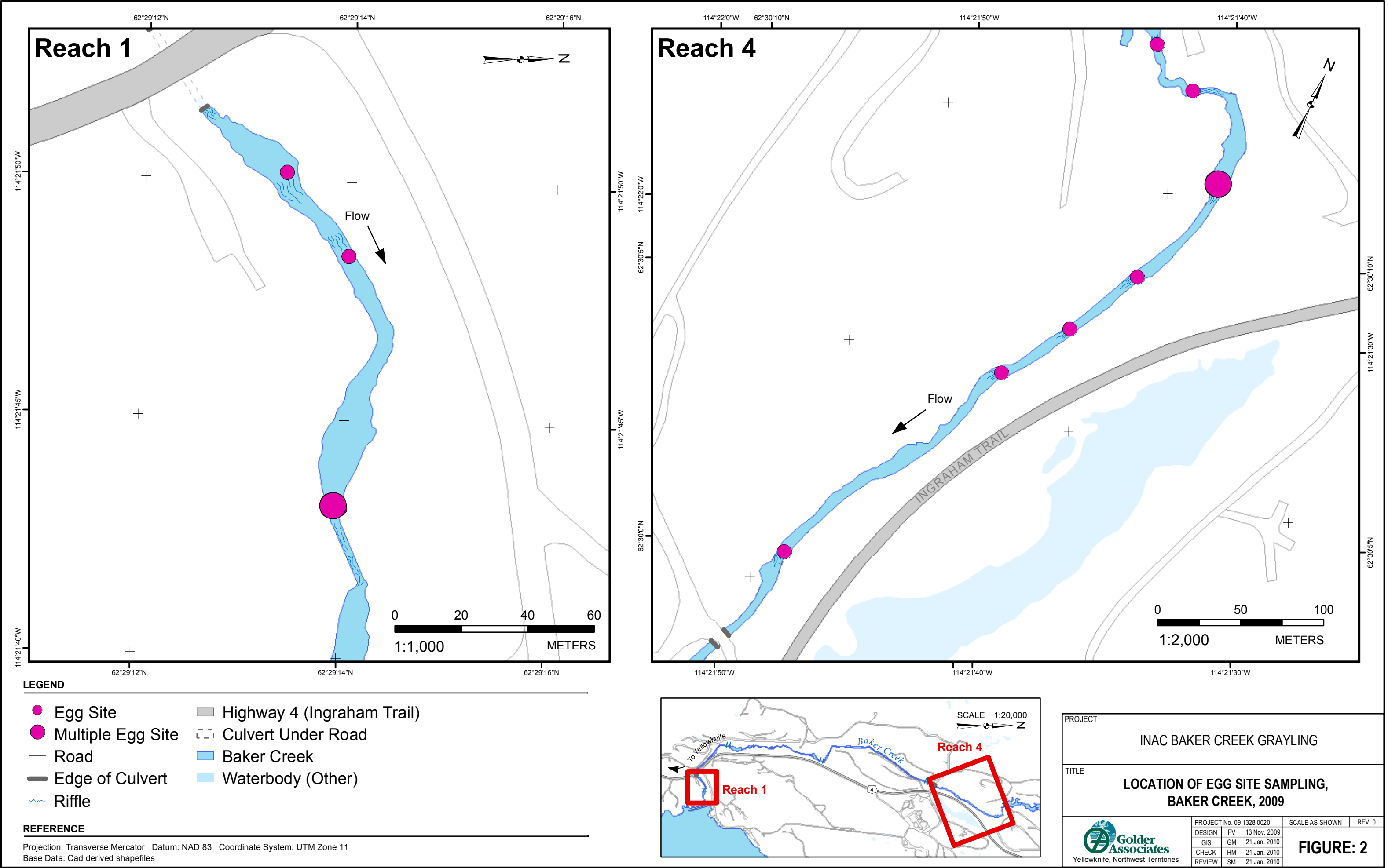
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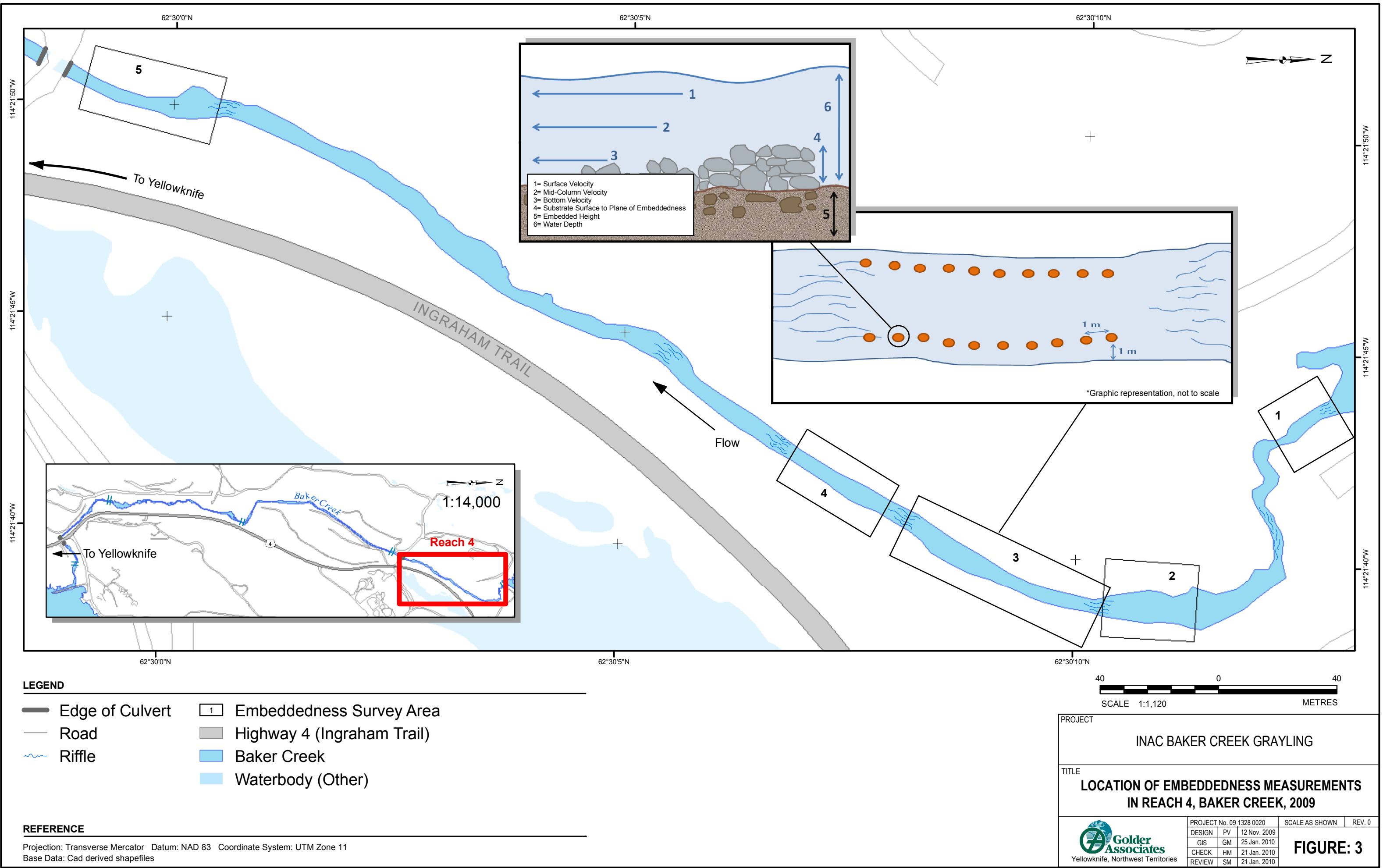
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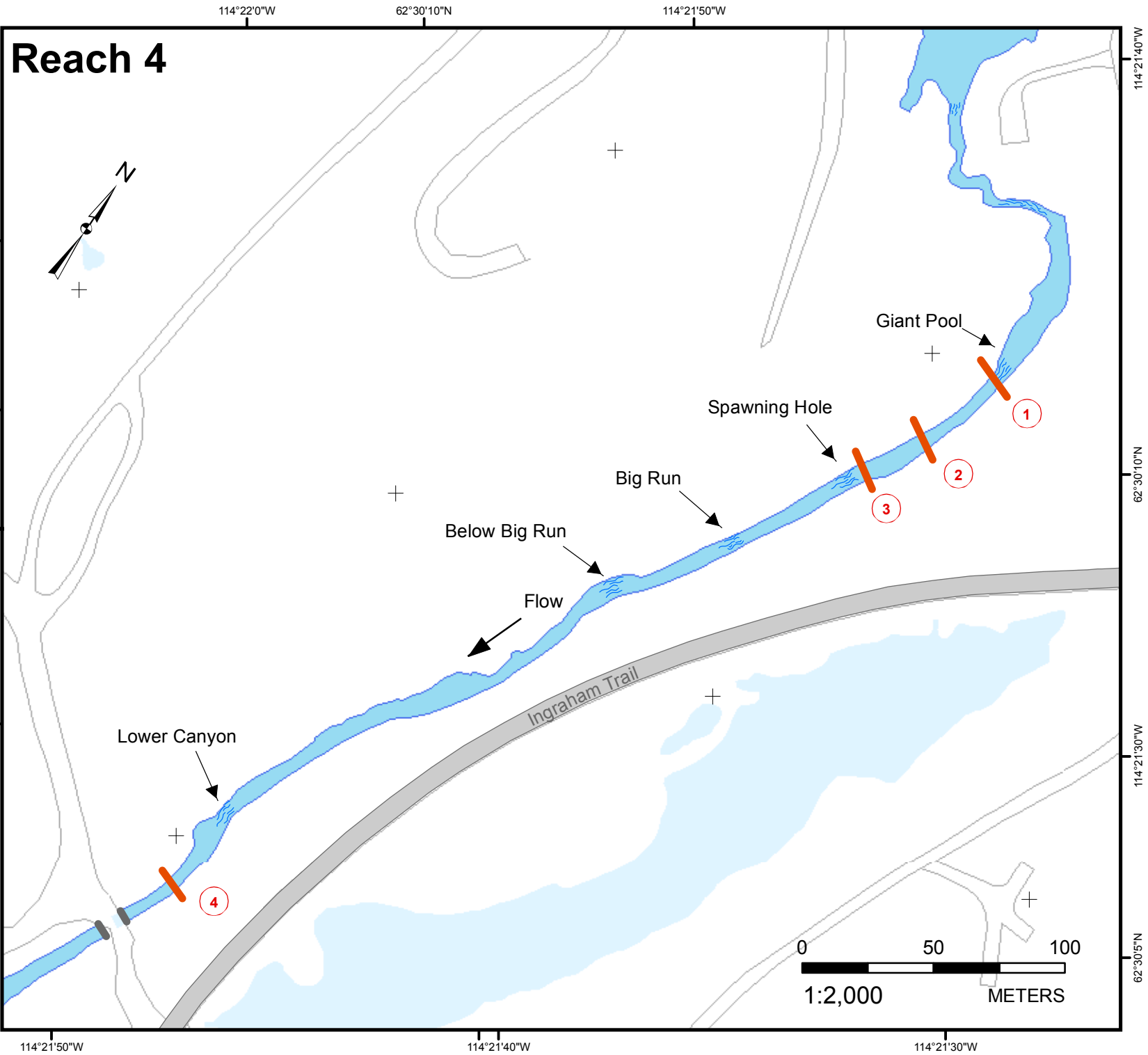
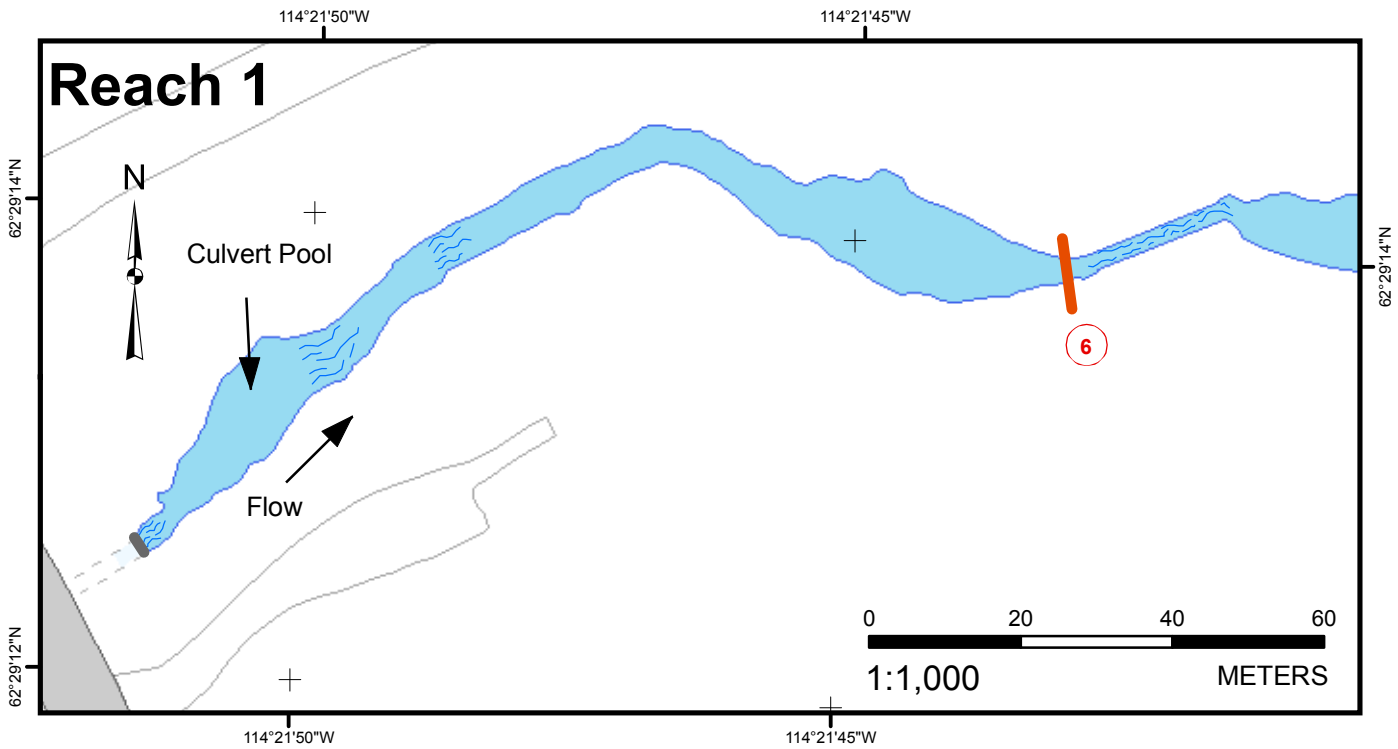
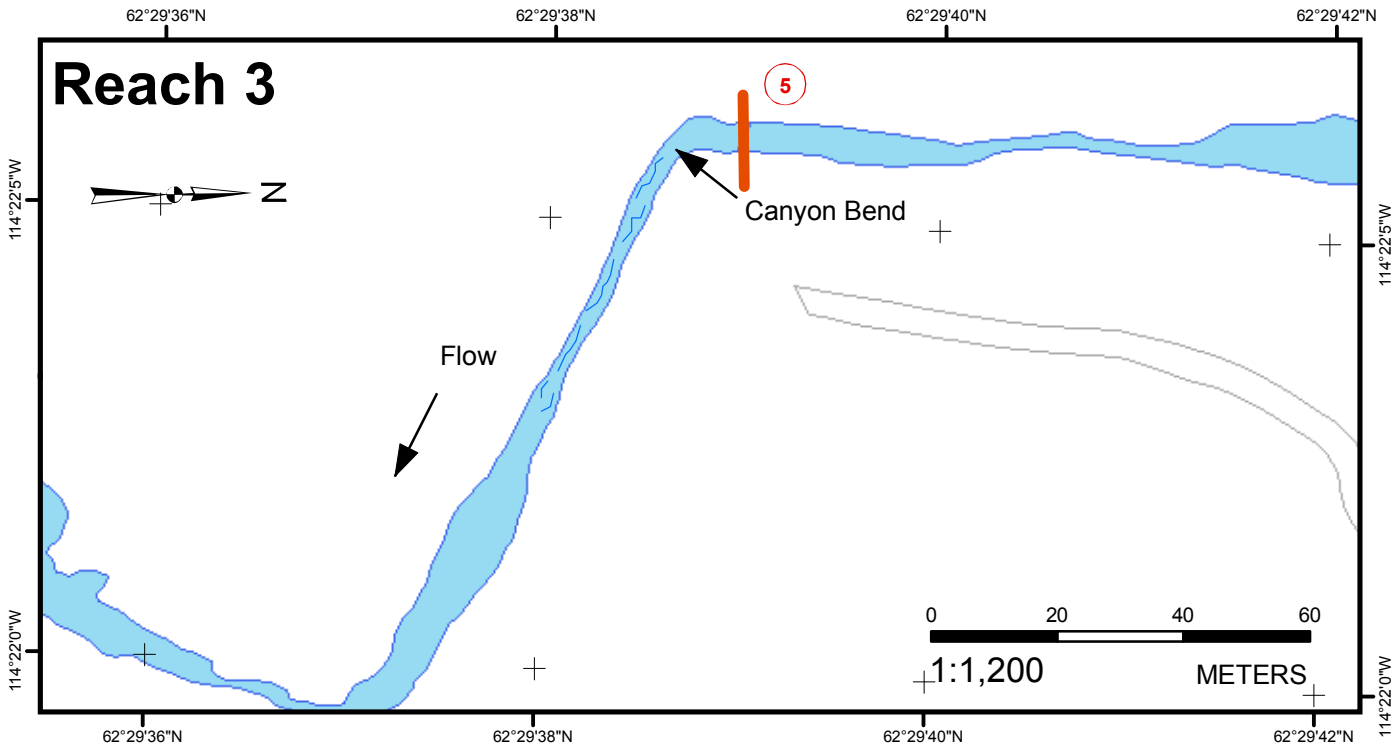
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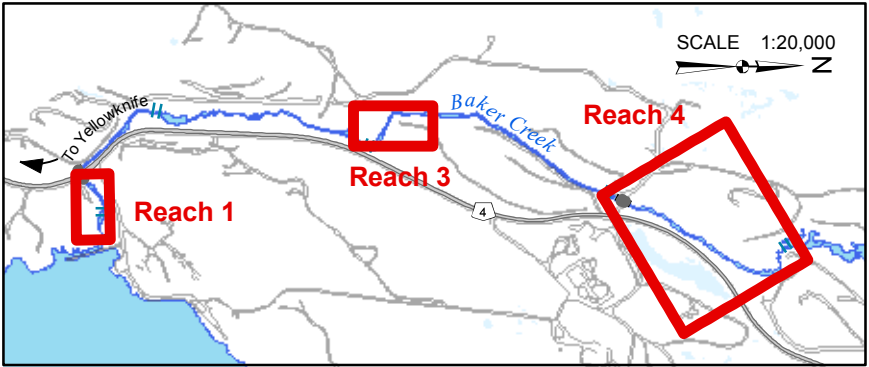



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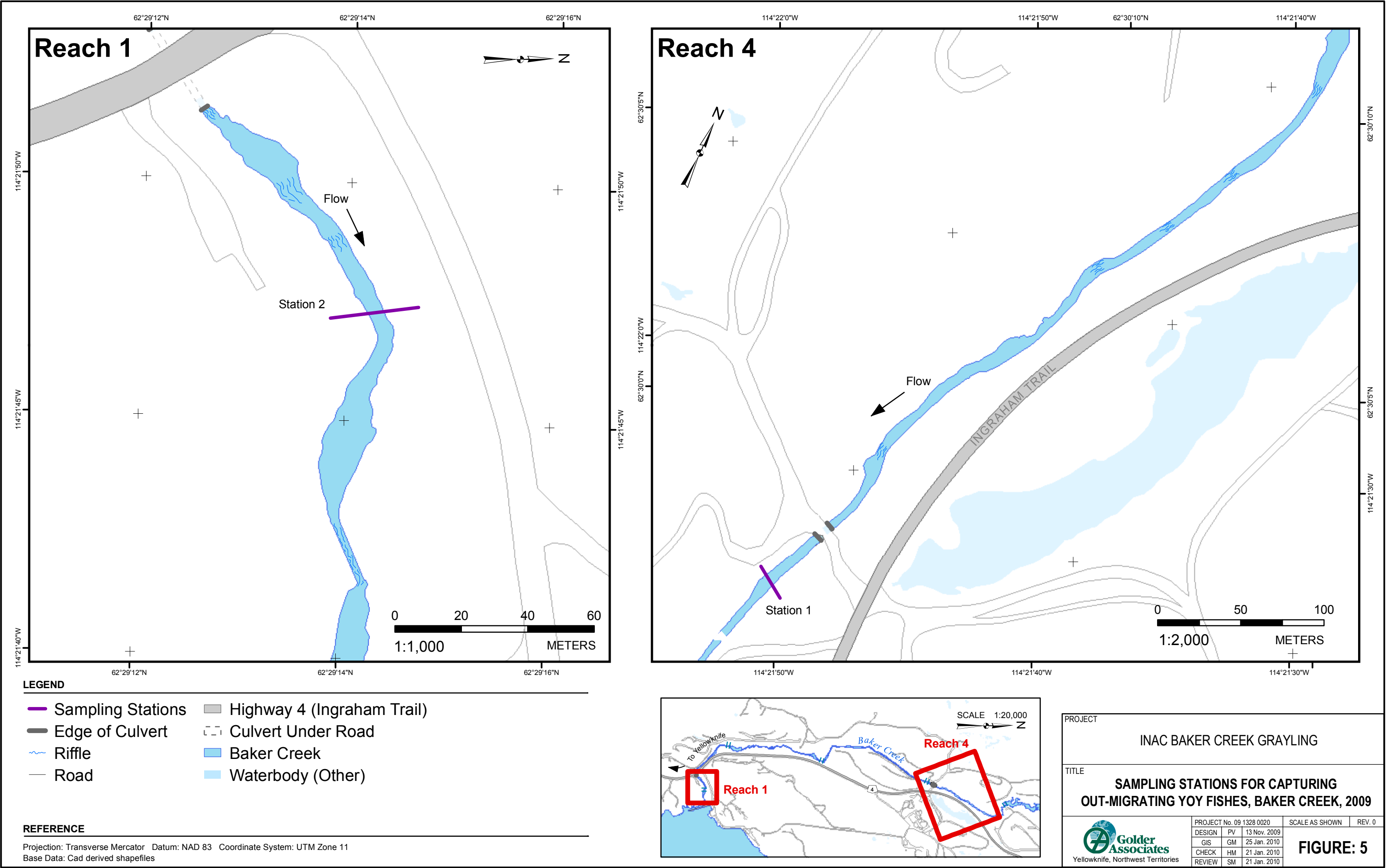
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- Riffle
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- Culvert Under Road
- Baker Creek
- Waterbody (Other)

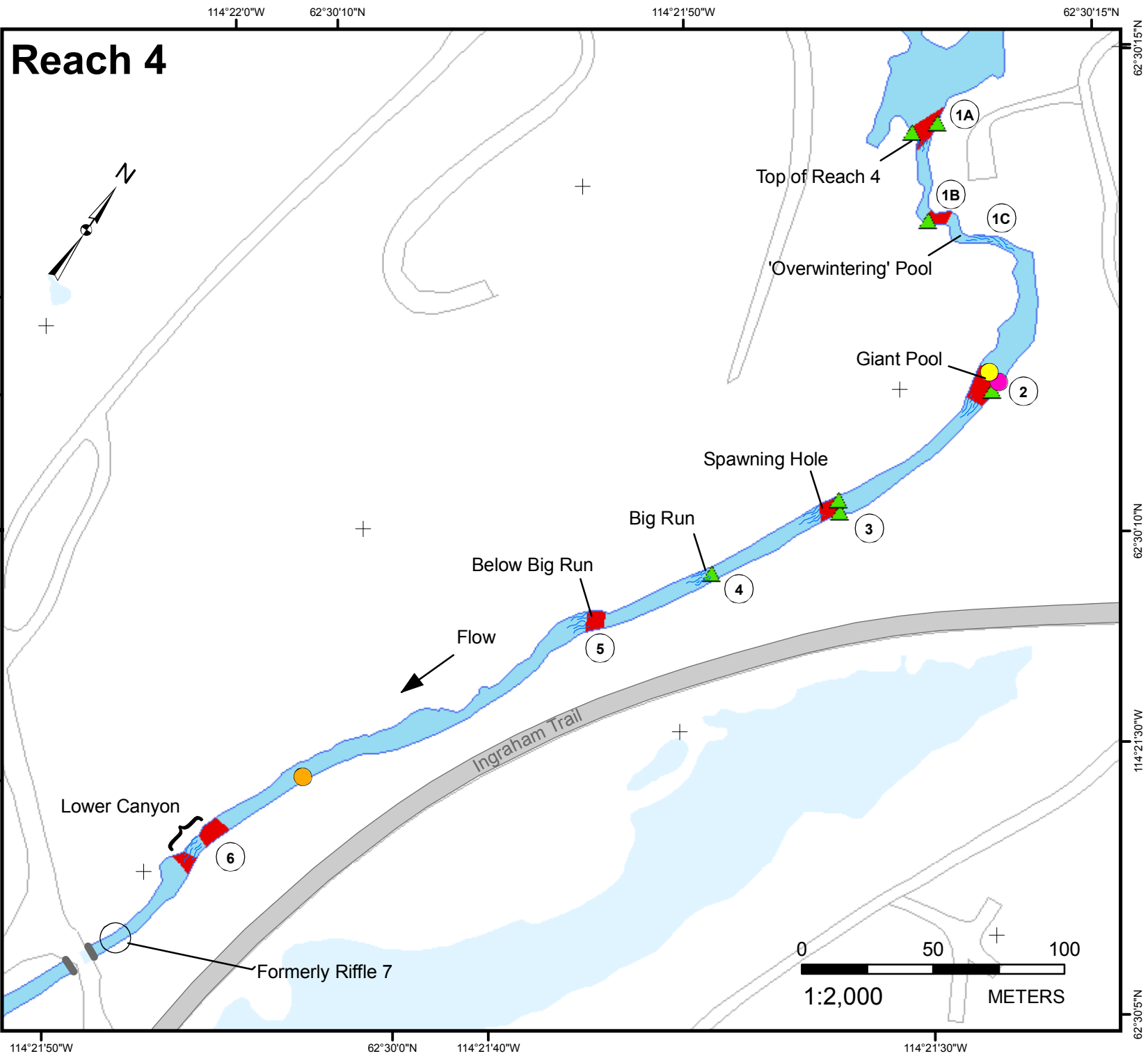
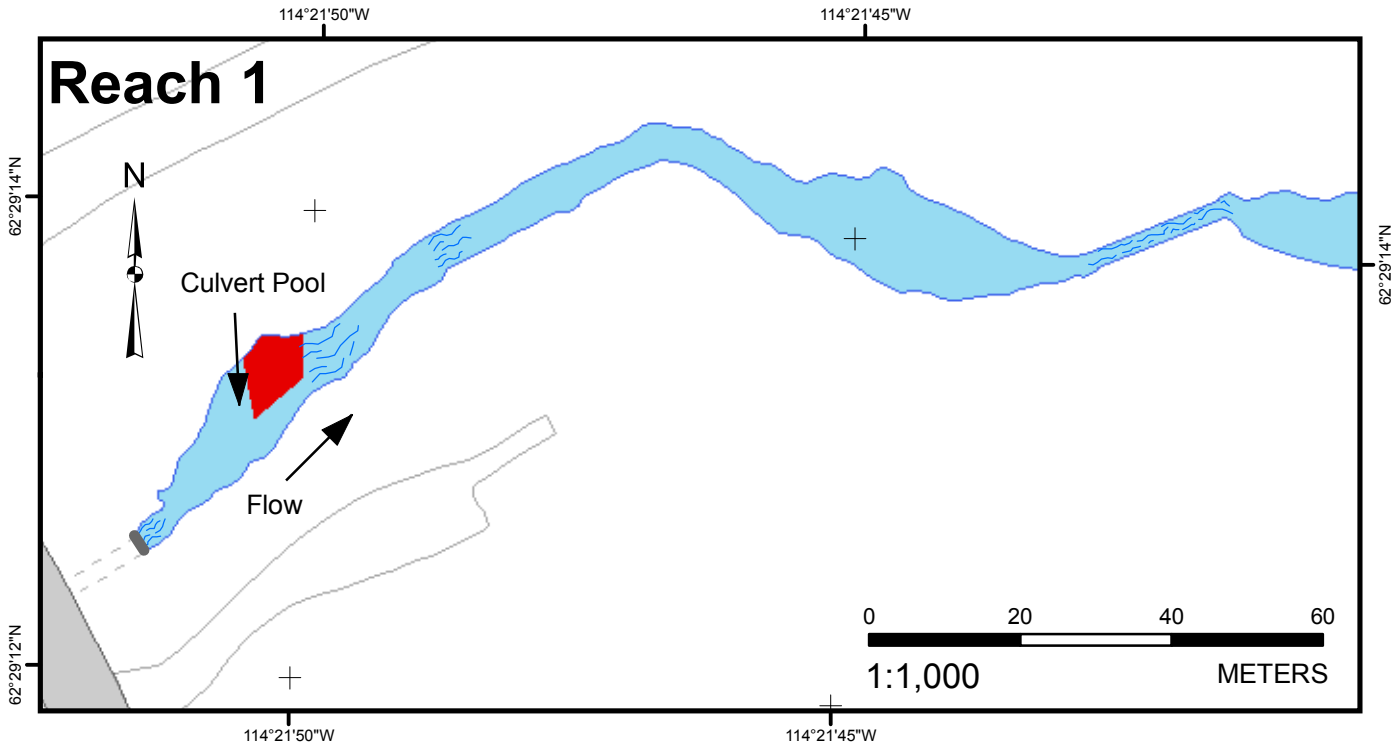
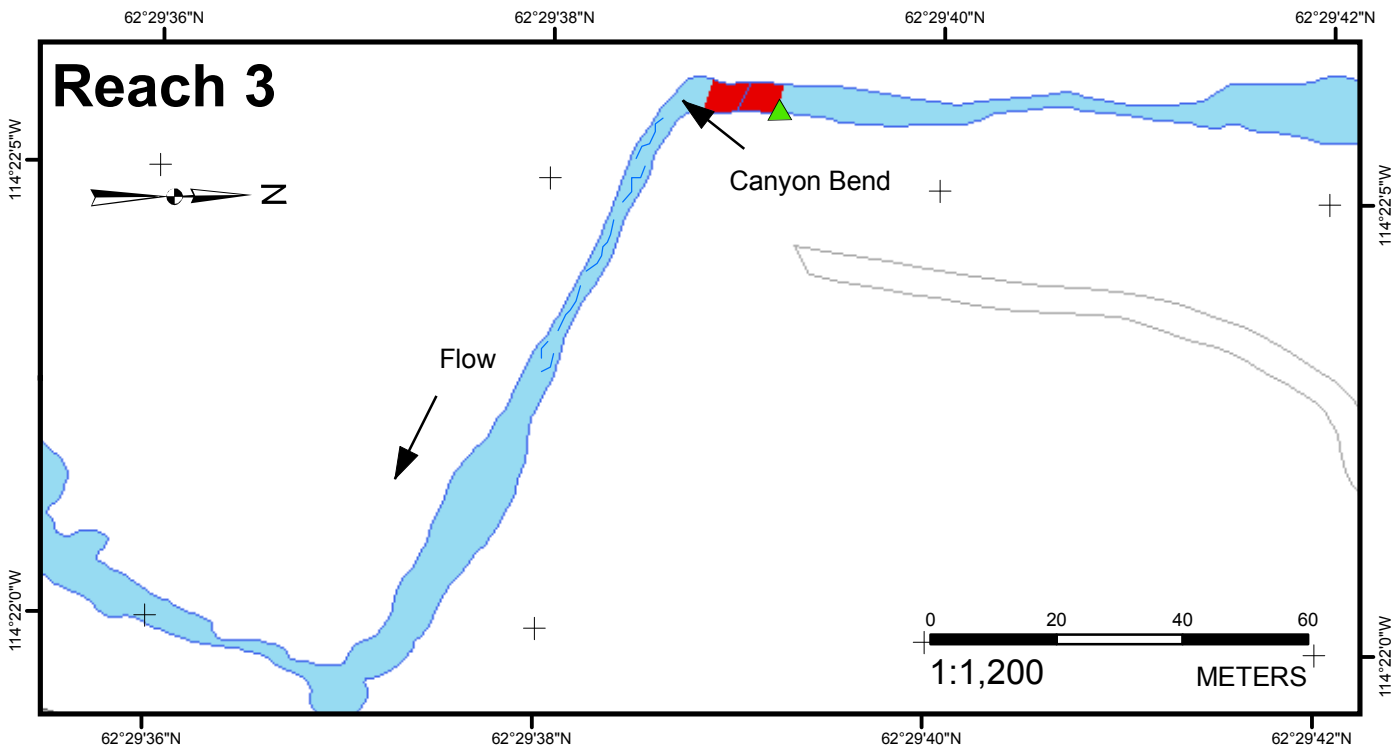
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	CHECK	HM	21 Jan. 2010	
	REVIEW	SM	21 Jan. 2010	





