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Final Report

WATERSHED RESTORATION PROGRAM

MIDDLE SHUSWAP RIVER WATERSHED STREAM ASSESSMENT

Prepared for:

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Project 511.03

March 28, 1996.







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March 28, 1995

Reference: 511.03

Mr. Phil Epp, P.Ag.
B.C. Ministry of Environment, Lands & Parks
Southern Interior Sub-Regional Office
201, 3547 Skaha Lake Road
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Dear Mr. Epp:

Re: Middle Shuswap River Watershed Stream Assessments

Summit Environmental Consultants Ltd. is pleased to provide you with four (4) bound and one (1) unbound copies of the **final report** for the above project. A total of 20 sites were identified as having high impacts due to forest harvest ativities. The impacts include reaches with excessive amounts of large woody debris (9 sites) landslides (5 sites), problems with bridges or culverts (4 sites) and road cutslope/fillslope erosion (2 sites).

We trust that this completes our assignment to your satisfaction. If you have any questions, please call.

Yours truly,

Summit Environmental Consultants Ltd.

Hugh Hamilton, Ph.D., P.Ag. Senior Environmental Scientist

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1.0 INTRODUCTION

1.1 Background

The Shuswap River is a tributary of the Thompson River, which is in turn part of the Fraser River system in British Columbia. The Fraser River is one of the world's most productive salmon rivers and maintaining fish habitat values and water quality throughout the Fraser Basin is important to ensure the sustainability of the Fraser's fisheries resources. There are five anadromous salmonid species, six resident sport fish species, and numerous non-game species distributed within the Shuswap River watershed upstream of Mara Lake. The life histories of the anadromous species have spatial and temporal variations within the watershed specific to each species. Some species spend several years in freshwater before migrating to the Pacific Ocean. Resident fish populations have life histories that can be lacustrine, fluvial, or migratory fluvial-adfluvial. These complex life histories are often represented within one species, for example rainbow trout, which adds difficulty in attempting to separately document these populations.

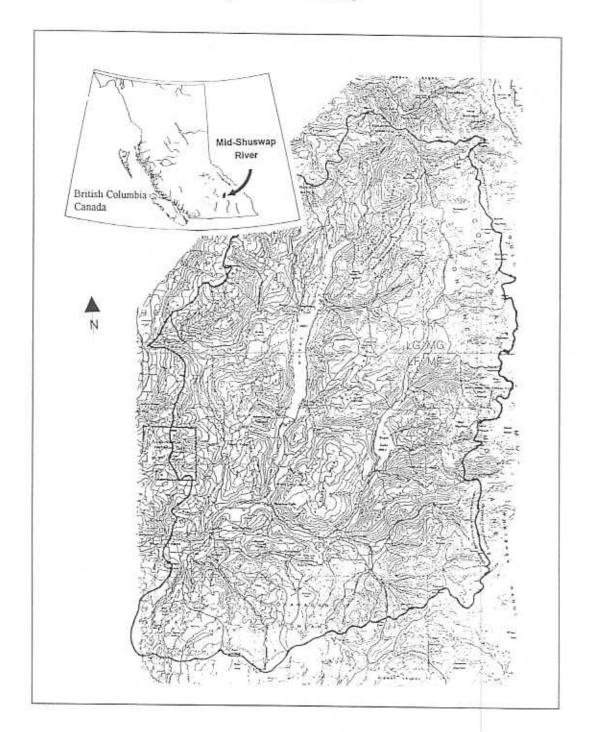
In 1994 the Middle Shuswap River watershed (Figure 1.1), which is defined as the watershed area upstream of the town of Enderby and downstream of the south end Mabel Lake (including Mabel Lake tributaries), was selected for inclusion in the provincial Watershed Restoration Program (WRP). The four phases of WRP are:

- Assessment
- 2. Prescription
- 3. Implementation, and
- 4. Monitoring

In the Kamloops Forest Region the assessment phase has been divided into i) streams/riparian zones and ii) upslope areas. Summit Environmental Consultants Ltd. ("Summit") was retained by the B.C.

3/28/96

Figure 1.1 Middle Shuswap River location map.



Ministry of Environment, Lands and Parks (B.C. MELP) in October 1994 to conduct the assessment phase of the WRP for the Middle Shuswap watershed. The overall intent of the Middle Shuswap WRP assessment project is to identify and evaluate potential stream restoration opportunities to improve fish habitat and water quality within the watershed (see Appendix A - Terms of Reference). The watershed assessment phase includes fish habitat and stream channel assessments, with emphasis on those sites which are associated with forest harvest activities. The Upper Shuswap River, which is defined as the watershed upstream of the south end of Mabel Lake, has been assessed by Summit under a separate contract.

It is important to note that the definition of "Upper", "Middle" and "Lower" Shuswap River used in this report is different from that commonly used by the Department of Fisheries and Oceans (DFO), where the watershed downstream from the Mabel Lake outlet to the outlet of Mara Lake is called the Lower Shuswap.

1.2 Objectives

The specific objectives of the WRP assessment for the Middle Shuswap River are to:

- Videotape a selected number of streams from a helicopter and provide audio commentary concerning geomorphological and stream habitat features and possible degraded sites. The streams that were inspected were pre-selected by B.C. MELP staff in Penticton and include Sowsap, Latewhos, Tsuius, Whip, Hound, Wap, Kingfisher, Cooke, and Brash Creeks;
- Review the videotapes and map those sites which were identified as being potentially degraded.
 Classify the potentially degraded sites according to type, cause, source and degree of impact;
- Conduct ground truthing surveys at each of the sites identified on the helicopter video at which
 there appeared to be a significant impact associated with forestry operations. Assess stream

channel morphology, photograph each site, and compile habitat information according to Appendices 2 and 3 of Watershed Restoration Technical Circular No. 8. (B.C. MELP/B.C. MOF, 1994);

- 4 Review existing literature, reports, historic and recent aerial photographs, and hydrotechnical data concerning each sub-watershed;
- Compile an inventory of sediment sources to each stream; 5
- Collect anecdotal information on the streams from persons and agencies familiar with the 6. streams:
- Priorize degraded sites, reaches and/or streams for restoration and propose initial remedial 7. measures; and
- Identify and recommend further assessment procedures, as required. 8.

2.0 METHODS

2.1 Helicopter Surveys and Initial Site Classification

The helicopter surveys were conducted October 11-13, 1994. A hydrologist/geomorphologist and a fisheries biologist were present on all flights. A video camera was mounted in the nose of the helicopter, and a global positioning system (GPS) in the helicopter provided continuous location coordinates in latitude/longitude units (degrees/minutes/hundredths of minutes) which were imprinted on the video tape. All personnel in the helicopter were outfitted with a microphone and provided

verbal commentary direct to the video/audio tape regarding watershed and habitat characteristics and the location of potentially degraded sites.

When the helicopter surveys were completed, a coding system for stream impacts was drawn up for use when reviewing the video tape (Table 2.1). The video tapes were reviewed in late October 1994. To ensure consistency, a single individual reviewed all the video tape for the Middle Shuswap watershed, as well as the other three watersheds assessed in the 1994-95 WRP for the Okanagan-Shuswap Region (Mission Creek, Naramata/Robinson Creeks, Upper Shuswap River). The sites identified on the video were then classified according to the code on Table 2.1, and the information summarized into tables, with one table per stream. The locations of the sites were plotted on 1:50,000 scale NTS map sheets (see Section 3.0 - Project Deliverables).

2.2 Field Surveys

The field surveys were initiated during November 1994 and completed in the spring and early summer of 1995. The field crew consisted of hydrologist/geomorphologist and a fisheries biologist. The objective was to visit all sites which had been classified from the videotape as having a high probable impact and where the source was either forestry (i.e., F.1 - source of problem is forestry activities, high probable impact) or unknown (i.e., U.1 - uncertain source, high probable impact). This was about 10-15% of the total number of sites observed from the helicopter survey.

The steps taken in the field included:

The site location was verified using a hand-held GPS receiver and maps (1:50,000 NTS 1 and larger scale forest cover maps)

Table 2.1 Coding system for stream impacts.

The coding system employed is a combination of four factors which are outlined in the order they appear in the code, as follows:

Potential Problem

Water quality	Q
Fish barrier	Fb
Fish spawning habitat degradation	Fs
Fish Rearing habitat degradation	Fr

Cause of the Problem

Streambanks (slumps, slides, bank erosion)	S
Road fill-slopes	F
Culverts or bridges	C
Debris	D
Bank Protection	P
Waterfall	W

Land Use Activity Contributing to the Problem

Forestry	F
Agriculture	A
Highways/Roads/Railways	Hw
Residential/recreational/industrial	R
Natural	N
Uncertain	11

Estimated Degree of Impact

High	1
Medium	2
Low	3
Unknown	4

Examples:

Q.F.F.2	Water quality . Road fill-slopes . Forestry . Medium Impact
Fs.D.F/N_1	Fish spawning habitat degradation • Debris • Forestry/Natural • High

- A general reconnaisance of the reach was conducted, typically over a distance of 250 m upstream and 250 m downstream of the site identified from the video
- Fish habitat information was compiled by completing DFO/MELP Stream Information Summary System (SIS) forms. The forms include stream gradient, width (channel and wetted), depth, bed material, cover, bank height, debris, obstructions, and observed fish species. The information collected meets and generally exceeds the information requirements in Technical Circular No. 8 (B.C. MELP/B.C. MOF, 1994)
- Stream geomorphology was examined and documented, including bed and bank materials, stream gradient, sediment deposition areas, width of floodplain, slope of adjacent hillsides, presence/absence of exposed slopes, tree stability on banks and slopes, and potential sediment sources. The channel assessments were similar to the subsequently released Channel Assessment Procedure (B.C. MOF, 1995).
- The amount of large woody debris (LWD) present in the streams was noted and any implications for fish passage, spawning and rearing were assessed
- Photographs were taken of stream habitat features and potential sources of problems
- Notes were made regarding any fish or wildlife observations
- Estimates were made on how existing stream regimes (geomorphology, water quality, fish habitat) vary from natural (e.g., pre-harvest) conditions (including natural variation)
- 9. The nature and extent of forest harvest impacts were assessed, and

 Site feasibility for restoration was assessed, including site sensitivity to restoration (i.e., level of effort needed to produce a significant result), possible methods, site access and logistics.

2.3 Information Review and Summary

The field investigations were supplemented by reviewing published information on the subject streams and by telephone or personal interviews with persons familiar with each stream. Published information included:

- NTS 1:50,000 topographic maps
- B.C. MOF forest cover maps (typical scales 1:15,000-1:30,000) and biogeoclimatic zone maps
- aerial photographs from 1992-1993 (colour, scale approx. 1:20,000) and the 1950s (black and white, scale approx. 1:15,000)
- DFO/MOELP Stream Information Summary sheets and MELP fisheries files
- MELP water licence data
- available geomorphological and soil survey reports and maps

For each stream, reaches were delineated based on changes in stream gradient and/or valley shape (e.g., U-shaped or incised) as determined from the topographic maps and field notes.

2.4 Sediment Source Inventory

The black and white aerial photographs from the 1950s were obtained for historical comparison with the 1992-93 aerial photographs. The comparisons assisted in determining locations and degrees of impacts caused by forest harvesting, and were used to locate sediment sources and to estimate rates of sediment supply, where feasible.

Erosion and sedimentation are naturally occurring processes. Even in watersheds where no forest harvest has occurred, erosion (surface, gully, bank) and natural mass movements contribute sediment to streams. These processes are considered "geologic" or natural erosion. Erosion caused by forest harvest or other land use activities is termed "accelerated" erosion. The overall contribution of individual sediment sources to the sediment load of a stream is difficult to determine, even in detailed studies. It is possible that high frequency but low magnitude sources, such as bank erosion, contribute as much or more sediment than low frequency - high magnitude sources such as landslides. However the large magnitude sources are easier to identify from aerial photographs and field reconnaisance, and are more likely to respond to mitigative measures. Thus the sediment source inventory focused on two sediment source types:

- 1. Large natural erosion (e.g., large exposures of soil on the outside of a river meander), and
- Accelerated erosion (e.g., mass movements related to roads, erosion at bridges, and bank erosion near log jams).

A list of sources was compiled for each creek covered by the assessment. Where possible (e.g., land slide scars), the dimensions were determined and note was made on changes between the 1950s and 1990s.

3.0 REPORT FORMAT AND PROJECT DELIVERABLES

Each of the nine (9) streams included in this report is described in a separate report section. The tributaries of Mabel Lake are presented first, followed by the tributaries of Shuswap River between Mabel Lake and Enderby. Following the individual stream sections is a summary of the assessment work completed for the Middle Shuswap watershed, and recommendations on potential restoration sites (Section 13.0).

Laminated 1:50,000 scale NTS maps for the areas included in this report are presented in Attachment 1. The maps show the locations of reach breaks and the sites that were identified from the helicopter survey, with the final impact codes. Colour aerial photographs from the period 1989-1993 (henceforth referred to as the "1990s") are included as Attachment 2, and black-and-white aerial photographs from the 1950s are included as Attachment 3. Other information compiled for each sub-watershed, including photographs, SIS forms, SIS summaries, and video transcripts, are included in Appendices II through X.

4.0 SOWSAP CREEK

4.1 General Description

Sowsap Creek is a tributary of Mabel Lake. It discharges into the lake at the southern end, about 1 km west of the point where the Shuswap River flows into Mabel Lake. Sowsap Creek originates in the Trinity Hills just west of Mabel Lake. Styx Creek is a tributary. Additional information about Sowsap Creek is found in Table 4.1. The NTS map sheet covering the creek (82 L/7) is in Attachment 1, the colour aerial photographs from 1992-93 are included as Attachment 2, and the 1950s black and white photos are included as Attachment 3. The video transcripts, photographs, SIS survey forms, and DFO/MELP Stream Information Summary Sheet are provided in Appendix II.

No videotape is available of Sowsap Creek. Thus the following assessment was based on notes taken during the helicopter flight, a reconnaisance-level field inspection, and a review of aerial photographs.

4.2 Reach Descriptions

Reach #1 is a low gradient reach that crosses the floodplain of the Shuswap River at the south end of Mabel Lake. It is accessible to fish from Mabel Lake. Reach #2 is a steeper section that is incised into a v-shaped valley. Both the upper and lower boundaries of Reach #3, which has a mean gradient of 3%, are marked by increases in gradient. Styx Creek enters Sowsap Creek near the upper boundary of Reach #3. The channel in Reach #4 is more confined than in #3. The start of Reach #5 is marked by an increase in gradient, and the channel is deeply incised.

Reach #6 is a lower gradient section, bordered by wetlands. Reach #7 is a small lake, about 500 m in length. There is some sloping terrain along the west shore and some marshy areas along the

Table 4.1. General characteristics of Sowsap Creek.

Parameter	Information	
Map sheet no.	82 L/7	
Latitude & longitude of mouth	50° 27′ N, 118° 45′ W	
Watershed area (km²)	58.7	
Stream length (km)	15	
No. of reaches	n/a	
Discharge (mean/highest month/lowest month)	not gauged	
Biogeoclimatic zone(s)/subzone(s) ¹	ICHmw2	
General flow direction	southeast	
Next higher order stream or lake	Mabel Lake	
Land use	forestry, recreation	
Known water licences	none	
Known fish species ²	RB in Styx Cr. (a tributary)	
No. of F1 and U1 sites identified	none	
No. of field sites checked	2	

Stream reach data summary for Sowsap Creek. Table 4.2

Reach#	Reach length (m)	Gradient (%)	Map sheet#	Site #'s within Reach
1	550	7	82 L/7	n/a
2	1500	11	82 L/7	n/a
3.	3750	3	82 L/7	n/a
4	1650	7	82 L/7	n/a
5	3050	10	82 L/7	n/a
6	2500	3	82 L/7	n/a
7	350	0	82 L/7, 82 L/10	ru/n
8	750	1	82 L/10	n/a
9	250	0	82 L/10	n/a
Total	14350			n/a

Biogeoclimatic zone codes are listed in Appendix XI. Fish species codes are listed in Appendix XII.

east shore. Reach #8 is a 750 m long reach that joins two small lakes (Reaches #7 and #9). It has a gradient of less than 5% with gently slopes on both side of the valley. Reach #9 is a small lake (250 m long) that forms the headwaters of Sowsap Creek.

4.3 Field Check Site Descriptions

Site #: 1

Date Inspected: Nov. 22/95

Impact Code: n/a

Coordinates: 50°27.04'N 118°50.31'W

Reach #: 3

Map sheet #: NTS 82 L/7

This site is a forest road bridge crossing near the confluence with Styx Creek. The bridge has good clearance and the banks are riprapped on both sides. The channel substrate is cobbles, gravel and sand. Channel gradient is 3.5%. The bridge is in good condition and is not having any adverse effects on Sowsap Creek.

Site #: 2

Date Inspected: Nov. 22/95

Impact Code: Q.S.N.1

Coordinates: 50°28.01'N 118°50.50'W

Reach #: 3

Map sheet #: NTS 82 L/7

This site is a natural landslide located on an outside meander of Sowsap Creek. The slide scar is approximately 15-20 m high and 23 m wide near the base. The slide was initiated by the creek undercutting the slope. The slide is visible on the 1989 aerial photographs, although it does not appear to be quite as large as the observations in 1995 indicate, suggesting that it has not stabilized.

On-going undercutting means that the exposure continues to erode. The materials on the exposure include a few boulders in a cobble-gravel-sand matrix. The material appeared to be unsorted, suggesting kame deposits. Some large woody debris is in the stream channel as a result of the erosion, although it does not appear to be influencing stream flow.

The channel has a gradient of 4% and a wetted width of 5 m at this site. On the day of the inspection the creek was 0.3 m deep and the flow velocity was about 0.4 m/s.

4.4 Sediment Source Inventory

The results of the sediment source inventory are summarized in Table 4.3. A total of 11 sources were identified from the review of aerial photographs. Eight of the sources are tributaries to the main stem of Sowsap Creek. The remaining three sources are all eroding stream banks that were sufficiently large that they could be identified on the photos (Note: Site #2 above is not one of these eroding banks). The eroding banks were all present on the 1950s photos, and none appeared noticeably larger on the photos from the 1989 photos compared to the 1950s photos.

4.5 Sowsap Creek Summary and Conclusions

Potential forest harvest effects on Sowsap Creek are related to two forest roads which run parallel to the creek from the Styx Creek confluence down to near the mouth. Based on a reconnaisance field survey and a review of aerial photographs, no sites were identified with a high level of impact due to forest activities. A natural slide and three areas of significant bank erosion were noted, but none of these are directly related to forest harvest.

Table 4.3 Sowsap Creek Sediment Source Inventory

Location symbol(1)	Coordinates				Dimensions(3)		Present in(4)		Larger in
	Lat (N)	Long (W)	Feature	Composition(2)	Width (m)	Length (m)	1950's yes/no?	1990's yes/no?	1990's yes/no?
3a	n/a	n/a	Tributary	sa, g	n/a	n/a	yes	yes	no
3Ь	n/a	n/a	Tributary	sa, g	n/a	n/a	yes	yes	no
3c	n/a	n/a	Tributary	sa, g	n/a	n/a	yes	yes	no
3d	n/a	n/a	Tributary	sa, g	n/a	n/a	yes	yes	по
Зе	n/a	n/a	Tributary	sa, g	n/a	n/a	yes	yes	no
5a	n/a	n/a	Tributary	sa, g	n/a	n/a	yes	yes	no
-5b	n/a	n/a	Eroding bank	sa, g	80	30	yes	yes	no
5c	rı/a	n/a	Tributary	sa, g	n/a	n/a	yes	yes	no
5d	n/a	n/a	Eroding bank	sa, g	40	20	yes	yes	по
Se	n/a	n/a	Eroding bank	sa, g	20	20	yes	yes	no
Sf	n/a	n/a	Tributary	53, g	n/a	n/a	yes	yes	no

(1): Refer to map: 82 L/7, 82 L/10

 Composition is determined from aerial photographs. Locations which have been checked in the field are indicated by a subscript 'f'. Compositions in brackets indicate minor amounts of the given texture.

si = sift sa = sand

g = gravel

(3) Width is distance measured along the stream. Length is distance measured from the toe to the zone of initiation (In the case of an eroding bank, length refers to 'bank height')

(4). Two sets of aerial photos were examined in this study: one set flown in 1950's and second set flown in 1990's

(5): n/c - No aerial photo coverage available at the time of the Sediment Source Inventory

(6) Location symbols designated with "R" are referenced by reach locations (e.g. R3a is located in Reach 3).

(7): Location symbols designated with a number are referenced by site numbers from the video transcript (e.g. 18a is located between sites #16 and #19).

5.0

LATEWHOS CREEK

5.1 General description

Latewhos Creek is a tributary of Mabel Lake which originates in the Park Range between Mabel and Sugar Lakes. Latewhos Creek discharges into Mabel Lake near the lake's south end, through Mabel Lake Provincial Park. Additional descriptive information about Latewhos Creek is found in Table 5.1. The NTS map sheet covering the creek (82 L/7) is provided in Attachment 1. The colour aerial photographs from 1992-93 are included as Attachment 2, and the 1950s black and white photos are included as Attachment 3. The video transcripts, photographs, SIS survey forms, and DFO/MELP Stream Information Summary Sheet are provided in Appendix III.

No videotape is available of Latewhos Creek. Thus the following assessment was based on notes taken during the helicopter flight, a reconnaisance-level field inspection, and a review of aerial photographs.

5.2 Reach Descriptions

Reach #1 is the low gradient section which flows across the delta at Mabel Lake. There is potential fish spawning habitat in the reach, and there are no obstructions to fish entering the creek from the lake. The start of Reach #2 is marked by a sharp increase in gradient. It is deeply incised with steep valley walls, and the gradient alone is likely a barrier to fish migration. Reach #3 is a relatively low gradient reach with some meanders. However the valley walls are still relatively steep.

Reach #4 is steeper than Reach #3, with many small tributaries. Reach #5 is the first portion of the stream located on the upper plateau. There is evidence of good fish habitat, based on low gradient,

Table 5.1. General characteristics of Latewhos Creek.

Parameter	Information		
Map sheet no.	82 L/7		
Latitude & longitude of mouth	50°28' N, 118°42' W		
Watershed area (km²)	55,6		
Stream length (km)	18		
No. of reaches	n/a		
Discharge (mean/highest month/lowest month)	not gauged		
Biogeoclimatic zone(s)	ICHmw2, ESSFwc2		
General flow direction	southwest		
Next higher order stream or lake	Mabel Lake		
Land use	recreation forestry		
Known water licences	none		
Known fish species	no data		
No. F1 and U1 sites identified	none		
No. of field sites checked	1		

Stream reach data summary for Latewhos Creek. Table 5.2

Reach #	Reach length (m)	Gradient (%)	Map sheet #	Site #'s within Reach
1	1250	8	82 L/7	n/a
2	4000	18	82 L/7	n/a
3	2250	5	82 L/7	n/a
4	1250	17	82 L/7	n/a
5	900	5	82 L/7	n/a
6	950	3	82 L/10	n/a
7	2000	5	82 L/10	n/a
8	1000	17	82 L/10	n/a
Total	13600			n/a

wider valley walls, and the presence of spawning-sized gravels. Reach #6 shows some channel meandering, and the valley has widened. Reach #7 is more confined than #6, with a steeper gradient. At 17%, Reach #8 is much steeper than #7. Reach #9 marks a return to a lower gradient. Reach #10 is a small lake (150 m x 150 m) which forms the headwaters of Latewhos Creek.

5.3 Field Check Site Descriptions

Site #: 1 Date Inspected: Nov. 22/95

Impact Code: Q/Fs•C•F•3 Coordinates: 50°27.53'N 118°43.19'W

Reach #: 1 Map sheet #: NTS 82 L/7

This site is the crossing of the Mabel Lake Forest Service Road over Latewhos Creek. The bridge is 13 m wide and has a span height of about 3.0 m. The bridge appears to cause the creek to be constricted during high flows, but there are no signs of bank erosion or channel instability. There is bank riprap on both sides of the bridge. At the time of the inspection, the creek was 10 m wide at the bridge, with a depth of 0.5 m and a mean gradient of 6%. Flow velocity was estimated by the floating chip method to be about 0.5 m/s.

The substrate through much of Reach #1 is cobbles and boulders, although there are pockets of sand and gravel, including some spawning sized gravel. The channel splits in places, and there are areas with a natural levee. Trees on the delta include cedar, hemlock and aspen. At the upper end of the delta were a number of trees with root wads, indicating bank erosion upstream.

Other Sites

Due to snow cover on the day of the site inspection, the survey was limited to an overview assessment of Reaches #2 and #3. These reaches have steep valley walls, thus no logging has taken place within the valley. Several tributaries to Latewhos Creek through these reaches have

had logging in their watersheds. The tributaries have culverts where they cross the Latewhos Forest Service Road.

Forest harvest has taken place in the upper Latewhos Creek watershed. These areas were not inspected and no videotape is available to determine if there have been any related impacts.

5.4 Sediment Source Inventory

The results of the sediment source inventory are summarized in Table 5.3. A total of seven sources were identified from the review of aerial photographs, all being tributaries to the main stem of Latewhos Creek.

5.5 Latewhos Creek Summary and Conclusions

Latewhos Creek originates in the hills between Mabel and Sugar Lakes, and flows down towards Mabel Lake through a steep canyon. The gradient of Reaches #2 and #3 limits fish access from Reach #1, which is a short reach in the creek delta. The gradient of Reaches #2 and #3 has also meant that there has been no forest harvest along these reaches. Logging has taken place on the plateau, although the degree to which forest harvest has impacted the upper reaches of Latewhos Creek has yet to be determined.

Table 5.3 Latewhos Creek Sediment Source Inventory

Location symbol(1)	Coordinates				Dimensions(3)		Present in(4)		Larger in
	Lat (N)	Long (W)	Feature	Composition(2)	Width (m)	Length (m)	1950's yes/no?	1990's yes/no?	1990's yes/no?
2a	n/a	n/a	Tributary	sa, g	n/a	n/a	yes	yes	no
3a	n/a	n/a	Tributary	sa, g	n/a	n/a	yes	yes	no
4a	n/a	n/a	Tributary	sa, g	n/a	n/a	yes	yes	no
4b	n/a	n/a	Tributary	sa, g	n/a	n/a	yes	yes	no
4c	n/a	n/a	Tributary	sa, g	n/a	n/a	yes	yes	no
7a	n/a	n/a	Tributary	sa, g	n/a	n/a	yes	yes	no
7b	n/a	n/a	Tributary	sa, g	n/a	n/a	yes	yes	no

(1): Refer to map: 82 L/7, 82 L/10

(2): Composition is determined from nerial photographs. Locations which have been checked in the field are indicated by a subscript 'f'. Compositions in brackets indicate minor amounts of the given texture.

si = silt

sa = sand

g = gravel

- (3): Width is distance measured along the stream. Length is distance measured from the toe to the zone of initiation (In the case of an eroding bank, length refers to 'bank height')
- (4): Two sets of aerial photos were examined in this study: one set flown in 1950's and second set flown in 1990's
- (5): n/c No aerial photo coverage available at the time of the Sediment Source Inventory
- (6): Location symbols designated with "R" are referenced by reach locations (e.g. R3a is located in Reach 3).
- (7): Location symbols designated with a number are referenced by site numbers from the video transcript. (e.g. 18a is located between sites #18 and #19).

6.0 TSUIUS CREEK

6.1 General Description

Tsuius Creek is a tributary of Mabel Lake. It is known locally as Cottonwood Creek, and the forest service road is labelled as the Cottonwood Road. It enters the lake on the east side near "The Narrows" where it forms a delta. Its headwaters are located on the western flanks of Tsuius Mountain at an elevation of about 1830-1980 m (6000-6500') and some of the flow is derived from glacial meltwater. Major tributaries of Tsuius Creek include Mabel Creek, Hound Creek, and Whip Creek. The average gradient is about 6%, and there are some very steep sections as the creek descends into Mabel Lake. Fish were thought to occupy only the lowest 0.8 km (DFO/MOEP, 1990a). However large fish (30-40 cm) were observed from the air in the upper watershed.

Additional descriptive information about Tsuius Creek is found in Table 6.1. The NTS map sheets covering the creek (82 L/9, 82 L/10) are provided in Attachment 1. The colour aerial photographs from 1992-93 are included as Attachment 2, and the 1950s black and white photos are included as Attachment 3. The video transcripts, photographs, SIS survey forms, and DFO/MELP Stream Information Summary Sheet are provided in Appendix IV.

Two (2) sites were classified as having high potential impacts due to forest harvest or unknown activities (i.e., "F.1" or "U.1" - see Table 2.1) from the helicopter video, and both were inspected during November 1994.

6.2 Reach Descriptions

A total of eight (8) stream reaches were identified. Gradient and length data for the individual reaches are found in Table 6.2.

Table 6.1. General characteristics of Tsuius Creek.

