

**Reconnaissance (1:20,000) Fish and Fish Habitat Inventory
of the
Lower Bridge River Watershed (below Hurley River,
excluding Yalakom River and Tyaughton Creek Watersheds)**

Prepared for:

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Lillooet Division

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May 2001

PROJECT REFERENCE INFORMATION

FRBC Project Number	TOM-98-403
FRBC Activity Number	716984
FDIS Project Number	03-SETN-300000001-1998
FRBC Region	Thompson Okanagan Region
MoELP Region	Southern Interior - Region 3
FW Management Unit	3-32 and 3-33
DFO Sub-District	29F - Lillooet
Forest Region	Kamloops Forest Region
Forest District	Lillooet Forest District
Forest Licensee	Ainsworth Lumber Company Ltd.
First Nations Claim Area	Stl'atl'imx (Lillooet) First Nations

WATERSHED INFORMATION

Watershed Group SETN Group

Watershed Names (a selection of sampled basins within the 2000/2001 study area)

Moon Creek
Applespring Creek
Camoo Creek
Antoine Creek
Sebring Creek
Cedarvale Creek
Nosebag Creek
Keary Creek
Jones Creek
Marshall Creek
Tommy Creek
Bobb Creek
Truax Creek
Gun Creek
LaJoie Creek
Leckie Creek
Slim Creek
Warner Creek
Fergusson Creek

Watershed Codes

Moon Creek	100-241900-04000
Applespring Creek	100-241900-07800
Camoo Creek	100-241900-11000
Antoine Creek	100-241900-14400
Sebring Creek	100-241900-31100
Cedarvale Creek	100-241900-34600
Nosebag Creek	100-241900-35600
Keary Creek	100-241900-37000
Jones Creek	100-241900-38800
Marshall Creek	100-241900-39900
Tommy Creek	100-241900-42900
Bobb Creek	100-241900-44000
Truax Creek	100-241900-48800
Gun Creek	100-241900-55400
LaJoie Creek	100-241900-55400-05500
Leckie Creek	100-241900-55400-34100
Slim Creek	100-241900-55400-34100-1160
Warner Creek	100-241900-55400-70100
Fergusson Creek	100-241900-59200

UTM at Stream Mouth

Moon Creek	10 571198 5626323
Applespring Creek	10 567661 5629904
Camoo Creek	10 563662 5630345
Antoine Creek	10 560225 5633551
Sebring Creek	10 548483 5625137
Cedarvale Creek	10 543967 5627049
Nosebag Creek	10 542580 5627959
Keary Creek	10 540917 5629295
Jones Creek	10 539475 5632024
Marshall Creek	10 538022 5632339
Tommy Creek	10 533523 5632773
Bobb Creek	10 531649 5633643
Truax Creek	10 525317 5637097
Gun Creek	10 515961 5637828
LaJoie Creek	10 514201 5639531
Leckie Creek	10 503033 5642753

Slim Creek	10 501113 5643757
Warner Creek	10 491363 5652332
Fergusson Creek	10 511932 5634586

Study Area Size 1,610 km²

Total of all Stream Lengths 4,635 km

Stream Orders

Moon Creek	4 th
Applespring Creek	5 th
Camoo Creek	4 th
Antoine Creek	5 th
Sebring Creek	4 th
Cedarvale Creek	4 th
Nosebag Creek	4 th
Keary Creek	4 th
Jones Creek	4 th
Marshall Creek	5 th
Tommy Creek	5 th
Bobb Creek	4 th
Truax Creek	4 th
Gun Creek	6 th
LaJoie Creek	4 th
Leckie Creek	5 th
Slim Creek	5 th
Warner Creek	4 th
Fergusson Creek	4 th

NTS Maps 92I/13, 92J/9, 92J/10, 92J/14, 92J/15, 92J/16, and 92O/3

TRIM Maps 92I.071, 92I.081, 92J.077, 92J.078, 92J.079, 92J.080, 92J.084, 92J.085, 92J.086, 92J.087, 92J.088, 92J.089, 92J.090, 92J.094, 92J.095, 92J.096, 92J.097, 92J.098, 92J.100, 92O.004, 92O.005, and 92O.006.

BEC Zones

Alpine Tundra – Engelmann Spruce-Subalpine Fir
Parkland (AT – ESSF)
Engelmann Spruce-Subalpine Fir (ESSF)
Interior Douglas Fir (IDF)
Montane Spruce (MS)
Ponderosa Pine (PP)

Aerial Photographs

30BCC97127	100-125, 155-180
30BCC97219	142-150, 182-197
30BCC97220	85-105, 130-142
30BCC97221	35-45, 80-84

SAMPLING DESIGN SUMMARY

	Phases I to III (1998 / 1999)	Phases IV to VI (Proposed 2000/2001)	Phases IV to VI (Completed 2000/2001)	Remaining
Total Number of Stream Reaches	7,428	7,804	7,804 ¹	0
Total Number of Lake Reaches	129	4	4	0
Random Sample Sites	138	138	134 ²	0
Biased Sample Sites	26	27	38 ³	0
Total Sample Sites	164	165	172	0
Dates	April 1999	n/a	August 9, 2000 – September 24, 2000	n/a

Note:

- 1 The total number of reaches completed (7,428) differs from the number of reaches initially identified in Phases I to III (7,804). This discrepancy is due to the addition of reaches as a result of field sampling and the ground-truthing of mapped reach breaks.
- 2 The total number of random sites completed during 1999 and 2000 field sampling (134) does not reflect the total number of random sites proposed (138). This is due to the logistical problems encountered when attempting to access these random sites. Random sites that were not accessible were replaced with biased sites in similar adjacent basins.
- 3 The total number of biased sites completed during field sampling (38) does not reflect the total number of biased sites initially proposed in Phases I to III (26). This is due to the replacement of inaccessible random sites, the addition of biased sites by MoELP or Ainsworth in subsequent years, or the addition of biased sites by field crews at the time of sampling.

DISCLAIMER

This product has been accepted as being in accordance with approved standards within the limits of ministry quality assurance procedures. Users are cautioned that interpreted information on this product developed for the purposes of the Forest Practices Code Act and Regulations, for example stream classifications, is subject to review by a statutory decision maker for the purposes of determining whether or not to approve an operational plan.

ACKNOWLEDGMENTS

Funding for this inventory was provided by Forest Renewal British Columbia, through Ainsworth Lumber Company Ltd. In addition, acknowledgements are extended to Integrated Woods Services Ltd. (IWS) for their GIS support, and Hamaguchi Fish Aging Services for the ageing of scale samples.

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LIST OF ATTACHMENTS (AVAILABLE AT MoELP OFFICE)

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- Attachment II. Photographs and Field Notes
- Attachment III. Fish Ageing Structures
- Attachment IV. Negatives, Photo Summary Report and Photo CD ROM
- Attachment V. Digital Data

1.0 INTRODUCTION

1.1 PROJECT SCOPE AND OBJECTIVES

Ainsworth Lumber Company Ltd., retained ARC Environmental Ltd., in partnership with the Stl'atl'imx (Lillooet) First Nation, to conduct a Reconnaissance (1:20,000) Fish and Fish Habitat Inventory Program (FFHIP). This inventory was conducted in order to describe watershed-wide fish distribution and habitat characteristics for all basins within the *Lower Bridge River Watershed* study area. Funding was provided by Forest Renewal British Columbia (FRBC). The project also included sampling protocols to satisfy stream classification requirements in specific stream reaches potentially affected by planned forest harvesting activities for input into the Silviculture Prescription and Road Layout and Design under the Forest Practices Code (BC Forest Practices Code 1998).

In 1998/1999, ARC Environmental Ltd. completed Phases I through III of the FFHIP for 4 units within the Lillooet Forest District; *Fraser River Tributaries*, *Yalakom River Watershed*, *Tyaughton Creek Watershed*, and *Lower Bridge River Watershed* (below Hurley River). Upon completion, 336 sites (294 random and 42 biased), were proposed for sampling, 164 (138 random and 26 biased) of which were part of the sampling plan within the *Lower Bridge River Watershed* study area.

Following consultation in 2000 with Ainsworth Lumber Company Ltd. and the Ministry of Environment, Lands and Parks (D. Tesch, Contract Monitor), one additional biased site and four primary lake surveys were added to the sampling plan. At the request of Ainsworth Lumber Company Ltd., it was also decided that two biased reaches in the Tommy Creek basin be moved due to previous stream classification sampling. For 2000/2001 it was decided that the Phase IV-VI components would complete all of the 165 proposed reaches (138 random and 27 biased) and four lakes within the *Lower Bridge River Watershed*.

Results for lake sampling are reported in: *Reconnaissance Lake Inventory of Keary Lake* (ARC Environmental Ltd. 2001a); *Reconnaissance Lake Inventory of Unnamed Lake (3070)* (alias Truax Lake) (ARC Environmental Ltd. 2001b); *Reconnaissance Lake Inventory of Unnamed Lake (3102)* (ARC Environmental Ltd. 2001c); and *Reconnaissance Lake Inventory of Warner Lake* (ARC Environmental Ltd. 2001d). In addition, field sampling within the *Fraser River Tributaries, Yalakom River, and Tyaughton Creek Watersheds* was initiated in 1999/2000 and completed in 2000/2001. Results are provided in the two following reports: *Reconnaissance (1:20,000) Fish and Fish Habitat Inventory of the Fraser River Tributaries, Yalakom River, and Tyaughton Creek Watersheds* (ARC Environmental Ltd. 2000); and *Reconnaissance (1:20,000) Fish and Fish Habitat Inventory of the Fraser River Tributaries, Yalakom River, and Tyaughton Creek Watersheds* (ARC Environmental Ltd. 2001e).

Within the *Lower Bridge River Watershed*, a total of 172 sites (134 random and 38 biased) were completed. Due to difficulties with access, four random and two biased reaches could not be sampled. Four similar biased reaches were chosen as replacements to the inaccessible random reaches, and the two inaccessible biased reaches were replaced with reaches immediately downstream. Seven additional biased reaches were also sampled, six as part of the lake inventory sampling, and one added at the field crew's discretion. In total, 172 sites were completed, 134 random, 25 original biased, 6 replacement biased and 7 additional biased.

The completion of the 172 sites within the *Lower Bridge River Watershed* study area, meet the following objectives of the Reconnaissance Inventory for the entire project area:

- i) Provide the essential fish and fish habitat information required for resource planning and/or decision-making that may affect fisheries resources,

- ii) Describe watershed-wide fish distributions and habitat characteristics, and
- iii) Provide information to meet British Columbia Forest Practices Code (BC FPC) stream classification requirements for reaches sampled within the study area. This involves the recommendation of stream classifications which are then vetted by appropriate agency staff. The Forest District Manager ultimately approves stream classifications.

1.2 LOCATION

The *Lower Bridge River Watershed* study area encompasses a region of approximately 160,976 ha. This includes the majority of the Bridge River system below the confluence with the Hurley River, and excludes the Yalakom River and Tyaughton Creek watersheds. The study area spans from the town of Lillooet to the town of Gold Bridge and includes drainage areas such as the Gun Creek basin, Carpenter Lake tributary basins, and the lower Bridge River drainage, below Terzaghi Dam. All areas are within the Ministry of Environment, Lands, and Parks (MoELP) Southern Interior Region (Region 3), the Lillooet Forest District of the Kamloops Forest Region, and the Department of Fisheries and Oceans (DFO) Lillooet Sub-district (Area 29F).

Table 1 describes watershed information for a selection of streams within the *Lower Bridge River Watershed* study area. These basin areas are located on 22 Terrain Resource Information Management (TRIM) maps (92I.071, 92I.081, 92J.077, 92J.078, 92J.079, 92J.080, 92J.084, 92J.085, 92J.086, 92J.087, 92J.088, 92J.089, 92J.090, 92J.094, 92J.095, 92J.096, 92J.097, 92J.098, 92J.100, 92O.004, 92O.005, and 92O.006), and seven National Topographic System (NTS) maps (92I/13, 92J/9, 92J/10, 92J/14, 92J/15, 92J/16, and 92O/3) (Figure 1).

Table 1. Watershed information for selected streams within the *Lower Bridge River Watershed*.

Gazetted Name	Watershed Code	UTM Zone	Easting	Northing	Order	Mainstem Length (km) ¹
Moon Creek	100-241900-04000	10	571198	5626323	4	9.7
Applespring Creek	100-241900-07800	10	567661	5629904	5	9.4
Camoo Creek	100-241900-11000	10	563662	5630345	4	9.5
Antoine Creek	100-241900-14400	10	560225	5633551	5	13.4
Sebring Creek	100-241900-31100	10	548483	5625137	4	6.5
Cedarvale Creek	100-241900-34600	10	543967	5627049	4	7.7
Nosebag Creek	100-241900-35600	10	542580	5627959	4	8.9
Keary Creek	100-241900-37000	10	540917	5629295	4	11.1
Jones Creek	100-241900-38800	10	539475	5632024	4	6.6
Marshall Creek	100-241900-39900	10	538022	5632339	5	6.9
Tommy Creek	100-241900-42900	10	533523	5632773	5	17.9
Bobb Creek	100-241900-44000	10	531649	5633643	4	10.2
Truax Creek	100-241900-48800	10	525317	5637097	4	15.0
Gun Creek	100-241900-55400	10	515961	5637828	6	48.3
LaJoie Creek	100-241900-55400-05500	10	514201	5639531	4	6.2
Leckie Creek	100-241900-55400-34100	10	503033	5642753	5	22.4
Slim Creek	100-241900-55400-34100-1160	10	501113	5643757	5	35.3
Warner Creek	100-241900-55400-70100	10	491363	5652332	4	9.6
Fergusson Creek	100-241900-59200	10	511932	5634586	4	11.4

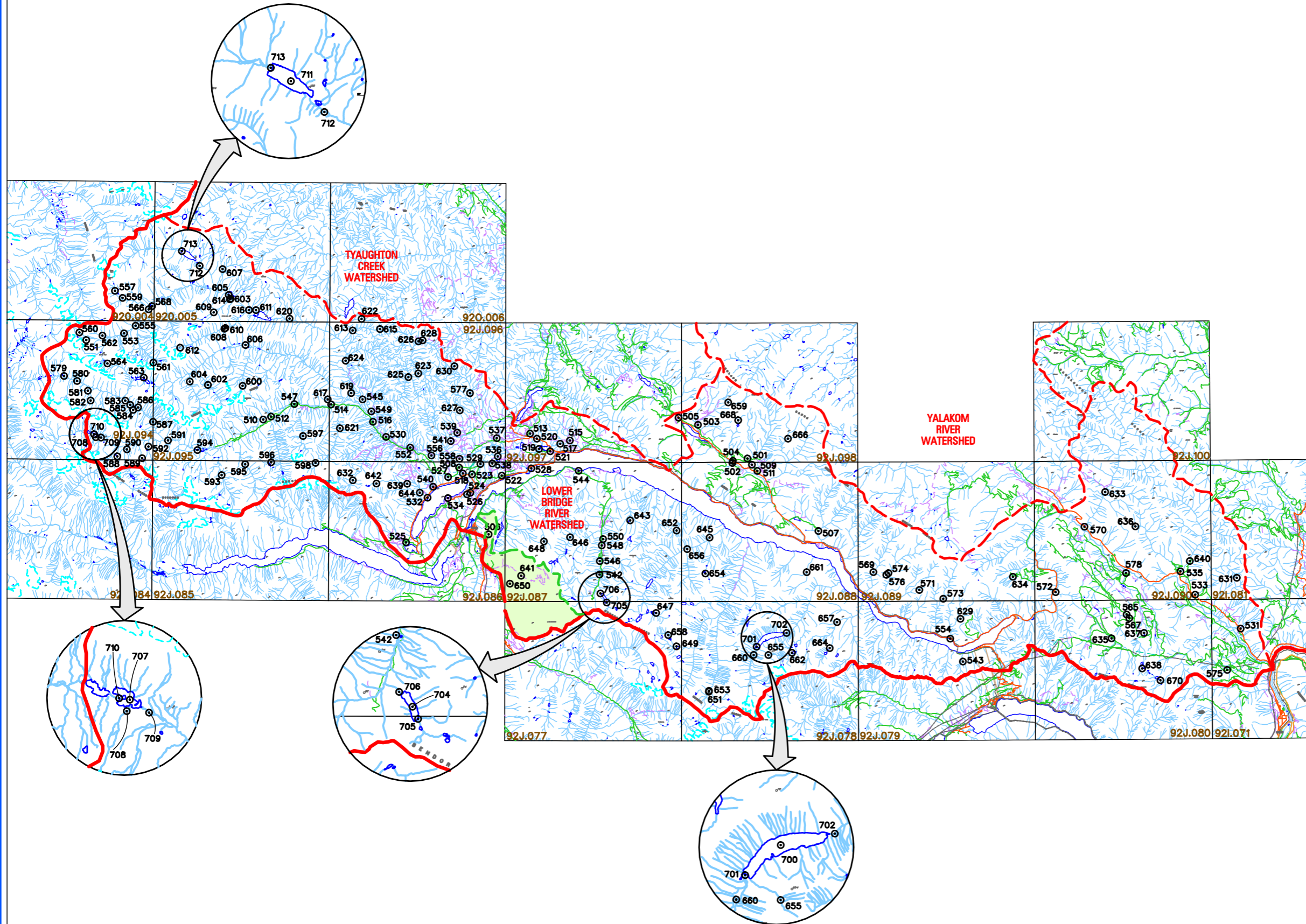
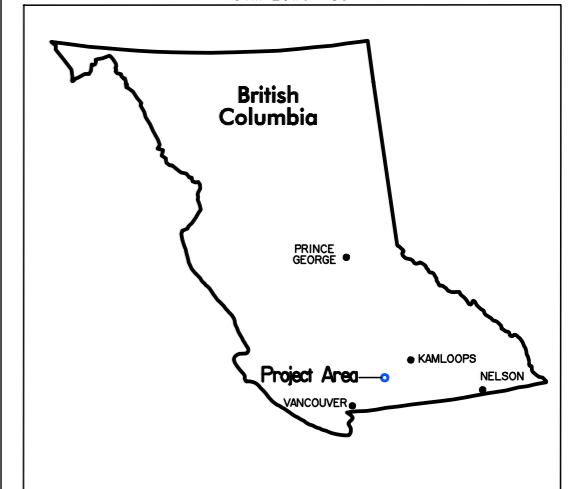
Note: ¹ mainstem length totals do not include the length of lake reaches

The *Lower Bridge River Watershed* lies within five biogeoclimatic zones; Alpine Tundra – Engelmann Spruce-Subalpine Fir Parkland (AT – ESSF), Engelmann Spruce-Subalpine Fir (ESSF), Montane Spruce (MS), Interior Douglas Fir (IDF), and Ponderosa Pine (PP) (MoF 1989a; MoF 1989b; MoF 1989c; and MoF 1989d). Typically, the headwater ridges and peaks of basins such as Gun, Marshall, and Camoo Creeks lie within the AT – ESSF zone (1700 – 2900 m). With decreasing elevation, the study area passes through the ESSF (1350 – 2100 m), and MS (1000 – 1800 m) zones before finally entering the IDF zone (500 – 1600 m) within the lower valley of Bridge River and Carpenter Lake. A portion of the lower valley within the Bridge River, below Terzaghi Dam, is also characterized by the PP zone. Generally, these zones are further described by two precipitation and four temperature subzones. The precipitation

Figure 1:
OVERVIEW MAP

Lower Bridge
River Watershed
FFHIP 2000/2001

Project Code: 03-SETN-30000001-1998
Date: March 14, 2001
Inventory Company: ARC Environmental Ltd.
Printed in Canada by: Integrated Woods Services
UTM Zone: 10



Scale 1:325,000
0 1 2 3 4 5 10
kilometres

- Streams
- Lakes
- Glacier
- Study Area Boundary
- Study Area Unit Boundaries
- Highway
- Secondary Highway
- Logging Roads
- Trails
- Sample Sites
- Community Watershed



BASE: IR _____ STR SYM: INV _____
LOC: FDE _____ LK SYM: NA _____
HAB: INV _____ FISH: INVG _____
INV MGMT: OTH _____
DATE INV: Aug. 9, 2000 - Sept. 24, 2000

Prepared By:
Integrated
Woods Services Ltd.

subzones range from dry to very dry, with temperature variations from cool, cold to very cold, with a hot subzone lying within the PP areas of the lower Bridge River valley, below Terzaghi Dam.

1.2.1 Access

Road access is limited within the *Lower Bridge River Watershed*. However, 60 sites were road accessible and these were reached by travelling northwest out of the town of Lillooet onto Road 40. This road is the main highway through the study area and continues west from Lillooet to Goldbridge, following the north side of the Bridge River mainstem and Carpenter Lake reservoir. Road 40 and additional roads, were used to access some basins and headwater areas within the study area. These include highway 2028, to access the Marshall Creek basin, highway 2090, to access the Gun Lake area, as well as the Slim Creek Forest Service Road (FSR), to access the Slim Creek basin. A gated controlled road was also used to access sites on the south side of Bridge River, specifically on Mission Ridge. The gate is located on Xwisten reserve land, and a key was obtained from the band office.

The 110 helicopter sites used numerous staging areas within the *Lower Bridge River Watershed*. The Slim Creek FSR, Carpenter Lake area Recreation Sites, and the Goldbridge helipad provided field locales from which the majority of these helicopter sites were accessed. In addition, two sites were accessed by float plane. Tyax Air Service from Tyaughton Lake was used to ferry equipment and field crews into Keary Lake for stream and lake fish inventory sampling.

2.0 RESOURCE INFORMATION

i) First Nations Issues and Interests in the Area

The Stl'atl'imx (Lillooet) First Nations have traditional territories within the *Lower Bridge River Watershed* study area (Union of BC Indian Chiefs 1993). The Xwisten (Bridge River) Indian Band is the only band to have Indian Reserve land within the study area (Lillooet Tribal Council 2000; and MoF undated). The reserve extends along the lower Bridge River valley, below Terzaghi Dam, from the mouth to the confluence with Antoine Creek. The reserve land also extends up into the Mission Ridge area on the south side of the lower Bridge River. No other Indian Reserves are located within the study area, although the Chalath (Seton Lake), T'it'kit (Lillooet), and Xaxl'ip (Fountain) Indian Bands have reserves in the vicinity (Lillooet Tribal Council 2000; and MoF undated).

The First Nations within the Lillooet Forest District maintain traditional cultural and spiritual uses of the land. This includes hunting, fishing, and gathering (MoF 1995). Specifically, the Stl'atl'imx First Nations harvest sockeye (*Oncorhynchus nerka*), chinook (*O. tshawytscha*), and coho salmon (*O. kisutch*), as well as steelhead trout (*O. mykiss*) (Komori 1997a). Harvesting occurs by dipnetting, with some gillnetting, throughout their territory along the Fraser River. An important fishing location exists at the confluence of the Bridge and Fraser Rivers.

More specifically, within the *Lower Bridge River Watershed* study area, the Xwisten and Chalath Indian Bands have historically used the lower Bridge River, Carpenter Lake valley and tributaries areas such as Marshall Creek, for the hunting of moose (*Alces alces*) and mule deer (*Odocoileus hemionus*), fishing of salmon, and trapping of fur-bearers (Clayton Resources Ltd. 1991).

ii) Developments and Land Use

The Lillooet Forest District is subject to numerous developments and land use activities. Timber harvesting, agriculture, urban and linear developments, hydroelectric developments, mining activities, as well as tourism and recreational activities are prevalent throughout the district:

- Timber harvesting is the main industry providing economic activity within the Lillooet Timber Supply Area (TSA), and is conducted within the study area, primarily by Ainsworth Lumber Company Ltd., with additional areas harvested by J.S. Jones and the Small Business Forest Enterprise Program (MoF 1999). The Small Business Forest Enterprise Program conducts forest harvesting within lower Gun Creek, on the south side of Carpenter Lake from the Ferguson Creek basin to Truax Creek basin, within the Tommy Creek basin, and within the Hog Creek basin of the Marshall Creek watershed.
- Agriculture is limited in the Lillooet area, and is closely tied to its water resources. The portion of the Lillooet area's land base in the Agricultural Land Reserve (ALR) is significantly below the provincial average (2.8% vs. 5.0%). Limited forage production and ranching activities occur in localized areas throughout the study area. However, crown rangelands are prevalent throughout all BEC zones of the Lillooet area (MoF 1999).
- Developments are generally limited within the study area. Linear developments are limited to Road 40, a few secondary highways (eg. highway 2028), and forestry maintained access roads. A hydro right-of-way also passes along the north side of Carpenter Lake, crossing the lake over into Mission Pass. Another hydro right-of-way crosses east-west along Mission Ridge from Lillooet to Shalath. The town of Goldbridge lies within the study area at the confluence of the Bridge and Hurley Rivers. Residents also live in the vicinity of Gun and Marshall Lakes.

- BC Hydro currently operates a storage facility (Terzaghi Dam) at the outlet of Carpenter Lake. This facility stores water for a diversion to a hydroelectric powerhouse on Seton Lake (Komori 1997b). Construction of the development was initiated in 1934 with the construction of a diversion through Mission mountain. A low level temporary diversion dam was first completed in 1948 and was known as Mission Dam. The construction of the current facility, Terzaghi Dam, was completed in 1960, 2.4 km downstream of Mission Dam. (Triton Environmental Consultants Ltd. 1991). Carpenter Lake water levels fluctuate throughout the year with drawdown from December through March, and filling from spring to fall with the accumulation of water released from the overwinter snowpack. Generally, this facility has completely diverted the upper Bridge River flows into the Seton system. However, in 2000, water was released from Terzaghi Dam in order to restore salmon habitat to approximately 4 km of the lower Bridge River (A. Caverly, Bio Resource Fish/Power Specialist, Ministry of Environment, Lands and Parks, *pers. comm.*).
- Rich mineral resources exist, primarily gold, silver, zinc, and copper, within the Lillooet Forest District and the area is known to have a long history of exploration and development (MoF 1999). Within the study area, mineral occurrences and activities exist within Truax Creek, and placer mining activity has been authorized, in the Marshall Creek basin (Komori 1997b).
- The Lillooet area offers a rich variety of tourism and recreation opportunities, including hiking, camping, hunting, angling, horseback riding, mountain biking, snowmobiling, skiing, mountaineering and nature study (MoF 1999). Additionally, 15 Forest Recreation Sites and three Forest Recreation Trails exist within the study area (MoF undated).

iii) Other Concerns, Developments, or Points of Interest

The *Lower Bridge River Watershed* offers a variety of resource use and recreational opportunities. Currently the Lillooet Land and Resource Management Plan (LRMP) is in

preparation with the intention of identifying and describing the land and resource values within the Lillooet TSA (MoF 1999). To date, the Spuce area, a portion of which lies within the *Lower Bridge River Watershed*, is being proposed as a protected area. In addition, the 15 Forest Recreation Sites (MoF undated), Gun Lake Resort on Gun Lake, and Forest Recreation Trails, particularly the Spruce Lake Trail system, offer access to locales that are considered regionally significant as Semi-Primitive Non-Motorized areas (MoF 1999).

iv) Impacts and Uses by Wildlife

The Lillooet Timber Supply Area provides habitat for a diversity of common wildlife species and four species at risk. Common are moose (*Alces alces*), mountain goats (*Oreamnos americanus*), bighorn sheep (*Ovis canadensis*), mule deer (*Odocoileus hemionus*), coyotes (*Canis latrans*), wolves (*Canis lupus*), cougars (*Felis concolor*), lynx (*Lynx canadensis*), bobcat (*Lynx rufus*), and black bears (*Ursus americanus*), while the grizzly bear (*Ursus arctos*), spotted owl (*Strix occidentalis*), fisher (*Martes pennanti*), and tailed frog (*Ascaphus truei*) are at risk (MoF 1999; and BC FPC 1997).