LEGEND

- ▲

 Substrate Measurements

●

 Benthic Sample

●

 Plankton Sample

●

 Water Quality Sample
- Edge of Culvert

—

 Road

—

 Riffle
- Measured Spawning Area

■

 Highway 4 (Ingraham Trail)

■

 Culvert Under Road

■

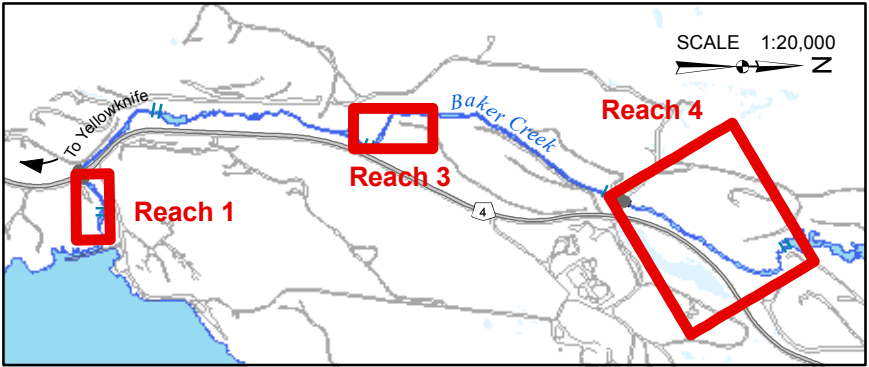
 Baker Creek

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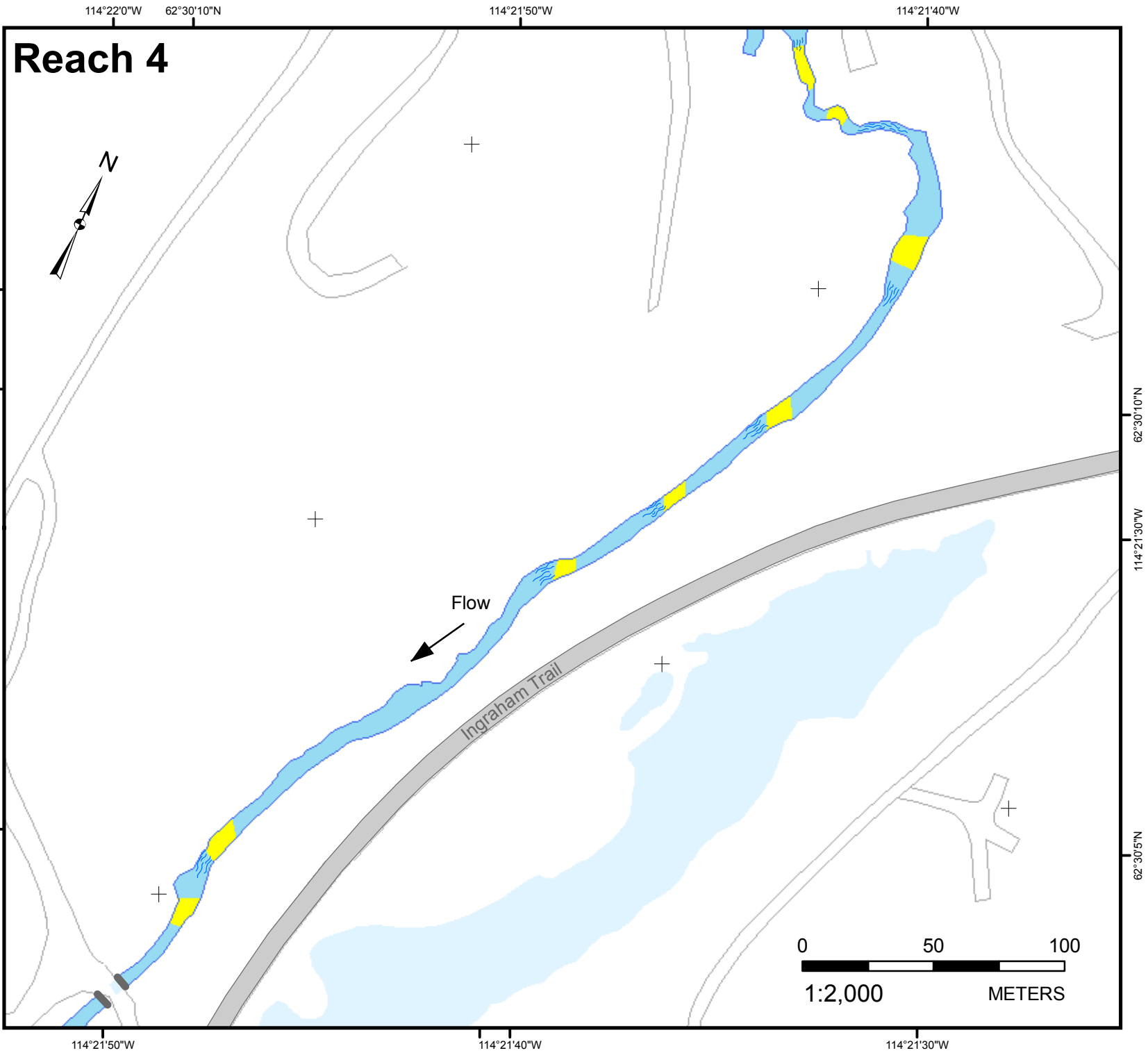
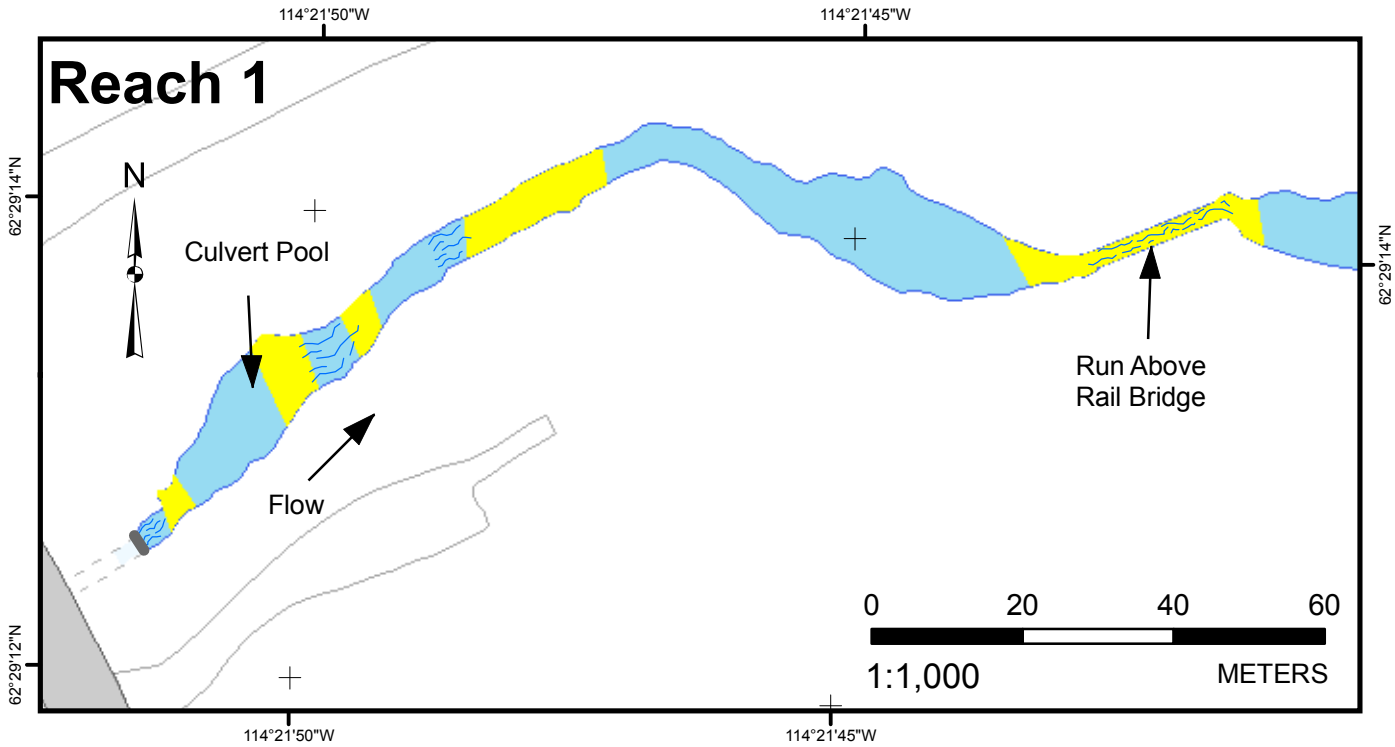
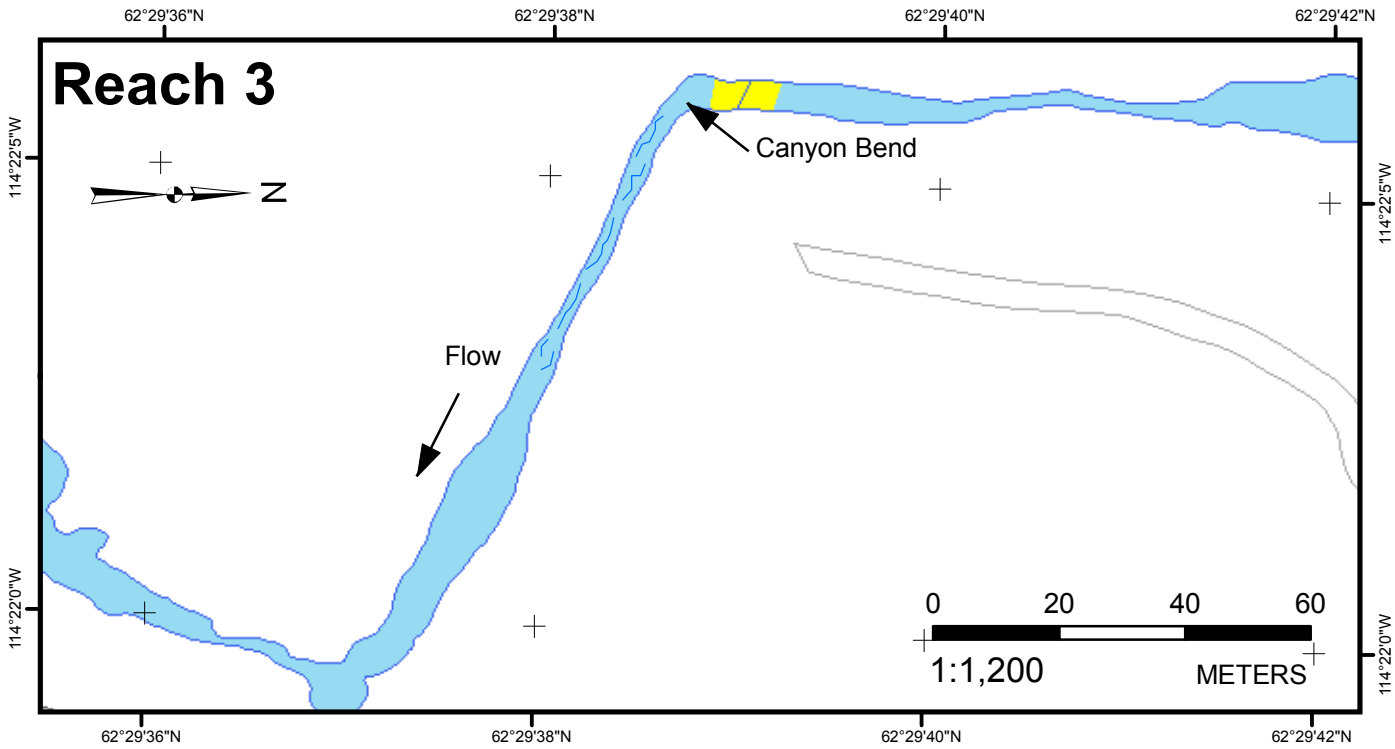
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Base Data: Cad derived shapefiles



PROJECT	INAC BAKER CREEK GRAYLING			
TITLE	LOCATIONS OF HABITAT MEASUREMENT, BAKER CREEK, 2009			
<div><div><div><div></div><div></div></div><div><div>Golder Associates</div><div>Yellowknife, Northwest Territories</div></div></div></div>	PROJECT No. 09 1328 0020		SCALE AS SHOWN	REV. 0
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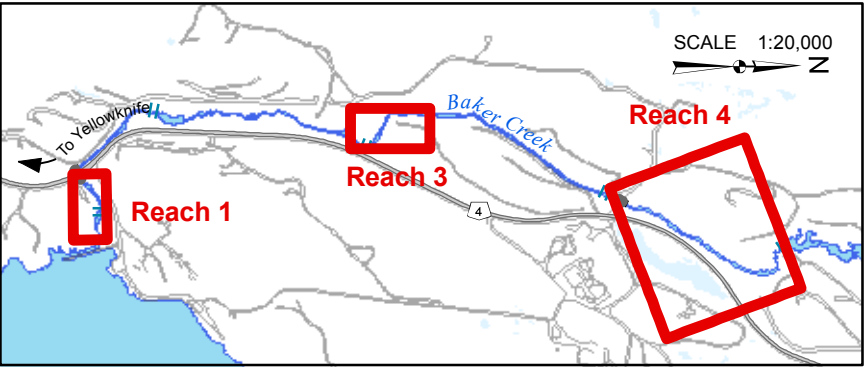



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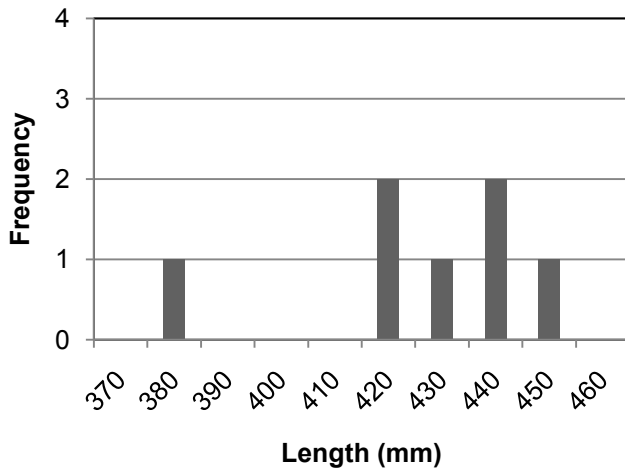
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- Spawning Area
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- Culvert Under Road
- Baker Creek
- Waterbody (Other)

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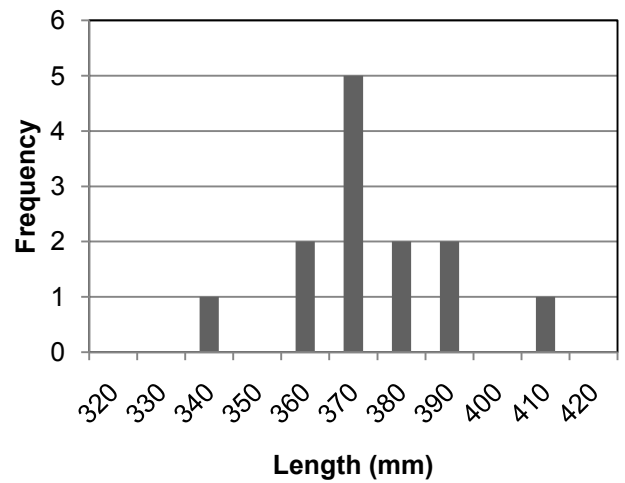
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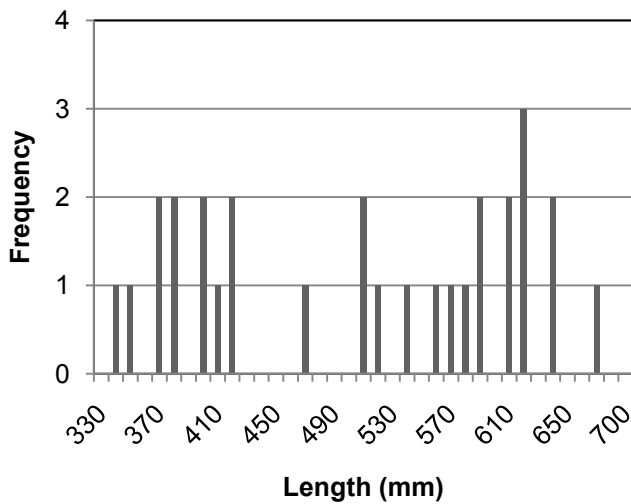
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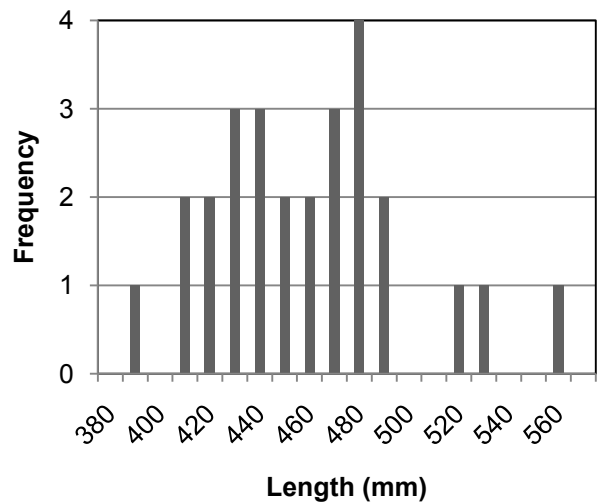
a) White Sucker



b) Lake Whitefish



c) Northern Pike



d) Longnose Sucker



LENGTH-FREQUENCY HISTOGRAMS OF
LARGE-BODIED FISH, BAKER CREEK, 2009

DRAWN: PS

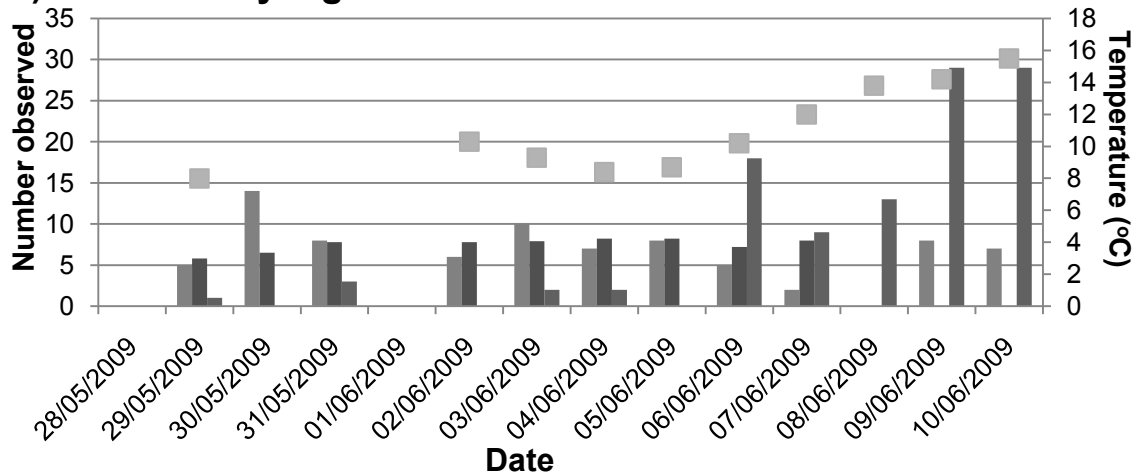
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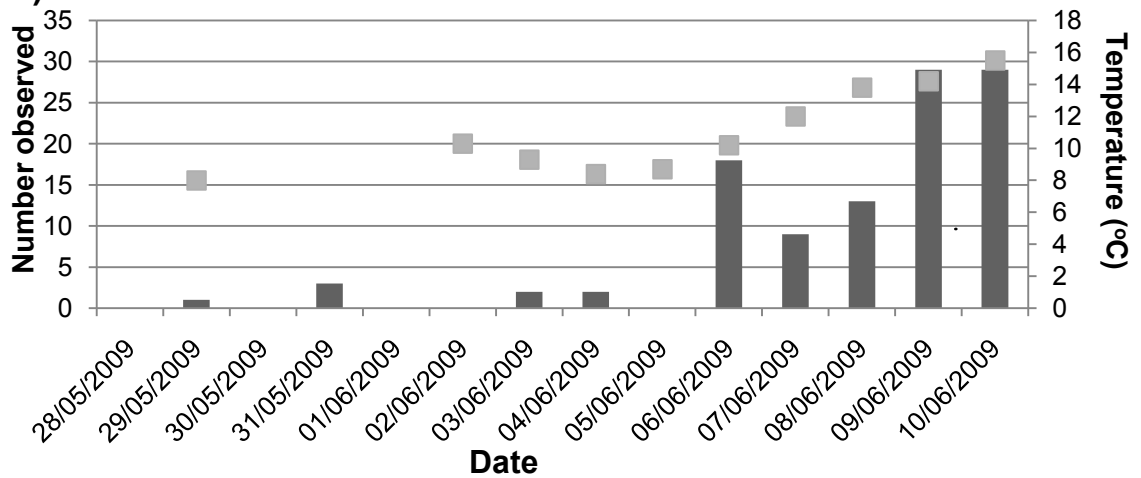
PROJECT: 09-1328-0020

