OVERVIEW
FISH HABITAT ASSESSMENT
BRIDGE CREEK WATERSHED
(129-3604-239-984-995)

Final

Prepared for:

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Executive Summary

An Overview Fish Habitat Assessment was conducted on the Bridge Creek watershed to determine the target fish species, assess fisheries habitat, identify forest related limiting factors of fish production and identify potential areas for higher level assessments and potential for fish habitat restoration. The target species for the watershed was identified as rainbow trout (*Oncorhynchus mykiss*). Barriers to fish passage (culverts) were identified as an immediate limitation to the target species.

No major impacts from forest harvesting activities were identified. The majority of significant changes to stream morphology and chemistry are attributed to urban development and private land use. Due to a large portion of the study area containing private land, any fish habitat restoration work will require sources of funding other than WRP, as well as the cooperation of the landowners.

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1.0 Introduction

Ainsworth Lumber Co. Ltd. of Savona, B.C. contracted BioTerra Consulting (Inland Timber Management Limited) of Williams Lake, B.C. in November 1997, to conduct an Overview Fish Habitat Assessment of the Bridge Creek watershed. Additional studies conducted on this watershed include an Interior Watershed Assessment Procedure.

This project was initiated by Ainsworth Lumber Co. Ltd. with the assistance of the Ministry of Environment, Lands and Parks, to assess the current state of the fish and fish habitat resource values within the Bridge Creek watershed. This information will be used to develop and implement effective, integrated, cost efficient projects at the watershed scale to rehabilitate and/or restore fishery resources that have been adversely impacted by past forestry practices.

2.0 Background and Study Area

Bridge Creek watershed drains approximately 1550 km^2, with 2640 kilometers of roads including deactivated roads (McElhanney Consulting Services Ltd., 1997). There are approximately 1586 kilometers of stream within the study area, including intermittent or ephemeral streams (McElhanney, 1997).

Bridge Creek watershed (Figure 1) is in several Biogeoclimatic zones. These include Engelmann Spruce - Sub-alpine Fir (ESSF) variant dc2, Interior Douglas-fir (IDF) variants mw2 (small part at Canim Lake) and dk3, Sub-boreal Pine Spruce (SBPS) variant mk, and Sub-boreal Spruce (SBS) variants mc1 and dw1. ESSF is typified by a short growing season and long cold winters. SBS forests are moderately productive, but endure a severe climate (cold). SBPS zones are also identified by a cold, dry climate, and contain numerous wetlands. IDF is a warmer zone than the previously mentioned areas. It is dry, and subject to fires.

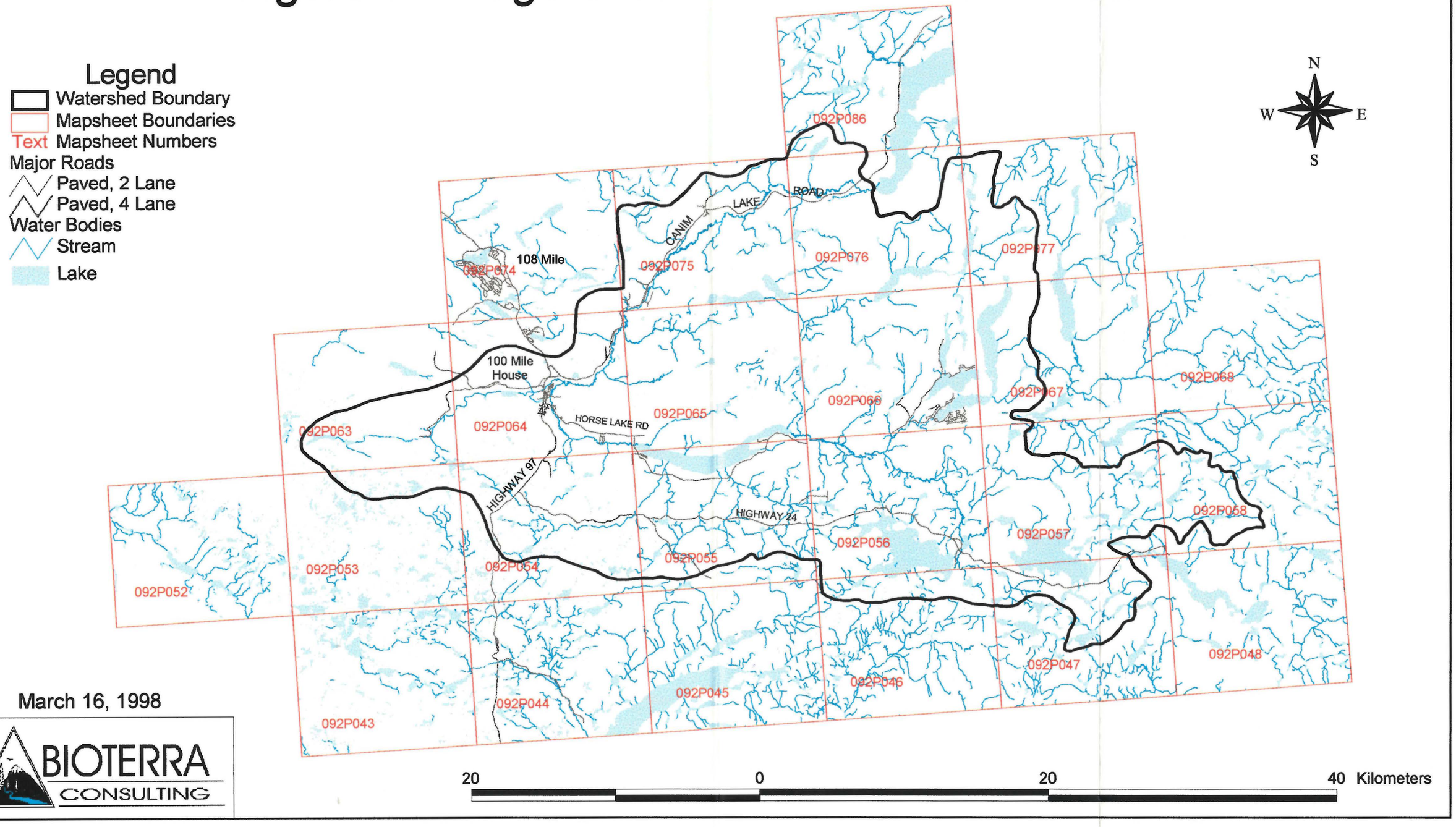
The watershed is located in the Central Interior Ecoprovince, Fraser Plateau Ecoregion, and the Cariboo Plateau and Cariboo Basin ecosections. The Fraser Plateau is typically a flat and gently rolling country with large areas of undissected upland (Holland, 1976). The eastern section of the study area rises to approximately 1800 meters.

The majority of the study area is accessible by 2-wheel drive vehicle, due to the high proportion of private land within the watershed. The Canim Lake road turns east off Highway 97, approximately 5 kilometers north of 100 Mile House, and provides access to the lower portion of the watershed. To access the upper reaches of Bridge Creek, use the Horse Lake Road (off Highway 97 in 100 Mile House) or Highway 24 (off Highway 97 approximately 10 kilometers south of 100 Mile House).

The majority of the study area is within the Interlakes Special Resource Development Zone (SRDZ) as according to the Cariboo-Chilcotin Land Use Plan (CCLUP) (Government of British Columbia, 1995). Within this area, it is the mandate of the plan to manage the Bridge Creek watershed for hydrologic stability through watershed assessment and monitoring programs. The CCLUP states that there should also be management for riparian habitats through the establishment of riparian management zones on all streams, lakes and wetlands as specified under the Forest Practices Code and Riparian Guidelines.

Extensive harvesting during the early 1960s to 1970s has occurred within the study area. The Ainsworth mill operates along Little Bridge Creek, west of 100 Mile House. The majority of harvesting has occurred in the headwaters of the watershed. Harvesting by major licensees is limited due to the large amount of privately owned land along Bridge Creek mainstem and many of the tributaries. Forest users include Ainsworth Lumber Co. Ltd., Lignum Limited, Weldwood of Canada Ltd., and the Small Business Forest Enterprise Program.

Figure 1. Bridge Creek Watershed Overview



March 16, 1998

BIOTERRA CONSULTING

3.0 Overview Assessment

The Overview Fish Habitat Assessments followed the procedure outlined by Johnston and Slaney (1996) in Watershed Restoration Technical Circular No. 8. The following section outlines specific details of the methodology as it pertains to the Bridge Creek Fish Habitat Assessment.

The objectives of the overview assessment were to:

- determine target fish species;
- assess fisheries habitat from available maps and air photo analysis;
- identify forest related limiting factors on fish production; and
- identify potential areas for higher level assessment and potential for fish habitat restoration.

3.1 Methodology

All FISS data (1:20,000 scale maps) was reviewed to determine species present, barriers, and areas of fisheries significance. Development plans for the area were studied, and areas of harvesting near streams were identified. Currently, there is little ability to conduct restoration activities on privately owned land under present guidelines of the Watershed Restoration Program, and other funding avenues may be needed to address the large scale of private land impacts which dominate this watershed. Therefore, streams with a high percentage of private land were not assessed unless existing fisheries information suggested high value. Based on this criteria, specific areas of the watershed were chosen for further assessment. The following methodology applies to those areas.

A literature and Internet search for background information on Bridge Creek was conducted. The following were contacted for data:

- Environment Canada for hydrometric data
- BC Conservation Data Centre for rare vertebrate animals found in the 100 Mile House Forest District
- Ministry of Environment, Lands and Parks for results of the Interior Watershed Assessment Procedure, inventory reports, and water quality information
- Watershed Database Query page for watershed codes pertaining to the Bridge Creek system
- Maurice Lirette and Darin Sollitt, Ministry of Environment, Lands and Parks.

Forest development plans, obtained from Ainsworth (100 Mile) were also consulted. Data from the Fish Information Summary System (FISS) was obtained from the Internet and available FISS mapsheets. The FISS data was summarized for all assessed reaches and entered into Form 1 - Fish Distribution Summary Form (in FHAP manual). Pertinent FISS data (i.e., significant/sport species present, barriers, and upper limits) were transcribed onto 1:20,000 scale TRIM maps for digital mapping. Watershed codes were also transferred to 1:20,000 scale mapsheets using the UTM coordinates provided. Watershed codes appear only for those tributaries significant to fisheries or having possible fish values.

Reach breaks were identified using 1:20,000 scale TRIM maps, which provided contour information, and confirmed by 1:15,000 scale aerial photography. After initial reach break determination, an aerial video was conducted over selected watersheds within the study area. The video was recorded on October 30, 1997, using VHS format tapes and a video recording system supplied by Northern Mountain Helicopters of Williams Lake. The information provided by the overflight and video was used in conjunction with the air photos and TRIM maps to refine the reach breaks. However, those streams with high canopy closure were still difficult to assess. Criteria for reach breaking were primarily based on channel confinement and stream pattern, and to a lesser degree on gradient changes and discharge.

Reach breaks were assigned to each stream, and linked to the stream's watershed code. Each system was numbered beginning at one (1) for its most downstream reach, and continued sequentially to the upper most reach.

The upper and lower elevation of each reach was determined using 20 meter contour lines on the 1:20,000 TRIM mapsheets. The length of each reach was determined by GIS. Percent gradient was determined by dividing the difference in elevation between the upper and lower points of the reach by the length of the reach and multiplying by 100. Gradients were recorded in the Habitat Condition Summary - Form 2 to one decimal place. Channel types, disturbance types, barriers, pools code, large woody debris (LWD) codes, canopy closures and offchannel habitats were assessed using the 1:15,000 scale aerial photography, and the results entered into Form 2. Many channel types were based on gradient, as detail was not easily seen on the scale of photos available. Guidelines set out in the Forest Practices Code Channel Assessment Procedure Field Guidebook (December 1996) were consulted along with the air video.

Upon completion of aerial photo interpretation, all data was analyzed and major impacts on salmonid habitat within selected reaches were identified (Form 3 - Overview Assessment - Preliminary Habitat Evaluation Form). The majority of impacts were related to urban and agricultural development; therefore, the impacts column in Form 3 has included these impacts (e.g. water usage, urban development). This is to address the limitations of Table 2 (FHAP manual) which only references instream impacts which, at times, were difficult to assess from the limited view of the stream channel (i.e. high canopy cover).

3.2 Results and Discussion

3.2.1 Streams identified for assessment

Based on the methodology outlined at the beginning of section 3.1, the following streams were identified as significant and requiring a detailed Overview assessment (Table 1).

Table 1. Streams identified for an Overview Fish Habitat Assessment Procedure within the Bridge Creek watershed study area.