Within the TSA, the populations of mountain goats, grizzly bear, spotted owl and fisher are of significance. Specifically, mountain goats in the district have some of the highest densities in the province, whereas the grizzly bear, spotted owl, fisher, and tailed frog, due to their, 'at risk,' species status (BC CDC 1999), require specific resource management considerations (MoF 1999). Generally spotted owls have been identified outside of the study area within the Cayoosh Creek system (J. Surgenor, Rare and Endangered Species Specialist, MoELP, *pers. comm.*). In addition, tailed frog inventory work has revealed that tailed frogs are located within the study area, specifically the Tommy Creek drainage (J. Surgenor, Rare and Endangered Species Specialist, MoELP, *pers. comm.*).

Harlequin Duck (*Histrionicus histrionicus L.*) have also been reported within the area, specifically along the Bridge and Yalakom Rivers (Wright 1998). Provincially the

Harlequin Duck has received a, “yellow list,” designation and is considered a species of management concern. A preliminary brood enumeration survey has been conducted along the Bridge River (below Terzaghi Dam) and Yalakom River mainstems (Wright 1998), and broods were discovered within the upper reach of the Bridge River below Terzaghi Dam.

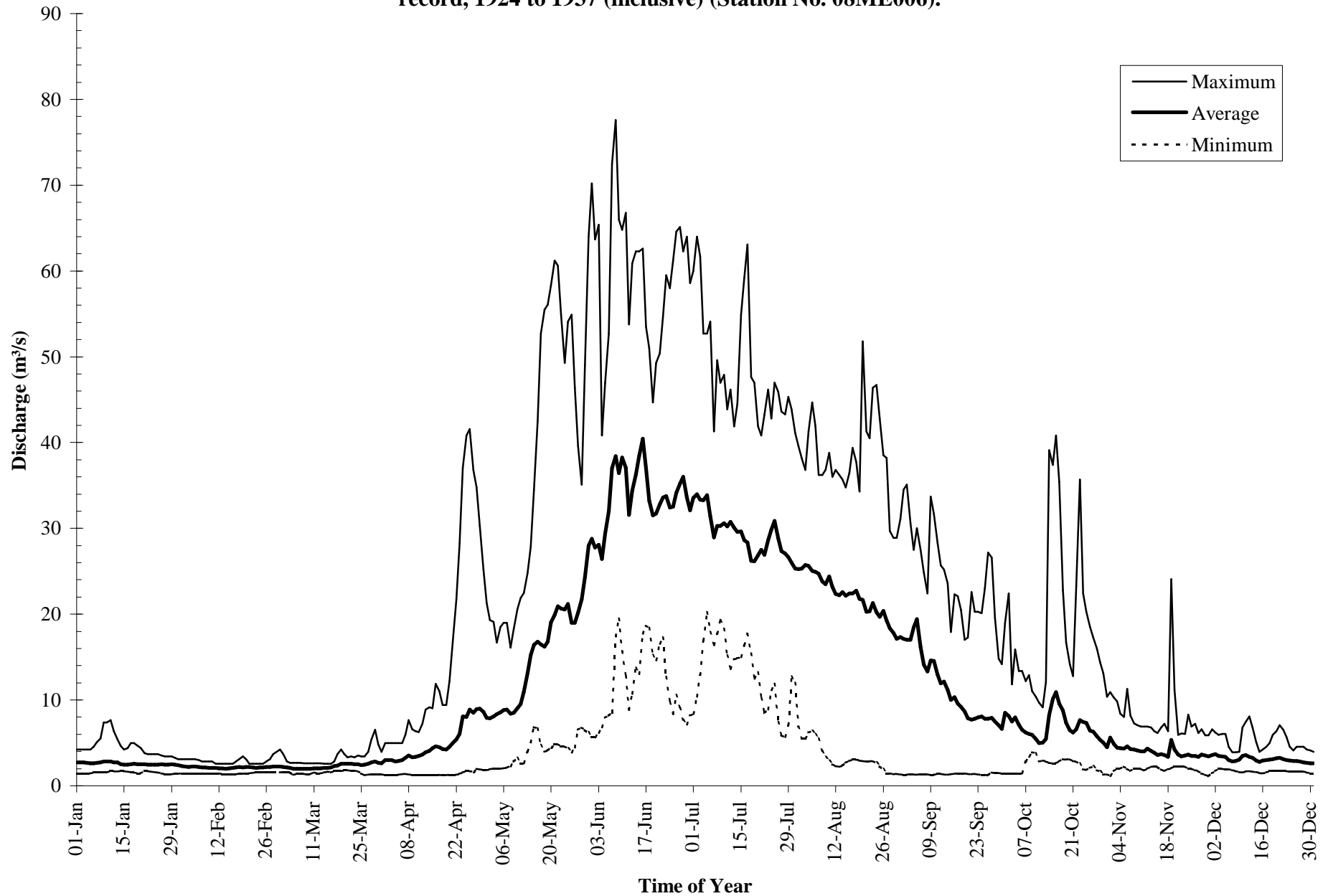
v) Water Use

Water quality and quantity issues have been noted as having the potential to impact regional growth and development (MoF 1999). Currently, BC Hydro is the largest licensed water user, while the agricultural industry is second (MoF 1999). Fergusson Creek is the only community watersheds within the *Lower Bridge River Watershed* (MoELP 1999a), and all streams within the basin will receive an S1 – S4 classification.

The *Lower Bridge River Watershed* supports a total of 134 registered water licenses on 20 gazetted name waterbodies, including Bridge River, Ama, Moon, Antoine, Michelmoon, Jones, Brett, Jim, Howe, LaJoie, Sumner, Walker, Penrose, Pearson, Lick, Lindsey, and Fergusson Creeks, as well as Gun, LaJoie, and Carpenter Lakes (MoELP 1999b). The majority of licenses are allocated for consumptive purposes, primarily domestic and irrigation. Additional uses include power-residential, conserved/stored water, storage-power, enterprise and waterworks.

There is limited hydrological data within the *Lower Bridge River Watershed*. Hydrograph measurements have been recorded for brief periods at three inactive Water Survey of Canada stations; 08ME014 on Bridge River, below Tyaughton Creek, 08ME006 on Gun Creek, near Minto City, and 08ME001 on Bridge River, near Shalath. The station on Gun Creek, near Minto City, demonstrated a typical hydrological pattern for a tributary system within the study area by showing a sharp peak and drawn out decrease in annual discharge (Figure 2). The average mean daily discharge increased from 4.05 m³/s in mid April to an average peak flow of 33.50 m³/s in early July. Generally, by mid September, discharge decreased significantly to an average of 10.30

Figure 2. Gun Creek (near Minto City): mean, maximum and minimum daily discharges for the period of record, 1924 to 1937 (inclusive) (Station No. 08ME006).



m³/s, and lower flows of 5.78 m³/s were established by early November. A maximum peak flow of 77.60 m³/s was recorded on June 8, 1929, while a minimum discharge of 1.13 m³/s was recorded on November 30, 1925 (Environment Canada 1999).

vi) Previous Presence of Fish

Some references have mentioned the presence of Dolly Varden (*Salvelinus malma*). However, according to McPhail and Baxter (1996), Dolly Varden is generally recognized as a coastal species, while bull trout (*S. confluentus*) is an interior species. As a result, accounts of Dolly Varden in the report and on the *Project* and *Interpretive* maps should be considered as records of bull trout.

Although the Fraser River was not part of the study area, its fisheries resources are related to those of the lower Bridge River, below Terzaghi Dam. The Fraser River offers an important migration corridor and rearing area for a variety of fish species. Anadromous salmonids, such as steelhead trout, sockeye, chinook, coho, pink (*Oncorhynchus gorbuscha*), and chum (*O. keta*) salmon utilize this corridor (Komori 1997a). Additional species such as, rainbow trout (*O. mykiss*), bull trout, white sturgeon (*Acipenser transmontanus*), largescale sucker (*Catostomus macrochelius*), longnose sucker (*C. catastomus*), leopard dace (*Rhynchichthys falcatu*), longnose dace (*R. cataractae*), peamouth chub (*Mylocheilus caurius*), redbelt shiner (*Richardsonius balteatus*), pikeminnow, formerly northern squawfish, (*Ptychocheilus oregonensis*), lamprey species (*Lamptera spp.*), sculpins (*Cottus spp.*) and whitefish species (*Prosopium spp.*) have also been documented within the upper Fraser River (Triton Environmental Consultants Ltd. 1994; and BC CDC 1999).

Within the study area, below Terzaghi Dam, the Bridge River mainstem supports spawning populations of pink, chinook, sockeye, and coho salmon, as well as steelhead trout (Triton Environmental Consultants Ltd. 1991). For the period of record from 1980 – 1989, escapements of pink salmon were the highest, while chinook, sockeye, and coho were comparably lower (Table 2). In 1991, Triton Environmental Consultants Ltd.

reported that the Yalakom River contributed 75 to 90% of flows to the lower reaches of the Bridge River. However, salmon spawning, specifically pink salmon, has been observed from the mouth of the Bridge River up to Terzaghi Dam (Triton Environmental Consultants Ltd. 1991). Chinook salmon also spawn throughout the river, yet the highest concentrations occur between Camoo Creek and 10 km upstream of the confluence with the Yalakom River (Stewart and Matthew 1984). The greatest concentration of coho spawners has been observed between Camoo Creek and the Yalakom River (Stewart and Matthew 1984; and Jarvis and Stewart 1985), and sockeye spawners generally concentrate in the area adjacent to Camoo Creek (Triton Environmental Consultants Ltd 1991). In 2000, water releases from Terzaghi Dam were initiated in order to restore salmon habitat to approximately 4 km of the lower Bridge River (A. Caverly, Bio Resource Fish/Power Specialist, Ministry of Environment, Lands and Parks, *pers. comm.*). Due to the water storage facility, anadromous salmon are excluded from the upper reaches of the Bridge River, above Terzaghi Dam. However, historical accounts indicate that Gun Creek supported anadromous salmon (Crawford 1981).

Table 2. Summary of average and maximum anadromous salmonid escapements for the Bridge River, 1980 – 2000.

Fish Species	1980-1989 ¹		1990-2000		Spawning Period
	Average	Maximum	Average	Maximum	
pink salmon	59,161	104,000	not available	not available	October
chinook salmon	512	956	882 ²	1968 ²	August – September
coho salmon	408	850	343 ²	900 ²	September – October
sockeye salmon	431	2,500	418 ³	1050 ³	August – September
steelhead trout	50	200	250 ⁴	350 ⁴	May – June

Note: ¹ Escapement data extracted from Fish Habitat Inventory and Information Program (1992).

² Escapement data provided by R. Bailey (Stock Assessment, FOC, *pers. comm.*), enhanced returns in 1996 and 1997.

³ Escapement data available for 1990, 1992, 1994, and 2000 only, provided by T. Cone (Stock Assessment, FOC, *pers. comm.*).

⁴ Escapement data available for 1999 and 2000 only, provided by A. Caverly (Bio Resource Fish/Power Specialist, MoELP, *pers. comm.*).

Salmonid enhancements have occurred on three occasions within the lower Bridge River. First, spawning platforms were constructed upstream of the confluence with the Yalakom River in 1978 (Neilson and Shepard 1983). This has since been washed out by flood

releases from Terzaghi Dam. Coho, chinook and steelhead fry have also been released by the Lillooet Rod and Gun Club in 1980, 1982, 1983, and 1986 (Triton Environmental Consultants Ltd. 1991). Release ranged from 3,750 to 50,000 over these years. More recently, releases of an average of 11,600 (ranging from 6,250 to 13,500) coho, and an average of 15,900 (ranging from 5,000 to 27,000) chinook, have occurred from 1994 to 2000 within the lower Bridge River, below Terzaghi Dam (D. Demontier, Fisheries and Oceans Canada, *pers. comm.*). An additional enhancement involved the removal of a series of partial barriers in the lower Bridge River near the confluence with the Fraser River. This was initiated in the 1970's in order to improve upstream migration of spawning pink salmon (Triton Environmental Consultants Ltd. 1991).

Non-anadromous species within the lower Bridge River, below Terzaghi Dam, include rainbow trout, Dolly Varden, mountain whitefish (*Prosopium williamsoni*), prickly sculpin (*Cottus asper*), redbside shiner, longnose sucker, and Pacific lamprey (*Lamptera tridentata*) (Triton Environmental Consultants Ltd. 1991).

Carpenter Lake is known to support populations of rainbow trout and Dolly Varden (Triton Environmental Consultants Ltd. 1991). Kokanee (*Oncorhynchus nerka*) are also present within Carpenter Lake as a result of stocking by MoELP (1999c). Releases of 96,000 to 555,000 kokanee fry or fingerlings have occurred in 1970, 1971 and 1973. Stocking of 10,000 rainbow trout eyed eggs also occurred in 1950. More recently, sampling of the reservoir by Griffith (1999) revealed that rainbow trout, bull trout, kokanee salmon, mountain whitefish, redbside shiners, prickly sculpins, and suckers are present within the reservoir. Specifically, Griffith reported respectable numbers of bull trout and rainbow trout in comparison to other lakes in the region. Bull trout were captured in the greatest abundance, followed by rainbow trout and kokanee.

Sampling within the *Lower Bridge River Watershed* tributaries is limited. Prior to this fish inventory, Griffith (1999) conducted the most extensive sampling within the reservoir's tributaries, sampling a total of 41 sites, 15 of which were outside of the *Lower*

Bridge River Watershed study area. Stream sampling occurred within the first reaches of tributaries on the north and south sides of Carpenter Lake, specifically, Cedarvale, Bighorn, Marshall, Nosebag, Keary, Tommy Bobb, Willams, Truax, Howe, Girl, McDonald, Fergusson, and Gun Creeks. Additional sampling occurred at three sites within the Slim Creek basin. Generally, these reaches were low gradient and contiguous with fish habitat in the Carpenter Lake reservoir. Rainbow trout were the most frequently captured species followed by sculpins. Griffith (1999) reported that this trout/sculpin complex dominated much of the stream habitat close to the reservoir. Bull trout were the next most frequently captured species. Kokanee and mountain whitefish were not captured within any of the study area tributaries. No fish were caught within the Slim Creek basin. Anecdotal records of fish in the Camoo Creek basin, have also been reported (B. Jack, Administrator, Xwisten Indian Band, *pers. comm.*).

Fisheries accounts within the lakes of the *Lower Bridge River Watershed* are generally a result of stocking by the Ministry of Environment, Lands and Parks (Table 3). A total of 17 lakes have records of fish, 10 of which have been stocked. Specifically, rainbow trout, kokanee, eastern brook trout, and steelhead trout have been stocked. Next to Carpenter Lake, Gun Lake and LaJoie Lake are the largest of the 17 known fish bearing lakes, and contain a diversity of fish. Gun Lake contains kokanee, rainbow trout, Dolly Varden and redbside shiner (MoELP 1998). Kokanee spawning has been documented in several of Gun Lake's tributaries, specifically, Walker Creek, as well as LaJoie Creek, at the inlet and outlet of Gun Lake (Pankratz 1990). In 1990, the majority of kokanee spawning was observed in the outlet. LaJoie Lake has records of rainbow trout, Dolly Varden, redbside shiner, peamouth chub, prickly sculpin, and cutthroat trout (*Oncorhynchus clarki*) (MoELP 1998). Even though, cutthroat trout were recorded, stocking records do not support the account of this species (MoELP 1999c). Kokanee spawning has been documented in Penrose Creek and within the outlet to LaJoie Lake (Pankratz 1990). The remaining 14 known fish bearing lakes within the study area do not have historical records indicating diverse fish populations. Fish populations within these lakes are limited to rainbow trout and eastern brook trout (Table 3).

Table 3. Summary of fish bearing lakes within the Lower Bridge River Watershed.

Gazetted Name	Stream ILP No.	Stream ILP Map No.	Reach No.	Lake ILP No.	NID Map No.	Species	Species and No. of Releases (min-max)	Life Cycle Stage and Stocking Year*	References
Plateau Pond	1	92J.096	2	3	92J.096	EB	EB (2,000)	Fry, fingerlings, or unknowns in 1979, 1981, 1983, 1984, and 1988-2000.	(Cartwright 1981; and MoELP 1999c)
McDonald Lake	12	92J.087	3	210	92J.086	RB			(MoELP 1998; Tredger & Burns 1974; and Department of Energy, Mines and Resources 1990)
Sucker Lake	188	92J.086	4	199	92J.086	RB			(MoELP 1998)
Unnamed Lake	188	92J.086	7	203	92J.086	RB			(Department of Energy, Mines and Resources 1990)
Gun Lake	88	92J.097	2	118	92J.086	RB, KO, BT, DV, RSC	RB (10,000-50,000) KO (75,000-150,000)	RB yearlings or unknowns in 1950-1953, 1970, 1974, 1982, 1983, 1985, 1986, 1988, and 1995-2000. KO fry or fingerlings in 1985, 1987, 1988, and 1996-2000.	(Department of Energy, Mines and Resources 1990; MoELP 1998; MoELP 1999c; Acres International Ltd. 1990; Pankratz 1990; and MoELP 1994)
LaJoie Lake	88	92J.097	4	121	92J.086	KO, CT***, RB, PCC, CAS, RSC, DV	RB (3,000-5,001)	Yearlings or unknowns in 1970, 1982, and 1987-2000.	(MoELP 1999c; MoELP 1998; Department of Energy, Mines and Resources 1990; MoELP 1994; Pankratz 1990; MoELP undated; and DFO & MoELP 1995)
Noel Lake	204	92J.086	2	78	92J.087	RB	RB (20,000)	Eyed eggs in 1947.	(Department of Energy, Mines and Resources 1990)
Kingdom Lake	204	92J.086	2	88	92J.087	RB	RB (20,000)	Eyed eggs in 1947.	(MoELP 1999c; Department of Energy, Mines and Resources 1990; and Hockley et al. undated)
Bobb Lake	281	92J.088	3	497	92J.087	RB	RB (5,000)	Fry or eyed eggs in 1937, 1950, 1951.	(MoELP 1999c)
Mowson Pond	30	92J.097	2	34	92J.097	RB			(MoELP 1999c; MoELP 1998; Cartwright 1981; and MoELP 1974)
Pearson Pond	73	92J.097	3	75	92J.097	EB	EB (4,000-40,000)	Fry, fingerlings, or unknowns in 1962, and 1977-2000	(MoELP 1999c; and Cartwright 1981)
Marshall Lake	133	92J.088	3	227	92J.098	RB, ST	RB (3,000-30,000) ST (3,659)	RB eggs, eyed eggs or unknowns in 1937, 1938, 1976-1982, 1984, and 1986-2000. ST unknowns in 1978.	(MoELP 1999c; Cartwright 1981; and Department of Energy, Mines and Resources 1990)
Unnamed Lake	180	92J.088	4	191	92J.098	RB			(Holman 1994)
Unnamed Lake	135	92J.088	2	307	92J.098	RB			(MoELP 1998)
Keary Lake	11	92J.088	4	108	92J.078	RB**			(Department of Energy, Mines and Resources 1985b)
Carpenter Lake	2	92I.071	2	24	92J.086	KO, RB, BT, DV, MW, RSC, CAS, LSU	KO (96,000-555,000) RB (10,000)	KO fry or fingerlings in 1970, 1971, and 1973. RB eyed eggs in 1950.	(Griffith 1999; Hallam Knight Piesold Ltd. 1994; Department of Energy, Mines and Resources 1985a; and Maricle 1995)
Moon Lake	52	92I.071	3	43	92J.080	RB	RB (2,000)	Unknowns in 1980.	(MoELP 1999c)

Note: * Release Records Database: Extracted from the BC Fisheries web site, <http://www.bcfisheries.gov.bc.ca/fishinv/db/default.asp>
 ** inlet, outlet and lake sampling in 2000/2001 suggests that no fish are present.
 *** no stocking records for cutthroat trout were identified.

RB - rainbow trout (*Oncorhynchus mykiss*)
 BT - bull trout (*Salvelinus confluentus*)
 DV - Dolly Varden (*Salvelinus malma*), should be considered as a record of bull trout
 KO - kokanee (*Oncorhynchus nerka*)
 EB - eastern brook trout (*Salvelinus fontinalis*)
 CT - cutthroat trout (*Oncorhynchus clarki*)
 MW - mountain whitefish (*Prosopium williamsoni*)
 ST - steelhead (*Oncorhynchus mykiss*)
 RSC - redbelt shiner (*Richardsonius balteatus*)
 CAS - prickly sculpin (*Cottus asper*)
 LSU - longnose sucker (*Catostomus catostomus*)
 PCC - peamouth chub (*Mylocheilus caurinus*)

Stream surveys and sampling within the *Lower Bridge River Watershed* study area has also been conducted as part of forest operations. Specifically, Hugh Hamilton Ltd. (1999) conducted a stream classification survey within the upper reaches of tributaries draining the southern aspect of Gun Lake. Although no fish sampling occurred, the lower reaches of tributaries such as Sumner and Walker Creeks were visually assessed and designated as fish bearing (S3) on the basis of their low gradient and continuity with fish bearing habitat. The upper reaches of Sumner, Walker and several unnamed tributaries were designated as non-fish bearing (S5 or S6) on the basis of having gradients >20% and identified fish barriers. In addition, Wildstone Resources Ltd. (1998) conducted a fish inventory and stream classification within the Tommy Creek basin. Stream sampling within seven sites above an identified barrier revealed that no fish are present within the upper reaches of the basin. Finally, stream sampling by Forsite Consultants Ltd. (2001) at four sites within the Nosebag Creek basin revealed that the mainstem, south fork and two unnamed tributaries are non-fish bearing.

3.0 METHODS

The *Lower Bridge River Watershed* Fish and Fish Habitat Inventory project involved six phases;

- Phase I: Existing Data Review,
- Phase II: Map and Aerial Photograph Analysis,
- Phase III: Sampling Design and Project Plan,
- Phase IV: Field Data Collection,
- Phase V: Data Compilation, and
- Phase VI: Report Preparation and Mapping.

Phases I through III were completed in 1998/1999 for four units within the Lillooet Forest District; the *Fraser River Tributaries*, *Yalakom River Watershed*, *Tyaughton Creek Watershed*, and *Lower Bridge River Watershed* (below Hurley River). In 2000/2001, Phases IV through VI were completed for the *Lower Bridge River Watershed*. The sampling and reporting in 2000/2001 completes the proposed sampling plan identified in Phase III for this unit. Phases IV through VI for the remaining units, the *Fraser River Tributaries*, *Yalakom River*, and *Tyaughton Creek Watersheds*, were initiated in 1999/2000 and completed in 2000/2001. Results are reported in *Reconnaissance (1:20,000) Fish and Fish Habitat Inventory of the Fraser River Tributaries, Yalakom River and Tyaughton Creek Watersheds* (ARC Environmental Ltd. 2000; and ARC Environmental Ltd. 2001e).

3.1 PHASE I: EXISTING DATA REVIEW

The objective of the *Existing Data Review* phase was to refine the project objectives through a review of the existing information, both physical and biological.

The review of the existing information identified and systematically recorded the physical characteristics of the watershed including, but not limited to; watershed boundaries, reach

delineation, and barriers to fish migration. The existing information on the watershed was sought from various sources. Data was obtained from MoELP – Southern Interior Region, DFO – Kamloops, MoF – Kamloops Forest Region, MoF – Lillooet Forest District, and Ainsworth Lumber Company Ltd.

In addition, the availability of the following information was determined and reviewed;

- i)* Gazetteer of Canada,
- ii)* 1:50,000 National Topographic Series (NTS) maps,
- iii)* 1:20,000 Terrain Resource Information Management (TRIM) maps,
- iv)* Aerial photographs,
- v)* 1:100,000 Biogeoclimatic Ecosystem Classification maps with Identification and Interpretation Guide,
- vi)* Water licensee(s),
- vii)* Forest Recreation maps,
- viii)* Timber licensee(s),
- ix)* Forest tenure type, and
- x)* Forest Cover and Development Plan, and private lands maps.

The above information was tabulated and, where appropriate, indicated on 1:20,000 TRIM maps. Interim Locational Points (ILPs) were added to all waterbodies including lakes and streams. Lakes and streams were required to have an area of at least 0.5 ha or length of 100 m in order to be assigned ILPs. Where possible, existing watershed codes were included in the ILP Table to assist the MoELP Inventory Branch – Victoria in locating reference streams. The ILP Table and corresponding ILP maps were forwarded to MoELP in Victoria via the Contract Monitor to determine watershed coding for uncoded waterbodies. Each 1:20,000 TRIM map feature was referenced with a Numeric Identifier (NID) unique to the project. The NID number provides a unique identifier to link locational data recorded on the Interim Map to attribute data recorded in the database (Attachment I).

The focus of the review was on: the occurrence of rare, threatened, endangered or regionally significant fish; historic trends in abundance and distribution of salmon and sport fish; historic trends in water quality and quantity; trends in recreational use, and special public concerns [Resources Inventory Committee (RIC) 1998a]. The following sources, in addition to the above section, were reviewed to identify fish distribution and abundance in the watershed:

- i) Interviews with DFO, MoELP, and MoF agency personnel, First Nations, and the public,
- ii) Stream Information Summary System (SISS) & Salmon Escapement Data System (SEDS), reviewed using the Fish Habitat Inventory & Information Program (1992),
- iii) Fisheries Information Summary System (FISS),
- iv) DFO and MoELP paper files,
- v) BC Forest Practices Code (BC FPC) stream classifications, and
- vi) MoELP world wide web queries of lake surveys and release records databases.

Once reviews of the available information were complete, existing fish information within the study area was transcribed onto the 1:20,000 TRIM maps. If reports were found that were not referenced in the FISS database, FISS updates were completed using Stream and/or Lake Forms along with annotated 1:50,000 NTS maps. All FISS maps, forms and reports were sent to the Contract Monitor at MoELP in Kamloops, to be forwarded to MoELP in Victoria.

3.2 PHASE II: MAP AND AERIAL PHOTOGRAPH ANALYSIS

The objective of Phase II was to systematically classify watershed characteristics and determine reach sampling sites.

When the basins in the project area were classified, and their boundaries transcribed onto the Interim Maps, the *Basin Classification Table* was completed (RIC 1998a). Reach

breaks were delineated on the basis of changes in order, pattern, confinement, gradient, and riparian vegetation and were determined by the analysis of airphotos and TRIM data. Airphotos, dated 1997, were obtained from the MoF – Kamloops Forest Region office. NID numbers were assigned to reach breaks and barriers prior to the entry of the reach properties into the *Reach Table* (RIC 1998a). Ultimately, reach breaks were confirmed in the field for those sites visited.

After delineating reaches and determining channel pattern, stream gradient, stream order and stream basin type, reach data was entered into the Field Data Information System (FDIS) database (version 6.5), for a total of 7,428 reaches.