Figure: 8

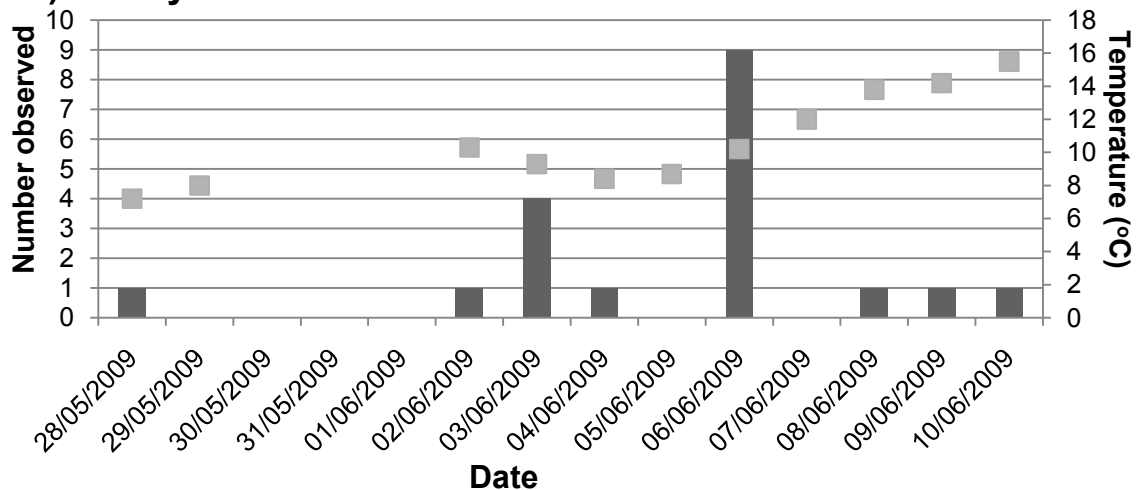
A) Arctic Grayling



B) Lake Whitefish



C) Walleye



Temperature
 Count of Number of Fish



SNORKLING OBSERVATIONS OF SELECT SPECIES IN BAKER CREEK, 2009

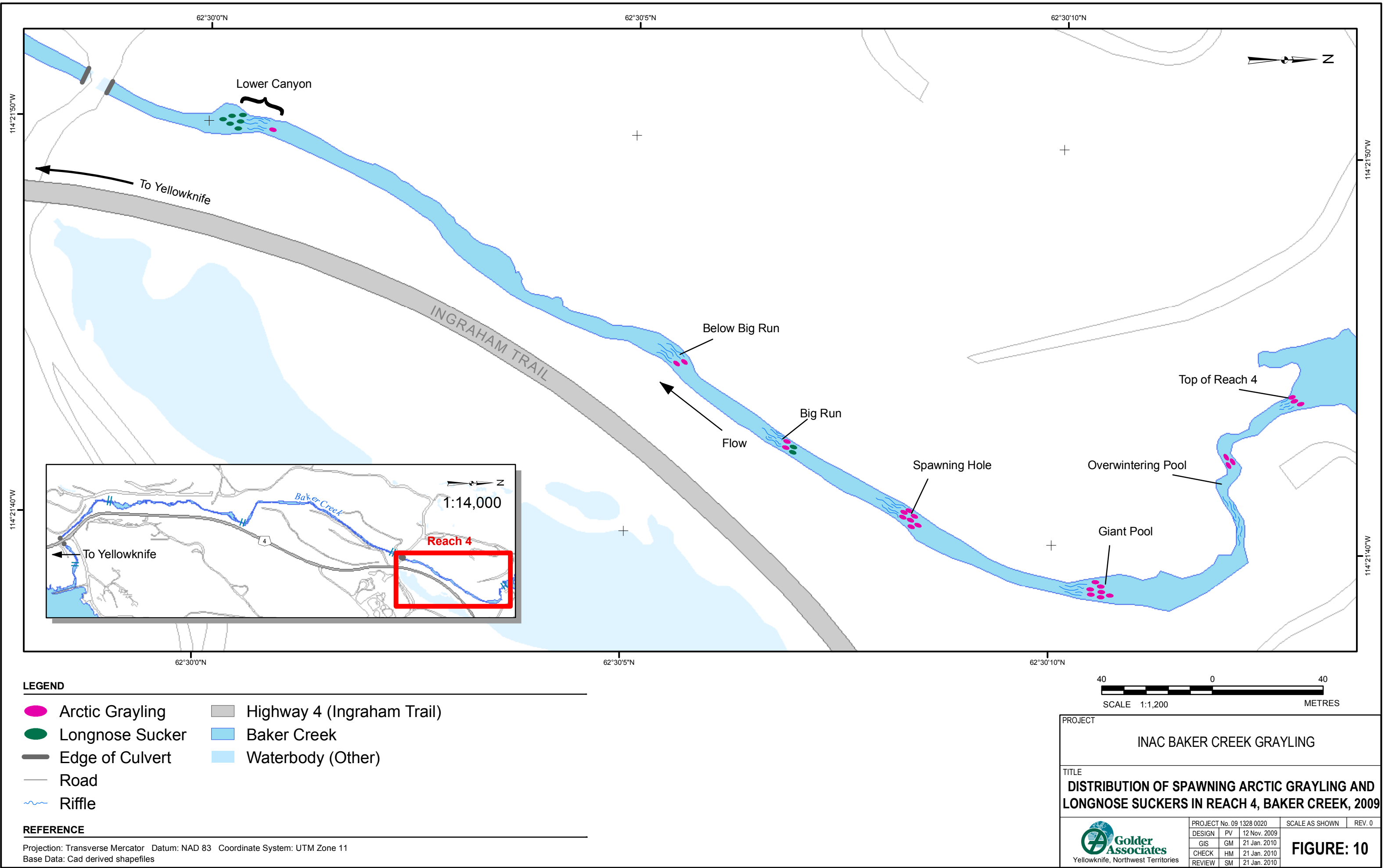
DRAWN: PS

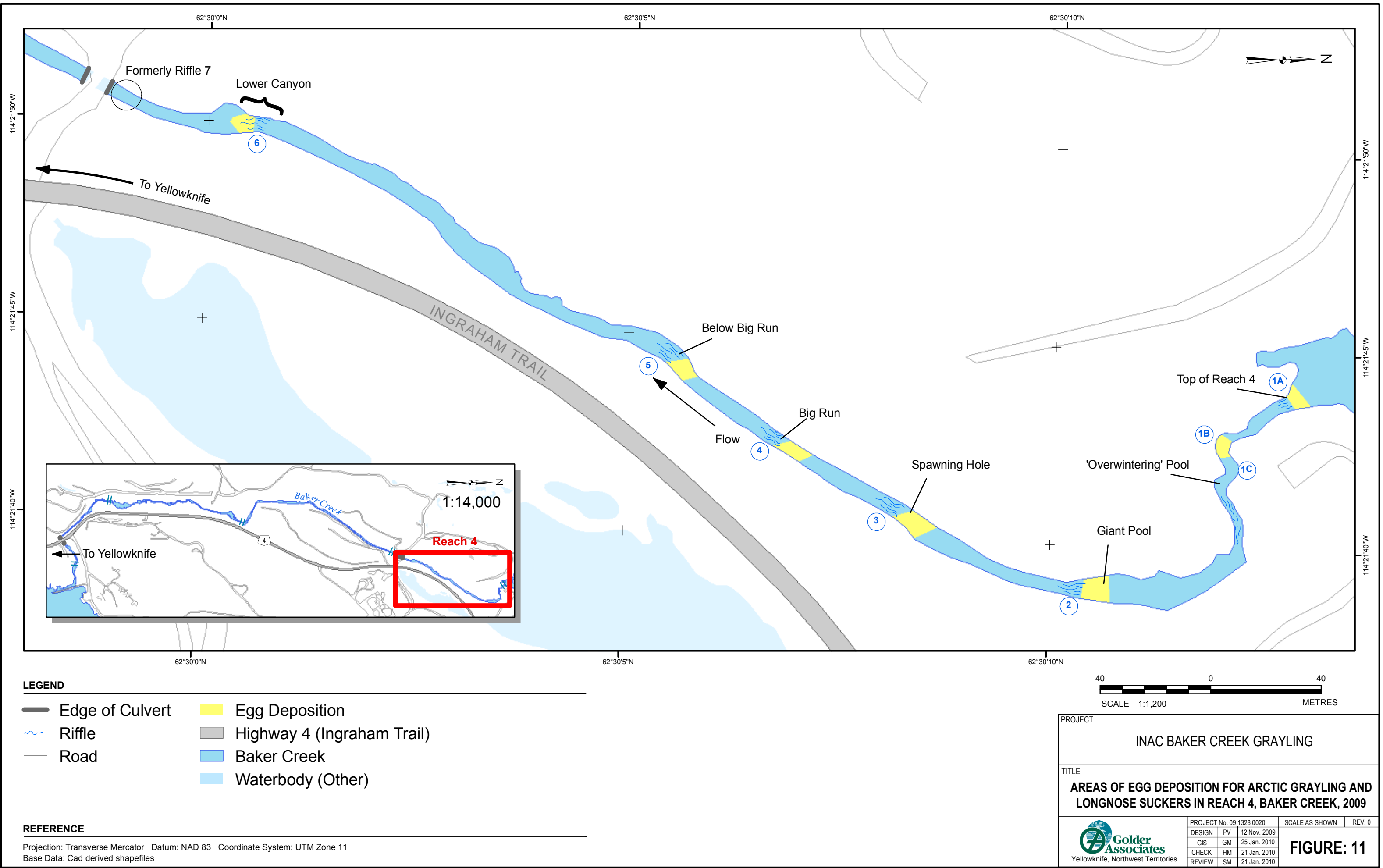
APPROVED: SM

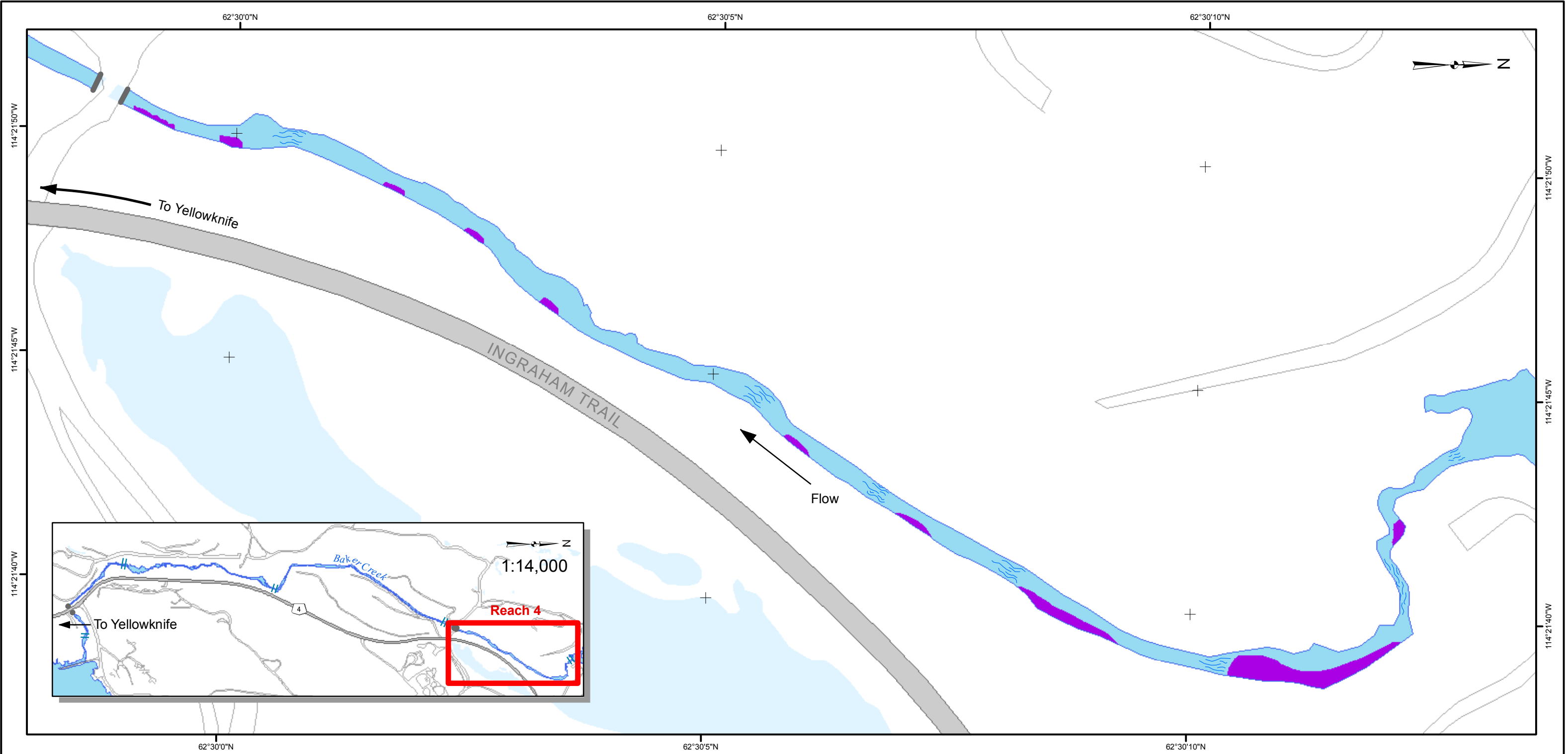
DATE: 20 January, 2010

PROJECT: 09-1328-0020

Figure: 9





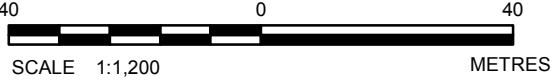


LEGEND

- Edge of Culvert
- Riffle
- Road
- Protolarvae
- Highway 4 (Ingraham Trail)
- Baker Creek
- Waterbody (Other)

REFERENCE

Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 11
Base Data: Cad derived shapefiles




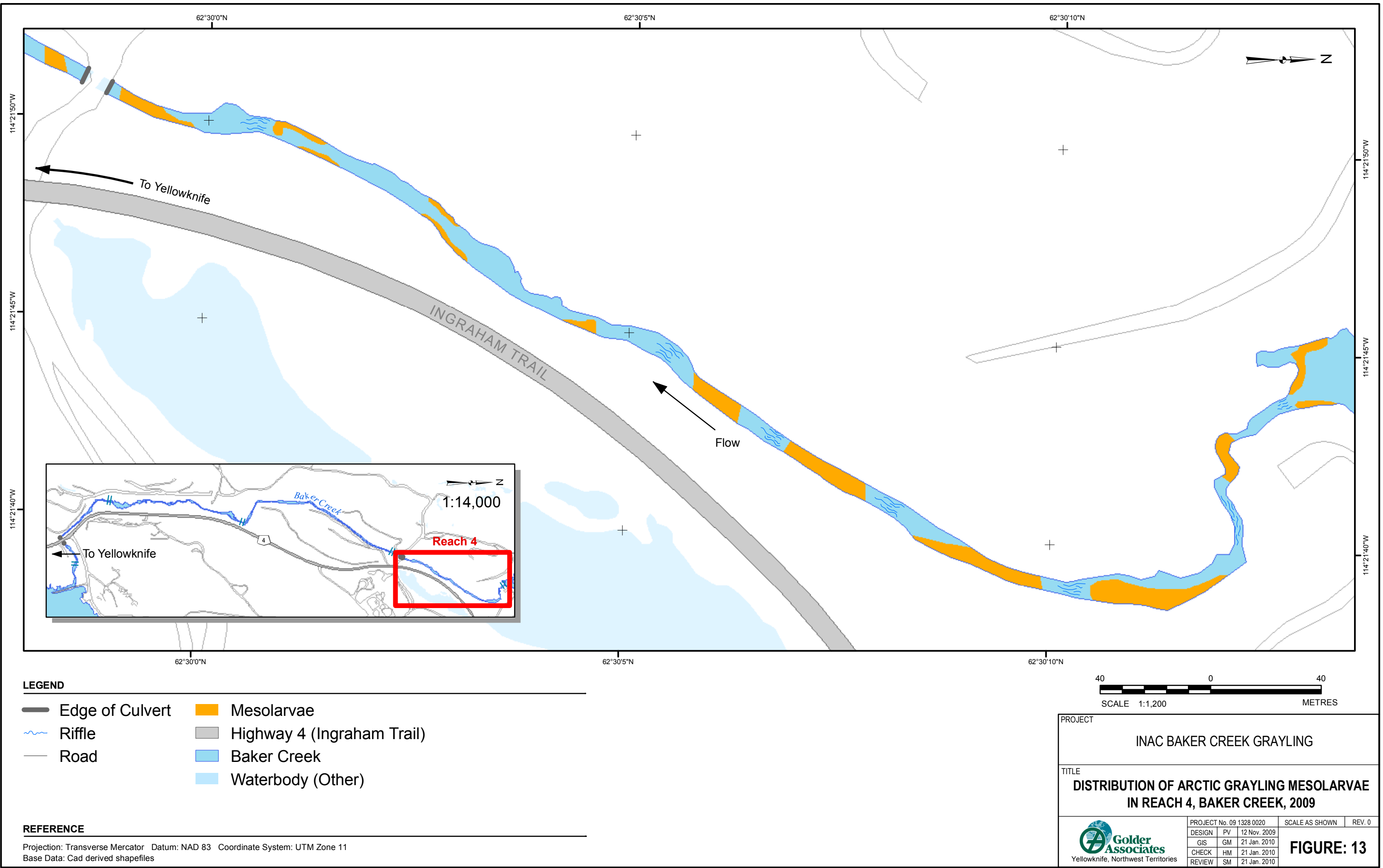
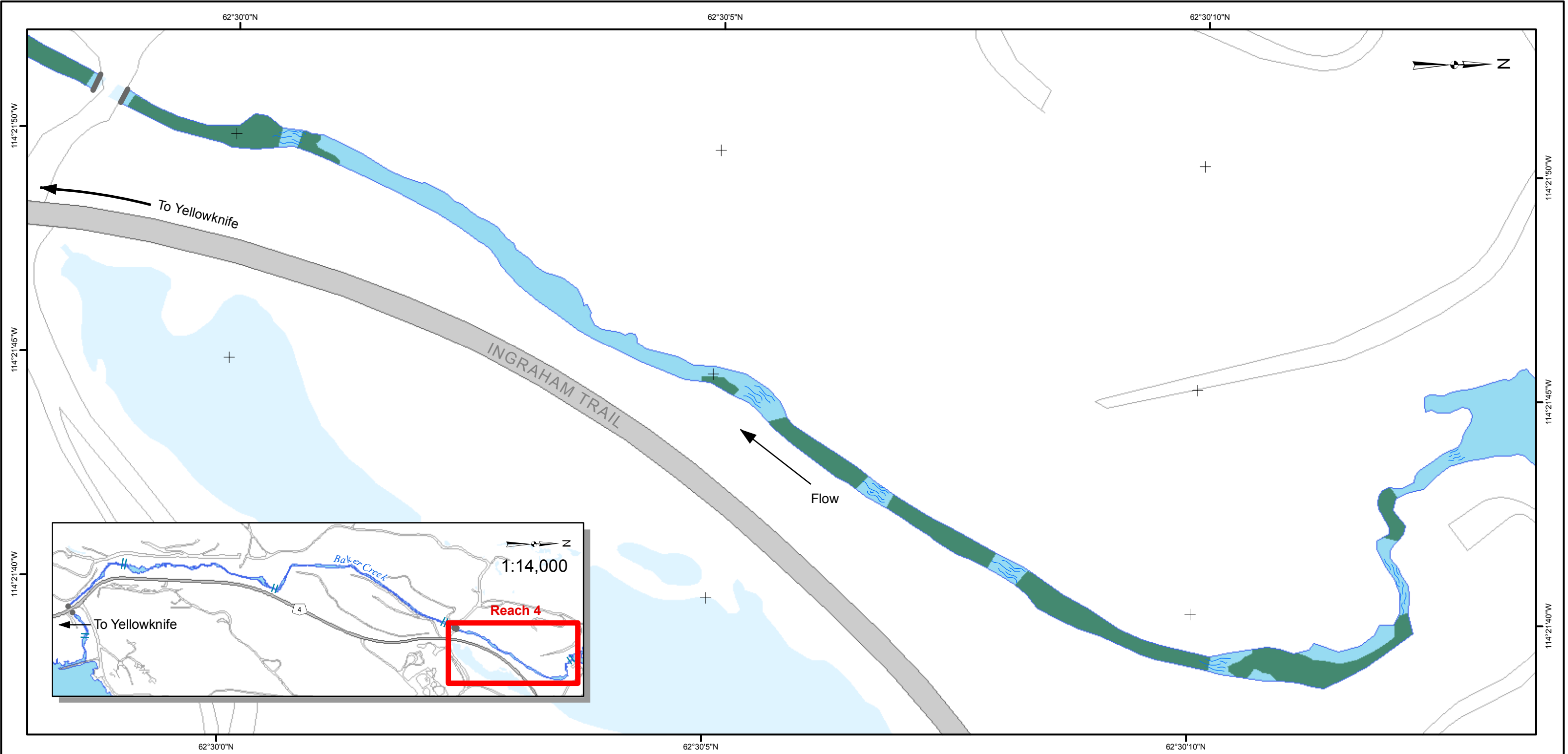
PROJECT		INAC BAKER CREEK GRAYLING	
TITLE		DISTRIBUTION OF ARCTIC GRAYLING PROTOLARVAE AFTER EMERGENCE IN REACH 4, BAKER CREEK, 2009	
 Golder Associates Yellowknife, Northwest Territories	PROJECT No. 09 1328 0020		SCALE AS SHOWN
	DESIGN	PV 12 Nov. 2009	REV. 0
	GIS	GM 21 Jan. 2010	
	CHECK	HM 21 Jan. 2010	
	REVIEW	SM 21 Jan. 2010	

FIGURE: 12



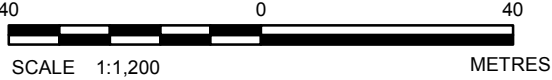



LEGEND

- Culvert
- Riffle
- Road
- Juvenile
- Highway 4 (Ingraham Trail)
- Baker Creek
- Waterbody (Other)

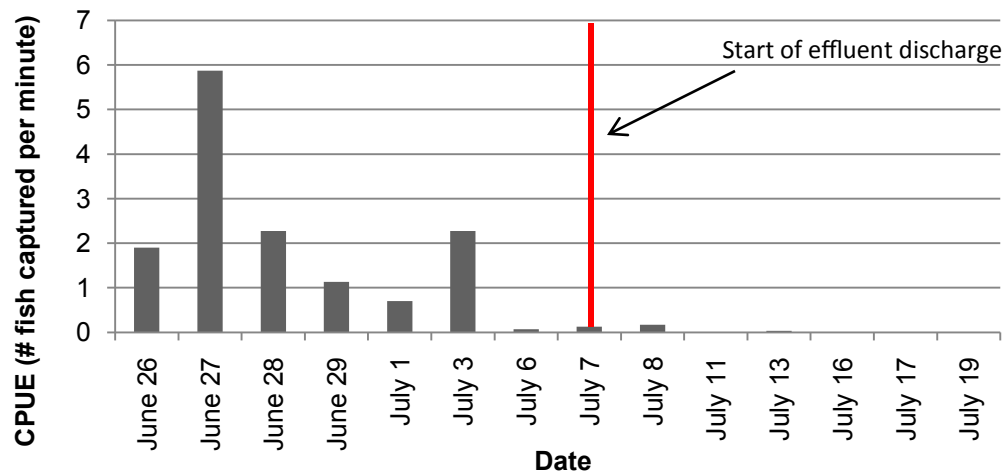
REFERENCE

Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 11
Base Data: Cad derived shapefiles

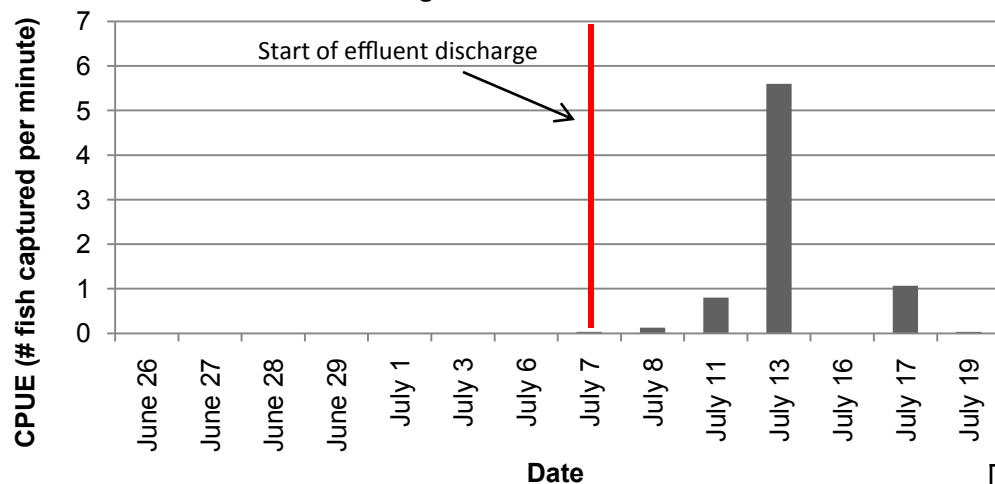


PROJECT		INAC BAKER CREEK GRAYLING	
TITLE		DISTRIBUTION OF JUVENILE ARCTIC GRAYLING IN REACH 4, BAKER CREEK, 2009	
 Yellowknife, Northwest Territories	PROJECT No. 09 1328 0020		SCALE AS SHOWN
	DESIGN	PV 12 Nov. 2009	FIGURE: 14
	GIS	GM 21 Jan. 2010	
	CHECK	HM 21 Jan. 2010	
REVIEW		SM 21 Jan. 2010	

YOY Arctic Grayling Stations 1 and 2



YOY Longnose Suckers Stations 1 and 2



OUTMIGRATION OF YOY ARCTIC GRAYLING AND LONGNOSE SUCKERS, BAKER CREEK, 2009

DRAWN: PS

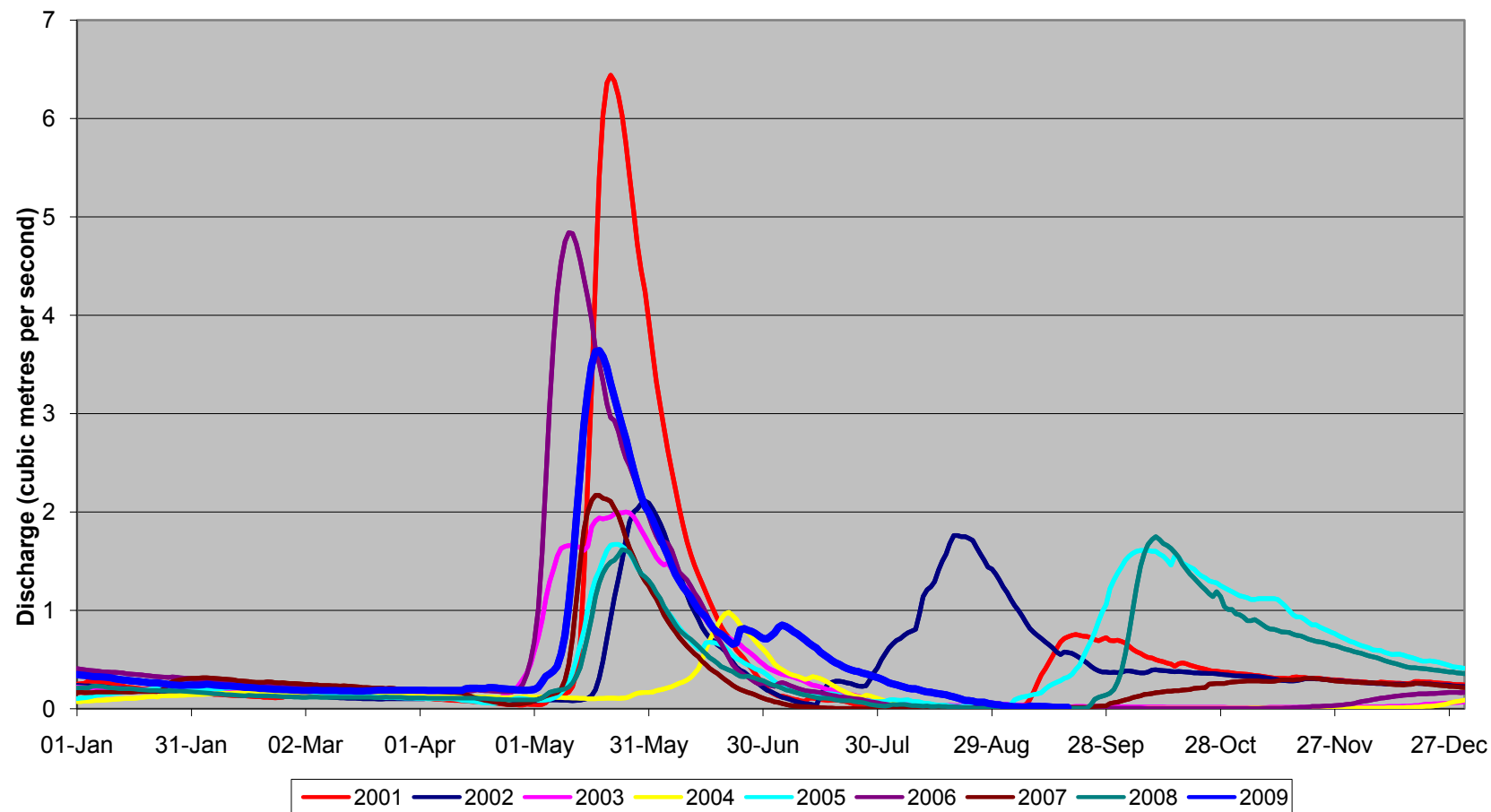
APPROVED: SM

DATE: 20 January, 2010

PROJECT: 09-1328-0020

FIGURE: 15

Baker Creek Flows - 2001 to 2009



Source: Environment Canada 2009 -
Station#:07SB013 Lower Martin Lake Outlet



HISTORIC FLOWS IN BAKER CREEK, (2001 TO PRESENT)

DRAWN: PS

APPROVED: SM

DATE: January 20, 2010

PROJECT: 09-1328-0020

FIGURE: 16

2007

Movement Upstream



?

Movement Downstream



May

June

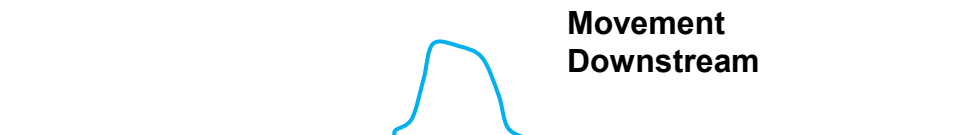
July

2008

Movement Upstream



Movement Downstream



May

June

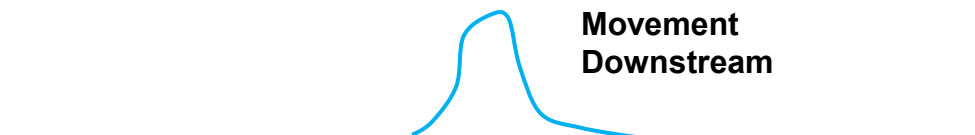
July

2009

Movement Upstream



Movement Downstream



May

June

July

- Adult Arctic Grayling
- Adult suckers
- YOY Arctic Grayling
- - Peak freshet



SCHEMATIC DIAGRAM OF ADULT AND YOY ARCTIC GRAYLING AND LONGNOSE SUCKER MOVEMENT, BAKER CREEK, 2009

DRAWN: PS

APPROVED: SM

DATE: January 20, 2010

PROJECT: 09-1328-0020

Figure: 17



APPENDIX A

Raw Data

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APPENDIX A

Raw Data

Table A-1: Adult and Juvenile Fish Capture Data, Baker Creek 2009

Date	Species	Length (mm)	Weight (g)	Girth (mm)	Sex	Stage	Maturity state	Reach	Capture Location	Status
5/31/2009	Arctic Grayling	310	-	-	unknown	adult	unknown	1	Below Culvert	released
5/31/2009	Arctic grayling	380	-	-	unknown	adult	unknown	1	Below Culvert	released
6/3/2009	Arctic grayling	356	-	-	unknown	adult	unknown	1	Below Culvert	released
6/6/2009	Arctic grayling	382	719.2	228	male	adult	resting	1	Below Culvert	preserved
6/6/2009	Arctic grayling	381	-	-	unknown	adult	unknown	1	Below Culvert	released
6/6/2009	Arctic grayling	414	-	-	male	adult	unknown	1	Below Culvert	released
6/6/2009	Arctic grayling	427	959.2	250	female	adult	resting	1	Below Culvert	preserved
6/6/2009	Arctic grayling	389	811.9	257	female	adult	resting	1	Below Culvert	preserved
6/6/2009	Arctic grayling	391	747.8	240	unknown	adult	resting	1	Below Culvert	preserved
6/6/2009	Arctic grayling	351	594	217	male	adult	resting	1	Below Culvert	preserved
6/6/2009	Arctic grayling	401	-	-	male	adult	unknown	1	Below Culvert	released
6/6/2009	Arctic grayling	338	-	-	unknown	adult	unknown	1	Below Culvert	released
6/6/2009	Arctic grayling	378	-	-	male	adult	unknown	1	Below Culvert	released
6/6/2009	Arctic grayling	363	-	-	male	adult	unknown	1	Below Culvert	released
6/6/2009	Arctic grayling	361	-	-	male	adult	unknown	1	Below Culvert	released
6/6/2009	Arctic grayling	411	-	-	male	adult	unknown	1	Below Culvert	released
6/7/2009	Arctic grayling	300	-	-	female	adult	unknown	1	Below Culvert	released
6/7/2009	Arctic grayling	392	-	-	male	adult	unknown	1	Below Culvert	released
6/7/2009	Arctic grayling	372	535	215	unknown	adult	resting	1	Below Culvert	preserved
6/7/2009	Arctic grayling	440	-	-	male	adult	unknown	1	Below Culvert	released
6/16/2009	Arctic grayling	385	-	-	male	adult	unknown	1	Below Culvert	released
6/16/2009	Arctic grayling	335	-	-	male	adult	unknown	1	Below Culvert	released
6/16/2009	Arctic grayling	360	-	-	male	adult	unknown	4	Giant Pool	released
6/17/2009	Arctic grayling	342	500	190	male	adult	unknown	4	Giant Pool	released
6/17/2009	Arctic grayling	415	-	-	male	adult	unknown	4	Giant Pool	released
6/18/2009	Arctic grayling	360	650	250	male	adult	unknown	1	Below Culvert	released
5/20/2009	Arctic grayling	~390	-	-	male	adult	unknown	4	Top of Reach 4	Preserved, found dead
6/9/2009	Arctic grayling	408	846.9	255	male	adult	resting	1	Below Culvert	preserved
6/2/2009	lake whitefish	385	-	-	unknown	adult	unknown	1	Culvert Pool	released
6/2/2009	lake whitefish	360	-	-	unknown	adult	unknown	1	Culvert Pool	released
6/2/2009	lake whitefish	335	-	-	unknown	adult	unknown	1	Culvert Pool	released
6/5/2009	lake whitefish	370	-	-	unknown	adult	unknown	1	Culvert Pool	released
6/5/2009	lake whitefish	390	-	-	unknown	adult	unknown	1	Culvert Pool	released
6/5/2009	lake whitefish	380	-	-	unknown	adult	unknown	1	Culvert Pool	released
6/5/2009	lake whitefish	375	-	-	unknown	adult	unknown	1	Culvert Pool	released
6/5/2009	lake whitefish	410	-	-	unknown	adult	unknown	1	Culvert Pool	released
6/5/2009	lake whitefish	372	-	-	unknown	adult	unknown	1	Culvert Pool	released
6/5/2009	lake whitefish	365	-	-	unknown	adult	unknown	1	Culvert Pool	released
6/5/2009	lake whitefish	358	-	-	unknown	adult	unknown	1	Culvert Pool	released
6/7/2009	lake whitefish	370	-	-	unknown	adult	unknown	1	Run above rail bridge	released
6/19/2009	lake whitefish	365	-	-	unknown	adult	unknown	1	Run above rail bridge	released
6/2/2009	northern pike	615	-	-	female	adult	unknown	1	Culvert Pool	released
6/2/2009	northern pike	635	-	-	female	adult	unknown	1	Culvert Pool	released
6/2/2009	northern pike	640	-	-	female	adult	unknown	1	Culvert Pool	released
6/2/2009	northern pike	605	-	-	unknown	adult	unknown	1	Culvert Pool	released
6/2/2009	northern pike	610	-	-	male	adult	unknown	1	Culvert Pool	released



APPENDIX A

Raw Data

Table A-1: Fish Capture Data, Baker Creek 2009 (Continued)

Date	Species	Length (mm)	Weight (g)	Girth (mm)	Sex	Stage	Maturity state	Reach	Capture Location	Status
6/5/2009	northern pike	540	-	-	male	adult	unknown	1	Culvert Pool	released
6/5/2009	northern pike	590	-	-	female	adult	unknown	1	Culvert Pool	released
6/5/2009	northern pike	340	-	-	male	adult	unknown	1	Culvert Pool	released
6/5/2009	northern pike	400	-	-	female	adult	unknown	1	Culvert Pool	released
6/5/2009	northern pike	620	-	-	male	adult	unknown	1	Culvert Pool	released
6/5/2009	northern pike	580	-	-	female	adult	unknown	1	Culvert Pool	released
6/5/2009	northern pike	370	-	-	male	adult	unknown	1	Culvert Pool	released
6/5/2009	northern pike	680	-	-	female	adult	unknown	1	Culvert Pool	released
6/5/2009	northern pike	520	-	-	male	adult	unknown	1	Culvert Pool	released
6/5/2009	northern pike	420	-	-	male	adult	unknown	1	Culvert Pool	released
6/5/2009	northern pike	470	-	-	female	adult	unknown	1	Culvert Pool	released
6/5/2009	northern pike	570	-	-	female	adult	unknown	1	Culvert Pool	released
6/5/2009	northern pike	588	-	-	unknown	adult	unknown	1	Culvert Pool	released
6/5/2009	northern pike	614	-	-	female	adult	unknown	1	Culvert Pool	released
6/5/2009	northern pike	560	-	-	male	adult	unknown	1	Culvert Pool	released
6/5/2009	northern pike	508	-	-	female	adult	unknown	1	Culvert Pool	released
6/19/2009	northern pike	415	-	-	unknown	adult	unknown	1	Culvert Pool	released
6/19/2009	northern pike	380	-	-	unknown	adult	unknown	1	Culvert Pool	released
6/19/2009	northern pike	395	-	-	unknown	adult	unknown	1	Culvert Pool	released
6/19/2009	northern pike	380	-	-	unknown	adult	unknown	1	Culvert Pool	released
6/19/2009	northern pike	510	-	-	unknown	adult	unknown	1	Culvert Pool	released
6/22/2009	northern pike	158	-	-	unknown	adult	unknown	4	Big Run	released
7/4/2009	northern pike	406	-	-	unknown	adult	unknown	1	Culvert Pool	released
7/4/2009	northern pike	350	-	-	unknown	adult	unknown	1	Culvert Pool	released
7/4/2009	northern pike	370	-	-	unknown	adult	unknown	1	Culvert Pool	released
6/2/2009	longnose sucker	480	-	-	female	adult	unknown	1	Culvert Pool	released
6/2/2009	longnose sucker	440	-	-	male	adult	unknown	1	Culvert Pool	released
6/2/2009	longnose sucker	450	-	-	male	adult	unknown	1	Culvert Pool	released
6/2/2009	longnose sucker	478	-	-	female	adult	unknown	1	Culvert Pool	released
6/2/2009	longnose sucker	520	-	-	female	adult	unknown	1	Culvert Pool	released
6/2/2009	longnose sucker	465	-	-	male	adult	unknown	1	Culvert Pool	released
6/2/2009	longnose sucker	470	-	-	female	adult	unknown	1	Culvert Pool	released
6/2/2009	longnose sucker	450	-	-	male	adult	unknown	1	Culvert Pool	released
6/2/2009	longnose sucker	475	-	-	male	adult	unknown	1	Culvert Pool	released
6/5/2009	longnose sucker	470	-	-	female	adult	unknown	1	Culvert Pool	released
6/5/2009	longnose sucker	422	-	-	male	adult	unknown	1	Culvert Pool	released
6/5/2009	longnose sucker	438	-	-	male	adult	unknown	1	Culvert Pool	released
6/5/2009	longnose sucker	440	-	-	male	adult	unknown	1	Culvert Pool	released
6/5/2009	longnose sucker	408	-	-	male	adult	unknown	1	Culvert Pool	released
6/10/2009	sucker species	43	-	-	unknown	juvenile	juvenile	1	Run below Culvert Pool	released
6/10/2009	sucker species	47	-	-	unknown	juvenile	juvenile	1	Run below Culvert Pool	released
6/19/2009	longnose sucker	490	-	-	unknown	adult	unknown	1	Culvert Pool	released
6/19/2009	longnose sucker	430	-	-	unknown	adult	unknown	1	Culvert Pool	released
6/19/2009	longnose sucker	388	-	-	unknown	adult	unknown	1	Culvert Pool	released
6/19/2009	longnose sucker	426	-	-	unknown	adult	unknown	1	Culvert Pool	released
6/19/2009	longnose sucker	488	-	-	unknown	adult	unknown	1	Culvert Pool	released
6/19/2009	longnose sucker	410	-	-	unknown	adult	unknown	1	Culvert Pool	released
6/19/2009	longnose sucker	460	-	-	male	adult	unknown	1	Culvert Pool	released