Parameter	Information				
Map sheet no.	82 L/9, 82 L/10				
Latitude & longitude of mouth	50° 37' 48"' N lat, 118° 40' 80''W long				
Watershed area (km²)	207.9				
Stream length (km)	24				
No. of reaches	8				
Discharge (mean/highest month/lowest month)	not gauged				
Biogeoclimatic zone(s)	ICHmw2, ICHwk1, ESSFwcp				
General flow direction	south then west				
Next higher order stream or lake	Mabel Lake				
Land use	forestry, recreation				
Known water licences	none				
Known fish species	Coho salmon, Sockeye salmon in dominant Adams River cycle years only. Fish thought to be in lower 0.8 km only (DFO/MOEP, 1990a), although large fish were observed in the upper watershed during this study.				
No. of F1 and U1 sites identified	2				
No. of field sites checked	2				

Stream reach data summary for Tsuius Creek. Table 6.2

Reach no.	Reach length (km)	Gradient (%)	Map sheet no.	Site nos. within reach	
1	1.3	2	82 L/10	1-2	
2	2.0	8	82 L/10	3-9	
3	4.8	5	82 L/10	10-18	
4	2.0	9	82 L/10	19-22	
5	7.0	3	82 L/10	23-33	
6	2,3	3	82 L/9, 82 L/10	34	
7	2.0	1	82 L/9	35	
8	2.5	16	82 L/9	36-38	
Total	24.0			38	

Reach #1 is located on the delta of Tsuius Creek. The gradient is less than 5% and the channel has good spawning and rearing habitat. It is this reach that is utilized by spawning sockeye. The delta area has a number of private cabins, and dikes and bank protection have been installed along the creek. The upper end of the reach is delineated by a 12 m high waterfall that is a barrier to upstream fish passage.

Reach #2 has a moderate overall gradient (5-10%) with some steep sections, and steep bedrock canyon walls. The substrate is mostly bedrock with some large cobbles and a small amount of gravels and sand. Numerous deep pools and small falls are present in this reach of the stream. The active channel width is 20 - 25 m and the wetted width on the day of the field inspection was approximately 14 m. The fish habitat is generally poor in this reach.

Reach #3 is a low gradient but deeply incised portion of the stream. Several small tributaries enter the creek from both sides. Reach #4 is similar to Reach #3, with the exception that the valley is somewhat wider. Whip Creek and several other streams are tributaries to Reach #3.

Reach #5 is a low gradient, meandering reach. There are sections where the valley flat area is several hundred metres wide, although the valley walls are steep. Hound Creek plus numerous small streams are tributaries. Reach #6 is also a low gradient, meandering section, with the addition of several wetlands in the riparian zone. Reach #7 marks a further widening of the floodplain. The reach possesses excellent spawning and rearing habitat, including deep pools, spawning gravel, and overhanging vegetation. Numerous large salmonids were observed during the helicopter survey, despite the presence of significant barriers to fish passage in Reach #2.

Reach #8 is the final reach. It has a steep gradient throughout, and is characterized by natural avalanche tracks and debris fans which enter the riparian zone.

6.3 Field Check Site Descriptions

Site #: 4 Date Inspected: Nov. 12/94

Impact Code: Fb/Q•D•N•3 Coordinates: 50°37.19'N 118°39.53'W

Reach #: 2 Map sheet #: NTS 82 L/10

This site is located in the canyon section of Reach #2. The site was originally classified as Fb/Q•D•U•1 due to the presence of woody debris, but was changed to Fb/Q•D•N•3 following the site visit. The potential impact is that woody debris jams may act as a fish barrier. However the general steepness of the reach plus the presence of water falls severely limit fish access, and as a result, the presence of debris appears to have little bearing on access. Photo 1 (Appendix IV) shows the large debris jam at this site which has the potential to be transported downstream at higher water levels. However, the debris is very old (moss covered), suggesting that it is stable. The debris appears to be natural in origin and is not a concern for the WRP.

Site #: 7 Date Inspected: Nov. 12/94

Impact Code: Fs/Q•F•F•1 Coordinates: 50°37.23'N 118°38.71'W

Reach #: 2 Map sheet #: NTS 82 L/10

This site consists of a logging road (Mabel Lake Forest Service Road) fill slope which is actively eroding into the stream channel. The toe of the fill slope is on the natural slope above the stream, but rills and small debris tracks on the exposed slope indicate that sediment is likely being transported to the stream. The exposed hillslope has a 60% gradient and is mainly composed of coarse sand and fine gravel. There are some small trees growing on the slope.

A possible prescription to reduce erosion is seeding the exposed slope with hydro-seeding or geotextiles, if more surface protection is required. Given the proximity of this site to the sockeye spawning habitat in the lowest 0.8 km of the creek, this site should be a priority for action.

6.4 Sediment Source Inventory

The results of the sediment source inventory are summarized in Table 6.3. A total of 11 sources were identified from the review of aerial photographs. Six of the sources are tributaries to the main stem of Tsuius Creek.

Three of the identified sources are road fillslopes (Site #7 plus two additional sites not identified by the helicopter or field surveys). None of the roads were present in the 1950s aerial photographs, indicating that these are new sources of sediment since that time. Two landslides were also identified from the aerial photos. Neither was present in the 1950s.

6.5 Tsuius Creek Summary and Conclusions

Two sites on Tsuius Creek were given impact codes based on the helicopter survey ending with F.1 or U.1 (high potential impact due to either forest harvest or unknown activities). Both sites were inspected in November 1994. Following the field inspections, only Site #7 remained with an F.1 code:

Site #7 Logging road fillslope on an incised valley section. Surface erosion likely is transporting sediment to the stream. Since downstream areas include salmon spawning habitat, steps should be taken to control erosion.

In addition to Site #7, several other sites were identified from aerial photographs as being sources of sediment (Table 6.3). These are two additional fill slopes and two landslides.

Table 6.3

Tsuius Creek Sediment Source Inventory

Location symbol(1)	Coordinates		-		Dimensions(3)		Present in(4)		Larger in
	Lat (N)	Long (W)	Feature	Composition(2)	Width (m)	Length (m)	1950's yes/no7	1990's yes/no?	1990's yes/no?
7	50°37.23'	118°38.71	Road fillslope	g, sa, si	30	50	no	yes	yes
7a	n/a	n/a	Road fillslope	g, sa, si	20	30	no	yes	yes
R3a n/a	n/a	n/a	Tributary	g, sa	n/a	n/a	yes	yes	n/a
R3b	n/a	n/a	Tributary	g, sa	n/a	n/a	yes	yes	n/a
17	50°36.98'	118°35.33'	Slide	g, sa	10	150	no	yes	yes
18	50°36.99'	118*35,05	Slide	g, sa	40	200	n/a	yes	yes
R4a	n/a	n/a	Tributary	g, 5a	n/a	n/a	yes	yes	n/a
R4b	n/a	n/a	Tributary	g, sa	n/a	n/a	yes	yes	n/a
R5a	n/a	n/a	Tributary	g, sa	n/a	n/a	yes	yes	n/a
23	50°37.56'	118°32,80°	Road fillslope	g, 53	50	70	no	yes	yes
R5b	n/a	n/a	Tributary	g, sa	n/a	n/a	yes	yes	n/a

82 L/9, 82 L/10

(2): Composition is determined from aerial photographs. Locations which have been checked in the field are indicated by a subscript 'f'. Compositions in brackets indicate minor amounts of the given texture.

si = sit sa = sand g = gravei

- (3) Width is distance measured along the stream. Length is distance measured from the toe to the zone of initiation. (In the case of an eroding bank, length refers to 'bank height')
- (4): Two sets of aerial photos were examined in this study: one set flown in 1950's and second set flown in 1990's
- (5): n/c No aerial photo coverage available at the time of the Sediment Source Inventory
- (6): Location symbols designated with "R" are referenced by reach locations (e.g. R3a is located in Reach 3).
- (7): Location symbols designated with a number are referenced by site numbers from the video transcript (e.g. 16a is located between sites #18 and #19).

Two tributaries of Tsuius Creek were evaluated as part of this assessment, Hound Creek (Section 7.0) and Whip Creek (Section 8.0). Each has a number of potential sediment sources which ultimately contribute sediment to Tsuius Creek.

7.0 HOUND CREEK

7.2 General description

Hound Creek is a tributary of Tsuius Creek. It originates in the Sawtooth Range of the Monashee Mountains, west of Mabel Lake, and enters Tsuius Creek at a point approximately 14 km upstream from the mouth. Additional descriptive information about Hound Creek is found in Table 7.1. The NTS map sheets covering the creek (82 L/9, 82 L/10) are provided in Attachment 1. The colour aerial photographs from 1992-93 are included as Attachment 2, and the 1950s black and white photos are included as Attachment 3. The video transcripts, photographs, SIS survey forms, and DFO/MELP Stream Information Summary Sheet are provided in Appendix V.

Only one site was identified from the helicopter survey as an "F.1" site (Table 2.1). It was inspected in July 1995.

7.2 Reach Descriptions

There are a total of four (4) stream reaches identified from the 1:50,000 NTS map. Reach length and gradient data for the individual reaches is provided in Table 7.2.

Reach #1 has a moderately steep gradient with some areas of confining valley walls. There is some potentially good rearing habitat, and there are no barriers which would prevent accessing the creek from Tsuius Creek. Reach #2 is deeply incised with a moderate gradient. These factors contribute to the generally poor fish habitat. Reach #3 is less steep than #2 at about 5%, but still has steep valley walls. There is some meandering and several tributaries enter the stream in this reach.

Table 7.1. General characteristics of Hound Creek.

Parameter	Information				
Map sheet no.	82 L/9, 82 L/10				
Latitude & longitude of mouth	50° 38' 24" N, 118° 32' 2" W				
Watershed area (km²)	32.4				
Stream length (km)	10.8				
No. of reaches	4				
Discharge (mean/highest month/lowest month)	not gauged				
Biogeoclimatic zone(s)	ICHwk1, ESSFwc2				
General flow direction	southwest				
Next higher order stream or lake	Tsuius Creek				
Land use	forestry				
Known water licences					
Known fish species	none				
No. of F1 and U1 sites identified	no data				
No. of field sites checked	1				

Table 7.2 Stream reach data summary for Hound Creek.

Reach no.	Reach length (km)	Gradient (%)	Map sheet no.	Site nos. within reach
1	1,3	8	82 L/10	1
2	1,8	7	82 L/9, 82 L/10	2-5
3	4.5	5	82 L/9	6-8
4	3.3	9	82 L/9	9-10
Total	10.8			10

Reach #4 is mostly within a sub-alpine bowl that forms the headwaters of Hound Creek. The reach is characterized by a moderately steep gradient and steep valley walls.

7.3 Field Check Site Descriptions

Site #: 3

Date Inspected: July 5, 1995

Impact Code: Fs/Q·S·F·1

Coordinates: 50°38.16' N, 118°30.73'W

Reach #:

Map sheet #: 82 L/10

This site is a large landslide track which is up to 25 m wide, and extends from the creek upslope past a large cutblock on the south side of the creek (Photo 1). A large (30 m across) lobe of coarse material (up to 1.5 m diameter) is present at streamside, although it does not present a barrier to fish passage and appeared to be generally stable. Surface water was running along the base of the slide scar throughout its length on a gravel/cobble pavement. The flow from the scar flows around the lobe and enters Hound Creek on the downslope side. The road, which passes along the base of the cutblock, passes over the slide scar, and the flow presently runs over the road surface and through a partial rock drain. Mangled remnants of culvert suggest that the road has been washed out on at least two occasions (Photo 2). On the cutblock above the road, the exposed gully face shows lobes of colluvium overlying glacial till, suggesting that one or more major slides took place before the area was logged.

It appears that the landslide track pre-dates road construction and logging, but that the track has remained active or was re-activated by harvest. About five similar tracks run downslope through or adjacent to the cutblock. The track immediately to the east (Site #4) and within the cutblock contains stumps and ground cover (Photo 3), indicating that that track had apparently been stable for some time, and that logging did not re-activate the slide. The slope below the road remains forested. In contrast, the apparently active slide track has no stumps or ground cover, and there are signs of on-going slumping along the gully sides, as well as sheet and rill erosion. Thus the

slide scar remains a major source of sediment to Hound Creek, and there is a risk of a major slide re-occurring.

As described above, the track extends well above the cutblock, and it is unlikely that any steps can be taken to eliminate the risk of a large slide. It may be possible to improve road drainage by completing the installation of the rock drain (or re-installing a culvert) across the entire road, thus reducing the risk of the road washing out. The catch basin at the inlet to the drain could also be expanded to settle out more of the fines washed down from upslope. A slope stability assessment should be completed before any additional logging or road building takes place along this reach.

7.4 Sediment Source Inventory

A total of three sediment sources were identified on Hound Creek from the aerial photograph survey (Table 7.3); a single tributary, a landslide, and an eroding gully. The slide (Site#3) and the eroding gully (Site#4) have been described above.

7.5 Hound Creek Summary and Conclusions

Only one site, Site #3, was identified from the helicopter survey as an "F.1" site (high impact due to forestry operations). It was inspected in July 1995:

Site #3 Large landslide track. The slide likely pre-dates forest harvest, but harvest and/or road building appears to have re-activated it. Evidence of surface erosion and minor instability. Road over slide track apparently needs frequent repairs.

Table 7.3 Hound Creek Sediment Source Inventory

Location	Coordi	nates			Dimensions(3)		ions(3)	Present i	Larger in
symbol(1)	tbol(1) Lat Long Feature Composition(2) (N) (W)	Width (m)	Length (m)	1950's yes/no?	1990's yes/no?	1990's yes/no?			
R2a	n/a	n/a	Tributary	g, sa	n/a	n/a	yes	yes	n/a
3	50°38.17'	118°31.01'	Slide	g, sa	40	70	no	yes	yes
4	50°38.25'	118°30.59'	Eroding gully	g, sa	35	001	по	yes	yes

(1): Refer to map: 82 L/9, 82 L/10

(2). Composition is determined from serial photographs. Locations which have been checked in the field are indicated by a subscript T. Compositions in brackets indicate minor amounts of the given texture.

si = sitt

sa = sand

- g = gravel

 (3) Width is distance measured along the stream. Length is distance measured from the toe to the zone of initiation (In the case of an eroding bank, length refers to 'bank height')
- (4). Two sets of aerial photos were examined in this study: one set flown in 1950's and second set flown in 1990's
- (5) n/c No aerial photo coverage available at the time of the Sediment Source Inventory
- (6): Location symbols designated with "R" are referenced by reach locations (e.g. R3a is located in Reach 3).
- (7). Location symbols designated with a number are referenced by site numbers from the video transcript (e.g. 18a is located between sites #18 and #19).

Other old slide scars in the area of Site #3 suggest the potential for instability. Steps should be taken to improve road drainage at Site #3, and drainage throughout the slide area should be assessed to ensure that the road bed is properly drained.

8.0

WHIP CREEK

8.1 General description

Whip Creek is a tributary of Tsuius Creek. The headwaters are located in a marshy plateau area south of the Sawtooth Range. It flows in a general north-northeast direction until it meets Tsuius Creek about 4 km downstream of the Hound Creek confluence. Additional descriptive information about Whip Creek is found in Table 8.1. The NTS map sheets covering the creek (82 L/9, 82 L/10) are provided in Attachment 1. The colour aerial photographs from 1992-93 are included as Attachment 2, and the 1950s black and white photos are included as Attachment 3. The video transcripts, photographs, SIS survey forms, and DFO/MELP Stream Information Summary Sheet are provided in Appendix VI.

A total of three (3) sites were coded from the helicopter as "F.1" or "U.1" sites, indicating high potential impacts due to forestry or unknown activities. All of these sites were inspected in July 1995.

8.2 Reach Descriptions

A total of seven (7) stream reaches were identified. Stream gradient and reach length data for the individual reaches is provided in Table 8.2.

Reach #1 is moderately steep, which limits the likelihood of fish moving into Whip Creek from Tsuius Creek. Reach #2, in contrast, has a mean gradient of <5% and is situated within a wide valley flat.

Reach #3 has a moderate gradient with the channel being somewhat incised. The valley walls are relatively steep along both sides of the creek. The upstream end is delineated by a six metre high

Table 8.1. General characteristics of Whip Creek.

Parameter	Information				
Map sheet no.	82 L/9, 82 L/10				
Latitude & longitude of mouth	50° 37 ° N, 118° 33° W				
Watershed area (km²)	45.7				
Stream length (km)	14.8				
No. of reaches	6				
Discharge (mean/highest month/lowest month)	not gauged				
Biogeoclimatic zone(s)	ICHwk1, ESSFwc2				
General flow direction	north and northeast				
Next higher order stream or lake	Tsuius Creek				
Land use	forestry				
Known water licences	none				
Known fish species	no data				
No. of F1 and U1 sites identified	3				
No. of field sites checked	3				

Table 8.2 Stream reach data summary for Whip Creek.

Reach no.	Reach length (km)	Gradient (%)	Map sheet no.	Site nos. within reach
1	1.0	17	82 L/10	1
2	4.8	4	82 L/10	2-5
3	1.3	10	82 L/9	6
4	6.5	10	82 L/9, 82 L/10	7
5	5,0	5	82 L/10	8-10
6	0.8	0	82 L/10	-
7	0,55	0	82 L/10	
Total	14.8			10

waterfall. Reach #4 is characterized by low gradient and several wetlands in the riparian zone. There is moderate fish rearing habitat with good cover and some deep pools. Stream banks are about one metre high with a high percentage of over stream vegetation.

Reach #5 has a mean gradient of about five percent. About 15% of the channel substrate is bedrock, 60% is cobble/boulder, and 25% is sand/gravel. There are some deep pools, but habitat values in Reach #5 are generally less than those in downstream reaches. An abundance of periphyton was noted in the channel.

Reach #6 includes two small lakes (each approx. 500 m long and 200-300 m wide), joined by a short section of stream flowing through a wetland. The lakes may be suitable for fish rearing, although the high altitude may mean that the lakes freeze solid in winter. Reach #7 is the headwaters. The stream is shown as ephemeral on the 1:50,000 scale maps, and fish habitat is likely poor.

8.3 Field Check Site Descriptions

Site #: 4 Date Inspected: July 5, 1995

Impact Code: Fb.D.F.2 Coordinates: 50°36.02'N 118°31,47'W

Reach #: 2 Map sheet #: 82 L/10

This site consists of a small log jam near a cutblock with a buffer of less than 15 m. The site was originally coded as Fb/Q.D.U.1 from the videotape, but was changed to Fb.D.F.2 based on the field inspection. Fish passage was possible on the day of the site visit, but may be restricted during low flow. The jam is relatively stable as the banks are bedrock and there is no bank erosion taking place. The presence of the log jam has created some pool habitat. Although the buffer is small, the riparian understory is well developed and there is good shade cover and a good source of detritus.

If convenient (i.e., if another WRP project is initiated nearby), removing the main cross piece of the jam could be considered. However, it is not a high priority site.

Site #: 7 Date Inspected: July 10/95

Impact Code: QoSoFo3 Coordinates: 50°34.857'N | 118°29.056'W

Reach #: 4 Map Sheet: 82 L/9

This site was originally identified as a road crossing with a cutblock on the left, and was coded as Fb/Q.C.F.1. However, field inspection revealed that although the road comes within 10 m of the right bank of Whip Creek, it does not cross the channel. There is no evidence that a bridge has ever been constructed across the channel at this site. There has been some sloughing of the road fill materials into the creek (Photo 1), however it is thought to have a minor impact upon Whip Creek

Site #: 8 Date Inspected: July 10/95

Impact Code: Fs/QoCoFo1 Coordinates: 50°33.951'N 118°30.295'W

Reach #: 4 Map Sheet: 82 L/10

A relatively recent bridge crosses Whip Creek at this site to access cutblocks in the headwaters area of Whip Creek. The bridge is constructed of two old steel flatbed railway cars with wood decks which span across the channel (Photo 2). The bridge deck is in poor condition and there are several holes through the deck where sediment is being transported to the creek. There is a gap in center portion of the bridge, where the two railway cars are joined, that also permits sediment to enter the creek. There has been some erosion of the road surface that has entered the creek along the left bank. The input of fine sediments from the bridge and the adjacent road may affect downstream spawning habitat.

The bridge should be repaired to meet the standards of the Forest Practices Code. As well, the road should be repaired and adjacent exposed soils seeded to minimize erosion.

8.4 Sediment Source Inventory

The results of the sediment source inventory are summarized in Table 8.3. A total of three sources were identified from the review of aerial photographs, two tributaries and an eroding bank. The eroding bank is adjacent to Site #8, described above.

8.5 Whip Creek Summary and Conclusions

Three sites on Whip Creek were identified from the helicopter survey as "F.1" or "U.1" sites. Following the field inspections in July 1995, one site remained with an "F.1" coding indicating high impacts related to forest harvest activities:

Site #8	Bridge over creek is in poor condition. Gaps in the bridge surface permit sediment to
	be introduced into the stream. Erosion is occurring on adjacent road surfaces.

The bridge should be repaired to bring it up to the standards required by the Forest Practices Code.

Table 8.3

Whip Creek Sediment Source Inventory

Location symbol(1)	Coordinates				Dimensions(3)		Present in(4)		Larger in
	Lat (N)	Long (W)	Feature	Composition(2)	Width (m)	Length (m)	1950's yes/no?	1990's yes/no?	1990's yes/no?
R2a	n/a	n/a	Tributary	g, sa	n/a	n/a	yes	yes	n/a
R2b	n/a	n/a	Tributary	g, sa	n/a	n/a	yes	yes	n/a
8	50°34.00'	118°30.24°	Eroding bank	g, sa	10	10	no	yes	yes

(1): Refer to map: 82 L/9, 82 L/10

(2) Composition is determined from aerial photographs. Locations which have been checked in the field are indicated by a subscript 'f'. Compositions in brackets indicate minor amounts of the given texture. si = sift

sa = sand

g = gravel

- (3): Width is distance measured along the stream. Length is distance measured from the toe to the zone of initiation (In the case of an eroding bank, length refers to bank height)
- (4). Two sets of serial photos were examined in this study: one set flows in 1950's and second set flows in 1990's
- (5): n/c No serial photo coverage available at the time of the Sediment Source Inventory
- (6): Location symbols designated with "R" are referenced by reach locations (e.g. R3a is located in Reach 3).
- (7). Location symbols designated with a number are referenced by site numbers from the video transcript (e.g. 18a is located between sites #18 and #19).

9.0

9.1 General Description

WAP CREEK

The headwaters of Wap Creek are located about 12 km southeast of Three Valley Gap, B.C., in the vicinity of Mount English, Davis Peak and Joss Mountain. It initially flows generally west before turning and flowing south until it enters Mabel Lake at the lake's northern end. The middle reach includes Wap Lake (area 40 ha) and several wetland (swamp/marsh) areas. Major tributaries include Iron, Devil, Dale, Cavenaugh, Derry and Bowman Creeks. Fish species present include Sockeye, Coho, and Chinook salmon, Bull trout, Kokanee, Rocky Mountain whitefish, Rainbow trout, and sculpins (DFO/MELP, 1990b). Two water falls (Frog Falls) located about 29 km upstream of the mouth restrict the passage of salmon beyond that point. Wap Creek was heavily impacted by logging activity in the 1940s and 1950s (K. Gray, personal communication, 1994), but natural restoration processes have at least partially restored stream productivity. However the after-effects of logging (debris accumulation, erosion and channelization) still limit fish habitat and water quality (DFO/MELP, 1990b).

Additional descriptive information about Wap Creek is found in Table 9.1. The NTS map sheets covering the creek (82 L/7, 82 L/15, 82 L/16) are provided in Attachment 1. The 1992-93 colour aerial photographs are in Attachment 2 and the 1950s black and white photos are are in Attachment 3. Video transcripts, photographs, SIS survey forms, and DFO/MELP Stream Information Summary Sheet are provided in Appendix VII.

Four (4) sites were given impact codes ending in "F.1" or "U.1" (Table 2.1) from the helicopter video.

All of these sites were inspected.

General characteristics of Wap Creek. Table 9.1.

Parameter	Information				
Map sheet no.	82 L/7, 82 L/15, 82 L/16				
Latitude & longitude of mouth	50° 44' N lat, 118° 37'W long				
Watershed area (km²)	352.2				
Stream length (km)	45				
No. of reaches	9				
Discharge (mean/highest month/lowest month)	Not gauged				
Biogeoclimatic zone(s)	ICHmw2, ICHwk1, ICHvk1, ESSFwc2				
General flow direction	west then south				
Next higher order stream or lake	Mabel Lake				
Land use	forestry, recreation				
Known water licences	1 (Three Valley Motel)				
Known fish species	Coho, Sockeye*, & Chinook salmon; Bull trout, Kokanee*, Rocky Mountain whitefish, Rainbow trou and sculpins (DFO/MELP, 1990b).				
No. of F1 and U1 sites identified	4				
No. of field sites checked	4				

Table 9.2 Stream reach data summary for Wap Creek.

Reach no.	Reach length (km)	Gradient (%)	Map sheet no.	Site nos. within
1	4.3	1	82 L/7, 82 L/15	1-5
2	3,0	2	82 L/15	6-9
3	12.3	0.5	82 L/15	10-20
4	1.0	0	82 L/15	21-22 (Wap L.)
5	3.0	0.5	82 L/15	23
6	4.5	0.7	82 L/15,82 L/16	24-27
7	1.0	7	82 L/16	28-31
8	14.0	8	82 L/16	32-42
9	1.3	6	82 L/16	-
Total	44.3			42

9.2 Reach Descriptions

There are a total of nine (9) stream reaches identified from the 1:50,000 NTS maps. Information on reach length and gradient is provided in Table 9.2.

Reach #1 has a mean gradient of 1% and a maximum channel width of 25 m. The banks are variable in height, ranging from < 1 m up to 3 m. The banks are actively eroding in places. Deep pools and good cover are present in this reach creating overall excellent fish habitat in some places, limited by excessive woody debris (see Site #4 below). Several spawning salmon were seen in this reach during the site visit (November 12, 1994) as well as some salmon carcasses.

Reach #2 runs between the confluences of Cavanaugh Creek and Derry Creek. It has a slightly steeper gradient than Reach #1. Reach #3 is a low gradient (<1%) reach with a wide valley flat up to about 750 m wide, bordered by alluvial terraces. Reach #4 is Wap Lake, which has an area of 40 ha. Reach #5 is characterized by tight meanders and a marshy floodplain. Two large ponds are connected by side channels to the main stem of Wap Creek. Reach #6 is still low gradient, but the valley is more confined.

Reach #7 begins at Frog Falls which marks the upper limit of fish migration in Wap Creek. The average channel gradient is about 7%. Reach #8 is a long (14 km) reach confined in a v-shaped valley. Reach #9 is made up of two small lakes, joined by a short section of stream, that make up the headwaters of Wap Creek.

9.3

Field Check Site Descriptions

Site #: 4

Date Inspected: Nov. 12/94

Impact Code: Fb/O·D·F·1

Coordinates: 50°44.69'N 118°34.90'W

Reach #: 1

Map sheet #: NTS 82 L/7

In this case, "Site" refers to the majority of Reach #1. The floodplain was logged to streamside, including islands in the stream, and burned. Cover on the floodplain is presently dominated by alder and willow with some cedar. The stream banks are vertical and composed of interbedded fluvial and lacustrine sediments, and layers of peat (Photo 1, Appendix VII). stratigraphy indicates changes in the level of Mabel Lake through the post-glacial period, including periods when the area around the site was covered by wetlands.

Site impacts are largely associated with large debris piles and log jams. As well, there are remnants of an old bridge that used to cross the creek. The collapsed bridge abutments (Photo 2) are located at the downstream end of a portion of the channel with extensive amounts of LWD. At high water levels much of this debris could potentially be washed downstream and into Mabel Lake. The large amount of LWD in the channel is contributing to increased bank erosion of the left bank (Photo 3). The bank erosion continues for a distance of 200 - 300 m. There is a side channel approximately 200 m upstream from the abandoned bridge which is completely blocked at the upstream end by debris. A beaver dam was noted on a side channel 700 m upstream from the washed out bridge. Several spawning salmon and some redds were observed at this site on the inspection date. Evidence of fish consumption by bears was also present.

This reach would benefit from a program of debris removal and stabilization. Since the reach is utilized by salmon, considerable care should be taken during the planning and implementation of any restoration programs.

Date Inspected: Nov. 12/94

Impact Code: Fs/Q+S/D+F+1

Coordinates: 50°52.78'N 118°26.78,W

Reach #: 8

Map sheet #: NTS 82 L/16

Site # 35 is an incised section of the channel just downstream from a bridge crossing. The road above the left bank was built across an exposed slope that was partly blasted into bedrock, and blasted boulders form part of the fill slope. The cut and fill slopes also contain exposures of unconsolidated material. The stream bed includes large colluvial boulders and cobbles. Photo 4 shows the fill slope above the stream. Heavy snow cover prevented a comprehensive look at the type of material entering the channel, but fine sediments trapped behind boulders at the toe of the slope indicate that some erosion is taking place. Several large trees on the slope just downstream of the exposed slope were leaning toward the channel suggesting instability. Some LWD was noticed in the channel but it appears that the majority is very old and covered with moss.

A detailed assessment of this site is recommended to assess slope and road stability. Possible remediation measures include seeding of exposed slopes and improving road drainage.

Impact Code: Fs/Fb/Q•S/D•F•1

Reach #: 8

Date Inspected: July 10/95

Coordinates: 50°52,500'N | 118°26,396'W

Map Sheet: 82 L/16

Wap Creek at this site is confined in a narrow valley with steep side-slopes of 70-80%. The channel of Wap Creek has a gradient of 8-10% and the channel bed is dominated by cobbles and boulders. Logging occurred along both banks of Wap Creek several decades ago. Two logging roads are located along the right bank. An old inaccessible road is located approximately 10 m from the right bank of Wap Creek. A new logging road (Wap Creek Main) has been constructed higher up on a terrace. A cutblock, logged in 1974-1979, is located above the new road.