3.3 PHASE III: SAMPLING DESIGN AND PROJECT PLAN

The objective of Phase III was to finalize the field plan which would allow for the collection of field data in Phase IV. A project plan was developed, and included site finalization, the budget, and sampling logistics. The plan proposed to describe the watershed-wide fish species presence and distribution, and fish habitat characteristics.

The *Random Sampling* portion of FDIS determined that a total of 138 random sites were to be sampled within the entire project area (*ca.* 1.9 % of reaches). These sites were selected by FDIS based on the following criteria; basin type, stream order, gradient and channel pattern. Sites were then located and marked onto inking film over the 1:20,000 scale Interim Maps. These maps, with inking film, were presented to Ainsworth Lumber Company Ltd. and MoELP (D. Tesch, Contract Monitor) for review. After consultation, the location of sampling sites was confirmed on the basis of: 1) the ability to obtain an even distribution of sites throughout the watershed and entire project study area; and 2) the location of logging activities in the watershed in subsequent years. As a result of the initial consultation, 26 biased sites were added. Thus, the total number of sites selected in Phase III was 164. One additional biased site was added through consultation in subsequent years.

For the 2000/2001 season, it was proposed that field sampling address the entire *Lower Bridge River Watershed* study area. The finalized plan proposed that 165 sites (138 random and 27 biased) be completed, of which 172 sites (134 random and 38 biased) were completed. It was also proposed that four lakes be sampled within the study area. Methods for lake sampling are discussed in: *Reconnaissance Lake Inventory of Keary Lake* (ARC Environmental Ltd. 2001a); *Reconnaissance Lake Inventory of Unnamed Lake (3070)* (alias Truax Lake) (ARC Environmental Ltd. 2001b); *Reconnaissance Lake Inventory of Unnamed Lake (3102)* (ARC Environmental Ltd. 2001c); and *Reconnaissance Lake Inventory of Warner Lake* (ARC Environmental Ltd. 2001d).

3.4 PHASE IV: FIELD DATA COLLECTION

The *Field Data Collection* phase for the selected stream reaches involved fish sampling, habitat description, water quality, wildlife observations, and photographic documentation. In addition to sampling the identified stream reaches for inventory purposes, the sampling also included protocols to satisfy fish stream classification (BC FPC 1998).

Field data was collected from August 9 to September 24, 2000 (MoELP Sampling Permit No. 00-30-0511, DFO Sampling License No. 00.191). DFO conservation concerns for coho salmon populations within the study area resulted in electrofishing restrictions on the fish sampling permit. In all reaches where coho were suspected, the use of alternate methods of fish capture were required.

During field sampling, a total of 172 sites (134 random and 38 biased) within 172 reaches were sampled within the *Lower Bridge River Watershed*. Of the originally identified sites, four randomly selected reaches were inaccessible to field crews. These sites were replaced with similar biased sites, selected by field crews at the time of sampling.

MoELP Site Cards, Fish Collection Forms, and Individual Fish Data forms were completed, where appropriate, at each sample site (Attachment II). Fish ageing structures were also taken from a selection of fish captured (Attachment III). Photo Survey Form 1 (Equipment Details) was completed for the project and is included in Attachment IV. Methodologies followed those provided in Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Standards and Procedures (RIC 1998a), Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Data Forms and User Notes (RIC 1998b), Fish Collection Methods and Standards (RIC 1997), Fish-stream Identification Guidebook (BC FPC 1998), and A Guide to Photodocumentation for Aquatic Inventory (RIC 1996). A list of field sampling equipment used is presented in Table 4.

Table 4. Field sampling equipment list.

Habitat Sampling Equipment

- hip chain and spare thread,
- measuring tape (50m),
- clinometer,
- compass,
- meter stick,
- camera, with 35 mm film,
- field notebook with waterproof paper,
- MoELP Site Cards, Fish Collection Forms, and Individual Fish Data sheets,
- alcohol thermometer,
- pH meter, and
- conductivity meter.

Fish Sampling Equipment

- electrofisher,
- electrofishing gloves,
- chest waders,
- polarized sunglasses,
- minnow traps and bait,
- pole seine,

- DFO & MoELP Fish Collection Permits,
- buckets,
- fish anaesthetic,
- measuring board,
- weighing scale,
- scale envelopes and slides,
- scalpel and scissors, and
- Fish Identification Guidebook.

Miscellaneous Equipment

- global positioning system (GPS) unit,
- first aid kit, Worker's Compensation Board (WCB) approved,
- tool kit,
- twine and flagging tape,
- radios,
- survival kit,
- location maps (1:50,000 and 1:20,000 scale),
- spare batteries (AA, 9V, etc.), and
- shovel.

3.4.1 *Fish Sampling*

Fish sampling focused on defining the overall distribution of all fish species in the *Lower Bridge River Watershed* study area by means of absence/presence sampling using electrofishing, minnow trapping, pole seining, and visual observation. Generally, the effectiveness of these sampling methods depend on fish size, fish behaviour, and stream habitat conditions (i.e. morphology, instream cover, velocity, conductivity, turbidity, and temperature) (RIC 1997). Within the study area, electrofishing was the first and most effective method employed at each site. Although less effective than electrofishing and minnow trapping, pole seining was used as the second most frequent method, where water depths and stream conditions (limited woody debris) allowed. If site access, time, and water depths allowed for the use of minnow traps, baited traps were left to soak overnight. The use of these methods reduced sampling gear bias and helped support non-fish bearing sampling results.

When sampling with any of these methods, minimum sample lengths were the greater of 100 m or 10 times the bankfull width. This varied and depended on whether fish were captured and/or to ensure that all habitat types were sampled in all sections of the primary, secondary and off-channel channel habitat.

In order to meet stream classification standards (BC FPC 1998), fish sampling was conducted in all habitats, using two methods (electrofishing and minnow traps, or electrofishing and pole-seining), within 100 linear meters, or 10 times bankfull width, whichever was greater. If no fish were captured within the original site, a second site that was equal in distance to the first was electrofished covering all habitat units. If no fish were captured after sampling the second site, an additional 500 linear meters of stream were sampled. Sampling beyond the initial site ended when any of the following criteria were met; fish were captured, crews sampled to the end of the reach, 700 m of the reach

was sampled, or the crew leader determined that sampling effort was sufficient to ensure a non-fish bearing status.

Fish Collection Forms were completed at each site where fishing was attempted. Individual Fish Data forms were completed where fish were sampled, and the following data was collected:

- i) all species (see below) were identified and enumerated, life stage determined, fork length (mm) and wet weight (g) measured, and
- ii) non-destructive ageing structures (scales) were taken from samples of Freshwater Game Species of a representative range of lengths, and analyzed by Hamaguchi Fish Aging Services of Kamloops, BC.

Fish identification was not possible for four fish at three sites (Sites 552, 558, and 620). Initially these trout fry were identified as bull trout. However, given their small fork length (25, 35, 45 and 45 mm), their size relative to other 0+ aged bull trout, and the life history of bull trout in general, their initial identification was in question. Fish identification is difficult for juvenile fish, and all four had a fork length < 50 mm. Also, bull trout fry are generally known to emerge in the spring. This means that if these four individuals were bull trout, they had been rearing throughout the spring and summer, up to the time of capture (August and September). This would suggest that the allowed time for growth should have been reflected in their size. However, this was not the case. The average lengths of these fry (40 mm) was significantly different than the average lengths of other aged 0+ bull trout (88 mm) captured within the study area. As a result, the identification of these fish was changed from bull trout (BT) to trout, general (TR). Consequently voucher specimens were not collected.

3.4.2 Habitat Description

Specific habitat characteristics were collected during field surveys from at least one site per reach. Site length was the greater of 100 m or 10 times the bankfull width. Site

length varied depending on total reach length, and/or the variability of reach characteristics. Site length was increased to adequately capture habitat sequences and to meet the requirements for stream classification.

The information collected was consistent with the MoELP Site Cards and all fields on the forms were completed with the exception of: 1) Req. No. (pertaining to water analysis), and 2) Environmental Monitoring System (EMS) number. Gradient was measured using a Suunto clinometer. An average gradient was determined from at least three sightings, where the distance was maximized (60 to 100 m) as much as possible. Channel and wetted widths were measured with a measuring tape, measuring stick, or hip chain. A minimum of six channel and wetted widths were taken from within a reach section, 100 m in length or greater, where the distance between measurements was at least 20 m apart within the reach (BC FPC 1998).

3.4.3 Water Quality

Water quality information was recorded on the MoELP Site Cards and Fish Collection Forms. Water temperature was measured with an alcohol thermometer, pH was measured with an Oakton pHTestr 2, and conductivity was measured with an Oakton TDSTestr 3 recording meter. Both pH and conductivity meters were calibrated on a daily basis. Turbidity was visually estimated.

3.4.4 Wildlife Observations

Wildlife observations were recorded on the MoELP Site Cards with specific reference to rare, threatened, and endangered species as listed by the British Columbia Conservation Data Center (BC CDC 1999).

3.4.5 Photographic Documentation

Photographs (35 mm) were taken of the stream reach sampling sites, fish species captured, all major features (e.g. fish passage barriers and obstructions, such as cascades, falls, beaver dams, slides, road crossings, and any other features affecting fish values), and any obvious fish habitat limitations or restoration opportunities. A record of photographs was documented on the MoELP Site Cards and Fish Collection Forms (Attachment II), and followed standards provided in *A Guide to Photodocumentation for Aquatic Inventory* (RIC 1996).

3.5 PHASE V: DATA COMPILATION

The objective of the *Data Compilation* phase was to organize the information collected. First, the FDIS database, created during Phases I to III, required updating from version 6.5 to 7.3. Upon upgrading, the information from completed Reach Cards, Site Cards, Fish Collection Forms and Individual Fish sheets was entered into the FDIS database (Appendix I and Attachment V). Photographs were labeled, referenced and arranged in a binder (Attachment II), and placed in a Kodak Photo CD format with an index along with Photo Survey Form 1 and indexed negatives (Attachment IV). In addition, FISS information was updated using annotated 1:50,000 NTS maps and FISS Stream Forms. These were submitted to MoELP in Victoria via the Contract Monitor.

3.6 PHASE VI: REPORT PREPARATION AND MAPPING

Three types of 1:20,000 TRIM based maps were prepared; the *Overview Map* (Figure 1), the *Project Map*, and the *Interpretive Map* (Appendix II). A total of 22 TRIM map sheets were digitized and used to create the appropriate maps according to MoELP standards (RIC 1998c).

The *Overview Map* provides a reference of the entire study area for presentation in the final report.

The information on the *Project Maps* and the attached ARC/INFO database includes, but is not limited to, field sampling data, sample site locations, reach breaks, ILP's, site features, and historical fisheries information.

The *Interpretive Map* includes stream classifications, fish distribution information and historical fisheries information. Stream classifications were assigned to those reaches where sampling occurred. Fish distribution information on the *Interpretive Map* is based on interpretations and conclusions from the synthesis of data collected during Phase I through Phase IV. The interpretation of fish presence/absence is generally based on the following:

- i) known fish bearing reaches (solid red line) are assigned on the basis of historical information or sampling results,
- ii) suspected fish bearing reaches (dotted red line) are assigned on the basis that, the reach is contiguous with a known fish bearing reach, that biological judgement would suggest so, or if sampling was considered to be insufficient to classify the reach as non-fish bearing,
- iii) non-fish bearing reaches (solid blue line) are assigned on the basis of historical information or sampling results, and
- iv) suspected non-fish bearing reaches (dotted blue line) are assigned on the basis that, the reach is contiguous with a non-fish bearing stream, or biological judgement would suggest so.

When using biological judgement, factors such as, known fish distribution, fish behavior, barriers, gradient, habitat quality, and the presence/absence of headwater lakes are considered.

4.0 RESULTS AND DISCUSSION

In total, 172 sites within 172 reaches were surveyed in the *Lower Bridge River Watershed* for the 2000/2001 field season (Table 5). Due to difficulties with access, six of the originally proposed sites (4 random and 2 biased) could not be completed. In addition, two originally proposed biased sites were moved to alternate locations, six additional sites were completed as part of the lake sampling protocol, and one site was added by the field crews at the time of sampling. This resulted in the completion of a total of 134 random, 25 original biased, 6 replacement biased and 7 additional biased sites.

Field investigations involved data collection to describe: habitat and fish distribution; fish age, size and life-history; significant features and fisheries observations; and fish bearing status.

4.1 LOGISTICS

Six of the originally proposed sites (4 random and 2 biased) were not surveyed, and are indicated in Table 5. The four inaccessible random reaches (ILP Map 92O.005, ILP 61, Reach 3; ILP Map 92J.096, ILP 114, Reach 1; ILP Map 92I.081, ILP 272, Reach 1; and ILP Map 92J.096, ILP 349, Reach 1) were replaced with similar sites in adjacent basins. The two inaccessible biased reaches on Antoine Creek (ILP Map 92J.090, ILP 186, Reach 5; and ILP Map 92J.090, ILP 186, Reach 2) were replaced with adjacent downstream reaches. Also, following discussions with Ainsworth Lumber Company Ltd., two biased reaches in the Tommy Creek basin, were moved due to previous stream class sampling within those reaches. Alternate sites were chosen on the basis of Ainsworth's operational needs, and as a result the mid reaches of Cedarvale Creek and Sebring Creek were sampled.

Table 5. Summary of sampling sites completed for the *Lower Bridge River Watershed*, August 9 to September 24, 2000.

Sampled Basin	Site No.	Site NID Map No.	Site NID No.	ILP Map No.	ILP No.	Reach No.	Access	Sample Type	Comment
Antoine Creek	570	92J.090	30570	92J.090	186	1	V2	B	replacement site
Antoine Creek	n/a	(92J.090)	n/a	(92J.090)	(186)	(2)	NA	(B)	not accessible
Antoine Creek	633	92J.090	30633	92J.090	186	3	H	B	replacement site
Antoine Creek	n/a	(92J.090)	n/a	(92J.100)	186	5	NA	(B)	not accessible
Applespring Creek	535	92J.090	30535	92J.090	12	0.1	V2	R	
Applespring Creek	636	92J.090	30636	92J.090	37	1	H	R	
Applespring Creek	640	92J.090	30640	92J.090	11	2	H	B	
Bobb Creek	645	92J.088	30645	92J.088	281	2	H	B	
Bobb Creek	647	92J.077	30647	92J.077	37	1	H	R	
Bobb Creek	654	92J.088	30654	92J.088	292	6	H	R	
Bobb Creek	656	92J.088	30656	92J.088	323	1	H	B	
Camoo Creek	565	92J.080	30565	92J.080	105	1	V4	R	
Camoo Creek	567	92J.080	30567	92J.090	147	2	V2	R	
Camoo Creek	578	92J.090	30578	92J.090	137	1	V4	B	
Camoo Creek	637	92J.080	30637	92J.090	137	5	H	B	
Camoo Creek	638	92J.080	30638	92J.090	137	8	H	R	
Carpenter Lake Tributaries	513	92J.097	30513	92J.097	30	4	V2	R	
Carpenter Lake Tributaries	515	92J.097	30515	92J.097	24	1	V4	R	
Carpenter Lake Tributaries	517	92J.097	30517	92J.097	39	1	V4	R	
Carpenter Lake Tributaries	519	92J.097	30519	92J.097	58	1	V4	R	
Carpenter Lake Tributaries	520	92J.097	30520	92J.097	62	2	V2	R	
Carpenter Lake Tributaries	521	92J.097	30521	92J.097	30	1	V2	R	
Carpenter Lake Tributaries	522	92J.086	30522	92J.086	154	1	V2	R	
Carpenter Lake Tributaries	524	92J.086	30524	92J.086	180	3	V2	R	
Carpenter Lake Tributaries	526	92J.086	30526	92J.086	182	1	V2	R	
Carpenter Lake Tributaries	528	92J.087	30528	92J.087	10	1	V2	R	
Carpenter Lake Tributaries	543	92J.079	30543	92J.079	107	1	V2	B	
Carpenter Lake Tributaries	554	92J.079	30554	92J.079	130	1	V2	R	
Carpenter Lake Tributaries	569	92J.089	30569	92J.089	151	2	H	B	
Carpenter Lake Tributaries	629	92J.079	30629	92J.079	147	1	H	R	
Carpenter Lake Tributaries	648	92J.087	30648	92J.087	17	1	H	B	
Carpenter Lake Tributaries	652	92J.087	30652	92J.087	420	1	H	R	
Carpenter Lake Tributaries	661	92J.088	30661	92J.088	128	2	H	B	
Cedarvale Creek	571	92J.089	30571	92J.089	104	1	H	R	

Table 5. Summary of sampling sites completed for the *Lower Bridge River Watershed*, August 9 to September 24, 2000.

Sampled Basin	Site No.	Site NID Map No.	Site NID No.	ILP Map No.	ILP No.	Reach No.	Access	Sample Type	Comment
Cedarvale Creek	574	92J.089	30574	92J.079	296	3	H	B	replacement site previously sampled (Wildstone Resources Ltd. 1998)
Tommy Creek	n/a	(92J.088)	n/a	(92J.078)	(219)	(3)	NA	(B)	
Cedarvale Creek	576	92J.089	30576	92J.089	132	1	H	B	
Fergusson Creek	506	92J.086	30506	92J.086	188	3	V2	R	
Fergusson Creek	641	92J.087	30641	92J.086	188	10	H	R	
Fergusson Creek	650	92J.087	30650	92J.087	79	1	H	R	
Gun Creek	516	92J.096	30516	92J.096	423	1	V2	R	
Gun Creek	530	92J.096	30530	92J.096	330	1	V2	R	
Gun Creek	537	92J.096	30537	92J.096	15	1	V2	R	
Gun Creek	539	92J.096	30539	92J.096	115	3	V4	R	
Gun Creek	541	92J.096	30541	92J.096	167	1	V4	R	
Gun Creek	545	92J.096	30545	92J.087	7	10	V4	R	
Gun Creek	549	92J.096	30549	92J.096	733	1	V2	R	
Gun Creek	551	92J.094	30551	92J.094	258	2	H	R	
Gun Creek	552	92J.096	30552	92J.087	7	6	V2	R	
Gun Creek	553	92J.094	30553	92J.087	7	16.1	H	R	
Gun Creek	555	92J.094	30555	92J.094	183	1	H	R	
Gun Creek	557	92O.004	30557	92O.004	19	1	H	R	
Gun Creek	558	92J.096	30558	92J.087	7	5	V4	R	
Gun Creek	559	92O.004	30559	92O.004	2	4	H	R	
Gun Creek	560	92J.094	30560	92J.094	259	1	H	R	
Gun Creek	561	92J.094	30561	92J.094	218	2	H	R	
Gun Creek	562	92J.094	30562	92J.094	242	1	H	R	
Gun Creek	566	92O.004	30566	92O.004	21	1	H	R	
Gun Creek	568	92O.004	30568	92J.087	7	16	H	R	
Gun Creek	577	92J.096	30577	92J.096	15	4	H	R	
Gun Creek	603	92O.005	30603	92O.005	101	1	H	R	
Gun Creek	605	92O.005	30605	92O.005	114	1	H	R	
Gun Creek	607	92O.005	30607	92O.005	136	4	H	R	
Gun Creek	608	92J.095	30608	92J.095	523	1	H	R	
Gun Creek	609	92O.005	30609	92O.005	101	4	H	R	
Gun Creek	610	92J.095	30610	92O.005	72	2	H	R	
Gun Creek	611	92O.005	30611	92O.005	61	1	H	B	replacement site not accessible
Gun Creek	n/a	(92O.005)	n/a	(92O.005)	(61)	(3)	NA	(R)	
Gun Creek	612	92J.095	30612	92J.095	558	1	H	R	
Gun Creek	613	92J.096	30613	92J.096	931	1	H	R	
Gun Creek	614	92O.005	30614	92O.005	108	1	H	R	
Gun Creek	615	92J.096	30615	92J.096	956	1	H	R	
Gun Creek	616	92O.005	30616	92O.005	71	1	H	R	
Gun Creek	620	92O.005	30620	92O.005	17	1	H	R	
Gun Creek	622	92O.006	30622	92O.006	4	1	H	R	
Gun Creek	623	92J.096	30623	92J.096	600	1	H	R	
Gun Creek	624	92J.096	30624	92J.096	842	1	H	R	
Gun Creek	625	92J.096	30625	92J.096	556	1	H	R	
Gun Creek	626	92J.096	30626	92J.096	706	1	H	R	
Gun Creek	627	92J.096	30627	92J.096	111	3	H	B	replacement site not accessible
Gun Creek	n/a	(92J.096)	n/a	(92J.096)	(114)	(1)	NA	(R)	
Gun Creek	628	92J.096	30628	92J.096	709	1	H	R	
Gun Creek	630	92J.096	30630	92J.096	85	1	H	R	

Table 5. Summary of sampling sites completed for the *Lower Bridge River Watershed*, August 9 to September 24, 2000.

Sampled Basin	Site No.	Site NID Map No.	Site NID No.	ILP Map No.	ILP No.	Reach No.	Access	Sample Type	Comment
Gun Creek	632	92J.086	30632	92J.086	244	1	H	B	replacement site
Gun Creek	n/a	(92J.096)	n/a	(92J.096)	(349)	(1)	NA	(R)	not accessible
Jones Creek	507	92J.088	30507	92J.088	57	3	V4	B	
Keary Creek	655	92J.078	30655	92J.078	152	3	H	R	
Keary Creek	660	92J.078	30660	92J.078	161	1	H	R	
Keary Creek	662	92J.078	30662	92J.078	67	6	H	R	
Keary Creek	701	92J.078	30701	92J.088	11	5	FW	B	additional site completed as part of the lake sampling protocol
Keary Creek	702	92J.078	30702	92J.088	11	3	FW	B	
LaJoie Creek	508	92J.086	30508	92J.086	13	1	V2	R	
LaJoie Creek	518	92J.086	30518	92J.086	10	1	V2	R	
LaJoie Creek	523	92J.086	30523	92J.097	88	1	V2	R	
LaJoie Creek	525	92J.086	30525	92J.086	146	1	V4	B	
LaJoie Creek	527	92J.086	30527	92J.086	28	3	V2	B	
LaJoie Creek	529	92J.086	30529	92J.086	2	1	V2	R	
LaJoie Creek	532	92J.086	30532	92J.086	60	1	V2	R	
LaJoie Creek	534	92J.086	30534	92J.086	36	1	V2	R	
LaJoie Creek	536	92J.096	30536	92J.096	1	1	V2	R	
LaJoie Creek	538	92J.086	30538	92J.096	5	1	V4	R	
LaJoie Creek	540	92J.086	30540	92J.086	45	2	V2	B	
LaJoie Creek	544	92J.087	30544	92J.087	153	1	V2	R	
LaJoie Creek	639	92J.086	30639	92J.086	60	4	H	B	
LaJoie Creek	642	92J.086	30642	92J.086	60	5	H	B	
LaJoie Creek	644	92J.086	30644	92J.086	62	1	H	R	
Leckie Creek	556	92J.096	30556	92J.096	243	1	V2	R	
Leckie Creek	563	92J.094	30563	92J.094	67	1	H	R	
Leckie Creek	564	92J.094	30564	92J.094	268	1	H	R	
Leckie Creek	600	92J.095	30600	92J.095	354	4	H	R	
Leckie Creek	602	92J.095	30602	92J.095	423	1	H	R	
Leckie Creek	604	92J.095	30604	92J.095	446	2	H	R	
Leckie Creek	606	92J.095	30606	92J.096	737	3	H	R	
Leckie Creek	619	92J.096	30619	92J.096	781	1	H	R	
Lower Bridge River Tributaries	531	92I.071	30531	92I.071	36	2	V2	R	
Lower Bridge River Tributaries	533	92J.090	30533	92J.080	205	4	V2	R	
Lower Bridge River Tributaries	572	92J.090	30572	92J.090	359	1	V2	R	
Lower Bridge River Tributaries	575	92I.071	30575	92I.071	14	3	V4	R	
Lower Bridge River Tributaries	631	92I.081	30631	92I.081	260	1	H	B	replacement site
Lower Bridge River Tributaries	n/a	(92I.081)	n/a	(92I.081)	(272)	(1)	NA	(R)	not accessible
Lower Bridge River Tributaries	634	92J.089	30634	92J.089	57	1	H	R	
Lower Bridge River Tributaries	635	92J.080	30635	92J.090	359	4	H	B	
Marshall Creek	501	92J.098	30501	92J.098	143	2	V4	R	
Marshall Creek	502	92J.088	30502	92J.088	181	1	V2	R	

Table 5. Summary of sampling sites completed for the *Lower Bridge River Watershed*, August 9 to September 24, 2000.

Sampled Basin	Site No.	Site NID Map No.	Site NID No.	ILP Map No.	ILP No.	Reach No.	Access	Sample Type	Comment
Marshall Creek	503	92J.098	30503	92J.098	208	1	V2	R	
Marshall Creek	504	92J.098	30504	92J.088	180	1	V2	R	
Marshall Creek	505	92J.097	30505	92J.097	484	1	V2	R	
Marshall Creek	509	92J.088	30509	92J.088	174	2	V2	R	
Marshall Creek	511	92J.088	30511	92J.088	175	1	V2	R	
Marshall Creek	659	92J.098	30659	92J.098	204	3	H	B	
Marshall Creek	666	92J.098	30666	92J.098	119	1	H	R	
Marshall Creek	668	92J.098	30668	92J.098	192	1	H	R	
Moon Creek	670	92J.080	30670	92I.071	52	2	H	B	
Nosebag Creek	657	92J.078	30657	92J.089	150	4	H	B	
Nosebag Creek	664	92J.078	30664	92J.078	29	3	H	R	
Sebring Creek	573	92J.089	30573	92J.079	154	3	H	B	replacement site
Tommy Creek	n/a	(92J.078)	n/a	(92J.078)	(251)	(3)	NA	(B)	previously sampled (Wildstone Resources Ltd. 1998)
Slim Creek	510	92J.095	30510	92J.095	137	1	V2	R	
Slim Creek	512	92J.095	30512	92J.095	92	1	V2	R	
Slim Creek	514	92J.096	30514	92J.096	782	1	V2	R	
Slim Creek	547	92J.095	30547	92J.095	68	1	V4	R	
Slim Creek	579	92J.094	30579	92J.094	120	1	H	R	
Slim Creek	580	92J.094	30580	92J.094	107	1	H	R	
Slim Creek	581	92J.094	30581	92J.094	100	1	H	R	
Slim Creek	582	92J.094	30582	92J.094	93	1	H	R	
Slim Creek	583	92J.094	30583	92J.094	28	1	H	R	
Slim Creek	584	92J.094	30584	92J.094	19	2	H	R	
Slim Creek	585	92J.094	30585	92J.096	782	6	H	B	additional site added by field crew at time of sampling
Slim Creek	586	92J.094	30586	92J.094	18	1	H	R	
Slim Creek	587	92J.094	30587	92J.094	1	1	H	R	
Slim Creek	588	92J.094	30588	92J.094	155	2	H	R	
Slim Creek	589	92J.094	30589	92J.094	140	2	H	R	
Slim Creek	590	92J.094	30590	92J.094	149	1	H	R	
Slim Creek	591	92J.095	30591	92J.095	230	1	H	R	
Slim Creek	592	92J.094	30592	92J.094	134	2	H	R	
Slim Creek	593	92J.085	30593	92J.085	50	1	H	R	
Slim Creek	594	92J.095	30594	92J.095	248	1	H	R	
Slim Creek	595	92J.085	30595	92J.085	76	1	H	R	
Slim Creek	596	92J.085	30596	92J.095	129	2	H	R	
Slim Creek	597	92J.095	30597	92J.095	50	1	H	R	
Slim Creek	598	92J.085	30598	92J.085	120	1	H	R	
Slim Creek	617	92J.095	30617	92J.096	783	1	H	R	
Slim Creek	621	92J.096	30621	92J.096	763	1	H	R	
Slim Creek	708	92J.094	30708	92J.094	288	1	H	R	
Slim Creek	709	92J.094	30709	92J.095	232	2	H	B	additional site completed as part of the lake sampling protocol
Slim Creek	710	92J.094	30710	92J.095	232	4	H	B	additional site completed as part of the lake sampling protocol
Tommy Creek	649	92J.077	30649	92J.078	297	4	H	R	
Tommy Creek	651	92J.078	30651	92J.078	391	1	H	B	

Table 5. Summary of sampling sites completed for the *Lower Bridge River Watershed*, August 9 to September 24, 2000.