APPENDIX A

Raw Data

Table A-1: Fish Capture Data, Baker Creek 2009 (Continued)

Date	Species	Length (mm)	Weight (g)	Girth (mm)	Sex	Stage	Maturity state	Reach	Capture Location	Status
7/4/2009	longnose sucker	457	-	-	unknown	adult	unknown	1	Culvert Pool	released
7/4/2009	longnose sucker	419	-	-	unknown	adult	unknown	1	Culvert Pool	released
7/4/2009	longnose sucker	533	-	-	female	adult	unknown	1	Culvert Pool	released
7/4/2009	longnose sucker	559	-	-	unknown	adult	unknown	1	Culvert Pool	released
7/4/2009	longnose sucker	483	-	-	female	adult	unknown	1	Culvert Pool	released
7/4/2009	longnose sucker	432	-	-	unknown	adult	unknown	1	Culvert Pool	released
7/4/2009	longnose sucker	483	-	-	female	adult	unknown	1	Culvert Pool	released
7/4/2009	longnose sucker	483	-	-	female	adult	unknown	1	Culvert Pool	released
7/5/2009	sucker species	51	-	-	female	juvenile	juvenile	1	Culvert Pool	released
7/4/2009	walleye	381	-	-	unknown	adult	unknown	1	Culvert Pool	released
6/5/2009	white sucker	420	-	-	male	adult	unknown	1	Culvert Pool	released
6/19/2009	white sucker	450	-	-	female	adult	unknown	1	Culvert Pool	released
6/19/2009	white sucker	440	-	-	unknown	adult	unknown	1	Run above rail bridge	released
6/19/2009	white sucker	375	-	-	unknown	adult	unknown	1	Run above rail bridge	released
6/19/2009	white sucker	420	-	-	unknown	adult	unknown	1	Run above rail bridge	released
6/19/2009	white sucker	438	-	-	unknown	adult	unknown	1	Run above rail bridge	released
6/20/2009	white sucker	426	-	-	unknown	adult	unknown	1	Run above rail bridge	released
6/20/2009	emerald shiner	70	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	62	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	74	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	73	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	71	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	85	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	76	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	85	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	73	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	77	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	76	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	80	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	71	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	48	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	69	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	92	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	68	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	65	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	64	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	82	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	77	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	78	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	71	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	75	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	73	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	74	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	69	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	87	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	74	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	69	-	-	unknown	unknown	unknown	1	Below rail bridge	released

[illegible]



APPENDIX A

Raw Data

Table A-1: Fish Capture Data, Baker Creek 2009 (Continued)

Date	Species	Length (mm)	Weight (g)	Girth (mm)	Sex	Stage	Maturity state	Reach	Capture Location	Status
6/20/2009	emerald shiner	68	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	77	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	72	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	70	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	75	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	74	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	75	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	75	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	77	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	74	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	72	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	72	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	69	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	72	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	73	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	58	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	77	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	77	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	78	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	78	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	81	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	74	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	68	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	85	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	76	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	68	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	84	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	84	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	77	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	74	-	-	unknown	unknown	unknown	1	Below rail bridge	released
6/20/2009	emerald shiner	81	-	-	unknown	unknown	unknown	1	Below rail bridge	released
7/13/2009	emerald shiner	40	-	-	unknown	unknown	unknown	1	Breakwater end	released
7/13/2009	emerald shiner	32	-	-	unknown	unknown	unknown	1	Breakwater end	released
7/13/2009	emerald shiner	30	-	-	unknown	unknown	unknown	1	Breakwater end	released
7/13/2009	emerald shiner	35	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/7/2009	ninespine stickleback	44	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/7/2009	ninespine stickleback	41	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/7/2009	ninespine stickleback	51	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/7/2009	ninespine stickleback	50	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/7/2009	ninespine stickleback	45	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/7/2009	ninespine stickleback	50	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/7/2009	ninespine stickleback	41	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/7/2009	ninespine stickleback	45	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/7/2009	ninespine stickleback	48	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/7/2009	ninespine stickleback	41	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/7/2009	ninespine stickleback	45	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/7/2009	ninespine stickleback	58	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/7/2009	ninespine stickleback	47	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/7/2009	ninespine stickleback	47	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released



APPENDIX A

Raw Data

Table A-1: Fish Capture Data, Baker Creek 2009 (Continued)

Date	Species	Length (mm)	Weight (g)	Girth (mm)	Sex	Stage	Maturity state	Reach	Capture Location	Status
6/7/2009	ninespine stickleback	50	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/7/2009	ninespine stickleback	50	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/7/2009	ninespine stickleback	55	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/7/2009	ninespine stickleback	44	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/7/2009	ninespine stickleback	43	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/7/2009	ninespine stickleback	43	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/7/2009	ninespine stickleback	46	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/7/2009	ninespine stickleback	48	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/10/2009	ninespine stickleback	41	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/10/2009	ninespine stickleback	41	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/10/2009	ninespine stickleback	46	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/10/2009	ninespine stickleback	39	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/10/2009	ninespine stickleback	46	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/10/2009	ninespine stickleback	42	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/10/2009	ninespine stickleback	38	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/10/2009	ninespine stickleback	43	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/10/2009	ninespine stickleback	43	-	-	unknown	unknown	unknown	1	Below Culvert Pool riffle	released
6/19/2009	ninespine stickleback	52	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/20/2009	ninespine stickleback	49	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/20/2009	ninespine stickleback	50	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/20/2009	ninespine stickleback	49	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/20/2009	ninespine stickleback	49	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/20/2009	ninespine stickleback	55	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/20/2009	ninespine stickleback	48	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/20/2009	ninespine stickleback	48	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/20/2009	ninespine stickleback	48	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/20/2009	ninespine stickleback	44	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/20/2009	ninespine stickleback	48	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/20/2009	ninespine stickleback	49	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/20/2009	ninespine stickleback	45	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/20/2009	ninespine stickleback	40	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/20/2009	ninespine stickleback	48	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/20/2009	ninespine stickleback	45	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/20/2009	ninespine stickleback	50	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/20/2009	ninespine stickleback	47	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/20/2009	ninespine stickleback	44	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/20/2009	ninespine stickleback	55	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/20/2009	ninespine stickleback	39	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/20/2009	ninespine stickleback	50	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/20/2009	ninespine stickleback	37	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/20/2009	ninespine stickleback	49	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/20/2009	ninespine stickleback	46	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/20/2009	ninespine stickleback	38	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/20/2009	ninespine stickleback	42	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/24/2009	ninespine stickleback	48	-	-	unknown	unknown	unknown	1	Below culvert	released
7/8/2009	ninespine stickleback	41	-	-	unknown	unknown	unknown	1	Station 2-below culvert	released
7/11/2009	ninespine stickleback	25	-	-	unknown	unknown	unknown	1	Station 2-below culvert	released
7/13/2009	ninespine stickleback	48	-	-	unknown	unknown	unknown	1	Breakwater end	released
6/4/2009	burbot	340	-	-	unknown	adult	unknown	1	Below Culvert Pool riffle	dead



APPENDIX A

Raw Data

Table A-1: Fish Capture Data, Baker Creek 2009 (Continued)

Date	Species	Length (mm)	Weight (g)	Girth (mm)	Sex	Stage	Maturity state	Reach	Capture Location	Status
7/6/2009	spottail shiner	78	-	-	unknown	unknown	unknown	1	Breakwater end	released
7/6/2009	spottail shiner	76	-	-	unknown	unknown	unknown	1	Breakwater end	released
7/6/2009	spottail shiner	78	-	-	unknown	unknown	unknown	1	Breakwater end	released
7/6/2009	spottail shiner	74	-	-	unknown	unknown	unknown	1	Breakwater end	released
7/6/2009	spottail shiner	77	-	-	unknown	unknown	unknown	1	Breakwater end	released
7/6/2009	spottail shiner	75	-	-	unknown	unknown	unknown	1	Breakwater end	released
7/6/2009	spottail shiner	74	-	-	unknown	unknown	unknown	1	Breakwater end	released
7/11/2009	spottail shiner	35	-	-	unknown	unknown	unknown	1	Breakwater end	released
7/11/2009	spottail shiner	36.5	-	-	unknown	unknown	unknown	1	Station 2- below culvert	released
7/13/2009	spottail shiner	28	-	-	unknown	unknown	unknown	1	Breakwater end	released
7/13/2009	spottail shiner	38	-	-	unknown	unknown	unknown	1	Breakwater end	released
7/13/2009	spottail shiner	30	-	-	unknown	unknown	unknown	1	Breakwater end	released
7/13/2009	spottail shiner	33	-	-	unknown	unknown	unknown	1	Breakwater end	released
7/13/2009	spottail shiner	42	-	-	unknown	unknown	unknown	1	Breakwater end	released
7/13/2009	spottail shiner	38	-	-	unknown	unknown	unknown	1	Breakwater end	released



APPENDIX A

Raw Data

Table A-2: Young-of-the-Year Fish Capture Data, Baker Creek 2009

Date	Species	Maturity	Length (mm)	Weight (g)	Reach	Capture Location	Status
6/15/2009	Arctic grayling	YOY	15.3	-	4	Giant Pool	released
6/15/2009	Arctic grayling	YOY	16.5	-	4	Giant Pool	released
6/15/2009	Arctic grayling	YOY	15.1	-	4	Giant Pool	photographed
6/15/2009	Arctic grayling	YOY	14.4	-	4	Spawning Hole	released
6/15/2009	Arctic grayling	YOY	14.9	-	4	Spawning Hole	released
6/15/2009	Arctic grayling	YOY	12.7	-	4	Spawning Hole	released
6/15/2009	Arctic grayling	YOY	17	-	4	Spawning Hole	released
6/15/2009	Arctic grayling	YOY	17.3	-	4	Lower Canyon	released
6/15/2009	Arctic grayling	YOY	16.4	-	4	Lower Canyon	released
6/15/2009	Arctic grayling	YOY	14.6	-	4	Lower Canyon	released
6/15/2009	Arctic grayling	YOY	16.9	-	4	Lower Canyon	released
6/15/2009	Arctic grayling	YOY	15.1	-	4	Lower Canyon	released
6/15/2009	Arctic grayling	YOY	15.9	-	4	Lower Canyon	released
6/15/2009	Arctic grayling	YOY	15	-	4	Lower Canyon	released
6/15/2009	Arctic grayling	YOY	16	-	4	Lower Canyon	released
6/15/2009	Arctic grayling	YOY	16.4	-	4	Lower Canyon	released
6/15/2009	Arctic grayling	YOY	15.2	-	4	Lower Canyon	released
6/17/2009	Arctic grayling	YOY	18.5	-	4	Giant Pool	released
6/17/2009	Arctic grayling	YOY	19.5	-	4	Giant Pool	released
6/17/2009	Arctic grayling	YOY	17.1	-	4	Giant Pool	released
6/17/2009	Arctic grayling	YOY	17.7	-	4	Giant Pool	released
6/17/2009	Arctic grayling	YOY	17.4	-	4	Giant Pool	released
6/17/2009	Arctic grayling	YOY	16.7	-	4	Giant Pool	released
6/17/2009	Arctic grayling	YOY	17.4	-	4	Giant Pool	released
6/17/2009	Arctic grayling	YOY	18.4	-	4	Giant Pool	released
6/17/2009	Arctic grayling	YOY	17.7	-	4	Giant Pool	released
6/17/2009	Arctic grayling	YOY	16.7	-	4	Giant Pool	released
6/17/2009	Arctic grayling	YOY	16.9	-	4	Giant Pool	released
6/17/2009	Arctic grayling	YOY	15	-	4	Giant Pool	released
6/17/2009	Arctic grayling	YOY	18.4	-	4	Giant Pool	released
6/17/2009	Arctic grayling	YOY	17	-	4	Giant Pool	released
6/17/2009	Arctic grayling	YOY	17.5	-	4	Giant Pool	released
6/17/2009	Arctic grayling	YOY	17.4	-	4	Giant Pool	released
6/18/2009	Arctic grayling	YOY	19	-	4	Below Giant pool riffle	released
6/18/2009	Arctic grayling	YOY	18.4	-	4	Below Giant pool riffle	released
6/18/2009	Arctic grayling	YOY	17.9	-	4	Below Giant pool riffle	released
6/18/2009	Arctic grayling	YOY	17.5	-	4	Below Giant pool riffle	released
6/18/2009	Arctic grayling	YOY	18.8	-	4	Below Giant pool riffle	released
6/18/2009	Arctic grayling	YOY	21.2	-	4	Below Giant pool riffle	released
6/18/2009	Arctic grayling	YOY	16.9	-	4	Below Giant pool riffle	released
6/18/2009	Arctic grayling	YOY	17.9	-	4	Below Giant pool riffle	released
6/18/2009	Arctic grayling	YOY	20.1	-	4	Below Giant pool riffle	released
6/18/2009	Arctic grayling	YOY	21.9	-	4	Below Giant pool riffle	released
6/18/2009	Arctic grayling	YOY	18.4	-	4	Below Giant pool riffle	released
6/18/2009	Arctic grayling	YOY	19.1	-	4	Below Giant pool riffle	released
6/18/2009	Arctic grayling	YOY	20.9	-	4	Below Giant pool riffle	released
6/18/2009	Arctic grayling	YOY	20.5	-	4	Below Giant pool riffle	released
6/18/2009	Arctic grayling	YOY	18.1	-	4	Below Giant pool riffle	released



APPENDIX A

Raw Data

Table A-2: Young-of-the-Year Fish Capture Data, Baker Creek 2009 (Continued)

Date	Species	Maturity	Length (mm)	Weight (g)	Reach	Capture Location	Status
6/19/2009	Arctic grayling	YOY	22	-	1	Below culvert	released
6/19/2009	Arctic grayling	YOY	19.5	-	1	Below culvert	released
6/19/2009	Arctic grayling	YOY	19	-	1	Below culvert	released
6/19/2009	Arctic grayling	YOY	17	-	1	Below culvert	released
6/19/2009	Arctic grayling	YOY	17	-	1	Below culvert	released
6/19/2009	Arctic grayling	YOY	17	-	1	Below culvert	released
6/19/2009	Arctic grayling	YOY	18	-	1	Below culvert	released
6/19/2009	Arctic grayling	YOY	17	-	1	Below culvert	released
6/19/2009	Arctic grayling	YOY	13.5	-	1	Below culvert	released
6/19/2009	Arctic grayling	YOY	16.5	-	1	Below culvert	released
6/19/2009	Arctic grayling	YOY	17	-	1	Below culvert	released
6/19/2009	Arctic grayling	YOY	19.2	-	1	Below culvert	released
6/19/2009	Arctic grayling	YOY	13	-	1	Below culvert	released
6/19/2009	Arctic grayling	YOY	18	-	1	Below culvert	released
6/19/2009	Arctic grayling	YOY	17	-	1	Below culvert	released
6/19/2009	Arctic grayling	YOY	21	-	1	Below culvert	released
6/20/2009	Arctic grayling	YOY	21	-	4	Lower Canyon Riffle	released
6/20/2009	Arctic grayling	YOY	21.5	-	4	Lower Canyon Riffle	released
6/20/2009	Arctic grayling	YOY	22.5	-	4	Lower Canyon Riffle	released
6/20/2009	Arctic grayling	YOY	22	-	4	Lower Canyon Riffle	released
6/20/2009	Arctic grayling	YOY	21	-	4	Lower Canyon Riffle	released
6/20/2009	Arctic grayling	YOY	23	-	4	Lower Canyon Riffle	released
6/20/2009	Arctic grayling	YOY	22	-	4	Lower Canyon Riffle	released
6/20/2009	Arctic grayling	YOY	18	-	4	Lower Canyon Riffle	released
6/20/2009	Arctic grayling	YOY	21.5	-	4	Lower Canyon Riffle	released
6/20/2009	Arctic grayling	YOY	21.5	-	4	Lower Canyon Riffle	released
6/20/2009	Arctic grayling	YOY	21	-	4	Lower Canyon Riffle	released
6/20/2009	Arctic grayling	YOY	18.5	-	4	Lower Canyon Riffle	released
6/20/2009	Arctic grayling	YOY	16.8	-	4	Lower Canyon Riffle	released
6/20/2009	Arctic grayling	YOY	18.5	-	4	Lower Canyon Riffle	released
6/20/2009	Arctic grayling	YOY	20	-	4	Lower Canyon Riffle	released
6/20/2009	Arctic grayling	YOY	19.5	-	4	Lower Canyon Riffle	released
6/20/2009	Arctic grayling	YOY	18.5	-	4	Lower Canyon Riffle	released
6/20/2009	Arctic grayling	YOY	17	-	4	Lower Canyon Riffle	released
6/20/2009	Arctic grayling	YOY	23.5	-	4	Lower Canyon Riffle	released
6/20/2009	Arctic grayling	YOY	17.5	-	4	Lower Canyon Riffle	released
6/20/2009	Arctic grayling	YOY	20	-	4	Lower Canyon Riffle	preserved
6/20/2009	Arctic grayling	YOY	23	-	4	Lower Canyon Riffle	preserved
6/20/2009	Arctic grayling	YOY	22.5	-	4	Lower Canyon Riffle	preserved
6/20/2009	Arctic grayling	YOY	18	-	4	Lower Canyon Riffle	preserved
6/20/2009	Arctic grayling	YOY	16.8	-	4	Lower Canyon Riffle	preserved
6/20/2009	Arctic grayling	YOY	20	-	4	Lower Canyon Riffle	preserved
6/20/2009	Arctic grayling	YOY	23	-	4	Lower Canyon Riffle	preserved
6/20/2009	Arctic grayling	YOY	22	-	4	Lower Canyon Riffle	preserved
6/20/2009	Arctic grayling	YOY	21.5	-	4	Lower Canyon Riffle	preserved
6/20/2009	Arctic grayling	YOY	19.7	-	4	Lower Canyon Riffle	preserved
6/20/2009	Arctic grayling	YOY	20.5	-	4	Lower Canyon Riffle	preserved
6/20/2009	Arctic grayling	YOY	18	-	4	Lower Canyon Riffle	preserved
6/20/2009	Arctic grayling	YOY	20.5	-	4	Lower Canyon Riffle	photographed



APPENDIX A

Raw Data

Table A-2: Young-of-the-Year Fish Capture Data, Baker Creek 2009 (Continued)

Date	Species	Maturity	Length (mm)	Weight (g)	Reach	Capture Location	Status
6/22/2009	Arctic grayling	YOY	25	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	27	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	24	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	24.5	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	23	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	24	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	23	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	28	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	22.5	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	19	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	25.5	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	23	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	20	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	23	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	26.5	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	24.5	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	28	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	22	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	21	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	22	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	22	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	22.5	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	21	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	21	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	25	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	21	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	22	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	24	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	21	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	22	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	23	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	25	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	20	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	21	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	22.5	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	23.5	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	23	-	4	Lower Canyon Riffle	released
6/22/2009	Arctic grayling	YOY	24	-	4	Lower Canyon Riffle	released
6/24/2009	Arctic grayling	YOY	26	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	28	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	24	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	26.5	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	32	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	22.5	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	33	-	4	Below Giant pool riffle	preserved
6/24/2009	Arctic grayling	YOY	26	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	29	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	25.5	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	28.5	-	4	Below Giant pool riffle	preserved



APPENDIX A

Raw Data

Table A-2: Young-of-the-Year Fish Capture Data, Baker Creek 2009 (Continued)

Date	Species	Maturity	Length (mm)	Weight (g)	Reach	Capture Location	Status
6/24/2009	Arctic grayling	YOY	24.5	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	22.5	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	30	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	27	-	4	Below Giant pool riffle	preserved
6/24/2009	Arctic grayling	YOY	29	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	28	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	24.5	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	30	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	25	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	27	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	26	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	22	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	24	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	30	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	28	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	26	-	4	Below Giant pool riffle	preserved
6/24/2009	Arctic grayling	YOY	28	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	29	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	27	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	25	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	25.5	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	23.5	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	23	-	4	Below Giant pool riffle	released
6/24/2009	Arctic grayling	YOY	28.5	-	4	Lower Canyon Riffle	released
6/24/2009	Arctic grayling	YOY	29	-	4	Lower Canyon Riffle	released
6/24/2009	Arctic grayling	YOY	28	-	4	Lower Canyon Riffle	released
6/24/2009	Arctic grayling	YOY	26.5	-	4	Lower Canyon Riffle	released
6/24/2009	Arctic grayling	YOY	27	-	1	Below culvert	released
6/24/2009	Arctic grayling	YOY	23	-	1	Below culvert	released
6/26/2009	Arctic grayling	YOY	32	0.29	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	16	0.064	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	21	0.207	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	20.5	0.073	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	25	0.139	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	25.5	0.099	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	26	0.141	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	27	0.162	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	30	0.432	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	27	0.273	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	30	0.243	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	31	0.575	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	33	0.626	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	28	0.178	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	30.5	0.221	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	30.5	0.262	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	30	0.317	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	33.5	0.298	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	24.5	0.05	4	Below Giant Pool riffle	preserved
6/26/2009	Arctic grayling	YOY	33.5	0.436	4	Below Giant Pool riffle	preserved



APPENDIX A

Raw Data

Table A-2: Young-of-the-Year Fish Capture Data, Baker Creek 2009 (Continued)

Date	Species	Maturity	Length (mm)	Weight (g)	Reach	Capture Location	Status
6/26/2009	Arctic grayling	YOY	29.5	0.205	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	27	0.144	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	33	0.267	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	32	0.265	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	24	0.394	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	23	0.151	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	22	0.09	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	27	0.141	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	34	0.306	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	26	0.17	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	32	0.271	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	26	0.154	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	25.5	0.361	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	35.5	0.399	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	21.7	0.075	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	24.5	0.12	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	28	0.076	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	33	0.165	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	28.5	0.155	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	29.7	0.153	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	28.8	0.157	4	Below Giant Pool riffle	released
6/26/2009	Arctic grayling	YOY	28	-	4	Station 1	released
6/26/2009	Arctic grayling	YOY	31	-	4	Station 1	released
6/26/2009	Arctic grayling	YOY	28	-	4	Station 1	released
6/26/2009	Arctic grayling	YOY	27	-	4	Station 1	released
6/26/2009	Arctic grayling	YOY	28.5	-	4	Station 1	released
6/26/2009	Arctic grayling	YOY	30.5	-	4	Station 1	released
6/26/2009	Arctic grayling	YOY	24.5	-	4	Station 1	released
6/26/2009	Arctic grayling	YOY	30.3	-	4	Station 1	released
6/26/2009	Arctic grayling	YOY	31	-	4	Station 1	released
6/26/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/26/2009	Arctic grayling	YOY	31	-	4	Station 1	released
6/26/2009	Arctic grayling	YOY	28.5	-	4	Station 1	released
6/26/2009	Arctic grayling	YOY	28	-	4	Station 1	released
6/26/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/26/2009	Arctic grayling	YOY	31.5	-	4	Station 1	released
6/26/2009	Arctic grayling	YOY	28	-	4	Station 1	released
6/26/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/26/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/26/2009	Arctic grayling	YOY	27.5	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	32	-	4	Lower Canyon Riffle	released
6/27/2009	Arctic grayling	YOY	30.5	-	4	Lower Canyon Riffle	preserved
6/27/2009	Arctic grayling	YOY	34.5	-	4	Lower Canyon Riffle	preserved
6/27/2009	Arctic grayling	YOY	32	-	4	Lower Canyon Riffle	preserved
6/27/2009	Arctic grayling	YOY	30.5	-	4	Lower Canyon Riffle	preserved
6/27/2009	Arctic grayling	YOY	29	-	4	Lower Canyon Riffle	preserved
6/27/2009	Arctic grayling	YOY	28	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	29.5	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	27.5	-	4	Station 1	released



APPENDIX A

Raw Data

Table A-2: Young-of-the-Year Fish Capture Data, Baker Creek 2009 (Continued)

Date	Species	Maturity	Length (mm)	Weight (g)	Reach	Capture Location	Status
6/27/2009	Arctic grayling	YOY	28	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	30.5	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	28.5	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	24.5	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	30.5	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	27.5	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	29	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	33	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	33.5	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	29.5	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	29	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	29	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	29	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	28.5	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	35	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	28	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	29	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	31	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	29	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	34	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	29	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	34	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	30.5	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	33	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	31	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	31	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	29	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	33	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	27.5	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	25	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	31	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	29	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	27	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	29	-	4	Station 1	released



APPENDIX A

Raw Data

Table A-2: Young-of-the-Year Fish Capture Data, Baker Creek 2009 (Continued)

Date	Species	Maturity	Length (mm)	Weight (g)	Reach	Capture Location	Status
6/27/2009	Arctic grayling	YOY	27	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	33	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	34	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	33	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	29	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	25	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	29	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	33	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	34	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	34	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	29	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	29	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	27.5	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	31	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	28	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	28.5	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	29	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	28	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	29	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	31	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	31	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	29	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	33	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	33	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	34	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	31	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	28	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	21	0.063	4	Station 1	preserved
6/27/2009	Arctic grayling	YOY	34	-	4	Station 1	released



APPENDIX A

Raw Data

Table A-2: Young-of-the-Year Fish Capture Data, Baker Creek 2009 (Continued)

Date	Species	Maturity	Length (mm)	Weight (g)	Reach	Capture Location	Status
6/27/2009	Arctic grayling	YOY	33	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	35	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	28	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	29	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	34	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	31	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	22	0.077	4	Station 1	preserved
6/27/2009	Arctic grayling	YOY	24	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/27/2009	Arctic grayling	YOY	34	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	40	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	31	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	29	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	31	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	34	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	24.5	0.146	4	Station 1	preserved
6/28/2009	Arctic grayling	YOY	39	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	33	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	33	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	38	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	38	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	29	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	33	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	31	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	35	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	27	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	19.7	0.039	4	Station 1	preserved
6/28/2009	Arctic grayling	YOY	30	0.202	4	Station 1	frozen
6/28/2009	Arctic grayling	YOY	36.3	0.384	4	Station 1	frozen
6/28/2009	Arctic grayling	YOY	32	0.245	4	Station 1	frozen
6/28/2009	Arctic grayling	YOY	35.5	0.341	4	Station 1	frozen
6/28/2009	Arctic grayling	YOY	35.5	0.355	4	Station 1	frozen



APPENDIX A

Raw Data

Table A-2: Young-of-the-Year Fish Capture Data, Baker Creek 2009 (Continued)

Date	Species	Maturity	Length (mm)	Weight (g)	Reach	Capture Location	Status
6/28/2009	Arctic grayling	YOY	35.2	0.348	4	Station 1	frozen
6/28/2009	Arctic grayling	YOY	31	0.198	4	Station 1	frozen
6/28/2009	Arctic grayling	YOY	32.8	0.239	4	Station 1	frozen
6/28/2009	Arctic grayling	YOY	33.5	0.3	4	Station 1	frozen
6/28/2009	Arctic grayling	YOY	26	0.119	4	Station 1	frozen
6/28/2009	Arctic grayling	YOY	38	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	39	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	29	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	34	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	33	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	29	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	34	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	34	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	39	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	28	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	29	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	33	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	33	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	31	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	24	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	29	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	31	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	36	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	33	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	31	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	36	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	34	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	35.5	-	4	Station 1	released
6/28/2009	Arctic grayling	YOY	32.5	-	4	Station 1	released
6/29/2009	Arctic grayling	YOY	33	-	4	Station 1	released
6/29/2009	Arctic grayling	YOY	35	-	4	Station 1	released
6/29/2009	Arctic grayling	YOY	28	-	4	Station 1	released
6/29/2009	Arctic grayling	YOY	36	-	4	Station 1	released
6/29/2009	Arctic grayling	YOY	33.5	-	4	Station 1	released
6/29/2009	Arctic grayling	YOY	30.5	-	4	Station 1	released
6/29/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/29/2009	Arctic grayling	YOY	30	-	4	Station 1	released
6/29/2009	Arctic grayling	YOY	34	-	4	Station 1	released
6/29/2009	Arctic grayling	YOY	31	-	4	Station 1	released
6/29/2009	Arctic grayling	YOY	35	-	4	Station 1	released
6/29/2009	Arctic grayling	YOY	24	-	4	Station 1	released
6/29/2009	Arctic grayling	YOY	34.5	-	4	Station 1	released



APPENDIX A

Raw Data

Table A-2: Young-of-the-Year Fish Capture Data, Baker Creek 2009 (Continued)