A large debris flow has initiated from the newer forestry road, impacting the right bank of Wap Creek at this site (Photo 5). The debris flow occurred through colluvial surficial materials overlying bedrock on a steep side slope (70-80%). The failure appears to have initiated at the road fill, as there was no evidence of instability in the road bed. The debris flow traveled approximately 100 m downslope before it started to deposit a large fan of debris along the right bank and into the channel (Photo 6). The debris did not appear to impact the left bank, however a lobe of sediment and LWD has been deposited in the channel. The LWD has created some large (1 m) waterfalls which may form a barrier to fish migration. There has been some localized bank erosion and scouring of the channel bed to accommodate flows through the debris. There is potential for good rainbow trout fish habitat at this site, however fish may not be present at this site due to possible barriers downstream at sites #28 and #30. No fish were observed when the site was inspected.

Potential remedial actions include re-vegetating the slide face to prevent further surface erosion from the slope, selective stabilization or removal of LWD deposited in the channel, and improved road drainage. This site is considered to be a high priority WRP site.

Impact Code: Fs/Fb/Q•S/D•F•1

Reach #: 8

Date Inspected: July 10/95

Coordinates: 50°52.295'N | 118°25.899'W

Map Sheet: 82 L/16

A large slide from a glacial terrace on the right bank has impacted Wap Creek by introducing a large amount of sediment and LWD to the channel. Two forestry roads are located along the right bank. The newer forest road (Wap Creek Main) is located approximately 100 m back from the right bank on the top of the glacial terrace. An older road is located at approximately midslope on the glacial terrace face and is within 20 m of the right bank. There is evidence of logging along both banks at this site, and many stumps remain along the banks and in the channel.

The slide at this site is approximately 200 m wide and 50 m long. It appears that the old road cut situated mid-slope on the terrace face may have unloaded the slope and initiated the slope failure. However, logging of the terrace slope when the old road was built may have also contributed to the slope failure. The slide face has revegetated with deciduous vegetation, and appears to have stabilized. No active erosion of the slide face was observed.

A large amount of LWD and sediment has been deposited in the creek for approximately 200 m. The majority of the debris is logging related, with some natural debris. A 2-3 m high waterfall has been created by a LWD jam formed in the channel (Photo 7). Approximately 90 m³ of sediment has been stored behind this LWD jam. There has been some localized bank erosion as flows are deflected around the debris deposited in the channel. Much of the debris at this site appears to be unstable. If the LWD jams storing sediment collapse, a large amount of sediment and LWD would be washed downstream. Large boulders were observed buried in the channel, indicating that a very large amount of sediment has been input to the channel at this site. This site would benefit from selective removal and stabilization of LWD in the channel. As well, drainage patterns along the old road should be evaluated.

9.4 Sediment Source Inventory

A total of nine sediment sources were identified from the review of aerial photographs (Table 9.3). Three of the sources are tributaries to the main stem of Wap Creek. The remaining sources include four eroding banks and two landslides. None of the eroding bank sites were present on the 1950s photos, suggesting that forest harvest since then has contributed to bank instability. One of the slides was present in the 1950s, but had grown larger by the time the aerial photographs were taken in the 1990s.

9.5 Wap Creek Summary and Conclusions

Wap Creek is a major tributary of Mabel Lake. The creek was heavily impacted by historic logging which has reportedly affected stream fish populations. Four sites were identified from the helicopter survey as "F.1" or "U.1" sites. All sites were inspected. Following the inspections, all four sites maintained a code ending in "F.1.", indicating a high level of impact due to forest harvest activities.

Site #4	"Site" actually refers to much of Reach #1. Considerable large woody debris is contributing to bank erosion and blockage of side channels.
Site #35	Erosion from adjacent road cut and fill slopes. Leaning trees suggest slope instability.
Site #36	Debris flow introduced sediment and LWD into stream. Debris still potential fish barrier. Exposed mineral soils present.
Site #37	Landslide. Now apparently stabilized. Considerable woody debris in channel which may not be stable. Debris is trapping sediment.

In addition to the above sites, the review of aerial photographs found several additional sources of sediment which were present in the 1990s but were not present in the 1950s.

Table 9.3

Wap Creek Sediment Source Inventory

Location	Coordi	nates			Dimensions(3)		Present in(4)		Larger in
symbol(1)	Lat (N)	Long (W)	Feature	Composition(2)	Width (m)	Length (m)	1950's yes/no?	1990's yes/no?	1990's yes/no?
9	n/a	118°33,01'	Tributary	sa, g	n/a	n/a	yes	yes	
13	n/a	118°34.01′	Eroding bank	sa, g, si	10	.5	no	yes	yes
20	n/a	118°33.99'	Tributary	sa, g	n/a	n/a	yes	yes	
26	n/a	118°29,18′	Eroding bank	si, g, sa	10	6	no	yes	yes
32	n/a	118°27.77°	Eroding bank	sa, g	10	20	по	yes	yes
34	n/a	118°27.11'	Slides	sa, g	40	70	yes	yes	yes
35	50°25,75'	118°26.80°	Eroding bank	g	200	40	no	yes	yes
36	n/a	118°26,37°	Slides	sa, g	30	70	yes	yes	yes
38	n/a	118°25.46'	Tributary	84, <u>E</u>	n/a	n/a	yes	yes	n/a

(1): Refer to map: 82 L/10, 82 L/15

(2): Composition is determined from sensal photographs. Locations which have been checked in the field are indicated by a subscript '!'. Compositions in brackets indicate minor amounts of the given texture.

\$i = salt

\$a = sand

\$a = sa

g = gravel

(3): Width is distance measured along the stream. Length is distance measured from the toe to the zone of initiation

(In the case of in eroding bank, length refers to bank height)

(4). Two sets of serial photos were examined in this study: one set flown in 1950's and second set flown in 1990's

(5): 11/c - No aerial photo coverage available at the time of the Sediment Source Inventory

(6): Location symbols designated with "R" are referenced by reach locations (e.g. R3a is located in Reach 3).

(7): Location symbols designated with a number are referenced by site numbers from the video transcript (e.g. 18a is located between sites #18 and #19).

10.0 KINGFISHER CREEK

10.1 General Description

Kingfisher Creek originates in the Cariboo Plateau about 15 km east of the town of Sicamous, within Ecological Reserve 49. It flows in a general southerly direction until it joins the Shuswap River just downstream of the outlet from Mabel Lake (50° 37'N lat, 118° 45'W long) at the small community of Kingfisher. Its major tributaries include Danforth Creek and Hunters Creek. Fish species include Coho salmon and Rainbow trout, and a number of salmonid enhancement projects have been inplemented in the Kingfisher Creek watershed (DFO/MOEP, 1990c). The stream is thought to be capable of supporting higher fish densities, with Rainbow trout and coho being the target species (DFO/MOEP, 1990c). "Violent" flooding is considered a limitation (DFO/MOEP, 1990c).

Additional descriptive information about Kingfisher Creek is found in Table 10.1. The NTS map sheets covering the creek (82 L/10, 82 L/15) are provided in Attachment 1. The 1992-93 colour aerial photographs are in Attachment 2 and the 1950s black and white photos are are in Attachment 3. Video transcripts, photographs, SIS survey forms, and DFO/MELP Stream Information Summary Sheet are provided in Appendix VIII.

A total of 13 sites had codes ending in "F.1" or "U.1" (Table 2.1) on the basis of the helicopter video, and five of these were inspected during the fall of 1994. The remainder were inspected in July 1995.

10.2 Reach Descriptions

A total of eight (8) stream reaches were identified. Length and gradient data for the individual reaches are provided in Table 10.2.

Table 10.1. General characteristics of Kingfisher Creek.

Parameter	Information				
Map sheet no.	82 L/10, 82 L/15				
Latitude & longitude of mouth	50° 37' N lat, 118° 45'W long				
Watershed area (km²)	191.8				
Stream length (km)	24				
No. of reaches	8				
Discharge (mean/highest month/lowest month)	not gauged				
Biogeoclimatic zones & subzones	ICHmw2, ICHwk1, ICHvk1, ESSFwc2				
General flow direction	south				
Next higher order stream or lake	Shuswap River				
Land use	suburban, agriculture, forestry				
Known water licences	(School District 89, Kingfisher Community Club, Kingfisher SEP)				
Known fish species	CO, RB (DFO/MOEP, 1990c).				
No. of F1 and U1 sites identified	15				
No. of field sites checked	13				

Table 10.2 Stream reach data summary for Kingfisher Creek.

Reach no.	Reach length (km)	Gradient (%)	Map sheet no.	Site nos. within reach	
1	1.3	2	82 L/10	1-3	
2	3.3	2	2 82 L/10		
3	4.3	1	82 L/10	9-16	
4	1,3	2	82 L/10	19-21	
5	5 4.0		82 L/10	22-28	
6 3.0 4 82 L/		82 L/10	29-32		
7 8.5 11 82 L/10,		82 L/10, 82 L/15	33-41		
Total	24.0			41	

Reach #1 is characterized by a wide (20 - 25 m) channel with a low gradient (2%). The floodplain is of variable width and is confined by relatively steep slopes where the river has cut down through fluvioglacial terraces. The substrate is mainly small cobbles and large gravels but has many areas with spawning sized gravel. Some deep pools, undercut banks, overhanging vegetation and side channels are present in this reach creating moderate habitat for some fish species.

Reach #2 has moderate fish spawning and rearing habitat, and some small salmon were observed at the time of the field inspection. Many deep (>1 m) pools, overhanging vegetation, and boulders are providing good cover for fish rearing. Several areas of spawning sized gravels were identified along the stream banks. The stream channel is confined by a steep bedrock slope in places.

Reach #3 has a similar gradient to reach #1 but the channel is narrower (width approx. 16 m). The substrate is generally smaller in size and has many areas with spawning size gravel. At site #13 within this reach, 10 adult salmon were observed ranging in size from 50 - 70 cm fork length. The large debris jam at this site was preventing upstream migration of these salmon. Deep pools and good cover are present in this reach creating an overall excellent fish habitat.

Reach #4 has excellent fish spawning and rearing habitat. The channel meanders within a wide floodplain, and there are many side channels and abundant off-channel habitat. There are numerous pools greater than 2 m deep to provide over-wintering habitat for resident fish. Hundreds of salmon fry (30-50 mm length) were present in the pools within the reach when the reach was inspected.

Reach #5 is similar to Reach #3, with a slightly higher proportion of cobbles in the substrate. No fish were observed in this reach, but heavy snow cover obscured much of the channel.

Reach #6 is somewhat steep than Reach #5, and the valley is more narrow. There is potentially good rearing habitat in the reach, and perhaps some spawning habitat. Reach #7 is marked by an increase in gradient. The channel is incised throughout, and there are numerous avalanche tracks and ephemeral streams entering the main channel. Reach #8 is the headwater. The downstream boundary is delineated by a small lake at the base of an avalanche track. The lake outlet is blocked by woody debris.

10.3 Field Check Site Descriptions

Site #: 3 Date Inspected: Nov. 14/94

Impact Code: Fb/Q•D•N/F•1 Coordinates: 50°37.15'N 118°44.25'W

Reach #: 1 Map sheet #: NTS 82 L/10

The site is located just west of the Kingfisher community landfill. The level floodplain areas are bordered by fluvioglacial terraces with relatively steep slopes. The floodplain was logged to streamside in the past, but natural regeneration has occurred. Terrace materials around the landfill are primarily coarse sands. The floodplain deposits consist of interbedded sands, gravels and cobbles. Large cobble (25 cm diameter) are present on the floodplain surface in places. Some trees along the river bank are angled toward the stream suggesting active bank erosion.

Impacts at Site #3 consist of one large debris jam and a substantial amount of LWD scattered throughout the (Photo 1, Appendix VIII) for a distance of about 400 m. Photo 2 shows the eroding left bank immediately adjacent to the floodplain. Most of the debris appears unstable. The debris piles have apparently caused scouring out of some deep pools and accumulations of gravel and sand deposits.

Selective removal and/or stabilization of woody debris could prove beneficial at this site.

Date Inspected: July 7/95

Impact Code: N/A

Coordinates: 50°38.341'N | 118°44.854'W

Reach #: 2

Map Sheet: 82 L/10

Kingfisher Creek at Site #5 in incised into a deep canyon and the channel is frequently confined by bedrock outcrops. A small debris jam with trees across the channel was identified from the video transcript and coded as Fb/Q.D.O.I. However, no debris jams were noted between sites #4 and #8, and the debris accumulations noted from the video transcript have presumably been washed out since the time of the helicopter survey. There are occasional pieces of woody debris along the channel banks, but these have a minor impact upon either fish habitat or Kingfisher Creek.

Site #: 6

Date Inspected: July 7/95

Impact Code: N/A

Coordinates: 50°38.341'N 118°44.854'W

Reach #: 2

Map Sheet: 82 L/10

Kingfisher Creek at this site is very similar to Site #5. A large debris jam on the left was noted on the video transcript and coded as Fb/Q.D.U.1. However, no debris jams were observed between Sites #4 and #8, and the debris accumulations noted on the video transcript have presumably been washed out.

Site #: 8

Date Inspected: July 4/95

Impact Code: QoDoN/Fo3

Coordinates: 50°38'N 118°45,02'W

Reach #: 2

Map Sheet: 82 L/10

A large amount of debris covering the channel was noted from the video transcript at this site, and the site was originally coded Fb/Q.D.U.1. However, no debris jam covering the channel was encountered during field inspection of the site. Two small debris piles were observed on the left bank of Kingfisher Creek. LWD in the debris piles is of both forestry and natural origin. It is believed that prior to the spring freshet, these debris piles may have covered the channel. The amount of debris present at this site has little impact upon Kingfisher Creek.

Site #: 9

Date Inspected: July 4/95

Impact Code: Fb/QoCoFo3

Coordinates: 50°39.368'N 118°45.083'W

Reach #: 3

Map Sheet: 82 L/10

Kingfisher Creek at this site is a moderate gradient (5%) meandering river within a 50 m wide floodplain. A very old bridge crossing is present at this site, however only the concrete bridge abutments remain. The abutment on the left bank is still in its original position and is stable. The abutment on the right bank has shifted so that it is oriented lengthwise into the channel. The right bridge abutment has constricted the channel by approximately 3 m, and flows have scoured a large 2 m pool in response. There is a potential for a debris jam to form at this site due to the constricted channel. A small accumulation of LWD trapped by the right bridge abutment provides proof that the potential for LWD jams at this site does exist (Photo 6). At present, Site #9 has had a minimal impact upon Kingfisher Creek and is considered to be a low priority site for restoration

Site #: 13

Date Inspected: Nov. 14/94

Impact Code: Fb/O•D•N/F•1

Coordinates: 50°39.90'N 118°45.09'W

Reach #: 3

Map sheet #: NTS 82 L/10

Site #13 consists of a series of log jams around an island. There is a large debris jam (Photo 3) which has completely blocked the main channel on the right bank of the stream at the downstream end of the channel. At the time of the survey, approximately 10 adult salmon were stranded in the pool at the downstream end of this debris jam. The side channel around the left side of the island

in is partly blocked by debris at the upstream end of the island. Immediately upstream from the debris jam there is more LWD in the main channel.

On the left bank the channel runs along the edge of the floodplain against the valley slope. There is a cut block on the floodplain on the right bank where a buffer strip was retained. Some tree blowdown is occurring along the buffer and along the stream bank near the lower log jam. Soil conditions in the cut block are wet, and cattails occupy some of the depressions.

This site is a candidate for WRP. The site is located downstream of an existing salmonid enhancement project on Danforth Creek and log jams restrict fish access. As well, there is relatively good access to the site through the cut block.

Site #: 19

Date Inspected: July 7/95

Impact Code: Fb/Fs/Q.D.o.N/F.1

Coordinates: 50°41.216'N 118°44.965'W

Reach #: 4

Map Sheet: 82 L/10

Kingfisher Creek at this site is composed of multiple channels which span across the 50-70 m wide floodplain. Riparian logging occurred along the banks of Kingfisher Creek several decades ago. Islands present in the channel range from unstable ephemeral bars to stable vegetated islands with >10 years growth of coniferous and deciduous vegetation.

Several large debris jams were observed in the channel at this site for at least 500 m upstream from site #19. Between the debris jams, the channel of Kingfisher Creek is relatively free of LWD. The debris jams appear to be stable and composed of a combination of natural and logging-related debris. There are significant accumulations of sediment upstream of some of the debris jams. One large natural debris jam was observed, originating from windfall of several old hemlock trees across the channel. None of the debris jams observed formed a barrier to fish migration at the time of the site inspection, however there is potential for barriers to be created.

Flows have scoured pools beneath the debris, creating excellent rearing habitat for fish. Numerous salmon fry were observed in side channels and small pools at this site.

Site #: 20 Date Inspected: July 7/95

Impact Code: Fb/Fs/Q•D•N/F•1 Coordinates: 50°41.216'N 118°44.965'W

Reach #: 4 Map Sheet: 82 L/10

Site #20 can be considered as part of the same site as Site #19. The entire length of channel between Sites #19 and #20 (approximately 500 m) is very similar in character, with sporadic accumulations of LWD.

Site #: 23 Date Inspected: Nov. 14/94

Impact Code: Fb/Q•D•N/F•1 Coordinates: 50°44.41'N 118°44.13'W

Reach #: 5 Map sheet #: NTS 82 L/10

Impacts at Site #23 consist of LWD in the channel. Access to this site was not possible on foot due to the heavy snow cover. The downstream limit of the cut block as seen from the bridge is shown in Photo 4. It was not possible to determine if the LWD was natural or forestry related. However, given the amount of forest harvest debris throughout the reach, it is likely that this site also has remnant woody debris from logging.

Date Inspected: Nov. 14/94

Impact Code: Fb/Q.D.F.1

Coordinates: 50°42.62'N 118°45.29'W

Reach #: 5

Map sheet #: NTS 82 L/10

Site #25 was initially assigned an F•2 code from the video. It was visited in the process of trying to access Site #23. The large amount of LWD in the channel (Photo 5) that was of logging origin warranted changing the classification to F.1. These accumulations of LWD have caused large amounts of gravel and cobbles to be deposited upstream of the debris. If the debris mobilizes, a flush of sediment could be released downstream. Some of the debris is natural in origin, probably originating from the eroding banks. The cut block along the left bank has approximately 20 years of regeneration and has a buffer retained along its length.

Site #: 26

Date Inspected: July 7/95

Impact Code: Fb/Fs/Q•D•F•1

Coordinates: 50°43.47'N 118°45,26'W

Reach #: 5

Map Sheet: 82 L/10

Site #26 is approximately 1 km downstream from Site #28. A forestry road comes within 10 m of the right bank of Kingfisher Creek. Several old stumps were observed along the channel banks, indicating that riparian logging has occurred several decades ago. LWD has accumulated in discrete debris piles along the channel similar to that seen at Sites #19-25. Three discrete debris jams were observed during field investigation to this site. The channel in between the debris jams was relatively free of debris. The debris jams observed are causing localized scour of the channel banks upstream of the debris jam and are also trapping large amounts of bedload. Several large trees along the channel banks have fallen across the channel due undercutting and erosion of the channel banks. It is believed that the majority of the LWD in the channel is a result of the riparian logging that occurred at the site several decades ago.

There is excellent fish habitat at this site. Several side channels, overhanging riparian vegetation, and undercut banks provide good rearing habitat for fish. Many of the gravel bars have spawningsized gravels. One of the debris jams observed at this site may pose a barrier to fish migration. This site would benefit from selective removal and stabilization of debris in the channel.

Site #: 28

Date Inspected: July 7/95

Impact Code: Fb/Fs/QoDoFo1

Coordinates: 50°43.47'N 118°45.26'W

Reach #: 5

Map Sheet: 82 L/10

Kingfisher Creek at this site is a low gradient, anastomozed stream which is very similar in appearance to Sites #19-#26. However, a large amount debris is scattered throughout the channel at this site which has not accumulated in discrete piles along the length of channel. Riparian logging along the channel banks has occurred several decades ago, and it appears that the banks have become inherently unstable. The channel banks (1-2 m high) appear recently undercut, exposing gravel, cobble, and sand materials. A large proportion of the channel substrate appears to be mobile, based on recent accumulations of gravel bars in the channels of Kingfisher Creek.

There is a large amount of LWD and debris jams scattered across the 50-70 m wide floodplain at this site. The debris appears to be both natural and forestry related. Some of the LWD has cut ends and is presumably related to the historical logging in the area. Several debris jams have accumulated at the entrance to side channels and eventually have blocked flows to the side channel (Photos 6 and 7). Kingfisher Creek has carved a new channel through the floodplain in response to the debris jams. LWD in the channel has enhanced fish habitat at this site through the creation of pools scoured beneath the LWD.

Due to the large forestry impact at this site, it has been recommended for further attention under WRP. Potential restoration projects include selective removal or stabilization of LWD in the

channel. Also, the side channels should be cleared of debris since they form potentially good rearing habitat.

Site #: 31a

Date Inspected: Nov. 14/94

Impact Code: Q.C.F.3

Coordinates: 50°44.41' N 118°44.13' W

Reach #: 6

Map sheet #: NTS 82 L/10

Photos were not taken at this site mainly due to the snow cover of the channel substrate and surrounding features. The bridge crossing at this site was not noted on the video and the site was assigned an Q•C•F•3 classification in the field. There are cut blocks on both sides of the channel at this site, both with buffers ranging from 10 - 20 m wide. Some erosion of the stream banks was noted as well as some LWD but all appears to be natural in origin. The banks range from 0.5 - 2.0 m in height and are composed of coarse sand and gravel. The stream substrate is large cobbles and boulders.

10.4 Sediment Source Inventory

A total of eight (8) sediment sources were identified on Kingfisher Creek from the aerial photograph review (Table 10.3). All were tributaries to the main stem. In addition to these major sources of sediment, there are cases of accelerated bank erosion in many areas, usually associated with accumulations of woody debris.

10.5 Kingfisher Creek Summary and Conclusions

Kingfisher Creek is utilized by Coho salmon as well as Rainbow trout and other fish species. Like nearby Wap Creek, it was heavily impacted by historic logging which has reportedly affected

3/29/96

Table 10.3 Kingfisher Creek Sediment Source Inventory

Location symbol(1)	Coordinates				Dimensions(3)		Present in(4)		Larger in
	Lat (N)	Long (W)	Feature	Composition(2)	Width (m)	Length (m)	1950's yes/no?	1990's yes/no?	1990's yes/no?
12	n/a	118°45.15'	Tributary	sa, g	n/a	n/a	yes	yes	n/a
17	n/a	118°45.08'	Tributary	sa, g	n/a	n/a	yes	yes	n/a
21	50"35.05"	118°44.83'	Tributary	sa, g	n/a	n/a	yes	yes	n/a
29	n/a	118°45.37'	Tributary	sa, g	n/a	n/a	yes	yes	n/a
R7a	n/a	n/a	Tributary	sa, g	n/a	n/a	yes	n/a	n/a
R7b	n/a	n/a	Tributary	sa, g	n/a	n/a	yes	n/a	n/a
36	n/a	118°45.63'	Tributary	sa, g	n/a	n/a	yes	n/a	n/a
39	n/a	118°45.59'	Tributary	sa, g	n/a	n/a	yes	n/a	n/a

(1): Refer to map: 82 1/10, 82 L/15

(2): Composition is determined from aerial photographs. Locations which have been checked in the field are indicated by a subscript 'f'. Compositions in brackets indicate minor amounts of the given texture.

si = silt

sa = sand

g = gravel

- (3): Width is distance measured along the stream. Length is distance measured from the toe to the zone of initiation (In the case of an eroding bank, length refers to 'bank height')
- (4): Two sets of aerial photos were examined in this study: one set flown in 1950's and second set flown in 1990's
- (5): n/c No aerial photo coverage available at the time of the Sediment Source Inventory
- (6): Location symbols designated with "R" are referenced by reach locations (e.g. R3a is located in Reach 3).
- (7): Location symbols designated with a number are referenced by site numbers from the video transcript (e.g. 18a is located between sites #18 and #19).

stream fish populations. A total of 13 sites were classified as "F.1" or "U.1" from the helicopter video, and five of these were inspected during the fall of 1994. The remainder were inspected in July 1995.

Following the inspections, eight sites maintained an impact code ending in "F.1.", indicating a high level of impact due to forest harvest activities.

Site #3	Debris jams, many appear unstable. Sediment accumulations behind some jams. Bank erosion. Large debris jams blocking fish access around an island. Blow down into channel from adjacent cutblock. Large woody debris spread throughout reach. Potential fish barriers (main stem and side channels). Sediment accumulating behind some debris piles; risk of sediment flush.			
Site #13				
Sites #19, 20, 23, 26, 26				
Site #28	Similar to Sites 19-26, except debris is more scattered. Channel shifted and active bank erosion. Side channel blocked.			

It is clear from the above that excessive amounts of large woody debris is the main type of habitat degradation found in Kingfisher Creek. The debris is contributing to bank erosion and is a barrier to fish passage. Although fish passage along the main stem is blocked in some places, at least through part of the year, access to side channels is more frequently blocked. The side channels are important for fish rearing. In some places, the debris is relatively stable and has contributed to habitat values by creating pools. The development of any restoration plan for Kingfisher Creek will need to address the balance between the positive and negative impacts of woody debris on stream habitat values.

11.0 COOKE CREEK

11.1 General description

Cooke Creek originates in the Hunters Range about 10 km east of the south end of Mara Lake. It flows southeast then south, and discharges into the Shuswap River about 10 km downstream of the Mabel Lake outlet. Additional descriptive information about Cooke Creek is found in Table 11.1. The NTS map sheet covering the creek (82 L/10) is provided in Attachment 1 of the final report. The 1992-93 colour aerial photographs are in Attachment 2 and the 1950s black and white photos are are in Attachment 3. Video transcripts, photographs, SIS survey forms, and the DFO/MELP Stream Information Summary Sheet are provided in Appendix IX.

A total of six (6) sites were given a code of "F.1" or "U.1" (Table 2.1) on the basis of the helicopter survey. Eight sites were inspected.

11.2 Reach Descriptions

A total of four (4) stream reaches were identified. Gradient and reach length data for the individual reaches are found in Table 11.2.

Reach #1 is a low gradient reach with a wide floodplain. It is accessible to fish present in the Shuswap River. The upstream end of the reach is delineated by a culvert crossing which is likely a barrier to upstream fish migration. Reach #2 is characterized by good fish spawning and rearing habitat. There reach includes many areas with spawning sized gravel, a split channel, deep pools and abundant cover. The upstream end is delineated by a series of waterfalls totalling a 4 m drop. Reach #3 has better fish habitat on average than Reach #2, but is probably not accessible to fish migrating from Reach #2 due to the waterfalls. Habitat values include a low gradient, overhanging banks, deep pools, and side channels.

Table 11.1. General characteristics of Cooke Creek.

Parameter	Information		
Map sheet no.	82 L/10		
Latitude & longitude of mouth	50°35.96' N, 118°50.6' W		
Watershed area (km²)	70.3		
Stream length (km)	15.5		
No. of reaches	4		
Discharge (mean/highest month/lowest month)	not gauged		
Biogeoclimatic zone(s)	ICHmw2, ICHwk1, ESSFwcp		
General flow direction	east and south		
Next higher order stream or lake	Shuswap River		
Land use	agriculture, forestry		
Known water licences	(Kingfisher Environmental Interpretive Centre)		
Known fish species	no data. KO* in Shuswap R. near mouth of Cooke		
No. of F1 and U1 sites identified	6		
No. of field sites checked	8		

Table 11.2 Stream reach data summary for Cooke Creek.

Reach no.	Reach length (km)	Gradient (%)	Map sheet no.	Site nos. within reach	
1	1.0	9	82 L/10		
2 4.5		6	82 L/10	3-9	
3	2.8	7	82 L/10	10-12	
4 7.3		13	82 L/10	13-19	
Total	15.5			19	

Reach #4 has a moderate gradient with a frequently confined channel and steep valley walls. The substrate includes a high percentage of cobbles. There is potentially good fish rearing habitat, characterized by abundant cover and a split channel.

11.3 Site Descriptions

Site #: 3

Date Inspected: April 6/95

Impact Code: Q.S.N.2

Coordinates: 50°36.74'N 118°50.85'W

Reach #: 2

Map Sheet: 82 L/10

This site was originally coded as Fs/Q.S.F.1 based on the presence of two landslides which approach the channel. Following the field inspection and a review of aerial photographs, the code was changed to Q•S•N•2 since the slides appear to be natural in origin. The failure slope is about 75%.

Site #: 4

Date Inspected: April 6/95

Impact Code: QoS/DoFo2

Coordinates: 50°37.18'N 118°50.66'W

Reach #: 2

Map Sheet: 82 L/10

Originally coded Fs/Q.S.N.2, the coding was changed to Q•S/D•F•2 after the field inspection and aerial photo review. Although the slide originates about 35 m downslope of a logging road, the slide does not appear on photos which pre-date road construction, indicating a link between the presence of the road and the slide. While the slide did apparently extend to the stream, it is now apparently stable and is being revegetated naturally. The slide face has a slope of about 70% and is made up of coarse sand and gravel.

Although not presently impacting the creek directly, this slide and adjacent areas should be inspected periodically to ensure that road drainage is adequate and that the slides remain inactive.

Site #: 6a

Impact Code: QoSoFo1

Reach #: 2

Date Inspected: April 6/95

Coordinates: 50°37.49'N 118°50.63'W

Map Sheet: 82 L/10

This site was not detected during the helicopter flight, but was identified during the field inspections of nearby sites. It consists of two relatively new landslides which originate from a forest road fillslope.