Sampled Basin	Site No.	Site NID Map No.	Site NID No.	ILP Map No.	ILP No.	Reach No.	Access	Sample Type	Comment
Tommy Creek	653	92J.078	30653	92J.078	392	1	H	R	
Tommy Creek	658	92J.077	30658	92J.078	297	8	H	R	
Truax Creek	542	92J.087	30542	92J.087	316	1	V4	R	
Truax Creek	546	92J.087	30546	92J.087	301	1	V4	R	
Truax Creek	548	92J.087	30548	92J.087	173	3	V2	R	
Truax Creek	550	92J.087	30550	92J.087	274	1	V2	R	
Truax Creek	643	92J.087	30643	92J.087	194	1	H	R	
Truax Creek	646	92J.087	30646	92J.087	220	2	H	B	
Truax Creek	705	92J.077	30705	92J.087	331	3	H	B	additional site completed as part of the lake sampling protocol
Truax Creek	706	92J.087	30706	92J.087	331	1	H	B	additional site completed as part of the lake sampling protocol
Warner Creek	712	92O.005	30712	92O.005	135	2	H	B	additional site completed as part of the lake sampling protocol
Warner Creek	713	92O.005	30713	92O.005	135	4	H	R	

Note: **bold text** - replacement site
 () - site not completed
 n/a - not applicable
 V2 - two wheel drive
 V4 - four wheel drive
 H - helicopter
 FW - fixed wing
 NA - not accessible
 R - random site
 B - biased site

4.2 HABITAT AND FISH DISTRIBUTION

In total, 172 sites were sampled within the *Lower Bridge River Watershed* study area. Selected habitat sampling parameters include channel morphology, available instream cover and substrate composition, and are summarized in Table 6.

In addition to these selected habitat sampling parameters, newly identified features are documented within sample sites and also some reaches that were not surveyed. These features may be *barriers* to fish migration (e.g. a waterfalls where fish cannot move upstream at any time), *obstructions* to fish migration (e.g. a beaver dam which may impede, but not block upstream fish passage), or other types of features which may impact fish habitat values, but not fish migration (e.g. effluent outfalls). Features may be natural (e.g. cascades, beaver dams) or man-made (e.g. culverts). Within the *Lower Bridge River Watershed* study area 90 new features were identified in 2000/2001.

Of the 172 surveyed, 72 sites (42%) had no visible channel, 11 sites (6%) were dry/intermittent, and the remaining 89 sites (52%) had wetted channels. Photographs of five typical sites are provided in Figures 3, 4, 5, 6, and 7. Figure 3 illustrates a site with no visible channel, Figure 4 illustrates a small order headwater non-fish bearing reach, Figure 5 illustrates a larger order non-fish bearing reach, Figure 6 illustrates a reach where fish were captured, and Figure 7 illustrates a turbid larger order fish bearing reach. Generally, these types of sites were the most prevalent throughout the study area.

For those 89 sites which had a wetted channel, and the 5 dry/intermittent sites which allowed for the collection of water quality data, turbidity, stage, pH, water temperature, and conductivity, were measured. Field estimates of water turbidity were described as clear at 75 sites (80%), lightly turbid at 15 sites (16%), moderately turbid at three sites (3%), and turbid at one site (1%), suggesting overall low sediment inputs from erosion at the time of sampling. Stage of flow was described as low at 56 sites (60%), moderate at 37 sites (39%) and high at 1 site (1%). In addition, the pH ranged from 7.1 to 9.4

Table 6. Habitat data summary of sampling sites for the Lower Bridge River Watershed, August 9 to September 24, 2000.

Sampled Basin	Site No.	Site Map No.	Site NID No.	ILP Map No.	ILP No.	Reach No.	Site Length	Channel and Morphology					Instream Cover						Bed Material			
								Channel Morphology	Channel Condition	Average Channel Width (m)	Average Gradient (%)	Average Pool Depth (m)	Total Cover	SWD Cover	LWD Cover	Boulder Cover	Cutbank Cover	Deep Pool Cover	Overhanging Vegetation Cover	Instream Vegetation Cover	Dominant Bed Material	Subdominant Bed Material
Antoine Creek	570	92J.090	30570	92J.090	186	1	320	CP	-	3.9	10	0.3	A	N	S	S	T	D	T	N	C	B
Antoine Creek	633	92J.090	30633	92J.090	186	3	150	CP	-	4.1	4	0.2	M	N	T	D	T	S	S	N	G	C
Applespring Creek	535	92J.090	30535	92J.090	12	1	100	CP	-	3.2	16	0.2	T	T	N	S	S	D	N	N	G	C
Applespring Creek	636	92J.090	30636	92J.090	37	1	100	-	NVC	-	5	-	-	-	-	-	-	-	-	-	-	-
Applespring Creek	640	92J.090	30640	92J.090	11	2	285	RPc-w	-	6.7	13	0.3	A	T	S	S	T	D	T	N	C	B
Bobb Creek	645	92J.088	30645	92J.088	281	2	145	CPc-w	-	11.6	14	0.5	M	T	T	S	N	D	T	N	C	B
Bobb Creek	647	92J.077	30647	92J.077	37	1	100	CP	Dry/Int.	0.6	18	-	N	N	N	N	N	N	N	N	G	C
Bobb Creek	654	92J.088	30654	92J.088	292	6	587	SP	Dry/Int.	0.8	26	0.1	N	N	N	N	N	N	N	N	C	B
Bobb Creek	656	92J.088	30656	92J.088	323	1	780	RP	-	5.4	30	0.2	T	S	S	D	N	T	T	N	C	B
Camoo Creek	565	92J.080	30565	92J.080	105	1	100	-	NVC	-	0	-	-	-	-	-	-	-	-	-	-	-
Camoo Creek	567	92J.080	30567	92J.090	147	2	100	-	NVC	-	1	-	-	-	-	-	-	-	-	-	-	-
Camoo Creek	578	92J.090	30578	92J.090	137	1	360	SP	-	2.4	26	0.3	M	T	S	S	T	D	T	N	F	B
Camoo Creek	637	92J.080	30637	92J.090	137	5	150	LC	-	2.3	4	no pools	T	S	T	T	S	D	N	T	F	C
Camoo Creek	638	92J.080	30638	92J.090	137	8	100	CP	-	0.5	28	0.2	T	T	N	N	S	D	N	N	G	F
Carpenter Lake Tributaries	513	92J.097	30513	92J.097	30	4	100	LC	Dry/Int.	1.1	17	-	-	-	-	-	-	-	-	-	F	G
Carpenter Lake Tributaries	515	92J.097	30515	92J.097	24	1	100	-	NVC	-	2	-	-	-	-	-	-	-	-	-	-	-
Carpenter Lake Tributaries	517	92J.097	30517	92J.097	39	1	100	-	NVC	-	5	-	-	-	-	-	-	-	-	-	-	-
Carpenter Lake Tributaries	519	92J.097	30519	92J.097	58	1	100	-	NVC	-	14	-	-	-	-	-	-	-	-	-	-	-
Carpenter Lake Tributaries	520	92J.097	30520	92J.097	62	2	100	-	NVC	-	4	-	-	-	-	-	-	-	-	-	-	-
Carpenter Lake Tributaries	521	92J.097	30521	92J.097	30	1	100	CP	Dry/Int.	1.5	7	-	-	-	-	-	-	-	-	-	G	C
Carpenter Lake Tributaries	522	92J.086	30522	92J.086	154	1	100	-	NVC	-	40	-	-	-	-	-	-	-	-	-	-	-
Carpenter Lake Tributaries	524	92J.086	30524	92J.086	180	3	100	-	NVC	-	2	-	-	-	-	-	-	-	-	-	-	-
Carpenter Lake Tributaries	526	92J.086	30526	92J.086	182	1	100	-	NVC	-	2	-	-	-	-	-	-	-	-	-	-	-
Carpenter Lake Tributaries	528	92J.087	30528	92J.087	10	1	100	-	NVC	-	3	-	-	-	-	-	-	-	-	-	-	-
Carpenter Lake Tributaries	543	92J.079	30543	92J.079	107	1	100	-	NVC	-	24	-	-	-	-	-	-	-	-	-	-	-
Carpenter Lake Tributaries	554	92J.079	30554	92J.079	130	1	225	SP	-	4.0	17	0.2	M	T	S	S	N	S	D	N	G	B
Carpenter Lake Tributaries	569	92J.089	30569	92J.089	151	2	100	RPg-w	-	2.7	6	0.3	T	T	N	S	T	D	S	N	G	C
Carpenter Lake Tributaries	629	92J.079	30629	92J.079	147	1	100	SP	-	1.9	26	0.2	T	S	S	T	N	D	T	N	G	C
Carpenter Lake Tributaries	648	92J.087	30648	92J.087	17	1	100	-	NVC	-	24	-	-	-	-	-	-	-	-	-	-	-
Carpenter Lake Tributaries	652	92J.087	30652	92J.087	420	1	100	-	NVC	-	79	-	-	-	-	-	-	-	-	-	-	-
Carpenter Lake Tributaries	661	92J.088	30661	92J.088	128	2	100	CP	-	3.0	21	0.2	T	S	N	T	N	D	N	N	G	C
Cedarvale Creek	571	92J.089	30571	92J.089	104	1	100	-	NVC	-	22	-	-	-	-	-	-	-	-	-	-	-
Cedarvale Creek	574	92J.089	30574	92J.079	296	3	800	CP	-	2.9	7	0.2	A	T	D	T	T	S	S	N	C	G
Cedarvale Creek	576	92J.089	30576	92J.089	132	1	100	-	NVC	-	17	-	-	-	-	-	-	-	-	-	-	-

Table 6. Habitat data summary of sampling sites for the Lower Bridge River Watershed, August 9 to September 24, 2000.

Sampled Basin	Site No.	Site Map No.	Site NID No.	ILP Map No.	ILP No.	Reach No.	Site Length	Channel and Morphology					Instream Cover							Bed Material		
								Channel Morphology	Channel Condition	Average Channel Width (m)	Average Gradient (%)	Average Pool Depth (m)	Total Cover	SWD Cover	LWD Cover	Boulder Cover	Cutbank Cover	Deep Pool Cover	Overhanging Vegetation Cover	Instream Vegetation Cover	Dominant Bed Material	Subdominant Bed Material
Fergusson Creek	506	92J.086	30506	92J.086	188	3	140	CP	-	21.3	13	0.2	M	T	D	S	T	T	S	N	C	B
Fergusson Creek	641	92J.087	30641	92J.086	188	10	100	RP	-	2.9	3	0.3	M	T	T	S	D	S	T	N	F	G
Fergusson Creek	650	92J.087	30650	92J.087	79	1	100	-	NVC	-	2	-	-	-	-	-	-	-	-	-	-	-
Gun Creek	516	92J.096	30516	92J.096	423	1	100	-	NVC	-	4	-	-	-	-	-	-	-	-	-	-	-
Gun Creek	530	92J.096	30530	92J.096	330	1	100	CP	-	13.1	25	0.2	M	T	T	D	S	T	T	N	B	C
Gun Creek	537	92J.096	30537	92J.096	15	1	100	CPb	-	6.0	15	0.4	M	T	T	S	T	D	N	N	B	C
Gun Creek	539	92J.096	30539	92J.096	115	3	100	-	NVC	-	9	-	-	-	-	-	-	-	-	-	-	-
Gun Creek	541	92J.096	30541	92J.096	167	1	100	-	NVC	-	3	-	-	-	-	-	-	-	-	-	-	-
Gun Creek	545	92J.096	30545	92J.087	7	10	205	RP	-	15.6	1	0.5	T	N	T	D	S	T	T	N	C	B
Gun Creek	549	92J.096	30549	92J.096	733	1	200	-	NVC	-	3	-	-	-	-	-	-	-	-	-	-	-
Gun Creek	551	92J.094	30551	92J.094	258	2	100	-	NVC	-	0	-	-	-	-	-	-	-	-	-	-	-
Gun Creek	552	92J.096	30552	92J.087	7	6	100	RP	-	15.0	6	0.2	M	N	T	D	N	S	S	N	G	B
Gun Creek	553	92J.094	30553	92J.087	7	16.1	150	CP	-	8.2	6	0.3	M	T	T	S	T	D	S	N	C	B
Gun Creek	555	92J.094	30555	92J.094	183	1	100	CP	-	5.3	6	0.2	M	N	T	S	T	D	T	N	C	B
Gun Creek	557	92O.004	30557	92O.004	19	1	100	-	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-
Gun Creek	558	92J.096	30558	92J.087	7	5	100	RP	-	20.0	4	0.2	A	N	T	D	T	S	T	N	C	B
Gun Creek	559	92O.004	30559	92O.004	2	4	100	SPb	-	4.6	25	0.2	T	N	N	S	T	D	T	T	B	C
Gun Creek	560	92J.094	30560	92J.094	259	1	700	SP	-	3.2	22	0.2	T	N	N	D	N	S	N	N	B	C
Gun Creek	561	92J.094	30561	92J.094	218	2	100	-	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-
Gun Creek	562	92J.094	30562	92J.094	242	1	500	CP	-	0.8	11	no pools	T	N	N	T	D	N	S	N	C	F
Gun Creek	566	92O.004	30566	92O.004	21	1	700	LC	-	0.6	1	no pools	T	N	N	N	S	N	D	N	F	G
Gun Creek	568	92O.004	30568	92J.087	7	16	120	RP	-	10.1	3	no pools	M	N	D	T	T	N	S	N	G	F
Gun Creek	577	92J.096	30577	92J.096	15	4	150	RPg-w	-	5.0	8	0.3	M	N	S	D	N	S	N	N	G	C
Gun Creek	603	92O.005	30603	92O.005	101	1	100	CP	-	2.1	1	0.2	M	T	T	D	S	T	S	N	G	C
Gun Creek	605	92O.005	30605	92O.005	114	1	100	LC	-	9.9	0	0.9	M	N	T	N	S	D	N	N	G	F
Gun Creek	607	92O.005	30607	92O.005	136	4	100	-	Dry/Int.	0.5	13	-	-	-	-	-	-	-	-	-	G	C
Gun Creek	608	92J.095	30608	92J.095	523	1	100	-	NVC	-	21	-	-	-	-	-	-	-	-	-	-	-
Gun Creek	609	92O.005	30609	92O.005	101	4	100	CP	-	3.6	7	0.3	M	N	T	D	T	S	N	N	C	G
Gun Creek	610	92J.095	30610	92O.005	72	2	185	SP	-	4.1	6	0.3	A	T	T	S	T	D	S	N	G	B
Gun Creek	611	92O.005	30611	92O.005	61	1	100	-	NVC	-	2	-	-	-	-	-	-	-	-	-	-	-
Gun Creek	612	92J.095	30612	92J.095	558	1	100	-	NVC	-	20	-	-	-	-	-	-	-	-	-	-	-
Gun Creek	613	92J.096	30613	92J.096	931	1	100	-	NVC	-	7	-	-	-	-	-	-	-	-	-	-	-
Gun Creek	614	92O.005	30614	92O.005	108	1	100	-	NVC	-	2	-	-	-	-	-	-	-	-	-	-	-
Gun Creek	615	92J.096	30615	92J.096	956	1	100	-	NVC	-	17	-	-	-	-	-	-	-	-	-	-	-
Gun Creek	616	92O.005	30616	92O.005	71	1	100	-	NVC	-	20	-	-	-	-	-	-	-	-	-	-	-
Gun Creek	620	92O.005	30620	92O.005	17	1	104	SP	-	2.4	20	0.2	M	T	S	S	T	T	D	N	G	C
Gun Creek	622	92O.006	30622	92O.006	4	1	100	-	NVC	-	35	-	-	-	-	-	-	-	-	-	-	-
Gun Creek	623	92J.096	30623	92J.096	600	1	100	CP	-	2.9	8	0.2	M	T	T	D	S	S	N	N	C	G
Gun Creek	624	92J.096	30624	92J.096	842	1	580	SP	-	0.7	54	0.1	T	S	D	T	T	N	S	N	C	G
Gun Creek	625	92J.096	30625	92J.096	556	1	100	-	NVC	-	4	-	-	-	-	-	-	-	-	-	-	-
Gun Creek	626	92J.096	30626	92J.096	706	1	104	-	NVC	-	14	-	-	-	-	-	-	-	-	-	-	-
Gun Creek	627	92J.096	30627	92J.096	111	3	100	-	NVC	-	4	-	-	-	-	-	-	-	-	-	-	-
Gun Creek	628	92J.096	30628	92J.096	709	1	396	SP	-	1.2	34	0.1	T	S	S	D	N	N	T	N	G	C
Gun Creek	630	92J.096	30630	92J.096	85	1	170	SP	Dry/Int.	0.5	19	-	-	-	-	-	-	-	-	-	G	C
Gun Creek	632	92J.086	30632	92J.086	244	1	100	-	NVC	-	15	-	-	-	-	-	-	-	-	-	-	-
Jones Creek	507	92J.088	30507	92J.088	57	3	130	CP	-	9.3	12	0.2	T	N	T	S	N	D	T	N	C	B
Keary Creek	655	92J.078	30655	92J.078	152	3	100	-	NVC	-	2	-	-	-	-	-	-	-	-	-	-	-
Keary Creek	660	92J.078	30660	92J.078	161	1	700	LC	-	3.2	2	0.3	T	T	N	N	D	S	S	T	F	G
Keary Creek	662	92J.078	30662	92J.078	67	6	470	CP	-	10.8	1	0.2	T	N	N	T	S	D	N	N	F	G
Keary Creek	701	92J.078	30701	92J.088	11	5	100	RP	-	8.0	1	0.3	T	N	N	T	D	T	T	N	G	F
Keary Creek	702	92J.078	30702	92J.088	11	3	150	CP	-	5.7	66	0.3	T	T	S	D	N	S	N	T	B	C
LaJoie Creek	508	92J.086	30508	92J.086	13	1	100	-	NVC	-	3	-	-	-	-	-	-	-	-	-	-	-
LaJoie Creek	518	92J.086	30518	92J.086	10	1	100	-	NVC	-	3	-	-	-	-	-	-	-	-	-	-	-
LaJoie Creek	523	92J.086	30523	92J.097	88	1	100	RPg-w	-	8.6	2	0.3	A	T	S	N	T	D	S	T	G	F

Table 6. Habitat data summary of sampling sites for the Lower Bridge River Watershed, August 9 to September 24, 2000.

Sampled Basin	Site No.	Site Map No.	Site NID No.	ILP Map No.	ILP No.	Reach No.	Site Length	Channel and Morphology					Instream Cover						Bed Material						
								Channel Morphology	Channel Condition	Average Channel Width (m)	Average Gradient (%)	Average Pool Depth (m)	Total Cover	SWD Cover	LWD Cover	Boulder Cover	Cutbank Cover	Deep Pool Cover	Overhanging Vegetation Cover	Instream Vegetation Cover	Dominant Bed Material	Subdominant Bed Material			
LaJoie Creek	525	92J.086	30525	92J.086	146	1	100	-	NVC	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	
LaJoie Creek	527	92J.086	30527	92J.086	28	3	100	LC	Dry/Int.	0.7	21	-	-	N	N	N	N	N	N	N	N	N	N	F	G
LaJoie Creek	529	92J.086	30529	92J.086	2	1	200	-	NVC	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LaJoie Creek	532	92J.086	30532	92J.086	60	1	100	SP	-	3.6	7	0.3	M	N	T	S	T	D	T	N	C	G	-	G	
LaJoie Creek	534	92J.086	30534	92J.086	36	1	100	-	NVC	-	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LaJoie Creek	536	92J.096	30536	92J.096	1	1	170	LC	-	1.6	2	no pools	T	S	N	N	D	N	T	T	F	NA	-	NA	
LaJoie Creek	538	92J.086	30538	92J.096	5	1	100	-	NVC	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LaJoie Creek	540	92J.086	30540	92J.086	45	2	100	CP	-	1.1	16	0.2	T	T	N	N	T	D	S	N	G	C	-	C	
LaJoie Creek	544	92J.087	30544	92J.087	153	1	100	-	NVC	-	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LaJoie Creek	639	92J.086	30639	92J.086	60	4	100	SPB	-	3.8	34	0.2	T	T	N	S	N	D	S	N	B	C	-	C	
LaJoie Creek	642	92J.086	30642	92J.086	60	5	740	SP	-	1.4	10	0.2	T	T	N	D	T	S	T	N	C	B	-	B	
LaJoie Creek	644	92J.086	30644	92J.086	62	1	100	-	NVC	-	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Leckie Creek	556	92J.096	30556	92J.096	243	1	100	-	NVC	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Leckie Creek	563	92J.094	30563	92J.094	67	1	100	LC	-	1.4	12	0.2	N	N	N	N	N	N	N	N	G	C	-	C	
Leckie Creek	564	92J.094	30564	92J.094	268	1	100	-	NVC	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Leckie Creek	600	92J.095	30600	92J.095	354	4	100	-	NVC	-	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Leckie Creek	602	92J.095	30602	92J.095	423	1	100	-	NVC	-	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Leckie Creek	604	92J.095	30604	92J.095	446	2	705	SP	-	9.3	14	0.3	A	N	S	S	T	D	T	N	C	B	-	B	
Leckie Creek	606	92J.095	30606	92J.096	737	3	700	RP	-	9.1	2	0.7	A	T	S	N	T	D	T	N	G	F	-	F	
Leckie Creek	619	92J.096	30619	92J.096	781	1	200	-	NVC	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lower Bridge	531	92I.071	30531	92I.071	36	2	100	CP	Dry/Int.	1.0	21	-	-	-	-	-	-	-	-	-	G	C	-	C	
River Tributaries																									
Lower Bridge	533	92J.090	30533	92J.080	205	4	100	CP	-	2.5	21	0.2	T	S	N	T	S	D	N	N	G	C	-	C	
River Tributaries																									
Lower Bridge	572	92J.090	30572	92J.090	359	1	100	CP	-	3.7	26	0.3	A	T	T	D	N	S	T	N	B	C	-	C	
River Tributaries																									
Lower Bridge	575	92I.071	30575	92I.071	14	3	100	-	NVC	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
River Tributaries																									
Lower Bridge	631	92I.081	30631	92I.081	260	1	100	-	NVC	-	57	-	-	-	-	-	-	-	-	-	-	-	-	-	-
River Tributaries																									
Lower Bridge	634	92J.089	30634	92J.089	57	1	100	-	NVC	-	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-
River Tributaries																									
Lower Bridge	635	92J.080	30635	92J.090	359	4	100	RPg-w	-	2.6	6	0.3	M	T	S	T	S	D	N	N	G	C	-	C	
River Tributaries																									
Marshall Creek	501	92J.098	30501	92J.098	143	2	100	-	NVC	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Marshall Creek	502	92J.088	30502	92J.088	181	1	100	-	NVC	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Marshall Creek	503	92J.098	30503	92J.098	208	1	100	-	NVC	-	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Marshall Creek	504	92J.098	30504	92J.088	180	1	100	-	NVC	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Marshall Creek	505	92J.097	30505	92J.097	484	1	100	-	NVC	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Marshall Creek	509	92J.088	30509	92J.088	174	2	100	CPc-w	-	6.0	12	0.2	T	T	T	D	T	S	T	N	C	G	-	G	
Marshall Creek	511	92J.088	30511	92J.088	175	1	100	-	NVC	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Marshall Creek	659	92J.098	30659	92J.098	204	3	100	CP	-	1.8	18	0.2	T	N	N	S	T	D	N	N	G	C	-	C	
Marshall Creek	666	92J.098	30666	92J.098	119	1	100	-	NVC	-	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Marshall Creek	668	92J.098	30668	92J.098	192	1	100	-	NVC	-	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Moon Creek	670	92J.080	30670	92I.071	52	2	100	SP	-	1.4	8	0.1	M	T	S	T	D	S	T	N	G	C	-	C	
Nosebag Creek	657	92J.078	30657	92J.089	150	4	120	SP	-	6.4	21	0.4	M	N	S	S	T	D	N	N	C	B	-	B	
Nosebag Creek	664	92J.078	30664	92J.078	29	3	810	RP	-	3.2	5	0.3	A	T	S	T	T	S	D	N	C	G	-	G	
Sebring Creek	573	92J.089	30573	92J.079	154	3	100	CP	-	3.6	22	0.4	M	N	S	T	N	D	T	N	G	C	-	C	
Slim Creek	510	92J.095	30510	92J.095	137	1	704	LC	Dry/Int.	3.7	0	-	T	T	T	N	S	N	T	D	F	NA	-	NA	
Slim Creek	512	92J.095	30512	92J.095	92	1	100	-	NVC	-	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Slim Creek	514	92J.096	30514	92J.096	782	1	900	RP	-	18.0	3	no pools	M	N	N	D	S	T	N	C	C	B	-	B	
Slim Creek	547	92J.095	30547	92J.095	68	1	100	-	NVC	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Slim Creek	579	92J.094	30579	92J.094	120	1	100	LC	-	0.7	1	0.6	T	N	N	N	N	D	N	S	F	C	-	C	
Slim Creek	580	92J.094	30580	92J.094	107	1	215	SP	Dry/Int.	1.1	5	0.1	T	N	N	S	D	T	T	N	F	C	-	C	
Slim Creek	581	92J.094	30581	92J.094	100	1	150	CP	-	8.4	23	0.1	N	N	N	N	N	N	N	N	B	C	-	C	
Slim Creek	582	92J.094	30582	92J.094	93	1	700	SP	-	1.3	12	no pools	T	N	N	S	D	N	T	N	C	B	-	B	
Slim Creek	583	92J.094	30583	92J.094	28	1	100	RP	-	1.1	5	0.2	M	N	N	S	T	S	D	N	G	C	-	C	

Table 6. Habitat data summary of sampling sites for the Lower Bridge River Watershed, August 9 to September 24, 2000.