Date	Species	Maturity	Length (mm)	Weight (g)	Reach	Capture Location	Status
6/29/2009	Arctic grayling	YOY	34	-	4	Station 1	released
6/29/2009	Arctic grayling	YOY	32	-	4	Station 1	released
6/29/2009	Arctic grayling	YOY	35.5	-	4	Station 1	released
6/29/2009	Arctic grayling	YOY	28.5	-	4	Station 1	released
6/29/2009	Arctic grayling	YOY	31.5	0.189	4	Station 1	frozen
6/29/2009	Arctic grayling	YOY	32.5	-	4	Station 1	released
6/29/2009	Arctic grayling	YOY	39	-	4	Station 1	released
6/29/2009	Arctic grayling	YOY	34	-	4	Station 1	released
6/29/2009	Arctic grayling	YOY	25.5	-	4	Station 1	released
6/29/2009	Arctic grayling	YOY	33.5	-	4	Station 1	released
6/29/2009	Arctic grayling	YOY	34	-	4	Station 1	released
6/29/2009	Arctic grayling	YOY	34.3	0.336	4	Station 1	frozen
6/29/2009	Arctic grayling	YOY	35	0.326	4	Station 1	frozen
6/29/2009	Arctic grayling	YOY	34.7	0.35	4	Station 1	frozen
6/29/2009	Arctic grayling	YOY	31.4	0.235	4	Station 1	frozen
6/29/2009	Arctic grayling	YOY	32.3	0.245	4	Station 1	frozen
6/29/2009	Arctic grayling	YOY	34.5	0.329	4	Station 1	frozen
6/29/2009	Arctic grayling	YOY	27.2	0.151	4	Station 1	frozen
6/29/2009	Arctic grayling	YOY	31	0.225	4	Station 1	frozen
6/29/2009	Arctic grayling	YOY	36	0.373	4	Station 1	frozen
6/29/2009	Arctic grayling	YOY	31	0.231	4	Station 1	frozen
6/29/2009	Arctic grayling	YOY	34	0.309	4	below Reach 4 bridge	frozen
6/29/2009	Arctic grayling	YOY	35.3	0.381	4	below Reach 4 bridge	frozen
6/29/2009	Arctic grayling	YOY	36.8	0.395	4	below Reach 4 bridge	frozen
6/29/2009	Arctic grayling	YOY	32.5	0.295	4	below Reach 4 bridge	frozen
6/29/2009	Arctic grayling	YOY	34.2	0.317	4	below Reach 4 bridge	frozen
6/29/2009	Arctic grayling	YOY	33	0.284	4	below Reach 4 bridge	frozen
6/29/2009	Arctic grayling	YOY	30.5	0.223	4	below Reach 4 bridge	frozen
6/29/2009	Arctic grayling	YOY	34.3	0.276	4	below Reach 4 bridge	frozen
6/29/2009	Arctic grayling	YOY	34	0.309	4	below Reach 4 bridge	frozen
6/29/2009	Arctic grayling	YOY	34.6	0.315	4	below Reach 4 bridge	frozen
6/29/2009	Arctic grayling	YOY	25	0.141	4	below Reach 4 bridge	frozen
6/29/2009	Arctic grayling	YOY	33	0.294	4	below Reach 4 bridge	frozen
6/30/2009	Arctic grayling	YOY	18	-	4	Flood plain /Lower Canyon side channel	released
6/30/2009	Arctic grayling	YOY	16	-	4	Flood plain /Lower Canyon side channel	released
6/30/2009	Arctic grayling	YOY	17.5	-	4	Flood plain /Lower Canyon side channel	released
6/30/2009	Arctic grayling	YOY	16	-	4	Flood plain /Lower Canyon side channel	released
6/30/2009	Arctic grayling	YOY	15.5	-	4	Flood plain /Lower Canyon side channel	released
6/30/2009	Arctic grayling	YOY	16.5	-	4	Flood plain /Lower Canyon side channel	released
7/1/2009	Arctic grayling	YOY	28	-	4	Station 1	released
7/1/2009	Arctic grayling	YOY	34	-	4	Station 1	released
7/1/2009	Arctic grayling	YOY	31	-	4	Station 1	released
7/1/2009	Arctic grayling	YOY	50	-	4	Station 1	released
7/1/2009	Arctic grayling	YOY	34	-	4	Station 1	released
7/1/2009	Arctic grayling	YOY	36.5	-	4	Station 1	released
7/1/2009	Arctic grayling	YOY	35	-	4	Station 1	released
7/1/2009	Arctic grayling	YOY	33	-	4	Station 1	released
7/1/2009	Arctic grayling	YOY	32	-	4	Station 1	released
7/1/2009	Arctic grayling	YOY	39.7	0.53	4	Station 1	frozen



APPENDIX A

Raw Data

Table A-2: Young-of-the-Year Fish Capture Data, Baker Creek 2009 (Continued)

Date	Species	Maturity	Length (mm)	Weight (g)	Reach	Capture Location	Status
7/1/2009	Arctic grayling	YOY	40.2	0.642	4	Station 1	frozen
7/1/2009	Arctic grayling	YOY	42.3	0.698	4	Station 1	frozen
7/1/2009	Arctic grayling	YOY	41	0.623	4	Station 1	frozen
7/1/2009	Arctic grayling	YOY	37	-	4	Station 1	released
7/1/2009	Arctic grayling	YOY	37.5	-	4	Station 1	released
7/1/2009	Arctic grayling	YOY	34.5	-	4	Station 1	released
7/1/2009	Arctic grayling	YOY	37	-	4	Station 1	released
7/1/2009	Arctic grayling	YOY	39	-	4	Station 1	released
7/1/2009	Arctic grayling	YOY	38	0.401	4	Station 1	frozen
7/1/2009	Arctic grayling	YOY	37.5	0.392	4	Station 1	frozen
7/1/2009	Arctic grayling	YOY	38.3	0.42	4	Station 1	frozen
7/3/2009	Arctic grayling	YOY	36	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	32	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	34.5	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	39.5	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	32	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	36	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	35.5	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	44	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	40	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	36	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	39.5	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	39	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	36	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	41	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	34.5	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	39.5	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	33	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	33	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	40	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	38	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	35.5	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	39.5	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	36	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	34.5	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	29.5	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	38	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	42	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	35	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	39	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	38.5	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	36	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	38	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	35	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	29	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	29	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	35	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	35.5	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	36	-	4	Station 1	released



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Raw Data

Table A-2: Young-of-the-Year Fish Capture Data, Baker Creek 2009 (Continued)

Date	Species	Maturity	Length (mm)	Weight (g)	Reach	Capture Location	Status
7/3/2009	Arctic grayling	YOY	36	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	39	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	35	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	44	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	35	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	38	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	31	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	32	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	39	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	36	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	41	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	34.5	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	40	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	37	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	39	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	34.5	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	38	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	38.5	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	37	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	38	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	33.5	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	35	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	38	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	39.5	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	37	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	40	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	41	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	37.5	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	33	-	4	Station 1	released
7/3/2009	Arctic grayling	YOY	37.5	-	4	Station 1	released
7/5/2009	Arctic grayling	YOY	48	-	1	Station 2 below culvert	released
7/5/2009	Arctic grayling	YOY	39	-	1	Station 2 below culvert	released
7/5/2009	Arctic grayling	YOY	37	-	1	Station 2 below culvert	released
7/5/2009	Arctic grayling	YOY	37.5	-	1	Station 2 below culvert	released
7/5/2009	Arctic grayling	YOY	36.5	-	1	Station 2 below culvert	released
7/5/2009	Arctic grayling	YOY	45	-	1	Station 2 below culvert	released
7/5/2009	Arctic grayling	YOY	39.5	-	1	Station 2 below culvert	released
7/5/2009	Arctic grayling	YOY	38	-	1	Station 2 below culvert	released
7/5/2009	Arctic grayling	YOY	48	-	1	Station 2 below culvert	released
7/5/2009	Arctic grayling	YOY	46	-	1	Station 2 below culvert	released
7/5/2009	Arctic grayling	YOY	42	-	1	Station 2 below culvert	released
7/5/2009	Arctic grayling	YOY	40	-	1	Station 2 below culvert	released
7/6/2009	Arctic grayling	YOY	42	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	45	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	40	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	38	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	38	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	32	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	50	-	0	Breakwater GSL side	released



APPENDIX A

Raw Data

Table A-2: Young-of-the-Year Fish Capture Data, Baker Creek 2009 (Continued)

Date	Species	Maturity	Length (mm)	Weight (g)	Reach	Capture Location	Status
7/6/2009	Arctic grayling	YOY	40	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	40	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	42	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	38	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	36	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	42	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	36	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	34	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	43	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	35	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	42	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	49	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	38	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	34	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	41	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	42	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	34	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	35	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	39	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	30	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	29	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	20	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	33	-	0	Breakwater GSL side	released
7/6/2009	Arctic grayling	YOY	40	-	4	Station 1	released
7/6/2009	Arctic grayling	YOY	41	-	4	Station 1	released
7/7/2009	Arctic grayling	YOY	48	-	4	Station 1	released
7/7/2009	Arctic grayling	YOY	45	-	4	Station 1	released
7/7/2009	Arctic grayling	YOY	44.5	-	4	Station 1	released
7/7/2009	Arctic grayling	YOY	53	-	4	Station 1	released
7/8/2009	Arctic grayling	YOY	34	-	1	Station 2 below culvert	released
7/8/2009	Arctic grayling	YOY	55	-	1	Station 2 below culvert	released
7/8/2009	Arctic grayling	YOY	39.5	-	1	Station 2 below culvert	released
7/8/2009	Arctic grayling	YOY	46	-	1	Station 2 below culvert	released
7/8/2009	Arctic grayling	YOY	51	-	1	Station 2 below culvert	released
7/8/2009	Arctic grayling	YOY	33	-	1	Station 2 below culvert	released
7/8/2009	Arctic grayling	YOY	48	-	1	Station 2 below culvert	released
7/8/2009	Arctic grayling	YOY	36	-	1	Station 2 below culvert	released
7/8/2009	Arctic grayling	YOY	48	-	1	Station 2 below culvert	released
7/8/2009	Arctic grayling	YOY	54	-	4	Station 1	released
7/11/2009	Arctic grayling	YOY	46	-	0	Breakwater Baker side	released
7/11/2009	Arctic grayling	YOY	46	-	0	Breakwater Baker side	released
7/11/2009	Arctic grayling	YOY	50	-	0	Breakwater Baker side	released
7/11/2009	Arctic grayling	YOY	48	-	0	Breakwater Baker side	released
7/11/2009	Arctic grayling	YOY	50	-	0	Breakwater Baker side	released
7/11/2009	Arctic grayling	YOY	40	-	0	Breakwater Baker side	released
7/11/2009	Arctic grayling	YOY	49	-	0	Breakwater Baker side	released
7/11/2009	Arctic grayling	YOY	42	-	0	Breakwater Baker side	released
7/11/2009	Arctic grayling	YOY	43	-	0	Breakwater Baker side	released
7/11/2009	Arctic grayling	YOY	44	-	0	Breakwater Baker side	released



APPENDIX A

Raw Data

Table A-2: Young-of-the-Year Fish Capture Data, Baker Creek 2009 (Continued)

Date	Species	Maturity	Length (mm)	Weight (g)	Reach	Capture Location	Status
7/13/2009	Arctic grayling	YOY	65	-	1	Station 2 below culvert	released
7/13/2009	Arctic grayling	YOY	46	-	0	Breakwater Baker side	released
7/13/2009	Arctic grayling	YOY	38	-	0	Breakwater Baker side	released
7/13/2009	Arctic grayling	YOY	46	-	0	Breakwater Baker side	released
7/13/2009	Arctic grayling	YOY	33	-	0	Breakwater Baker side	released
7/13/2009	Arctic grayling	YOY	52	-	0	Breakwater Baker side	released
7/13/2009	Arctic grayling	YOY	42	-	0	Breakwater Baker side	released
7/13/2009	Arctic grayling	YOY	42	-	0	Breakwater Baker side	released
7/13/2009	Arctic grayling	YOY	35	-	0	Breakwater Baker side	released
7/13/2009	Arctic grayling	YOY	49	-	0	Breakwater Baker side	released
7/13/2009	Arctic grayling	YOY	35	-	0	Breakwater Baker side	released
7/13/2009	Arctic grayling	YOY	38	-	0	Breakwater Baker side	released
7/13/2009	Arctic grayling	YOY	38	-	0	Breakwater Baker side	released
7/16/2009	Arctic grayling	YOY	42.5	-	0	Breakwater Baker side	frozen
7/16/2009	Arctic grayling	YOY	32.3	-	0	Breakwater Baker side	frozen
7/16/2009	Arctic grayling	YOY	34.5	-	0	Breakwater Baker side	frozen
7/17/2009	Arctic grayling	YOY	37.1	-	0	Breakwater Baker side	frozen
7/17/2009	Arctic grayling	YOY	41.9	-	0	Breakwater Baker side	frozen
7/19/2009	Arctic grayling	YOY	47.4	-	0	Breakwater Baker side	frozen
7/19/2009	Arctic grayling	YOY	43.9	-	0	Breakwater Baker side	frozen
6/19/2009	longnose sucker	YOY	11	-	1	Below culvert-rail bridge	released
6/19/2009	longnose sucker	YOY	11	-	1	Below culvert-rail bridge	released
6/22/2009	longnose sucker	YOY	11	-	1	Below culvert-rail bridge	released
6/24/2009	longnose sucker	YOY	13.5	-	4	Below Giant Pool riffle	preserved
6/24/2009	longnose sucker	YOY	12	-	4	Below Giant Pool riffle	released
6/24/2009	longnose sucker	YOY	12.5	-	4	Below Giant Pool riffle	released
6/24/2009	longnose sucker	YOY	13	-	4	Below Giant Pool riffle	released
6/24/2009	longnose sucker	YOY	12.5	-	4	Below Giant Pool riffle	released
6/24/2009	longnose sucker	YOY	13	-	4	Below Giant Pool riffle	released
6/24/2009	longnose sucker	YOY	12	-	4	Below Giant Pool riffle	released
6/24/2009	longnose sucker	YOY	12.5	-	4	Below Giant Pool riffle	released
6/24/2009	longnose sucker	YOY	12.5	-	4	Below Giant Pool riffle	released
6/24/2009	longnose sucker	YOY	12	-	4	Below Giant Pool riffle	released
6/24/2009	longnose sucker	YOY	12	-	4	Below Giant Pool riffle	released
6/24/2009	longnose sucker	YOY	12	-	4	Below Giant Pool riffle	released
6/24/2009	longnose sucker	YOY	12	-	1	Below Giant Pool riffle	released
6/24/2009	longnose sucker	YOY	11.5	-	1	Below culvert-rail bridge	released
6/24/2009	longnose sucker	YOY	11.5	-	1	Below culvert-rail bridge	released
6/24/2009	longnose sucker	YOY	13	-	1	Below culvert-rail bridge	released
6/24/2009	longnose sucker	YOY	13	-	1	Below culvert-rail bridge	released
6/24/2009	longnose sucker	YOY	12.5	-	1	Below culvert-rail bridge	released
6/24/2009	longnose sucker	YOY	12	-	1	Below culvert-rail bridge	released
6/24/2009	longnose sucker	YOY	12	-	1	Below culvert-rail bridge	released
6/24/2009	longnose sucker	YOY	12	-	1	Below culvert-rail bridge	released
6/24/2009	longnose sucker	YOY	13	-	1	Below culvert-rail bridge	released
6/24/2009	longnose sucker	YOY	11.5	-	1	Below culvert-rail bridge	released
6/24/2009	longnose sucker	YOY	14	-	1	Below culvert-rail bridge	released
6/24/2009	longnose sucker	YOY	13.5	-	1	Below culvert-rail bridge	released



APPENDIX A

Raw Data

Table A-2: Young-of-the-Year Fish Capture Data, Baker Creek 2009 (Continued)

Date	Species	Maturity	Length (mm)	Weight (g)	Reach	Capture Location	Status
6/24/2009	longnose sucker	YOY	12	-	1	Below culvert-rail bridge	released
6/29/2009	longnose sucker	YOY	15	0.012	4	Station 1	released
7/6/2009	longnose sucker	YOY	18	-	0	Breakwater GSL side	released
7/6/2009	longnose sucker	YOY	18	-	0	Breakwater GSL side	released
7/6/2009	longnose sucker	YOY	17	-	0	Breakwater GSL side	released
7/7/2009	longnose sucker	YOY	24	-	1	Station 2 Below Culvert	released
7/8/2009	longnose sucker	YOY	20	-	1	Station 2 Below Culvert	released
7/8/2009	longnose sucker	YOY	21.5	-	1	Station 2 Below Culvert	released
7/8/2009	longnose sucker	YOY	20	-	4	Station 1	released
7/8/2009	longnose sucker	YOY	22	-	4	Station 1	released
7/8/2009	longnose sucker	YOY	22	-	4	Station 1	released
7/8/2009	longnose sucker	YOY	20	-	4	Station 1	released
7/8/2009	longnose sucker	YOY	22	-	4	Station 1	released
7/8/2009	longnose sucker	YOY	19	-	4	Station 1	released
7/11/2009	longnose sucker	YOY	20	-	1	Station 2 Below Culvert	released
7/11/2009	longnose sucker	YOY	21.5	-	1	Station 2 Below Culvert	released
7/11/2009	longnose sucker	YOY	26	-	1	Station 2 Below Culvert	released
7/11/2009	longnose sucker	YOY	24	-	1	Station 2 Below Culvert	released
7/11/2009	longnose sucker	YOY	26.5	-	1	Station 2 Below Culvert	released
7/11/2009	longnose sucker	YOY	24	-	1	Station 2 Below Culvert	released
7/11/2009	longnose sucker	YOY	23.5	-	1	Station 2 Below Culvert	released
7/11/2009	longnose sucker	YOY	22	-	1	Station 2 Below Culvert	released
7/11/2009	longnose sucker	YOY	22	-	1	Station 2 Below Culvert	released
7/11/2009	longnose sucker	YOY	22.5	-	1	Station 2 Below Culvert	released
7/11/2009	longnose sucker	YOY	25	-	1	Station 2 Below Culvert	released
7/11/2009	longnose sucker	YOY	20	-	1	Station 2 Below Culvert	released
7/11/2009	longnose sucker	YOY	22	-	1	Station 2 Below Culvert	released
7/11/2009	longnose sucker	YOY	23	-	1	Station 2 Below Culvert	released
7/11/2009	longnose sucker	YOY	24	-	1	Station 2 Below Culvert	released
7/11/2009	longnose sucker	YOY	24.5	-	1	Station 2 Below Culvert	released
7/11/2009	longnose sucker	YOY	22.5	-	1	Station 2 Below Culvert	released
7/11/2009	longnose sucker	YOY	21.5	-	1	Station 2 Below Culvert	released
7/11/2009	longnose sucker	YOY	21.5	-	1	Station 2 Below Culvert	released
7/11/2009	longnose sucker	YOY	22.5	-	1	Station 2 Below Culvert	released
7/11/2009	longnose sucker	YOY	23	-	1	Station 2 Below Culvert	released
7/11/2009	longnose sucker	YOY	48	-	0	end of breakwater	released
7/11/2009	longnose sucker	YOY	58	-	0	end of breakwater	released
7/13/2009	longnose sucker	YOY	28	-	1	Station 2 Below Culvert	released
7/13/2009	longnose sucker	YOY	25	-	1	Station 2 Below Culvert	released
7/13/2009	longnose sucker	YOY	23	-	1	Station 2 Below Culvert	released
7/13/2009	longnose sucker	YOY	22	-	1	Station 2 Below Culvert	released
7/13/2009	longnose sucker	YOY	22	-	1	Station 2 Below Culvert	released
7/13/2009	longnose sucker	YOY	23	-	1	Station 2 Below Culvert	released
7/13/2009	longnose sucker	YOY	23	-	1	Station 2 Below Culvert	released
7/13/2009	longnose sucker	YOY	26	-	1	Station 2 Below Culvert	released
7/13/2009	longnose sucker	YOY	26	-	1	Station 2 Below Culvert	released
7/13/2009	longnose sucker	YOY	25	-	1	Station 2 Below Culvert	released
7/13/2009	longnose sucker	YOY	25	-	1	Station 2 Below Culvert	released
7/13/2009	longnose sucker	YOY	24	-	1	Station 2 Below Culvert	released



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Table A-2: Young-of-the-Year Fish Capture Data, Baker Creek 2009 (Continued)

Date	Species	Maturity	Length (mm)	Weight (g)	Reach	Capture Location	Status
7/13/2009	longnose sucker	YOY	21	-	1	Station 2 Below Culvert	released
7/13/2009	longnose sucker	YOY	26.5	-	1	Station 2 Below Culvert	released
7/13/2009	longnose sucker	YOY	24	-	1	Station 2 Below Culvert	released
7/13/2009	longnose sucker	YOY	25	-	1	Station 2 Below Culvert	released
7/13/2009	longnose sucker	YOY	19	-	1	Station 2 Below Culvert	released
7/13/2009	longnose sucker	YOY	23	-	1	Station 2 Below Culvert	released
7/13/2009	longnose sucker	YOY	23	-	1	Station 2 Below Culvert	released
7/13/2009	longnose sucker	YOY	21	-	0	end of breakwater	released
7/13/2009	longnose sucker	YOY	19	-	0	end of breakwater	released
7/13/2009	longnose sucker	YOY	20	-	0	end of breakwater	released
7/13/2009	longnose sucker	YOY	21	-	0	end of breakwater	released
7/13/2009	longnose sucker	YOY	22	-	0	end of breakwater	released
7/13/2009	longnose sucker	YOY	25	-	0	end of breakwater	released
7/13/2009	longnose sucker	YOY	24	-	0	end of breakwater	released
7/13/2009	longnose sucker	YOY	23	-	0	end of breakwater	released
7/13/2009	longnose sucker	YOY	23	-	0	end of breakwater	released
7/13/2009	longnose sucker	YOY	25	-	0	end of breakwater	released
7/13/2009	longnose sucker	YOY	26	-	0	end of breakwater	released
7/13/2009	longnose sucker	YOY	26	-	0	end of breakwater	released
7/13/2009	longnose sucker	YOY	25	-	0	end of breakwater	released
7/13/2009	longnose sucker	YOY	25	-	0	end of breakwater	released
7/13/2009	longnose sucker	YOY	24	-	0	end of breakwater	released
7/13/2009	longnose sucker	YOY	21	-	0	end of breakwater	released
7/13/2009	longnose sucker	YOY	26.5	-	0	end of breakwater	released
7/13/2009	longnose sucker	YOY	24	-	0	end of breakwater	released
7/13/2009	longnose sucker	YOY	25	-	0	end of breakwater	released
7/13/2009	longnose sucker	YOY	19	-	0	end of breakwater	released
7/13/2009	longnose sucker	YOY	23	-	0	end of breakwater	released
7/13/2009	longnose sucker	YOY	23	-	0	end of breakwater	released
7/13/2009	longnose sucker	YOY	23	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	23	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	22	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	28	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	24	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	25	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	24.5	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	22	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	28	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	25	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	24	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	23	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	23	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	27	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	26	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	16	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	16	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	16	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	18	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	17	-	4	Station 1	released



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Table A-2: Young-of-the-Year Fish Capture Data, Baker Creek 2009 (Continued)

Date	Species	Maturity	Length (mm)	Weight (g)	Reach	Capture Location	Status
7/13/2009	longnose sucker	YOY	17	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	25	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	22	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	17	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	18	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	20	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	18	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	15	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	18	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	18	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	18	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	19	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	19	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	16.5	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	17	-	4	Station 1	released
7/13/2009	longnose sucker	YOY	25	-	4	Station 1	released
7/17/2009	longnose sucker	YOY	23	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	23	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	22.5	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	22	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	18	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	26	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	26	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	19	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	20	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	28	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	21	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	20	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	21	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	24	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	21	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	21	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	23	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	24	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	24	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	20	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	21	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	20	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	19.5	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	21	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	22	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	21	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	21	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	22	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	24.5	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	25	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	24	-	1	Station 2 Below Culvert	released
7/17/2009	longnose sucker	YOY	20	-	1	Station 2 Below Culvert	released
7/19/2009	longnose sucker	YOY	20	-	1	Station 2 Below Culvert	released



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Table A-2: Young-of-the-Year Fish Capture Data, Baker Creek 2009 (Continued)

Date	Species	Maturity	Length (mm)	Weight (g)	Reach	Capture Location	Status
7/8/2009	northern pike	YOY	38	-	1	Station 2 Below culvert	released
7/8/2009	northern pike	YOY	58	-	1	Station 2 Below culvert	released
7/8/2009	northern pike	YOY	38	-	1	Station 2 Below culvert	released
7/11/2009	Northern pike	YOY	31	-	1	Station 2 Below culvert	released
7/7/2009	whitefish species	YOY	-	-	4	Station 1, Reach 4	preserved
7/7/2009	whitefish species	YOY	-	-	4	Station 1, Reach 4	preserved
7/8/2009	whitefish species	YOY	45.5	-	1	Station 2 Below culvert, Reach 1	released
7/8/2009	whitefish species	YOY	48	-	1	Station 2 Below culvert Reach 1	released
7/8/2009	whitefish species	YOY	50	-	1	Station 2 Below culvert Reach 1	released
7/11/2009	whitefish species	YOY	32	-	0	Breakwater end	released
7/11/2009	whitefish species	YOY	36	-	0	Breakwater end	released
7/11/2009	whitefish species	YOY	29	-	0	Breakwater end	released
7/11/2009	whitefish species	YOY	35	-	0	Breakwater end	released
7/11/2009	whitefish species	YOY	38	-	0	Breakwater end	released
7/11/2009	whitefish species	YOY	40	-	0	Breakwater end	released
7/11/2009	whitefish species	YOY	29	-	0	Breakwater end	released
7/11/2009	whitefish species	YOY	48	-	0	Breakwater end	released
7/11/2009	whitefish species	YOY	35	-	0	Breakwater end	released
7/11/2009	whitefish species	YOY	32	-	0	Breakwater end	released
7/11/2009	whitefish species	YOY	36	-	0	Breakwater end	released
7/11/2009	whitefish species	YOY	44	-	0	Breakwater end	released
7/11/2009	whitefish species	YOY	45	-	0	Breakwater end	released
7/11/2009	whitefish species	YOY	38	-	0	Breakwater end	released
7/11/2009	whitefish species	YOY	38	-	0	Breakwater end	released
7/13/2009	whitefish species	YOY	38	-	0	Breakwater end	released
7/13/2009	whitefish species	YOY	33	-	0	Breakwater end	released
7/13/2009	whitefish species	YOY	30	-	0	Breakwater end	released
7/13/2009	whitefish species	YOY	39	-	0	Breakwater end	released
7/13/2009	whitefish species	YOY	34	-	0	Breakwater end	released
7/13/2009	whitefish species	YOY	40	-	0	Breakwater end	released
7/13/2009	whitefish species	YOY	34	-	0	Breakwater end	released
7/13/2009	whitefish species	YOY	35	-	0	Breakwater end	released
7/17/2009	whitefish species	YOY	42	-	0	Breakwater end	preserved
7/17/2009	whitefish species	YOY	38.5	-	0	Breakwater end	preserved
7/17/2009	whitefish species	YOY	41.5	-	0	Breakwater end	preserved
7/17/2009	whitefish species	YOY	37.5	-	0	Breakwater end	preserved
7/17/2009	whitefish species	YOY	39	-	0	Breakwater end	preserved
7/17/2009	whitefish species	YOY	46	-	0	Breakwater end	preserved
7/17/2009	whitefish species	YOY	41	-	0	Breakwater end	preserved
7/17/2009	whitefish species	YOY	41.5	-	0	Breakwater end	preserved
7/17/2009	whitefish species	YOY	45.5	-	0	Breakwater end	preserved
7/17/2009	whitefish species	YOY	41	-	0	Breakwater end	preserved
7/17/2009	whitefish species	YOY	40	-	0	Breakwater end	preserved
7/17/2009	whitefish species	YOY	40	-	0	Breakwater end	preserved
7/17/2009	whitefish species	YOY	40	-	0	Breakwater end	preserved
7/17/2009	whitefish species	YOY	36	-	0	Breakwater end	preserved
7/17/2009	whitefish species	YOY	39	-	0	Breakwater end	preserved
7/17/2009	whitefish species	YOY	38.5	-	0	Breakwater end	preserved
7/17/2009	whitefish species	YOY	37	-	0	Breakwater end	preserved



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Table A-2: Young-of-the-Year Fish Capture Data, Baker Creek 2009 (Continued)

Date	Species	Maturity	Length (mm)	Weight (g)	Reach	Capture Location	Status
7/17/2009	whitefish species	YOY	36	-	0	Breakwater end	preserved
7/17/2009	whitefish species	YOY	38	-	0	Breakwater end	preserved
7/17/2009	whitefish species	YOY	42	-	0	Breakwater end	preserved
7/13/2009	ninespine stickleback	YOY	6	-	4	Station 1 Reach 4	released



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Table A-3 Habitat Measurements along Six transects with Young-of-the-Year, Baker Creek 2009

Date	Location	Width (m)	Total Depth (cm)	Bottom Velocity (m/s)	Mid-Velocity (m/s)	Surface Velocity (m/s)	Observations/ Notes
6/19/2009	Transect 1 Reach 4	0.5	16	0.01	0.01	0	
		1	19	0.01-0.04	0.04-0.06	0.07-0.08	
		1.5	28	0	0	0	Most YOY grayling observed at this location of the transect
		2	32	0	0	0	
		2.5	21	0.01	0.02	0.03-0.04	
		3	21	0.03-0.06	0.39-0.31	0.48-0.53	
		3.5	28	0.94-0.97	1.08-1.06	1.03-1.04	
		4	30	0.54-0.59	1.20-1.24	1.36-1.32	
		4.5	34	1.20-1.18	1.67-1.63	1.78-1.77	
		5	32	0.97-0.98	0.95-1.41	1.85-1.89	
		5.5	34	0.55-0.89	1.07-1.08	0.95-0.87	
		6	42	0.63-0.62	1.00-1.05	0.80-0.87	
		6.5	41	0.35-0.33	0.84-0.83	0.80-0.78	
		7	40	0.08-0.05	0.38-0.40	0.56-0.61	
		7.5	32	0.04-0.01	0.30-0.32	0.41-0.35	
		8	27	0.01-0.01	0.10-0.11	0.18-0.15	Most YOY grayling observed at this location of the transect
		8.5	26	0	0.08-0.09	0.09-0.09	Most YOY grayling observed at this location of the transect
		9	18	0	0	0	
6/19/2009	Transect 2 Reach 4	0.5	11	0.09-0.14	0.12-0.15	0.06-0.19	Most YOY grayling observed at this location of the transect
		1	42	0.01-0.04	0.03-0.01	0.02-0.10	Some YOY grayling observed at this location of the transect
		1.5	53	0.04-0.08	0.09-0.12	0.03-0.03	
		2	74	0.13-0.15	0.10-0.20	0.05-0	
		2.5	61	0.15-0.13	0.16-0.18	0.02-0	
		3	60	0.30-0.24	0.17-0.25	0.16-0.21	
		3.5	87	0.22-0.19	0.19-0.18	0.11-0.02	
		4	87	0.13-0.14	0.24-0.23	0.05-0.04	
		4.5	89	0.22-0.11	0.17-0.11	0.05-0.10	
		5	90	0.14-0.10	0.21-0.16	0.02-0.12	
		5.5	88	0.06-0.05	0.11-0.14	0.17-0.14	
		6	90	0.04-0.10	0.10-0.19	0.14-0.12	
		6.5	90	0.03-0.06	0.07-0.16	0.14-0.15	
		7	68	0.03-0.09	0.08-0.13	0.08-0.03	
		7.5	63	0.01-0.03	0.05-0.04	0.01-0.03	
6/19/2009	Transect 3 Reach 4	0.5	16	0.10-0.11	0.10-0.11	0.10-0.11	
		1	28	0.17-0.19	0.25-0.24	0.24-0.22	
		1.5	39	0.19-0.21	0.22-0.25	0.25-0.23	
		2	41	0.15-0.21	0.23-0.25	0.24-0.25	
		2.5	41	0.20-0.21	0.27-0.29	0.29-0.29	
		3	34	0.23-0.24	0.27-0.29	0.28-0.29	
		3.5	36	0.27-0.28	0.27-0.26	0.25-0.26	
		4	43	0.18-0.17	0.26-0.29	0.29-0.32	
		4.5	40	0.19-0.23	0.28-0.29	0.31-0.29	