Stream (Watershed code)	UTM	Rationale
Bridge Creek mainstem (129-3604-239-984-995)	10.645403 5737401	Mainstem of stream comprising watershed (study area).
Little Bridge Creek (129-3604-239-984-995-465)	10.619491 5723609	Past harvesting (1995-1997), proposed harvesting 2001.
Judson Creek (129-3604-239-984-995-840)	10.5714724 649145	Past harvesting (1980s to 1992), proposed harvesting 2002.
Donald Creek (129-3604-239-984-995-985)	10.5707831 659240	Past harvesting (1978-1982), proposed harvesting 2000 and 2002.
O'Neil Creek (129-3604-239-984-995-760)	10.5716654 642931	Past harvesting (1976 and 1992), proposed harvesting. Presence of eastern brook trout (unique).

3.2.1 Stream summaries

The following sections describe the data collected during the literature search, aerial photo interpretation, and the overflight. Summaries of fish distribution (Form 1) are presented in Appendix 1. The habitat condition summaries (Form 2) for all streams studied are in Appendix 2, and the preliminary habitat assessment forms (Form 3) are in Appendix 3. A review of all available data indicated the presence of 13 fish species in the study watersheds. Table 2 lists these species. There are no red or blue listed species.

Target Species and Distribution

The target species identified as the candidate species for restoration efforts is rainbow trout. A review of all data and personal communication with MOELP staff has provided a picture of widespread distribution of rainbow trout. It is believed that the majority of these fish originated from the many large lakes within this watershed, and are recruited to the mainstem of Bridge Creek and its many tributaries.

Table 2. Species list for streams studied within Bridge Creek watershed. Abbreviated codes are included. Salmonid species are highlighted.

Watershed name	Species	Common name	Abbreviation
Bridge Creek	*Oncorhynchus mykiss*	rainbow trout	RB
	Oncorhynchus nerka	kokanee	KO
	Salvelinus namaycush	lake trout	LT
	Lota lota	burbot	BB
	Catostomus macrocheilus	largescale sucker	CSU
	Richardsonius balteatus	redside shiner	RSC
	Catostomus catostomus	longnose sucker	LSU
	Ptycheilus oregonensis	northern squawfish	NSC
	Mylocheilus caurinus	peamouth chub	PCC
Little Bridge Creek	*Oncorhynchus mykiss*	rainbow trout	RB
	Catostomus catostomus	longnose sucker	LSU
	Coregonus clupeaformis	lake whitefish	LW
	Ptycheilus oregonensis	northern squawfish	NSC
	Couesius plumbeus	lake chub	LKC
	Richardsonius balteatus	redside shiner	RSC
O'Neil Creek	*Oncorhynchus mykiss*	rainbow trout	RB
	Salvelinus malma	eastern brook trout	EB
	Couesius plumbeus	lake chub	LKC
Donald Creek	*Oncorhynchus mykiss*	rainbow trout	RB
	Oncorhynchus nerka	kokanee	KO
	Lota lota	burbot	BB
	Catostomus commersoni	white sucker	WSU
	Catostomus catostomus	longnose sucker	LSU
Judson Creek	*Oncorhynchus mykiss*	rainbow trout	RB
	Catostomus catostomus	longnose sucker	LSU

3.2.1.1 Bridge Creek (129-3604-239-984-995)

Extensive assessment and fisheries information exists for this system. The target species of concern for Bridge Creek was rainbow trout. Major lakes include Sheridan, Bridge, Horse, Deka, Sulphurous, Buffalo and Canim. A summary of sportfishing significance based on angler days for these lakes and others found in the study area is presented in Appendix 4.

Rainbow trout must compete with a presumed dominance of non-game fish species in this system. Bridge Creek is dominated by extensive, monotypic habitat, which includes low gradient glides and pools associated with an irregular stream pattern and extensive beaver activity. The preferred habitat for rainbow trout typically includes channel types with complexity, including LWD, riffle-pool sequences and associated spawning gravel. These areas are limited within the mainstem of Bridge Creek. Reaches identified from the Overview as containing these characteristics (reaches 4, 12, 14, 19 and 21) were assigned high fish values. The dominant morphology found within Bridge Creek is preferred by non-gamefish species however two year plus rainbow trout are suspected to utilize these areas for rearing habitat (Lirette, pers. comm.).

Several management and enhancement activities have taken place in the Bridge Creek mainstem. Spawning gravel was placed at the inlet to Lesser Fish Lake and the channel connecting Lesser Fish Lake with Bridge Lake to enhance spawning opportunities for kokanee salmon (Anon, 1987). Gravel was also placed in the channel between Bridge Lake and Stack Lake. Stream cleaning has occurred from Horse Lake 13.4 kilometers upstream (reaches 17 and 18). Spawning gravel placement and juvenile outplant of 200,000 eyed rainbow trout eggs occurred in Bridge Creek within the 100 Mile House city limits (reach 11) during 1990 (Anon, 1996). Beaver dam removal from Horse Lake to the crossing at old Deka Creek school to facilitate kokanee spawning has also occurred.

Many fisheries constraints exist within the Bridge Creek mainstem. These constraints can be linked to private land (e.g., high water usage, urbanization, pollution, cattle impacts, and removal of riparian vegetation). These constraints are believed to impact water quality and are concentrated within the portion of stream between Horse Lake and Canim Lake. Major bank or valley sidewall failures exist; some are from natural erosion, while others are linked to cattle access or removal of riparian vegetation (agriculture).

Barriers or potential barriers to fish migration exist within the mainstem of Bridge Creek. These barriers include beaver dams, which are concentrated within the low gradient meandering reaches which dominate the stream. A series of falls are present in the portion of stream flowing through 100 Mile House (reach 12). The downstream falls is 6.0 meters high, while the remaining two are 2.0 meters high. These falls limit the upstream migration of all fish. A man-made barrier to non-game species exists near the inlet to Lesser Fish Lake. The purpose is to prevent these species from entering Bridge Lake. The barrier is a log structure, approximately 0.45 meters high, which spans the channel (Lirette, pers. comm.).

Hydrometric data (1974-1996)(Appendix 5) was available for a station established at the outlet of Horse Lake on the Bridge Creek mainstem (Environment Canada, 1998). Low flow occurs during the month of January (average 0.912 m^3/sec), and highest flows occur in May (average 5.78 m^3/sec), attributed to spring runoff. Environment Canada discontinued the Bridge Creek station in 1996. Peak flow hazard indices were calculated for the watershed during the IWAP (McElhanney, 1997). However, an accurate comparison between hazard indices and hydrometric data can not be completed due to differences in the study area (sub-basin) boundaries used.

Reach Descriptions

Reach 1:

Mapsheet: 092P 076
Air Photo: 30BCC95084 No.22

This reach flows into Canim Lake after flowing through a large agricultural region (south of Canim Lake road) containing a network of irrigation ditches running parallel to the main channel. The irrigation ditches are likely used as off-channel rearing habitat. Preferred habitat for rainbow trout is not present, due to a lack of LWD and channel complexity. Limited LWD is due to a lack of mature coniferous and deciduous trees resulting from agricultural clearing in the riparian area. The channel morphology is monotypic, consisting primarily of extensive glides with pools lacking cover. The substrate is dominated by fines, effectively eliminating reach 1 as favourable spawning habitat for salmonid species, although adequate spawning for non-gamefish species may be present.

Reaches 2 and 3:

Mapsheet: 092P 075&076
Air Photos: 30BCC95084 No. 24to29

An irregular meander stream pattern dominates these reaches. Agricultural activities have altered the riparian area, resulting in a dominant shrub structure. An abundance of off-channel habitat exists, including isolated channels and short sidechannels (primarily in reach 2). Beaver activity was concentrated at the start of reach 2. Reach 2 is unconfined, while reach 3 becomes occasionally confined. Disturbance indicators (mid-channel bars and sediment wedges) were identified above the Canim Lake road crossing within reach 3, and are likely due to sediment transported from reach 4. A Level 1 assessment of this area is recommended to quantify the impact of sediment transportation (concentrated in the upper limits of reach 3) to fish habitat.

Reach 4:

Mapsheet: 092P 075
Air Photos: 30BCC95084 No. 30

This reach contains preferred habitat for rainbow trout due to the presence of riffle-pool sequences and spawning gravel (noted on air video). Gradient also increases, but is not depicted in Form 2 average gradient calculations. Sections of this reach contain gradients >4.0%. There is a marginal increase in cover (LWD and riparian). The channel becomes confined by steep valley walls. Due to fine soils and the steep valley walls within this reach, the removal of the coniferous forest (logging on the upper plateau of the reach) is believed responsible for an accelerated rate of erosion. A Level 1 assessment is proposed to address suspected impacts to this reach from forest harvesting.

Reaches 5-10:

Mapsheet: 092P 064&075
Air Photos: 30BCC95067 No. 147, 30BCC95077 No. 73&145, 30BCC95079 No. 175to177.

These reaches are grouped together due to a repetitive stream morphology, including pattern, confinement and gradient. These reaches contained low to moderate habitat value for rainbow trout due to a monotypic morphology dominated by extensive glides and a lack of LWD. Few areas exist within these reaches that contain extended riffle-pool patterns. Beaver activity and bank erosion were present. The low gradient and suspected higher temperatures due to a lack of riparian cover provide suitable habitat for non-game species such as suckers and redside shiners. Buffalo Creek is a major tributary that enters the mainstem (reach 7) from the east (UTM 10.624319, 5727647). Buffalo Creek is known to contain rainbow trout. No overview

assessment was conducted on Buffalo Creek due to the high concentration of private land and low forest harvesting related impacts noted on the Forest Development Plan maps.

Reaches 11 and 12:

Mapsheet: 092P 064
Air photo: 30BCC95079 No. 41

Little Bridge Creek (see Section 3.2.1.2) enters Bridge Creek mainstem from the west at the start of reach 11. Reaches 11 and 12 flow through the community of 100 Mile House and are directly affected by urban activities. The riparian area is predominantly mature coniferous dominated forest, except for the western edge of reach 11 where much of the riparian area has been removed. The upper portion of reach 11 and all of reach 12 are suspected to contain favourable habitat for rainbow trout due to the presence of large pools below the falls, which provide cover and rearing habitat. The higher gradient and increased oxygen input are also important during the high temperatures in summer. However, the falls (Map #1) limit upstream migration.

Reach 13:

Mapsheet: 092P 064
Air photo: 30BCC95076 No. 161 and 30BCC95079 No. 41

This reach starts directly below the Horse Lake road bridge crossing. The stream returns to an irregular meandering pattern and low gradient (1.0%). Beaver activity was noted. Off-channel habitat also exists, mainly as sidechannels connected to the mainstem (good access). The upper end of this reach becomes confined and evidence of natural erosion of the steep valley walls is present. The riparian area was cleared for agriculture (primarily cattle ranching), and is now dominated by low shrub.

Reach 14:

Mapsheet: 092P 064
Air photo: 30BCC95076 No. 161, 163

At this point, the stream becomes confined, with an increase in gradient. The stream pattern changes from an irregular meander to sinuous. The air video indicates an abundance of LWD, and the habitat was preferential to rainbow trout (good cover, stream complexity, spawning and rearing habitat). Mature coniferous forest dominates the riparian zone. Cleared private land is present at the boundary between reach 15 and 14. Disturbances (i.e., cattle impacts and eroding banks) within this reach are likely linked to the cleared private land and influences from reach 15. A Level 1 assessment is proposed due to suspected high fisheries value and high connectivity to upslope impacts.

Reach 15:

Mapsheet: 092P 064&065
Air photo: 30BCC95076 No. 21

Reach 15 is a broad channel outlet of Horse Lake. The riparian area was cleared on both banks for agriculture. Major impacts (evident from the air video) include bank erosion (cattle watering). Fish habitat value is high due to proximity to Horse Lake, but present value is low due to a high degree of fines (identified during air video), lack of cover and monotypic morphology. This reach is suspected to be transporting sediment to reach 14. A Level 1 site is recommended although impacts are not forest harvesting related. Restoration efforts may focus on providing spawning habitat for kokanee salmon, stabilizing banks, as well as controling sediment input from cattle impacts.