Sampled Basin	Site No.	Site Map No.	Site NID	ILP Map No.	ILP No.	Reach No.	Site Length	Channel and Morphology					Instream Cover						Bed Material			
								Channel Morphology	Channel Condition	Average Channel Width (m)	Average Gradient (%)	Average Pool Depth (m)	Total Cover	SWD Cover	LWD Cover	Boulder Cover	Cutbank Cover	Deep Pool Cover	Overhanging Vegetation Cover	Instream Vegetation Cover	Dominant Bed Material	Subdominant Bed Material
Slim Creek	584	92J.094	30584	92J.094	19	2	1000	SP	-	2.3	29	0.2	T	N	T	D	T	S	T	N	C	B
Slim Creek	585	92J.094	30585	92J.096	782	6	200	RP	-	10.4	1	0.6	T	N	N	S	D	T	S	N	C	G
Slim Creek	586	92J.094	30586	92J.094	18	1	400	LC	-	2.2	2	no pools	T	T	N	N	T	N	S	D	F	NA
Slim Creek	587	92J.094	30587	92J.094	1	1	100	LC	-	0.9	0	0.6	A	N	N	N	D	S	S	N	F	NA
Slim Creek	588	92J.094	30588	92J.094	155	2	200	CPc-w	-	1.4	5	0.1	M	N	T	S	D	S	T	N	F	C
Slim Creek	589	92J.094	30589	92J.094	140	2	100	-	NVC	-	6	-	-	-	-	-	-	-	-	-	-	-
Slim Creek	590	92J.094	30590	92J.094	149	1	700	SP	-	1.4	11	0.2	M	N	N	S	D	S	T	N	F	B
Slim Creek	591	92J.095	30591	92J.095	230	1	300	-	NVC	-	3	-	-	-	-	-	-	-	-	-	-	-
Slim Creek	592	92J.094	30592	92J.094	134	2	225	SP	-	3.2	19	0.1	M	N	N	D	N	S	N	N	B	C
Slim Creek	593	92J.085	30593	92J.085	50	1	100	CP	-	1.4	22	0.1	T	N	N	D	N	S	N	N	G	C
Slim Creek	594	92J.095	30594	92J.095	248	1	165	LC	-	14.6	2	no pools	M	N	T	S	S	N	T	D	F	B
Slim Creek	595	92J.085	30595	92J.085	76	1	100	-	NVC	-	30	-	-	-	-	-	-	-	-	-	-	-
Slim Creek	596	92J.085	30596	92J.095	129	2	740	-	NVC	-	26	-	-	-	-	-	-	-	-	-	-	-
Slim Creek	597	92J.095	30597	92J.095	50	1	100	CP	-	3.6	11	0.2	T	N	N	D	T	S	N	N	C	F
Slim Creek	598	92J.085	30598	92J.085	120	1	200	-	NVC	-	25	-	-	-	-	-	-	-	-	-	-	-
Slim Creek	617	92J.095	30617	92J.096	783	1	100	-	NVC	-	12	-	-	-	-	-	-	-	-	-	-	-
Slim Creek	621	92J.096	30621	92J.096	763	1	100	-	NVC	-	10	-	-	-	-	-	-	-	-	-	-	-
Slim Creek	708	92J.094	30708	92J.094	288	1	100	RP	-	3.7	2	0.2	T	N	N	N	D	T	N	T	G	F
Slim Creek	709	92J.094	30709	92J.095	232	2	100	RP	-	4.0	5	0.3	M	N	N	D	S	T	N	S	B	C
Slim Creek	710	92J.094	30710	92J.095	232	4	100	RP	-	1.0	3	0.1	M	N	N	S	D	T	T	T	G	F
Tommy Creek	649	92J.077	30649	92J.078	297	4	150	RP	-	2.4	1	0.3	T	T	N	N	D	S	T	N	G	F
Tommy Creek	651	92J.078	30651	92J.078	391	1	100	LC	-	0.6	13	no pools	N	N	N	N	N	N	N	N	F	NA
Tommy Creek	653	92J.078	30653	92J.078	392	1	120	RP	-	3.6	6	0.2	M	T	N	S	S	D	N	N	C	G
Tommy Creek	658	92J.077	30658	92J.078	297	8	100	-	NVC	-	9	-	-	-	-	-	-	-	-	-	-	-
Truax Creek	542	92J.087	30542	92J.087	316	1	100	-	NVC	-	29	-	-	-	-	-	-	-	-	-	-	-
Truax Creek	546	92J.087	30546	92J.087	301	1	150	SP	Dry/Int.	1.3	32	-	T	N	T	D	N	N	S	T	G	C
Truax Creek	548	92J.087	30548	92J.087	173	3	700	CP	-	7.3	7	0.3	A	N	T	S	T	D	S	N	G	C
Truax Creek	550	92J.087	30550	92J.087	274	1	170	CP	-	1.0	29	0.1	T	D	T	N	S	N	N	N	G	C
Truax Creek	643	92J.087	30643	92J.087	194	1	100	LC	-	1.1	8	0.2	T	D	S	N	N	T	T	N	F	NA
Truax Creek	646	92J.087	30646	92J.087	220	2	1000	SP	-	3.2	13	0.2	M	T	T	S	T	D	T	N	C	B
Truax Creek	705	92J.077	30705	92J.087	331	3	120	CP	-	1.3	22	0.2	T	N	N	D	N	N	N	T	B	C
Truax Creek	706	92J.087	30706	92J.087	331	1	200	RP	-	6.1	21	0.2	M	N	N	D	N	N	T	S	B	C
Warner Creek	712	92O.005	30712	92O.005	135	2	100	CP	-	6.4	5	0.2	T	N	N	S	N	D	N	N	C	B
Warner Creek	713	92O.005	30713	92O.005	135	4	100	RP	-	5.2	0	0.4	T	N	T	N	S	D	N	N	G	F

Note: Channel and Morphology: RP - Riffle-pool
 CP - Cascade-pool
 SP - Step-pool
 LC - Large channel
 b - boulder substrate
 g-w - gravel substrate with functioning large woody debris
 c-w - cobble substrate with functioning large woody debris
 Channel Condition: NVC - No Visible Channel
 Dry/Int. - dry channel, seasonal drainage
 Instream Cover: N - None
 T - Trace
 M - Moderate
 A - Abundant
 D - Dominant
 S - Subdominant
 Instream Cover Type: LWD - Large Woody Debris
 SWD - Small Woody Debris
 Bed Material: F - Fines (<2mm)
 G - Gravel (2-64 mm)
 C - Cobble (64-256 mm)
 B - Boulder (>256 mm)
 NA - None Available



Figure 3. *Lower Bridge River Watershed: View of a non visible channel (NVC). Site 591, ILP Map 92J.095, ILP 230, Reach 1, September 11, 2000.*



Figure 4. *Lower Bridge River Watershed: Upstream view of small order headwater non-fish bearing reach with cascade-pool morphology, 22% gradient, gravel-cobble substrate, and trace amounts of cover. Site 593, ILP Map 92J.085, ILP 50, Reach 1, September 11, 2000.*



Figure 5. *Lower Bridge River Watershed*: Upstream view of a non-fish bearing reach with cascade-pool morphology, 8% gradient, gravel cobble substrate, and moderate amounts of cover. Site 623, ILP Map 92J.096, ILP 600, Reach 1, September 14, 2000.



Figure 6. *Lower Bridge River Watershed*: Downstream view of Pearson Creek, a fish bearing reach with cascade-pool morphology, 15% gradient, boulder-cobble substrate, and moderate amounts of cover. Site 537, ILP Map 92J.096, ILP 15, Reach 1, August 23, 2000.



Figure 7. *Lower Bridge River Watershed: Downstream view of Gun Creek, a turbid fish bearing reach with riffle-pool morphology, 3% gradient, gravel-fine substrate, and moderate amounts of cover. Site 568, ILP Map 92J.087, ILP 7, Reach 16, August 30, 2000.*

(mean = 8.1, SD = 0.5, n = 94), temperatures from 1.0°C to 16.0°C (mean = 6.9, SD = 3.3, n = 94) and conductivity from 10 µS to 390 µS (mean = 78, SD = 75, n = 94). A total of 13 sites (Sites 581, 583, 592, 638, 641, 643, 651, 653, 656, 657, 660, 662, and 705) had water temperatures less than 4.0°C. Fish absence was confirmed at optimal water conditions downstream and/or downstream barriers were identified for seven of these, Sites 643, 651, 653, 657, 660, 662, and 705. Four sites had gradient sections >25%, Sites 581, 592, 638, and 656. Fish presence was suspected at Site 583, and Site 641 was located within a community watershed, meaning that these sites received a fish bearing designation. In summary, due to the additional sampling at suitable water temperatures, identified barriers, and high gradient, it is unlikely that fish had migrated to overwintering areas as a result of low water temperatures, and avoided sampling. At the 17 sites where conductivity was less than 30 µS, salt was used to increase electrofishing effectiveness.

In reaches where water flow allowed for fish sampling, sampling procedures were judged to be sufficient to determine fish presence or absence. Within the *Lower Bridge River Watershed*, a total of 157 fish were sampled at 28 sites. These included, 122 rainbow trout (Figure 8), 25 bull trout (Figures 9 and 10), 5 mountain whitefish (Figure 11), 1 eastern brook trout and 4 unidentified trout. Fish were captured by electrofishing, minnow traps, and pole seining, while some fish were also noted by visual observation. The Catch-Per-Unit-Effort (CPUE) by species and method are listed in Table 7. Of the remaining 143 sites where no fish were caught, 10 were suspected as fish bearing, 61 were non-fish bearing (one was located within a community watershed and received a fish bearing designation), and 72 had no visible channel.

Within the *Lower Bridge River Watershed*, 13 new barriers and 5 historic barriers were identified (Table 8). These include 13 waterfalls, 2 cascades, 1 velocity barrier (waterfall/chute), 1 dam, and 1 culvert. The 20.0 m high waterfall on Warner Creek (Figure 12), provides an example of a typical natural barrier limiting the upstream migration of fish. A 1.6 m high culvert (Figure 13) on Brett Creek was also identified



Figure 8. *Lower Bridge River Watershed: Three age classes of rainbow trout, 0+, 1+ and 2+, captured in a tributary to Applespring Creek. Site 535, ILP Map 92J.090, ILP 12, Reach 0.1, August 22, 2000.*



Figure 9. *Lower Bridge River Watershed: Adult bull trout captured in Walker Creek. Site 532, ILP Map 92J.086, ILP 60, Reach 1, August 16, 2000.*



Figure 10. *Lower Bridge River Watershed: One age class of bull trout, 1+, captured in a tributary to Gun Creek. Site 555, ILP Map 92J.094, ILP 183, Reach 1, August 30, 2000.*



Figure 11. *Lower Bridge River Watershed: One age class of mountain whitefish, 6+, captured in a tributary to Gun Creek. Site 555, ILP Map 92J.094, ILP 183, Reach 1, August 30, 2000.*

Table 7. Catch-Per-Unit Effort for fish species captured in the *Lower Bridge River Watershed*.

Species	No. of EF fish / 100 m ²					No. of EF fish / 100 seconds					No. of MT fish / hr					No. of SN fish / 100 m ²				
	Mean	SD	n	max	min	Mean	SD	n	max	min	Mean	SD	n	max	min	Mean	SD	n	max	min
rainbow trout	2.36	3.53	16	11.00	0.10	1.27	1.29	16	4.18	0.27	-	-	1	-	0.12	-	-	1	-	0.81
bull trout	0.85	0.45	6	1.36	0.33	0.61	0.25	6	0.89	0.22	-	-	-	-	-	-	-	1	-	0.28
mountain whitefish	0.19	0.09	3	0.28	0.10	0.48	0.45	3	1.00	0.15	-	-	-	-	-	-	-	-	-	-
eastern brook trout	-	-	1	-	2.22	-	-	1	-	0.74	-	-	-	-	-	-	-	-	-	-
unidentified trout	0.71	0.19	3	0.96	0.50	0.45	0.07	3	0.36	0.54	-	-	-	-	-	-	-	-	-	

Note: EF - electrofishing

MT - minnow trapping

SN - pole seining

SD - standard deviation

n - sample size (# of sites)

Table 8. Summary of new and historic barriers to fish migration identified in the Lower Bridge River Watershed.

Site No.	ILP Map No.	ILP No.	Reach No.	Feature Map No.	Feature NID No.	Barriere Type	Height (m)	Length (m)	Verified in field?	Comments
n/a	92J.088	11	1	92J.088	20028	F	2.0	-	No	Keary Creek - barrier within reach, additional barrier, 20 m falls upstream.
n/a	92J.089	150	1	92J.079	20033	F	40.0	-	No	Nosebag Creek - barrier to upstream fish migration from Carpenter Lake.
n/a	92I.071	2	1	92J.079	20062	D	54.0	360	Yes	Bridge River - Terzaghi Dam, barrier to upstream migration of all species, delineates upstream limit of anadromous salmon distribution.
n/a	92J.088	133	1	92J.088	20159	F	6.0	-	No	Marshall Creek - barrier to upstream migration of fish from Carpenter Lake, additional waterfall, unspecified height, downstream near mouth.
n/a	92J.087	366	1	92J.087	20163	F	1.5	-	No	Williams Creek - barrier within reach, additional barrier, 2 m waterfall upstream.
n/a	92J.087	173	2	92J.087	20227	F	3.0	-	No	Truax Creek - barrier with no documented height.
n/a	92J.088	174	1	92J.088	31503	CV	1.6	12	Yes	Brett Creek - perched culvert, confirmed as a barrier to upstream fish migration, located on highway 2028.
n/a	92J.088	57	1	92J.088	31517	C	2.0	1	Yes	Jones Creek - barrier within reach, additional barrier, 18 m falls upstream.
535	92J.090	12	0.1	92J.090	31521	F	2.5	2	Yes	unnamed tributary to Applespring Creek - barrier 100 m upstream from mouth.
n/a	92J.089	10	1	92J.089	31530	F	7.0	5	Yes	Hell Creek - barrier to upstream fish migration from Bridge River.
553	92J.087	7	16.1	92J.094	31546	C	60.0	400	Yes	Gun Creek - rocky cascade acting as barrier within upper alpine reaches.
570	92J.090	186	1	92J.090	31550	VB	5.0	6	Yes	Antoine Creek - falls/chute type barrier at upstream end of reach.
712	92O.005	135	2	92O.005	31551	F	20.0		Yes	Warner Creek - barrier to upstream fish migration from Gun Creek.
n/a	92J.096	737	1	92J.096	31553	F	30.0	-	Yes	Leckie Creek - barrier to upstream fish migration from Gun Creek.
n/a	92J.096	435	2	92J.096	31555	F	15.0	-	Yes	Eldorado Creek - barrier to upstream fish migration from Gun Creek.
645	92J.088	281	2	92J.088	31565	F	30.0	-	Yes	Bobb Creek - barrier to upstream fish migration from Carpenter Lake.
n/a	92J.088	219	2	92J.088	31569	F	20.0	-	Yes	Tommy Creek - barrier to upstream fish migration within mid reaches of mainstem.
n/a	92J.098	204	2	92J.098	31573	F	10.0	-	Yes	Jim Creek - barrier to upstream migration of fish.
514	92J.096	782	1	92J.096	31590	F	30.0	60	Yes	Slim Creek - barrier to upstream migration of fish from lower reaches of Leckie Creek.

Note: n/a - not applicable

C - cascades

CV - culvert

F - waterfalls

D - dam

VB - velocity barrier (i.e. waterfall/chute)



Figure 12. *Lower Bridge River Watershed: Aerial view of a 20.0 m high waterfall on Warner Creek, NID Map 92O.005, NID 31,551, ILP Map 92O.005, ILP 135, Reach 2, September 12, 2000.*



Figure 13. *Lower Bridge River Watershed: Upstream view of a 1.6 m high culvert on Brett Creek, NID Map 92J.088, NID 31,503, ILP Map 92J.088, ILP 174, Reach 1, August 9, 2000.*

as limiting the upstream migration of fish. Field sampling revealed that fish are utilizing habitat up to the culvert, while extensive sampling immediately upstream determined that no fish are present. The impact of this culvert is discussed in section 4.4.2.3 *Restoration and Rehabilitation Opportunities*.

In addition to these 13 new barriers, 77 new features (53 natural and 24 man-made) were noted within the unit. The natural features included 5 beaver dams, 15 cascades, 2 dams (i.e. stream sections naturally dammed by rock), 14 waterfalls, 2 reach sections with subsurface flow, 2 fisheries sensitive zones, 2 stream sections with bank sloughing or landslides, 2 unmapped tributaries, 1 velocity barrier (i.e. waterfall/chute), and 8 log jams. The man-made features include 1 general crossing (an old bridge foundation), 4 bridges, 17 culverts, 1 dam, and 1 vehicle ford. None of these man-made features were identified as impacting localized or downstream fish habitat. A total of 36 (17 natural and 19 man-made) of 77 features were noted within fish bearing reaches, of which 12 (10 natural and 2 man-made) may be seasonally obstructing fish migration. Specifically, these include three beaver dams on Moon Creek, a general crossing (an old bridge foundation) on Ferguson Creek, a cascade on a tributary to Gun Creek, a culvert and velocity barrier (i.e. waterfall/chute) on Antoine Creek, two log jams on Viera Creek, two logs jam on Brett Creek, and a log jam on Applespring Creek.

The sampling results suggest that fish distribution in the *Lower Bridge River Watershed* is naturally limited to the low gradient valley bottoms of accessible drainages, such as Gun Creek and Marshall Creek, as well as the low gradient and accessible first reaches of the Bridge River and Carpenter Lake tributaries, such as Applespring, Antoine, and Viera Creeks. However, fish distribution is also expanded into higher gradient tributary basins such as the Camoo, Moon, Bobb, Ferguson, and Slim Creek drainages as a result of stocking in headwater lake areas. In contrast, fish distribution is excluded from some study area basins as a result of barriers within the first reaches of tributary mainstems, such as the Keary and Truax Creek drainages. The relative abundance of newly identified

waterfalls (22) and cascades (18), 40 of 90 identified features, was reflective of the steep topography within the lower Bridge River, below Terzaghi Dam, the tributary basins along the north and south sides of Carpenter Lake, and along the valley sidewalls of basins such as Gun Creek.

The possible limiting factors to fish distribution within the *Lower Bridge River Watershed* study area, and causes for the absence of fish in some of the sampled reaches include:

- i) a barrier to fish migration at some point below the sampling site, and/or,
- ii) low abundance of fish populations within the watershed, resulting in the exclusive use of the lower more productive reaches even though headwater reaches were contiguous with fish habitat (Raleigh *et al.* 1984), and/or,
- iii) limited amounts of overwintering (due to lack of deep pools) or spawning habitat.

4.3 FISH AGE, SIZE AND LIFE HISTORY

Within the *Lower Bridge River Watershed*, a total of 157 fish (122 RB, 25 BT, 5 MW, 1 EB, and 4 TR) were sampled at 28 sites. Of these, only 134 fish (102 RB, 22 BT, 5 MW, 1 EB, and 4 TR) were captured at 26 sites. The remaining 23 fish were visually observed without capture. Table 9 provides a summary of the fish sampling results for the *Lower Bridge River Watershed* study area, and include sampling methods, species captured, fork length, and wet weight, as well as information on the ageing structures and age estimates of selected individual fish. Length-frequency histograms for rainbow trout and bull trout are provided in Figures 14 and 15 respectively.

Of the 134 fish captured, scale samples were taken from a representative sample of 36 rainbow trout, 10 bull trout, 5 mountain whitefish, and 1 eastern brook trout. Scale

Table 9. Fish sampling summary for the *Lower Bridge River Watershed*, August 9 to September 24, 2000.

Sampled Basin	Site No.	ILP Map No.	ILP No.	Reach No.	Species	Capture Method	Fork Length (mm)	Wet Weight (g)	Ageing Structure No.	Age*
Antoine Creek	570	92J.090	186	1	RB	EF	155	50.5	SC1	2+
Antoine Creek	570	92J.090	186	1	RB	EF	122	31.7	SC2	2+
Antoine Creek	570	92J.090	186	1	RB	VO	150			
Antoine Creek	570	92J.090	186	1	RB	VO	100			
Applespring Creek	535	92J.090	12	0.1	RB	EF	187	69.7	SC1	2+
Applespring Creek	535	92J.090	12	0.1	RB	EF	101	14.1	SC2	1+
Applespring Creek	535	92J.090	12	0.1	RB	EF	45	1.7		
Applespring Creek	535	92J.090	12	0.1	RB	EF	41	1.1		
Applespring Creek	535	92J.090	12	0.1	RB	EF	38	0.7		
Applespring Creek	535	92J.090	12	0.1	RB	EF	63	3.4		
Applespring Creek	535	92J.090	12	0.1	RB	EF	44	1.6		
Applespring Creek	535	92J.090	12	0.1	RB	EF	41	1.1		
Applespring Creek	535	92J.090	12	0.1	RB	EF	37	0.7		
Applespring Creek	535	92J.090	12	0.1	RB	EF	75	5.1		
Applespring Creek	535	92J.090	12	0.1	RB	EF	38	0.8		
Applespring Creek	640	92J.090	11	2	RB	EF	155		SC1	n/a
Applespring Creek	640	92J.090	11	2	RB	EF	152		SC2	2+
Bobb Creek	645	92J.088	281	2	RB	EF	168		SC1	2+
Bobb Creek	645	92J.088	281	2	RB	EF	212		SC2	n/a
Bobb Creek	645	92J.088	281	2	RB	EF	193			
Bobb Creek	645	92J.088	281	2	RB	EF	195			
Bobb Creek	645	92J.088	281	2	RB	EF	90			
Camoo Creek	578	92J.090	137	1	RB	EF	168	10.5	SC1	1+
Camoo Creek	578	92J.090	137	1	RB	VO	150			
Camoo Creek	578	92J.090	137	1	RB	VO	150			
Camoo Creek	578	92J.090	137	1	RB	VO	150			
Camoo Creek	578	92J.090	137	1	RB	EF	190	15.0		
Carpenter Lake Tributaries	554	92J.079	130	1	RB	EF	116	26.5	SC1	1+
Fergusson Creek	506	92J.086	188	3	RB	EF	115	18.1	SC1	1+
Fergusson Creek	506	92J.086	188	3	RB	EF	180	50.5	SC2	2+
Fergusson Creek	506	92J.086	188	3	RB	EF	128	32.2	SC3	n/a
Fergusson Creek	506	92J.086	188	3	RB	EF	75	5.9		
Fergusson Creek	506	92J.086	188	3	RB	EF	82	5.9		
Fergusson Creek	506	92J.086	188	3	RB	EF	117	14.7		
Fergusson Creek	506	92J.086	188	3	RB	EF	74	4.6		
Fergusson Creek	506	92J.086	188	3	RB	EF	115	18.5		
Gun Creek	530	92J.096	330	1	BT	EF	150	17.6	SC1	1+

Table 9. Fish sampling summary for the *Lower Bridge River Watershed*, August 9 to September 24, 2000.

Sampled Basin	Site No.	ILP Map No.	ILP No.	Reach No.	Species	Capture Method	Fork Length (mm)	Wet Weight (g)	Ageing Structure No.	Age*
Gun Creek	537	92J.096	15	1	RB	EF	172	64.3	SC1	2+
Gun Creek	537	92J.096	15	1	RB	EF	200	83.5	SC2	2+
Gun Creek	537	92J.096	15	1	RB	EF	210	123.4	SC3	3+
Gun Creek	537	92J.096	15	1	RB	EF	168	63.8		
Gun Creek	537	92J.096	15	1	RB	EF	202	102.6		
Gun Creek	537	92J.096	15	1	RB	EF	222	144.9		
Gun Creek	537	92J.096	15	1	RB	EF	167	63.9		
Gun Creek	537	92J.096	15	1	RB	EF	183	74.7		
Gun Creek	537	92J.096	15	1	RB	EF	174	58.6		
Gun Creek	537	92J.096	15	1	RB	EF	203	101.9		
Gun Creek	545	92J.087	7	10	RB	EF	170	59.0	SC1	2+
Gun Creek	545	92J.087	7	10	BT	EF	82	8.5		
Gun Creek	545	92J.087	7	10	BT	EF	69	5.1		
Gun Creek	545	92J.087	7	10	RB	EF	28	3.3		
Gun Creek	545	92J.087	7	10	RB	EF	75	7.2		
Gun Creek	552	92J.087	7	6	BT	EF	95	12.1	SC1	0+
Gun Creek	552	92J.087	7	6	BT	EF	100	11.2	SC2	0+
Gun Creek	552	92J.087	7	6	TR	EF	35	1.5		
Gun Creek	553	92J.087	7	16.1	BT	EF	138	29.2	SC1	1+
Gun Creek	553	92J.087	7	16.1	BT	EF	113	16.8	SC2	1+
Gun Creek	553	92J.087	7	16.1	BT	EF	115	21.9		
Gun Creek	553	92J.087	7	16.1	BT	EF	111	18.3		
Gun Creek	553	92J.087	7	16.1	BT	EF	104	13.4		
Gun Creek	553	92J.087	7	16.1	BT	EF	116	18.2		
Gun Creek	553	92J.087	7	16.1	BT	EF	104	13.0		
Gun Creek	553	92J.087	7	16.1	BT	EF	105	14.3		
Gun Creek	553	92J.087	7	16.1	BT	EF	112	17.4		
Gun Creek	553	92J.087	7	16.1	BT	EF	105	13.8		
Gun Creek	555	92J.094	183	1	MW	EF	315	152.4	SC1	6+
Gun Creek	555	92J.094	183	1	BT	EF	167	65.8	SC2	2+
Gun Creek	555	92J.094	183	1	BT	EF	147	31.7	SC3	1+
Gun Creek	555	92J.094	183	1	BT	EF	74	4.2		
Gun Creek	558	92J.087	7	5	TR	EF	25	0.2		
Gun Creek	558	92J.087	7	5	TR	EF	45	0.5		
Gun Creek	558	92J.087	7	5	RB	EF	30	0.3		
Gun Creek	568	92J.087	7	16	MW	EF	265	242.5	SC1	n/a
Gun Creek	568	92J.087	7	16	MW	EF	255	223.0	SC2	5+
Gun Creek	568	92J.087	7	16	MW	EF	220	210.0	SC3	4+
Gun Creek	603	92O.005	101	1	BT	EF	75	4.5	SC1	0+
Gun Creek	603	92O.005	101	1	BT	EF	82	6.1	SC2	0+
Gun Creek	603	92O.005	101	1	BT	EF	121	22.2	SC3	1+
Gun Creek	605	92O.005	114	1	RB	EF	212	124.9	SC1	3+
Gun Creek	605	92O.005	114	1	MW	EF	192	101.0	SC2	4+
Gun Creek	620	92O.005	17	1	TR	EF	45	2.5		
Gun Creek	624	92J.096	842	1	BT	VO	80			
LaJoie Creek	523	92J.097	88	1	RB	EF	101	11.3	SC1	1+
LaJoie Creek	523	92J.097	88	1	RB	EF	106	13.4	SC2	1+
LaJoie Creek	523	92J.097	88	1	RB	EF	102	13.4		
LaJoie Creek	523	92J.097	88	1	RB	MT	71	6.9		
LaJoie Creek	523	92J.097	88	1	RB	EF	65	3.2		
LaJoie Creek	523	92J.097	88	1	RB	EF	52	1.5		
LaJoie Creek	523	92J.097	88	1	RB	MT	87	8.0		

Table 9. Fish sampling summary for the *Lower Bridge River Watershed*, August 9 to September 24, 2000.