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Table A-3 Young-of-the-Year Habitat Measurements , Baker Creek 2009 (Continued)

Date	Location	Width (m)	Total Depth (cm)	Bottom Velocity (m/s)	Mid-Velocity (m/s)	Surface Velocity (m/s)	Observations/ Notes
6/19/2009	Transect 3 (Continued) Reach 4	5	46	0.18-0.17	0.18-0.31	0.27-0.30	
		5.5	25	0.24-0.30	0.32-0.31	0.32-0.31	
		6	20	0.12-0.10	0.02-0.04	0.40-0.41	Most YOY grayling observed at this location of the transect
		6.5	33	0.29-0.27	0.34-0.36	0.35-0.36	
		7	51	0.21-0.25	0.22-0.35	0.34-0.33	
		7.5	48	0.21-0.28	0.34-0.33	0.33-0.32	
		8	50	0.23-0.22	0.28-0.27	0.27-0.29	
		8.5	36	0.19-0.16	0.27-0.28	0.28-0.29	
		9	21	0.25-0.19	0.28-0.27	0.29-0.28	
6/20/2009	Transect 5 Reach 3	9.5	12	0.11-0.12	0.11-0.12	0.11-0.12	Most YOY grayling observed at this location of the transect
		0.5	13.5	0.07-0.13	0.09-0.08	0.04-0.05	
		1	27	0.67-0.45	0.66-0.72	0.50-0.48	
		1.5	37	0.82-0.79	1.04-1.01	1.12-1.13	
		2	36	0.83-0.77	1.05-1.04	1.08-1.09	
		2.5	37	0.70-0.67	0.86-0.89	0.86-0.83	
		3	32	0.47-0.48	0.52-0.55	0.48-0.46	
		3.5	32	0.20-0.27	0.19-0.20	0.26-0.23	
		4	29	0.13-0.18	0.40-0.33	0.64-0.66	
		4.5	29	0.11-0.09	0.03-0.05	0.07-0.13	
	Transect 6 Reach 1	5	31	0.06-0	0	0	
		5.5	31	0	0	0	
		0.5	43	0.28-0.32	0.39-0.44	0.59-0.70	
		1	62	0.22-0.21	0.42-0.48	0.52-0.66	
		1.5	48	0.42-0.43	0.53-0.62	0.62-0.68	
6/22/2009	Transect 4 Reach 4	0.5	22	0.01	0.03	0.03	
		1	39	0.02	0.09-0.03	0.01-0	
		1.5	59	0.01-0	0.24-0.23	0.21-0.22	
		2	63	0.18-0.07	0.31-0.26	0.09-0.19	
		2.5	70	0.17-0.21	0.34-0.31	0.30-0.27	
		3	76	0.13-0.07	0.36-0.33	0.27-0.22	
		3.5	79	0.03-0	0.28-0.27	0.21-0.18	
		4	73	0.09-0.08	0.18-0.25	0.12-0.20	
		4.5	78	0.15-0.12	0.19-0.18	0.02-0.03	
		5	75	0.14-0.12	0.14-0.19	0.12-0.08	
		5.5	73	0	0.03-0.01	0	Most YOY grayling observed at this location of the transect
		6	56	0	0	0.01-0.02	Most YOY grayling observed at this location of the transect
		6.5	29.5	0.01-0.01	0.05-0.06	0.04-0.04	Most YOY grayling observed at this location of the transect
		7	12	0	0	0	Most YOY grayling observed at this location of the transect



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Table A-3 Young-of-the-Year Habitat Measurements , Baker Creek 2009 (Continued)

Date	Location	Width (m)	Total Depth (cm)	Bottom Velocity (m/s)	Mid-Velocity (m/s)	Surface Velocity (m/s)	Observations/ Notes
6/25/2009	Transect 1 (2 nd visit)	0.5	10	0.07	0.07	0.07	
		1	21	0	0.11-0.10	0.16-0.18	
		1.5	39	0.02-0.01	0.02-0.01	0.01-0	
		2	39	0	0-0.01	0.01-0.01	
		2.5	31	0.01-0.01	0.03-0.04	0.02-0.02	
		3	26	0.05-0	0.01-0.04	0.13-0.22	
		3.5	38	0.04-0.02	0.57-0.58	0.83-0.97	
		4	50	0.05-0.09	0.63-0.83	0.96-1.26	
	Reach 4	4.5	37	0.60-0.52	1.55-1.61	1.71-1.60	
		5	50	0.03-0.07	1.06-1.20	1.43-1.53	
		5.5	51	0.13-0.16	0.28-0.82	0.86-0.95	
		6	55	0.06-0.07	0.11-0.18	0.45-0.56	
		6.5	21	0.13-0.10	0.09-0.32	0.32-0.35	
		7	35	0.01-0	0.01-0.05	0.07-0.13	
		7.5	22	0	0	0	
		8	6	0	0	0	
	Transect 2 (2 nd visit)	0.5	15	0.02-0.01	0.02-0.01	0.02-0.01	
		1	17	0.02-0.03	0.08-0.02	0.04-0.05	
		1.5	60	0.04-0.02	0	0	
		2	72	0.02-0.03	0.02-0.01	0.05-0.10	
		2.5	90	0	0	0.02-0.13	
		3	88	0.02-0.06	0.10-0.16	0.20-0.41	
		3.5	90	0.08-0.10	0.12-0.26	0.22-0.43	
		4	91	0.12-0.14	0.24-0.44	0.39-0.36	
	Reach 4	4.5	80	0.18-0.17	0.10-0.23	0.31-0.46	
		5	80	0.09-0.20	0.21-0.36	0.47-0.48	
		5.5	82	0.10-0.11	0.16-0.18	0.34-0.25	
		6	50	0.05-0.07	0.14-0.25	0.36-0.23	
		6.5	30	0.05-0.10	0.05-0.19	0.24-0.17	
		7	27	0	0.03-0.08	0.13-0.10	
		7.5	10	0	0	0	
	Transect 3 (2 nd visit)	0.5	12	0.07-0.06	0.07-0.06	0.07-0.06	
		1	30	0.12-0.10	0.22-0.29	0.28-0.27	
		1.5	39	0.24-0.26	0.30-0.27	0.33-0.30	
		2	40	0.19-0.22	0.30-0.32	0.33-0.38	
		2.5	39	0.24-0.21	0.29-0.35	0.34-0.35	
		3	39	0.21-0.20	0.30-0.31	0.31-0.34	
		3.5	43	0.14-0.16	0.18-0.35	0.35-0.32	
		4	40	0.22-0.25	0.25-0.30	0.28-0.34	
	Reach 4	4.5	44	0.18-0.22	0.25-0.31	0.31-0.30	
		5	30	0.29-0.30	0.30-0.31	0.22-0.31	
		5.5	25	0.20-0.21	0.35-0.22	0.30-0.29	
		6	50	0.19-0.17	0.19-0.30	0.29-0.32	
		6.5	51	0.20-0.18	0.30-0.31	0.28-0.29	
		7	46	0.17-0.16	0.22-0.28	0.30-0.28	
		7.5	20	0.06-0	0	0	
		8	6	0.04-0.09	0	0	

See Figure 4 for locations of transects; measurements taken every 0.5m across the stream from the right upstream bank to the left upstream bank



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Table A-4: Egg Size and Habitat Measurements, Baker Creek 2009

Date	Spawning Species	Location	Egg Size (mm)	Depth (cm)	Bottom Velocity (m/s)	Mid-Velocity (m/s)	Surface Velocity (m/s)	Notes
5/26/2009	Arctic Grayling	Glide Giant Pool, mine side	4.28	32-38	1.30-1.40	1.40-1.73	1.64-1.73	
5/26/2009	Arctic Grayling	Glide Giant Pool, mine side	4.42					
5/26/2009	Arctic Grayling	Glide Giant Pool, mine side	4.31					
5/26/2009	Arctic Grayling	Glide Giant Pool, mine side	4.21					
5/26/2009	Arctic Grayling	Glide Giant Pool, mine side	4.04					
5/26/2009	Arctic Grayling	Glide Giant Pool, other side	4.04	32-38	0.88-1.00	1.19-1.34	1.76-1.88	
5/26/2009	Arctic Grayling	Glide Giant Pool, other side	3.47					
5/26/2009	Arctic Grayling	Glide Giant Pool, other side	3.79					
5/26/2009	Arctic Grayling	Inside of Giant Pool, mine side	4.17	36-38	0.67-0.70	1.09-1.19	1.64-1.74	
5/26/2009	Arctic Grayling	Inside of Giant Pool, mine side	4.53					
5/26/2009	Arctic Grayling	Inside of Giant Pool, mine side	4.3					
5/26/2009	Arctic Grayling	Inside of Giant Pool, mine side	3.96					
5/26/2009	Arctic Grayling	Inside of Giant Pool, mine side	3.94					
5/26/2009	Arctic Grayling	Inside of Giant Pool, mine side	4.14					
5/26/2009	Arctic Grayling	Inside of Giant Pool, mine side	3.73					
5/26/2009	Arctic Grayling	Inside of Giant Pool, mine side	3.91					
5/26/2009	Arctic Grayling	Inside of Giant Pool, mine side	4.14					
5/26/2009	Arctic Grayling	Inside of Giant Pool, mine side	4.14					
5/26/2009	Arctic Grayling	Inside of Giant Pool, other side	4.11	55-59	0.48-0.55	0.48-0.55	0.58-0.60	
5/26/2009	Arctic Grayling	Inside of Giant Pool, other side	4.3					
5/26/2009	Arctic Grayling	Inside of Giant Pool, other side	4.06					
5/26/2009	Arctic Grayling	Run below culvert pool, Reach 1	3.68	55-59	0.73-0.82	0.82-0.94	0.33-0.48	
5/26/2009	Arctic Grayling	Run below culvert pool, Reach 1	3.84					
5/26/2009	Arctic Grayling	Run below culvert pool, Reach 1	4.36					
5/26/2009	Arctic Grayling	Run below culvert pool, Reach 1	4.26					
5/26/2009	Arctic Grayling	Run below culvert pool, Reach 1	4.39					
5/26/2009	Arctic Grayling	Run below culvert pool, Reach 1	3.9					



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Table A-4: Egg Size and Habitat Measurements, Baker Creek 2009 (Continued)

Date	Spawning Species	Location	Egg Size (mm)	Depth (cm)	Bottom Velocity (m/s)	Mid-Velocity (m/s)	Surface Velocity (m/s)	Notes
5/26/2009	sucker	Run below culvert pool, Reach 1	2.93					
5/26/2009	Arctic Grayling	Run below culvert pool, Reach 1	3.9					
5/26/2009	Arctic Grayling	Run below culvert pool, Reach 1	4.32					
5/26/2009	Arctic Grayling	Run below culvert pool, Reach 1	4.14					
5/26/2009	Arctic Grayling	Run below culvert pool, Reach 1	4.39					
5/26/2009	Arctic Grayling	Run below culvert pool, Reach 1	4.19					
5/26/2009	Arctic Grayling	Run below culvert pool, Reach 1	4.19					
5/26/2009	sucker species	Run below culvert pool, Reach 1	2.8					
5/26/2009	sucker species	Second riffle below culvert pool, Reach 1	2.81	53-58				
5/26/2009	sucker species	Second riffle below culvert pool, Reach 1	2.91					
5/26/2009	sucker species	Second riffle below culvert pool, Reach 1	2.67					
5/27/2009	Arctic Grayling	Glide Giant Pool, mine side, Reach 4	3.99	32-38				
5/27/2009	Arctic Grayling	Glide Giant Pool, mine side, Reach 4	3.96					
5/27/2009	Arctic Grayling	Glide Giant Pool, mine side, Reach 4	4.13					
5/27/2009	Arctic Grayling	Glide Giant Pool, mine side, Reach 4	4.07					
5/27/2009	Arctic Grayling	Glide Giant Pool, mine side, Reach 4	4.32					
5/27/2009	Arctic Grayling	Glide Giant Pool, mine side, Reach 4	4.34					
5/27/2009	Arctic Grayling	Glide Giant Pool, mine side, Reach 4	4.06					
5/27/2009	Arctic Grayling	Glide Giant Pool, mine side, Reach 4	4.69					
5/27/2009	Arctic Grayling	Top of Reach 4, mine side	4.05	37-41	1.77-1.79	1.92-2.07	1.95-2.01	
5/27/2009	Arctic Grayling	top of Reach 4, mine side	4.24					
5/27/2009	Arctic Grayling	Top of Reach 4, mine side	4.29					
5/27/2009	Arctic Grayling	Top of Reach 4, mine side	4.37					
5/27/2009	Arctic Grayling	Top of Reach 4, mine side	4.41					
5/27/2009	Arctic Grayling	Top of Reach 4, mine side	4.25					
5/27/2009	Arctic Grayling	Top of Reach 4, mine side	4.91					
5/27/2009	Arctic Grayling	Top of Reach 4, mine side	4.71					



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Table A-4: Egg Size and Habitat Measurements, Baker Creek 2009 (Continued)

Date	Spawning Species	Location	Egg Size (mm)	Depth (cm)	Bottom Velocity (m/s)	Mid-Velocity (m/s)	Surface Velocity (m/s)	Notes
5/27/2009	Arctic Grayling	Top of Reach 4, mine side	4.63					
5/27/2009	Arctic Grayling	Top of Reach 4, mine side	4.21					
5/27/2009	Arctic Grayling	Glide at Spawning Hole, Reach 4	4.28	39-40				
5/27/2009	Arctic Grayling	Glide at Spawning Hole, Reach 4	3.97					
5/27/2009	Arctic Grayling	Glide at Spawning Hole, Reach 4	4.45					
5/27/2009	Arctic Grayling	Glide at Spawning Hole, Reach 4	4.06					
5/27/2009	Arctic Grayling	Glide at Spawning Hole, Reach 4	3.74					
6/1/2009	Arctic Grayling	Above Over-wintering Pool, Reach 4	4.07	50-58	0.55-0.60	0.55-0.58	0.17-0.20	
6/1/2009	Arctic Grayling	Above Over-wintering Pool, Reach 4	3.89					
6/1/2009	Arctic Grayling	Above Over-wintering Pool, Reach 4	4.2					
6/1/2009	Arctic Grayling	Above Over-wintering Pool, Reach 4	4.33					
6/1/2009	Arctic Grayling	Above Over-wintering Pool, Reach 4	4.19					
6/1/2009	Arctic Grayling	Above Over-wintering Pool, Reach 4	4.05					
6/1/2009	Arctic Grayling	Above Over-wintering Pool, Reach 4	4.22					
6/1/2009	Arctic Grayling	Above Over-wintering Pool, Reach 4	3.86					
6/1/2009	Arctic Grayling	Above Over-wintering Pool, Reach 4	4.17					
6/1/2009	Arctic Grayling	Above Over-wintering Pool, Reach 4	4.17					
6/1/2009	Arctic Grayling	Above Over-wintering Pool, Reach 4	4.14					
6/1/2009	Arctic Grayling	Above Over-wintering Pool, Reach 4	3.83					
6/1/2009	Arctic Grayling	Above Over-wintering Pool, Reach 4	4.24					
6/1/2009	Arctic Grayling	Above Over-wintering Pool, Reach 4	4.24					
6/1/2009	Arctic Grayling	Glide in Big Run, Reach 4	4.15	41-51	0.15-0.21	0.24-0.27	0.82-0.94	
6/1/2009	Arctic Grayling	Glide in Big Run, Reach 4	4.1					
6/1/2009	Arctic Grayling	Glide in Big Run, Reach 4	4.12					
6/1/2009	Arctic Grayling	Glide in Big Run, Reach 4	4.12					
6/1/2009	Arctic Grayling	Glide in Big Run, Reach 4	4.02					
6/1/2009	Arctic Grayling	Glide in Big Run, Reach 4	4.07					



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Table A-4: Egg Size and Habitat Measurements, Baker Creek 2009 (Continued)

Date	Spawning Species	Location	Egg Size (mm)	Depth (cm)	Bottom Velocity (m/s)	Mid-Velocity (m/s)	Surface Velocity (m/s)	Notes
6/1/2009	Arctic Grayling	Glide in Big Run, Reach 4	4.07					
6/1/2009	Arctic Grayling	Second riffle below culvert pool, Reach 1	4.17	44-50	0.03-0.04	0.18-0.21	0.12-0.07	
6/1/2009	sucker species	Second riffle below culvert pool, Reach 1	2.45					
6/1/2009	sucker	Second riffle below culvert pool, Reach 1	3.2					
6/1/2009	sucker species	Second riffle below culvert pool, Reach 1	2.81					
6/1/2009	sucker species	Second riffle below culvert pool, Reach 1	3.04					
6/1/2009	sucker species	Second riffle below culvert pool, Reach 1	2.96					
6/1/2009	sucker species	Second riffle below culvert pool, Reach 1	2.81					
6/1/2009	sucker species	Second riffle below culvert pool, Reach 1	2.99					
6/1/2009	sucker species	Second riffle below culvert pool, Reach 1	3.11					
6/1/2009	sucker species	Second riffle below culvert pool, Reach 1	2.82					
6/1/2009	Arctic Grayling	Second riffle below culvert pool, Reach 1	4.19					
6/7/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	3.34	34-46				
6/7/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	2.94					
6/7/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	3.15					
6/7/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	3.15					
6/7/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	2.93					
6/7/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	3.15					
6/7/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	3.15					
6/7/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	2.82					
6/7/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	3.13					
6/7/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	2.83					
6/7/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	3.06					
6/7/2009	Arctic Grayling	Above rail bridge, second riffle below culvert pool, Reach 1	3.32					just laid
6/7/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	2.93					
6/7/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	2.91					
6/7/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	2.95					



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Table A-4: Egg Size and Habitat Measurements, Baker Creek 2009 (Continued)

Date	Spawning Species	Location	Egg Size (mm)	Depth (cm)	Bottom Velocity (m/s)	Mid-Velocity (m/s)	Surface Velocity (m/s)	Notes
6/7/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	2.99					
6/9/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	3.13	26-35				
6/9/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	2.82					
6/9/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	3.13					
6/9/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	2.75					
6/9/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	2.92					
6/9/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	2.89					
6/9/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	2.74					
6/9/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	2.96					
6/9/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	3.01					
6/9/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	2.91					
6/9/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	2.91					
6/9/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	2.9					
6/9/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	3.04					
6/9/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	2.92					
6/9/2009	sucker species	Above rail bridge, second riffle below culvert pool, Reach 1	3.08					
6/9/2009	Arctic Grayling	Spawning Hole Reach 4	4.36					
6/9/2009	Arctic Grayling	Spawning Hole Reach 4	4.02					
6/9/2009	Arctic Grayling	Spawning Hole Reach 4	3.93					
6/9/2009	Arctic Grayling	Spawning Hole Reach 4	4.08					
6/9/2009	Arctic Grayling	Spawning Hole Reach 4	3.93					
6/9/2009	Arctic Grayling	Spawning Hole Reach 4	4.17					
6/9/2009	Arctic Grayling	Spawning Hole Reach 4	3.96					
6/9/2009	Arctic Grayling	Giant Pool Reach 4	4.01					
6/9/2009	Arctic Grayling	Giant Pool Reach 4	4.14					
6/9/2009	Arctic Grayling	Giant Pool Reach 4	4.14					
6/9/2009	Arctic Grayling	Giant Pool Reach 4	4.24					



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Table A-4: Egg Size and Habitat Measurements, Baker Creek 2009 (Continued)

Date	Spawning Species	Location	Egg Size (mm)	Depth (cm)	Bottom Velocity (m/s)	Mid-Velocity (m/s)	Surface Velocity (m/s)	Notes
6/9/2009	Arctic Grayling	Giant Pool Reach 4	4					
6/9/2009	Arctic Grayling	Giant Pool Reach 4	4.12					



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Table A-5: Baker Creek, Reach 4 In-Stream Temperatures, 2009

Date	Temperature (°C)	Date	Temperature (°C)
5/6/2009	0.5	6/9/2009	14.2
5/8/2009	0.5	6/10/2009	15.5
5/11/2009	0.7	6/14/2009	15
5/14/2009	2.2	6/19/2009	17.3
5/16/2009	4	6/20/2009	19
5/18/2009	5.8	6/22/2009	21
5/19/2009	6.5	6/24/2009	21.5
5/20/2009	5.8	6/25/2009	16.5
5/21/2009	6.5	6/29/2009	19
5/22/2009	7.8	6/30/2009	17.9
5/24/2009	7.8	7/1/2009	16.8
5/25/2009	7.9	7/3/2009	18
5/26/2009	8.2	7/4/2009	19
5/27/2009	8.2	7/5/2009	20
5/28/2009	7.2	7/6/2009	21
5/29/2009	8	7/7/2009	21
6/2/2009	10.3	7/8/2009	18.5
6/3/2009	9.3	7/10/2009	14.8
6/4/2009	8.4	7/11/2009	17
6/5/2009	8.7	7/13/2009	19
6/6/2009	10.2	7/16/2009	19.3
6/7/2009	12	7/17/2009	18
6/8/2009	13.8	7/19/2009	19.5



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Table A-6: Embeddedness, Substrate Size, Velocity Measurements in Reach 4, Baker Creek, 2009

Site	Location Number ^a	Description	Depth (cm)	Bottom Velocity (m/s)	Mid-Velocity (m/s)	Surface Velocity (m/s)	Rock size (cm)					Embedded Height (cm)	Substrate to plane of embeddedness (cm)
1	1 (Right upstream bank)	Top of Reach4 - upstream, staring at glide near cattails, mine side	30	0.20-0.31	0.31-0.42	0.41-0.43	8	8	5.4	5.3	22	0	0
2			18	0.59-0.85*	0.59-0.85*	0.59-0.85*	7	11.2	15.3	8.5	17	0	0
3			28	0.33-0.53	0.78-1.13	1.15-1.17	9	6.2	15	9.8	15.5	0	0
4			24	0.79-0.76	0.85-0.88	0.92-1.01	10.3	14	18.2	11.8	11.3	0	0
5			32	0.74-0.76	0.86-1.13	1.14-1.06	14.2	21.8	16.3	8	5.7	0	0
6			31	0.61-0.44	0.56-0.96	1.09-1.10	14.2	21.8	16.3	8	5.7	0	0
7			37	0.34-0.38	0.51-0.56	0.62-0.60	25	15	10.7	5	7.3	0	0
8			36	0.37-0.38	0.51-0.56	0.79-0.62	21	15	9	6	7	0	0
9			43	0.43-0.49	0.52-0.68	0.73-0.69	20.3	11	26	11	8	0	0
10			45	0.39-0.51	0.61-0.62	0.65-0.68	14	7	5.8	13.8	7	0	0
1	1 (Left upstream bank)	Top of Reach4 upstream, staring at glide near cattails opposite bank	35	0.47-0.51	0.64-0.65	0.64-0.65	14	7	2.8	4.2	4	5	2.5
2			26	0.40-0.48	0.87-0.85	1.28-1.26	25	6	10	14.3	13	0	0
3			28	0.74-0.66	0.91-0.95	1.08-1.20	14	10	28	9	8	0	0
4			30	0.33-0.42	0.45-0.60	0.57-0.60	9	17	8.8	4.6	5.8	0	0
5			33	0.34-0.33	0.40-0.43	0.40-0.42	9.3	14	6	5	8	0	0
6			35	0.08-0.15	0.17-0.22	0.26-0.29	11.3	7	15.2	13	9	0	0
7			45	0.09-0.11	0.17-0.19	0.17-0.12	16	14	16	10	12.3	0	0
8			45	0.07-0.11	0.10-0.13	0.16-0.19	21	26	9	9	19	0	0
9			45	0.09-0.07	0.08-0.13	0.21-0.17	13	7	6	10	12.3	0	0
10			44	0.02-0.04	0.06-0.09	0.10-0.13	14	9	11	10	13	0	0
1	3 (Right upstream bank)	Spawning hole glide headed upstream, towards giant riffle pool, starting on mine side	24	0.37-0.29	0.52-0.61	0.64-0.70	11	2.3	2.7	2.8	1.2	2.4	4.1
2			22	0.32-0.35	0.36-0.47	0.62-0.62	5.2	2	3.8	2.5	3.2	0	0
3			25	0.23-0.24	0.36-0.58	0.59-0.59	2.8	3.3	1.3	1.5	0.8	1.4	2.6
4			30	0.25-0.22	0.29-0.35	0.33-0.35	3.6	3.1	3	1.5	2	0	0
5			43	0.16-0.16	0.19-0.26	0.26-0.29	5	4.2	2.8	2.2	2.5	0	0
6			51	0.06-0.09	0.15-0.18	0.14-0.09	3.5	2	2	2	3	0	0
7			60	0.06-0.01	0.03-0.01	0.08-0.11	13	18	8	8	16	0	0
8			82	0	0.02-0	0.01-0	2.3	2.2	3	1	2.8	3	2.2
9			61	0.01-0.08	0.15-0.17	0.01-0	5	3	6.6	6	14	0	0
10			80	0.02-0.10	0.09-0.12	0.14-0.15	1	1	2.4	2.6	2.3	4.2	2



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Table A-6: Velocity, Substrate Size, and Embeddedness Measurement, Baker Creek, 2009 (continued)

Site	Location Number ^a	Description	Depth (cm)	Bottom Velocity (m/s)	Mid-Velocity (m/s)	Surface Velocity (m/s)	Rock size (cm)					Embedded Height (cm)	Substrate to plane of embeddedness (cm)
1	3 (Left upstream bank)	Spawning hole glide headed upstream, towards giant riffle pool (other side)	31	0.31-0.29	0.41-0.50	0.36-0.28	2.5	0.6	2.2	1	0.6	4.1	1.8
2			40	0.29-0.24	0.17-0.08	0.30-0.34	3.6	3.3	3	3.6	2	1	1.5
3			47	0.07-0.19	0.29-0.22	0.19-0.21	1	1	2.5	3	1.6	3.4	1.1
4			64	0.08-0	0.04-0.02	0.06-0.13	1	3	1.2	4.4	2.5	2.8	1.8
5			64	0.10-0.09	0.11-0.11	0.12-0.03	1.8	0.6	0.5	4.2	2.4	1.6	1.1
6			60	0.11-0.09	0.08-0.04	0.06-0.10	fine muck					5.5	0
7			44	0.05-0.06	0.05-0.06	0.07-0.08	23	18.5	8.8	4.8	8	0	0
8			51	0.03-0.04	0.03-0.06	0.06-0.08	14	13	10	6.3	4.8	0	0
9			50	0	0-0.01	0.03-0.02	12	9	8	3.8	1	2.4	7
10			66	0.01-0.01	0.07-0.10	0.08-0.08	fine muck					7	0
1	5 (Right upstream bank)	Lower canyon - Canyon riffle and downstream towards bridge. Start on mine side	30	0.46-0.47	0.50-0.61	0.67-0.67	2.5	1.8	1	0.6	0.3	1.3	1
2			33	0.30-0.35	0.48-0.51	0.21-0.17	14	4.6	4	5.2	4	0	0
3			31	0.46-0.43	0.54-0.68	0.65-0.61	8	1.8	2.7	3.3	5	0.5	1.7
4			25	0.47-0.56	0.60-0.05	0.04-0.06	22	8.3	4.7	6	12	0	
5			28	0.42-0.41	0.48-0.74	0.88-0.93	3.3	1.5	3.2	3	2.8	0.3	1.8
6			30	0.24-0.25	0.23-0.22	0.23-0.11	2.6	3	4	2.8	2.3	0	0
7			29	0.21-0.26	0.49-0.66	0.77-0.74	0.6	0.6	0.5	2.4	1.8	2.3	1
8			27	0.20-0.05	0.47-0.67	0.84-0.93	8.8	9	7.8	7	4.8	0	0
9			17	0.46-0.61	/	/	3	7.7	3.8	5	7.2	0	0
10			30	0.19-0.24	0.18-0.19	0.25-0.23	0.5	3	2.8	2.2	3.8	1	1.8
1	5 (Left upstream bank)	Lower canyon - Canyon riffle and downstream towards bridge. Start on far side	30	0	0	0.20-0.01	0.4	0.2	0.1	0.1	0.2	0	0
2			30	0.04-0	0-0.08	0-0.01	13	14	17	4.3	3.3	0	0
3			25	0.14-0.21	0.31-0.31	0.35-0.32	6	3	3.8	3	5.2	0.6	5
4			21	0.17-0.61	0.70-0.77	0.75-0.80	18	5	4.2	5	11.5	0	0
5			29	0.36-0.26	0.39-0.52	0.61-0.71	19	7	6.5	14	3	0	0
6			24	0.18-0.12	0.24-0.31	0.20-0.26	11	8.6	12	10	4.6	0	0
7			31	0.38-0.36	0.41-0.36	0.48-0.49	18	10	6	8	6	0	0
8			26	0.32-0.36	0.38-0.41	0.42-0.37	4.6	2.8	3	1.6	4	0.3	5.8
9			24	0.53-0.60	0.65-0.72	0.78-0.79	2	1.5	1.5	2	3.6	1.3	2
10			25	0.30-0.36	0.45-0.62	0.68-0.79	1	2.5	0.7	2.4	3.5	2.2	1.1



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Table A-6: Velocity, Substrate Size, and Embeddedness Measurement, Baker Creek, 2009 (continued)