Reach 16:

Mapsheet: 092P 055&065
Air photo: 30BCC95076 No. 11-20

Horse Lake. Species list include BB, CSU, KO, LSU, LT, NSC, PCC, RB, RSC. Angling emphasis is on kokanee salmon, rainbow trout and lake trout. Angler days on this lake have been fairly consistent since the late 1980`s, averaging near 11,000 angler days/year (Berezay and Lirette, 1997). Major tributaries enter Horse Lake on the south side. They include Ninety-three Mile (UTM 10.5717384 627608), Atwood (UTM 10.5716860 631225) and Fawn (UTM 10.5716976 631852) Creeks. No detailed assessments were conducted on these tributaries due to extensive private land, no visible impacts and no proposed future development related to forest harvesting.

Reaches 17 and 18:

Mapsheet: 092P 056&065
Air photo: 30BCC95076 No. 7-11

Reach 17 is the inlet to Horse Lake, and flows through private agricultural land. The stream pattern is an irregular meander with extensive glides. Some off-channel habitat consisting of isolated back-channels (some with good access) is present. Stream clearing (beaver dam removal) was conducted to facilitate kokanee spawning (Anon, 1987). Reach 17 contains rearing habitat; however, these reaches are more likely to serve as a migration corridor to the more highly productive Horse Lake. Spawning may occur, but due to stream morphology, is likely limited for rainbow trout. O'Neil Creek (see Section 3.2.1.5), which drains Sheridan Lake, enters reach 18 from the south. Reach 18 contains more off-channel habitat (dominated by isolated back-channels) than reach 17 but is similar in morphology. No forestry impacts were identified within either reach.

Reach 19:

Mapsheet: 092P 056
Air photo: 30BCC95066 No. 167 and 168

This reach contains preferred fish habitat for all life stages of rainbow trout, but especially for fry and spawning adults. The reach is confined with a sinuous pattern, and a mature coniferous forest dominates the riparian area, providing LWD for instream habitat complexity. A riffle-pool morphology is present, and favourable spawning habitat was identified during the overflight. Some bank erosion is present, associated with private land located half way upstream of the start of this reach. Deka Creek tributary enters reach 19 from the northeast (approximately 800 meters upstream of the reach break 18/19) and is another system containing the target species.

Reach 20:

Mapsheet: 092P 056
Air photo: 30BCC95066 No. 169

The stream pattern of this reach returns to an irregular meander, and is frequently confined. The riparian area is open and dominated by shrub. Extensive beaver activity (lodge, dams) was noted. No other major disturbances were identified. Fish usage is believed to be rearing habitat for all species (dominated by non-gamefish species) and as a migration corridor to more suitable rainbow trout habitat in reach 19.

Reach 21:

Mapsheet: 092P 056
Air photo: 30BCC95075 No. 195

This reach has similar characteristics to reach 19. High connectivity to the steep side walls is present. Logging (1993) has occurred extensively on both sides of this reach, but no visible signs of disturbance were identified. Back-channels were created in a short section where the stream pattern changes from sinuous to

an irregular meander. Judson Creek (see Section 3.2.1.3) enters this reach from the east and was identified as a tributary for Overview assessment due to presence of forest harvesting.

Reaches 22 and 23:

Mapsheet: 092P 056
Air photo: 30BCC95075 No. 131

Reach 23 flows out of Roe Lake. Extensive beaver activity was noted, both on FISS maps and during the overflight. Most disturbances were associated with private agricultural land (e.g., water usage for irrigation). Steep banks have created areas of natural erosion. A large open pit located adjacent to the bridge crossing near Roe Lake (reach 23) (eastern side) may be a sediment source during high precipitation events, and should be field checked.

Reach 24:

Mapsheet: 092P 056
Air photo: 30BCC95075 No. 131

Roe Lake. This lake supports a dominant population of non-game species (FISS), including largescale sucker, longnose sucker, northern squawfish, and redside shiner. Rainbow trout is documented as the only sport fish. No impacts were noted along the shoreline.

Reaches 25 and 26:

Mapsheet: 092P 056&057
Air photo: 30BCC95075 No. 132

These reaches connect Roe Lake with Lesser Fish Lake. Private land impacts such as riparian vegetation removal, bank erosion and water removal for irrigation exist. Beaver activity was also noted, with several dams and lodges observed within reach 26. Fish habitat value in reach 26 is moderate to low. However, the stream pattern, gradient and lack of cover tend to be more preferential to non-game species. Reach 25 is adjacent to Roe Lake, and contains possible spawning habitat.

Reach 27:

Mapsheet: 092P 057
Air photo: 30BCC95075 No. 134

Lesser Fish Lake. FISS data indicates the presence of rainbow trout. This lake likely supports similar species to Bridge Lake, with the possible exception of lake trout. No impacts were identified.

Reach 28:

Mapsheet: 092P 057
Air photo: 30BCC95075 No. 134

This reach contains high fish values since it provides spawning habitat for both Bridge and Lesser Fish Lake species. No impacts were identified, and the channel attributes are difficult to determine due to high canopy cover over the stream.

Reach 29:

Mapsheet: 092P 057
Air photo: 30BCC95075 No. 135-137 and 30BCC95028 No. 17-19

Bridge Lake. This lake contains several species (BB, CSU, KO, LSU, LT, NSC, PCC and RB). A high sport fish value exists, primarily focusing on rainbow trout and kokanee salmon. Since the introduction of kokanee in the mid to late 1980's, angling effort has tripled. The most recently recorded angling effort is 12,005 angler days in 1996 (Berezay and Lirette, 1997).

3.2.1.2 Little Bridge Creek (129-3604-239-984-995-465)

Little Bridge Creek enters Bridge Creek at the north end of 100 Mile House and drains the area west from Holden Lake. Species identified within this system were lake chub, longnose sucker, lake whitefish, northern squawfish, redside shiner and rainbow trout. Lake whitefish appear exclusive to this system from review of FISS information .

Beaver dams were present along Little Bridge Creek, concentrated in the upper reaches around Little Holden Lake. Two falls exist approximately 500 meters downstream of Valentine Road crossing, and are noted as the upstream limits of rainbow trout distribution (reach 14).

Favourable fish habitat containing an abundance of LWD, riffle-pool habitat, and spawning habitat was identified during the overflight in reaches 9, 11, and 13. FISS data indicates that two lakes above the falls (Holden and Little Holden) contain wild stocks of lake chub only. No game fish were reported.

Land use is predominantly agriculture in the lower reaches to Exeter Lake, with private and crown land dominating the upper watershed. Harvesting is concentrated above reach 13 and future harvesting by Ainsworth Lumber is planned around Holden and Little Holden Lakes.

Reach Descriptions

Reaches 1-3:

Mapsheet: 092P 064
Air Photo: 30BCC95079 No. 42

These reaches flow east from Exeter Lake, passing through the community of 100 Mile House and private agricultural land. Bank erosion and a lack of riparian vegetation and were present. A lack of streamside fencing has allowed livestock access to the creek, creating areas of sedimentation, especially within reach 2. A number of small wooden bridges cross the stream in reach 2. Fish habitat was considered of low value due to a high degree of fines covering spawning gravel, a lack of LWD and extensive monotypic morphology (riffle/glides). Reach 3 contains channel alterations that created nesting sites for waterfowl (Ducks Unlimited Project). Some off-channel habitat exists in reach 3 as man-made side-channels (designed for waterfowl, not fish).

Reach 4:

Mapsheet: 092P 064
Air Photo: 30BCC95079 No. 43

This reach is Exeter Lake. The lake contains a dominance of non-game species (LSU, NSC) and, unique to the area, lake whitefish. The target species, rainbow trout, are also present in the lake. Angling efforts in this lake have declined dramatically since the late 1980's (angler days 566 in 1987) to no observed boats in 1996. This may indicate a considerable decline in population of rainbow trout and a dominance of non-game fish species no longer attracting anglers. The decline may be attributed to loss of spawning habitat through suspected impacts to reaches 5-8.

Reaches 5-8:

Mapsheet: 092P 064
Air Photo: 30BCC95079 No. 45&46

These reaches are located adjacent to the Ainsworth Lumber Co. Ltd. mill site, and flow east into Exeter Lake. A number of disturbances were identified, including both private land and forest related issues (roads, mill site). Reach 6, which flows through private land, contains a ford crossing in the beginning of the reach. This crossing has created an area of increased sedimentation and disturbance to the channel. Multiple channels exist in this reach, due in part to a low bank height, which allows the main channel to move during

high flow events (HCE, BT0008 on Map #1). The riparian area was dominated by shrub within reach 5. The riparian zone changes in reach 6 from shrub to coniferous dominated forest, which acts as a minimal buffer to the cleared agricultural area adjacent, and provides some possible LWD recruitment.

Little Bridge Creek crosses under a railway line and road accessing the mill site within reach 7. These crossings should be assessed for possible fish passage problems. The riparian area is dominated by mature coniferous forest (lodgepole pine). During the overflight, several areas suitable for spawning were noted.

Reach 8 was characterized by channelized wetland dominated by low shrub and patches of coniferous forest. Off-channel habitat exists, which includes small isolated channels. Rainbow trout were sampled within reaches 6-8 (FISS). This reach is identified as rearing habitat.

Reach 9 & 11

Mapsheet: 092P 064
Air Photos: 30BCC95079 No. 46&47

Evidence of good rainbow trout habitat was identified during the overflight (air photo interpretation would not have revealed this). This reach is characterized by a pool/riffle morphology and an abundance of LWD. The riparian area consists of mature, coniferous forest, which provides large wood to the stream. Extensive areas of spawning habitat were noted throughout. A dominance of gravel and sub-dominant cobble were present. A few minor bank failures were attributed to the natural hydrological processes of the stream. Good rearing habitat was associated with wood cover and a relatively high pool frequency.

Reaches 10 & 12

Mapsheet: 092P 063
Air Photos: 30BCC95079 No. 47

These reaches flow through an extensive wetland complex dominated by a shrub riparian zone. Beaver activity has created shallow ponds in reaches 10 and 12. During the overflight, an abundance of waterfowl was noted. Fish habitat value was considered low due to shallow depth of the ponds and suspected high temperatures in summer. These factors limit the reaches to overwintering habitat and short term rearing (temperature dependent for target species). Beaver activity may impede fish migration in summer and low flow periods.

Reach 13

Mapsheet: 092P 063
Air Photos: 30BCC95076 No. 153

This reach contains favourable rainbow trout habitat (air overflight assessment) similar to that identified in reach 9 and 11. A set of falls (2.0 meters and 3.5 meters)(FISS) within the middle of the reach is the upper limit of rainbow trout distribution. A small tributary entering from the west (129-3604-239-984-995-465-538) may provide off-channel habitat and access to two small lakes in the tributary's upper reaches. The road crossing the above mentioned tributary should be assessed to determine if the culvert is a fish migration barrier, as the tributary provides access to two small pothole lakes which may provide high water refuge.

Reaches 14-22

Mapsheet: 092P 063
Air Photos: 30BCC95076 No. 147 to 152

FISS indicates the presence of lake chub in these reaches. The fact that rainbow trout is not found within these reaches is likely due to a barrier preventing fish migration at reach 13. Most of these reaches are characterized by channelized wetlands, small ponds and extensive beaver activity. Much of the forest harvesting occurred in the late 1960's to early 1980's, with minimal future harvesting planned. One

cutblock is proposed below Little Holden Lake (1999 Ainsworth block CP299 Blk2). Past harvesting occurred to the stream edge along Little Bridge Creek (reach 14). The vegetation surrounding the stream is expected (wetland, shrub and grasses) to act as a sediment filter, preventing sediment from entering the stream. If Holden Lake is stocked with rainbow trout, the only favourable spawning habitat occurs between Little Holden and Holden Lake (reach 21). Private land and agricultural usage were present, and a homestead was located on the northwest end of Little Holden Lake. No Level 1 assessments were proposed due to the absence of the target species.

3.2.1.3 Judson Creek (129-3604-239-984-995-840)

Judson Creek flows into the Bridge Creek mainstem at reach 21. FISS identified longnose sucker and rainbow trout as species within the system. A high abundance of rainbow trout is present in this system (Sollitt, pers. comm.). No obstructions were identified. Harvesting has occurred in the upper reaches of Judson Creek and further logging is planned by Ainsworth Lumber. Favourable rainbow trout habitat is believed concentrated within the upper reaches (reaches 10 to 13) near High Lake (Cariboo lakes classification number 6100) and is the location of future logging.

As part of a water quality monitoring program within the Bridge Creek basin, two sites were established on Judson Creek. Elevated levels of both turbidity and non-filterable residue were identified, with levels improving from the upstream site to the downstream site (Simpson, 1997). The cause was not determined.