The track of the first slide does reach the creek, while the second one does not. The second slide may

be somewhat older, as indicated by small conifers growing in the track.

The first slide is about 150 m long and 40-45 m wide at the top, narrowing down to about 4 m wide at

the bottom of the track. The base of the slide track has a cobble/boulder pavement, but the sides

includes particles from sand to large cobbles. Trees adjacent to the track are falling into the track,

suggesting that the track sides are eroding. On the day of the site inspection, cobbles and boulders

from the cutslope had fallen onto the road surface, indicating cutslope erosion.

The second slide originates on the slope below the outlet of a 30 cm diameter culvert. It joins the first

slide track just above Cooke Creek. Examination of aerial photos showed that the slides are located in

a natural draw. No culvert is present at the location of the first slide.

This site should be re-inspected to evaluate the adequacy of road drainage and to assess the feasibility

of seeding and other erosion control methods to stabilize the slide tracks and reduce the risk of future

slides.

Site #: 8

Impact Code: Fs/QoC/D/SoFoI

Reach #: 2

Date Inspected: July 4/95

Coordinates: 50°38.78'N 118°50.24'W

Map Sheet: 82 L/10

A very large slide, originating from a culvert, has impacted Cooke Creek from the right bank. The forest road from which the slide was initiated is approximately 100 m from the channel. It appears that the culvert crossing of the road has been a chronic problem area for several years. An old culvert which was not conveying flow was observed to be buried in the road bed. A newer culvert has been installed, however it is taking a small portion of flow. The majority of the flow is moving through the road fill.

The large slide at this site was initiated at the outfall of the culvert (Photo 1). Surficial materials consist of a thin (2-5 m) veneer of colluvium overlying bedrock. The culvert outfall apparently saturated these sediments, causing the slope to fail. The slide area is approximately 30 m wide and 100 m long. An estimated 2000 m3 of sediment was displaced by the slide. As the slide flowed downslope it encountered a large (20 m high) knoll consisting of alluvial sands and bedrock (Photo 2). The knoll deflected the slide to the right. The knoll was subsequently eroded by the debris flow. Just past the knoll, most of the sediments entrained in the debris flow were deposited. Sediment did reach the channel of Cooke Creek, as evidenced from the 1 m high scars on trees located where the flow impacted the right bank. However the sediment which reached the creek was a small portion of the total slide volume. There is no evidence that the channel was moved due to the introduction of a large pulse of sediment to the creek. Also, there is no evidence of any sediment or debris deposited on the left bank of the creek. The majority of the debris and sediment displaced appeared to have been deposited in the last 25 m of the slide track above the right bank. A large debris jam was observed approximately 30 m downstream of where the debris flow impacted the right bank (Photo 3). Much of the LWD in the jam may be related to the debris flow. The debris jam does not appear to be a barrier to fish passage.

The failure observed at this site is a result of altering the natural drainage patterns present. The present culvert is not adequate and there is a possibility that the road may fail again in the near future. The culvert located at the road should be pulled and either a Squamish culvert or log culvert should be installed at this site. Stabilization of the exposed slide face by seeding is also suggested.

Site #: 8A

Date Inspected: July 4/95

Impact Code: Fb/Q•D/W•N•2

Coordinates: 50°38.78'N 118°50.24'W

Reach #: 2

Map Sheet: 82 L/10

This site is located just upstream from site #8, on the east side of the knoll described at Site #8. Cooke Creek has eroded a 20 m deep canyon through bedrock and created several large (1-3 m) chutes and waterfalls, which are barriers to upstream fish migration.

Just upstream of the knoll, there is a series of riffles and pools controlled by natural LWD. The floodplain is fairly wide (20 m) here with many bars and side channels providing excellent fish habitat. A very old side channel, blocked by LWD, was observed along the right bank. This side channel is presently inactive, however if the channel were active it would convey flows around the west side of the bedrock knoll. It is believed that the main channel of Cooke Creek has historically occupied channels on both the east and west sides of the knoll. LWD jams along the right bank at the entrance to the side channel are the main factor influencing whether the side channel around the west side of the knoll is occupied. If the side channel leading around the west side of the knoll is re-activated then there is a possibility that flows will remobilize much of the sediment deposited by the debris flow at Site #8.

Possible remedial actions could include reinforcing the right bank at the entrance to the side channel with rip-rap, to prevent the side channel from becoming re-activated.

Site #: 10

Impact Code: Fb/Q•D•N/F•2

Reach #: 3

Date Inspected: July 4/95

Coordinates: 50°39.11'N 118°50.24'W

Map Sheet: 82 L/10

Cooke Creek at this site is a single channel with a gradient of 5%. The channel is approximately 10 m wide and the bed is composed of cobbles and gravels. A bridge crossing Cooke Creek at this site was originally coded as Fb/QoCoFo1. However field inspection of the bridge revealed it is constructed with steel stringers and there is no apparent constriction of the channel width. The bridge is having little impact upon Cooke Creek.

The code at this site has been revised to Fb/QODON/FO2 to indicate the presence of several small LWD jams in the channel approximately 50 m downstream of the bridge. The LWD in the jams are both natural or forestry-related and appears to be stable. Some localized bank erosion has taken place where flows have been diverted around the debris. Flows have scoured beneath the LWD creating some nice pools beneficial for over-wintering fish habitat. Gravel has accumulated around the LWD, creating several small gravel bars.

There is excellent habitat for fish at this site. The LWD jams have improved fish habitat at this site by improving cover, deep pools, and undercut banks.

Site #: 15

Date Inspected: July 4/95

Impact Code: QoD/SoFo3

Coordinates: 50°40.66'N 118°52.11'W

Reach #: 4

Map Sheet: 82 L/10

A recent cutblock has been logged to within 5 m of the right bank of Cooke Creek at this site. The channel of Cooke Creek has not been adversely impacted by the cutblock near the right bank. All logging debris from harvesting in the riparian zone has been pulled back approximately 10 m and gathered in debris piles. Along the length of the cutblock, only two trees were observed that have fallen across the channel. It appears that these trees may pre-date the harvesting of the cutblock. There are no signs of bank erosion due to the cutblock or thin riparian buffer located along the right bank.

A steel span bridge to access the cutblock on the right bank crosses Cooke Creek at the downstream end of the cutblock. The bridge does not appear to constrict the channel width and rip-rap has been installed around the bridge abutments. The forest road continuing along the right bank has been deactivated and several cross-ditches and/or water bars have been installed. Several small slumps have occurred at the cross-ditches, however the sediment is being deposited on a small terrace. Little sediment is entering the creek from these slumps.

Site #: 16

Date Inspected: July 4/95

Impact Code: Fs/QoSoFo2

Coordinates: 50°40.80'N 118°52.69'W

Reach #: 4

Map Sheet: 82 L/10

A large debris flow originating from the edge of a cutblock, logged in 1972-3, has come within 20 m of the left bank of Cooke Creek at this site. The debris flow occurred through glaciofluvial coarse sand and gravels on a 60% side-slope. The debris flow crossed a forest road, blocking the culvert and deposited a large fan of debris on the floodplain on the left bank. The fan of debris was deposited within 20 m of the left bank of the creek. A very small amount of sediment was routed to the channel. The debris fan is revegetated with horsetail (Equisetum sp.). The absence of later successional plants suggests that there is on-going surface erosion of the debris fan. However, the debris flow itself appears to be relatively stable and there is no evidence of subsequent debris flows occurring.

A makeshift road has been rebuilt across the slide area, however a culvert was not installed. Active seepage from the slide face above the road was observed in the field. There is a possibility that the absence of a culvert at this site may initiate further failure of the roadbed. The site should be inspected to determine if the road could be deactivated. Whatever the status of the road, drainage should be improved and the slide face seeded.

11.4 Sediment Source Inventory

A total of 10 sediment sources were identified on Cooke Creek from the aerial photograph review (Table 11.3). There were five landslides, four tributaries, and a slump in a road fillslope. Four of the slides were not present in the 1950s photos. The fifth may have been present, but the resolution on the older photos made it difficult to confirm its presence. The fillslope was also not present on the older photos.

11.5 Cooke Creek Summary and Conclusions

A total of six sites on Cooke Creek were coded as "F.1" or "U.1" sites. Eight sites were inspected. Following the inspections, two sites remained with an "F.1" coding, indicating a high degree of impact due to forest harvest activities.

Site #6a	Two landslides which originate from a forest road which runs across a draw. Apparent unstable as indicated by falling trees and colluvium on the road surface.		
Site #8	Landslide originating from a culvert under forest road. Culvert appears to be a chronic problem, but remains potentially undersized. Exposed slide deposits still a sediment source.		

In addition to these specific problem areas, there are other areas of apparent slope instability along Cooke Creek. A road condition assessment is recommended for the forest roads which run parallel to Cooke Creek, including an evaluation of road drainage.

Table 11.3 Cooke Creek Sediment Source Inventory

Location symbol(1)	Coordinates				Dimensions(3)		Present in(4)		Larger in
	Lat (N)	Long (W)	Feature	ure Composition(2)	Width (m)	Length (m)	1950's yes/no?	1990/s yes/no?	1990's yes/no?
3	50°36.74'	118°50.85'	Slide	sa, g	30	30	no	yes	yes
4	50°37.18'	118°50.66′	Slide	sa, g	15	100	no	yes	yes
4a	50°37,49'	118°50.63'	Slide	sa, g	15	150	no	yes	yes
ба	n/a	n/a	Slide	sa, g	20	250	по	yes	yes
R2a	n/a	n/a	Tributary	sa, g	n/a	n/a	yes	yes	yes
8	50"38.69"	118°50.32°	Fillslope slump	sa, g	70	80	по	yes	yes
R2 n/a	n/a	n/a	Tributary	sa, g	n/a	n/a	yes	yes	n/a
R3a	n/a	n/a	Tributary	sa, g	n/a	n/a	yes	yes	n/a
14	50°40.71°	118°51,92'	Slide	n/a	n/a	n/a		unconfirme	d
R4	50"41.99"	118°54.34'	Tributary	sa, g	n/a	n/a	yes	yes	yes

(1) Refer to map: 82

(2): Composition is determined from aerial photographs. Locations which have been checked in the field are indicated by a subscript 'f'. Compositions in brackets indicate minor amounts of the given texture.

si = silt

sa = sand

g = gravel

- (3). Width is distance measured along the stream. Length is distance measured from the toe to the zone of initiation (In the case of an eroding bank, length refers to 'hank height')
- (4): Two sets of aerial photos were examined in this study: one set flown in 1950's and second set flown in 1990's
- (5): n/c No aerial photo coverage available at the time of the Sediment Source Inventory
- (6) Location symbols designated with "R" are referenced by reach locations (e.g. R3x is located in Reach 3).
- (7): Location symbols designated with a number are referenced by site numbers from the video transcript (e.g. 18a is located between sites #18 and #19).

12.0 BRASH CREEK

12.1 General description

Brash Creek flows into the Shuswap River at a point about seven kilometres upstream of the City of Enderby, and serves as a source of water for the City. The City has recently constructed a reservoir and will decrease the usage of Brash Creek as a source of domestic water, while increasing the use of water from the Shuswap River. Additional descriptive information about Brash Creek is found in Table 12.1. The NTS map sheets covering the creek (82 L/10, 82 L/11) are provided in Attachment 1. The 1992-93 colour aerial photographs are in Attachment 2 and the 1950s black and white photos are are in Attachment 3. Video transcripts, photographs, SIS survey forms, and DFO/MELP Stream Information Summary Sheet are provided in Appendix X.

A total of five (5) sites were given codes ending in "F.1" or "U.1" (Table 2.1) based on the helicopter survey. All were inspected.

12.2 Reach Descriptions

A total of three (3) stream reaches were identified. Length and gradient data for the individual reaches are found in Table 12.2.

Reach #1 is a low gradient section of Brash Creek which crosses the floodplain of the Shuswap River. It is accesible to fish migrating from the Shuswap River. The upstream end of Reach #1 is delineated by a small dam which is a barrier to fish passage. Reach #2 has a deeply incised valley cut into bedrock. The stream gradient ranges up to 40%. Reach #3 is less incised than Reach #2, but has a steeper average gradient. Between the effects of the dam at the beginning of Reach #2 and the gradient in Reaches #2 and #3, it is unlikely that fish occupy these reaches.

Table 12.1. General characteristics of Brash Creek.

Parameter	Information
Map sheet no.	82 L/10, 82 L/11
Latitude & longitude of mouth	50°33.18' N, 118°01.7' W
Watershed area (km²)	34.4
Stream length (km)	10.0
No. of reaches	3
Discharge (mean/highest month/lowest month)	not gauged
Biogeoclimatic zone(s)	IDFxh1, IDFmw1, MSmm, ICHmw2
General flow direction	south & southwest
Next higher order stream or lake	Shuswap R.
Land use	agriculture, forestry
Known water licences	(City of Enderby, R.H. Baird)
Known fish species	RB (CH* & SK* in Shuswap R.above and below confluence, CO* above confluence)
No. of F1 and U1 sites identified	5
No. of field sites checked	5

Table 12.3 Stream reach data summary for Brash Creek.

Reach no.	Reach length (km)	Gradient (%)	Map sheet no.	Site nos. within reach
1	2.0	5.2	82 L/11	1-7
2	6.0	12.8	82 L/10, 82 L/11	8-15
3	2.0	15.2	82 L/10	16
Total	10.0			16

12.3 Field Check Site Descriptions

Site #: 4 Date Inspected: April 6/95

Impact Code: n/a Coordinates: 50°33.53'N 119°02.24'W

Reach #: 1 Map Sheet: 82 L/11

This site is the location of the Shimole Lumber Ltd. sawmill, just downstream of where the gradient of Brash Creek decreases as it breaks out onto the terraces adjacent to the Shuswap River. The mill yard is immediately adjacent to the creek, with no buffer strip. The substrate of Brash Creek is about 70% cobble and 30% gravel, and the gradient is about 2.5%. The banks are about 2.5 m high with about 80% of the bank area vegetated with grasses and small deciduous trees. The banks appear relatively stable. A pump adjacent to the creek suggests that water is occasionally taken from the creek for mill yard operations (i.e., dust control). Several fish, probably Rainbow trout, were observed in the stream at the site on the day of the site inspection.

With the exception of lack of a buffer strip, the mill yard did not appear to having a negative impact on water quality or fish habitat. The original Fs/Q.S.F.1 code was changed to "not applicable", since the activity was not directly related to forest harvest.

Site #: 5 Date Inspected: April 6/95

Impact Code: Q.C.F.1 Coordinates: 50°33.82'N 119°02.39'W

Reach #: 1 Map Sheet: 82 L/11

There is a forest road bridge at this site which provides access to the Brash Mainline road. The banks are armoured with riprap beneath the bridge. The flow beneath the bridge is directed to the left bank causing the bank just downstream of the bridge to slump into the creek. This is apparently an on-going problem since logs have been placed alongside the creek in an attempt to control bank erosion. However the logs appeared to be in poor condition and erosion is

continuing. Other support logs have apparently been washed away. The bridge itself appeared to be in good condition.

The log structure should be replaced with riprap to prevent erosion and avoid potential future problems with bank and bridge stability.

Site #: 8 Date Inspected: April 6/95

Impact Code: n/a Coordinates: 50°35,25'N 119°01,66'W

Reach #: 2 Map Sheet: 82 L/11

At this site Brash Creek is confined in a steep v-shaped valley. The gradient is 15% and the channel bed is primarily on bedrock. Some LWD was present in a series of chutes and falls, most of which appeared natural in origin and were stable. The falls suggest that fish are unlikely to access this section of the stream. Given the absence of apparent forest harvest impacts and the low fish habitat value, the code at this site was changed from Fb/Q.D.U.1 to "not applicable."

Site #: 12 Date Inspected: June 15/95

Impact Code: Fs/Q•C•F•1 Coordinates: 50°36.403'N 118°59.620'W

Reach #: 2 Map Sheet: 82 L/10

Brash Creek at this site is a high gradient (40%) stream with channel bed materials comprised of gravel, cobbles, and boulders. No fish are present at this site due to the high channel gradient.

A road crosses Brash Creek at this site with a 50 cm diameter culvert (Photo 1). Several old logs have been buried in the roadbed at the culvert inlet. The logs show signs of rotting and movement, indicating that the roadbed may fail in the near future. Poor road surface drainage has caused erosion of approximately 2 m³ of sediment from the roadbed, which has been conveyed by large rills to Brash Creek along the right bank (Photo 2).

The status of this road should be reviewed to determine the need to maintain a culvert at the crossing. If the culvert is to remain, both the culvert and the road should be repaired to minimize the potential for surface erosion and/or road failure.

Site #: 13

Date Inspected: June 15/95

Impact Code: Fs/Q•C•F•1

Coordinates: 50°36.222'N 118°59.620'W

Reach #: 2

Map Sheet: 82 L/10

This site is very similar to Site #12 in both the degree and type of impact, and is located one switchback upslope from Site #12. The road crosses over Brash Creek using a 50 cm diameter culvert. Approximately 8-10 logs have been laid across the top of the culvert outlet to support the road fill. The culvert outlet has been crushed to half its original diameter due to settling of the road (Photo 3), and the flow is constricted. Presently, the logs do not show signs of losing strength. If the logs break down in the future, a large amount of sediment and LWD could be transported downstream in the form of a debris flow. If a debris flow occurs from this site, it will definitely affect downstream fish habitat and water quality.

As outlined for Site #12, the status of the road should be reviewed and, depending on the outcome, the culverts should be removed or replaced.

12.4 Sediment Source Inventory

A total of eight (8) sediment sources were identified on Brash Creek from the aerial photograph review (Table 12.3). There were three areas of bank erosion, four tributaries, and a single landslide. Two of the areas of bank erosion were similar in size on the 1990s aerial photos as on the photos from the 1950s, while the third was not present on the earlier photos. The landslide was also present on the older photos, and did not appear to have grown in size on the 1990s photos.

76

Table 12.3

Brash Creek Sediment Source Inventory

Location symbol(1)	Coordinates				Dimensions(3)		Present in(4)		Larger in
	Lat (N)	Long (W)	Feature	Composition(2)	Width (m)	Length (m)	1950's yes/no?	1990's yes/no?	1990's yes/no?
5	50°33.82'	119°02.39′	Bank erosion	si, sa, g	5	2	по	yes	yes
R2a	50"35.25"	119"01,66"	Tributary	sa, g	n/a	n/a	yes	yes	n/a
9	50°35,33°	119°01.68	Eroding bank	sa, g	70	50	yes	yes	no
10	50"35.85"	119*00.71	Eroding bank	sa, g	50	50	yes	yes	no
10a n/a	n/a	n/a	Slide	g, sa	n/a	n/a	yes	yes	no
11	50°36,32'	119°00.05°	Tributary	sa, g	n/a	n/a	yes	yes	n/n
13	50"36.24"	118"59,72"	Tributary	53, <u>g</u>	n/a	n/a	yes	yes	n/a
14	50°36,55'	119°00.04°	Tributary	sa, g	n/a	n/a	yes	yes	:n/a

Refer to map: 82 L/10, 82 L/11
 Composition is determined from aerial photographs. Locations which have been checked in the field are indicated by a subscript T. Compositions in brackets indicate minor amounts of the given texture.

si = sitt

sa = sand

- g = gravel

 (3). Width is distance measured along the stream. Length is distance measured from the toe to the zone of initiation (In the case of an eroding bank, length refers to 'bank height')
- (4): Two sets of serial photos were examined in this study: one set flown in 1950's and second set flows in 1990's
- (5): n/c No serial photo coverage available at the time of the Sediment Source Inventory
- (6): Location symbols designated with "R" are referenced by reach locations (e.g. R3a is located in Reach 3).
- (7): Location symbols designated with a number are referenced by site numbers from the video transcript (e.g. 18a is located between sites #18 and #19).

12.5 Brash Creek Summary and Conclusions

A total of five sites on Brash Creek were identified from the helicopter survey as having a high level of impact from forestry (F.1) or unknown (U.1) activities. All were inspected. Following the field inspections, three sites remained with an "F.1" rating. These are:

Site # 5	Flow beneath forest service road bridge is directed to bank causing erosion. Bank should be protected.		
Site # 12	Culvert in poor condition on steep section of stream. Road potentially unstable. Surface erosion. Risk of debris flow.		
Site # 13	A second culvert in poor condition just upstream of Site #12		

The most pressing problems are those associated with Sites #12 and #13. At the time of the site inspections in June 1995, the road in the vicinity of these sites, as well as other locations in the watershed, was in poor condition. Level 1 and 2 road condition assessments should be completed to assess the need for rehabilitation in the Brash Creek watershed road system.

MIDDLE SHUSWAP SUMMARY AND RECOMMENDATIONS 13.0

This report has presented the results of stream channel surveys completed on nine (9) tributaries of the middle reach of the Shuswap River, which is defined as the Mabel Lake to Enderby section of the river. The tributaries covered in the report are Sowsap, Latewhos, Tsuius (or Cottonwood), Hound, Whip, Wap, Kingfisher, Cooke and Brash Creeks. All of these creeks originate in rolling terrain on the Interior Plateau, and flow over some steep sections as they drop down from the plateau to either Mabel Lake or the Shuswap River.

The stream channel assessment was initiated by a helicopter survey which was used to identify sites with potential water quality and/or fish habitat impacts due to land use activities. Videotapes from the helicopter surveys were reviewed and each site assigned an impact code based on the type of problem, the cause of the problem, the land use activity involved, and the degree of impact. Field inspections were carried out on those sites where the land use activity contributing to the potential problem was either forestry or unknown, and where the degree of impact was estimated to be high (i.e., those sites given a code ending in "F.1" or "U.1" [Table 2.1]). Videotapes were unavailable for two of the creeks, Sowsap and Latewhos, and field inspections were limited to reconnaisance-level surveys.

Within the watersheds surveyed, a total of 33 sites were identified from the helicopter survey as F.1 (forestry activity, high impact) or U.1 (unknown activity, high impact). The coding procedure was intentionally conservative to minimize the risk that a high impact site would not be inspected. Following the inspections, a total of 20 sites remained with an F.1 code, or 61%. Brief descriptions of these sites are provided in Table 13.1. The sources of impacts at the sites can be broken down into four categories:

Cutslope/Fillslope Erosion

2 sites

Landslides

5 sites

Table 13.1 Middle Shuswap River watershed: Summary of sites identified with high level of impact due to forest harvest activities.

Creek/Site	Description
Tsuius Creek	
Site #7	Logging road fillslope on an incised valley section. Surface erosion likely is transporting sediment to the stream. Since downstream areas include salmon spawning habitat, steps should be taken to control erosion.
Hound Creek	
Site #3	Large landslide track. The slide likely pre-dates forest harvest, but harvest and/or road building appears to have re-activated it. Evidence of surface erosion and minor instability. Road over slide track apparently needs frequent repairs.
Whip Creek	2 and a state apparently noods request repairs.
Site #8	Bridge over creek is in poor condition. Gaps in the bridge surface permit sediment to be introduced into the stream. Erosion is occurring on adjacent road surfaces.
Wap Creek	on majarota satisfaces.
Site #4	"Site" actually refers to much of Reach #1. Considerable large woody debris is contributing to bank erosion and blockage of side channels.
Site #35	Erosion from adjacent road cut and fill slopes. Leaning trees suggest slope instability.
Site #36	Debris flow introduced sediment and LWD into stream. Debris still potential fish barrier. Exposed mineral soils present.
Site #37	Landslide. Now apparently stabilized. Considerable woody debris in channel which may not be stable. Debris is trapping sediment.
Kingfisher	
Creek	
Site #3	Debris jams, many appear unstable. Sediment accumulations behind some jams. Bank erosion.
Site #13	Large debris jams blocking fish access around an island. Blow down into channel from adjacent cutblock.
Sites #19, 20,	Large woody debris spread throughout reach. Potential fish barriers (main stem and
23, 26, 26	side channels). Sediment accumulating behind some debris piles; risk of sediment flush.
Site #28	Similar to Sites 19-26, except debris is more scattered. Channel shifted and active bank erosion. Side channel blocked.
Cooke Creek	
Site #6a	Two landslides which originate from a forest road which runs across a draw. Apparently unstable as indicated by falling trees and colluvium on the road surface.
Site #8	Landslide originating from a culvert under forest road. Culvert appears to be a chronic problem, but remains potentially undersized. Exposed slide deposits still a sediment source.

Table 13.1 Middle Shuswap River watershed: Summary of sites identified with high level of impact due to forest harvest activities (continued).

Brash Creek

Site # 5 Flow beneath forest service road bridge is directed to bank causing erosion. Bank

should be protected.

Site # 12 Culvert in poor condition on steep section of stream. Road potentially unstable.

Surface erosion. Risk of debris flow.

Site # 13 A second culvert in poor condition just upstream of Site #12

3. Bridges/Culverts

4 sites

4. Excessive Large Woody Debris

9 sites

Excessive accumulations of large woody debris was a problem on two creeks, Wap Creek and Kingfisher Creek. Of the nine creeks, these two have the longest sections of low gradient stream set within a wide valley. Both were logged to streamside in the past, permitting woody debris to be directly introduced to the channel. Selective removal and or stabilization of woody debris is recommended for both Wap and Kingfisher Creeks. Planning for a debris management program needs to take a number of factors into account, notably the distribution of fish habitat types within the impacted reaches, the positive role that some LWD accumulations play in habitat heterogeneity, site access, and effects of LWD on island and bank stability.

Landslides are an issue on Hound, Wap and Cooke Creeks. The largest of these is the slide on Hound Creek, which is a large debris flow that likely pre-dates forest harvest. However road building and/or harvest appears to have reactivated the slide to a degree, as indicated by evidence of repeated road wash-outs, surface erosion, and new deposition in the lobe area. The other landslides listed in Table 13.1 are smaller in area than the Hound Creek slide, and generally originate near forest roads which parallel the creeks, or on the outside of a stream meander. In addition to the specific slides listed on Table 13.1, a number of other slides were identified from aerial photographs as sediment sources.

Problems identified with culverts, bridges and cut and fill slopes in this study are limited to the main stems of the creeks surveyed. Culverts and bridges carrying the flow of tributaries (permanent and ephemeral) were not assessed. Road condition assessments (Moore, 1994) should be completed on those resource roads in the study area which are not presently being actively maintained. Of the watersheds evaluated in this study, Brash and Cooke Creeks appeared to be most in need of road rehabilitation.

As described earlier, forest harvest took place within the riparian zone of several creeks in the past (up to the 1960s), and some of the problems identified relate to this activity. Natural restoration processes have apparently partially offset losses in stream productivity resulting from riparian harvest, notably in Kingfisher and Wap Creeks. Further restoration should be able to accelerate the rate of stream restoration to improve habitat values in these systems.

14.0 REFERENCES

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15.0 GLOSSARY AND ACRONYMS

Alluvial fan Sediment deposit usually occurring where a stream emerges from a

confined valley into a broader valley. Typically resembles a segment of a

cone.

Anastomozing Stream channel consisting of distributaries which branch and rejoin. They

resemble braided streams except that the channels are discrete,

interconnected channels separated by bedrock or stable alluvium. Thus

they are erosional rather than depositional forms.

Braided streams Flow is divided by islands or bars formed of alluvium. Formed by excessive

sediment deposition in stream channels.

Colluvial deposits Gravity deposits (e.g., rock falls) along valley sides. Usually found in the

more confined stream reaches.

DFO Department of Fisheries and Oceans.

Fluvial deposits Generally well sorted gravels, sands and silts transported and deposited by

streams and rivers.

Fluvioglacial deposit Materials deposited by glacial melt water either in contact with ice or

beyond the ice margin as outwash.

GPS Global Positioning System. A collection of earth-orbiting satellites which

can be used to determine location on the ground. A receiver "picks up"

signals from usually three or more satellites to fix the location.

Kames	Ice contact deposits resembling steep knolls. Formed when stagnant ice left
	hummocks of drift which were modified by water flowing around the base.

Kame terraces	Ice contact, stratified deposits along the valley sides originating from
	meltwaters flowing between the glacier and the valley wall.

MELP	B.C. Ministry of Environment, Lands and Parks.

MoF	B.C. Ministry of Forests
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NTS	National Topographic System.	The system of topographic maps produced
	by Natural Resources Canada.	

Outwash terraces	Materials deposited by meltwaters downstream from a glacier.	Subsequent
	down cutting leaves terrace features on the valley sides.	

Oxbow Lake	Small lake created when a stream meander is isolated by the stream channel
	overrunning the meander loop during high flows. Oxbow lakes typically
	accumulate channel-fill deposits during subsequent floods.

Thalweg	In a stream, the line of maximum depth along the channel bottom.

WRP	Watershed Restoration Program.

APPENDIX I

Terms of Reference

Mid Shuswap River Stream Assessment

CONTROL NO.: 1080-20 Water Restoration 8SC-94-26

TERMS OF REFERENCE

<u>Background</u>: This contract is funded under the Watershed Restoration Program. The intent of this project is to identify and evaluate potential stream restoration opportunities to improve fish habitat and water quality within the Mission Creek watershed. This will include fish habitat and stream channel assessments with emphasis on impacts associated with forest harvest activities.

The contractor will:

- Provide fish habitat and hydrology assessments on preselected watersheds (Appendix 1) as follows:
 - A) Video tape existing stream conditions using helicopter video with GPS mapping, all of which will be provided by MOELP.
 - participate directly in accompanying the helicopter and providing voice over describing the fish habitat and hydrological conditions of the subject stream. Stream habitat features should be recorded using the methods provided in Appendix 2 and 3 of Watershed Restoration Technical Circular No. 8 where applicable.

 communicate directly with the helicopter contractor provided by MOELP to set up logistics of scheduling the flights on the preselected watersheds (Appendix 1).