Site	Location Number ^a	Description	Depth (cm)	Bottom Velocity (m/s)	Mid-Velocity (m/s)	Surface Velocity (m/s)	Rock size (cm)					Embedded Height (cm)	Substrate to plane of embeddedness (cm)
1	4 (Right upstream bank)	Big run -One glide down from spawning run/glide, headed upstream, mine side	25	0.04-0.38	0.58-0.63	0.60-0.63	3.5	2.8	2.3	2	2.5	0	0
2			29	0.19-0.14	0.25-0.28	0.51-0.59	1	3.5	5	2.3	4.5	0	0
3			30	0.39-0.32	0.41-0.44	0.46-0.47	0.8	0.5	0.8	3.5	3	0.3	2
4			35	0.21-0.21	0.25-0.28	0.27-0.26	3	0.8	1.5	1.4	1.1	0.8	2.2
5			56	0.10-0.11	0.14-0.21	0.19-0.20	1.4	0.8	1.2	0.5	2.3	0.8	1.8
6			70	0.08-0.09	0.13-0.17	0.15-0.16	1.5	1.5	0.5	3	1.2	0.5	2
7			60	0.04-0.10	0.08-0.02	0.03-0.04	3	2	0.8	1.1	0.5	5	1.5
8			77	0.03-0.01	0.10-0.14	0.13-0.15	0.2	2	1.5	1	1	4	0
9			60	0.04-0.05	0.08-0.13	0.11-0.15	19	7.5	4	2	3.5	0	0
10			58	0.02-0.05	0.04-0.09	0.08-0.10	12	2	3	3.3	5.8	0	0
1	4 (Left upstream bank)	Big run-One glide down from spawning run/glide, headed upstream, other side	25	0.55-0.51	0.65-0.56	0.51-0.53	3	1.5	1.8	2.6	3	0	0
2			31	0.22-0.25	0.23-0.35	0.17-0.23	4.8	1	2	5	3	0	0
3			32	0.41-0.32	0.42-0.52	0.51-0.50	2	1.8	2.8	3	2.4	4.8	1
4			37	0.29-0.30	0.38-0.44	0.42-0.43	2.8	2.5	3	1	1.3	2.6	1
5			41	0.22-0.21	0.33-0.34	0.35-0.38	1	0.6	2.5	3.3	2.8	3	0.5
6			51	0.21-0.20	0.26-0.27	0.29-0.30	1.3	1	1.8	1.8	0.5	1.2	1
7			58	0.15-0.14	0.17-0.16	0.17-0.20	fine silt					3.3	0
8			61	0.04-0.03	0-0.02	0.01-0	fine silt					4	0
9			55	0.05-0.03	0.07-0.12	0.15-0.10	9	9	12	4	7	0	0
10			63	0.05-0.01	0.06-0.04	0.08-0.07	9	8	16	7	8	0	0
1	2 (Right upstream bank)	Giant Pool, starting from mine side, from glide going upstream	21	0.15-0.18	0.23-0.30	0.36-0.39	4.8	2.8	3.2	3.3	4	0	0
2			22	0.09-0.23	0.28-0.33	0.35-0.37	3	3	4.5	4	4	0	0
3			35	0.07-0.11	0.13-0.20	0.21-0.22	3	3	3.5	3	1.8	0	0
4			31	0.18-0.14	0.22-0.24	0.26-0.26	3	3	3	4	4.5	0	0
5			45	0.06-0.01	0.21-0.19	0.20-0.19	5	3.4	3.3	3.5	3	0	0
6			50	0.08-0.05	0.14-0.22	0.18-0.17	1.2	2.2	3	3	3.8	1.1	3
7			61	0.08-0.07	0.20-0.19	0.15-0.17	2.5	3	3.8	3	3.5	0	0
8			61	0.08-0.07	0.20-0.19	0.15-0.17	6	8	6	1	0.3	0	0
9			62	0.08-0.11	0.16-0.22	0.17-0.17	6	2	6.5	15	2	0	0
10			65	0.15-0.08	0.15-0.12	0.15-0.22	0.6	0.5	1.7	1.3	1.5	5.6	1



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Table A-6: Velocity, Substrate Size, and Embeddedness Measurement, Baker Creek, 2009 (continued)

Site	Location Number ^a	Description	Depth (cm)	Bottom Velocity (m/s)	Mid-Velocity (m/s)	Surface Velocity (m/s)	Rock size (cm)					Embedded Height (cm)	Substrate to plane of embeddedness (cm)
1	2 (Left upstream bank)	Giant Pool, starting from other side, from glide going upstream	21	0.06-0.01	0.04-0.05	0.03-0.01	2	3	4.3	3.5	3.3	0	0
2			22	0.06-0.09	0.19-0.15	0.21-0.25	3	5	2.8	4	2.5	0	0
3			22	0.08-0.07	0.14-0.15	0.19-0.21	2	4	5	2.5	3.6	0	0
4			26	0.06-0.02	0.14-0.10	0.12-0.17	4	3.5	3	4	2	1.6	3.5
5			33	0.15-0.04	0.02-0.01	0.04-0.01	fine silt					2.8	0
6			40	0.03-0.02	0.05-0.06	0.05-0.06	3.8	4.2	4	5	1	1	0
7			45	0.03-0.04	0.06-0.07	0.09-0.08	1.3	1	1.5	3.5	4	5	1
8			43	0	0.01-0.01	0.01-0.01	0.3	0.1	0.6	1.8	2	4	0
9			58	0	0.01-0.01	0	4	4	2	0.4	0.8	4	0
10			42	0.01-0	0.01-0	0.01-0.01	1	0.5	0.3	0.3	0.8	1.4	1

^a Location Numbers correspond to Figure 3



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Table A-7 Substrate Size and Depth at Egg Deposition Sites, Baker Creek, July 10, 2009

substrate size (cm)	Depth (cm)	substrate size (cm)	Depth (cm)	substrate size (cm)	Depth (cm)	substrate size (cm)	Depth (cm)
Site 3 (Spawning Hole) (6/15/2009)		Reach 3 (Canyon Bend) (6/15/2009)		Site 1A (Top of Reach 4 – Right Upstream Bank)) (6/16/2009)		Site 1A (Top of Reach 4 - Left Upstream Bank)) (6/16/2009)	
23	Not	13	Not	7	35-46	19	26-35
10	done	7.3	done	8.3		8	
13.2		27		5.5		15	
20		23		13		14	
15		14		8		14	
12		10.3		7		11	
9.5		16		4.1		8.3	
8		17		3		8	
11		7.5		6		6.2	
8.3		6		2.8		6	
12		65		12		7.2	
29		59		14		8	
30		9.5		3.3		6.5	
14		16.5		3		8	
7		12		3		9	
22		8.3		2		9	
5.5		5.4		5		6	
4.2		6.2		4.2		9	
2		13		7		13	
8		7		6		12	
6.8				10.5		6	
9				12.3		7	
8.5				3		7	
9				5.2		5	
10				6		7	
9.5				7		10	
13				12		6	
12				3.5		6	
4.3				4.5		9	
6				2		5.2	



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Table A-7: Substrates Size and Depth at Egg Deposition Sites, Baker Creek, July 10, 2009 (Continued)

substrate size (cm)	Depth (cm)	substrate size (cm)	Depth (cm)	substrate size (cm)	Depth (cm)	substrate size (cm)	Depth (cm)
Site 1B (6/16/2009)		Site 2 (Giant Pool) (6/16/2009)		Site 5 (Below Big Run) (6/17/2009)		Site 4 (Big Run) (6/17/2009)	
3	29-40	3	32-40	3	37-50	5	37-50
4		3		3		3.1	
4.2		3.5		3.1		4	
3		9		3		3	
4.3		3.3		4		3	
2		3.8		4		3	
7		4		4		2.5	
4		7		3		4	
4		5		2		1	
3		4		2		1.5	
4		3		1.2		2	
11		22		3		2.5	
10		10		4		3	
8.3		7		2		2	
8		9		2		2	
18		5		3		2	
10		2		3		2	
6.2		22.2		2.1		3	
8		4		7		1.5	
14		5.4		2.5		2	
6		2.2		8.3		2	
16		7		14		3	
12		5		11		4.1	
13		3		4		6	
4.1		3.8		9		5	
4		3.6		9		3	
3		4.2		8		4.2	
2		4		11		4	
3		4		5		6	
6				4		4	
						5	
						2	
						2	

Site numbers
based on Figure
6 and Figure 11.



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Table A-8 Zooplankton in Reach 4, Baker Creek Spring 2009

Major Taxonomic Group	Taxa	Actual Count		Abundance (#/m ³)
		Split 1 ^a	Split 2	
Cladocera	<i>Ceriodaphnia</i> sp.	1	5	0.28
	<i>Chydorus sphaericus</i>	17	23	1.86
	<i>Alona</i> sp.	3	1	0.19
	<i>Acroperus harpae</i>	5	7	0.56
	<i>Pleuroxus</i> sp.	1	2	0.14
Calanoida	<i>Heterocope septentrionalis</i>	5	3	0.37
	calanoid nauplii	0	1	0.05
Cyclopoida	<i>Cyclops capillatus</i>	1	3	0.19
	<i>Diacyclops bicuspidatus thomasi</i>	0	1	0.05
	Cyclopoid copepodid	7	5	0.56
	Cyclopoid nauplii	1	1	0.09
Rotifera	<i>Notholca</i> sp.	1	0	0.05
	<i>Brachionus</i> sp.	13	15	1.30
	<i>Conochilus</i> sp. colony	1	0	0.05
	<i>Keratella hiemalis</i>	1	0	0.05

#/m³ = number of individuals per cubic metre; sp. = species singular.

(a) Four tow samples were taken and then composited into one. Total volume of composite sample was 45 mL and 20 mL of the sample was analyzed in two splits (i.e., Split 1 and Split 2). These splits were combined for a total zooplankton abundance.



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Table A-9 Benthic Invertebrates in Reach 4, Baker Creek Spring 2009

Major Taxonomic Group	Family	Subfamily/Tribe	Genus/Species	Riffle	Giant pool
				Dip Net	Ekman grab
Hydrozoa	Hydridae		<i>Hydra</i>		13
Nematoda				4	
Oligochaeta	Naididae		<i>Stylaria lacustris</i>		213
Oligochaeta	Tubificidae			20	
Copepoda - Calanoida					4
Copepoda - Cyclopoida					1
Cladocera	Chydoridae				1
Amphipoda	Gammaridae		<i>Gammarus lacustris</i>		1
Gastropoda	Planorbidae		<i>Gyraulus</i>	1	1
Ephemeroptera	Baetidae		<i>Baetis</i>	2	264
Ephemeroptera	Heptageniidae (d)				17
Ephemeroptera	Heptageniidae		<i>Maccaffertium terminatum</i>		2
Ephemeroptera	Leptophlebiidae (d)		<i>Paraleptophlebia ?</i>		41
Ephemeroptera	Leptophlebiidae		<i>Leptophlebia</i>		2
Trichoptera	Leptoceridae		<i>Oecetis</i>	1	
Trichoptera	Polycentropodidae		<i>Neureclipsis</i>		1
Trichoptera	Polycentropodidae		<i>Polycentropus</i>		1
Diptera	Ceratopogonidae		<i>Bezzia</i>		1
Diptera	Ceratopogonidae		<i>Probezzia</i>	4	
Diptera	Simuliidae		<i>Simulium</i>		37
Diptera	Tabanidae		<i>Chrysops</i>	1	
Diptera	Chironomidae - pupa			1	9
Diptera	Chironomidae	Tanypodinae	<i>Larsia</i>		1
Diptera	Chironomidae	Tanypodinae	<i>Nilotanypus</i>		2
Diptera	Chironomidae	Tanypodinae	<i>Thienemannimyia</i> gr.		22
Diptera	Chironomidae	Chironomini	<i>Parachironomus</i>		1
Diptera	Chironomidae	Tanytarsini	<i>Micropsectra</i>		51
Diptera	Chironomidae	Orthoclaadiinae	<i>Brillia</i>		1
Diptera	Chironomidae	Orthoclaadiinae	<i>Cricotopus/Orthocladus</i>		1
Diptera	Chironomidae	Orthoclaadiinae	<i>Nanocladius</i>		2
Diptera	Chironomidae	Orthoclaadiinae	<i>Parakiefferiella</i>		1
Terrestrial					4

Notes: d = small or damaged. Shaded organisms were removed from the results for the following reasons:

Nematoda – removed because samples were sieved through a 500-µm mesh sieve; therefore, abundances of these organisms (part of meiofauna) are not representative; Crustacea – Cladocera, Calanoida, and Cyclopoida – removed because these are planktonic organisms; Chironomidae pupae – not strictly benthic organisms as they are unattached and have a tendency to drift; and Terrestrial invertebrates – not aquatic, therefore, not applicable.



APPENDIX A

Raw Data

Table A-10 Water Quality Results, Reach 4, June 2009

Year		CWQG ^(a)	2009		Detection Limit
Sample ID			Sample 1	Sample 2	
Sample Date			05-June-2009	30-June-2009	
Parameter	Units				
Physical / Chemical					
Alkalinity, Total (as CaCO ₃)	mg/L	-	-	41.8	1
Alkalinity, Carbonate (as CaCO ₃)	mg/L	-	-	< 1	1
Alkalinity, Hydroxide (as CaCO ₃)	mg/L	-	-	< 1	1
Acidity (as CaCO ₃)	mg/L	-	-	3	1
Hardness (as CaCO ₃)	mg/L	-	38	45.8	0.5
Total Dissolved Solids	mg/L	-	62.2	68	1.2
Total Suspended Solids	mg/L	(b)	1.9	2.1	1
Turbidity	NTU	-	1.08	2.47	0.1
Major Ions					
Chloride	mg/L	-	-	2.49	0.5
Fluoride	mg/L	-	-	0.065	
Sulphide as S	mg/L	-	< 0.02	< 0.02	0.02
Sulphate (SO ₄)	mg/L	-	-	4.11	0.5
Nutrients					
Ammonia (as nitrogen)	mg/L	0.83	< 0.005	0.0153	0.005
Nitrate and Nitrite (as nitrogen)	mg/L	-	0.0118	0.0248	0.005
Nitrate (as nitrogen)	mg/L	2.9	0.0118	< 0.001	0.001
Total Kjeldahl Nitrogen	mg/L	-	0.533	0.665	0.05
Total Dissolved Phosphate (as phosphorus)	mg/L	-	0.0064	0.0062	0.02
Total Phosphate (as phosphorus)	mg/L	-	0.0123	0.0177	0.002
Cyanides					
Total cyanide	mg/L	-	< 0.005	< 0.005	0.005
Total Metals					
Aluminum (Al)	mg/L	0.1 ^(d)	0.0398	0.0637	0.001
Antimony (sb)	mg/L	-	0.00168	0.00223	0.0001
Arsenic (As)	mg/L	0.005	0.0261	0.0699	0.0001
Barium (Ba)	mg/L	-	< 0.01	< 0.01	0.01
Beryllium (Be)	mg/L	-	< 0.005	< 0.005	0.005
Bismuth (Bi)	mg/L	-	< 0.2	< 0.2	0.2
Boron B)	mg/L	-	< 0.1	< 0.1	0.1
Cadmium (Cd)	mg/L	0.00003 0.0001 and 0.0009 ^(e)	< 0.00005	< 0.00005	0.00005
Calcium (Ca)	mg/L	-	10.2	11.8	0.05
Chromium (Cr)	mg/L	-	< 0.01	< 0.01	0.01
Cobolt (Co)	mg/L	-	< 0.01	< 0.01	0.01
Copper (Cu)	mg/L	0.002 and 0.004 ^(f)	0.00227	0.00446	0.0001



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Table A-10 Water Quality Results, Reach 4, June 2009 (Continued)

Year		CWQG ^(a)	2009		Detection Limit
Sample ID			Sample 1	Sample 2	
Sample Date			05-June-2009	30-June-2009	
Parameter	Units				
Iron (Fe)	mg/L	0.3	0.102	0.177	0.01
Lead (Pb)	mg/L	0.002 and 0.007 ^(g)	0.000114	0.000237	0.00005
Lithium (Li)	mg/L	-	< 0.01	< 0.01	0.01
Magnesium (Mg)	mg/L	-	3.15	3.7	0.1
Manganese (Mn)	mg/L	-	0.0108	0.0268	0.005
Mercury (Hg)	mg/L	0.026	< 0.00001	< 0.00001	0.00001
Molybdenum (Mo)	mg/L	0.073	0.000399	0.000478	0.00005
Nickel (Ni)	mg/L	0.065 and 0.150 ^(h)	0.00062	0.00145	0.0005
Phosphorus (P)	mg/L	-	< 0.3	< 0.3	0.3
Potassium (K)	mg/L	-	< 2	< 2	2
Selenium (Se)	mg/L	0.001	< 0.001	< 0.001	0.001
Silicon (Si)	mg/L	-	0.28	0.273	0.05
Silver (Ag)	mg/L	-	< 0.01	< 0.01	0.01
Sodium (Na)	mg/L	-	2.3	2.7	2
Strontium (Sr)	mg/L	-	0.0379	0.0447	0.005
Thallium (Tl)	mg/L	-	< 0.2	< 0.2	0.2
Tin (Sn)	mg/L	-	< 0.03	< 0.03	0.03
Titanium (Ti)	mg/L	-	< 0.01	< 0.01	0.01
Uranium (Ur)	mg/L	-	0.000207	0.000225	0.00001
Vanadium (V)	mg/L	-	< 0.03	< 0.03	0.03
Zinc (Zn)	mg/L	0.03	< 0.004	< 0.004	0.004
Dissolved Metals					
Aluminum (Al)	mg/L	-	0.013	0.0202	0.001
Antimony (Sb)	mg/L	-	0.00158	0.00218	0.0001
Arsenic (As)	mg/L	-	0.0236	0.0697	0.0001
Barium (Ba)	mg/L	-	< 0.01	0.011	0.01
Beryllium (Be)	mg/L	-	< 0.005	< 0.005	0.005
Bismuth (Bi)	mg/L	-	< 0.2	< 0.2	0.2
Boron B)	mg/L	-	< 0.1	< 0.1	0.1
Cadmium (Cd)	mg/L	-	< 0.00005	< 0.00005	0.00005
Calcium (Ca)	mg/L	-	10.1	12.1	0.05
Chromium (Cr)	mg/L	-	< 0.01	< 0.01	0.01
Cobolt (Co)	mg/L	-	< 0.01	< 0.01	0.01
Copper (Cu)	mg/L	-	0.00173	0.0032	0.0001
Iron (Fe)	mg/L	-	0.045	0.084	0.01
Lead (Pb)	mg/L	-	< 0.00005	0.000087	0.00005
Lithium (Li)	mg/L	-	< 0.01	< 0.01	0.01
Magnesium (Mg)	mg/L	-	3.12	3.78	0.1
Manganese (Mn)	mg/L	-	< 0.005	0.0143	0.005
Mercury (Hg)	mg/L	-	< 0.00001	< 0.00001	0.00001



APPENDIX A

Raw Data

Table A-10 Water Quality Results, Reach 4, June 2009 (Continued)

Year		CWQG ^(a)	2009		Detection Limit
Sample ID			Sample 1	Sample 2	
Sample Date			05-June-2009	30-June-2009	
Parameter	Units				
Molybdenum (Mo)	mg/L	-	0.000331	0.000434	0.00005
Nickel (Ni)	mg/L	-	< 0.0005	0.00066	0.0005
Phosphorus (P)	mg/L	-	< 0.3	< 0.3	0.3
Potassium (K)	mg/L	-	< 2	< 2	2
Selenium (Se)	mg/L	-	< 0.001	< 0.001	0.001
Silicon (Si)	mg/L	-	0.23	0.232	0.05
Silver (Ag)	mg/L	-	< 0.01	< 0.01	0.01
Sodium (Na)	mg/L	-	2.2	2.7	2
Strontium (Sr)	mg/L	-	0.037	0.045	0.005
Thallium (Tl)	mg/L	-	< 0.2	< 0.2	0.2
Tin (Sn)	mg/L	-	< 0.03	< 0.03	0.03
Titanium (Ti)	mg/L	-	< 0.01	< 0.01	0.01
Uranium (Ur)	mg/L	-	0.000184	0.000205	0.00001
Vanadium (V)	mg/L	-	< 0.03	< 0.03	0.03
Zinc (Zn)	mg/L	-	< 0.004	< 0.004	0.004
Organics					
Total Organic Carbon	mg/L	-	10.4	12.4	0.5
Dissolved Organic Carbon		-	10.2	12.4	0.5
Oil and Grease	mg/L	-	< 1	< 1	1

Notes: CWQG = Canadian Water Quality Guidelines; $\mu\text{S/cm}$ = microSiemens per centimetre; NTU = nephelometric turbidity unit; mg/L = milligrams per litre; Bq/L = Becquerels per litre; < = less than method detection limit; - = not available; n/a = not applicable.

Bolded values indicate analyte exceeded the applicable CWQG.

a: CCME guidelines are for the protection of freshwater aquatic life (CCME 1999 and 2007).

b: Maximum increase of 25 mg/L above background levels for any short-term exposure (*i.e.*, any 24 hour period). Maximum average increase of 5 mg/L from background levels for longer term exposure (*i.e.*, 24 hours to 30 days).

c: Maximum increase of 8 NTU from background levels for any short-term exposure.

d: Aluminum guideline is 0.100 mg/L at pH \geq 6.5.

e: Cadmium guideline is dependent on water hardness: 0.0009 mg/L at JB-WQ1 and JB Near-field, 0.0001 mg/L at JB-WQ2 and 0.00003 at HB-WQ1, HB-WQ2, REF-WQ1 and REF-WQ2.

f: Copper guideline is dependent on water hardness: 0.002 at water hardness of 0 to 120 mg/L CaCO_3 and 0.004 mg/L at water hardness >180 mg/L CaCO_3 .

g: Lead guideline is dependent on water hardness: 0.002 at water hardness of 60 to 120 mg/L CaCO_3 and 0.007 mg/L at water hardness >180 mg/L CaCO_3 .

h: Nickel guideline is dependent on water hardness: 0.065 at water hardness of 60 to 120 mg/L CaCO_3 and 0.150 mg/L at water hardness >180 mg/L CaCO_3 .



APPENDIX A

Raw Data

Table A-11: Area (m²) of Select Spawning Locations for Arctic Grayling and Longnose Sucker in Reach 4, 2009

Location	Species	Area Measured (m)	Total Area (m ²)
Reach 1, Below Culvert Pool	Arctic Grayling	0.6 x 0.6	0.36
Reach 3, 'Canyon Bend'	Arctic Grayling	1.5 x 0.9	1.35
Reach 4, Riffle 6 'Canyon'	Arctic Grayling	1.8 x 6.1	10.98
	Longnose Sucker	1.5 x 0.9	1.35
Reach 4, Riffle 4, 'Big Run'	Arctic Grayling	5.5 x 3.9	21.45
Reach 4, Riffle 3 'Spawning Hole'	Arctic Grayling	7.6 x 5.2	39.52
Reach 4, Riffle 2, 'Giant Pool'	Arctic Grayling	8.2 x 5.2	42.64
Reach 4, Riffle 1B, 'above wintering hole'	Arctic Grayling	3.1 x 3.0	9.30
Reach 4, Riffle 1A, 'top of Reach 4'	Arctic Grayling	3.6 x 2.7	9.72

Note: Corresponds to some of the locations on Figure 7. Only key or the 'most representative' spawning areas in each reach were measured.

Table A-12: Snorkelling observations for Arctic Grayling, Lake Whitefish and Walleye, Baker Creek 2009

Species	Date	Location	Number Observed
Arctic Grayling	20/05/2009	3 in Reach 1, 2 in Reach 4	5
	21/05/2009	6 in Reach 1, 8 in Reach 4	14
	22/05/2009	4 in Reach 1, 4 in Reach 4	8
	24/05/2009	3 in Reach 1, 3 in Reach 4	6
	25/05/2009	3 in Reach 1, 7 in Reach 4	10
	26/05/2009	4 in Reach 1, 7 in Reach 4	11
	27/05/2009	Reach 4	8
	28/05/2009	4 in Reach 1, 1 in Reach 4	5
	29/05/2009	Reach 1	2
	31/05/2009	Reach 1	8
	01/06/2009	1 in Reach 1, 6 in Reach 4	7
	02/06/2009	Reach 1	6
	03/06/2009	Reach 1	7
	04/06/2009	Reach 1	4
	05/06/2009	Reach 4	23
	06/06/2009	Reach 1	25
	07/06/2009	Reach 1	14
	08/06/2009	16 in Reach 1, 5 in Reach 4	21
	09/06/2009	30 in Reach 1, 13 in Reach 4	43
	10/06/2009	30 in Reach 1, 8 in Reach 2 30 in Reach 3, 21 in Reach 4	89
	14/06/2009	Reach 1	1
	16/06/2009	Reach 4	10
	18/06/2009	Reach 4	7
	20/06/2009	Reach 1	2



APPENDIX A

Raw Data

Table A-12: Snorkelling observations for Arctic Grayling, Lake Whitefish and Walleye, Baker Creek 2009 (Continued)

Species	Date	Location	Number Observed
Walleye	28/05/2009	Reach 1	1
	29/05/2009		-
	30/05/2009		-
	31/05/2009		-
	01/05/2009		-
	02/06/2009		1
	03/06/2009		4
	04/06/2009		1
	05/06/2009		0
	06/06/2009		9
	07/06/2009		0
	08/06/2009		1
	09/06/2009		1
	10/06/2009		1
Lake Whitefish	8/06/2009	Reach 4	1
	29/05/2009	Reach 1	1
	30/05/2009		
	31/05/2009		3
	01/06/2009		-
	02/06/2009		-
	03/06/2009		2
	04/06/2009		2
	05/06/2009		-
	06/06/2009		18
	07/06/2009		9
	08/06/2009		13
	09/06/2009		29
	10/06/2009		29

- = no observations made on that date

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Appendix B-Baker Creek Photo Journal, 2009



All photographs were taken on site at Baker Creek. Underwater images of fish life history were captured using a Nikon D-40 placed in an Ikelite Plexiglas housing. Shore based observation was also used as a means to photograph habitat and stream fauna using a Nikon D-200 and 12-24 mm wide-angle lens. Close-up photographs were made using a 105 mm micro lens.

May 02, 2009

The Baker Creek culvert is full of ice with some minimal flow passing underneath. Entire Reach 1 is still frozen with up to 2 m of ice in some areas. Water continues to pool above culvert intake because of excessive ice build-up inside culvert



May 04, 2009

This photo taken from the bridge at the lower end of Reach 4 shows anchor ice build-up in the main channel. Further downstream, entire Reach 1 Section is still frozen.



May 11, 2009

The 2009 Baker Creek team, consisting of INAC, DFO, YK Dene and Golder Associates pose for a photograph.



May 11, 2009

All of Reach 1 is still frozen except for a small area upstream at the culvert intake. Areas in Reach 0 that appear to be open have large amounts of anchor ice throughout the stream bed. Water temperature of 0.7°C recorded at culvert intake.



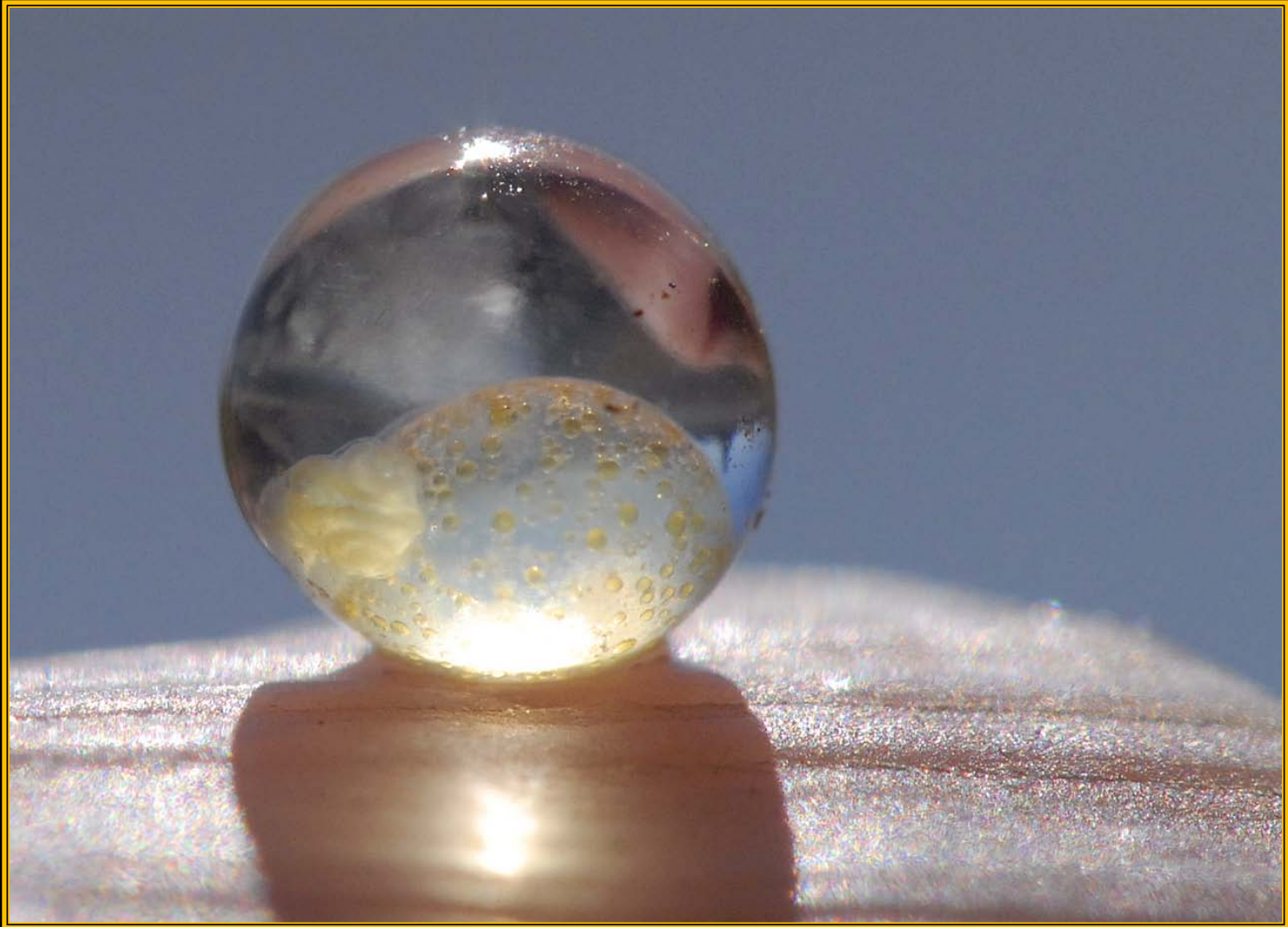
May 18, 2009

Baker Creek is now free of ice cover below the culvert. Much ice remains along the shorelines, extending considerably from shore. Many Northern pike are seen moving upstream along the banks and concentrating below the culvert outwash. A few grayling present in Culvert Pool area. Water temperature has risen to 6°C.



May 28, 2009

A developing Arctic grayling embryo inside the egg. Many eggs were photographed and measured to record various developmental Stages prior to hatching in Reach 4.



May 29, 2009

Snorkeling on outside of breakwater on the Yellowknife Bay side. Meanwhile, species diversity throughout Reach 1 is almost at its peak. However, white suckers are very few and no walleye so far.



May 31, 2009

Peak of northern pike activity in Reach 1. Longnose suckers beginning to appear in large numbers throughout Reach 1 but high discharge at culvert prevents any fish from migrating upstream. Also observed four longnose and two pike with 2007 Floy tags. First grayling captured in Reach 1.



June 03, 2009

Two walleye hold in Reach 1 while a large longnose sucker passes by. The observations and photo documentation represent the first proof of walleye presence in Baker Creek for over half a century. Water temperature has reached 9°C.



June 06, 2008

On this day, large numbers of Arctic grayling were observed in lower Reach 1. Individuals such as the large 440 mm male shown here, were feeding on longnose suckers eggs and ninespine sticklebacks.



June 06, 2009

An Arctic grayling is about to inhale a small aquatic invertebrate suspended in the water column. This photo was taken at the Reach 1/Reach 0 interface which was the primary feeding site for non-spawning adult Arctic grayling.



June 07, 2009

Two male Arctic grayling face-off with one another during a territorial dispute in lower Reach 1. The red colouration of the tail is indicative of spawning fish. Many sucker eggs were measured and photographed. Water temperature has reached 11°C.



June 07, 2009

Longnose sucker moving through lower Reach 1. Almost all of Reach 1 below the culvert had suitable substrate for sucker spawning and several sites were identified.



June 08, 2009

Assumed to be relatively rare in Baker Creek until this 2009 survey, many white suckers (such as this large male) were observed in Reach 1 during our snorkelling surveys along with large numbers of feeding lake whitefish. Water temperature has reached 14°C.



June 09 , 2009

A male longnose sucker moves towards a spawning mass of fish. In this instance, three males pursued a large female but several hours before spawning. This photo was taken against the rock wall at Canyon Rapids in lower Reach 4. Note that the longnose suckers are using the upper run and riffle for spawning and not the glide as do Arctic grayling.