Reach Descriptions

Reaches 1-2

Mapsheet: 092P 056
Air Photo: 30BCC95066 No. 170

The riparian area of reach 1 is dominated by shrubs. A double culvert road crossing is present at the upper end of reach 1, and may be a possible sediment source. Rainbow trout were captured below this road crossing (FISS). Judson Creek likely provides spawning and rearing habitat for Bridge Creek species. The attributes of reach 2 are not visible due to the thick canopy cover (mature, coniferous forest). There is suspected spawning habitat and favourable rearing habitat in the lower end of reach 2.

Reaches 3-5, 9-10

Mapsheet: 092P 056 & 057
Air Photo: 30BCC95066 No. 171, 174, 175

A series of small ponds and connected, channelized wetlands dominated by low velocity glides, a lack of LWD and shrub dominated riparian areas characterize these reaches. It is presumed that there is good rearing habitat, but poor spawning opportunities. Beaver activity is noted in reaches 5 and 9, creating backwater ponds. Off-channel habitat is present as side channels to isolated ponds. A potential barrier is a road crossing (suspected culvert) potentially preventing fish migration, located within reach 4. Reach 9 has a harvested block along the western edge and contains a large landing that may be contributing sediment. A Level 1 assessment is recommended.

Reach 6

Mapsheet: 092P 057
Air Photo: 30BCC95066 No. 172

This reach connects a pond in reach 5 to a channelized wetland in reach 7. The riparian area is dominated by mature, coniferous dominated forest, with shrub adjacent to the stream. An abundance of cover provides good rearing habitat and possible spawning habitat.

Reach 7

Mapsheet: 092P 057
Air Photo: 30BCC95066 No. 172 & 173

This reach opens to a channelized wetland with a lack of cover. The mid to upper portion of the reach along the northern edge has been recently harvested, and may be contributing sediment. A Level 1 site is recommended. Beaver activity (dam), providing the best rearing habitat, is noted in the mid-reach. An area harvested to the wetland edge is also present on the south side of the reach but no impacts are apparent.

Reach 8

Mapsheet: 092P 057
Air Photo: 30BCC95066 No. 173

Aerial overflight of this short, higher gradient reach (approximately 6% gradient) indicates the presence of a cascade section and possible low water barriers (low falls). There is an abundance of LWD and pools. This reach contains preferred rearing habitat for rainbow trout (well oxygenated with good cover). A road runs along the northern edge, and may be a sediment source. This site should be checked.

Reaches 11-13

Mapsheet: 092P 057
Air Photo: 30BCC95075 No. 190

The channel is confined and the riparian zone is dominated by mature coniferous forest. Rainbow trout have been sampled within reach 12 (FISS). These reaches rise from the valley bottom to the upper watershed area draining High Lake. The riparian area of reach 13 has been logged on the northern edge adjacent to the lake outlet. Reaches 11-13 are suspected to contain the primary spawning and rearing habitat for Judson Creek and High Lake. A Level 1 FHAP assessment is recommended for reaches 12 and 13 to determine possible impacts from the adjacent block (none were apparent from air photos and overflight).

Reaches 14-15

Mapsheet: 092P 057
Air Photo: 30BCC95075 No. 189

Reach 14, High Lake, is known to contain rainbow trout. Reach 15 is an inlet draining the mountains that surround the lake. Possible spawning habitat is suspected in reach 15. The reach is believed to be ephemeral and limited to seasonal usage.

3.2.1.4 Donald Creek (129-3604-239-984-995-985)

Donald Creek is the headwaters of Bridge Creek, and flows into Bridge Lake from the northeast. Enhancement and management activities within the system included gravel placement to facilitate kokanee spawning of Bridge Lake stock. A diversity of species exist within Donald Creek (FISS), including important sport species such as rainbow trout and kokanee, and non-gamefish species such as burbot, longnose sucker, and white sucker. Reaches 1-10 are dominated by private land and a series of lakes (Stack Lakes, Wilson and other small lakes). Ainsworth Lumber has been actively logging the upper reaches of this watershed, especially the area surrounding Willow Lake (reach 18). Additional blocks are proposed in 2000.

3.2.1.4.1 Reach Descriptions

Reaches 1 and 3

Mapsheet: 092P 057
Air Photo: 30BCC95028 No. 16

Reach 1 is a short segment between Stack Lakes and Bridge Lake. Reach 3 connects the Stack Lakes. High fisheries values exist in these two reaches due to enhanced spawning beds for kokanee (FISS). Reach 3 is also an observed spawning area of Bridge Lake kokanee.

Reaches 2 and 4

Mapsheet: 092P 057
Air Photo: 30BCC95028 No. 16

These reaches are the two lakes forming Stack Lakes. Harvesting has occurred along the northern edge of the most downstream lake. The upper lake is surrounded by private land (agricultural). Suspected species include burbot, kokanee, longnose sucker, rainbow trout and white sucker. No impacts associated with the above mentioned block were noticed on the air photos.

Reach 5

Mapsheet: 092P 057
Air Photo: 30BCC95028 No. 14

This reach connects Wilson Lake with the upper Stack Lake. It is surrounded by privately owned land and contains road crossings. The riparian area is dominated by mature coniferous forest and shrub. The reach may provide suitable spawning habitat for lake species. However, lake species are not identified on FISS. Road crossings are most likely bridges in this reach; therefore, restriction to migration is not expected. Possible impacts attributed to the proximity of private land exist (i.e., riparian removal, water useage, fertilizer input to stream).

Reach 6

Mapsheet: 092P 057
Air Photo: 30BCC95028 No. 14

Wilson Lake. FISS data does not indicate the presence of kokanee. This is surprising since kokanee spawning was noted in the tributary creek on the northern edge (129-3604-239-984-995-985-263). It is therefore assumed that kokanee are recruited to Wilson Lake from Bridge Lake.

Reaches 7 and 9

Mapsheet: 092P 057
Air Photo: 30BCC95028 No. 12 & 13

These reaches make up two channels connecting two small pothole lakes. Both reaches are dominated by mature coniferous cover and channelized wetlands. Suitable spawning and rearing habitat for the two lakes may be provided by these stream sections. Reach 7 contains one road crossing and a recently logged cutblock (unspecified on forest development plan maps). A riparian buffer has been maintained along this cutblock. The road crossing should be assessed to determine if any fish passage problems exist.

Reaches 8 and 10

Mapsheet: 092P 057
Air Photo: 30BCC95075 No. 142

These reaches are two small pothole lakes which provide good rearing habitat in spring and summer. The lakes appear shallow and may be susceptible to winter kill.

Reaches 11-13

Mapsheet: 092P 057
Air Photo: 30BCC95075 No. 143

These two reaches are characterized by channelized wetlands and a riparian area dominated by shrub. Air photo analysis determined extensive off-channel habitat opportunity. Summer and winter rearing habitat is good.

Reach 14

Mapsheet: 092P 058
Air Photo: 30BCC95075 No. 143

Reach 14 is confined. Many attributes are not visible on aerial photographs due to thick canopy cover (mature coniferous forest). A noticeable increase in gradient (determined from TRIM contours) occurs. This reach is likely characterized by segments of cascade type morphology. Fish values may be high for Willow Lake rainbow trout due to suspected spawning habitat, channel complexity and a presumed abundance of LWD. No impacts were noted, but sediment may be transferred from the road crossing in reach 15.

Reaches 15-17

Mapsheet: 092P 058
Air Photo: 30BCC95075 No. 145

These reaches contain diverse habitat and are probably of high fish value (spawning and rearing habitat) due to their proximity to Willow Lake. Reaches 15 and 17 contain similar channelized wetland characteristics to reaches 11 and 12 (off-channel habitat suspected). Sampling within reach 15 at the road crossing resulted in recovery of longnose sucker and rainbow trout (FISS). The only forest harvest related impacts are the road crossings and paralleling road network (i.e., sediment input, fish passage problems). The gradient (TRIM derived) and presumed abundant cover (LWD, riparian) within reach 16 are likely to provide spawning habitat. A Level 1 FHAP assessment within all three reaches is proposed to assess the road crossing and possible sedimentation on spawning gravel from the heavily logged headwaters.

Reach 18

Mapsheet: 092P 058
Air Photo: 30BCC95075 No. 146

Willow Lake. The perimeter of this lake has been extensively logged, especially on the south edge. However, any sediment is likely to settle in the lake. An assessment is recommended below the lake. Non-gamefish species include longnose sucker and minnow (general); rainbow trout are also present.

Reach 19-22

Mapsheet: 092P 058
Air Photo: 30BCC95075 No. 147 & 148

The headwaters of Donald Creek experienced extensive logging (late 1970s), concentrated on the northern side. In much of the harvested area, riparian buffers (minimum 200 meters) were maintained along the stream. The dominant riparian type is mature, coniferous forest. Ainsworth has two proposed blocks on the southern edge of reaches 20 and 21 for the year 2000. Sampling within reach 21 in 1994 (MELP) resulted in no fish caught, although sampling effort was minimal (Sollitt, pers. comm.). In reach 20, two small ponds are present, and are surrounded by wetland. These ponds may provide good rearing habitat. No major impacts were identified during photo interpretation. Further sampling within these reaches is recommended to determine fish bearing or non-fish bearing status.

3.2.1.5 O'Neil Creek (129-3604-239-984-995-760)

O'Neil Creek flows from Sheridan Lake into the Bridge Creek mainstem. Eastern brook trout, rainbow trout and lake chub have been identified as present within this short tributary (5 kilometers) to Bridge Creek. It is suspected that O'Neil Creek may serve as an important spawning area for Eastern brook trout and rainbow trout. Enhancement activities within Sheridan Lake included creation of an artificial spawning channel for reduction of eggbound fish (rainbow trout). Chemical lake rehabilitation has also occurred. Creel survey data indicated high angler usage, with the majority of fish caught being rainbow trout. Sheridan Lake provides the highest angler days of all lakes within this watershed recording an average of 36,000/year since 1986 (Berezay and Lirette, 1997).

Much of the land surrounding Sheridan Lake and O'Neil Creek is privately owned. Impacts range from inputs of phosphorus and nitrogen (e.g., septic systems, cattle) to cattle and/or road crossings. Many of the impacts from past harvesting (i.e., riparian removal) have recovered; however, recent logging impacts along O'Neil Creek need to be assessed.

3.2.1.5.1 Reach Descriptions

Reaches 1-2

Mapsheet: 092P 056
Air Photo: 30BCC95066 No. 165

Fish sampling in reach 1 during 1994 (Sollitt, pers. comm.) resulted in the capture of Eastern brook trout unique to this watershed. Reaches 1 and 2 are dominated by a mature lodgepole pine riparian zone. Stream morphology is likely dominated by riffle-pool habitat units, with short sections of cascade (based on length and gradient measurements (TRIM)). A barrier to upstream migration from the mainstem of Bridge Creek exists within reach 2 (FISS). This barrier is in the form of a small concrete wier to prevent non-game species from entering Sheridan Lake (Sollitt, pers. comm.).

The channel is confined and is likely containing most of the LWD within this watershed due to a limited amount of mature forest in the remainder of reaches. Spawning habitat for eastern brook trout and rainbow trout has been confirmed in reach 1 (Sollitt, pers. comm.), and eastern brook juveniles have been captured within reach 1.

Reach 3

Mapsheet: 092P 056
Air Photo: 30BCC95066 No. 165

This reach is low gradient, and consists of an irregular meander type pattern. The east bank has been logged, leaving little to no riparian vegetation. Fisheries values are moderate. This reach functions primarily as rearing (overwintering) habitat. There is also possible off-channel habitat. Beaver activity was also noted within this reach. This reach is considered for a Level 1 FHAP site to assess immediate and downstream impacts from the adjacent cutblock on the eastern stream edge.

Reach 4

Mapsheet: 092P 056
Air Photo: 30BCC95066 No. 165

This reach has similar riparian composition to reach 2. Channel features are difficult to assess due to the thick canopy cover. However, this reach most likely provides good rearing and possible spawning opportunities due to the suspected presence of LWD (gravel entrapment).

Reach 5

Mapsheet: 092P 056
Air Photo: 30BCC95075 No. 200

This reach extends from a recently logged block through private land (agriculture) and ends at a small (shallow) pothole lake near the outlet of Sheridan Lake. A number of factors that may be contributing to habitat degradation include road crossings, agriculture and logging. Suspected fish usage is early summer rearing (potential high water temperatures in the late summer may move fish out of this reach) and possible spawning (due to the close proximity to Sheridan Lake). A Level 1 FHAP is recommended to assess possible restoration opportunities, which may include LWD placement, bank stabilization and stream crossing assessments.