- helicopter flights should be timed to coincide with deciduous leaf drop and high sun angle to ensure good visibility.
- B) Review video tapes and compare with supplemental information as follows:
- review existing literature, historical watershed information, relevant hydrotechnical data bases (including individuals with experience in the watershed).
- review historical and recent air photos and interpret the degree of stream degradation and instability by stream reach.
- document results of the video tape and supplemental information review on air photos and maps as appropriate.
- C) Ground truthing video habitat\feature parameter estimates.
- for each stream reach, visually estimated values of parameters should be confirmed \ calibrated by ground measurement; ground truthing should not exceed 10% of representative habitat.

- photographic records and stream habitat features from Appendix 2 and 3, Tech. Circular No. 8 should be recorded at ground truthing locations.

- weather may prevent completion of ground measurements, so a prioritized list of stream reaches should be completed after or during the video work; the prioritized list must be discussed with and approved by the contract monitors prior to execution.
- D) Priorize Impacts and Propose Possible Remedial Measures
- identify near channel instabilities and all active or potential sources of stream sediment in the watershed on maps of appropriate scale.

- identify reaches that require remediation on maps of

appropriate scale.

- suggest initial remedial measures for each stream reach or stream, and recommend further prioritized fish and hydrology assessment or restoration.
- Provide progress reports on work to date with each billing period.
- 3) Be prepared to communicate closely with MOELP contract monitors and MOF upslope contractors for selected watersheds.
- 4) Be prepared to attend meetings with agency staff or the public regarding mitigation\restoration measures that the contractor may recommend.
- 5) Provide a draft final report by February 1, 1995 and a final report by March 31, 1995. Five (5) copies of the final report are required, including one (1) unbound master with maps suitable for copying.

An interim report documenting the results of the work carried out may be required instead of a final report in the event that the ground truthing specified in Item 1C is not completed during the 1994 field season.

6) Be familiar with, and conform to the Worker's Compensation Board Industrial Health and Safety Regulations.

APPENDIX II

Sowsap Creek Stream Information File DFO/MOE STREAM SURVEY FORM

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APPENDIX III

Latewhos Creek Stream Information File DFO/MOE STREAM SURVEY FORM

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APPENDIX IV

Tsuius Creek Stream Information File

MID-SHUSWAP STREAM ASSESSMENT

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TSUIUS CREEK

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October 11, 1994

TAPE:

WRP Tape 1

= to	LOCATION	CODE	COMMENTS	TIME	COORDINATES			
ye	SYMBOL				North	West		
	1	Fb-P-R-2	► fences to control flow away from cabin	2:05	50.37.48	118.40.88		
	2	Fb-P-R-2	- dyke on left bank	2:10	50.37.45	118.40.80		
لمعان	3	Fb-W-N-1	► 12m falls	3:40	50.37.17	118.39.84		
2/11/94	* 4	Fb/Q-D-U-1	► major log jam	3:59	50.37.19	118.39.53		
	5	Q-S-N-3	- exposed bank	4:07	50.37.19	118.39.46		
	6	Q-S-U-2	► landslide scar	4:45	50.37.18	118.39.07		
ريزنجدا	* 7	Q/Fs-F-F-1	- active fillslope erosion (road)	4:53	50.37.16	118.38.95		
12/11/94	8	Q-C-F-2	 bridge crossing 	5:05	50.37.13	118.38.80		
	9	Fs-P-F-2	· riprap along channel	5:16	50.37.12	118.38.68		
	10	Fs/Q-F-F-2	► slide from road cut	5:57	50.37.07	118.38.04		
	11		· recent cutblock with some greenup	6:10	50.37.03	118.37.71		
	12	Fs/Q-F-U-2	► slide on right side	6:22	50.37.01	118.37.65		
	13	Fs/Q-C-F-2	 logging road crossing (repl. wooden with steel) 	7:23	50.36.93	118.36.77		
	14	Fs/Q-F-F-2	 road adjacent to stream 	7:53	50.36.92	118.36.33		
	15		► large cutblock on left side	8:06	50.36.97	118.36.13		
	16	Fs/Q-S-F-2	 (old logging road here) 	8:10	50.36.97	118.36.01		
	17	Fs/Q-S-U-2	- slide (exposure)	9:00	50.36.98	118.35,33		
	18	Fs/Q-S-U-2	- cutblock on right side with slide	9:22	50.36.99	118.35.05		
	19	Fs/Q-S-F-2	- gully into stream from old cutblock	10:29	50.37.01	118.34.23		
	20		recent cutblock on right side	11:21	50.37.17	118.33.46		
	21	Fb/Q-D-U-2	- log jam (100m d/s)	11:30	50.37.22	118.33.25		
	22	Fs/Q-S-U-2	 exposed slopes on right side 	11:55	50.37.39	118.33.09		
	23	Fs/Q-F-F-2	- active gully from the road into the stream	12:25	50.37.56	118.32.80		

Page 2

STREAM:	TSUIUS CREEK
DATE:	October 11, 1994
TAPE:	WRP Tape 1

	WILL	Tape 1			
LOCATION SYMBOL	CODE	COMMENTS	TIME		INATES
				North	West
24	Fs/Q-C-F-2	 bridge (steel span with wood deck) 	12:54	50.37.74	440.00.0
25	Fb-D-U-2	→ some blowdown across the stream	13:39	50.38.18	118.32.5
26	Fs/Q-S-F-2	 stream passes through an old cutblock logged up to the channel 	14:06	50.38.32	118.32.20
27	Fs/Q-S-U-2	 exposed sand banks 	15:46	50.39.39	1100
28	Fb/Q-D-U-2	- large log jam	16:17	50.39.69	118.31.62
29	Fs/Q-C-F-2	- bridge (3800' elevation)	16:24	50.39.74	118.31.36
30	Fs/Q-S-F-2	 active slides from the road 	16:50	50.39.97	118.31.27
021	Fb/Q-D-U-2	 debris in the channel, log jams 	17:00	50.40.08	118.31.14
	Fs/Q-S-N-1	 natural snow avalanche tracks & active slide areas 	17:15	50.40.23	118.30.91
ANGER IN	Fs/Q-F-F-2 Fb/Q-D-U-2	 logging road with exposed cutbanks, sand 	18:12	50.40.64	118.30.43
	ru/u-u-u-2	 bridge (pool at u/s end) & some log jams u/s of the bridge 	20:00	50.41.69	118.29.71
35		 fish observed in the stream 	20:19	50.42.29	440.00
36 F	b-C-F-2	- culvert	23:37	50.42.29	118.29.62
37		► small cutblock on the right	24:13	50.42.71	118.28.27 118.27.56
38 Q	-S-N-1	- natural debris fan	24:59	50.42.40	118.27.05

NOTE: 1-33: Map 82 L/10 1:50,000 34-38: Map 82 L/9 1:50,000

DFO/MOEP FISH HABITAT INVENTORY AND INFORMATION PROGRAM STREAM INFORMATION SUMMARY

Watershed Code: 03-5400-260 Stream Wame: TSUIUS CREEK Page: 1

A. DESCRIPTION

Stream Mame:

TSUIUS CREEK

Local Mame:

COTTOMWOOD CREEK

Watershed Code: 03-5400-260

FRASER RIVER
1 KANLOOPS
29K SALMON ARN

O.F.O. Division: District: Subdistrict: Statistical Subarea: M.O.E. Region: Management Unit;

B DKANAGAR

24

Tributaries	Code	Topographic (1-50k) Warrenson to
WHIP CREEK HOUNG CREEK	020 030	020 U.T.M. Mouth: 11 1810 56005
		Location: FLOWS S THEN W INTO MABEL LAKE, KANLOOPS

50.00	627		stream from a	500000	Comments
5 x	.5 - 21	2 - 5%	5 - 10%	>10\$	FIRST SOO M. MODERATELY STEEP, LARGE BOULDERS; STEEP GRADIENT ABOVE. (REF. 29K-46)

B. OBSTRUCTIONS TO MIGRATION

Sarrier	Height	Location	lapassable	Comments
(Type)	(seters)	(km U/S)	to (species)	
NO INFORMAT	ION AVAILABLE			7

C. FLOW

Flow Control:	Water Survey of Canada	(WSC) Flow Gauge:	No. 4:
W.S.C. Station Mo. 1:	No. 2:	No. 3:	
NO INFORMATION AVAILABLE			

D. DISTRIBUTION SUMMARY

Species	Watershed Distribution
ZK SOCKERE SYTHON	1982 ONLY; SPANNING IN LOWER O.8 KM. (IN DOMINANT CYCLE YEARS). (REF. 29K-46)
CO CORRO SALHON	SPANNING IN LOWER 0.8 KM (REF. 29K-46)

E. ESCAPENENT SUNOVARY

Species		Escapement		Max feue		Management Target Escapement	Ref. No.
	Mean	Period of Record	Ref. No.	Recorded Escapement	Ref. No.		
SK SOCKEYE SALHON	35	1978 - 1987	28A-18	126	28A-18	25.52.52.25.25.25.2	1 100000
CO COHO SALNON		1978 - 1987		10	28A-18		

DEO/MOEP FISH HABITAT INVENTORY AND INFORMATION PROGRAM STREAM INFORMATION SUMMARY

Watershed Code: 03-Sem SD Stream Mame: TSD[US REK

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Checked by: LID	IA JAREMOVIC JAREMOVIC						Oate: Oate: Oate:	1986/12 1988/04 1990/09	/27				_

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Photo 1. Debris jam on the right bank jammed between the boulders and the bank.

Stream Name: Tsuius Creek Site #: 4 Reach #: 2

Coordinates: 50°37'19N 118°39'53W Code: Fb/Q•D•N•3

APPENDIX V

Hound Creek Stream Information File

MID-SHUSWAP STREAM ASSESSMENT

STREAM:

HOUND CREEK

DATE:

October 11, 1994

TAPE:

WRP Tape 1

*-10	LOCATION CODE SYMBOL	COMMENTS	TIME	COORDI		
3		_			North	West
	1		➤ mouth of creek	28:00	50.38.24	118.32.27
	2		- cutblock on the right side ~100m uphill	29:33	50.38.16	118.31.07
July 7/95	* 3	Fs/Q-S-F-1	 slide from within the block into the stream 	29:41	50.38.17	118.31.01
7/45	4	Fs/Q-S-U-3	 gully on the right side, historically contributed sediment to the stream 	30:27	50.38.25	118.30.59
	5	Fs/Q-C-F-2	 bridge, some exposed cutbanks 	31:07	50.38.40	118.30.20
	6		· cutblock on the left side	33:55	50.38.99	118.28.55
	7	Fs/Q-C-F-2	 bridge 	34:29	50.38.13	118.28.20
	8		 cutblocks on both sides of the channel with 30-60m buffers 	35:00	50.38.26	118.27.93
\cup	9	Fs/Q-C-F-2	 road crosses creek but no bridge @ 5400' elevation 	37:46	50.40.17	118.27.20
	10		- headwaters	40:06	50.41.30	118.26.35

NOTE: 1-5: Map 82 L/10 1:50,000 6-10: Map 82 L/9 1:50,000

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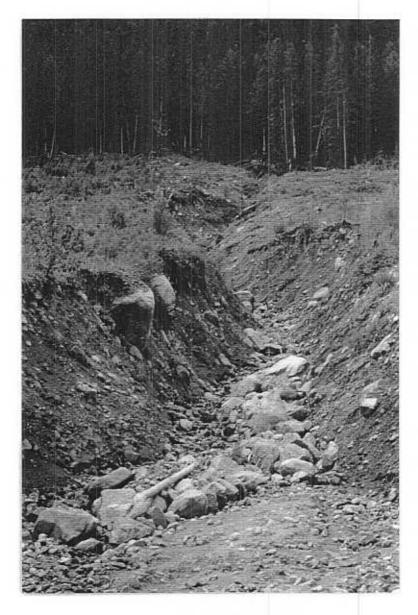


Photo 1. Landslide track at Site #3, Hound Creek, looking upslope from the road.

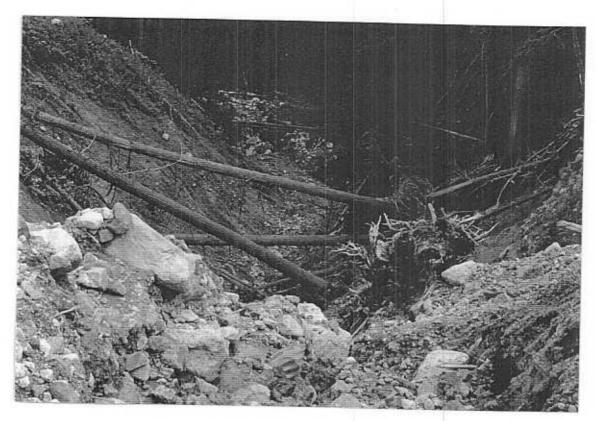


Photo 2. Landslide track looking downslope towards Hound Creek. Note culvert remanants in the forground.



Photo 3. Stable landslide track to the east of one shown in Photos 2 and 3.

APPENDIX VI

Whip Creek Stream Information File

MID-SHUSWAP STREAM ASSESSMENT

STREAM:

WHIP CREEK

DATE:

October 11, 1994

TAPE:

WRP Tape 1

f- to se	LOCATION SYMBOL	CODE	COMMENTS	TIME	COORDIN.	ATES West
	` 1		► mouth of the creek	41:06	50.36.99	118.33.80
	2	Q-S-F-3	 large cutblock on the left & right, generally a good buffer 	41:48	50.36.29	118.32.91
المم	3	Fb/Q-D-U-2	 LWD across the stream, some deposition zones in the channel 	44:39	50.36.10	118.32.03
July 7/9	5 * 4	Fb-D-F-2 Fb/8-10-U-1	log jam, old cutblock with no buffer	45:34	50.36.02	118.31.47
	5	Fb/Q-D-N-3	► natural blowdown across the stream	47:50	50.35.40	118.30.22
	6	Fb-W-N-2	► waterfalls	48:45	50.35.28	118.29.54
JU110/	195× 7	Fb/Q-6-F-1 Q-5-F-3	 cutblock on left & road crossing (not sure if it is a bridge) with logging 	50:13	50.34.857 50.34.99	11 8.29.2 0
- 4 19	19EK 8	Fs/Q-C-F-2_	- bridge	50:25	50.34.00	118 - 3c - 29.5 118.30:24
	9	Fs/Q-S-F-2	 large cutblock on the right with the road close to the stream @ 5900' elevation 	54:25	50.33.49	118.31.55
	10	Fb-W-N-2	► waterfalls just d/s of a small lake @ 6300' elevation	55:24	50.33.43	118.32.17
	11		- headwaters of the stream	56:17	50.32.03	118.32.29

NOTE: 1-5: 6-7: 8-11:

1:50,000 1:50,000 1:50,000

Map 82L/10 Map 82L/9 Map 82L/10

_					OTTICAL COLL		Onm								
Str	eam Name (gaz)) air	reek		flocati						Acci	ess		м	ethod
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	COVER: Total %		04-06	Ž.	Carges ige cobble (128	-256mm	8	32	- Su	D.	Dry	L	(M)	н	Floor
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機	COVER: Total %					器	Larges	ige conti	1128-256	imi	灐	10	哪	Stag	e	Dry	L	M	н	Flood
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湖流	Crown Closure %		Case	Aspect		96	Daglam	C	Compac	tion	L	и н	130	Water Temp (%	10,5	Turb.lcm1		Cond	125°C	
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聯	Discharge (m ³ /s)	4									Щ		IWid	in valley Chan	net,Stopet				iBed A	(Isineta)

FISH SUMMARY	STREAM/VALLEY CROSS-SECTION
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	COMMENTS
Channel Stability . Debris . Management Concerns	Obstructions . Riparian Zone , Valley Wall Processes . Etc.
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36 Table 1	
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(880)	Date Y M O

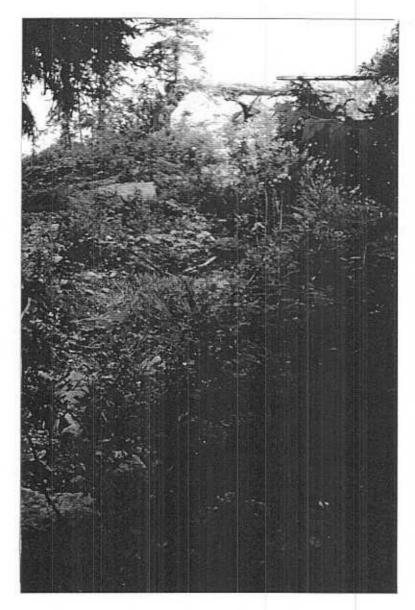


Photo 1. Exposed old road fill-slope with some gravels/boulders reaching the right bank of stream. Stream Name: Whip Creek Site #: 7 Reach #: 4 Coordinates: 50°34.86' 118°29.05' Code: Q•S•F•3

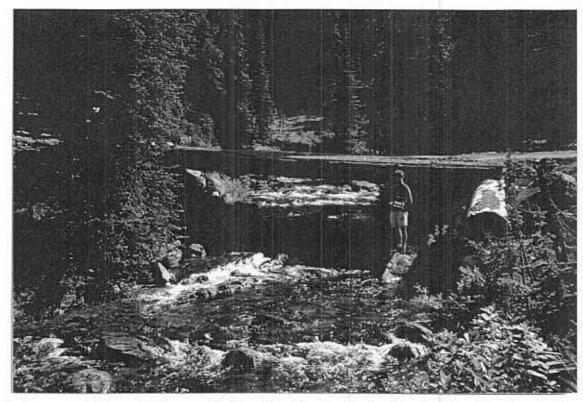


Photo 2. Steel-span (railway cars) bridge with rotting wood deck and erosion of road surface, u/s view.

Stream Name: Whip Creek Site #: 8 Reach #: 4

Coordinates: 50°39.95' 118°30.30' Code: Fs/Q•C•F•1

APPENDIX VII

Wap Creek Stream Information File

MID-SHUSWAP STREAM ASSESSMENT

	STREAM: DATE: TAPE:	WAP CRE October 11 WRP Tape	2, 1994 Keyren Level thoto	Nots 40 S	Le Gre Field III.	05/04/15
	LOCATION SYMBOL	CODE	COMMENTS	TIME	COORDINA North	TES West
	1		- mouth of the stream (north of Mabel Lake)	1:30:55	50.47.92*	118.37.04
	2		• fish (salmon?) spawning in the channel	1:32:37		118.36.04
	3	Q-F-F-2	· road visible on the right at the edge of the flood plain	1:33:52		118.35.22
12/11/	H¥ 4	Fb/Q-D-F-1	 LWD some pieces with saw-cuts & continues u/s for quite a distance 	1:34:34	50.44.69	118.35.00
	5	Q-S-F-3	 cutblock on the left (~20 years regen.) with a 15-20m buffer 	1:35:35		118.34.92
	6	Fb-D-N-3	- series of beaver dams along the channel on the right	1:36:05		118.34.84
	7		→ fish (salmon?) in the channel	1:36:52		118.34.43
	8	Fs/Q-S-N-3	 high eroding bank on the left with evidence of logging to the edge (gravel is of spawning size) 	1:38:11		118.34.20
	9		- confluence with Derry Creek	1:39:20		118.33.01
	10	Fb-D-N-3	 beaver dams in the side channel on the right 	1:39:48		118.34.03
	11	Q-S-F-3	 historic cutblock on the left 	1:40:27		118.34.43
	12	Q-S-F-3	 large cutblock on the right with a 30m buffer 	1:42:23		118.34.22
	13	Fb/Q-C-F-2	- bridge	1:43:05		118.34.01
	14	Fb-D-N-2	 large beaver dam across the channel; some broken areas 	1:43:19		118.33.89
	15	Q-S-F-2	 entire floodplain has been logged to the left of the channel & the right 	1:44:36		118.33.39
	16	Fb-D-N-3	► broken beaver dam	1:45:56		118.33.45
	17	Fs/Q-S-F-2	- recent cutblock on the left	1:46:08		118.33.57
	18	Fb/Q-C-F-2	► bridge & 500 KV powerline	1:46:25		118.33.80
	19	Fb/Q-D-U-2	➤ stumps/LWD in the channel	1:49:02		118.34.39
	20		- tributary on the left	1:49:47		118,33.99
	21	Q-S-F-3	 cutblock on the right with a 15m buffer 	1:49:47		118.33,99

STREAM: DATE: TAPE:

WAP CREEK

October 12, 1994

WRP Tape 3

	LOCATION SYMBOL	CODE	COMMENTS	TIME	COORDINA North	TES West
	22		 Wap Lake, road runs along the shore on the right 	1:50:46	50.47.92*	118.33.16
	23	Fs/Q-F-F-2	 logging road <5m from the channel on the right 	1:52:51		118.31.26
	24	Fb-D-N-2	- broken beaver dam	1:53:33		118.30.84
	25	Fb-D-N-2	- broken beaver dam	1:54:57	1:54:57	
	26	Fb/Q-C-F-2	- steel bridge with riprap	1:56:56		118.29.18
	27	Fs/Q-S-N-3	• exposed bank on the right	1:57:19		118.28.90
	28	Fb-W-U-2	- waterfall with a weir at the u/s end	1:57:29		118.28.81
	29	Fs/Q-S-F-2	 logging roads on both sides a recent cutblock on the left 	1:57:57		118.28.50
	30	Fb-C-U-2	adjustable weir	1:58:11		118.28.35
	31	Fb-C-U-2	 small dam with a holding pool/pond u/s 	1:58:37		118.27.95
	32		► 500 KV powerline	1:58:47		118.27.77
	33	Q-S-F-2	- cutblock on the left side	1:59:28		118.27.31
	34	Fs/Q-S-N-3	 exposed bank on the left contributing sediment to the stream 	1:59:44		118.27.11
12/11/24	¥ 35	Fs/Q-F-F-1	 cutblock on the right, road along the stream & evidence of erosion into the stream @ ~2600' elevation 	2:00:14	50° 52.75	118.26.80
July 10/95 DH/Mb	★ 36	F 6/Q-S-F-1 Fr/Fb/Q-5/0-F-1	Slide on the left entering the stream corresponds with the road on the left @ ~3100' elevation	2:00:57	50.52,500 1 N	118.26.37
JLY 10/95 DH/MH	* 37	Es/Q=D-F-1 Fs/Fb/Q-S/p-F-	► log jams/LWD with cut ends & sediment accumulating	2:01:26	50 52,295	118.25.899 / 118.26.05
	38	Q-F-F-2	 road on the left now ~10m from the channel tributary from Joss Pass 	2:02:24		118.25.46
	39	Fb/Q-C-F-2	► bridge	2:02:31		118.25.36
	40	Fs/Q-S-F-2	 roads on both sides, cutblock on the right side some portions with no buffer 	2:03:18		118.24.68
	41		 abandoned *Skidder* on the road 	2:03:34		118.24.42
	42		• video ran out	2:03:47		118.24.26

STREAM: DATE:

WAP CREEK

October 12, 1994

TAPE:

WRP Tape 3

LOCATION SYMBOL

CODE

COMMENTS

TIME

COORDINATES

Page 3

North

West

* didn't quite reach the headwaters

NOTE: 1-5: Map 82 L/10 6-24: Map 82 L/15 25-42: Map 82 L/16 1:50,000 1:50,000 1:50,000

OFO/MOEP FISH HABITAT INVENTORY AND INFORMATION PROGRAM STREAM INFORMATION SUMMARY

Watershed Code: 03-5400-240 Stream Name: WAP CREEK Page: 1

A. DESCRIPTION

Stream Mame: WAP CREEK

Local Name:

Watershed Code: 03-5400-240

D.F.O. Division: Ofstrict:

Subdistrict: Statistical Subarea: M.O.E. Region: Management Unit:

FRASER RIVER KANLOGPS 29K SALMON ARM

OKANAGAN

Tributaries	Code
I ROW CREEK	010
DEVIL CREEK DALE CREEK	020
CAVENAUGH CREEK	030
DERRY CREEK	040
BOWMAN CREEK	050
	060

Topographic (1:50k) Map: 82L/10 8.C.G.S. (1:20k) Map: U.T.M. Mouth: Lat./Long. Mouth: Mainstem Length: Watershed Area:

11.3862.56205 11.1862.36205 50 06. 44' 0'' 118 DG. 37' 0'' 47.7 km Ref. No.: 29J-61 Ref. No.:

Location: FLOWS SW INTO MABEL LAKE AT WORTH END, KAMLOOPS DISTRICT.

		Comments		3200		tion (ka ups	101 - 1117	
SARDIENT DISCUSSED. BELOW FALLS, LOW TO MODERATE 29K-40)	E. (REF	BELOW FALLS, LOW TO MODERATE.	GRADIENT DISCUSSED.	>10%	5 - 10%	2 - 5x	.5 - 21	51

8. DESTRUCTIONS TO MIGRATION

Barrier (Type)	Height (meters)	Location (km U/S)	[mpassable to (species)	Comments
F FALLS	3.0	29.3	CH CHI HOOK SALMON CO COHO SALMON SK SOCKEYE SALMON	TWO FALLS 3M. 21-30M (REF. 29K-2, REF. 29K-3, REF. 29K-40)

C. FLOW

Flow Control: Water Survey of Canada (WSC) Flow Gauge: M W.S.C. Station No. 1: No. 2: Comments: WAP LAKE IS LOCATED 22.5 KM UPSTREAM FROM THE MOUTH, WAP LAKE: AREA - 0.4 SQ.KM; PERIMETER - 3.4 KM. (REF. 29J-61,

D. DISTRIBUTION SUMMARY

Species	Watershed Distribution	
SK SOCKEYE SALMON	SPANNING IN LOWER 4 KM (REF. 29K-46)	
CO COHO SALHON	5 KM ABOVE AND SKM BELOW WAP LAKE. (REF. 29K-22)	
NOWING WOOMIND NO	PRESENCE MOTED (REF. 29K-46)	
CC SCULPINS (GENER		
DY DOLLY VARDEN	PRESENCE MOTED (REF. 29K-34, REF. 29K-40)	W
KD KDKANEE	LOWER SECTION (REF. 29K-40)	
MN ROCKY NIN WHITE		
RE RAINBOW FROUT	PRESENCE MOTEO (REF. 29K-34, REF. 29K-40)	

Watershed Code: 03-5400-240 Stream Make: WAAP CHEEK Page:

E. ESCAPEMENT SUMMARY

Species		Escapement		Maximum		Management	
	Mean	Period of Record	Ref. No.	Recorded Escapement	Ref. No.	Target Escapement	Ref. No
SK SOCKEYE SALMON	176	1978 - 1987	28A-18	1069	28A-18		202.4
CO COHO SALMON	218	1978 - 1987	28A-18	450	28A-18		

F. LIFE HISTORY TIMING

Species	Activity	Jan	Feb	Mar	Apr	Hay	Jun	Jul	Aug	Sep	Oct	Nov 1	5e
CO COHO SALMON	Migration Spawning Incubation Rearing											x ı	r

G. ENGANCEMENT/MANAGEMENT ACTIVITIES IN WATERSHED

Type of Activity	Species	Location (km U/S)	Comments	Perrod of Operation Start/Finish
PRIJAMPLING	RS RAINBOW TROUT		BIOPHYSICAL RECONNAISSANCE STUDY. KINGFISHER COMMUNITY CLUB AND NOE. (REF. 29J-55)	1989/1989

H. LAND USE/MATER USE/MATER QUALITY

Activity	Description/Location
FO FORESTRY	LOGGING AFTER EFFECTS INCLUDE LOG JAMS, DEBRIS ACCUMULATION, EROSION AND CHANNELIZATION. (RE 29K-22)
LD LIKEAR DEVELOPMENT	B.C. HYDRO POWER TRANSMISSION LINES. (REF. 29K-22)
DA DANS	SMALL HYDRO POWER DEVELOPMENT AT FROG FALLS. (REF. 29K-46)

I. FISH PRODUCTION POTENTIAL/CONSTRAINTS/GENERAL COMMENTS

ALTHOUGH HABITAT POTENTIAL IS NOT QUANTIFIED, IT APPEARS THIS STREAM OFFERS EXCELLENT OPPORTUNITY FOR COHO EXHANCEMENT. SYSTEM APPEARS TO BE IMPORTANT TO REGIONAL COHO AND SOCKEYE PRODUCTION. (REF. 29K-S3)

POTENTIAL PROJECTS FOR ENHANCEMENT: 1. INCUBATION/REARING FACILITY FOR COHO AND CHINOOK 2. CHINOOK EGG OR FRY PLANTS 3. FRY STOCKING BEHIND BEAVER DAMS 4. PEN REARING IN MAP LAKE 5. DEVELOPMENT OF A SENI-MATURAL SPANNING/REARING CHANNEL. (REF. 29K-3)

J. FISHERY OFFICER MARRATIVE

A COMPANY NEW WARRANCE AND A STREET OF THE S	
te Prepared: 1988/04/01	Prepared By: 8. KURTZ, OP. FRANKWORK

K. SIS COMPLETED BY

Completed by:	O. FARRELL	Oate: 1986/12/22	
Checked by:	LIDIA JAREHOVIC	Date: 1988/04/27	
Last updated by:	CATHY GEE	Date: 1990/09/19	
Last checked by:	L. JAREMOVIC	Date: 1990/09/19	

8	REFERENCING INFORMA	ation.							
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DFO/MOE STREAM SURVEY FORM

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DFO/MOE STREAM SURVEY FORM

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Photo 1. Streambank at Site #4 showing interbedded layers of sand and peat. Note charcoal layers indicating historic fire.