Sampled Basin	Site No.	ILP Map No.	ILP No.	Reach No.	Species	Capture Method	Fork Length (mm)	Wet Weight (g)	Ageing Structure No.	Age*
LaJoie Creek	523	92J.097	88	1	RB	EF	48	1.4		
LaJoie Creek	523	92J.097	88	1	RB	MT	67	4.2		
LaJoie Creek	523	92J.097	88	1	RB	EF	55	2.2		
LaJoie Creek	523	92J.097	88	1	RB	EF	46	1.2		
LaJoie Creek	523	92J.097	88	1	RB	EF	38	0.9		
LaJoie Creek	523	92J.097	88	1	RB	EF	59	3.0		
LaJoie Creek	523	92J.097	88	1	RB	EF	55	3.5		
LaJoie Creek	523	92J.097	88	1	RB	EF	53	1.8		
LaJoie Creek	532	92J.086	60	1	BT	SN	750	3000		
LaJoie Creek	532	92J.086	60	1	BT	VO	750			
LaJoie Creek	532	92J.086	60	1	BT	VO	75			
LaJoie Creek	536	92J.096	1	1	EB	EF	110	73.0	SC1	1+
Lower Bridge River Tributaries	572	92J.090	359	1	RB	EF	138	41.2	SC1	2+
Lower Bridge River Tributaries	572	92J.090	359	1	RB	EF	132	37.3	SC2	2+
Lower Bridge River Tributaries	572	92J.090	359	1	RB	EF	40	0.9		
Moon Creek	670	92I.071	52	2	RB	EF	130	32.2	SC1	1+
Moon Creek	670	92I.071	52	2	RB	EF	140	40.1	SC2	2+
Moon Creek	670	92I.071	52	2	RB	EF	40	0.9		
Moon Creek	670	92I.071	52	2	RB	EF	35	2.0		
Moon Creek	670	92I.071	52	2	RB	EF	36	0.7		
Moon Creek	670	92I.071	52	2	RB	EF	40	0.8		
Moon Creek	670	92I.071	52	2	RB	EF	38	1.4		
Moon Creek	670	92I.071	52	2	RB	EF	40	1.7		
Moon Creek	670	92I.071	52	2	RB	EF	46	2.5		
Moon Creek	670	92I.071	52	2	RB	VO	40			
Moon Creek	670	92I.071	52	2	RB	VO	40			
Moon Creek	670	92I.071	52	2	RB	VO	40			
Moon Creek	670	92I.071	52	2	RB	EF	45	3.7		
Moon Creek	670	92I.071	52	2	RB	VO	40			
Moon Creek	670	92I.071	52	2	RB	VO	40			
Moon Creek	670	92I.071	52	2	RB	VO	40			
Moon Creek	670	92I.071	52	2	RB	VO	40			
Moon Creek	670	92I.071	52	2	RB	VO	40			
Moon Creek	670	92I.071	52	2	RB	VO	40			
Moon Creek	670	92I.071	52	2	RB	VO	40			
Moon Creek	670	92I.071	52	2	RB	EF	32	2.0		
Moon Creek	670	92I.071	52	2	RB	VO	40			
Slim Creek	588	92J.094	155	2	RB	EF	190	66.7	SC1	3+
Slim Creek	588	92J.094	155	2	RB	EF	165	67.7	SC2	2+
Slim Creek	588	92J.094	155	2	RB	EF	158	48.5	SC3	2+
Slim Creek	590	92J.094	149	1	RB	VO	190			
Slim Creek	594	92J.095	248	1	RB	VO	200			
Slim Creek	594	92J.095	248	1	RB	VO	200			
Slim Creek	708	92J.094	288	1	RB	SN	230	111.2	SC1	5+
Slim Creek	708	92J.094	288	1	RB	SN	210	76.8	SC2	4+
Slim Creek	708	92J.094	288	1	RB	SN	203	93.0	SC3	4+
Slim Creek	709	92J.095	232	2	RB	EF	193	84.8	SC1	4+
Slim Creek	709	92J.095	232	2	RB	EF	207	100.9	SC2	4+
Slim Creek	709	92J.095	232	2	RB	EF	174	65.3	SC3	3+

Table 9. Fish sampling summary for the *Lower Bridge River Watershed*, August 9 to September 24, 2000.

Sampled Basin	Site No.	ILP Map No.	ILP No.	Reach No.	Species	Capture Method	Fork Length (mm)	Wet Weight (g)	Ageing Structure No.	Age*
Slim Creek	709	92J.095	232	2	RB	EF	150	39.1	SC4	3+
Slim Creek	709	92J.095	232	2	RB	EF	122	22.0	SC5	2+
Slim Creek	709	92J.095	232	2	RB	EF	108	13.5	SC6	2+
Slim Creek	709	92J.095	232	2	RB	EF	224	120.3		
Slim Creek	709	92J.095	232	2	RB	EF	108	15.5		
Slim Creek	709	92J.095	232	2	RB	EF	168	46.6		
Slim Creek	709	92J.095	232	2	RB	EF	197	84.6		
Slim Creek	709	92J.095	232	2	RB	EF	207	87.8		
Slim Creek	709	92J.095	232	2	RB	EF	212	94.6		
Slim Creek	709	92J.095	232	2	RB	EF	207	105.5		
Slim Creek	709	92J.095	232	2	RB	EF	207	96.4		
Slim Creek	709	92J.095	232	2	RB	EF	195	89.3		
Slim Creek	709	92J.095	232	2	RB	EF	201	105.2		
Slim Creek	709	92J.095	232	2	RB	EF	194	75.8		
Slim Creek	709	92J.095	232	2	RB	EF	93	9.7		
Slim Creek	709	92J.095	232	2	RB	EF	98	9.8		
Slim Creek	709	92J.095	232	2	RB	EF	115	15.5		
Slim Creek	709	92J.095	232	2	RB	EF	207	198.0		

Note: RB - rainbow trout (*Oncorhynchus mykiss*) EF - electrofishing SC - scale
 BT - bull trout (*Salvelinus confluentus*) MT - minnow trapping
 MW - mountain whitefish (*Prosopium willian*) SN - pole seining
 EB - eastern brook trout (*Salvelinus fontinalis*) VO - visual observation
 TR - trout, species unspecified

* - ageing data from BT and EB can be unreliable (RIC 1997)

Figure 14. Length-frequency histogram of rainbow trout sampled in the *Lower Bridge River Watershed*, August 9 to September 24, 2000 (n=122).

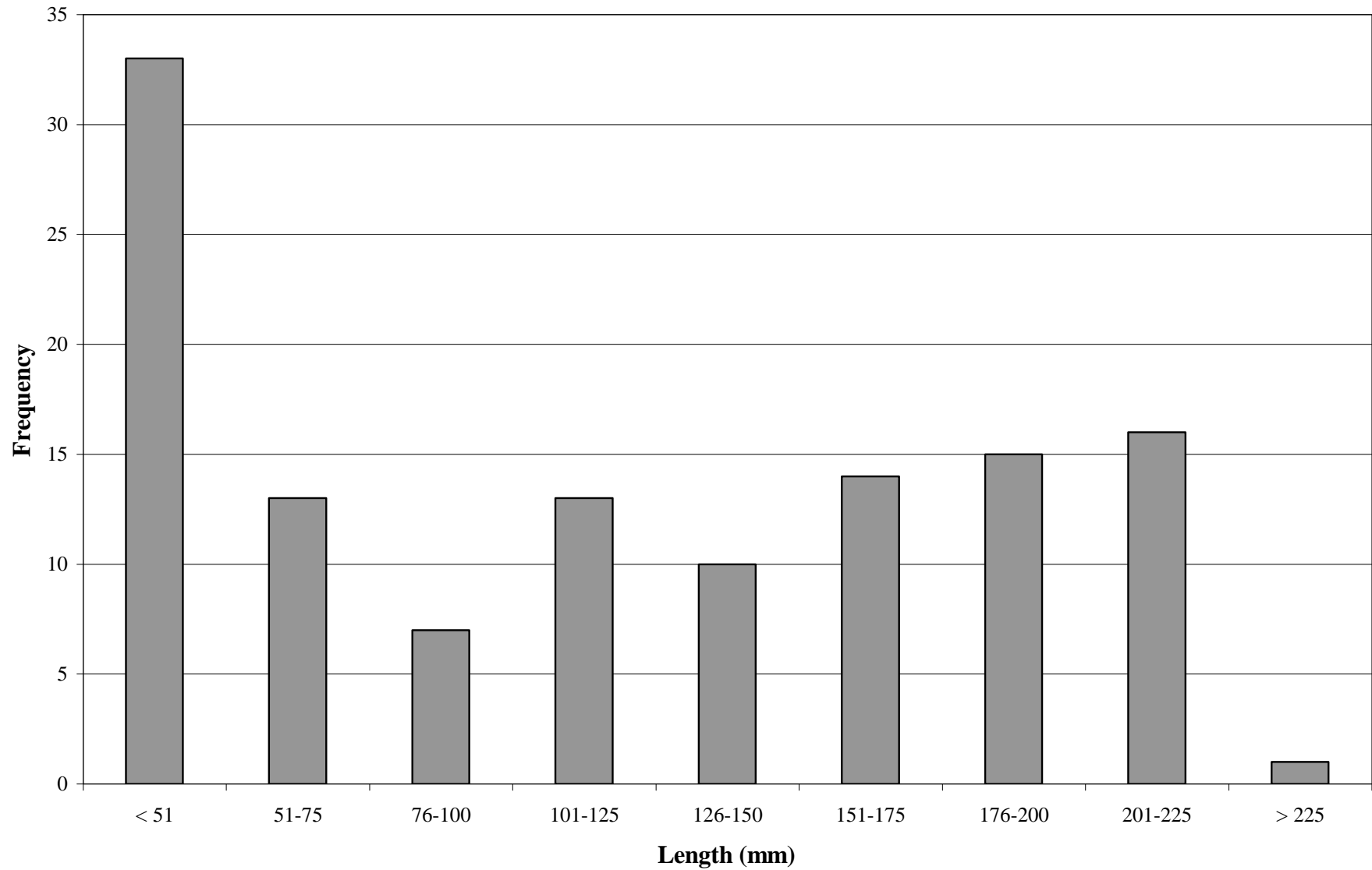
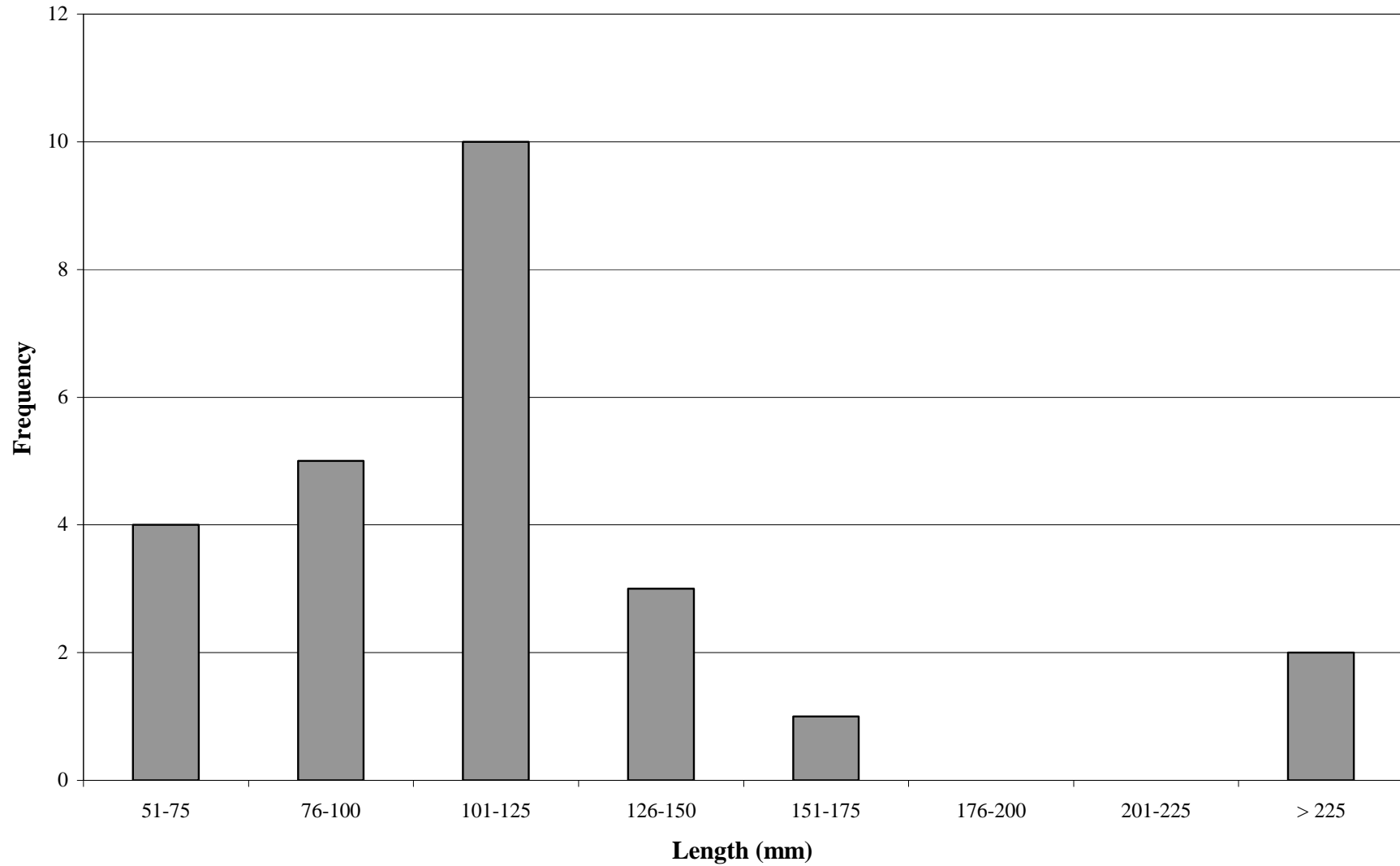


Figure 15. Length-frequency histogram of bull trout sampled in the *Lower Bridge River Watershed*, August 9 to September 24, 2000 (n=25).



analysis was provided by Hamaguchi Fish Aging Services (Attachment III). Table 10 provides a summary of the length-at-age data from rainbow trout, bull trout, mountain whitefish, and eastern brook trout, sampled in the *Lower Bridge River Watershed*. Length-at-age graphs for rainbow trout and bull trout are provided in Figures 16 and 17 respectively. Given the small sample size of aged mountain whitefish, and eastern brook trout, no length-at-age graphs are provided.

Rainbow trout populations in the Lillooet area may exhibit one of three life history strategies; adfluvial – spawning and rearing for one to three years in streams before moving into lakes to rear or mature, fluvial – spawning and rearing in smaller tributaries and rearing as adults in mainstems or large tributaries, or resident – living their entire lives within smaller (usually headwater) tributaries (Ford et al. 1995).

Rainbow trout are spring spawners, and depending on stream flow and water temperatures, will spawn from mid-April to mid-June. Fry emergence usually occurs between mid-June to mid-August. As fry emerge from spawning gravels, they move into slower moving water along the margins and/or pools of stream channels. As the fish grow, they may inhabit riffle areas where they remain for the summer or move into rearing areas in associated mainstems or lakes. By late summer and early fall the young of the year and juveniles may take up residence in suitable overwintering habitat within mainstems, large tributaries or lake systems (Ford et al. 1995).

Scale samples were taken from 36 rainbow trout within the *Lower Bridge River Watershed*. Ageing results determined that 7 were 1+, 16 were 2+, 5 were 3+, 4 were 4+, and 1 was 5+ (Table 9). Ageing data could not be determined for three sampled fish. Given the abundance of sampled basins (Table 1), variety of available stream and lake habitat, and ageing results, it is likely that rainbow trout will demonstrate all three life history strategies within the study area.

Table 10. Summary of length-at-age data from rainbow trout, bull trout, eastern brook trout, and mountain whitefish sampled in the Lower Bridge River Watershed, August 9 to September 24, 2000.

Sampled Basin	Site No.	ILP Map No.	ILP No.	Reach No.	Species	Age *	No. of Fish	Mean Length	Range of Lengths (mm)
Antoine Creek	570	92J.090	186	1	RB	2+	2	138	122-155
Applespring Creek	535	92J.090	12	0.1	RB	1+	1	101	-
Applespring Creek	535	92J.090	12	0.1	RB	2+	1	187	-
Applespring Creek	640	92J.090	11	2	RB	2+	1	152	-
Bobb Creek	645	92J.088	281	2	RB	2+	1	168	-
Camoo Creek	578	92J.090	137	1	RB	1+	1	168	-
Carpenter Lake	554	92J.079	130	1	RB	1+	1	116	-
Tributaries									
Fergusson Creek	506	92J.086	188	3	RB	1+	1	115	-
Fergusson Creek	506	92J.086	188	3	RB	2+	1	180	-
Gun Creek	530	92J.096	330	1	BT	1+	1	150	-
Gun Creek	537	92J.096	15	1	RB	2+	2	186	172-200
Gun Creek	537	92J.096	15	1	RB	3+	1	210	-
Gun Creek	545	92J.087	7	10	RB	2+	1	170	-
Gun Creek	552	92J.087	7	6	BT	0+	2	98	95-100
Gun Creek	553	92J.087	7	16.1	BT	1+	2	126	113-138
Gun Creek	555	92J.094	183	1	BT	1+	1	147	-
Gun Creek	555	92J.094	183	1	BT	2+	1	167	-
Gun Creek	555	92J.094	183	1	MW	6+	1	315	-
Gun Creek	568	92J.087	7	16	MW	4+	1	220	-
Gun Creek	568	92J.087	7	16	MW	5+	1	255	-
Gun Creek	603	92O.005	101	1	BT	0+	2	78	75-82
Gun Creek	603	92O.005	101	1	BT	1+	1	121	-
Gun Creek	605	92O.005	114	1	RB	3+	1	212	-
Gun Creek	605	92O.005	114	1	MW	4+	1	192	-
LaJoie Creek	523	92J.097	88	1	RB	1+	2	104	101-106
LaJoie Creek	536	92J.096	1	1	EB	1+	1	110	-
Lower Bridge River	572	92J.090	359	1	RB	2+	2	135	132-138
Tributaries									
Moon Creek	670	92I.071	52	2	RB	1+	1	130	-
Moon Creek	670	92I.071	52	2	RB	2+	1	140	-
Slim Creek	588	92J.094	155	2	RB	2+	2	162	158-165
Slim Creek	588	92J.094	155	2	RB	3+	1	190	-
Slim Creek	708	92J.094	288	1	RB	4+	2	206	203-210
Slim Creek	708	92J.094	288	1	RB	5+	1	230	-
Slim Creek	709	92J.095	232	2	RB	2+	2	230	108-122
Slim Creek	709	92J.095	232	2	RB	3+	2	324	150-174
Slim Creek	709	92J.095	232	2	RB	4+	2	200	193-207

Note: RB - rainbow trout (*Oncorhynchus mykiss*)
 BT - bull trout (*Salvelinus confluentus*)
 MW - mountain whitefish (*Prosopium williamsoni*)
 EB - eastern brook trout (*Salvelinus fontinalis*)

* - ageing data from BT and EB can be unreliable (RIC 1997)

Figure 16. Length-at-age of rainbow trout based on scale samples taken in the *Lower Bridge River Watershed*, August 9 to September 24, 2000 (n=33).

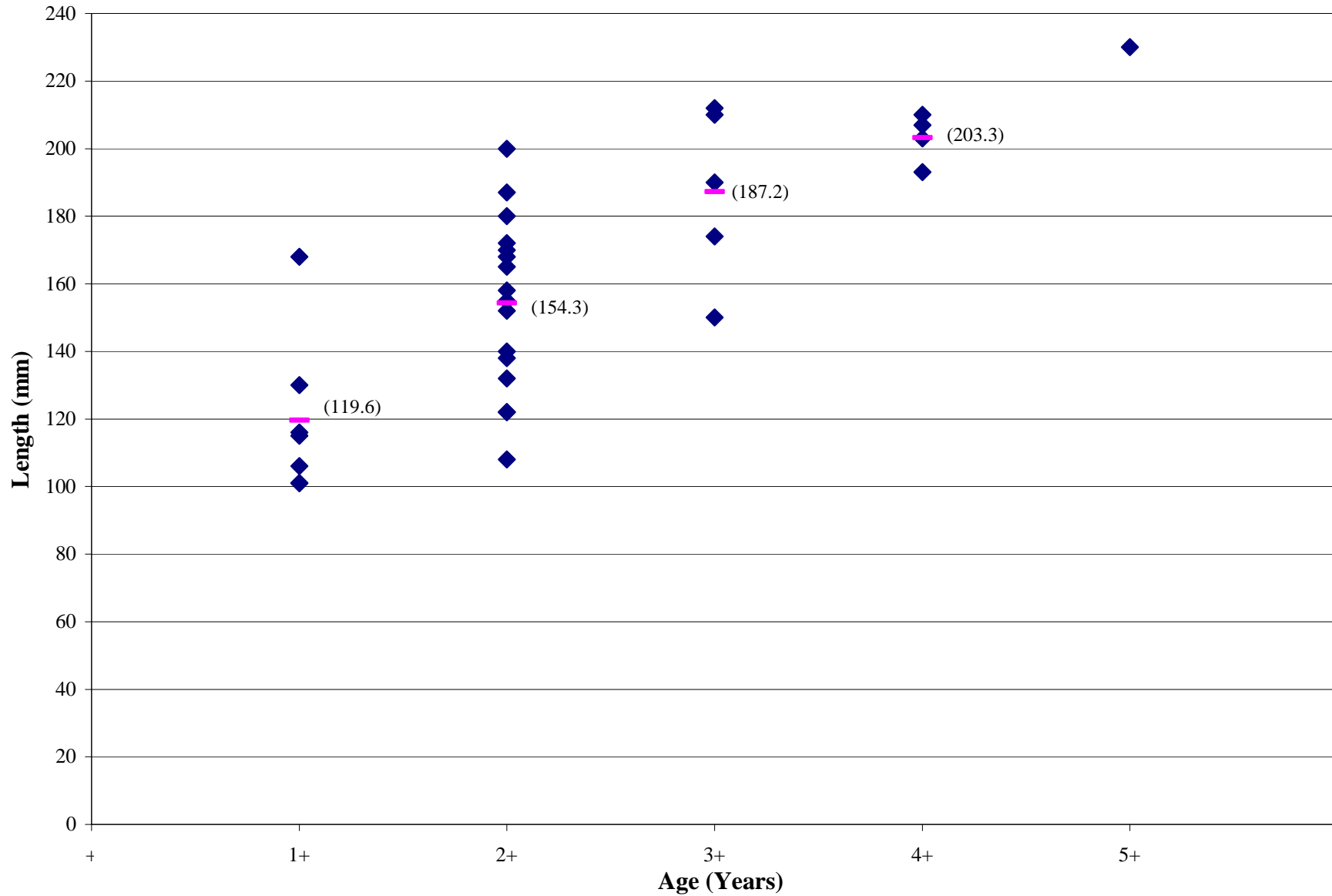
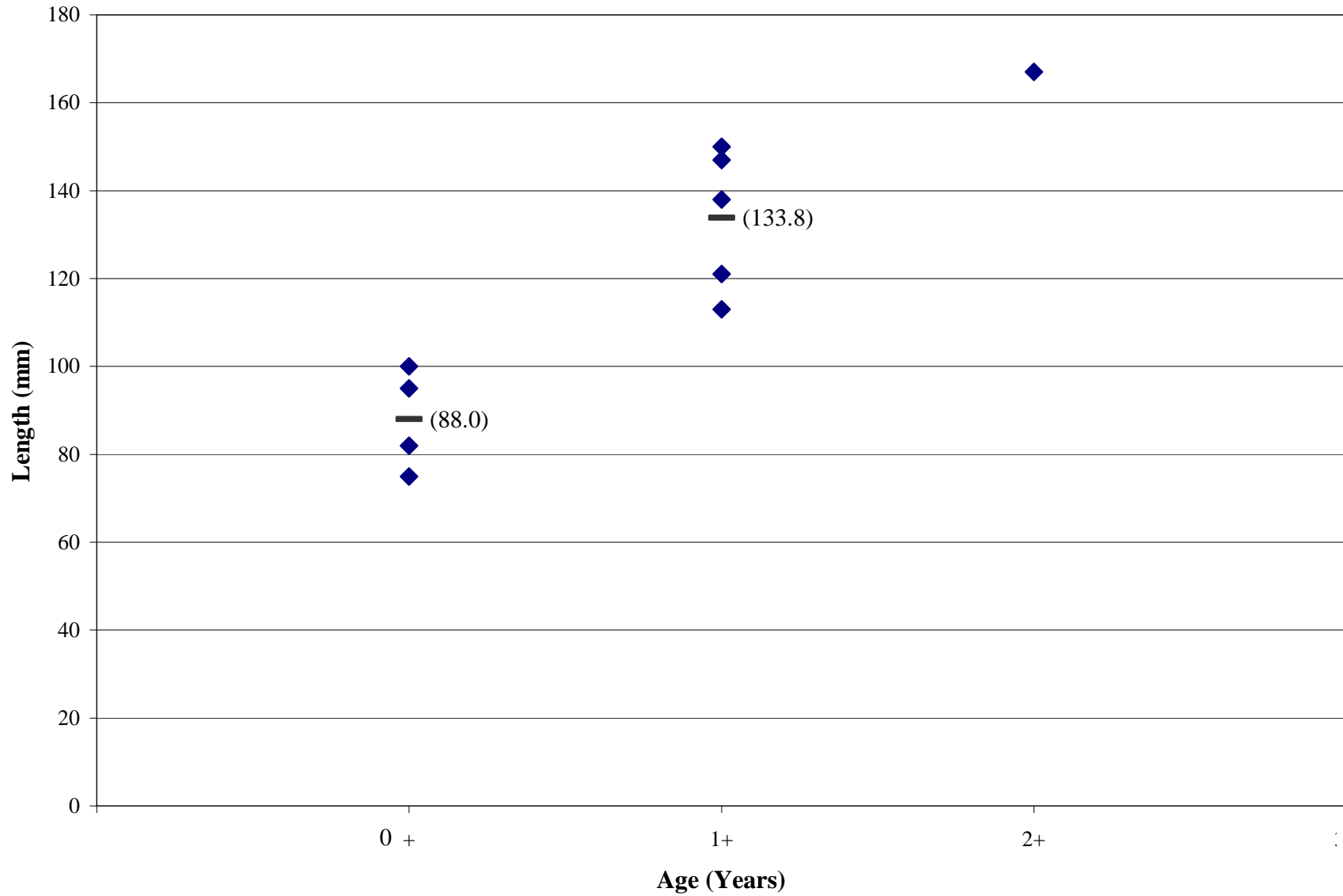


Figure 17. Length-at-age of bull trout based on scale samples taken in the *Lower Bridge River Watershed*, August 9 to September 24, 2000 (n=10).



For example, juveniles and adults, 2+, 3+, 4+ and 5+ individuals, were captured within an area around a headwater lake of the Slim Creek basin. The presence of juveniles and adults in an area localized around a lake suggests that this population will demonstrate an adfluvial life history, where juveniles rear in small tributaries and adults in lakes. The presence of suitable lake habitat within the Gun, Marshall, Camoo, and Moon Creek basins suggests rainbow populations in these systems may also be demonstrating adfluvial life histories. In contrast, the lack of available lake habitat and lack of mature rainbow trout older than 3+ in the lower Bridge River tributaries, below Terzaghi Dam, suggests that rainbow are fluvial, where juveniles rear in small tributaries, such as Applespring and Antoine Creeks, and adults in larger mainstems such as the Bridge River. It is also possible that, in this area, adults were unavailable for capture due to habitat partitioning (adults live in separate areas from juveniles), or sampling gear bias. Although the ageing results do not provide an example of a resident rainbow population, it may be possible that rainbow trout dropping down through high gradient mainstems, such as Bobb and Camoo Creeks, will not be able to migrate to lakes or larger tributaries and may demonstrate a resident life history.