Reach 6

Mapsheet: 092P 056
Air Photo: 30BCC95066 No. 200

This reach is a small pothole lake which is too shallow for overwintering habitat (winter kill). There is probable short term rearing in this lake, and it most likely acts as a migration corridor. The lake also appears to be used for irrigation and livestock watering (buildings are present adjacent to the lake).

Reach 7

Mapsheet: 092P 056
Air Photo: 30BCC95066 No. 200

Reach 7 is at the outlet of Sheridan Lake. This reach is low gradient (1.0%), and has an irregular meander channel type dominated by low shrub in the riparian zone and a lack of LWD. This reach contains probable spawning habitat, although there is limited cover. It is suspected that the main fisheries value of this reach is as a migration corridor and short term rearing habitat (preference for target species to utilize Sheridan Lake for rearing after two years stream residency).

4.0 Conclusions

No obvious direct links to forestry impacts are present. However, due to the large size of this watershed (1550 km^2), the amount of harvesting is believed to have a cumulative effect on changing the hydrology from past to present (suspected a higher rate of runoff during spring freshet and possibly an increase in ambient temperatures of the stream due to riparian removal). These changes are believed less significant than the changes taking place from urban development and private land use (e.g., agricultural clearing, water usage, and cattle impacts). The natural topography (i.e., low gradient, meandering stream pattern) lends itself to dissipating many immediate impacts from increased sediment loads from logging and private land, and buffers many natural and man-made impacts in comparison to a coastal watershed.

The sites chosen for Level 1 assessment are focused on those reaches identified as important fish habitat. These assessments are proposed to determine by field visits the degree of impact (if any) on the most important fisheries areas within Bridge Creek and associated tributaries. Seven high priority sites were identified, and these are the minimum number of sites that should be assessed.

In conjunction with the Level 1 assessment, a Fish Passage Culvert Inspection is recommended. This assessment would focus on high fish value sub-basins, including Little Bridge, Deka, Donald, Judson and O'Neil Creeks. Additional sub-basins would be added in consultation with the fisheries specialist from MOELP. Barriers to fish passage are believed to be a more immediate limitation to the target species than any other factors due to limited naturally occurring habitat for rainbow trout. Benefits to the fishery resource are immediate, and usually relatively inexpensive. The extensive road networks and many

crossings in this watershed may impede rainbow trout from migrating to more favourable lake environments or available spawning and critical overwintering habitats.

Beaver activity in relation to fish passage is an ongoing problem within the Cariboo. This animal is distributed throughout Bridge Creek, and has affected the target species ability to migrate. This animal can be very detrimental to spawning habitats by impounding water, creating backwaters which act as a settling basin for sediment, resulting in the sedimentation of once present spawning gravels. Beaver activity does provide good rearing habitat; however, this may be offset by preventing the passage of fish, especially juveniles and fry, to more favourable habitat. Beaver activity also promotes monotypic habitat, which is not favourable for salmonid spawning. Ongoing stream clearing by local community volunteer organizations within known spawning areas for kokanee and rainbow trout should be encouraged on a annual basis. Natural recruitment is a better management tool than relying on the high cost of stocking programs. Identification and protection of spawning areas will help to sustain natural wild stocks and preserve genetic diversity.

Direct instream work on mainstem Bridge Creek requires the cooperation of local landowners. Any work should focus on limiting cattle from entering the stream (riparian fencing). Since this does not fall under funding for WRP, other avenues of funding should be considered (e.g., Grazing Enhancement Fund).

The value of rainbow trout as a stream resident is considered low from a sport fishing perspective due to the high degree of private land limiting access. The main function of Bridge Creek for the target species is likely as nursery for the many larger lakes within the watershed (Canim, Horse, Sheridan and Bridge). The creek would provide adequate spawning and juvenile rearing to fish of a two year age class before they migrate back into the lakes.

Eastern brook trout in O'Neil Creek have been identified as a regionally significant species as they exist as an isolated population. Protection of their habitat is required.

5.0 Recommendations

Table 3 outlines the major impacts, restoration opportunities and field site prioritization for Bridge Creek watershed. Some of the field sites are proposed within reaches that flow through private land or impacts are not forestry related. Approximately 37 kilometers of stream have been identified for Level 1 Fish Habitat Assessments. Seven non-FHAP sites (fish passage culvert inspections) and one fish inventory site have been suggested.

Table 3. Major impacts, restoration opportunities and field site prioritization for selected reaches within the Bridge Creek and associated sub-basins.

Stream	1:20 000 Mapsheet	Reach/ Section	Estimated Stream Length for Assessment (km)	Major Impacts	Assessment Priority	FHAP Field Site Proposed	Non-FHAP Field Site Proposed	Restoration Opportunities
Bridge Creek 129-3604-239-984-995	92P075	4	3.0	Possible aggradation due to sediment input from reach, evidenced by areas of unvegetated bars upper section of reach 3.	H	Y		- Require Level 1 FHAP assessment to determine level of impact from adjacent private logging, opportunities for restoration/rehab. Options may include placement of LWD to promote pool development and capture of spawning gravels, (based on field assess.).
	92P064	15	3.4	Possible silt input from cattle watering and lack of riparian vegetation, Downstream impacts may include bed load movement in-filling of pools and possible spawning substrate.	H *	Y		- Require Level 1 assessment to determine level of FHAP restoration/rehab opportunities. Private land therefore would need to qualify under another source of funding. Downstream impacts warrant assessment.
	92P075	3	15.0	Sediment impact from reach 4 evident by large sediment wedges and unvegetated bars. Natural upslope failures noted may be accelerated by removal of upslope coniferous cover.	M	Y		- LWD and boulder clustering to entrap spawning gravels and attempt to stabilize channel. Reach may provide the first available spawning habitat for Canim Lake rainbow trout. - Stabilize upslope failures
	92P056	23	n/a	Possible sediment input from open pit adjacent to bridge crossing	M		Y	- Bank stabilization
	92P064	14	2.4	Upper section of this reach considered to be impacted by sediment transfer from reach 15.	M *	Y		- Bank stabilization, riparian fencing.
Little Bridge Creek 129-3604-239-984-995-465	92P064	6	n/a	Ford crossing (possible spawning gravel degradation), sedimentation, scour	H *		Y - FPCI^	- LWD placement - Stabilize ford crossing with cobble
	92P064	7	n/a	Assess road crossings for possible fish passage problems	H		Y - FPCI	- Possible crossing replacement - Fish Passage Culvert Inspection
	92P064	1	0.6	Eroding banks, sedimentation	M *	Y		- Bank stabilization
	92P064	2	2.0	Limited pool frequency, sedimentation from cattle crossings	M *	Y		- LWD placement, bank stabilization, riparian fencing
	92P063	13	1.6	Natural barriers limiting access for target species	M *	Y		- Barrier removal or fishway construction
O'Neil Creek 129-3604-239-984-995-760	92P056	3	0.8	Loss of riparian area from adjacent cutblock, possible sediment input	H	Y		- LWD placement, bank stabilization
	92P056	5	1.4	Lack of riparian cover, lack of LWD, road crossing	H *	Y		- Assess crossing, LWD placement, bank stabilization (reach contains both harvesting and private land)
	92P056	1	n/a	Potential migration barrier at road crossing	H		Y - FPCI	- Assess crossing - Fish Passage Culvert Inspection
	92P056	1	0.2	Potential impacts from upstream	M	Y		- Assess possible sediment transfer from upper reach
	92P056	2	1.0	Expected sediment from reach 3	M	Y		- Assess possible sediment transfer from upper reach

Stream	1:20 000 Mapsheet	Reach/ Section	Estimated Stream Length for Assessment (km)	Major Impacts	Assessment Priority	FHAP Field Site Proposed	Non-FHAP Field Site Proposed	Restoration Opportunities
Judson Creek 129-3604-239-984-995-840	92P057	13	0.4	Adjacent cutblock deemed to be contributing sediment to possible spawning habitat	H	Y		- LWD placement, stabilize upslope impacts - Eliminate sediment movement through bank rehabilitation (planting, deactivation)
	92P057	7 & 9	1.0	lack of riparian cover, possible sedimentation from adjacent cutblock	M	Y		- Bank stabilization (planting)
	92P057	8	n/a	Possible sediment input from road	M	N	Y	- Stabilize upslope impacts
	92P057	12	0.6	Possible sediment input from adjacent cutblock	M	Y		- LWD placement - Stabilize upslope impacts
Donald Creek 129-3604-239-984-995-985	92P057	15 to 17	n/a	Possible sedimentation from heavy logging around Willow Lake, potential road crossing barriers in 16 and 17	H	N	Y - FPCI	- Proper crossing installation, LWD placement to improve suspected spawning habitat for Willow lake rainbow trout. - Fish Passage Culvert Inspection
	92P057	7	n/a	Possible fish passage concerns	M	N	Y - FPCI	- Proper crossing installation - Fish Passage Culvert Inspection
	92P058	19 to 22	2.6	None identified	H	N	Y	- Sampling to determine fish bearing or non-fish bearing status
	92P058	14	1.2	Possible sediment transport from upper reaches	M	Y		- rehabilitate upslope/upstream impacts

* Reach contains private land
^ FPCI = Fish Passage Culvert Inspection

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APPENDIX 1: OVERVIEW FISH HABITAT ASSESSMENT, FORM 1: FISH DISTRIBUTION SUMMARY FORM

Codes

Data Source:

RAB (resource analysis branch)
FISS (fisheries information summary system)
MELP (BC Fisheries Branch reports or studies)
DFO (Canada Department of Fisheries and Oceans reports or special studies)
BT (BioTerra Consulting)

Survey Methods

AG = angling
EL = electrofishing
UN = unknown
VO = visual observation (i.e., shore count)

Fish Presence

N = not present
K = presence known
S = suspected presence
H = historically present
U = unknown

OVERVIEW ASSESSMENT- Fish Distribution Summary Form 1

Watershed Name: Bridge Creek (Judson Creek)
Watershed Code: 129-3604-239-984-995-840

NTS maps: 92P10
Forest District: 100 Mile House
Date: 1997/12/19

Reach Number	Section Number	Data Source	Survey Method		RB		
			juv	ad	juv	ad	sp
1+		RAB	UN	UN	K	S	S
2+		BT			S	S	S
3		RAB	UN	UN	K	S	S
4		MOELP	EL	UN	K	S	S
5		BT			S	S	S
6+		BT			S	S	S
7		BT			S	S	S
8+		BT			S	S	S
9		MOELP	EL	UN	K	S	S
10		BT			S	S	S
11+		BT			S	S	S
12+		MOELP	EL	UN	K	S	S
13+		BT			S	S	S
14	Lake	FISS	AG	AG	K	K	S
15		BT			S	S	S

+ = suspected high fish value reach for target species (rearing and spawning)

BT - BioTerra

OVERVIEW ASSESSMENT- Fish Distribution Summary Form 1

Watershed Name: Bridge Creek (O'Neil Cr)
Watershed Code: 129-3604-239-984-995-760

NTS maps: 92P10
Forest District: 100 Mile House
Date: 1997/12/19

Reach	Section	Data	Survey Method			RB			EB	
Number	Number	Source	juv	ad	juv	ad	sp	juv	ad	sp
1		MELP	EL	UN	K	S	S	K	S	S
+2		BT			S	S	S	S	S	S
3		BT			S	S	S	S	S	S
+4		BT			S	S	S	S	S	S
+5		MELP	EL	UN	K	S	S	K	S	S
6	Pond	BT			S	S	N	S	S	N
7		BT			S	S	S	S	S	S

+ = suspected high fish value reach for target species (rearing and spawning)

BT - BioTerra

OVERVIEW ASSESSMENT- Fish Distribution Summary Form 1

Watershed Name: Bridge Creek (Donald Creek)
Watershed Code: 129-3604-239-984-995-985

NTS maps: 92P10
Forest District: 100 Mile House
Date: 1997/12/19

Reach	Section	Data	Survey Method		KO			RB			BB		
Number	Number	Source	juv	ad	juv	ad	sp	juv	ad	sp	juv	ad	sp
+1		FISS/BT	UN	VO	U	K	K	S	S	S	S	S	S
2	Lake	FBT			S	S	S	S	S	N	S	S	S
+3		FISS/BT	UN	VO	U	K	K	S	S	S	S	S	S
4	Lake	BT			S	S	S	S	S	N	S	S	S
+5		BT			U	S	S	S	S	S	S	S	S
6	Lake	FISS/BT	UN	AG	S	S	S	S	K	S	S	K	S
7		BT			N	S	S	S	S	S	S	S	S
8	Lake	BT			N	N	N	S	S	N	N	N	N
9		BT			N	N	N	S	S	S	N	N	N
10	Lake	BT			N	N	N	S	S	S	N	N	N
11		BT			N	N	N	S	S	S	N	N	N
12		BT			N	N	N	S	S	S	N	N	N
13		BT			N	N	N	S	S	S	N	N	N
+14		BT			N	N	N	S	S	S	N	N	N
+15		BT			N	N	N	S	S	S	N	N	N
+16		MELP	EL	UN	N	N	N	K	S	S	N	N	N
+17		BT			N	N	N	S	S	S	N	N	N
18	Lake	MELP	EL	AG	N	N	N	S	K	S	N	N	N
+19		BT			N	N	N	S	S	S	N	N	N
20		BT			N	N	N	S	S	S	N	N	N
21		MELP	EL		N	N	N	N	N	N	N	N	N
22		BT			N	N	N	N	N	N	N	N	N