Photo 2. Wap Creek: Washed out bridge abutments at Site #4.



Photo 3. LWD scattered across channel at Wap Creek Site #4. Note eroding bank at right.



Photo 4 Hill slump originating at the road 20 m above the channel on the left bank.

Stream Name: Wap Creek Site #: 35 Reach #: 8

Coordinates: 50°52'78N 118°26'78W Code: Fs/Q+S+F+1

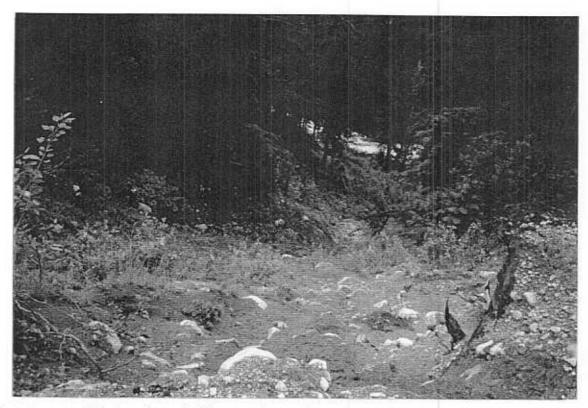


Photo 5

Slide from the road with some active erosion and some regeneration of vegetation.

Stream Name: Wap Creek

Site #: 36

Reach #: 8

Coordinates: 50°52.53' 118°26.26' Code: Fb/Fs/Q+D/S+F+1



Photo 6

Debris jam at the base of the slide with much of the debris being unstable, d/s view.

Stream Name: Wap Creek Coordinates:

50°52.53'

Site #: 36 118°26.26'

Reach #: 8

Code: Fb/Fs/Q·D/S·F·1

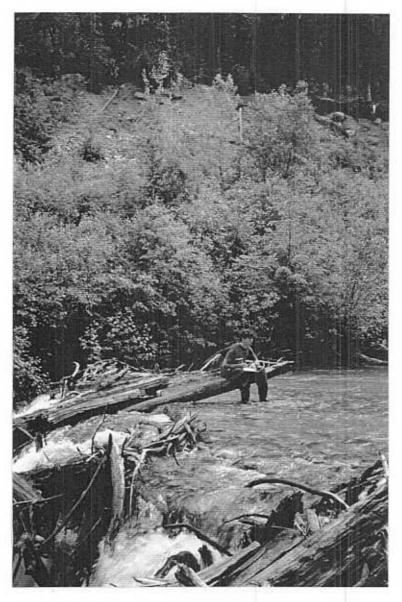


Photo 7 Debris jam (2 m high) with accumulation of sediment and channel widened to 20 m.

Stream Name: Wap Creek Site #: 37 Reach #: 8

Coordinates: 50°52.30' 118°25.90' Code: Fb/Fs/Q•D/S•F/N•1

APPENDIX VIII

Kingfisher Creek Stream Information File

							.1 7
			N	IID-SHUSWAP STREAM ASSESSM	ENT	Site #32	
	STREAM:	KINGFISH			S145000Ta	in Nov 14/0	14 however
	DATE:	October 1				no write-v	p in Inter
	TAPE:	WRP Tap				report and	I cm't
X-to	LOCATION SYMBOL	CODE		COMMENTS	TIME	find field	notes for
	1				1	- the site.	
			•	mouth of the stream	1:14:33	- DH	
Visited	2	Q-C-Hw-3	٠	bridge	114:33		
14/11/9	4	Eb/Q-D-U=1 F b/Q-D-N/F	-1	LWD on the right	1:15:59	50 37,15	118.44.29
	4	Fs/Q-S-N-3	٠	high eroding pank on the left	1:16:21	50.38.321	118.44.40
July 7/9 DM/MU	V	Eb/Q-D-U-1 N/A	•	trees across the channel & a small debris jam.	1:18:12	50.38.341	118.44.73
July 7/9 DH/M	4.	F <u>Ь/Q-D-</u> tJ-1 №/А	٠	large debris jam on the left	1:18:26	50.38.341	118.44.81
	7	Fs/Q-S-N-3	٠	small colluvial slide on the left	1:18:46		118.44.94
JULY 4/		Q-D-N/F-3 F b/Q-D-U-1	٠	large amount of debris covering the channel	1:19:58		118.45.02
July 4/95	₹9	_Eb/Q-C-U-1 ■ Q-c-F-3	٠	old concrete bridge abutment falling into the channel	1:20:57	50.39.368	118.45.08 118.45.21
	10	Fb-D-N-3	٠	side channel on the right controlled by a beaver dam	1:21:39		118.45.34
	11	Q-S-F-3	٠	cutblocks on both sides up on the terrace, not affecting the stream	1:22:01		118.45.25
ited	12	Tile a de i	٠	tributary on the left side (not <i>Hunter's Creek</i> as was mentioned on the video)	1:22:18	*	118.45.15
14/11/24	¥ 13	Fb/Q-D-V/F-1 Eb/ Q-D-U- 1	٠	large amount of LWD covering the entire channel	1:22:29	50 39.90	118.45.19
	14	Q-S-F-2	٠	old cutblocks on the terrace on the left	1:22:49		118.45.32
	 1 5	Fb/Q-D-U-1	٠	large debris jam	1:22:59		118.45.27
	16	Fs/Q-S-F-2	٠	recent cutblock on the left with a buffer of 5-10m	1:23:17		118.45.25
	17		*	starting up Hunter's Creek, incorrectly named as being Kingfisher at the confluence with Danforth Creek *actually still ~1km d/s from Danforth	1:26:02		118.45.08
	18		ħ	advanced video to point where Kingfisher is correctly named	1:35:55		118.45.22
	/ 19	Fb/Q-B-U-T Fb/Fs/Q-D-N/	, F-1	log jam	1:36:08	50.41.216	118.44.965 148.45.11
July 7/95 Dil/min	米 20	Eb/Q-D-U-1 Fb/Fs/Q-D-N	٠	LWD across the channel	1:36:58	50.41.216	148.44.87
		1 13/6-12-10/					1141114

STREAM: DATE: KINGFISHER CREEK October 13, 1994 WRP Tape 4

TAPE: WRP Tape 4

	LOCATION	CODE		COMMENTS	TIME	COORDINA North	TES West
	21			500 KV powerline, just d/s of confluence with Danforth	1:37:15	50:35:05*	118.44.83
-7 40	22	Q-D-U-2	ĸ	LWD across the channel, not a barrier to fish; some LWD has cut ends	1:37:42		118.44.97
4/11/64 vs/pg		Q-S-F-1	٠	large cutblock on the right; some areas with no buffer	1:38:44		118.45.26
14/11/1	4 ^{->} 24	Q-S-R-2	٠	dolomite operation on the right	1:39:05		
114	q4 x 25	Q=S-F-2- F-6/a-D-F-1	۶	old cutblocks on both sides with buffers ranging from 10-15 m	1:40:03	50° 42.62	118.45.42
7/5 PUCT 7/5: DH/HU	5 ∦ 26	Fb/B-D-U-1 Fb/Fs/a-D-F-1		very extensive LWD through this section of the stream	1:40:14	50.42,989	118.45.45
	27	Q-F-F-2	,	road on the left <5m from the channel	1:40:21		118.45.45
M 44	- ≯ 28	Fb/Q-D-U-T Fb/Fs/a-D-F-1	٠	large debris jam	1:40:51	50,43,472	118:45:42
July 7/	95 29	7.40-01	٠	tributary on the left	1:41:32		118.45.37
	30	Q-S-F-3	٠	cutblock on the left with ~5-10 years regen., up above the channel on the terrace	1:42:29		118.44.75
لدبيها	31	Q-S-F-3		cutblock on the right ~30m buffer	1:43:46	50 -4	118.44.16
14(11)	¹⁹⁴ ¥ 32	Fs/Q-F-F-1	٠	sand slumping from the road adjacent to the stream, not apparent if it impacted the stream	1:44:20	50 =4 1=	118.44.10
	33	Q-S-F-2	٠	cutblock on the left ~5 years old	1:45:23		118.44.50
	34	Fs/Q-S-N-3	٠	historic eroding bank on the left @ ~3500' elevation	1:46:34		118.44.89
	35	Q-S-F-2		recent cutblock on the left @ ~4000' elevation	1:48:10		118.45.49
	36		٠	tributary on the left climbing steeply up a valley	1:49:24		118.45.63
	37			4900' elevation	1:50:14		118.45.40
	38	Fb/Q-D-U-2	٠	small lake at the base of an avalanche track on the right, blocked by LWD at the outlet	1:51:12		118.45.37
	39	Fb-S-N-2		large slide on the right has moved the channel to the left	1:52:23		118.45.59
	40	Fb-W-N-3	*	series of waterfalls over bedrock	1:52:36		118.45.48

STREAM: DATE:

KINGFISHER CREEK October 13, 1994

TAPE:

WRP Tape 4

LOCATION SYMBOL

CODE

COMMENTS

TIME

COORDINATES North West

Page 3

41

- headwaters on the plateau @ ~5700' elevation

1:53:17

118.45.08

NOTE: 1-32:

1-32: Map 82 L/10 33-41: Map 82 L/15

1:50,000 1:50,000

^{*} GPS Coordinate for Latitude stuck

DFO/MOEP FISH HABITAT INVENTORY AND INFORMATION PROGRAM STREAM INFORMATION SUMMARY

Watershed Code: 03-5400-210 Stream Mame: KINGFISHER CREEK Page: 1

A. DESCRIPTION

Stream Hame; KINGFISHER CREEK

Local Name:

Watershed Code: 03-5400-210

D.F.O. Division: District:

Subdistrict: Statistical Subarea: M.O.E. Region: Management Unit:

FRASER RIVER KAMLOGPS 29K SALMON ARM

8 OKANAGAN 25

	Tributaries		
HUNTERS CREEK		Code	Topographic (
DANFORTH CREEK		020	B.C.G.S. (1:2 U.T.M. Mouth:

(1:50k) Map: 82L/10 20k) Map:

11.3768.56080

Lat./Long. Mouth: Mainstem Length: Watershed Area:

11.3768.56080 50 DG. 37' 0'' 118 DG. 45' 0'' 28.3 km Ref. No.: 29J-61 Ref. No.:

Location: FLOWS S INTO LOWER SHUSWAP RIVER APPROXIMATELY 1.400 DOWNSTREAM OF MABLE LAKE, KAMLOOPS DISTRICT

* **		and the second	stream from m	ucnj	Comments
) - ,5 x	.5 - 2 x	2 - 5x	5 - 101	>10%	GRADIENT DISCUSSED. LOWER REACHES MODERATE TO RELATIVEL STEEP: UPPER MIDDLE SECTION IS FLAT; UPPER REACHES STEEP (REF. 29K-46)

8. OBSTRUCTIONS TO MIGRATION

Barrier (Type)	Height (meters)	Location (km U/S)	Impassable to (species)	
NO INFORMAT	ION AVAILABLE			Comments

C. FLOW

low Control: N I.S.C. Station No. 1:	Water Survey of Canada (WSC) Flow Gauge: N	
	No. 2: Ko. 3:	No. 4:
IKFORMATION AVAILABLE		(1) Exercise

D. DISTRIBUTION SUMMARY

Species	Watershed Distribution	
CO COHO SALMON	SPAWN FROM 8 DN - 13 DM. (REF. 29K-46)	
R8 RAINBOW TROUT	LARSE MIGRATORY RAINBOW HAVE BEEN SEEN SPANNING (REF. 29K-35)	

E. ESCAPENENT SUMMARY

Species		Escapement		Maximum		Management	/
	Mean	Period of Record	Ref. No.	Recorded Escapement	Ref. No.	Farget Escapement	Ref. No.
CO COHO SYLMON	54	1978 - 1987	204 10			a semperative	ner. No.
10000	19201	130/	81-A85	120	28A-18		

F. LIFE HISTORY TINING

Species	Activity	Jan	Feb	Mar	Apr	May	Jun	Ju l	Aug	Sep	Oct	Nav	-
NO INFORMATION AVAILABLE							000	200	0.52	345	000	MOV	Dec

Watershed Code: 03-5400-210 Stream Name: KINGFISHER CREEK Page: 2

G. EMPANCEMENT MANAGEMENT ACTIVITIES IN WATERSHED

Type of Activity	Species	location (km U/S)	Comments	Period of Operation
CO COLONIZATION	CO COHO SALHON			Start/Finish
			EGGS TO KINGFISHER HATCHERY ON LOWER SHUSWAP RIVER AND DUTPLANTED BACK TO KINGFISHER, EGG TARGET 20,000. (PIP PROJECT). (REF. 29K-46)	1982/
CF COUNTING FENCE	CO COHO SALHON	0.2		
	RB RAINBOW TROUT	700	KINGFISHER COMMUNITY CLUB. (REF. 29K-55)	1984/1985

H. LAND USE/WATER USE/WATER QUALITY

Activity	Description/Location	
O FORESTRY	EXTENSIVE LOGGING IN UPPER WATERSHED. (REF. 29K-46)	
1000000	THE OFFER WATERSHED. (REF. 29K-46)	

I. FISH PRODUCTION POTENTIAL/CONSTRAINTS/GENERAL COMMENTS

AVERAGE COHO FRY DEMSITY-0.44/METRE SQUARED; RAINBOW-0.27/METRE SQUARED; STREAM COULD BE CAPABLE OF SUPPORTING CONSIDERABLY HIGHER FISH DEMSITIES. RAINBOW THE MOST APPROPRIATE SPECIES TO ENHANCE SOME LEVEL OF COHO ALSO. VIOLENT FLOODING IS LIMITING FACTOR. (REF. 29K-35)

J. FISHERY OFFICER MARRATIVE

Date Prepared: 1988/04/01 Prepared By: B. KURTZ, OP. FRAMEWORK

K. SIS COMPLETED BY

Completed by: Checked by: Last updated by: Last checked by:		Date: 1985/12/17 Date: 1988/04/27 Date: 1990/09/19 Date: 1990/09/19	
--	--	--	--

DFO/MOEP FISH HABITAT INVENTORY AND INFORMATION PROGRAM STREAM INFORMATION SUMMARY

Watershed Code: 03-5400-000-000-000-000-99L Stream Name: SHUSWAP RIYER

Page: 1

A. DESCRIPTION

Stream Mame: SHUSWAP RIVER

Local Mame:

LOWER SHUSWAP RIVER

Watershed Code: 03-5400-000-000-000-000-991

D.F.O. Division: District:

Subdistrict: Statistical Subarea: M.O.E. Region:

FRASER RIVER KANLOOPS 29K SALMON ARM

B OKAMAGAN 25

		Management Unit:	B OKAMAGAN 25
Tributaries	Code	Topographic (1:50k) Map:	82L/11
		U.I.M. Mouth: Lat./Long. Mouth:	11.3556.56208 50 OG. 43' 0'' 119 DG. 3' 0'' 88.6 km Ref. No.: 29J-61 Ref. Ko.:
			L LAKE INTO THE SOUTH END OF MARA SISS TRIBUTARIES TO MARA L AND ERSHED CODES FROM DID TO 210. 00, FOR LISTING).

Sient Class/Location (km upstream from mouth)	Connents
- 10x >10x	
MTION AVAILABLE	
TOW AVAILABLE	

B. OBSTRUCTIONS TO MIGRATION

Barrier (Type)	Height (meters)	(km U/S)	impassable to (species)	
NE NO BARRIER		200	40 (species)	Comments
				ACCESS TO MABEL LAKE. (REF. 29K-46)

C. FLOW

Flow Control: W.S.C. Station No. 1: DBLCDOZ

Water Survey of Canada (WSC) Flow Gauge: Y No. 2: No. 3:

No. 4:

Conments: LAKE FED. MABEL LAKE: 88.6 DM UPSTREAM: AREA - 59.1 SQ.RM; PERIMETER - 77.8 DM. (REF. 29J-61)

VANDELS NOTTUBLISTEID . 0

Species	
CK CACADIN	Watershed Distribution
SK SOCKEYE SALMON	ASHTON CREEK TO MABEL LAKE; HEAVIEST JUST BELOW HUPEL (REF. 29K-2, REF. 29K-30)
CD CDHD SALWOW	THE PROPERTY OF THE PROPERTY O
CO COHO SALMON	SAME AS SOCKEYE (REF. 29K-2, REF. 29K-30)
De Dive com	(ALT. 23x-2, REF. 29K-30)
PK PINK SALMON	PRESENCE MOTED (REF. 29K-1)
CH CULTINOS ST.	
CH CHINODE SAUNON	JUYENILE REARING DISTRIBUTION SIMILAR TO ADULT SPANNING DISTRIBUTION; FLOODED PASTURES, BACKWATER
	AND SLOUGHS ADJACENT TO SPANNING AREAS ARE THE PREFERRED REARING HABITAIS. (REF. 29K-26)
Of Ottoor same	
MONTRS YDON IND HD	SAME AS SOCKEYE (REF. 29K-2, REF. 29K-30)
DV DOLLY VARDER	(- 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -
DV DOLLY VARDEN	
	PRESENCE THROUGHOUT (REF. 29K-53)
III III IIII III III III III III III I	PRESENCE THROUGHOUT (REF. 29K-53)
III III III III III III III III III II	PRESENCE THROUGHOUT (REF. 29K-53) SAME AS SUCKEYE (REF. 29K-30)
	PRESENCE THROUGHOUT (REF. 29K-53) SAME AS SUCKEYE (REF. 29K-30)
TI LAKE IROUT	PRESENCE THROUGHOUT (REF. 29K-S3) SAME AS SOCKEYE (REF. 29K-S0) PRESENCE THROUGHOUT (REF. 29K-S3)
III III III III III III III III III II	PRESENCE THROUGHOUT (REF. 29K-53) SAME AS SUCKEYE (REF. 29K-30) PRESENCE THROUGHOUT (REF. 29K-53)

Watershed Code: 03-5400-000-000-000-000-991 Stream Wame: SHUSWAP REVER

E. ESCAPENENT SUMMARY

Species		Escapement	54	Maxinum		40	_
	Xean	Period of Record	Ref. No.	Recorded	200	Management Target	
SK SOCKEYE SALMON	133997	1978 - 1987		Escapement	Ref. No.	Escapement	Ref. No
CO COHO SALMON		1310 - 1387	28A-18	600495	Z8A-18		
	310	1978 - 1987	28A-18	350	244 44	The Residence	
PK PINK SALMON	5	1979 - 1987	204.44	130	28A-18		
CH CHEMOOK SALMON	84	137.5 - 1307	28A-18	13	28A-18		
CELES SALVES AND PRIVATE	7892	1978 - 1987	28A-18	12000	201.10		
.onments: SOCKEYE DOM	MAKT CYCLE	1978, 1982, 1985 (RE		*******	28A-18		

F. LIFE HISTORY TIMING

Species	Activity	Jan	Feb	Mar	Apr			-	_				
K SOCKEYE SALMON	Migration		977	114	Apr	May	Jun	Je t	Aug	Sep	Oct	Nov	Dec
	Spawning Incubation Rearing									x	r r	1	
D COHO SALMON	Migration		-							M)			
	Spawning Incubation Rearing										I	r r	
H CHIMOOK SALMON	Higration	-											
	Spawning Incubation Rearing							II	11	rr	11	x	

EMERGENCE OF CHINOOK FRY MID APRIL TO EARLY MAY (REF. 29K-26)

G. ENHANCEMENT/MANAGEMENT ACTIVITIES IN WATERSHED

Type of Activity	Species	Location	Comments	
		(km U/S)	Comments	Period of Operation
EZ ETZH ZYNDLING	SK SOCKEYE SALMON		Dispersor	Start/Finish
FS FISH SAMPLING	ZK SOCKEYE SALMON		DOWNSTREAM FRY TRAPPING. (REF. 291-100)	1987/1987
MR MARK RECOVERY	(7)		DOWSTREAM FRY TRAPPING. (REF. 291-100)	1979/1979
	CH CHINOOK SALMON	0.0	72,000 DOWNSTREAM CHIMOOK FRY CODED WIRE TAGGED AND RELEASED -PART OF A FEASIBILITY STUDY FOR ENHANCEMENT POSSIBILITIES (REF. 29K-22)	1979/1981
FP MULTIPLE STRATEGY	CH CHINOOK SALMON	0.0	EGG TAKES AND OUTPLANTING FROM SHUSWAP RIVER HATCHERY (REF. 29K-20, REF. 29K-46)	1984/
NR MARK RECOVERY	CH CHI HOOK SALHOX	0.0	PETERSON DISC. SHUSWAP FALLS HATCHERY CREW. (REF. 29K-55)	1989/
MR MARK RECOVERY	OH CHIMOOK SALMON	0.0	CDOED WIRE TAG RECOVERY: SPANNING ESCAPENENT ESTIMATES: AGE, LENGTH AND SEX COMPOSITION. (REF. 29K-65, REF. 29K-66)	1983/1985
HY HATCHERY	CH CHI NOOK SALMOK	79.6	O.SIN DOWNSTREAM OF COOKE CREEK. KINGFISHER HAICHERY (KINGFISHER COMMUNITY CLUB), EGG TARGET LSO,000. RELOCATED TO CONFLUENCE OF COOKE C. (1989). (REF. 29K-55)	1981/

DFO/MOEP FISH HABITAT INVENTORY AND INFORMATION PROGRAM STREAM INFORMATION SUMMARY

Watershed Code: 03-5400-000-000-000-000-991 Stream Name: SHUSWAP RIVER

3

H. LAND USE/WATER USE/WATER QUALITY

O

Activity	
ec tentes -	Description/Location
AG AGRICULTURE	ALFALFA CULTIVATION, DAIRY FARMING, AND HAY PRODUCTION THROUGHOUT (REF. 29K-22)
TRAMPOLAYAD REARLY CO	CPR. HIGHMAY 974 FOLLOW THE REMOVE THE REMOVE THE RESIDENCE (REF. 29K-22)
MQ WATER QUALITY	CPR, HIGHMAY 97A FOLLOW THE RIVER FROM EXDERBY TO MARA LAKE (REF. 29K-22)
The State of the S	CITY OF ENDERBY DISCHARGES CHLORINATED SEWAGE INTO THE RIVER (REF. 29K-22)
LO LINEAR DEVELOPMENT	REVELSTOKE TRANSMISSION LINE FOLLOWS AND CROSSES RIVER EAST FROM ENDERBY. (REF. 29K-46)
	CREE PULLUES AND CROSSES RIVER EAST FROM ENDERBY. (REF. 29K-46)

1. FISH PRODUCTION POTENTIAL/CONSTRAINTS/GENERAL COMMENTS

FEASIBILITY OF A PROPOSED HATCHERY SLIE FOR CHLHOOK AND COHO IMMEDIATELTY DOWNSTREAM OF MABEL LAKE HAS BEEN EXAMINED AND

REARING SURVEYS INDICATED THAT COHO SALMON SMOLTS WERE MORE ABUNDANT THAN IN MIDDLE SHUSWAP RIVER. (REF. 29K-28) WATER QUALITY DISCUSSED (REF. 29K-27)

J. FISHERY OFFICER MARRATIVE

Oate Prepared: 1988/04/01

Prepared By: B. KURTZ, OP. FRANEWORK

K. SIS COMPLETED BY

Completed by: GEORGE FARRELL Checked by: Last updated by: Last checked by: LIDIA JAREMOVIC L. JAREMOVIC L. JAREMOVIC

Oate: 1986/12/17 Oate: 1988/04/27 Date: 1990/09/26 Date: 1990/09/19

REFERENCING INFO	DRMATION									
Stream Name:		IPVE AND YOU		Aug*		7	-			
K. / N. G. F. / S. H.	E.R. C.R.	E.E.K.						77 74	94 = 38/5 V	E 8
1,2,8,-,8,3,				A.m./2					- 5.5	
Watershed Code cont	-01 10101.	2, 7, 40,0			1 1 1	1 1 1		21. 2	4 - 4	
SISS/RAB Code		-, , , ,	- 1 1 1				\ \ _			
SISS/RAB Code				Acces to the state of the						-1 1
Map No.	- 1	-116			-,,					
Confluence ID: 0,8,2	L.1.0	2 .0	ON	ConfluenceUTA		EASTING		NORTHING		
completed by:		Pagame				1111	للبا		L I I	(yyemenes
KOPEG C,		1111	1 1 1					0.0	. 75	711
STREAM INFORMAT									I I P	01/
VATER SURVEY OF CANADA ST Map No.	TATIONS ID	52	260000							
oc. Ref:	I P	WSC	tation No.							
	P	WSC			-					
	P	W S C			-					
	P	WSC		111						
VATER QUALITY	(3)49	All residents		1111	ال					
Map No.	ID IP	And the second s	tation No.	ti\.	Ref No.					
-1-1-1-1	1 1 1 1	w a s	111		, ,			17		
-1-1-1-1	1 1 1 1	was								
-1-1-1-1	1 1 1	WQS	111		, ,					
	1111	300	111							
NHANCEMENT AN	egement Objective 1:		Managemen	t Objective 2						
ENHANCEMENT AN	D MANAGEN Type Acouty		Managemen IVITIES	t Objective 2 Start Finish		(list all sc	ecies by cod	e)	Ref #	
NHANCEMENT AND NO. 15, 2, L, 1, D 7, 0, 1	D MANAGEN Type Activity 3, 4P F.S.	MENT ACT	Managemen	start Finish	P.R.	D.V.			Rel 8	1 1
ENHANCEMENT AN	D MANAGEN Type Actity 3, 4 P F.S. Cmt ON	MENT ACT Project JE DF 51	Managemen	start Finish	P.R.	D.V.	4 STUD			1 1
NHANCEMENT AND NO. 15, 2, L, 1, D 7, 0, 1	D MANAGEN Type Actify 3, 4P F.S., cmt ON	MENT ACT Project JE DF S1	Managemen TVITIES X FISH	Start Finish 8,4 8,4 SAM ALIN 6	R.B.	D.V.	4 STUD	′ ′	8,0,7,1,	1 1
NHANCEMENT AND NO. 15, 2, L, 1, D 7, 0, 1	D MANAGEN Type Actify 3, 4P F.S., cmt ON	MENT ACT Project JE DF S1	Managemen TVITIES X FISH	Start Finish 8,4 8,4 SAM ALIN 6	R.B.	D.V.	4 STUD	′ ′	8,0,7,1,	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
NHANCEMENT AND NO. 15, 2, L, 1, D 7, 0, 1	D MANAGEN Type Actify 3, 4P F.S., cmt ON	MENT ACT Project JE DE SI Sing Stuce Sfuhar	Managemen TVITIES X FISH	Start Finish 8,4 8,4 SAM ALIN 6	R.B.	D.V.	4 STUD	′ ′	8,0,7,1,	1 1
NHANCEMENT AND NO. 15, 2, L, 1, D 7, 0, 1	D MANAGEN Type Assity 3, 4P P.S., Cmt ON , WE, 14,5	MENT ACT Project JE DE SI Sing Stue Sfuhar	Wanagemen IVITIES X FISH :	Start Finish 8,4 8,4 SAM ALIN 6	R.B.	D.V.	4 STUD	′ ′	8,0,7,1,	1 1
NHANCEMENT AND NO. 15, 2, L, 1, D 7, 0, 1	D MANAGEN Type Asynty 3, 4P F.S., Cmt ON , WE 145	MENT ACT Project JE DE SI Sing Stue Sfuhar	Wanagemen IVITIES X FISH :	Start Finish 8,4 8,4 SAM ALIN 6	R.B.	D.V.	4 STUD	′ ′	8,0,7,1,	1 1
NHANCEMENT AND NO. 15, 2, L, 1, D 7, 0, 1	D MANAGEN Type Asynty 3, 4P F.S., Cmt ON , WE 145	MENT ACT Project JE DE SI Sing Stue Sfuhar	Wanagemen IVITIES X FISH :	Start Finish 8,4 8,4 SAM ALIN	R.B.	D.V.	4 STUD	′ ′	8,0,7,1,	1 1
NHANCEMENT AND NO. 15, 2, L, 1, D 7, 0, 1	D MANAGEN Type Actify 3, 4 P F.S., Cmt ON , W E 14,5 Cmt 149 Kin	MENT ACT Project JE DE SI Sing Stue Sfuhar	Wanagemen IVITIES X FISH :	Start Finish 8,4 8,4 SAM ALIN	R.B.	D.V.	4 STUD	′ ′	8,0,7,1,	1 1
NHANCEMENT AND NO. 15, 2, L, 1, D 7, 0, 1	D MANAGEN Type Actify 3, 4 P F.S., Cmt ON , W E 14,5 Cmt 149 Kin	MENT ACT Project JE DE SI Sing Stue Sfuhar	Wanagemen IVITIES X FISH :	Start Finish 8,4 8,4 SAM ALIN	R.B.	D.V.	4 STUD	′ ′	8,0,7,1,	
NHANCEMENT AND NO. 15, 2, L, 1, D 7, 0, 1	D MANAGEN Type Actify 3, 4 P F.S., Cmt ON , W E 14,5 Cmt 149 Kin	MENT ACT Project JE DE SI Sing Stue Sfuhar	Wanagemen IVITIES X FISH :	Start Finish 8,4 8,4 SAM ALIN	R.B.	D.V.	4 STUD	′ ′	8,0,7,1,	1 1
NHANCEMENT AND NO. 15, 2, L, 1, D 7, 0, 1	D MANAGEN Type Actify 3, 4P P.S. Cmt ON WE, 145 Cmt 1AG Kin	MENT ACT Project JE DE SI Sing Stue Sfuhar	Wanagemen IVITIES X FISH :	Start Finish 8,4 8,4 SAM ALIN	R.B.	D.V.	4 STUD	′ ′	8,0,7,1,	
NHANCEMENT AND NO. 15, 2, L, 1, D 7, 0, 1	D MANAGEN Type Actify 3, 4P P.S. Cmt ON WE, 145 Cmt 1AG Kin	MENT ACT Project JE DE SI Sing Stue Sfuhar	Wanagemen IVITIES X FISH :	Start Finish 8,4 8,4 SAM ALIN	R.B.	D.V.	4 STUD	′ ′	8,0,7,1,	1 1
NHANCEMENT AND NO. 15, 2, L, 1, D 7, 0, 1	D MANAGEN Type Assity 3, 4P P.S. Cmt ON WE, 145 Cmt 1AG Kin Cmt Cmt	MENT ACT Project JE DE SI Sing Stue Sfuhar	Wanagemen IVITIES X FISH :	Start Finish 8,4 8,4 SAM ALIN	R.B.	D.V.	4 STUD	′ ′	8,0,7,1,	
NHANCEMENT AND NO. 15, 2, L, 1, D 7, 0, 1	D MANAGEN Type Assuty 3, 4 P P.S., Cmt ON , W E. 14,5 Cmt 1AG Kin Cmt Cmt Cmt Cmt Cmt	MENT ACT Project JE DE SI Sing Stue Sfuhar	Wanagemen IVITIES X FISH :	Start Finish 8,4 8,4 SAM ALIN	R.B.	D.V.	4 STUD	′ ′	8,0,7,1,	
NHANCEMENT AND NO. 15, 2, L, 1, D 7, 0, 1	D MANAGEN Type Assity 3, 4P P.S. Cmt ON WE, 145 Cmt 1AG Kin Cmt Cmt	MENT ACT Project JE DE SI Sing Stue Sfuhar	Wanagemen IVITIES X FISH :	Start Finish 8,4 8,4 SAM ALIN	R.B.	D.V.	4 STUD	′ ′	8,0,7,1,	
NHANCEMENT AND NO. 15, 2, L, 1, D 7, 0, 1	D MANAGEN Type Assuty 3, 4 P P.S., Cmt ON , W E. 14,5 Cmt 1AG Kin Cmt Cmt Cmt Cmt Cmt	MENT ACT Project JE DE SI Sing Stue Sfuhar	Wanagemen IVITIES X FISH :	Start Finish 8,4 8,4 SAM ALIN	R.B.	D.V.	4 STUD	′ ′	8,0,7,1,	
NHANCEMENT AND NO. 15, 2, L, 1, D 7, 0, 1	D MANAGEN Type Assuty 3, 4 P P.S., Cmt ON , W E. 14,5 Cmt 1AG Kin Cmt Cmt Cmt Cmt Cmt	MENT ACT Project JE DE SI Sing Stue Sfuhar	Wanagemen IVITIES X FISH :	Start Finish 8,4 8,4 SAM ALIN 6	R.B.	D.V.	4 STUD	′ ′	8,0,7,1,	
NHANCEMENT AND NO. 15, 2, L, 1, D 7, 0, 1	D MANAGEN Type Asynty 3, 4 P F.S., Cmt ON , W E.H.S. Cmt IAG KIN Cmt Cmt Cmt Cmt Cmt	MENT ACT Project JE DE SI Sing Stue Sfuhar	Wanagemen IVITIES X FISH :	Start Finish 8,4 8,4 SAM ALIN 6	R.B.	D.V.	4 STUD	′ ′	8,0,7,1,	
NHANCEMENT AND NO. 15, 2, L, 1, D 7, 0, 1	D MANAGEN Type Asswity 3, 4P P.S., Cmt ON WE, 145 Cmt 1AG Kin Cmt Cmt Cmt Cmt Cmt Cmt Cmt Cmt	MENT ACT Project JE DE SI Sing Stue Sfuhar	Wanagemen IVITIES X FISH :	Start Finish 8,4 8,4 SAM ALIN 6	R.B.	D.V.	4 STUD	′ ′	8,0,7,1,	
NHANCEMENT AND NO. 15, 2, L, 1, D 7, 0, 1	D MANAGEN Type Asynty 3, 4 P F.S., Cmt ON , W E.H.S. Cmt IAG KIN Cmt Cmt Cmt Cmt Cmt	MENT ACT Project JE DE SI Sing Stue Sfuhar	Wanagemen IVITIES X FISH :	Start Finish 8,4 8,4 SAM ALIN 6	R.B.	D.V.	4 STUD	′ ′	8,0,7,1,	
NHANCEMENT AND NO. 15, 2, L, 1, D 7, 0, 1	D MANAGEN Type Asswity 3, 4P P.S., Cmt ON WE, 145 Cmt 1AG Kin Cmt Cmt Cmt Cmt Cmt Cmt Cmt Cmt	MENT ACT Project JE DE SI Sing Stue Sfuhar	Wanagemen IVITIES X FISH :	Start Finish 8,4 8,4 SAM ALIN 6	R.B.	D.V.	4 STUD	′ ′	8,0,7,1,	