June 09, 2009

Two large lake whitefish cruise the slow current at the Reach 0/Reach 1 interface. During this period, it was not uncommon to see up to 20 whitefish feeding on sucker eggs and invertebrates throughout lower Baker Creek. Peak numbers of whitefish coincided with height of grayling activity in reach 1.



June 15, 2009

A new Arctic grayling spawning site in Reach 3 was identified in 2009. Here, Golder Associates biologist Paul Vecsei descends into the ravine to sample eggs from the glide (extreme right in photo).



June 17, 2009

Several species of invertebrates were sampled on June 17, 2009, during our plankton and benthic surveys in the lower portion of Giant Pool in Reach 4. Post-spawn grayling captured in Giant Pool of Reach 4.



June 19, 2009

By this period, the YOY grayling have transformed from protolarvae to mesolarvae and were between 15-20 mm in length. Longnose sucker Eggs found in Reach 4. Water temperature has reached 17.3°C.



June 20 , 2009

A school of emerald shiners in upper Reach 0. Fewer large-bodied fish observed throughout Reach 1. Water temperature has reached 19°C.



June 20 , 2009

Holly Patrick (Golder Associates) prepares for habitat transect where depth and velocities will be correlated with YOY Arctic grayling distribution.



June 24 , 2009

Within days of hatching, longnose suckers were abundant in the slack waters throughout Reach 4. Surface foam often served as cover, attracting large numbers of individuals. Many grayling and longnose suckers were measured, photographed and released in reach 4. Water temperature has reached 21°C.



July 07 , 2009

A school of spottail shiners swim below the surface along the breakwater in lower reach 0. During this period, the importance of lower Reach 0 became obvious. Adult, juvenile and young-of-year of several species were observed in large numbers. The biomass of YOY suckers, was at times, astounding.



July 07 , 2009

Close-up of a spottail shiner from Reach 0. For species identification purposes, a subset of seine captures from Reach 0 were placed in an aquarium and photographed. Such methods ensured a proper visual inventory of even the smallest of fish captured during the 2009 survey.



July 08 , 2009

One of the many coregonids captured in Reach 0 at the end of the breakwater. Based on size of these juveniles, they probably represent age 1+ rather than young-of-year. The connection between Reach 0 and Yellowknife Bay is the most productive portion of Baker Creek and serves as a nursery for a large biomass of fishes and aquatic invertebrates for a small area.



July 19 , 2009

The diversity and overall biomass of YOY and juvenile fishes in the breakwater area continues to surprise us. In this photo, a juvenile coregonid (above) moves towards an adult lake chub. In the background, several adult spottail shiners and YOY longnose suckers are visible.



July 19, 2009

During mid July, it was not uncommon to seine upwards of a thousand YOY longnose suckers (25-35 mm). A subset of approximately a hundred individuals would be dip netted out of the semi closed seine before the large net was re-opened.





APPENDIX C

Developmental Stages of YOY Arctic Grayling in Baker Creek

Developmental Stages of YOY Arctic Grayling in Baker Creek

Grayling YOY: The larval period in salmonids is short. Balon (1977) has demonstrated that oviparous fishes with a reproductive 'hiding' strategy (e.i. burying eggs) have largely eliminated the larval period and ensures large size of YOY with the onset of exogenous feeding. Like other salmonids, the grayling "hides" the early stages of ontogeny remaining in the substrate existence upon hatching (3 to 5 days), and then a short larval period (divided into proto and mesolarva). The embryonic period begins with activation (fertilization) and ends with the start of exogenous feeding. For Baker Creek grayling, this period has been demonstrated to last between 24 and 36 days. Such precocious development is rare in oviparous fishes and is the most rapid among grayling (Walting and Brown 1955).

Embryonic period

Size range: egg diameter ranged from 3.32-4.91 mm (Appendix A, Table A-4; Appendix C, Table C-1).

Period: In 2009, eggs were observed and measured between 26 May and 9 June, 2009.

Biology and development: During the initial ontogenetic interval, nutrition to the yolk is provided by the internal supply of morphogenetic substances in the yolk and continuous gas exchange takes place throughout the egg (Walting and Brown 1955). The rapid development within the egg; from early cleavage to morula, to gastrula and finally developing early embryos has been carefully documented during the 2009 incubation period between 26 May to 9 June 2009.

Protolarvae (yolk-sac larvae)

Size range: Specimens ranged from 12-15 mm.

Period: In 2009, the protolarvae period was almost undocumented due to a two day delay between hatching and the start of measuring YOY. However, protolarvae were first observed on 17 June and multiple spawning events ensured that some protolarvae were observed and measured.

Biology and development: Protolarvae encompass the period of endogenous feeding (using available nutrition from their yolk-sacs). Immediately upon emergence, the yolk-sac was still obvious and supplied food reserves for several days prior to exogenous feeding. Once the yolk-sac was absorbed, the most apparent structure in grayling protolarvae was the thin, erect, medial finfold. This structure extended from the mid dorsum, around the end of the notochord and anteriorly along the ventrum to the posterior margin of the vent. The pectoral fin buds were already apparent in protolarvae.

Pigmentation: Black pigmentation in protolarvae was limited to a narrow section on either side of the dorsal ridge. Large pigments were also visible along the midline of the ventrum. The yolk-sac was virtually free of pigment except the area where it joined the body. The entire dorsal surface of the head was covered by small pigments

Mesolarvae

Size range: Specimens ranged from 15-27 mm (Appendix C, Table C-1)

Period: In 2009, the mesolarvae period was widespread due to multiple spawning events. Mesolarvae were first observed on June 17 but were still present during larval drift on June 29, 2009.

Biology and development: The dorsal, anal and caudal fins began to differentiate from the median finfold. The dorsal fin was apparent as a rise in the dorsal median finfold and pigmented fin rays could be discerned. During this phase, the finfold diminished around the developing fins. Pelvic fins were now apparent as small buds along the abdomen on either side of the preanal finfold. The tail (caudal fin) began to take its shape but remained more



APPENDIX C

Developmental Stages of YOY Arctic Grayling in Baker Creek

rounded than truncate. The adipose fin was clearly visible and distinguishable from the surrounding median finfold.

Pigmentation: Specimen 17.9 mm: Pigments began appearing on the dorsal and caudal fin rays. Folds appeared to be non-pigmented. Ventral pigmentation was less dense than along dorsum but more scattered. Along the flank, anteriorly the pigmentation was evenly distributed but larger in the gut area. Posteriorly, larger and more numerous pigments were present along the upper and lower caudal peduncle length. The dorsum of the head had over 60 medium sized spots per side in a triangular patch from the occiput to the anterior of the head with 3 to 5 larger spots per side in the anterior-most region (snout). The snout was pigmented but more finely. Some pigment was also visible along the anterior of the eye and along the pre-maxilla.

Pigmentation: Specimen 20.6 mm: Pigmentation more numerous and widespread than on protolarvae or early mesolarvae. Pigments lined the dorsal and caudal fin rays. Folds appeared to be non-pigmented but some individuals had small speckling along the outer margins. Ventral pigmentation was less dense than along dorsum and restricted to primarily the anterior body and region posterior to the anal opening. Along the flank, anteriorly the pigments were evenly distributed but were larger towards the dorsum and in the gut area. Pectoral fin insertion had some pigmentation but area directly anterior to fin insertion was relatively pigment free. Posteriorly, larger and more numerous pigments were present along the rays of the upper and lower caudal peduncle length. The dorsum of the head had large pigments in a triangular patch from the occiput to the anterior of the head. The snout was pigmented but more finely. Some pigment was also visible along the anterior of the eye and along the pre-maxilla and anterior maxilla. The dorsum of the head had over 60 medium sized spots per side in a triangular patch from the occiput to the anterior of the head with 3 to 5 larger spots and many smaller per side in the anterior-most region (snout).

Metalarvae (early juvenile)

Size range: Specimens ranged from ~27 to 40 mm (Appendix C, Table C-1)

Period: In 2009, the metalarvae period was observed and correlated with outmigration. Some metalarvae were first observed on 28 May, 2009, but were still present on 8 July.

Biology and development: The remnants of the finfold were apparent only ventrally. All fins were apparent with distinct, countable fin rays. The dorsal fin had the typical, large rounded shape associated with adult grayling and alone was enough to discern metalarvae grayling from any other species of salmonids. Proportionally, the adipose fin is much reduced in size and the caudal fin has the distinct in-groove in the middle, giving it a homocercle appearance. The finfold remnants have disappeared and scales begin forming on the body at 40 mm.

Pigmentation: Specimen 30 mm: Black pigmentation was widespread and no longer restricted to the dorsal ridge and ventral portion of the body. Black pigmentation lined the dorsal and caudal fin rays. Along the flank, anteriorly the pigmentation was larger towards the gut area. Posteriorly, larger and more numerous pigments were present along the upper and lower caudal peduncle length. The dorsum of the head has more numerous and evenly distributed black pigmentation. More pigment was also visible along the pre-maxilla and anterior maxilla.

Pigmentation: Specimen 30.29 mm: Similar to specimen in the 22-27 mm range but pigmentation was more widespread and uniform in size.

Juvenile

Size range: Specimens ranged from 40-65 mm (Appendix C, Table C-1)



APPENDIX C

Developmental Stages of YOY Arctic Grayling in Baker Creek

Period: In 2009, the bulk of outmigrating grayling were metalarvae (early juveniles) and juveniles. This period spanned from late June to the end of the study on 13 July, 2009, when the last and largest juvenile was captured in Baker Creek.

Biology and development: The remnants of the finfold have disappeared. The dorsal fin was prominent. Proportionally, the adipose fin was greatly reduced in size. Scales began appearing on specimens at 35-40 mm and covered the entire body on individuals over 50 mm.

Pigmentation: Specimen 40 mm: Black pigmentation was no longer obvious except on parts of the head, eye, fins and scale margins. Up to 13 large, distinct blue parr marks were evident along the lateral line along with 15-25 smaller parr marks in between the lateral line and dorsal ridge. The dorsal region was light brown and the adipose fin was lightly pigmented with tiny black spots. The gill cover (opercle) had taken on a silver, iridescent appearance and overall body coloration was silver with pale yellow to cream color ventrally.

Table C-1 Developmental Stages of Arctic Grayling, Baker Creek, 2009

Stage	Period	Length (mm)	Distinct features	Pigmentation
Egg embryo	26 May-9 June	3.3-4.9	Rapid rate of cell division with developing embryo and yolk sac reserve visible within a few days.	Pigmentation begins with "eyed egg" period as black pigments line the interior of the eyes. Black spotting covers dorsum and flank of embryo upon hatching.
Protolarva	17-June 19 June	12-15	At this stage, feeding is from internal reserves (yolk sac). Pectoral fin buds apparent. Median finfold surrounds entire mid and posterior region.	Pigmentation limited to narrow section along dorsal ridge and head.
Mesolarva	17 June-29 June	15-27	Dorsal, pelvic anal and caudal fins differentiate from finfold. Large adipose fin rises out from finfold.	Pigments appear on fins. Entire body and head covered with various sized black pigment.
Metalarva (Early juvenile)	28 May-8 July	27-40	Finfold almost disappeared. All fins distinct with near or full compliment of fin rays. Adipose reduced in size. Scales begin to appear along flank.	Widespread pigmentation of various size on head, finrays and body.
Juvenile	Late June-13 July	40-65	Finfold disappeared and all fins fully formed with full compliment of fin rays. Body covered with scales. Large sail-like dorsal fin prominent.	Up to 13 large blue parr marks along entire flank of body. 15-25 smaller parr marks btw lateral line and dorsal ridge.

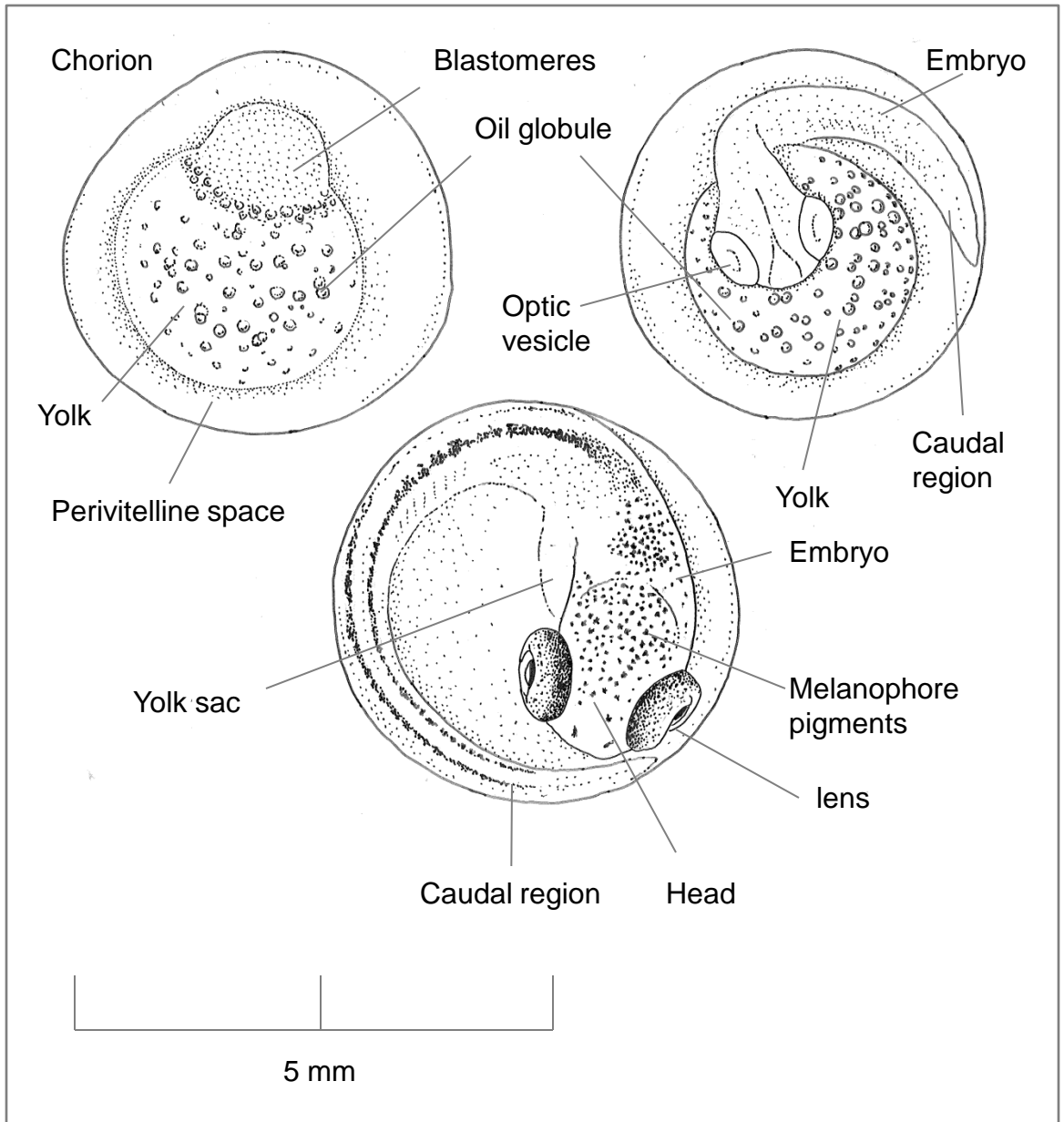


Figure C-1. Arctic grayling egg development

Upper left: Morula stage, 28 May, 2009

Upper right: Early embryo, 01 June, 2009

Bottom: Embryo prior to hatching, 09 June , 2009

All eggs from Reach 4, Baker Creek

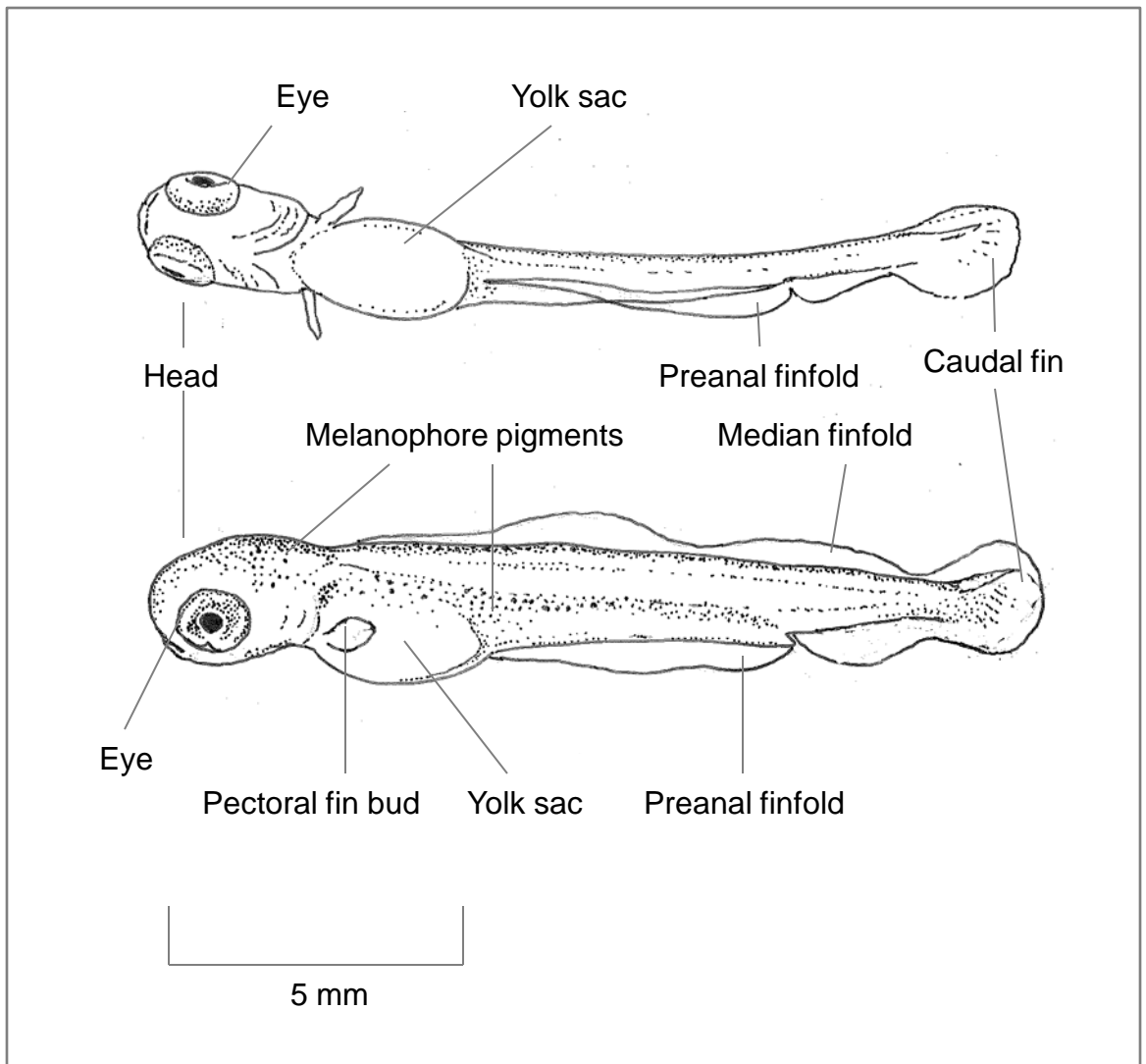


Figure C-2. Arctic grayling protolarva

Total length: 14.91 mm
Captured 15 June, 2009
Reach 4, Baker Creek

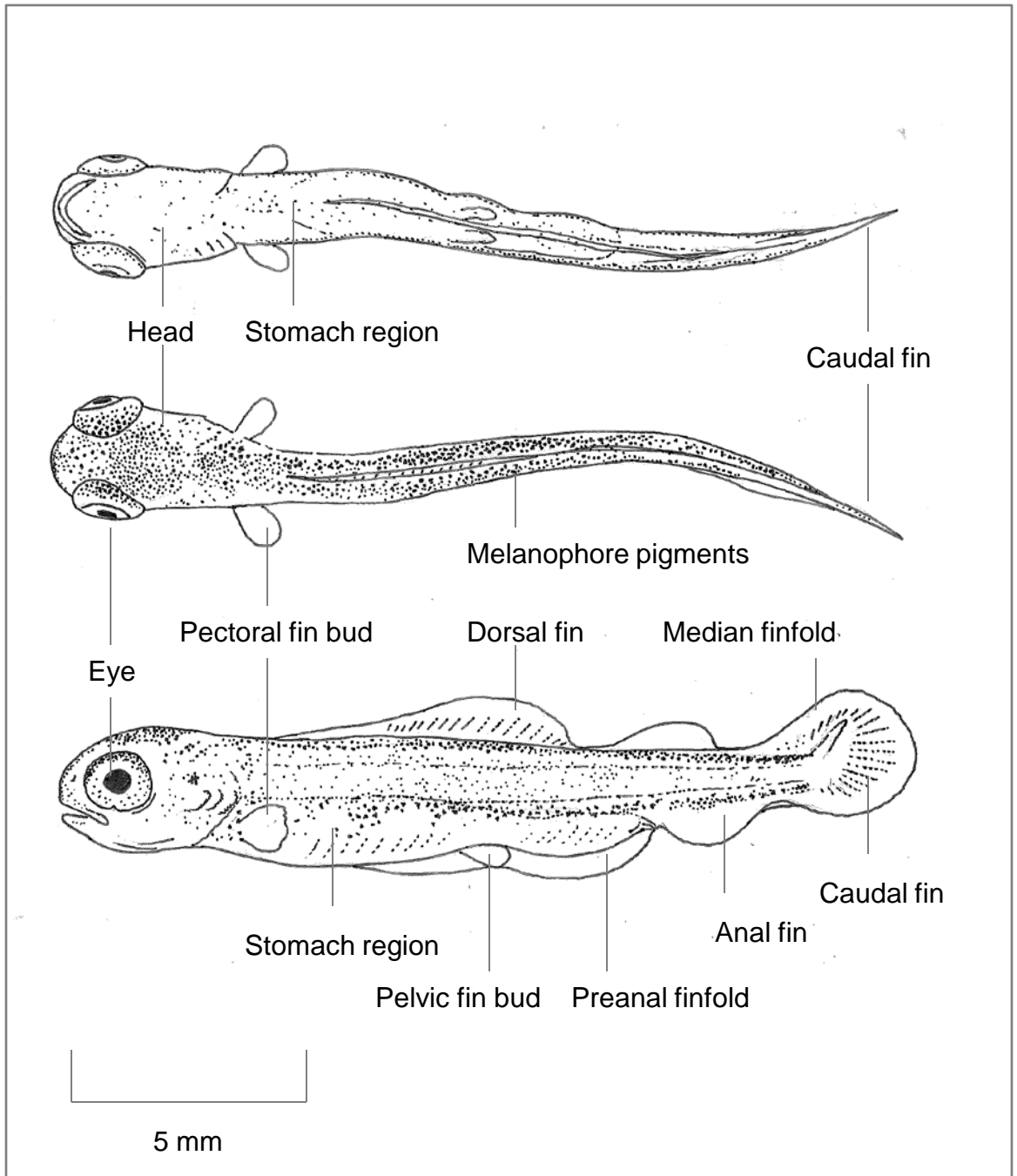


Figure C-3. Arctic grayling mesolarva

Total length: 17.94 mm
Captured 18 June, 2009
Reach 4, Baker Creek

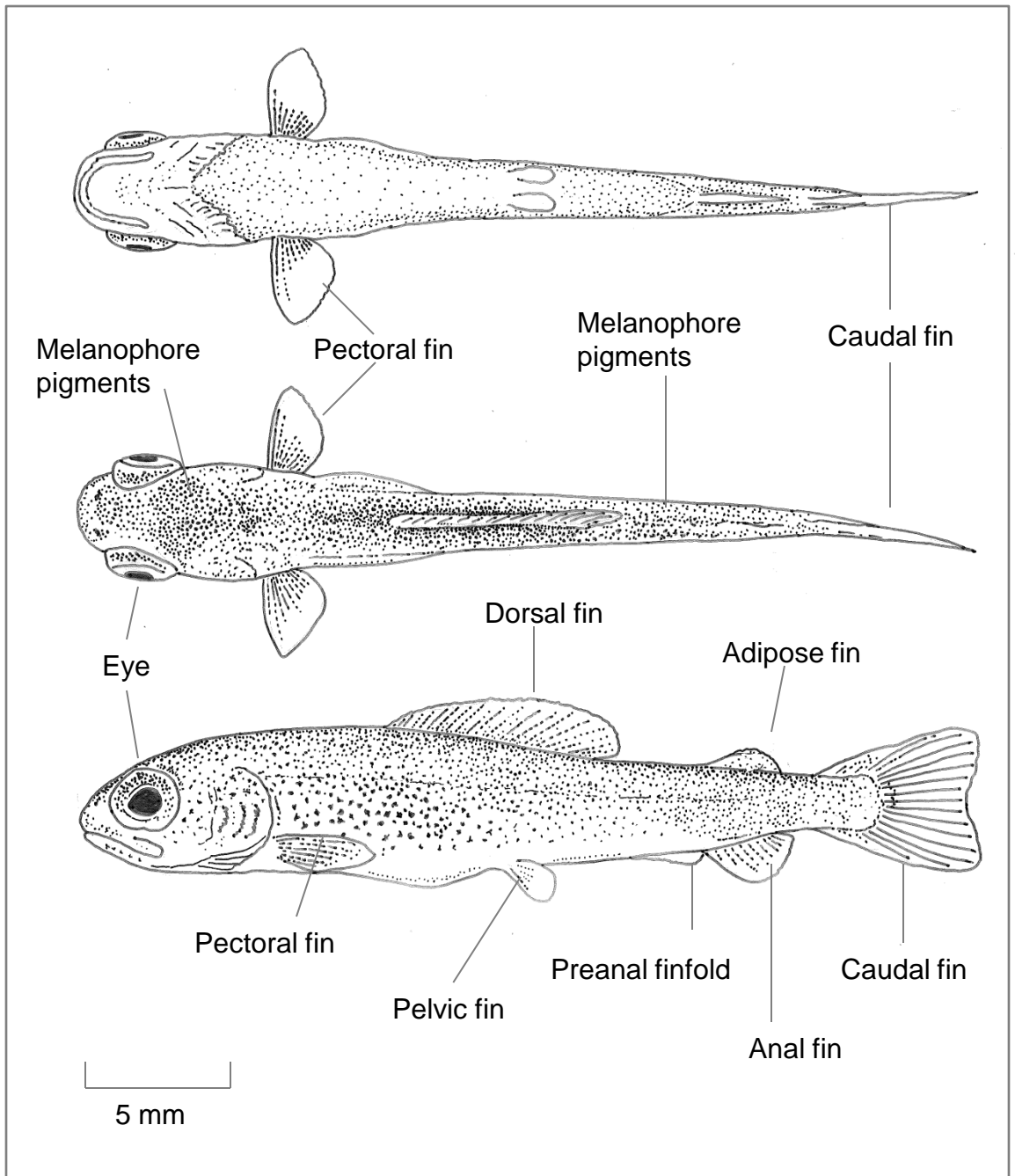


Figure C-4. Arctic grayling metalarva (early juvenile)

30.29 mm.

Captured 26 June, 2009

Reach 4, Baker Creek

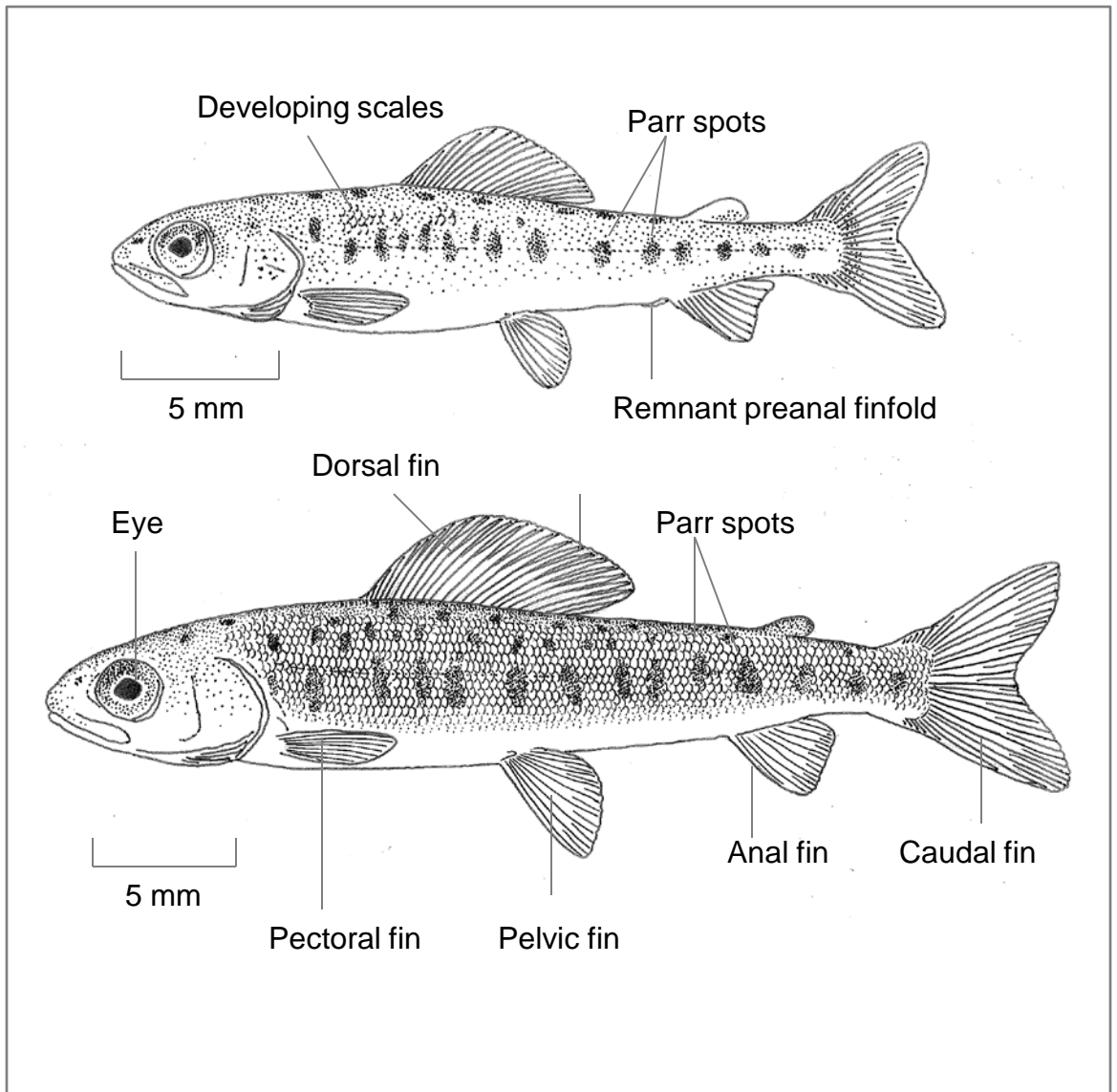


Figure C-5. Arctic grayling Juveniles

Top: Early juvenile
Fork length: 40 mm (early out-migrant)
Captured 03 July, 2009
Reach 4, Baker Creek

Bottom: Juvenile
Fork length: 65 mm (late out-migrant)
Captured 13 July, 2009
Reach 1, Baker Creek