NOTE:
Kokanee juveniles suspected in lakes only (rearing)
Burbot expected to spawn off shoal and in creek

= + suspected high fish value reach for target species (spawning and rearing)

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OVERVIEW ASSESSMENT- Fish Distribution Summary Form 1

Watershed Name: Bridge Creek
Watershed Code: 129-3604-239-984-995

NTS maps: 92P15
Forest District: 100 Mile House
Date: 1997/12/19

Reach	Section	Data	Survey Method			LT			KO			RB			BB	
Number	Number	Source	juv	ad	juv	ad	sp	juv	ad	sp	juv	ad	sp	juv	ad	sp
1		RAB	UN	UN	S	S	S	U	S	S	K	S	S	S	S	S
2		BT			U	U	U	U	U	U	S	S	S	S	S	S
+3		BT			N	N	N	N	N	N	S	S	S	S	S	S
+4		BT			N	N	N	N	N	N	S	S	S	N	N	N
5		BT			N	N	N	N	N	N	S	S	S	N	N	N
6		RAB	UN	UN	N	N	N	N	N	N	K	S	S	N	N	N
7		RAB	UN	UN	N	N	N	N	N	N	S	S	S	N	N	N
8		BT			N	N	N	N	N	N	S	S	S	N	N	N
9		RAB	UN	UN	N	N	N	N	N	N	K	S	S	N	N	N
10		BT			N	N	N	N	N	N	S	S	S	N	N	N
11		RAB			N	N	N	N	N	N	K	S	S	N	N	N
+12		BT			N	N	N	N	N	N	S	S	S	N	N	N
13		BT			N	N	N	N	N	N	S	S	S	N	N	N
+14		RAB			N	N	N	N	N	N	K	S	S	S	K	S
15		RAB			K	K	K	K	K	K	K	K	K	K	K	K
16	Lake	FISS	AG	AG	S	S	S	K	K	K	K	K	K	S	S	S
17		RAB			N	N	N	K	K	K	K	K	K	S	S	S
18		RAB			N	N	N	S	S	S	K	K	S	N	N	N
+19		MELP/RAB	EL	UN	N	N	N	N	N	N	K	K	S	N	N	N
20		BT			N	N	N	N	N	N	S	S	S	N	N	N
+21		BT			N	N	N	N	N	N	S	S	S	N	N	N
22		BT			N	N	N	N	N	N	S	S	S	N	N	N
23		RAB	UN	UN	N	N	N	N	N	N	K	K	S	N	N	N
24	Lake	FISS	AG	AG	N	N	N	N	N	N	K	K	K	N	N	N
25		BT			N	N	N	N	N	N	S	S	S	N	N	N
26		BT			N	N	N	N	N	N	S	S	S	N	N	N
27	Lake	FISS	AG	AG	N	N	N	N	N	N	K	K	S	N	N	N
28		RAB			S	S	S	S	S	S	S	S	S	K	K	S
29	Lake	FISS	AG	AG	K	K	K	K	K	K	K	K	K	K	K	K

+ = suspected high fish value reach for target species (spawning and rearing)

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OVERVIEW ASSESSMENT- Fish Distribution Summary Form 1

Watershed Name: Bridge Creek (Little Bridge)
Watershed Code: 129-3604-239-984-995-465
NTS maps: 92P11
Forest District: 100 Mile House
Date: 1997/12/19

Reach Number	Section Number	Data Source	Survey Method		RB		
			juv	ad	juv	ad	sp
1		BT			S	S	S
2		FISS	UN		K	S	S
3		BT			S	S	S
4	Lake	FISS	UN		K	K	S
5		BT			S	S	S
6		FISS	UN		K	S	S
7		FISS	UN		K	S	S
8		FISS	UN		K	S	N
+9		FISS	UN		K	S	S
10	Lake[B]	BT			S	S	N
+11		BT			S	S	S
12		BT			S	S	N
+13*		BT			S	S	S
14 to 22		BT			N	N	N

+ = suspected high fish value reach for target species (rearing and spawning)
*FISS indicate falls in reach 13 upper limits of RB

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APPENDIX 2: OVERVIEW FISH HABITAT ASSESSMENT, FORM 2: HABITAT CONDITION SUMMARY FORM

Codes

Wb = mean bankfull channel width

Channel type

SPr (block-step-pool)
SPb (boulder-step-pool)
SPbw (debris-boulder-step-pool)
CPb (boulder-cascade-pool)
CPcw (debris-cobble-cascade-pool)
RPcw (riffle-pool)
RPgw (riffle-bar-pool)
L (pond or small lake)
U (unknown)

Disturbance types

SC (extensive areas of scour)
DW (extensive areas of unvegetated bar)
WG (large, extensive sediment wedges)
MB (elevated mid-channel bars)
LR (extensive riffle zones)
FP (limited pool frequency and extent)
MC (multiple channels - braiding)
EB (eroding banks)
BC (isolated backchannels or sidechannels)
PD (most large woody debris (LWD) parallel to banks)
JM (recently formed LWD jams)

Potential barriers

CV = culverts
BR = disused bridges
LS = landslides or bank sloughing
X = log jams
BD = beaver dam
F = falls
C = cascades or chutes
G = gradient barriers
N = no barriers
U = unknown

Percent pools

0 = no pools
1 = 1-25% pool by area
2 = 26-50% pool by area
3 = 51-75% pool by area
4 - 76-100% pool by area
9 = unable to estimate pool area

Large Woody Debris (LWD)

N = no LWD
F = few
A = abundant
U = unknown
C = clumped
E = evenly distributed

Riparian Vegetation Type

N = unvegetated
G = non-forested grassland or bog
S = shrub/herb
C = conifer-dominated
D = deciduous-dominated
M = mixed conifer-deciduous

Riparian Structural Stage

INIT = non-vegetated
SHR = shrub/herb
PS = pole-sapling
YF = young forest
MF = mature forest

Canopy Closure

1 = 0-20% shade
2 = 20-40% shade
3 = 40-70% shade
4 = 70-90% shade
5 = >90% shade

Off-channel Fish Habitat

U = unknown
P = poor
F = fair
M = moderate
G = good

OVERVIEW ASSESSMENT- Habitat Condition Summary Form 2

Watershed Name: Bridge Creek
Watershed Code: 129-3604-239-984-995-840
Air photo series: BCC95066^
BCC95075^^
Photo Numbers: ^ 170-174
^^ 188-192

Sub-basin: Judson Creek
NTS maps: 92P10
Photo scale: 1:15,000

Reach Number	Length (m)	Elevation (m)		Gradient (%)	Wb (m)	Channel Type	Disurbance Types			Barriers	Pools Code	LWD Codes		Riparian Type	Stand Structure	Canopy Closure	Offchannel Habitats
		Upper	Lower														
1	607.67	1080	1070	2		RPgw				CV	9	U		S	SHR	2	F
2	763.78	1100	1100	< 1.0		U				U	9	U		C	MF	4	U
*3	1072.34	1130	1100	2.8		L				N	3	N		G	SHR	1	G
*4	815.48	1130	1130	< 1.0		RPgw				CV	9	N		S	SHR	3	G
*5	1226.73	1140	1130	0.8		L^B + RPgw	MC			Bd	3	F	E	S	SHR	1	G
*6	215.32	1140	1140	< 1.0		RPgw				U	3	F	E	C	MF	2	M
*7	2100.80	1160	1140	0.95		RPgw + LB	MC			N	2	F	E	S	SHR	2	G
*8	861.31	1200	1160	4.6		RPgw				F	9	A	E	C	MF	4	U
*9	884.77	1210	1200	1.1		L^B				N	4	F	E	S	SHR	2	G
*10	1060.25	1220	1210	0.94		L^B + RPgw				N	4	N		S	SHR	2	G
*11	1323.56	1230	1220	0.76		RPgw				U	9	F	E	C	MF	2	M
*12	718.50	1280	1230	6.96		RPgw				U	9	U		C	MF	4	U
*13	446.96	1320	1280	8.95		RPgw				U	9	U		C	MF	5	U
14	1097.26	1320	1320	< 1.0		LAKE (High)				-	-	-	-	-	-	-	-
15	601.77	1330	1320	1.7		U	MC			U	9	U		C	MF	4	U

* Habitat condition from air video analysis

OVERVIEW ASSESSMENT- Habitat Condition Summary Form 2

Watershed Name: Bridge Creek
Watershed Code: 129-3604-239-984-995-760
Air photo series: BCC95066^
BCC95075^^
Photo Numbers: ^ 163-166
^^ 199-200

Sub-basin: O'Neil Creek
NTS maps: 92P10
Photo scale: 1:15,000

Reach Number	Length (m)	Elevation (m) Upper	Elevation (m) Lower	Gradient (%)	Wb (m)	Channel Type	Disurbance Types	Barriers	Pools Code	LWD Codes	Riparian Type	Stand Structure	Canopy Closure	Offchannel Habitats
1	217.81	1020	1010	4.6		RPgw		CV	9	U	S	SHR	4	U
2	1201.22	1080	1020	5		U		D	9	U	C	MF	5	U
3	950.97	1090	1080	1		RPgw	Cutblock	U	9	N	S	SHR	2	P
4	964.70	1110	1090	1		U		U	9	U	C	MF	4	U
5	1569.56	1110	1110	< 1.0		RPgw	LR Cutblock	CV	1	N	S	SHR	1	F
6	612.56	1110	1110	< 1.0		L[B]	Agricultural							
7	538.96	1120	1110	1.9		RPgw		CV	1	N	S	SHR	1	P

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OVERVIEW ASSESSMENT- Habitat Condition Summary Form 2

Watershed Name: Bridge Creek
Watershed Code: 129-3604-239-984-995-985
Air photo series: BCC95028^
BCC95075^^
Photo Numbers: ^ 12-17
^^ 140-149

Sub-basin: Donald Creek
NTS maps: 92P10
Photo scale: 1:15,000

Reach Number	Length (m)	Elevation (m) Upper	Elevation (m) Lower	Gradient (%)	Wb (m)	Channel Type	Disurbance Types	Barriers	Pools Code	LWD Codes		Riparian Type	Stand Structure	Canopy Closure	Offchannel Habitats
1	85.98	1130	1130	<1		RPgw		N	9	F	C	C	MF	2	P
2	2507.66	1130	1130	<1		L	Stack 1								
3	143.40	1130	1130	<1		RPgw		CV	9	U		M	YF	2	P
4	1396.87	1130	1130	<1		L	Stack 2								
5	437.40	1140	1140	<1		RPgw		CV	9	F	E	C	MF	2	P
6	2042.32	1150	1150	<1		L	(Wilson)								
7	555.06	1160	1160	<1		RPgw		CV	9	U		C	MF	5	F
8	250.46	1160	1160	<1		L									
9	261.89	1160	1160	<1		RPgw		N	9	F	E	S	SHR	1	M
10	407.94	1170	1160	2.5		L									
11	1157.26	1180	1170	0.08		RPgw		U	9	U		S	SHR	2	F
12	881.13	1190	1180	1.1		RPgw		U	3	U		S	SHR	2	G
13	628.52	1200	1190	1.6		U		U	9	U		S	SHR	5	U
14	1389.58	1250	1200	3.6		U		U	9	U		C	MF	4	U
15	766.85	1270	1250	2.6		RPgw		CV	3	U		S	SHR	2	M
16	698.76	1290	1270	2.9		U		U	9	U		C	MF	5	U
17	460.65	1290	1290	<1		RPgw		CV	3	U		S	SHR	2	M
18	2025.02	1300	1290	0.05		L	(Willow Lake)								
19	695.76	1310	1300	1.4		U		U	9	U		C	MF	4	U
20	556.57	1310	1310	<1		L^B									
21	1005.05	1360	1310	5		CP_b		U	9	U		C	MF	5	P
22	718.65	1620	1360	36.2		SP_b		U	9	U		C	MF	5	P