DFO/MOE STREAM SURVEY FORM

	- 27	100	2.65		31	TEAM :	SURVEY	FOR	M :									
Stream Name (gaz.)	Ki	1	ishe			locall			-					Acces	. T		1.	200000
Watershed Code	1 1	75	1	1 1	111		1 200	1	1	11	Reach	199 Z	1			_	M	tethoo
ocation ALL B	8	1 5	+6	1	1		Мар#		1 1	-	A SECTION	0	_	engthu			-	
	-	1		1					-		Site No	17.71	-	thisury		50	06	F
TIONE DINY OIL	n 14 h	Time	U 00	Agency	Cit	MMG/	UT.M.	nu			F(sh Ca	- Contract	(N) (F	leld	H	ist.
C PARAMETER		VALL	-	METH.	1001	THE MONT	DHI	Photos			Air Pho	tos		_				
Ave.Chan.Width (m)	573-7		2	GE				SPECIF	IC DA	ATA				_		STRU	CTIO	INS
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Ave Max Riffle Dept	1000			GE										3	38			
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11.50 11.70	C422.60	290	3	9-			(EBIAL)	The second second	6	C.		BANKS	ä .					
N Pool Olo Riffie Go		000		GE	認知首次	clay, sit, s	and IC2mm	15		端 H	sight(m)	/ %Un	stable	10	34			
	o ko∐y		Service Control	GE	Grav	small (2-	16mmi	-6	45	Te	xture	F(6	L) R	9			
Debris Area% 50	0.00		15D	GE		large IT 6	(GAmm)	K	60	-	Con	finement	EN	(co	FC .	OC	UC	N/A
Stable %		90)	GE		sm.cobbl	• 064-128mm			w.	alley: Ch	annel Rati		-2 (2-	5)	-	200	N/A
COVER: Total %		30)	115	C re	es ige coops	e i128-256m			71277 Com	-	00.00	_	ry L	8	M	-	Flood
Comp. Dp Pool L.O.D.	Boulder	in Veg 0	Over Veg	Cutbenk		boulder ()	255mm)	1	윘			ns Hilm		-	aided	-	1	-
01 00 4001	10		40	20	BE BABY	55 A) B	CONTRACT	R 10	7/48	100	ers 1%1	-	-	н	41060		1	2
Crown Closure %	30	C SA	spect	-	D ₉₀ (c	Company of the last	Сопрас	tion I	DH	1700	aler femp	W 11	Turb.	-	-<	Ofb		5
2		1	DISCH	HARGE	Section 20	1 19	- Series	100	2.1	Real "	are samp	17.1		- <		Cona.tz	2.0)	
Parameter	Value	Me	thod		S	pecific Data		-	-			HE/		SYMB(sh)	OL			
Wetted Width (m)						Mary Mary			-									
Mean Depth (m)							-		-		-		-		_		====	
Mean Velocity im/sl								_										
Discharge (m³/s)									-	DALLEY A	dada Ca							
				_	_					esignit.	valley Chi	ennet, Stope		HEVIS			ed Ma	denati

DFO/MOE STREAM SURVEY FORM

Stream Name (gaz.)	اعدا	Jish	1	(1001		flo	call							Ac	:055		-	Method
Watershed Code	17		1.1	Li	1	1.1	Lini	101	1767	1		Reach &	101 R.	Leno	thikmi		-	
Location beton oile	#8 -	*	de	4				Маря				Gite No.				250	2	GE
							3 7	U.T.M.		_	-	Fish Ca		N	1988	Field		Hist.
DALOYMOPKOA	OA T	me 13	30	Agency		Crew	MAN	1/	Photos		-	Air Phot	17744		PER	. 1010		1104-1
C PARAMETER		VALU	E	METH.		1/4		1	SPECIF	IC I	ATA				Τo	BSTR	UCTIO	ONS
Ave.Chan.Width (m)	1887	12		GE								-			C	Ht(m)	Туре	1
Ave.Wet,Width (m)	10 m	10)	1							7				囊		100	1
Ave.Max.Riffle Depth	(cm)	20	0								-				100		-	
Ave.Max.Pool Depth	(cm)	13		4											120		-	-
Gradient %	五型	6		CL	O.	1 SEAR	ED MATE	RIAL T	77	%	C		BANKS		500			1
C(*Pool O Rittle 4	Run	Oothe	40		***		cfay, sill, san		5	1	193999	Height(m)	-2 suns	Table 1	150			-
	7-10 1 10			5. A.	100	1000	1m40 12-14	mmi	-		1770,500	Texture	F G	L R	1106			
	0-5 P 5	The state of the s	-		觀	Gravels	targe 11 6 - 6	4mm!	25	1	1856	and complete the	inement	EN C	O FFO) 00	UC	N/A
Stable %	T	90			1	100 Pm	sm.cobble	64-128mr			300	Valley: Ch		22.00	2-5	-	10 •	NIA
COVER: Total %		20			震	Larges	tge cobble	128-2564	mi Ca		100		age 4%	Dry		(W)	н	Flood
Comp. Do Poor L.O.D.	Boulder		her Veg	Cuttens	1	137	boulder (>2	56mm1	50	-	No.	Flood Sig		17	Braic	-		N)
100% JO 10	10	7	40	20		Bedroo	k (R)		20		TE	Bars (%)	5	pH	/	200	¿ppm)	1
The state of the s	1D	CIM A		5		Daglem	4 1 1 1	Compan				Water Temp.	eral .	Turblemi	5	-	125°C	-
	-	1	-	IARGE	(SISPA	- 90	1-26				1000	Service Section		CH SY	100	0.000	7.7	1-
Parameter	Value	*	hod			Soe	ofic Data	9.70					HEA	(Fish)	MOOL			
Wetted Width (m)		-																
Mean Depth (m)										-	1						_	
Mean Velocity im/s/		1								_	1							
Discharge (m3/s)											Wid	in Valley Cha	Ime: Stone				rided 4	Materiali

		FISH S	UMMARY	200	4.	STREAM/VALLE	EY CROSS-SE	ECTION
S Spec	es No.	Size Range((mm) Life Phas	e Use Method/Ref	13	PLANIMETRIC		
-	\perp				3			
+	-		-		COMMENT	rs		
Char	inel Stat	bility . De	bris Mana	gement Concerns	Obstructions []	Riparian Zone .	Valley Wall Proc	cesses . Etc.
10	- mo	derate ch be arse s	tter : thereis	abition in the n Reads n, poor cove	nis abach			
i i								Edited by
								Date Y M D
			3				()	

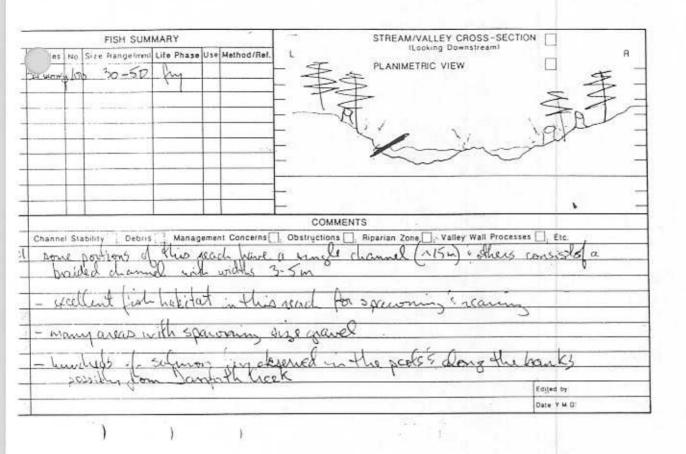
			FISH SUM	MARY	E CALL	34		STREAM/VAL			N T	-
And harmony has been dealers and the second	Species LC mc.	7	Size Range(mm)	Life Phase	Use Mathod/Re		7	PLANIMETRIC	ng Downstrea			
-		40	odity Debis	c chan	nel con	S Obstruct						
	- te		ente fi fy (.4			- Harris Contract Con		colíale	-, the	bank	Edited by	
									1		1	

DFO/MOE STREAM SURVEY FORM

				SIR	EAM SURVEY	FORM							
Stream Name (gaz.)	Kincli	shon (Your	1000	call	, 0,,,,,				Acc	ess	Pr-	Level
Vatershed Code	13		11.	. 1	1 1			1722,090	POPE -	_		1845	Method
ocation ALE = C	1			1111	1 1 1 1	1 1	1.1	Reach	2001/201 C	Leng	thtkml		1-2-
1 8140			_		Маря	8		Site		Lthsi	rv(m)	1000	GE
ALO YMD ON O P	lost le	1 . 5.45	No.	True per	UTM			FILE	ord Y	(N)	C	Field [Hist.
		ime (24)	Agency	Crew	MGIJA	Photos	E	Air Pho	itos			-	
- THE STATE OF L		VALUE	METH.	100000		SPECIFIC	DATA	4	-		Los	STRUCT	TIONIC
Ave.Chan.Width.(m	NULL TO THE REAL PROPERTY.	18	GE								40000000	A STATE OF THE STA	
Ave.Wet.Width (m)	100	15	GE							_	-	Ht(m) Typ	be Locin
Ave Max Riffle Dep	th (cm)	20	GE				-				50	_	
Ave Max Pool Dept	h (cm)	(80	GE								500		
Gradient %	1	5	101	EAST AND AND	L'ambant de la la	Cont	1	,			500		
1.11	O Run 3	1 2 1	12-		ED MATERIAL	34	C		BANKS				1
1 12 12	0 -	Other	GE	Fines	clay, sill, sand 102mm	LI A A	1	Heightimi	/ %Unst	table /O	新 司		
		-40 726 7			small (2-16mm)	基础 :	vo si	Texture	F (G	A H	1937		_
		-15 215		S ASSET	large (I.S64mm)	1923	た製	_	tinement	1	(FC	20c u	K N/A
Stable %		90	V	12 (26)	sm.cobble 164 - 1 28m/		7	-	anne Ratio		-		-
COVER: Total %		20		1990 9222	ige.cobble (128-2564		小圖	1 4 4 4			2-5(5-10 10	
Comp. Do Poor L.O.C	Bouce	THE RESERVE OF THE PARTY OF THE	Cutteria	美国 公司	WATER CONTROL TO SERVICE		似题		的过程	Dry	L	(M) H	Flood
100% 10 1C	100000			COLUMN PROPERTY.	boulder (>256mm)		17090	Flood Sig	ns Ht(m)	/	Braide	d Y	(N)
170170	110	50	20	Bedroc	(在) () () () () ()		震	Bars (%)	10	pH	/	Odppm	11
Crown Closure %	10	Call Aspect		D _{go} (cm)	Compac	tion L(M	川田	Water Temp	(tc)	Turb.lcmi	/	Cong.tzs*(
	-	DISC	HARGE	- 7/2	77 77				REA	CH SYN	(BOI	100000000000000000000000000000000000000	21 62
Parameter	Value	Method		Spec	ofic Data				1150	(Fish)	IDUL		
Wetted Width (m)							-						
Mean Dopthimi					31		-	-					2
Mean Velocity im/s	1						-						
Discharge (m3/s)													
							100.0	oth Valley Ch	annal, Slopel	-		iBed IEC 87	Malenati

DFO/MOE STREAM SURVEY FORM

_		->/	ister	Cicc	(local)						Acces	\$5		M	etho
_	tershed Code	1	111	11	HILLI	Lil	1.1	1 101	Reach No.	RY	Length	lkm)			
Loc	cation Me = 19 4	20				Mapr			Site Note:	13-1-	Lihsury	(m)	Str	5 6	GE.
_	- F Z1					U T.M.	HI EST		Fish Card	Y	N S				ist.
-	ONDAROHDE	Time	1030	Αροίον	の意識を)H/	Photos		Air Photos		- 19	SSG!	-	-	- seq_
С	PARAMETER	V.	ALUE	METH.			SPECIF	C DATA				0	BSTRU	CTIO	NS
3	Ave.Chan.Width (m)		15	GE							3	C)	Ht(m)	_	_
4	Avs.Wet.Width (m)		10	1							- 1			190	1001
1	Ave.Max.Riffle Depth for	nt	10											\rightarrow	_
	Ave.Max.Pool Depth (cm	12	00-200	77											-
	Gradient %		3	CL	G BED MAT	FRIAL SE	SE 5	l C	DA	NKS				-	
	*Pool 2 C Althe 6 O Ru	10	Other	GE	Finos clay sin, sa		5	1550	THE RESERVE OF THE PARTY OF THE	000370					
T,	Side Chan,% 300 0 0-10		100×40	211	and the second small (2-1	and passing a	1	40		%Unstat			-		_
	AreaN Colles				Gravels		-		-			0095		_	
	Stable %	1	70	7	Gerari Unit	1E4 - 1 28 mm	(3)	bo	Continen	-	EN CO	FC	-) uc	N/A
	COVER: Total %		40	V	Larges (pe cobble	OTA CILLOS CONTINUES	583	200	Valley: Channe		1000	-5((5-10)		N/A
	Comp. Op Pcui L.O.D. Box		Veg Over Veg	Cuthank	(250 ct 1)	7-12-23	-122	30	7.5.36.00 HE HOLD IN CO. L. C.		Dry	1	(M)	н	Floor
	100% 20 30	- 17	-		Doulder ():	Castan	5.4	-	Flood Signs	Ht(m)	-/ B	Iraid	ed C	F) N	43
-		1/0	Acres Avenue	80	Bedrock (R)	12	-		Bars (%)	40	pH	_	10/	(mqq	-
	Crown Clasure % 2.C	1 13	Aspect	5W	D _{so} lom) C	Compatt	on L(N	リトに発	Water Temp.(*C)	13	urb.icm/	_	-Cand.ta	25°C)	1
	Parameter V		The second second	HARGE							H SYMB	OL			
٥	Watted Width Imi	tive	Method	_	Specific Data						(Fish)				
-		-													
	Mean Depth(m)														
	Mean Velocity (m/s)	_ [
	Discharge (m3/s)							(W+d	th Valle - Channel	Stopel			17	Bed Ma	elmerk!



		FISH SUM	A STATE OF THE PARTY OF THE PAR	A SALO	STREAM/VALLEY CROSS-SECTION [
Species	No. 51	ze Rangelmmi	Life Phase	Use Method/Ref.	L B
Salmon	0	35 mm	Day	US 605	PLANIMETRIC VIEW ☐
			11		- Da 34
	-				$ \langle \alpha P_1 \rangle$
	-				
-	-		_		
					- 4
					74.0
	_				COMMENTS
F2575-11-0	2000				
Channel	Stabi				
- 7	2110	Juy DER	of alone	the left	Dank it sike 1 (2 55 mm)
-0,00	1 %	ol-labil	at in the	is readi	
-		mood	100 100 100		VEa
N	- 70.00	1114	1.49	- VI (1 1 2) II	* 12 - 1 - 1
- Mix	via	en from	Ante I	16 2 20 10	re wach beindary
	V	1-1 0 6			(1.1.ta
- WI	178°	7 128721	am i b	moun che	mel at uk 29
	-02000	1	- 11	110000000000000000000000000000000000000	Α
**	hand	ausas	and a	adwining	one gravel
				, ,)	8 9
1-00	0.4	in la	mer to	Jyon uniq	" if dollar isollects at the later of

	4	(1		O/MOE	FORM	(((1100		-
i	am Name (gaz.)	1	Calas	(110)	/		, 0,,,,,				Acc	ess	191	11 1	Metho
'n	lefshed Code	1	1	This	11111	11.1	1.1	1	Boachin	图 R <	Lenn	thiskmi	uen , a	4	-
CONTRACTOR OF THE PERSON NAMED IN	dies Met 28					Man			Elle No		100000	ity(m)	150	0 /	GF
	- F- G-	-				U.T.M.		+	in Scale	44	(N)	Levis	Field	Jen C	
	190950A	PR	間0730	10,00	医		Photos	-	Air Photo	967	(1)	360%	Linial	150	nor-1
C4	PARAMETER	1100	VALUE	METH.	BESHER II E	1/3/17/	SPECIFI	C DA	5.00 (100)390	**		Tron	STRU	ICTIC	MIC
ā	Ave Chan Width In 19		16	GE			SPECIFI	U DA	14	_		100000	-	-	WHITE SHAPE
į,	Ave Wet Width (m)	-	10	SIL.				-				ME33	Ht(m)	type	Loc
	Ave.Max.Rittle Depth	mark 200		-			_	-				639		_	
		_	10	+				_				100	_		-
相	Ave.Max.Pool Depth (75-100	CI	and the same of th	No.	20460	- 12				聯		1.0	_
8	Gradient & Des	29460	13	u_	Company of the Compan	MATERIAL	AC /51 S	- 1	5.65	BANKS		86			
3	10000000000000000000000000000000000000	學的	0000	(JE	Finely day.	sift, sand IC2mm	BR-453	2000	Hoight(m)	-2 %Unst	able / (響			
2	Side Chan X Y O 0 Do			1	100.4	(12-15mm)	陰	608	Texture (FG	LR	800	-571		
	Debris Neax 20000	家口類	10 DE 12		4100	(16-64mm)	60	4	Confi	nement	EN C	O FC	(oc) uc	N/
8	Stable %	700	70	Y	im.ci	abbie 164 - 128 mr	Section.	YOU	Valley: Cha	nnei Ratio	0-2	2-5	5410	10+	NI
×	COVER: Total %		30		Larges on c	obbie (128-256)	nmi 2	30	Sta Sta	ge s	Dry	L	(M)	н	Flo
3	Comp. Do Pool L.O.D.	Boulder	In Veg Over Veg	Cuttenia	bould	ler ()255mm)	- S	In	Di Flood Sign		2	Braid	00	(v	N
h	100% 20 40			10	Bedrock IR		Rectar Season	10	Bars (%)	30	DH		-	Imped	
3	Crown Closure %	20	10 do	56.7	THE RESERVE	of the party of the last of th	西班牙尼	_	Water Temp (-	Turb.(cm)	-		25°C1	-
- 1	Grown Gosgre A	ac	Admin	HARGE	D _{go} (cm)	Compar	THON L	2 1/2	Water lemp.	1.70			-Cond.	25:01	-
-	Parameter	Value	1	HANGE	Specific (-		REA	(Fight	MBOL			
7	5.104.000.000	A 9/1/6	Method		specific t	Jara		-			N. P. Carlotte				
A.	Wetted Width (m)		-	2				_	-		-			-	
	Mean Depthimi														
3	Mean Velocity im/s)														
-4	Discharge (m3/s)								Widsh, Valley Cha	nnei,Slope				Bed W	Aprel

	10. 2	FISH SUI	YRAMN		15.		STREAM/VALL	EV COOS	o cconou	F-754	
Specie	No	S-ze Hangelmo	Lite Phase	Use Meth	od/Ref		STREAM/VALL (Leoking	g Downstre	s-SECTION ami		
100100	1 4 1	20-30	try			<i>≯</i> 1	LANIMETRIC				B
W.	Ti	100	1-2.0			多法	>			1-1	
1			- ar			TI	> - 2	=	4		
						7	· 2	2	#		3
3						\/BV	/、手=		-	-	PA
-						VA	114	1/	174	1	11
	+		-	-			0	X	100		
-	1	211-11									
-	1					-					
_											
					_						
						OMMENTS	1			+	
Channe	Stab	ility Debris	Manag	ement Con	Cerns . Obstruc	OMMENTS	rian Zono 🗍 .	Falls, laten			
Channe	Stab	ility Debris	□ Manag	ement Con	Cerns Obstruc	OMMENTS	rian Zone 📗 v	Valléy Wall	Processes 🗌	į Ele.	
Channe	Stab				cerns : Obstruc	tions Ripar	rian Zone 🗀 v	Valley Wall	Processes 🗌	; Elc.	
Channe	Ne.				cerns . Obstruc	tions Ripar	rian Zone	Valley Wall	Processes [ela lea	(In)
-the_	la	oddin a	& sile £	23 io	SC-70m	tions Ripar	-	Valley Wall	(21), MC	sty lay	رسه
- he	lal	odskin a Had Lug side,	& sile £		SC-70m	ctions	-	J. st 1	12D, mc	عالم لي	رسه
- he	la	odskin a Had Lug side,	& sile £	23 io	SC-Jom	ctions	a lg an	13. le altent	ist, me	عالم لي	رسه
- he	lal	odskin a Had	& sile £	23 io	5C-70m	ctions	a lg an	1 je. k alkal	ist, me	عالم لي	(fun)
- he	lal	odskin a Had	& sile £	23 io	5C-70m	with will will and from god from	is through	13. le altent	ish, me friest is ing babi	مالو لين المار	(m)
- he	lal	olden a sed en side malar fab mal fish	d eife of channe ited at hebited	23 io	SC-Jom	ctions	is through	13. le altent	ist, me	مالو لين المار	er-)
- he	lal	olden a sed en side malar fab mal fish	& sile £	23 io	SC-70m	with will and frame god frame many de	is through	13. le altent	ish, me friest is ing babi	مالو لين المار	رسه
- hu	lal	olden a sed en side malar fab mal fish	d eife of channe ited at hebited	23 io	SC-70m	with will will and from god from	is through	13. le altent	ess, me freet in ingliabilist hanks	sty tog val.	رسه
- hu	lal	olden a sed en side malar fab mal fish	d eife of channe ited at hebited	23 io	SC-70m	with will and frame god frame many de	is through	13. le altent	ess, me freez pe ingliabilist at hanks	مالو لين المار	رسا

STREAM SURVEY FORM

many status (gaz.) Kurd'is	1 - 1 - 1	STREAM SURV	ET FORM		 .	
MERCHANISH STATES	det treek	(local)	E. C. Start () He		Access	Metho
60 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1111		12.12.3	(Signe 1	Lengthikm	知名性 聖
のからなった。		- W	ACTION SECTION	10 100	Programme Anna Parket	500. 震
च्या प्रदेशका अपूर्व		U.T	.м.	TO COME Y	N S	इताह 🖳 🔠 स
PARAMETER	F MENGANG	000 / /	Photos Ai	ir Photos		學局時期的
PARAMETER 1	VALUE METH.	20 . 4	SPECIFIC DATA		100	Santrole in la lais-
	W - 51 5 E	20-25	10000000000000000000000000000000000000		C	Type Loc
PARTY PERCENTER PROPERTY AND ADDRESS OF THE PARTY AND ADDRESS OF THE PA	Washing Sec	12-15 in 1-2 seno	wite and chan	ds ils	98	5. 起即 泡
	SirceLive Landau	15 A. T.		4.44		1/2 5/2 2
Ave.Max.Pool Depth (cm)	625 - 36 - 36 - 36 - 36 - 36 - 36 - 36 - 3		Sperage Partition of the	- Wall		后起 上线 198
20 775 17	-	S SECTION SECTION	17850	BANKS		240 004 153
State of the last		clay, silt, sand (<2	mm1 Hosp	phtimi Z %Unst	able 🖄	19 LAN 29
<u> </u>	1/20	small (Z-15mm)	A Part of the latest of the la	ture F G	L) R	(点) 金数 公
		large (16-64mm)	5° 80 80	Continement	EN CO FC	OC UC N/
Stable %	50	sm.cobb/s (64-12	- Citchell	ley: Channel Ratio	0-2 2-5	5-10) 10+ N//
	5-10	Engelige.cobbie II 28-2	756mm) 50 100	K(m)	Dry((L)	M H Floo
	Veg Over Veg Cuttent	boulder (>256mm	2.C	od Signs Ht(m)	2 Braide	M (Y) N
100% 20	0 60 10	grange de	Bar	s (x) 50	pH	O-(ppm)
Crown Closure % 风险的点点	Aspect	Dealami 15 Con	npaction L M H Wat	er Temp.(*C)	Turb.lcm1	Cond.i25*CI
	DISCHARGE			REA	CH SYMBOL	
Parameter Value	Method	Specific Data			(Fish)	
Wetted Width (m)	ort-Child	12276				
Mean Depth(m)	A-464	1000	151840			
Mean Velocity im/s)	920 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	ender 6	1127			
Discharge (m³/s) (经验)	TEN TEN		DWIGHT, V	alley Channel, Slopel		(Bed Maleria
	elingers mil er en milles	Gradani L		LEY CROSS-S		
			TEANIME INC	, VIEW	-	
	_					
6						
4-+		1000	En.			
951 201						
	+					
100						
		0011	MENTS			
Channel Stability 7 Dah	ris Managaman	Com Concerns : Obstruction	MENTS	Maller on a		
Den Charles Den	marragemen	ownerns LT operation	- C Miparian Zone C	valley Wall Pro	cesses [tc.
- moderate	1 1 1 1 1	E [TI.		
CTAIL	1 - mitat	in the act.	er your for	and the	(C)	
Mestly	bruce avec					
Gene Me	-x45 9		6 of Viena	We so		
- production	Side Cha	and to grant	a 16.			
		4				
311		1024 7-1-1				
				-		
201					Tease	2010
TOWN TOWN					Edited	72272.11
- THE					Date Y	M D