Bull trout also demonstrate three distinct life history strategies; resident, adfluvial, and fluvial. Resident populations are often found in small headwater streams where they spend their entire lives in one area (Rieman and McIntyre 1993), and overwinter in deeper pools (Berry 1994). Resident populations may be separated from others by natural geological barriers or degradation of downstream habitat (Goetz 1989). Resident adults range from 150 to 300 mm in length (Goetz 1989). Adfluvial populations rear in smaller tributaries for one to six years before migrating downstream into lakes or reservoirs as adults. Fluvial populations also rear in smaller tributaries from one to six years, however adults migrate into larger mainstems and tributaries to mature. As adults, bull trout from both migratory life history strategies usually reside in rivers or lakes from two to three years before returning to the smaller tributaries to spawn (McPhail and Baxter 1996; and

Goetz 1989). Migrations can be up to 225 kilometers (Shepard et al. 1984), with migratory fish frequently exceeding 600 mm in fork length (Goetz 1989).

Bull trout are fall spawners, and will spawn at some point from August to November with optimal water temperatures ranging from 5.0°C to 9.0°C (Armstrong and Morrow 1980; Brown 1992; McPhail and Murray 1979; and Shepard et al. 1984). Cutbanks are the primary cover associated with spawning, and redds are noted with average water velocities of 0.35 m/s, and average water depths of 30 cm (McPhail and Baxter 1996). Eggs are deposited in areas with large gravel and hatch in late winter or early spring (March or April), with fry emergence in late April or May.

Scale samples were taken from 10 bull trout within the *Lower Bridge River Watershed*. Ageing results determined that 4 were 0+, 5 were 1+, and 1 was 2+ (Table 9). All bull trout were captured within the Gun Creek basin. The length-at-age data for all sampled fish illustrates the absence of mature bull trout older than 3+ in any of the sampled reaches. This information suggests that bull trout in Gun Creek are part of an adfluvial or fluvial population. However, given the abundance of lake habitat (eg. Gun, Trigger, Hummingbird, and Carpenter Lake) within the Gun Creek area, it seems likely that bull trout are part of an adfluvial population. In support, one unaged adult bull trout (Figure 9), was captured within Walker Creek, an inlet to Gun Lake. This 750 mm bull trout was preparing to spawn, which suggests that this individual had been rearing in a nearby lake, such as Gun or Carpenter, and had migrated to a tributary, Walker Creek, to spawn.

In contrast to rainbow trout and bull trout, life history strategies for eastern brook trout in British Columbia are more difficult to determine, as they are non-indigenous and have adapted to different environments (Tim Yesaki, Head, Biological Services Unit, Ministry of Fisheries, pers. comm.). They demonstrate the most generalized life history strategy of the char species (Ford et al. 1995), and have been noted as both resident and migratory populations. Specifically, they have been found in small headwater streams, as

anadromous populations near the coast, as well as within lacustrine environments from ponds to lakes.

Eastern brook trout are late summer or fall spawners, depending on water temperatures. Fry emergence usually occurs in early spring. As fry emerge from the spawning gravels, they move into the shallow margins of streams, into suitable eddies, or even into mid-stream areas with slower currents. As fish increase in size they expand their territories and take up positions in deeper water. By late summer and early fall immature fish may take up residence in suitable overwintering habitat within the creek (Ford et al. 1995).

One eastern brook trout was captured within the *Lower Bridge River Watershed*. Ageing results determined that this was a 1+ individual (Table 9). As suggested earlier, life history strategies for eastern brook trout can be difficult to determine, especially given the small sample size of fish captured. However, given that sampling occurred at the outlet to Plateau Ponds, it seems likely that this fish is part of a population demonstrating an adfluvial life history. However, their presence in Plateau Ponds is a result of stocking, and generally stocked eastern brook trout are sterile and/or placed in lakes with no outlet (B. Chan, Senior Lakes Biologist, Ministry of Environment, Lands and Parks, *pers. comm.*). Stocking records exist from 1979 – 2000, with average releases of approximately 2,000 fry or fingerlings (MoELP 1999c).

Mountain whitefish are a migratory species demonstrating a plastic life history. Generally, populations rear as juveniles and adults in tributaries, larger streams or shallower lake areas, preferring water depths <3.0 m (Ford et al. 1995). Upon reaching a maturity of 3 or 4 years, adults will undergo extensive migrations to spawning areas. Spawning occurs in the fall or early winter, in gravel and cobble areas of riffle stream sections, or within gravel shoals of lakes. Spawning is nocturnal and no nest is prepared (Scott and Crossman 1998).

Fry generally emerge in early spring, and upon emergence, demonstrate poor swimming abilities (Thompson and Davies 1974). This results in the passive movement into suitable stream or lake margin habitats downstream of spawning areas (Davies and Thompson 1976). Juveniles will migrate with changing flow and habitat conditions, in order to inhabit suitable overwintering areas and avoid summer low flow areas. Adults also undergo seasonal migrations to maximize utilization of habitat. These movements are generally associated with spring feeding, summer feeding, prespawning, and overwintering behaviour (Ford et al. 1995). The mountain whitefish is also a long lived species, attaining a maximum age of 17-18 years (McHugh 1942).

Scale samples were taken from 5 mountain whitefish within the *Lower Bridge River Watershed*. Ageing results determined that 2 were 4+, 1 was 5+, and 1 was 6+ (Table 9). One individual could not be aged. All mountain whitefish were captured within the upper reaches of the Gun Creek basin. The length-at-age data determined that all sampled individuals were mature mountain whitefish, older than 4 years. Given the timing of capture, prior to spawning, it seems that these adults may have undergone migrations from distant adult rearing areas, such as Carpenter Lake. The absence of juveniles from sampling also suggests that the upper reaches of Gun Creek may be used for spawning by migrating adults. Upon emergence fry may have moved passively downstream into suitable stream habitat within the Gun Creek mainstem, or into lake margins within Trigger and Hummingbird Lakes. Juveniles may have also been unavailable for capture due to habitat partitioning, or sampling gear bias.

4.4 SIGNIFICANT FEATURES AND FISHERIES OBSERVATIONS

4.4.1 Fish and Fish Habitat

During field sampling in 2000/2001, a significant fisheries observation was noted within the Slim Creek basin. A 30.0 m high by 60.0 m long cascade (Figure 18) naturally limits the upstream migration of fish from the lower fish bearing reaches of Slim and



Figure 18. *Lower Bridge River Watershed:* Aerial view of a 30.0 m high and 60.0 m long cascade, acting as a barrier on Slim Creek. Site 514, NID Map 92J.096, NID 31,590, ILP Map 92J.096, ILP 782, Reach 1, August 11, 2000.

Gun Creeks. Extensive sampling at six wetted sites (Sites 510, 514, 583, 585, 586, and 587) within the mainstem of Slim Creek and first reach of its tributaries, as well as previous sampling by Griffith (1999), above this barrier, failed to capture any fish. However, a primary survey within an unnamed headwater lake (Lake No. 3102) (Figure 19) (ARC Environmental Ltd. 2001c) of Slim Creek and sampling within four adjacent stream reaches (Sites 588, 590, 708, and 709) above the Slim Creek barrier, determined that rainbow trout (Figure 20) are rearing within this headwater basin. A visual observation at Site 594, also identified a single rainbow trout within the first reach of a tributary to Slim Creek above the barrier and downstream from the headwater lake.

The presence and distribution of these fish in the Slim Creek headwater basin above the barrier is difficult to explain. Not only is this population upstream of a known barrier, but it appears to be limited in its downstream distribution since no rainbow were captured within six sampled reaches located downstream and above the barrier. A query of stocking records from the BC Fisheries release database failed to identify any stocking within the Slim Creek basin, and upon review of the ageing structures, it was determined that these individuals were wild fish (Sue Pollard, Geneticist, Ministry of Fisheries, *pers. comm.*). It appears likely that the headwater lake (Lake No. 3102) was stocked with wild rainbow trout from outside this headwater drainage at some time in the past by the public and is currently limited in its distribution.

An additional significant fisheries observation was noted within the *Lower Bridge River Watershed*. A discrepancy was noted between historical fisheries information and the 2000/2001 fish sampling results. FISS records anecdotally document rainbow trout within Keary Lake, and the reference to which FISS refers (Department of Energy, Mines and Resources 1985b), could not be obtained. Extensive stream sampling within three sites immediately upstream and downstream of the lake suggest that no fish are present. In addition, a primary lake survey of Keary Lake failed to capture fish (ARC Environmental Ltd. 2001a).



Figure 19. *Lower Bridge River Watershed:* Aerial view of the unnamed headwater lake within the Slim Creek basin. ILP Map 92J.095, ILP 232, Reach 3, September 11, 2000.



Figure 20. *Lower Bridge River Watershed:* A representative rainbow trout, age class 4+, captured within a reach adjacent to the unnamed headwater lake within the Slim Creek basin. Site 709, ILP Map 92J.095, ILP 232, Reach 2, September 11, 2000.

Also noteworthy is the observation of significant numbers of crayfish within LaJoie Creek at the outlet to Gun Lake (Site 523). The potential influence of these aquatic invertebrates on local fish is uncertain, however, crayfish are generally known to feed on small fish (Pearse et al. 1987). LaJoie Creek at the outlet to Gun Lake is known for kokanee spawning and there may be an interaction between these crayfish and kokanee fry and/or eggs.

4.4.2 Habitat Protection Concerns

4.4.2.1 Fisheries Sensitive Zones

Two fisheries sensitive zones were identified within the *Lower Bridge River Watershed* study area. Beaver activity, at Sites 549 and 603, has resulted in the damming and seasonal flooding of areas adjacent to known fish bearing reaches. Fish were observed utilizing the shallow flooded area within the fisheries sensitive zone at Site 549.

4.4.2.2 Fish Above 20% Gradients

During field sampling, fish populations were captured at 5 sites with gradients greater than 20%. Rainbow trout were captured at Sites 572 and 578, each with an average gradient of 26%. Sites 572 and 578 were located within the first reaches of tributaries to the lower Bridge River, below Terzaghi Dam. Specifically, Site 578 was located on Camoo Creek, and the capture of rainbow is most likely the result of the stocking, anecdotally reported (B. Jack, Administrator, Xwisten Indian Band, *pers. comm.*), within lakes upstream. In addition, bull trout were captured at Sites 530, 620, and 624, with average gradients of 25%, 20%, and 54% respectively. The capture of fish within Sites 530 (Roxey Creek), and 624 were localized within the first few meters of these reaches. Average site gradients are biased towards the higher gradient sections upstream of these sampling locations. It is therefore unlikely that fish are extensively utilizing habitat where gradients exceed 20% at these sites.

4.4.2.3 Restoration and Rehabilitation Opportunities

One restoration opportunity was identified in the *Lower Bridge River Watershed* study area. A 1.6 m high perched culvert (Figure 13) on Brett Creek (stream crossing structure located on Highway 2028) was identified as limiting the upstream distribution of fish. Rainbow trout were captured immediately downstream of the culvert, and extensive sampling upstream revealed the no fish are present. The culvert is impacting localized habitat by constricting the natural channel width at the crossing, and impacting fish habitat within the Brett Creek basin by restricting rainbow trout access to 2.0 km of potential upstream habitat.

4.5 FISH BEARING STATUS

Within the *Lower Bridge River Watershed* study area, reaches were described as having a fish bearing, suspected fish bearing, non- fish bearing or suspected non-fish bearing status. This information, combined with measurements of channel width and gradient, provided the opportunity to propose a riparian stream class for each reach where a sample site was completed (BC FPC 1995).

Within the study area, 172 reaches were surveyed, 40 (23%) of which were described as fish bearing (1-S1, 16-S2's, 15-S3's, and 8-S4's) (Table 11), 60 (35%) as non-fish bearing (27-S5's, and 33-S6's) (Table 12), and 72 (42%) had no visible channel (NVC) (Table 6).

4.5.1 Fish Bearing Reaches

A total of 40 of the 172 reaches surveyed within the *Lower Bridge River Watershed*, were designated as fish bearing (Table 11). Fish were captured within 30 of these reaches. Of the remaining 10 reaches, 7 were located within the Slim Creek basin, and suspected as fish bearing on the basis of fish capture within a headwater area, 1 was

Table 11. Summary of data from surveyed fish bearing reaches in the Lower Bridge River Watershed, August 9 to September 24, 2000.

Sampled Basin	Site No.	ILP No.	ILP Map No.	Reach No.	Survey Date	Fish Species Captured or Suspected	Average Channel Width (m)	Average Gradient (%)	Water Temperature (°C)	Proposed Stream Class	Comment
Antoine Creek	570	186	92J.090	1	2000/08/31	RB, (BT)	3.9	10	9	S3	Excellent rearing, overwintering, limited spawning. Excellent variety of cover, comprised of deep pools, boulders, and LWD.
Applespring Creek	535	12	92J.090	1	2000/08/22	RB, (BT)	3.2	16	13	S3	Good rearing for juveniles, poor overwintering, limited spawning. Barrier 100 m upstream from mouth will limit fish distribution
Applespring Creek	640	11	92J.090	2	2000/09/20	RB, (BT)	6.7	13	7	S2	Excellent variety and abundance of cover for rearing, excellent substrate for spawning, and excellent overwintering cover available
Bobb Creek	645	281	92J.088	2	2000/09/22	RB	11.6	14	4	S2	Excellent habitat complexity for juvenile and adult rearing. Excellent deep pools and suitable substrate for overwintering. Limited gravels for spawning. Fish dropping down from Bobb Lake
Camoo Creek	578	137	92J.090	1	2000/09/07	RB	2.4	26	13	S3	High gradient site with moderate rearing, overwintering, and spawning habitat. Fish dropping down from stocked lakes upstream
Carpenter Lake Tributaries	521	30	92J.097	1	2000/08/14	RB, (BT), (MW), (CAS), (LSU), (RSC), (CC)	1.5	7		S3	Dry at time of survey. Poor to no fish habitat. Known rainbow trout in lake upstream, suspect fish dropping out of lake during high flows
Carpenter Lake Tributaries	554	130	92J.079	1	2000/08/27	RB, (BT), (CAS), (LSU), (RSC), (CC)	4.0	17	11	S3	Moderate rearing, spawning and good cover. Cover dominated by overstream vegetation, deep pools, and boulders.
Fergusson Creek	506	188	92J.086	3	2000/08/10	RB, (BT), (CAS), (LSU), (RSC), (CC)	21.3	13	11	S1	Moderate rearing habitat, variety of cover, no spawning, fair overwintering. Relatively high gradient, high water velocity, fish dropping down from lake.
Fergusson Creek	641	188	92J.086	10	2000/09/21	NFP	2.9	3	2	S3	Located within community watershed resulting in fish bearing classification. Shocked 700 m, used second sampling method. High gradient section downstream, suspected barrier.
Gun Creek	530	330	92J.096	1	2000/08/15	BT, (RB), (MW), (CAS), (LSU), (RSC), (CC)	13.1	25	7	S2	Moderate cover, poor spawning, moderate overwintering. Usable fish habitat limited to low gradient section near mouth
Gun Creek	537	15	92J.096	1	2000/08/23	RB, (BT), (MW), (CAS), (LSU), (RSC), (CC)	6.0	15	8	S2	Excellent rearing, overwintering, limited spawning. Excellent variety of cover, comprised of deep pools, boulders, LWD and SWD.
Gun Creek	545	7	92J.087	10	2000/08/27	RB, BT, (MW), (CAS), (LSU), (RSC), (CC)	15.6	1	10	S2	Mainstem habitat, providing juvenile rearing in stream margins, adult rearing in mainstem. Fair spawning, and good overwintering
Gun Creek	552	7	92J.087	6	2000/08/24	BT, (RB), (MW), (CAS), (LSU), (RSC), (CC)	15.0	6	8	S2	Mainstem habitat, providing juvenile rearing in stream margins, adult rearing in mainstem. Excellent overwintering, and moderate spawning habitat.

Table 11. Summary of data from surveyed fish bearing reaches in the Lower Bridge River Watershed, August 9 to September 24, 2000.

Sampled Basin	Site No.	ILP No.	ILP Map No.	Reach No.	Survey Date	Fish Species Captured or Suspected	Average Channel Width (m)	Average Gradient (%)	Water Temperature (°C)	Proposed Stream Class	Comment
Gun Creek	553	7	92J.087	16.1	2000/08/30	BT, (RB), (MW), (CAS), (LSU), (RSC), (CC)	8.2	6	4	S2	High elevation reach in alpine area. Moderately turbid water. Good rearing, good spawning and fair overwintering.
Gun Creek	555	183	92J.094	1	2000/08/30	MW, BT, (RB), (CAS), (LSU), (RSC), (CC)	5.3	6	9	S2	High elevation reach with moderately turbid water. Good rearing and overwintering, limited spawning.
Gun Creek	558	7	92J.087	5	2000/08/29	RB, TR, (BT), (MW), (CAS), (LSU), (RSC), (CC)	20.0	4	9	S2	Mainstem habitat, providing juvenile rearing in stream margins, adult rearing in mainstem. Excellent overwintering and spawning habitat. High water velocity.
Gun Creek	566	21	92O.004	1	2000/08/30	(BT), (MW), (RB), (CAS), (LSU), (RSC), (CC)	0.6	1	9	S4	Moderate rearing, poor overwintering, and no spawning habitat. Tributary to known fish bearing stream, rearing habitat available during higher flows.
Gun Creek	568	7	92J.087	16	2000/08/30	MW, (RB), (BT), (CAS), (LSU), (RSC), (CC)	10.1	3	12	S2	Mainstem habitat, providing juvenile rearing in stream margins, adult rearing in mainstem. Excellent rearing, overwintering and spawning habitat.
Gun Creek	603	101	92O.005	1	2000/09/12	BT, (RB), (MW), (CAS), (LSU), (RSC), (CC)	2.1	1	6	S3	Good rearing, poor overwintering, and good spawning. Moderate amounts of cover comprised of boulder, undercut banks, and overstream vegetation.
Gun Creek	605	114	92O.005	1	2000/09/12	MW, RB, (BT), (CAS), (LSU), (RSC), (CC)	9.9	0	9	S2	Good cover for rearing, excellent gravels for spawning, and excellent pools for overwintering. Primarily deep pool, undercut banks, and LWD cover.
Gun Creek	620	17	92O.005	1	2000/09/13	BT, (RB), (MW), (CAS), (LSU), (RSC), (CC)	2.4	20	5	S3	Moderate rearing, poor overwintering, and poor spawning. High gradient site, useable fish habitat limited to low gradient sections of reach
Gun Creek	624	842	92J.096	1	2000/09/13	BT, (RB), (MW), (CAS), (LSU), (RSC), (CC)	0.7	54	7	S4	Poor rearing, no overwintering, and poor spawning. High gradient site, useable fish habitat limited to low gradient sections of reach
LaJoie Creek	523	88	92J.097	1	2000/08/14	RB, (BT), (KO), (CAS), (LSU), (RSC), (CC)	8.6	2	16	S2	Abundant and various cover, excellent spawning, and overwintering. Cover comprised of deep pools, LWD, and overstream vegetation
LaJoie Creek	532	60	92J.086	1	2000/08/16	BT, (RB), (CAS), (LSU), (RSC), (CC)	3.6	7	5	S3	Moderate rearing and spawning, excellent overwintering. Variety of cover comprised of deep pools, boulder, LWD and overstream vegetation.
LaJoie Creek	536	1	92J.096	1	2000/08/22	EB	1.6	2	14	S3	Poor rearing, no spawning, and poor overwintering. Known eastern brook trout in pond.

Table 11. Summary of data from surveyed fish bearing reaches in the Lower Bridge River Watershed, August 9 to September 24, 2000.

Sampled Basin	Site No.	ILP No.	ILP Map No.	Reach No.	Survey Date	Fish Species Captured or Suspected	Average Channel Width (m)	Average Gradient (%)	Water Temperature (°C)	Proposed Stream Class	Comment
Lower Bridge River Tributaries	572	359	92J.090	1	2000/08/31	RB, (BT), (CAS), (LSU), (RSC), (CC), (CH), (CO), (PK), (SK)	3.7	26	10	S3	High gradient site with excellent rearing, overwintering, and good spawning. Overall good alternating cascade-pool habitat
Marshall Creek	509	174	92J.088	2	2000/08/12	(RB), (BT), (MW), (CAS), (LSU), (RSC), (CC)	6.0	12	8	S2	Limited rearing habitat, trace cover, limited spawning and fair overwintering. Culvert acting as barrier downstream.
Moon Creek	670	52	92I.071	2	2000/09/24	RB	1.4	8	7	S4	Excellent rearing, spawning, and overwintering habitats available. Fish dropping down from Moon Lake.
Slim Creek	510	137	92J.095	1	2000/08/11	(RB)	3.7	0	9	S3	Poor rearing, spawning and overwintering. Suspected fish presence resulting from fish captured in headwater lake within Slim Creek
Slim Creek	514	782	92J.096	1	2000/08/11	(RB)	18.0	3	9	S2	Moderate rearing habitat, variety of cover, poor spawning, and poor overwintering. Suspected fish presence resulting from fish captured in headwater lake within Slim Creek
Slim Creek	583	28	92J.094	1	2000/09/10	(RB)	1.1	5	2	S4	Fair rearing, poor spawning and no overwintering. Suspected fish presence resulting from fish captured in headwater lake within Slim Creek.
Slim Creek	585	782	92J.096	6	2000/09/10	(RB)	10.4	1	8	S2	Mainstem habitat, with good variety of rearing cover, excellent overwintering areas, and excellent spawning gravels. Suspected fish presence resulting from fish captured in headwater lake within Slim Creek.
Slim Creek	586	18	92J.094	1	2000/09/10	(RB)	2.2	2	10	S3	Poor rearing, no overwintering, and no spawning habitat. Suspected fish presence resulting from fish captured in headwater lake within Slim Creek
Slim Creek	587	1	92J.094	1	2000/09/10	(RB)	0.9	0	10	S4	Good rearing for juveniles, poor overwintering, no spawning. Suspected fish presence resulting from fish captured in headwater lake within Slim Creek.
Slim Creek	588	155	92J.094	2	2000/09/10	RB	1.4	5	8	S4	Moderate rearing, poor overwintering, and poor spawning. Cover comprised of undercut banks, deep pools, and boulders.
Slim Creek	590	149	92J.094	1	2000/09/10	RB	1.4	11	7	S4	Moderate rearing, poor overwintering, and moderate spawning. Cover comprised of undercut banks, deep pools, and boulders.
Slim Creek	594	248	92J.095	1	2000/09/11	RB	14.6	2	8	S2	Good rearing in deep off channel slough. No spawning, and good overwintering. Cover comprised of boulders, undercut banks and instream vegetation.
Slim Creek	708	288	92J.094	1	2000/09/10	RB	3.7	2	5	S3	Limited rearing habitat, abundance of spawning gravels, and no overwintering

Table 11. Summary of data from surveyed fish bearing reaches in the Lower Bridge River Watershed, August 9 to September 24, 2000.

Sampled Basin	Site No.	ILP No.	ILP Map No.	Reach No.	Survey Date	Fish Species Captured or Suspected	Average Channel Width (m)	Average Gradient (%)	Water Temperature (°C)	Proposed Stream Class	Comment
Slim Creek	709	232	92J.095	2	2000/09/11	RB	4.0	5	7	S3	Moderate cover, poor spawning, and moderate overwintering
Slim Creek	710	232	92J.095	4	2000/09/11	(RB)	1.0	3	9	S4	Good rearing and spawning, and moderate overwintering. Known fish in lake downstream

Note: RB - rainbow trout (*Oncorhynchus mykiss*)

BT - bull trout (*Salvelinus confluentus*)

MW - mountain whitefish (*Prosopium williamsoni*)

EB - eastern brook trout (*Salvelinus fontinalis*)

*KO - kokanee (*Oncorhynchus nerka*)

*CO - coho salmon

*CH - chinook salmon

*SK - sockeye salmon

*PK - pink salmon

*RSC - redbelt shiner (*Richardsonius balteatus*)

*CAS - prickly sculpin (*Cottus asper*)

*LSU - longnose sucker (*Catostomus catostomus*)

*CC - sculpins, general (*Cottus sp.*)

Fish Bearing Channel Width

S2 > 5 to 20 m

Stream Class S3 1.5 ≤ 5 m

S4 < 1.5 m

() - suspected fish presence

* - species not captured in this study

Table 12. Summary of data from surveyed non-fish bearing reaches in the *Lower Bridge River Watershed*, August 9 to September 24, 2000.

Sampled Basin	Site No.	ILP No.	ILP Map No.	Reach No.	Average Channel Width (m)	Average Gradient (%)	Electrofishing Specifications				Other Methods		Proposed Stream Class	Follow-up Sampling (Y/N)	Comments
							Distance (m)	Time (s)	Conductivity (µS)	Water Temperature (°C)	Type	Effort (hr:min)			
Antoine Creek	633	186	92J.090	3	4.1	4	700	1370	190	7	SN	01:23	S5	N	Shocked 700 m, used second sampling method. Identified, velocity barrier (waterfall/chute) acting as barrier downstream on Antoine Creek.
Bobb Creek	647	37	92J.077	1	0.6	18	-	-	50	5	-	-	S6	N	Dry/Intermittent at time of survey, not sampled. No available fish habitat within reach.
Bobb Creek	654	292	92J.088	6	0.8	26	100	172	80	4	SN	00:10	S6	N	Shocked 100 m, entire sampleable area within reach, used second sampling method. No available fish habitat within reach. Gradient section > 35% within reach.
Bobb Creek	656	323	92J.088	1	5.4	30	710	951	110	2	SN	00:15	S5	N	Shocked 700 m, used second sampling method. A 5 m high waterfall and 3 m high cascade acting as barriers within reach. Gradient > 35% within reach, limited residual pool depths, poor rearing.
Camoo Creek	637	137	92J.090	5	2.3	4	700	691	390	9	SN	01:11	S6	N	Shocked 700 m, used second sampling method. Confined and high gradient reach downstream, suspected barrier. No fish caught within beaver dam ponds and stream section, suitable habitat if fish were present.
Camoo Creek	638	137	92J.090	8	0.5	28	325	175	140	3	SN	00:40	S6	N	Shocked 325 m, entire sampleable area within reach, used second sampling method. Gradient > 25% within reach, minimal residual depths. Additional sampling downstream at Site 637 within Camoo Creek, no fish caught.
Carpenter Lake Tributaries	513	30	92J.097	4	1.1	17	-	-	-	-	-	-	S6	N	Dry/Intermittent at time of survey, not sampled. No available fish habitat within reach.
Carpenter Lake Tributaries	569	151	92J.089	2	2.7	6	700	919	100	7	SN	01:15	S6	N	Shocked 700m, used second sampling method. Previously identified waterfall downstream on Fall Creek.
Carpenter Lake Tributaries	629	147	92J.079	1	1.9	26	700	352	110	7	SN	01:10	S6	N	Shocked 700 m, used second sampling method. Gradient > 25% within reach, minimal cover, and minimal residual depths. High gradient downstream within Viera Creek, suspected barrier.
Carpenter Lake Tributaries	661	128	92J.088	2	3.0	21	700	282	200	4	SN	01:05	S6	N	Shocked 700 m, used second sampling method. High gradient section downstream, suspected barrier. Gradient section > 25% within reach.
Cedarvale Creek	574	296	92J.079	3	2.9	7	700	545	50	7	SN	00:15	S6	N	Shocked 700 m, used second sampling method. A 16 m high waterfalls located downstream.
Gun Creek	559	2	92O.004	4	4.6	25	550	385	30	10	SN	00:35	S5	N	Shocked 550 m, entire sampleable area within reach, used second sampling method. Gradient > 25% within reach.
Gun Creek	560	259	92J.094	1	3.2	22	700	271	40	4	SN	00:09	S5	N	Shocked 700 m, used second sampling method. No available fish habitat within reach. Gradient > 30% within reach.
Gun Creek	562	242	92J.094	1	0.8	11	-	-	40	12	-	-	S6	N	Dry/Intermittent at time of survey, not sampled. No fish habitat available within reach.
Gun Creek	577	15	92J.096	4	5.0	8	700	1430	150	4	SN	00:35	S5	N	Shocked 700 m, used second sampling method. A 9 m high waterfalls located downstream.
Gun Creek	607	136	92O.005	4	0.5	13	-	-	-	-	-	-	S6	N	Dry/Intermittent at time of survey, not sampled. No available fish habitat within reach.