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OVERVIEW ASSESSMENT- Habitat Condition Summary Form 2

Watershed Name: Bridge Creek
Watershed Code: 129-3604-239-984-995
Air photo series: 30BCC950844: 22-30
30BCC95067: 147
Photo Numbers: 30BCC95077: 73, 145
30BCC95079: 41, 175-177
30BCC95076: 7-21, 161-163
30BCC95066: 167-169
30BCC95028: 17-19
30BCC95075: 131-137, 195
Sub-basin: n/a
NTS maps: 92P10/11/14/15
Photo scale: 1:15,000

Reach Number	Length (m)	Elevation (m) Upper	Elevation (m) Lower	Gradient (%)	Wb (m)	Channel Type	Disturbance Types			Barriers	Pools Code	LWD Codes		Riparian Type	Stand Structure	Offchannel Habitats
1	3212.92	780	780	<1	12	RPgw				N	1	F	E	S	SHR	P
2	14906.76	780	780	<1	8	RPgw				BD	1	F	E	S	SHR	M
3	9146.83	800	780	0.2	7	RPgw	WG	MB		BD	2	F	E	S	SHR	G
4	4368.05	840	800	0.9	10	RPgw	WG	BC	EB	N	2	F	E	S	SHR	P
5	13540.12	840	840	<1	10	RPgw	WG	EB		BD	1	F	E	S	SHR	G
6	4850.23	860	840	0.4	10	RPgw	MB	WG	EB	BD	1	F	E	S	SHR	M
7	4798.11	880	860	0.4	9	RPgw	MB	WG	BC	BD	2	F	E	S	SHR	M
8	4758.95	900	880	0.4	11	RPgw				N	2	F	E	S	SHR	F
9	5450.69	900	900	<1	13	RPgw				BD	1	F	E	C	MF	M
10	1864.35	900	900	<1	15	RPgw	BC	EB	MB	N	1	F	E	S	SHR	F
11	2839.70	900	900	<1	14	RPgw	MB			N	1	F	E	S	SHR	M
12	731.21	940	920	2.7	10	CPcw				C	1	F	E	C	MF	P
13	4531.90	940	940	<1	8	RPgw	WG	EB	MB	N	2	F	E	S	SHR	G
14	2753.37	960	940	0.7	8	U	EB			N	9	U		C	MF	U
15	3691.22	980	980	<1	30	RPgw				N	1	F	C	S	SHR	P
16	6550.32	Horse Lake														
17	4485.63	980	980	<1	4	RPgw				N	1	N		S	SHR	F
18	8956.18	1000	980	0.2	5	RPgw	BC			N	2	N		S	SHR	G
19	6218.61	1060	1020	0.6	5	RPgw	BC			U	9	U		C	MF	F
20	4030.93	1080	1060	0.5	4	RPgw				N	1	N		S	SHR	M
21	4939.36	1100	1080	0.4	4	RPgw				N	1	U		C	MF	M
22	2947.42	1100	1100	<1	7	RPgw	EB	BC	MB	N	1	F	C	S	SHR	F
23	1374.58	1120	1120	<1	20	RPgw	EB			N	2	N		C	MF	P
24	1021.04															
25	2002.55	1120	1120	<1	11	RPgw				N	1	N		C	YF	P
26	992.59	1120	1120	<1	30	RPgw				N	3	N		C	MF	P
27	Lesser Fish Lake															
28		1120	1120	<1	14	RPgw				N	9	U		C	MF	P
29	Bridge Lake															

NOTE:
Due to the meandering stream pattern (increased stream length) gradient measurements do not accurately depict actual increased gradient reaches seen during the air video.

OVERVIEW ASSESSMENT- Habitat Condition Summary Form 2

Watershed Name: Bridge Creek
Watershed Code: 129-3604-239-984-995-465
Air photo series: BCC95079^
BCC95076^^
Photo Numbers: ^41-48
^^146-153

Sub-basin: Little Bridge Creek
NTS maps: 92P11
Photo scale: 1:15,000

Reach Number	Length (m)	Elevation (m) Upper	Elevation (m) Lower	Gradient (%)	Wb (m)	Channel Type	Disturbance Types			Barriers	Pools Code	LWD Codes		Riparian Type	Stand Structure	Canopy Closure	Offchannel Habitats
1	860.76	900	900	<1		RPgw	EB			N	9	U		C	MF	2	F
*2	1853.62	910	900	0.5		RPgw	EB	FP		BR	2	N		G	SHR	1	P
*3	1625.80	920	910	0.6		RPgw				BD	3	N		G	SHR	1	G
4	1485.60	Exeter Lake				L	(Exeter)					N		S	SHR	1	G
*5	745.31	930	920	1.3		RPgw	EB	MC		U	2	N		S	SHR	2	M
*6	925.21	950	930	2.2		RPgw	EB			BR	9	F	E	C	MF	2	U
*7	625.04	970	950	3.2		RPgw	EB	WG		BR	9	U		C	MF	4	U
*8	725.63	980	970	1.4		RPgw + L^B	MC			BD	3	F	E	S	SHR	2	G
*9	2099.83	1020	980	1.9		RPgw				U	2	A	E	C	MF	2	U
*10	209.07	1030	1020	4.8		L^B + RPgw		MC		BD		A	E	G	SHR	1	G
*11	904.94	1040	1030	1.1		RPgw				U	2	A	C	C	MF	2	U
*12	860.04	1050	1040	1.2		L^B				BD		F	E	S	SHR	1	G
*13	1892.1702	1120	1050	3.7		RPgw				F	9	A	E	C	MF	2	U
*14	1903.7996	1130	1120	0.5		RPgw + L^B				BD	3	F	E	S	SHR	1	G
*15	602.88365	1140	1130	1.7		RPgw				U	U	A	E	C	MF	3	U
*16	524.18285	1150	1140	1.9		L				BD							
*17	1879.2116	1160	1150	0.5		L^B + RPgw				BD	4	A	C	S	SHR	2	G
*18	473.71267	1160	1160	<1		L											
*19	1061.6339	1160	1160	<1		RPgw				BD	4	F	E	S	SHR	1	G
*20	985.05475	1160	1160	<1		L	(Little Holden)										
*21	836.90107	1160	1160	<1		RPgw					3	N		S	SHR	1	F
*22		1170	1160	<1		L	(Holden)										

*FISS + Air Video derived

APPENDIX 3. OVERVIEW FISH HABITAT ASSESSMENT, FORM 3: PRELIMINARY HABITAT ASSESSMENT FORM

OVERVIEW ASSESSMENT- Preliminary Habitat Assessment Form 3

Watershed Name: Bridge Creek (Judson Cr)
Watershed Code: 129-3604-239-984-995-840

UTM Coordinates: 10.649145E 5714724N
NTS Maps: 92P10

Reach	Section	Habitat Value	Upslope Impact Potential	Major Impacts	Priority for Level 1	Restoration Opportunities
1		H	L	potential road crossing problem	L	assess crossing
2		M	M	none	L	
3		M	L	none	L	
4		L	L	potential road crossing problem	L	assess crossing
5		M	L	none	L	
6		H	M	none	L	
7		M	H	lack of riparian cover, possible sedimentation from cutblock	M	assess severity of possible sedimentation
8		H	M	unknown	L	
9		L	H	possible sediment source from adjacent cutblock, lack of riparian cover on southern bank	M	bank stabilization
10		L	L	none	L	
11		H	M	none	L	
12		H	M	possible sedimentation, infilling of spawning gravels	M	LWD placement to trap spawning gravels
13		H	H	removal of riparian zone, possible infilling of spawning gravels	H	restore riparian zone, LWD placement, spawning gravels
14		H	H	none	L	
15		M	H	none	L	

OVERVIEW ASSESSMENT- Preliminary Habitat Assessment Form 3

Watershed Name: Bridge Creek (O'Neil Cr)
Watershed Code: 129-3604-239-984-995-760

UTM Coordinates: 10.642931E 5716651N
NTS Maps: 92P10

Reach	Section	Habitat Value	Upslope Impact Potential	Major Impacts	Priority for Level 1	Restoration Opportunities
1		H	H	Potential migration barrier at crossing	M	Assess Road crossing
2		M	M	Possible impacts from reach3 (sediment transport)	M	Lwd placement
3		M	L	Lack of riparian LWD, possible sediment input adjacent block	H	Bank stabilization, LWD placement
4		M	L		L	
5		H	L	Lack of riparian cover, lack LWD, road crossing	H	Assess crossing, LWD placement, bank stabilization
6		L	L		L	
7		M	L	Lack of riparian cover	L	LWD placement, possible spawning gravel introduction

OVERVIEW ASSESSMENT- Preliminary Habitat Assessment Form 3

Watershed Name: Bridge Creek (Donald Cr)
Watershed Code: 129-3604-239-984-985-984

UTM Coordinates: 10.659240E 5707831N
NTS Maps: 92P10

Reach	Section	Habitat Value	Upslope Impact Potential	Major Impacts	Priority for Level 1	Restoration Opportunities
1		H	M	None noted	L	
2		H	H	None noted (Stack Lake)	L	
3		H	L	Potential road crossing problems	L	Assess crossing, possible impacts on spawning area
4		H	L	None noted	L	
5		H	L	Potential road (two) crossing problems	L	Assess crossings, potential spawning gravel placement
6		H	L	None Noted (Wilson Lake)	L	
7		H	M	Potential crossing problem, possible sedimentation from road	L	Assess crossing, bank stabilization
8		H	L	None noted (unnamed lake)	L	
9		H	L	None noted	L	
10		H	L	None noted (unnamed lake)	L	
11-13		M	M-11,12 H-13	None noted	L	
14		H	M	Potential sediment transport from upper reaches	M	Stabilize upper reaches
15-17		H	M	sedimentation, potential road xing problem	H	Assess crossings, spawning habitat improvements, LWD placement
18		H	H	None (Willow Lake)	L	
19-20		M to H	H	None noted	L	
21-22		L	H	None noted	L	

NOTE:
Summary upper watershed logged and proposed harvesting (possible reaches affected 14-22).
Lower watershed private land, site evaluation based on fisheries potential not under WRP guidelines (reaches 1 to 10)

OVERVIEW ASSESSMENT- Preliminary Habitat Assessment Form 3

Watershed Name: Bridge Creek
Watershed Code: 129-3604-239-984-995

UTM Coordinates: 10.645403E 5737401
NTS Maps: 92P10,11,14,15

Reach	Section	Habitat Value	Upslope Impact Potential	Major Impacts	Priority for Level 1	Restoration Opportunities
1-2		M	L	Man-made irrigation channels, agricultural beaver activity, lack of LWD	L	Private land, Indian Reserve
3		H	M	Elevated mid channel bars (upper reach) sediment wedges	M	LWD placement, bank stabilization,private land
4		H	H	Bank erosion sediment wedges	H	Bank stabilization, LWD placement
5-10		M	M	Bank erosion, beaver dams, lack of riparian cover elevated mid channel bars	L	Bank stabilization, LWD placement, dam removal
11		M	M	urban development, eroding banks	L	Bank stabilization
12		H	H	Fish barriers, urban development	L	Fishway
13		L	M	Isolated side channels, beaver activity eroding banks, riparian removal	L	Bank stabilization, beaver dam removal
14		H	H	Eroding banks top of reach	L	Bank stabilization
15		H	L	Bank erosion, lack of riparian cover cattle watering, instream fencing	H	Bank stabilization, LWD placement riparian fencing
16		H	H	Horse Lake, water useage	L	
17-18		H	L	Agricultural impacts,riparian removal	L	Private land
19&21		H	H	Beaver dams, isolated back channels	L	Private land
20,22,23		M	M	Beaver dams, eroding banks, isolated backchannels	L	Bank stabilization
24		H	M	Roe Lake	L	
25-26		L	M	Eroding banks lack of riparian cover	L	Bank stabilization, Private land
27		H	L	Lesser Fish Lake	L	
28		H	L	None noted	L	
29		H	H	Bridge Lake	L	

NOTE:
All restoration opportunities would not qualify under watershed restoration due to Private land; however, many impacts exsist and therefore have been noted.