Table 12. Summary of data from surveyed non-fish bearing reaches in the *Lower Bridge River Watershed*, August 9 to September 24, 2000.

Sampled Basin	Site No.	ILP No.	ILP Map No.	Reach No.	Average Channel Width (m)	Average Gradient (%)	Electrofishing Specifications				Other Methods		Proposed Stream Class	Follow-up Sampling (Y/N)	Comments
							Distance (m)	Time (s)	Conductivity (µS)	Water Temperature (°C)	Type	Effort (hr:min)			
Gun Creek	609	101	92O.005	4	3.6	7	700	686	40	4	SN	00:40	S5	N	Shocked 700 m, used second sampling method. High gradient section downstream, suspected barrier.
Gun Creek	610	72	92O.005	2	4.1	6	700	947	30	7	SN	00:10	S5	N	Shocked 700 m, used second sampling method. High gradient section downstream, suspected barrier.
Gun Creek	623	600	92J.096	1	2.9	8	700	772	80	8	SN	00:50	S6	N	Shocked 700 m, used second sampling method. Identified 15 m high waterfall downstream on Eldorado Creek.
Gun Creek	628	709	92J.096	1	1.2	34	396	206	70	7	SN	00:10	S6	N	Shocked 396 m, used second sampling method. A 2 m high cascade and 8 m high waterfall located within reach. Gradient > 40% in sections, headwater reach.
Gun Creek	630	85	92J.096	1	0.5	19	-	-	-	-	-	-	S6	N	Dry/Intermittent at time of survey, not sampled. No available fish habitat within reach. Headwater reach with reach section > 20%.
Jones Creek	507	57	92J.088	3	9.3	12	700	919	220	9	SN	00:55	S5	N	Shocked 700 m, used second sampling method. Identified 18 m high waterfall and 2 m high cascade downstream on Jones Creek.
Keary Creek	660	161	92J.078	1	3.2	2	700	1410	30	1	SN	00:10	S5	N	Shocked 700 m, used second sampling method. Additional sampling at Sites 701 & 702, and within Keary Lake (ARC Environmental Ltd. 2001a), no fish caught. Two waterfalls downstream on Keary Creek, one 2 m and one 20 m high.
Keary Creek	662	67	92J.078	6	10.8	1	470	629	10	3	SN	00:15	S5	N	Shocked 470 m, used second sampling method. Two waterfalls downstream on Keary Creek, one 2 m and one 20 m high.
Keary Creek	701	11	92J.088	5	8.0	1	750	437	50	4	MT	15:15	S5	N	Shocked 750 m, used second sampling method. A 2 m high and 20 m high waterfalls identified downstream on Keary Creek. Additional sampling downstream at Site 702, and within Keary Lake (ARC Environmental Ltd. 2001a), no fish caught.
Keary Creek	702	11	92J.088	3	5.7	66	150	210	50	8	MT	30:35	S5	N	Shocked 150 m, used second sampling method. A 2 m high and 20 m high waterfalls identified downstream on Keary Creek. Additional sampling upstream at Site 701, and within Keary Lake (ARC Environmental Ltd. 2001a), no fish caught. An 800 m high cascade located downstream of reach.
LaJoie Creek	527	28	92J.086	3	0.7	21	-	-	-	-	-	-	S6	N	Dry/Intermittent at time of survey, not sampled. No available fish habitat within reach, gradient > 25% within reach.
LaJoie Creek	540	45	92J.086	2	1.1	16	700	526	170	8	MT	25:28	S6	N	Shocked 700 m, used second sampling method. Limited cover, poor overwintering and no spawning areas, minimal residual depths.
LaJoie Creek	639	60	92J.086	4	3.8	34	700	847	70	4	SN	01:55	S5	N	Shocked 700 m, used second sampling method. Gradient > 40% within reach. High water velocity with poor resting areas.

Table 12. Summary of data from surveyed non-fish bearing reaches in the *Lower Bridge River Watershed*, August 9 to September 24, 2000.

Sampled Basin	Site No.	ILP No.	ILP Map No.	Reach No.	Average Channel Width (m)	Average Gradient (%)	Electrofishing Specifications				Other Methods		Proposed Stream Class	Follow-up Sampling (Y/N)	Comments
							Distance (m)	Time (s)	Conductivity (µS)	Water Temperature (°C)	Type	Effort (hr:min)			
LaJoie Creek	642	60	92J.086	5	1.4	10	740	776	30	4	SN	00:10	S6	N	Shocked 740 m, used second sampling method. Additional sampling downstream at Site 639 within Walker Creek, no fish caught, gradient > 40% within reach.
Leckie Creek	563	67	92J.094	1	1.4	12	150	80	20	16	SN	00:20	S6	N	Shocked 150 m, entire reach, used second sampling method. Additional sampling downstream within Site 606, no fish caught. Identified 30 m high waterfall downstream within Leckie Creek.
Leckie Creek	604	446	92J.095	2	9.3	14	700	999	40	6	SN	00:15	S5	N	Shocked 700 m, used second sampling method. A 30 m waterfall downstream on Leckie Creek. Additional sampling downstream within Site 606, no fish caught.
Leckie Creek	606	737	92J.096	3	9.1	2	700	661	30	7	SN	00:20	S5	N	Shocked 700 m, used second sampling method. A 30 m waterfall downstream on Leckie Creek.
Lower Bridge River Tributaries	531	36	92J.071	2	1.0	21	-	-	-	-	-	-	S6	N	Dry/Intermittent at time of survey, not samped. No available fish habitat within reach, gradient > 30% downstream of site.
Lower Bridge River Tributaries	533	205	92J.080	4	2.5	21	700	696	250	10	SN	00:20	S6	N	Shocked 700 m, used second sampling method. Gradient > 25% within reach, minimal cover, high water velocity, minimal residual depths.
Lower Bridge River Tributaries	635	359	92J.090	4	2.7	6	740	1076	110	6	SN	01:01	S6	N	Shocked 740 m, used second sampling method. Confined and high gradient reaches downstream, suspected barrier.
Marshall Creek	659	204	92J.098	3	1.8	18	710	685	80	6	SN	00:50	S6	N	Shocked 700 m, used second sampling method. A 10 m high waterfall downstream on Jim Creek.
Nosebag Creek	657	150	92J.089	4	6.4	21	700	1051	80	2	SN	00:35	S5	N	Shocked 700 m, used second sampling method. A 40 m high waterfall downstream on Nosebag Creek. Gradient section > 25% within reach.
Nosebag Creek	664	29	92J.078	3	3.2	5	810	781	30	7	SN	00:10	S5	N	Shocked 810 m, used second sampling method. A 40 m high waterfall identified downstream on Nosebag Creek.
Sebring Creek	573	154	92J.079	3	3.6	22	450	716	40	8	SN	01:30	S5	N	Shocked 450 m, used second sampling method. Two 15 m high waterfalls located downstream on Sebring Creek. Gradient > 25% within reach.
Slim Creek	579	120	92J.094	1	0.7	1	100	91	10	4	SN	00:10	S6	N	Shocked 100 m, entire reach, used second sampling method. No available fish habitat within reach.
Slim Creek	580	107	92J.094	1	1.2	5	200	175	30	6	SN	00:15	S6	N	Shocked 200 m, entire reach, used second sampling method. No available fish habitat within reach.
Slim Creek	581	100	92J.094	1	8.4	23	-	-	20	1	-	-	S5	N	Not sampled, no available wetted channel. No fish habitat within reach. Channel acting as boulder torrent, water flows under rocky slope. Gradient > 25% within reach.
Slim Creek	582	93	92J.094	1	1.3	12	-	-	10	6	-	-	S6	N	Not sampled, no available wetted channel. Limited cover for rearing, no spawning or overwintering habitat. Minimal residual depths.
Slim Creek	584	19	92J.094	2	2.3	29	700	260	40	5	SN	00:15	S6	N	Shocked 700 m, used second sampling method. A 15 m high Cascade and 20 m high waterfall located downstream within reach. Limited rearing habitat, poor spawning, and fair overwintering habitat.

Table 12. Summary of data from surveyed non-fish bearing reaches in the *Lower Bridge River Watershed*, August 9 to September 24, 2000.

Sampled Basin	Site No.	ILP No.	ILP Map No.	Reach No.	Average Channel Width (m)	Average Gradient (%)	Electrofishing Specifications				Other Methods		Proposed Stream Class	Follow-up Sampling (Y/N)	Comments
							Distance (m)	Time (s)	Conductivity (µS)	Water Temperature (°C)	Type	Effort (hr:min)			
Slim Creek	592	134	92J.094	2	3.2	19	225	345	20	2	SN	00:15	S5	N	Shocked 225 m, entire sampleable area within reach, used second sampling method. Water passes under boulder slope within upper reach, not passable to fish. Overall poor rearing, spawning, and overwintering habitat within lower section of reach.
Slim Creek	593	50	92J.085	1	1.4	22	350	131	10	8	SN	00:30	S6	N	Shocked 350 m, entire sampleable area within reach, used second sampling method. Water passes under boulder slope within upper reach. Cascade and waterfall acting as barriers within reach. Gradient >20%, poor rearing, overwintering and spawning habitat.
Slim Creek	597	50	92J.095	1	3.6	11	400	385	30	5	SN	00:45	S5	N	Shocked 400 m, entire sampleable area within reach, used second sampling method. Water passes under boulder slope within upper reach. High gradient section downstream within mainstem, suspected barrier.
Tommy Creek	649	297	92J.078	4	2.4	1	400	651	10	4	SN	00:30	S6	N	Shocked 400 m, entire reach, used second sampling method. A 30 m high waterfall downstream within Tommy Creek.
Tommy Creek	651	391	92J.078	1	0.6	13	180	67	40	3	SN	00:15	S6	N	Shocked 180 m, entire reach, used second sampling method. A 30 m, high waterfall downstream within Tommy Creek.
Tommy Creek	653	392	92J.078	1	3.6	6	320	585	20	2	SN	00:35	S5	N	Shocked 320 m, entire sampleable area within reach, used second sampling method. Water passes under boulder slope within upper reach. A 30 m, high waterfall downstream within Tommy Creek.
Truax Creek	546	301	92J.087	1	1.3	32	-	-	50	15	-	-	S6	N	Dry/Intermittent at time of survey, not sampled. No available fish habitat within reach, gradient > 30%.
Truax Creek	548	173	92J.087	3	7.3	7	700	1150	40	7	SN	00:30	S5	N	Shocked 700m, used second sampling method. Previously identified waterfall downstream on Truax Creek.
Truax Creek	550	274	92J.087	1	1.0	29	171	94	150	9	SN	00:15	S6	N	Shocked 171m,entire reach, used second sampling method. Additional sampling within Site 548, no fish caught. Previously identified waterfall downstream on Truax Creek.
Truax Creek	643	194	92J.087	1	1.1	8	400	227	100	2	SN	00:20	S6	N	Shocked 400 m, entire reach, used second sampling method. A 3 m high waterfall downstream within Truax Creek. Poor rearing, no overwintering, and no spawning habitat.
Truax Creek	646	220	92J.087	2	3.2	13	700	795	60	4	SN	00:15	S5	N	Shocked 700 m, used second sampling method. A 15 m high cascade within reach, gradient > 20% within reach. A 3 m high barrier downstream within Truax Creek.
Truax Creek	705	331	92J.087	3	1.3	22	700	128	20	3	MT	20:11	S6	N	Shocked 700 m, used second sampling method. A 3 m high waterfall identified downstream on Truax Creek. Additional sampling downstream at Site 706 and within lake (ARC Environmental Ltd. 2001b), no fish caught.

Table 12. Summary of data from surveyed non-fish bearing reaches in the *Lower Bridge River Watershed*, August 9 to September 24, 2000.

Sampled Basin	Site No.	ILP No.	ILP Map No.	Reach No.	Average Channel Width (m)	Average Gradient (%)	Electrofishing Specifications				Other Methods		Proposed Stream Class	Follow-up Sampling (Y/N)	Comments
							Distance (m)	Time (s)	Conductivity (µS)	Water Temperature (°C)	Type	Effort (hr:min)			
Truax Creek	706	331	92J.087	1	6.1	21	35	88	20	7	MT	17:10	S5	N	Shocked 35 m, only sampleable area, used second sampling method. A 3 m high waterfall identified downstream on Truax Creek. Additional sampling upstream at Site 705 and within lake (ARC Environmental Ltd. 2001b), no fish caught.
Warner Creek	712	135	92O.005	2	6.4	5	170	338	40	9	MT	19:15	S5	N	Shocked 170 m, difficult shocking beyond 170 m, used two additional sampling methods. A 20 m high waterfall located downstream on Warner Creek. Additional sampling upstream at Site 713, and within Warner Lake (ARC Environmental Ltd. 2001d), no fish caught.
Warner Creek	713	135	92O.005	4	5.2	0	750	376	50	4	SN MT	01:00 19:55	S5	N	Shocked 750 m, used two additional sampling methods. A 20 m high waterfall located downstream on Warner Creek. Additional sampling downstream at Site 712, and within Warner Lake (ARC Environmental Ltd. 2001d), no fish caught.
											SN	0:30			

Note: EF - electrofishing
 SN - pole seine
 MT - minnow trap

Non-Fish Bearing
 Stream Class S5
 S6

Channel Width
 > 3 m
 ≤ 3 m

located upstream of a perched culvert which is limiting fish distribution, and 1 was contiguous with fish bearing habitat downstream. In addition, 1 site (Site 641) was located in Fergusson Creek, a community watershed, and received an S3 fish bearing designation even though no fish are present. This resulted in the following stream classifications; 1 reach was classified as S1, 16 as S2, 15 as S3, and 8 as S4.

The most frequently capture species was rainbow trout followed by bull trout, mountain whitefish, and eastern brook trout. However, the majority of these reaches were also known and/or suspected to provide rearing, spawning and overwintering habitat for prickly sculpin, longnose sucker, redbelt shiner, and a sculpin species. In addition, one reach was suspected for kokanee, and one tributary reach to the lower Bridge River was suspected for chinook, coho, pink and sockeye salmon. No kokanee, chinook, coho, pink, sockeye, prickly sculpin, longnose sucker, redbelt shiner, or sculpin species were captured during this study. However, previous historical records indicate that these species have been located within the study area and should be suspected in certain areas throughout the watershed.

Average gradients at sample sites ranged from 0% to 17%, with an additional five non-typical sites having average gradients > 20% (see section 4.4.2.2 Fish Above 20% Gradients). These gradients provided large channel, and riffle-pool to step-pool morphology. Amounts of cover ranged from trace to abundant, primarily consisting of boulders, undercut banks, and deep pools. Substrates were primarily comprised of cobbles and gravels (particle size from 2 mm – 256 mm).

4.5.2 Non-Fish Bearing Reaches

A total of 60 of 172 surveyed reaches in the *Lower Bridge River Watershed* were classified as non-fish bearing (Table 12), and 72 sites had no visible channel (Table 8).

A total of 50 non-fish bearing reaches were sampled where extensive sampling confirmed fish absence. The remaining 10 non-fish bearing reaches were not sampled because they were either dry at the time of survey, or had no available wetted channel for sampling. However, they were still designated as non-fish bearing because of confirmed fish absence downstream, known or suspected barriers, and/or lack of fish habitat. Of these non-fish bearing reaches, 27 were classified as S5, and 33 were classified as S6.

4.5.3 Follow-Up Sampling Requirements

The completion of 172 sites (134 random and 38 biased) addresses the entire sampling plan initially identified in Phase III. These 172 sites provide a description of habitat characteristics and fish distribution for the entire *Lower Bridge River Watershed* study area. These results are reflected on the *Project and Interpretive Maps* (Appendix II) and are included in the FDIS database, version 7.3. The *Project and Interpretive Maps* also include sampling results from the four primary lake surveys; *Reconnaissance Lake Inventory of Keary Lake* (ARC Environmental Ltd. 2001a); *Reconnaissance Lake Inventory of Unnamed Lake (3070)* (alias Truax Lake) (ARC Environmental Ltd. 2001b); *Reconnaissance Lake Inventory of Unnamed Lake (3102)* (ARC Environmental Ltd. 2001c); and *Reconnaissance Lake Inventory of Warner Lake* (ARC Environmental Ltd. 2001d).

During a review of the *Interpretive Maps* with Phil Holman (Forest Ecosystem Specialist, MoELP) and Dave Tesch (Fish Inventory Specialist, MoELP), additional sampling was suggested in two stream reaches within the *Lower Bride River Watershed* study area. These proposed reaches include one stream reach within Pearson Creek (ILP Map 92O.006, ILP 15, Reach 3). In 2000/2001 sampling within Reach 1 of Pearson Creek revealed that fish are utilizing habitat up to the road crossing, whereas sampling within Reach 4 revealed that no fish are present. No barriers have been identified on the

mainstem and the fish distribution is suspected up to Reach 2. Sampling within this basin will provide an upstream limit of fish distribution in the basin. In addition, stream sampling and the identification of a barrier within an unnamed tributary to Gun Creek (ILP Map 92O.005, ILP 72, Reach 1) will provide a better understanding of the fish distribution within this basin. Sampling in 2000/2001 revealed that no fish are present within Reach 2, and no barriers were identified between the sample site and the suspected limit of fish distribution in Reach 1.

5.0 GLOSSARY

Adfluvial – Life history strategy where individuals from the population will migrate to lakes to mature and rivers or streams to spawn and rear. Compare *fluvial* and *resident*.

Age class – A group of individuals of a species that have the same age.

Ageing structures – A morphological structure taken from an individual fish for the purpose of determining its age (e.g. scale, fin ray, otolith).

Anadromous – Moving from the sea for maturing to fresh water for reproduction.

Bankfull width – See *channel width*.

Basin – See *drainage area*.

Bed – The floor of a stream channel.

Bed Material – See *substrate*.

Boulders – Substrate particles greater than 256 mm in diameter. Compare *gravels*, *fines*, and *cobbles*.

Cascade – Stream segment with a stepped series of drops characterized by exposed rocks and boulders, high gradient, swift current, and much turbulence. Compare *riffle*, *pool*, and *glide*.

Cascade-pool – The morphology of the channel as indicated by the dominant cascade and pool segments within the channel. Compare *riffle-pool*, and *step-pool*.

Channel – Natural or artificial waterway of perceptible extent that periodically or continuously contains moving water. It has a defined bed and banks that serve to confine water.

Channel Morphology – See *morphology*.

Channel width (also *bankfull width*) – The distance of a stream channel between the tops of the streambanks as measured at right angles to the orientation of the banks. Compare *wetted width*.

Char – Species of the genus *Salvelinus*.

Cobble – Substrate particles 64-256 mm in diameter. Compare *finer*, *gravels*, and *boulders*.

Conductivity – The ability of a solution to carry electric current.

Confinement – The ability of a channel to migrate laterally on a valley flat between surrounding slopes.

Cover (also *instream cover*) – A structure in the wetted channel or within 1 m above the water surface that provides hiding, resting or feeding places for fish (e.g. deep pool, *boulder*, overstream vegetation, *cutbanks*, *large woody debris*, *small woody debris*).

Cutbanks – Streambanks where the base is cut away by the water and overhangs part of the stream.

Dipnetting – Fish sampling technique where hand-held nets are dipped into streams. Compare *electrofishing*, *minnow trapping*, *gillnetting*, *pole seining*.

Drainage area (also *basin*; *watershed*) – Total land area draining to any point in a stream, as measured on a map or aerial photo.

Eddy – Circular current of water, sometimes quite strong, diverging from the main current. It usually forms where the flow passes some obstruction or at the inside of river bends, and often forms backwater pools or pocket of water in riffles.

Electrofishing – Fish sampling technique where an electric current is passed through the water to attract and stun fish. Compare *minnow trapping*, *gillnetting*, *dipnetting*, and *pole seining*.

Escapement – That portion of an anadromous fish population that escapes the commercial and recreational fisheries and reaches the freshwater spawning grounds.

Features – Significant structures (e.g. bridges, culverts), natural landmarks (e.g. waterfalls, beaverdams) or anthropogenic influences (e.g. hatcheries, fishways) within the study area that are of concern to fish populations, fish habitat, or the inventory.

Fines – Sediment with particle sizes of 2 mm and less, including sand, silt, and clay.

Compare *gravels*, *cobbles*, and *boulders*.

Fisheries sensitive zones – A flooded depression, pond, or swamp (but not a stream, wetland, or lake) which either perennially or seasonally contains water, and which is seasonally occupied by a species listed in the definition of fish-stream under the Forest Practices Code.

Fluvial – Life history strategy where individuals from the population will migrate to main rivers to mature and smaller tributaries to spawn and rear. Compare *adfluvial* and *resident*.

Fork length – Measurement of length (in mm) for a fish from nose tip to fork of tail.

Fry – Life stage of trout and salmon after full absorption of the yolk sac and a somewhat arbitrarily defined fingerling or parr stage, which generally is reached by the end of the first summer. Compare *yearling*, and *smolt*.

Gillnetting – Fish sampling technique where nets are suspended in the water column and passively used to capture fish swimming into the meshes of the net. Compare *electrofishing*, *minnow trapping*, *dip netting*, and *pole seining*.

Glide – Slow, relatively shallow stream section with water velocities of 10-20 cm/s and little or no surface turbulence. Compare *riffle*, and *pool*.

Gradient – Average change in vertical elevation per unit of horizontal distance.

Gravel – Substrate particles between 2 and 64 mm in diameter. Compare *finer*, *cobbles*, and *boulders*)

Habitat sequences – See *habitat units*.

Habitat units (also *habitat sequences*) – The strata within a stream reach that consist of distinct, naturally-occurring fish habitat types (e.g. *riffle*, *pool*, and *glide*).

Headwater – The tributaries or other waters that form the source of a river.

Instream cover – See *cover*.

Lacustrine – Of or having to do with a lake.

Large Woody Debris (LWD) – Any large piece of woody material that intrudes into a stream channel, whose smallest diameter is greater than 10 cm, and whose length is greater than 1 m. Compare *small woody debris*.

Life history – The series of events within a life cycle that characterize the existence and development of an organism from its earliest stages to its death as a mature adult (e.g. *fluvial*, *adfluvial*, and *resident*).

Mainstem – Principal stream or channel of a drainage system. Compare *tributary*.

Minnow trapping – Fish sampling technique where baited net or wire enclosure traps are set in streams and lakes. Fish enter through funnel shaped openings and once inside find it difficult to escape. Compare *electrofishing*, *dipnetting*, *pole seining*, *gillnetting*.

Morphology (also *channel morphology*) – The general shape of the channel as indicated by the processes dominating the channel (e.g. *riffle-pool*, *cascade-pool*, and *step-pool*).

Off-channel – Channel structure that lies adjacent to the main stream channel and provides seasonal refuges or rearing areas for fish (e.g. pools, sidechannels, oxbows, and other backwaters accessible at high discharge). Compare *primary channel*, and *secondary channel*.

Order – A number, ranked from headwaters to river terminus, that designates the relative position of a stream or stream segment in a drainage basin. For example, first order streams have no discrete tributaries; the junction of two first order streams produces a second order stream; the junction of two second order streams produces a third order stream; etc.

Pattern – The path of the channel banks in relation to a straight line.

pH – A measure of the hydrogen-ion activity in a solution, expressed as the negative \log_{10} of hydrogen ion concentration on a scale of 0 (highly acidic) to 14 (highly basic); a pH of 7 is neutral.

Pole Seining – Fish sampling technique where nets are deployed to enclose a specific area of the stream. Compare *electrofishing*, *minnow trapping*, *gill netting*, and *dipnetting*.

Pool – Portion of a stream with reduced current velocity, often with deeper water than surrounding areas and with a smooth surface. Compare *glide*, and *riffle*.

Primary channel – The main stream channel. Compare *off-channel*, *secondary channel*.

Reach – Section of stream that demonstrates a generally homogenous channel structure (e.g. *morphology*, *pattern*, *confinement*, *order*, riparian vegetation), and differs in structure from adjacent upstream and downstream sections.

Redd – Nest made in gravel, consisting of a depression hydraulically dug by a fish for egg deposition (and then filled) and associated gravel mounds.

Resident – Life history strategy where individuals from the population spend their entire lives within smaller (usually headwater) tributaries. Compare *adfluvial*, and *fluvial*.

Riffle – Shallow section of stream or river with rapid current and a surface broken by gravel, cobble, or boulders. Compare *glide*, and *pool*.

Riffle-pool – The morphology of the channel as indicated by the dominant riffle and pool segments within the channel. Compare *cascade-pool*, and *step-pool*.

Secondary channel – The minor channels that are isolated from the main channel by vegetated islands. Compare *primary channel*, and *off-channel*.

Sediment – Fragments of rock, soil, and organic material transported and deposited in beds by wind, water, or other natural phenomena. The term can refer to any size of particles but is often used to indicate only fragments smaller than 6 mm.

Small Woody Debris (SWD) – Any debris with a diameter <10 cm which provides in-channel cover for fish. Compare *large woody debris*.

Smolt – Juvenile salmonid one or more years old that has undergone physiological changes to cope with a marine environment; the seaward migrant stage of an anadromous salmonid. Compare *fry* and *yearling*.

Stage – Amount of water passing through the stream channel.

Step-pool – The morphology of the channel as indicated by the dominant step and pool segments within the channel. Compare *cascade-pool*, and *riffle-pool*.

Substrate (also *bed material*) – Mineral or organic material that forms the bed of a stream.

Tributary – Stream flowing into a lake or larger stream. Compare *mainstem*.

Turbidity – The measure of the clarity of water which may reflect the concentration of suspended sediments [eg. clear water is described as having a low turbidity, whereas water with limited visibility is described as turbid (RIC 1998a)].

Watershed – See *drainage area*.

Wetted width – The width of the wetted portion of the stream channel. Compare *channel width*.

Yearling – A 1 year-old individual in its second year of life. Compare *fry*, and *smolt*.

The majority of these definitions were extracted from the following sources: Johnston and Slaney (1996); Meehan (1991); Resource Inventory Committee (1997); and Resource Inventory Committee (1998a).

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