OVERVIEW ASSESSMENT- Preliminary Habitat Assessment Form 3

Watershed Name: Bridge Creek (Little Bridge Cr)
Watershed Code: 129-3604-239-984-995-465

UTM Coordinates: 10.619491E 5723609N
NTS Maps: 92P11

Reach	Section	Habitat Value	Upslope Impact Potential	Major Impacts	Priority for Level 1	Restoration Opportunities
1		M	M	Eroding banks (natural)	M	Bank stabilization
2		M	L	Limited pool frequency	M	Streamside planting LWD placement
3		L	L		L	None
4		H	L		L	None
5		M	L		L	None
6		H	M	Ford crossing, possible spawning gravel degradation	H	Install proper crossing LWD placement for spawning gravel recruitment
7		M	L	Assess crossing for possible barrier	M	possible culvert replacement
8		M	L		L	None
9		H	M		L	None
10,12,14		M	M	Beaver dams may be blocking migration	L	Possible beaver dam removal
11		H	L		L	None
13		H	M	Falls blocking upstream limits of rainbow trout	M	Removal of barrier
15-22		L	L	*above known Rb distribution to falls in reach 13	L	None

APPENDIX 4: ANGLING EFFORT ESTIMATES FOR SURVEYED LAKES WITHIN THE BRIDGE CREEK WATERSHED

Adapted from Berezay and Lirette, 1997

LAKE NAME	YEAR	ANGLER DAYS
BOBBS	86	1132
BOBBS	87	174
BOBBS	88	231
BOBBS	89	51
BOBBS	90	84
BOBBS	91	96
BRIDGE	86	7980
BRIDGE	87	7247
BRIDGE	88	4392
BRIDGE	89	7446
BRIDGE	90	9516
BRIDGE	91	12455
BRIDGE	96	12005
CANIM	90	7452
CANIM	91	6147
CANIM	96	3763
DEKA	86	6154
DEKA	87	5800
DEKA	88	3787
DEKA	89	2881
DEKA	90	2649
DEKA	91	3273
DEKA	96	7105
EXETER	86	174
EXETER	87	566
EXETER	88	0
EXETER	89	96
EXETER	96	0
FAWN	86	750
FAWN	87	1794
FAWN	88	1402
FAWN	89	2328
FAWN	90	3363
FAWN	91	4823
FAWN	96	6192
HORSE	86	8449
HORSE	87	15310
HORSE	88	10243
HORSE	89	15509
HORSE	90	11529
HORSE	91	11715
HORSE	96	11343
SHERIDAN	86	31346

LAKE NAME	YEAR	ANGLER DAYS
SHERIDAN	87	38059
SHERIDAN	88	45312
SHERIDAN	89	43538
SHERIDAN	90	34407
SHERIDAN	91	34394
SHERIDAN	96	25527
SULPHUROUS	86	3877
SULPHUROUS	87	2160
SULPHUROUS	88	2373
SULPHUROUS	89	2366
SULPHUROUS	90	2296
SULPHUROUS	91	2225
SULPHUROUS	96	2640
STACK	96	32
WAVEY	96	1050
WILSON	96	354

APPENDIX 5: WATER SURVEY OF CANADA HYDROMETRIC DATA FOR BRIDGE CREEK AT OUTLET OF HORSE LAKE (1974-1996)

BRIDGE CREEK AT OUTLET OF HORSE LAKE - STATION NO. 08LA020

MONTHLY MEAN DISCHARGES IN CUBIC METRES PER SECOND FOR THE PERIOD OF RECORD

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN	YEAR
974	---	---	---	---	---	---	---	---	---	---	0.410	0.232	---	1974
1975	0.179	0.098	0.127	0.725	2.38	3.60	2.52	1.23	0.646	0.492	0.369	0.299	1.06	1975
1976	0.419	0.673	1.67	2.64	7.64	5.46	3.13	2.81	3.83	2.60	1.62	1.30	2.82	1976
977	1.13	1.21	1.14	2.05	4.67	4.35	2.38	1.22	0.711	0.511	0.382	0.306	1.67	1977
978	0.280	0.354	1.14	2.56	4.58	3.68	2.04	0.967	0.664	0.456	0.376	0.298	1.45	1978
1979	0.158	0.152	0.933	1.90	3.97	3.21	1.26	0.226	0.065	0.037	0.014	0.026	0.999	1979
1980	0.040	0.016	0.008	0.425	0.458	0.934	1.34	1.62	1.37	1.09	0.980	1.05	0.781	1980
981	1.14	1.22	1.17	1.54	2.13	2.73	2.61	1.81	1.05	0.750	0.679	0.533	1.45	1981
982	0.345	0.488	0.471	0.890	4.67	5.51	4.47	5.20	5.22	5.45	3.92	2.69	3.29	1982
1983	2.23	2.00	2.19	3.46	4.51	2.52	1.97	1.60	1.19	1.07	1.17	1.18	2.09	1983
1984	1.35	1.40	1.32	2.75	4.36	4.60	2.85	1.13	0.836	0.903	0.925	0.726	1.93	1984
985	0.870	1.48	1.55	2.75	7.48	7.44	2.95	0.541	0.600	0.596	0.421	0.343	2.25	1985
1986	0.457	0.454	0.647	1.84	1.71	1.16	1.06	0.860	0.139	0.220	0.583	0.237	0.782	1986
1987	0.208	0.296	0.387	0.584	0.567	0.302	0.108	0.146	0.082	0.151	0.096	0.096	0.251	1987
988	0.094	0.111	0.128	0.070	0.074	0.089	0.247	0.290	---	---	---	0.205	---	1988
989	0.142	0.065	0.161	0.385	1.31	0.951	0.600	1.11	0.965	0.695	0.923	1.14	0.708	1989
1990	1.30	1.15	1.18	2.29	4.39	10.9	9.67	3.09	1.57	1.13	1.08	0.855	3.22	1990
1991	0.674	1.93	1.41	1.79	3.27	3.03	2.25	0.896	0.477	0.151	0.239	0.610	1.39	1991
992	0.781	0.764	1.82	4.46	4.17	2.23	0.854	0.330	0.574	0.635	0.711	0.520	1.49	1992
1993	0.305	0.435	0.708	1.38	5.92	4.26	3.06	1.74	0.556	0.455	0.679	0.688	1.69	1993
1994	0.858	0.943	1.01	4.47	5.09	3.11	1.62	0.555	0.134	0.327	0.148	0.275	1.55	1994
995	0.341	0.413	0.474	1.31	2.95	2.07	1.21	0.965	0.995	0.650	0.648	0.910	1.08	1995
MEAN	0.633	0.745	0.935	1.92	3.63	3.44	2.30	1.35	1.08	0.918	0.780	0.660	1.60	MEAN

OCATION - LAT 51:36:25N DRAINAGE AREA 912 km2
LONG 121:13:50W REGULATED SINCE 1982

WATER SURVEY OF CANADA BRIDGE CREEK AT OUTLET OF HORSE LAKE STATION NO. 08LA020

FEB 4 1997 PAGE 1

WILLIAMS LAKE BC 10:36 READQQ DOS SEP/93

~~(PRELIMINARY)~~ DAILY DISCHARGE IN CUBIC METRES PER SECOND FOR 1996

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
31	1.05 B												
1	1.05 B	1.05 B	1.21 B	1.99	7.75	7.75	4.40	1.46	1.06	1.01	1.07	1.30	1
2	1.10 B	1.04 B	1.12 B	1.96	7.77	7.67	4.26	1.49	1.05	1.02	1.07	1.29 B	2
3	1.10 B	1.03 B	1.11 B	1.98	7.78	7.55	4.17	1.48	1.13	1.04	1.06	1.30 B	3
4	1.08 B	1.02 B	1.13 B	1.99	7.76	7.40	4.02	1.54	1.14	1.03	1.06	1.32 B	4
5	1.06 B	1.08 B	1.16 B	2.07	7.74	7.32	3.91	1.54	1.12	1.03	1.06	1.34	5
6	1.09 B	1.14 B	1.18	2.12	7.75	7.25	3.79	1.53	1.11	1.04	1.03	1.33	6
7	1.14 B	1.20 B	1.21	2.27	7.72	7.08	3.67	1.52	1.13	1.03	1.06	1.32 B	7
8	1.19 B	1.25 B	1.26	2.49	7.75	6.93	3.51	1.50	1.11	1.03	1.09	1.31 B	8
9	1.25 B	1.30 B	1.28	2.82	7.74	6.77	3.38	1.48	1.10	1.04	1.08	1.30 B	9
10	1.35 B	1.34 B	1.28	3.30	7.75	6.48	3.29	1.47	1.08	1.03	1.10	1.31	10
11	1.37 B	1.36	1.28	3.92	7.78	6.27	3.22	1.45	1.06	1.02	1.15	1.31	11
12	1.39 B	1.37	1.30	4.45	7.80	6.15	3.06	1.45	1.04	1.03	1.18	1.32	12
13	1.35 B	1.43	1.32	4.99	7.83	6.01	2.97	1.42	1.04	1.03	1.21	1.32 B	13
14	1.34 B	1.44	1.34	5.45	7.88	5.82	2.88	1.38	1.04	1.05	1.24	1.31 B	14
15	1.32 B	1.47	1.35	5.86	7.96	5.67	2.78	1.36	1.04	1.03	1.25	1.30 B	15
16	1.30 B	1.47 B	1.44	6.23	8.02	5.52	2.74	1.32	1.06	1.03	1.26	1.27 B	16
17	1.26 B	1.43	1.47	6.63	8.14	5.32	2.72	1.30	1.05	1.06	1.25 B	1.24 B	17
18	1.21 B	1.43	1.55	7.02	8.20	5.32	2.69	1.30	1.05	1.04	1.24 B	1.21 B	18
19	1.19 B	1.41	1.60	7.31	8.25	5.30	2.59	1.29	1.04	1.01	1.23 B	1.18 B	19
20	1.19 B	1.40	1.65	7.48	8.27	5.22	2.50	1.28	1.06	1.01	1.22 B	1.16 B	20
21	1.18 B	1.39	1.74	7.60	8.20	5.13	2.36	1.26	1.07	1.03	1.24 B	1.14 B	21
22	1.17 B	1.40	1.77	7.71	8.16	4.96	2.21	1.23	1.05	.999	1.26 B	1.12 B	22
23	1.16 B	1.37	1.81	7.82	8.17	4.96	2.10	1.20	1.06	.999	1.29 B	1.09 B	23
24	1.16 B	1.35 B	1.85	7.78	8.19	4.96	2.02	1.16	1.04	1.01	1.31 B	1.06 B	24
25	1.15 B	1.33 B	1.91	7.91	8.19	4.89	1.93	1.14	1.02	.991	1.33 B	1.03 B	25
26	1.14 B	1.31 B	1.92	7.86	8.07	4.85	1.88	1.12	1.02	1.01	1.32	1.00 B	26
27	1.12 B	1.29 B	1.94	7.88	8.00	4.75	1.81	1.10	1.01	1.05	1.34	.970 B	27
28	1.11 B	1.27 B	1.95	7.90	7.90	4.70	1.75	1.08	1.01	1.05	1.29	.940 B	28
29	1.10 B	1.24 B	1.95	7.82	7.89	4.65	1.69	1.05	1.01	1.04	1.31	.930 B	29
30	1.08 B		1.95	7.78	7.76	4.55	1.58	1.06	1.01	1.07	1.32	.940 B	30
31	1.07 B		1.98		7.74		1.53	1.08		1.07		.950 B	31
TOTAL	36.77	37.61	47.01	160.39	245.91	177.20	87.41	41.04	31.81	31.929	35.92	36.910	TOTAL
MEAN	1.19	1.30	1.52	5.35	7.93	5.91	2.82	1.32	1.06	1.03	1.20	1.19	MEAN
DAM3	3180	3250	4060	13900	21200	15300	7550	3550	2750	2760	3100	3190	DAM3
MAX	1.39	1.47	1.98	7.91	8.27	7.75	4.40	1.54	1.14	1.07	1.34	1.34	MAX
MIN	1.05	1.02	1.11	1.96	7.72	4.55	1.53	1.05	1.01	.991	1.03	.930	MIN

SUMMARY FOR THE YEAR 1996

MEAN DISCHARGE, 2.65 M3/S

TOTAL DISCHARGE, 83800 DAM3

MAXIMUM DAILY DISCHARGE, 8.27 M3/S ON MAY 20

MINIMUM DAILY DISCHARGE, .930 M3/S ON DEC 29

MAX INST DISCHARGE 8.39 m³/s @17:00PST ON MAY19 (GH=1.313)

TABLE #24 - JAN 1 TO JAN 31

TABLE #25 - FEB 1 to DEC 31

B-ICE CONDITIONS

PREPARED BY / DATE T. Parry, Feb 4/97

CHECKED BY / DATE [illegible] 5 FEB 97

APPROVED BY / DATE [signature] FEB. 6/97