\$ 100				DFO/ STREAM SU		RM					
or halps (gaz.) Y	in	SACA		Cocall			Arre		Access	- und	Metho
effective Line	14.	uli		11111	7-1-1	111	Heath	260	Lengthikm	200	- matrice
四点 50	39.6	4	-7 73	100	37000	1 - 1 - 1 - 1	sings	Tracks	citiconysi	111111	Tar.
国际经验————————————————————————————————————	44.6	局子			U.T.M.			AND THE PERSON NAMED IN	N SB	E SE	HIER .
300	H	明和	Services	Mar Maca/Sx	Photo	os	Air Pho	itos	N. S.	THE SERVE OF THE	(1) (1) (1) (1) (1) (1) (1) (1) (1) (1)
PARAMETER	•	VALUE	METH.		SPEC	CIFIC DAT	A		#SE	BSTHOOD	-
		0.0603	- 6.6	(chancel	11.51	She !	.A. 1	at main	21690	тур	NAME OF TAXABLE PARTY.
Contract to Gather and the	12100	San Bear	14 PM	(4.2)	3.51	4.67		1.5/ 11	X	60	d) 1050
Ave.Max.Riffle Depth	-	4 1540	1/0	20	10000	one de	1.486.9	1	505	3472	65 N/55
Ave.Max.Pool Depth	-	A Charles	74	2 150	Children o	700	1971-998	2500	- 35		5 880
	6	1.3	NO.	igni Afric	fig.y.	% 1	18	BANKS	100	1	100
80 60	副 引	C .		neb day, sitt, san	d (C2mm)	5	Height(m)	1 NUnst	1 11000		8 (14)
TIO 🗆	7			small (2-16	immi Io	4-8	Texture	(F 6)	LR	100	W 10 16
10		M ·		large (15-6	4mm) (D)	Was f	Cor	nfinement	EN CO F	c > oc u	IC N/A
Stable %	13	75		sm.cobble to	64-128mm)	100	Valley: C	nannel Ratio	0-2 2-5	(5-10 10	-
COVER: Total %		50		iletica i pe cobble i	128-256mm	20		467	Dry L	M H	Floo
Comp. Do Post L.O.O.	Boulder I	n Veg Over Veg	Cutterix	boulder (22)	56mm)	20	100	gns Ht(m)	Brai	ded (Y	N
100% 30		30 50	10	reinger mi		1	Bars (%)	1 20	pH	O-ippm	
Crown Closure % (45)	1907	Aspect	· · · · · · · · · · · · · · · · · · ·	solom) & Ell	Compaction I	100	Water Temp		Turb.(cm)	Cond.125*	-
		DISC	HARGE	Policy		1	N/BIS	1	CH SYMBO		-
Parameter	Value	Method		Specific Data				******	(Fish)		
Wetted Width (m)	10	i filikiya,	MS								
Mean Depth(m)	2017	-HADING	Charles Co.	6.77			_				
Mean Velocity (m/s)	10 To	語動は岩	(1000m) (1000m)	By Cal		-					
Discharge (m³/s)	16615	"连续放"	15.106 TO	to a		ry.	Vidth, Valley, Cr	nannel,Slopel	- 11	Bed	Material
20								3637-47-05391	REVISE	0 0EC 87	SSI
The state of supplier (e em	Mins),		語	S	TREAM/V	ALLEY CF	OSS-SEC	CTION [
			Use Malhodz	L L			oking Down	iaireamir 3			R
BENEZIEM No. Size Ha	STATE WITH	THE R. P. LEWIS CO., LANSING, MICH.	4 - 100000000000000000000000000000000000				RIC VIEW				

	No.	PiSt Still Size Rangetimi	(133) (133)	Use	ine siste	L	STREAM/VALLEY CROSS-SECTION [] (Looking Downstream) 3, R PLANIMETRIC VIEW
¥.2.	tp F	Marintan Te	[-](a)++c				
							COMMENTS
		anded the	-	Xe.	-	10 in	Variable A fancing her and 50-40 cm
		-+					
							Edited by: Date Y M D:

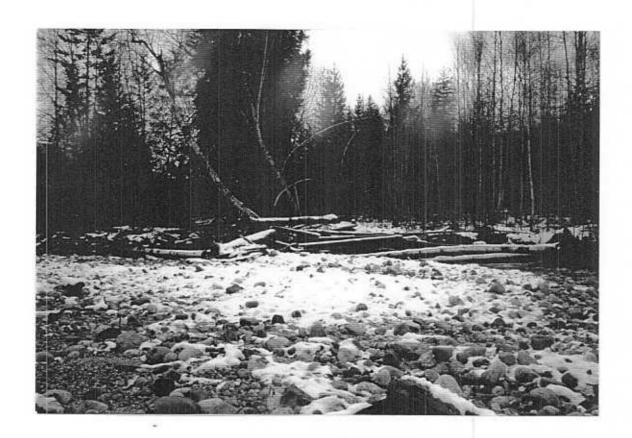


Photo 1. Kingfisher Creek Site #3: Debris jam (approx 20 m wide).



Photo 2. Eroding left bank at Site #3.

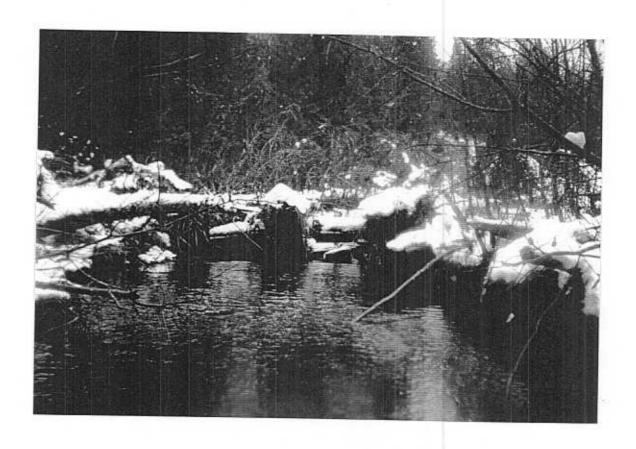


Photo 3. Debris jam at the downstream end of an island, blocking the main channel.



Photo 4 LWD across the channel 50 m upstream from the bridge crossing, upstream view.

Stream Name: Kingfisher Creek Site #: 23 Reach #: 5

Coordinates: 50°44'41N 118°44'13W Code: Fb/Q•D•N/F•2



Photo 5

LWD at the upstream end of the cutblock with a logged stump in the middle of the channel, downstream view.

Stream Name: Kingfisher Creek Site #: 25 Reach #: 5

Coordinates: 50°42'62N 118°45'29W Code: Fb/Q+D+F+1

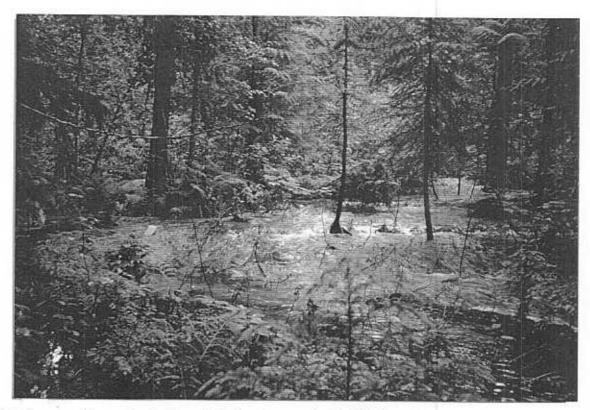


Photo 6

Stream flowing through the forest as a result of a debris jam u/s, u/s view.

Stream Name: Kingfisher Creek Coordinates:

50°43.47'

Site #: 28 118°45.26'

Reach #: 5

Code: Fb/Fs/Q•D•F•1



Photo 7

Substantial LWD blocking a side channel from the left bank of the main channel, u/s view.

Stream Name: Kingfisher Creek

Site #: 28

Reach #: 5

Coordinates:

50°43.47'

118°45.26"

Code: Fb/Fs/Q·D·F·1

APPENDIX IX

Cooke Creek Stream Information File

MID-SHUSWAP STREAM ASSESSMENT

STREAM: COOKE CREEK
DATE: October 13, 1994
TAPE: WRP Tape 5

* to	LOCATION SYMBOL	CODE	COMMENTS	TIME	COORDINA North	ATES West
	1		· mouth of the stream, very similar to Brash Greek	19:11	50.35.96	118.50.69
	2	Fb-C-Hw-1	- culvert & cement weirs	20:03	50.36.37	118.50.53
6/01/95	} 3 ≤×t -	no code con confirm s	• slide from the road on the left & a slide from the right (both enter the stream)	20:54 05/84/75 RE	50.36.78- 7/	118.50.72 85
76/04/95 124	, ,	0-5/0-F-7	at the foot of the slide	22:23	50.37 .28 /8	118.50,59⁴ ≪
	¥ 5	15.4501	- iaige log jaili	22:59	50.37.26	118.50.59*
26/04/95	Ba	Q-5-F-1 Fb-W-N-2	· road visible on the left side ~ 300m from the stream	23:55 06/04/15 Rt	50.37.26 50 *37.49	118.50.59*
61	chuzilto Lifromya RK	8(1/15	 chutes not a barrier to fish passage but would impede fish migration at low flow 	25:01	50.38.57	118.50.28
1/15 /m4	* 8	F6/Q-5/0-F-	 slump from the road eminating at a culvert, on the left with erosion on the fill slope from water exiting the 	25:17	50,38.69 50,38,779	118.50.32
July 4/		Fb/a-D/w-H-	2 culvert large (3-4 m) waterfall + bedrock canon		50.38.779	
DH/m	4 9	Fs/Q-S-F-2	 large continuous cutblock on the right and a cutblock on the left @ ~2600' elevation 	25:49	50.38.95	118.50.25
704 4/8 AM/HQ	5米10	Fb/Q-C-F-1 Fb/Q-D-N/F-2	· bridge, small LWD jams d/s of bridge	26:06	50.39.11	118.50.24
	11	Fs/Q-S-F-2	 cutblocks on the left & right sides @ ~3000' elevation 	27:26	50.39.81	118.50.46
	12	Fs/Q-F-F-2	 road running parallel to the right side 	27:59	50.40.04	118.50.76
	13	Fs/Q-S-F-2	- cutblock on the right side, above the road	28:46	50.40.45	118.51.24
	14	Fs/Q-S-U-2	• old slide on the left	29:31	50.40.71	118.51.92
JULY4/95 JM/MG	¥ 15	<u>FbO-C-F-1</u> Q-s/d-F-3	 new cutblock on the left & wood bridge buffer is ~5m wide with debris piles along the border 	29:44	50.40.66	118.52.11
July 4/95 Daymu	* 16	Fs/Q-S-F-1 Fs/Q-5-F-2	large slump from a cutblock on the right side may have entered the stream	30:30	50.40.80	118.52.69
	17	Fs/Q-S-N-2	 natural slide entering the stream on the left 	30:37	50.40.83	118.52.80
	18		 small waterfall entering the main channel from the left side ~200m d/s 	32:55	50.41.99	118.54.34

STREAM:

COOKE CREEK

DATE:

October 13, 1994

TAPE:

WRP Tape 5

LOCATION SYMBOL

CODE

COMMENTS

TIME

COORDINATES North West

Page 2

19

headwaters of the stream @ ~5500' elevation

34:04

50.42.66

118.54.96

NOTE: 1-19: Map 82 L/10 1:50,000

DFO/MOEP FISH HABITAT INVENTORY AND INFORMATION PROGRAM STREAM INFORMATION SUMMARY

Watershed Code: 03-5400-000-000-000-000-991 Stream Kame: SHUSWAP RIVER

Page: 1

A. DESCRIPTION

Stream Wame: SHUSWAP RIVER

Local Name:

LOWER SHUSWAP REVER

Watershed Code: 03-5400-000-000-000-000-991

D.F.O. Division: District:

Subdistrict: Statistical Subarea:

8 25

FRASER RIVER KANLOOPS 29K SALMON ARM

500-500-000-000-000-000-991		M.G.E. Region: Management Unit:	8 OKAMAGAM 25	
Tributaries	Code	TOPOGLODIL (1:50x) Man		
		B.C.G.S. (1:20k) Map: U.T.M. Mouth: Lat./Long. Mouth: Hainstem Length: Watershed Area:	B8.6 km	8 0'' 119 DG. 3' 0'' Ref. Ko.: 29J-61 Ref. Mo.:
		Location: FLOWS FROM MABE LAKE, KANLOOPS DISTRICT. LOWER SHUSWAP R. HAVE WAT (SEE SHUSWAP RIVER, 03-54	2177 IKIRALI	RIES TO KARA L AND

.5%		Service Made of the	stream from m	outh)	Comments	
SERVICE D	.5 - 2%	2 - 5%	5 - 10x	>10x		
FORMATI	ION AVAILABLE					

B. OBSTRUCTIONS TO MIGRATION

Barrier (Type)	Height (meters)	Location (km U/S)	(apassable to (species)	
ME NO SARRIER			1,0,0,0,0,0	Comments
				ACCESS TO MABEL LAKE, (REF. 29K-46)

C. FLOW

Flow Control: W.S.C. Station No. 1: OBLCDG2	Water Survey of Canada (W. Mo. 2:	SC) Flow Gauge: Y	
Comments: LAKE FED. MASEL LAKE: 88.	Mar. C.		No. 4;

O. DISTRIBUTION SCHOOLS

Species	West and the second
ZE CUCKENE CALMON	Watershed Distribution
SK SOCKEYE SALMON	ASHTON CREEK TO MABEL LAKE; HEAVIEST JUST BELOW HUPEL (REF. 29K-2, REF. 29K-30)
CO COHO SALMON	SUST BELOW HUPEL (REF. 29K-2, REF. 29K-30)
22 10/20/00/00/00	SAME AS SOCKEYE (REF. 29K-2, REF. 29K-30)
PK PINK SALMON	PRESENCE MOTED (REF. 29K-1)
MI MII	Control of the Contro
DE CHENOOK SALHON	JUVENILE REARING DISTRIBUTION SIMILAR TO ADULT SPANNING DISTRIBUTION: FLOODED PASTURES, BACKMATER AND SLOUGHS ADJACENT TO SPANNING AREAS ARE THE PREFERRED REARING HABITATS. (REF. 29K-26)
CHENOOK SALMON	SAME AS SOCKEYE (REF. 29K-Z, REF. 29K-30)
OV DOLLY VARDEN	The state of the s
	PRESENCE THROUGHOUT (REF. 29K-53)
D KDKAKEE	SAME AS SDCKEYE (REF. 29K-30)
I LAKE TROUT	PRESENCE THROUGHOUT (REF. 29K-53)
C See Control of Control	(REF. 29K-53)
W ROCKY NIN WHITEFISH	PRESENCE THROUGHOUT (REF. 29K-53)

Watershed Code: 03-5400-000-000-000-000-991 Stream Name: SHUSWAP RIYER

2

E. ESCAPENENT SUMMARY

Species		Escapement		Max faura			
	Mean	Period of Record	Ref. No.	Recorded Escapement	202 300	Management Target Escapement	
SK SOCKEYE SALMON	133997	1978 - 1987			Ref. No.		Ref. No.
WOM TAL MON		1978 - 1987	28A-18	600495	28A-18		
COHO SALMON	310	1978 - 1987	28A-18	250	1000		August 1
PK PINK SALMON	5	1070		350	28A-18		
7/ 000	-	1979 - 1987	28A-18	13	28A-18		
TH CHIMOOK SALMON	7892	1978 - 1987	28A-18	10000	10 How William		
omments: Shereve my	I WANT CHOICE	1978, 1982, 1986 (RE	107-10	12000	28A-18		

F. LIFE HISTORY TIMING

Species	Activity	Jan	Feb	Mar	Apr	May	9.00	1 / 2	_				
K SOCKEYE SALHOK	Migration			1.17.4	-Chr	nay	Jun	Ju1	Aug	Sep	Oct	Nov	Dec
	Spawning Incubation Rearing									x	11	r	
MONTAS CHOS	Migration			-									
	Spawning Incubation Rearing										x	x x	
H CHI MOOK SALMON	Migration		-										
	Spawning Incubation Rearing							x x	xx	II	x x	x	

EMERGENCE OF CHIMOOK FRY MID APRIL TO EARLY MAY (REF. 29K-26)

G. ENMANCEMENT/MANAGEMENT ACTIVITIES IN WATERSHED

Type of Activity	Species	Location		Ta
-530500500		(km U/S)		Period of Operation
PS FISH SAMPLING	SK SOCKEYE SALMON		MONET DEAN CON TRACES	Start/Finish
FS FISH SAMPLING	SK SOCKEYE SALMON	_	DOWNSTREAM FRY TRAPPING. (REF. 291-100)	1987/1987
	De - Kentanta Managara		DOWSTREAM FRY TRAPPING. (REF. 291-100)	1979/1979
MR MARK RECOVERY	CH CHINOCK SALMON	0.0	72,000 DOWNSTREAM CHIMOOK FRY CODED WIRE TAGGED AND RELEASED -PART OF A FEASIBILITY STUDY FOR ENHANCEMENT POSSIBILITIES (REF. 29K-22)	1979/1981
FP MULTIPLE STRATEGY	CH CHI HOOK SALHON	0.0	EGG TAKES AND OUTPLANTING FROM SHIJSWAP RIVER HATCHERY (REF. 29K-20, REF. 29K-46)	1984/
MR MARK RECOVERY	CH CHI MOOK SALMON	0.0	PETERSON DISC. SHUSWAP FALLS HATCHERY CREW. (REF. 29K-55)	1989/
MR MARK RECOVERY	CH CHI MOOK SALMON	0.0	CODED WIRE TAG RECOVERY; SPANNING ESCAPEMENT ESTIMATES; AGE, LENGTH AND SEX COMPOSITION. (REF. 29K-65, REF. 29K-66)	1983/1985
A HATCHERY	OH CHEMOR SALMON	79.6	0.500 DOWNSTREAM OF COOKE CREEK. KINGFISHER HATCHERY (KINGFISHER COMMUNITY CLUB), EGG TARGET 150,000. RELOCATED TO CONFLUENCE OF COOKE C. (1989). (REF. 29K-55)	1981/

OFO/MOEP FISH HABITAT INVENTORY AND INFORMATION PROGRAM STREAM INFORMATION SUMMARY

Watershed Code: 03-5400-000-000-000-000-991 Stream Name: SHUSWAP RIVER

Page:

H. LAND USE/MATER USE/MATER QUALITY

Activity	Description/Location
AG AGRICULTURE	
	ALFALFA CULTIVATION, DAIRY FARMING, AND HAY PRODUCTION THROUGHOUT (REF. 29K-22)
LINEAR DEVELOPMENT	CPR, HIGHMAY 97A FOLLOW THE RIVER FROM ENDERBY TO MARA LAKE (REF. 29K-22)
Q WATER QUALITY	CLIN OF SHORES
	CITY OF ENDERBY DISCHARGES CHLORINATED SEWAGE INTO THE RIVER (REF. 29K-22)
D LINEAR DEVELOPMENT	REVELSTOKE TRANSMISSION LINE FOLLOWS AND CROSSES RIVER EAST FROM ENDERBY. (REF. 29K-46)
	CERT FOLLOWS AND CHUSSES RIVER EAST FROM EMDERBY. (REF. 29K-46)

I. FISH PRODUCTION POTENTIAL/CONSTRAINTS/GENERAL COMMENTS

FEASIBILITY OF A PROPOSED HATCHERY SITE FOR CHIMOOK AND COMO IMMEDIATELTY DOWNSTREAM OF MARKE LAKE HAS BEEN EXAMINED AND APPEARS PROMISING. (REF. 29K-22)

REARING SURVEYS INDICATED THAT COHO SALMON SMOLTS WERE MORE ABUNDANT THAN IN MIDDLE SHUSWAP RIVER. (REF. 29K-28) WATER QUALITY DISCUSSED (REF. 29K-27)

J. FISHERY OFFICER MARRATIVE

Date Prepared: 1988/04/01 Prepared By: B. KURTZ, OP. FRAMEWORK

K. SIS COMPLETED BY

Completed by: Checked by:	GEORGE FARRELL	0
Last updated by:	LIDIA JAREMOVIC	Date: 1986/12/17
		Date: 1988/04/27
Last checked by:	L. JAREMOVIC	Date: 1990/09/26
Carrier Control		Date: 1990/09/19

DFO/MOE STREAM SURVEY FORM

					SIR	EAM SI	JRVEY	FORM								
Str	eam Name (gaz)	000	e Creek			call						Ac	ess	lel.		Method
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-	and and D	-					Map#			Ste No	3	Lthis	irvim)	200	0	GE
	18 21 1				V 10-		U.T.M.			Flat Car	4 6	N	C	Field	2223777	tist.
_	OF ONY	HI	ime 000	Agency	Crew	Mado	H/	Photos	10	Air Phot	05	- 11	1			
C	PARAMETER		VALUE	METH.				SPECIFIC	DATA	May		_	Lo	BSTR	LICTIO	ONIO:
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	Ave.Wet.Width (m)	and the same of the same of	7	GE					-				1000		-	Loc'n
	Ave Max Biffle Depth	(cm)	90	GE					-			-	CI	3-4	wit.	
15-	Ave.Max.Pool Depth to		190	GE					-			_	1.30	_	L/A	
	Gradient %		5	CL	C Sa	EDMATE	enial Pace	E-0 4	16031		BANKS			_		
	XPOOL O HUTTE GO	Run	Other	GE	Elnes	Actas will say	od (C2mm)		C		C-100 - 00 - 00 - 00 - 00 - 00 - 00 - 00	30 198	15			
-		100	40 20 3					5		Height(m)		1				
	Devide Area% / Color				CONTROL GREVEY	small 12-11	8,000,00	200	d 200	Texture	F (G	L) R	1	_		
	Debris Stable %			+		large 115 - 6		2018	中國	ALC: CONTRACT	nement	EN C	O CEC	00	UC	N/A
-	COVER: Total %	-	80	A			164-128mm		4 200	Valley: Cha	Charles Control	0-2	2-5	15-10	10 •	N/A
_			1		CONTRACTOR FLORESCENCE	ige cobbie		202	を	16 (a	30 0	Dry	L	M	н	Flood
	Sum	Boulder	In Veg Over Veg	Cutbenk	T10075 /6	boulder (>2		70000000000000000000000000000000000000	。臘	Flood Sign	ns Ht(m)		Braid	ed (Y)	N.
-	100%	-			Bedro	kalain k	300	× 550	-	Bacs 1%1	205	pH.	-	0,	Jppmi I	
	Crown Closure %		Aspect		Doolan	Ca	Compact	on L/M)	(階)	Water Temp (0 9	Turb.icm!	_	Cond	125°C	-
			DISCI	HARGE							REA	CH SY	KROL	-		-
e d	Parameter	Value	Method		Sor	ecific Data		St.			, nen	(Fish)	ooL			
fig.	Wetted Width (m)					14,			-							
V217	Mean Depth(m)								1		-		_	_	_	
1	Mean Velocity (m/s)															
12	Discharge (m3/s)								(Widt	n Valley Cha	nnel Sinoel	0.3			Bed to	fateriari
							_		1000	10127/55/00			11105	DEC 8	C-10-54	55187

DFO/MOE STREAM SURVEY FORM

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Location ====================================	Ð			CHESTON CO.	Mape		-		Site No.		Lthsu	-	100	6	E
					UTM	_		1	Fish Ca		N	9	Field [-	st.
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C PARAMETER		VALUE	METH.	-	a - 07 - 01(7	SPECIF	IC D	ATA			_	Lo	BSTRU	CTIO	NS
Ave.Chan,Width (m)	1000	15	GE									C	HttmJ	-	
Ave.Wet.Width (m)	产	10	GE								-			100	17
Ave.Max.Riffle Dept	h (cm)	20	GE				7	1				20			
Ave.Max.Pool Depth	(cm)	180	GE				+	+				185	-	-	
Gradient %	16-54	7	0	C	BED MATERIAL	in .	٧.	0		BANKS	_	100		-	_
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Debris Stable %		90	4	- The	A CONTRACTOR OF THE PARTY OF TH	_	120	Contraction of	7700	annei Ratio	0-2		(5-10)	-	N/A
COVER: Total %		40	1	Large	g lige cobble (128-256		40	+100		age	Dry	1	(M)	_	Flood
Comp. Dp Pcox LOD	Bouader	In Veg Over Veg	Cuttens		boulder (>256mm)	65	140	-		ns Ht(m)		Braid	4	7) N	. (
100% 10 20		40	20	Bedro	ck (R)		12	1100	Bars (%)		DH	Di di C	- 1	ppm)	PAR.
Crown Closure %	30	G Aspect	ac	Depler	To the last	etion 1/	M) H		Water Temp	20	Turb tomi	-	Cond.13	_	-
	20	2.740	HARGE	100000	- 1- 21 conte	الم المصا	7	0.63		110.0	CH SYN	100	CONC.	2.01	
Parameter	Value	Method	Innac	So	ecitic Data	_	-			HEA	(Fish)	MBOL			
Wetted Width (m)	Tunc	Name .				_									
Mean Depth(m)				-3-3			-				-1			-	
Mean Velocity im/s	1														
Discharge (m3/s)								levia	h Valley Ch	ennel Slopei	1 12			Bed Ma	etenati

		FISH SUM		23	1	STREAM/VALLEY CROSS-SECTION
Species	Na	Sire Hangelmed	Life Phase	Use	Mathod/Ref.	L ILOOKING Downstream!
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Channel	Stat	ulity Debois	Manag		I Canana E	COMMENTS
			manay	emer	i Concerns	Obstructions [], Riparian Zone [], Valley Wall Processes [], Etc.
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-1		*	ficely et	CV	ed forth	=10
	-	gest be	-		con la	defect banks operhance veg. and channel
	-	1.0	Se clib	w	13 Ces 1	the channel de brond to bate brown alile
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-	-		1		SATEN SECTION	
- A	X.v.	m mico	Nien	5.	un main	ane alove
	_					2 3
						Edited by

		H SUMMARY	1.000000000	STREAM/VALLEY CROSS-SECTION	_
Species			e Use Method/Het:	PLANIMETRIC VIEW	R
			Co	MMENTS	
Channel	Stability	Debris Mana	gement Concerns . Obstruct	ons . Riparian Zone . Valley Wall Processes . Etc.	
- the		11	the Knott to the !	this work have is a series of podephi ist present but there is an acrition	E
- 10th	receredo	with sp	amony and gre	wel.	
				Edited by	
				Oate Y M D	

DFO/MOE STREAM SURVEY FORM

				SIND	AM SURVEY	OHM	24	-				
Veam Name (gaz.)	onKe	e Creek	(lloc	all				Acces	is vel	. J	Methad
Valershed Code			1 1	1 1 1 1	Litter	111.	Beaching	4	Length	km) Æ		
Scallog Dile# 15	11				1920		505 885	-	Clfisury	1903		GE
Constituting 19165 19	116	42.			U.T.M.		File Free	v /	C. Strategick Co.	- A - A	(OC	mar.L
THO SI HOUSE	N/ Wit	560/3c		MACROS	-17 4	hotos	DESCRIPTION AND ADDRESS OF THE PARTY OF THE	, C	2 19	and cici	CI IN	2145/1
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The state of the s	and the state of	10_	01						- 1	Of His	n) Type	Loc.
Ave WelWidth smit	-	5	12/2						- 1		-	-
Ave.Max.Riffle Depth		20	GE								1	_
Ave.Max.Pool Depth (-	50	GÉ									_
Gradient & Good	1	10	CL	C/ #84	ED-MATERIAL TO	%	BA BA	NKS		200		
STARRY OFFE THE	樓2	0000	GE	9 (7)(65)	clay,sitt,sand (<2mm)	間	Height (m)	%Unstat	to 10	166 m		
Sice Chan's 5000	100	\$6 D \$45 D B	i i		small (2-16mm)	20	Texture F	(G() R	麗		
ANN SOLO	3000	35 D 20 D		e _{ov n}	lerge (16-64mm)	A Or	Conliner	nent	EN CO	(FC)	oc uc	N/
Debris Stable %		90	4	A 564	sm.cobble (64-128mm)	200	Valley: Channe	Ratio	0-2 (2	(-5)5-	10 10 •	NI
COVER: Total %		30		100	Ige. cobble (128-256mm	學证	Street Street	197	Dry	L (IN	Н	Floo
Comp. Op Pool LO.D.	Boater	In Veg Over Veg	Cutbank	湯養	boulder (>256mm)	24	Flood Signs	-	1 1	Braided	(P)	N.
100x 10 20	10	40	20		COURT	M 48/2	Bars (%)		7 pH	$\overline{}$	O-Jppml	1
Crown Closure %	20	Aspect	1.00	D _{so} lom			Water Temp.(*C)	T-	urb.lcm1		nd:25°C	-
41	V	Andrew	HARGE	THOUGHT A CHIEF TO THE THE	T Towns		The state of the s	REAC	H SYME	3OL		
Parameter	Value	Method	1	Spe	cific Data		1		(Fish)		-	
** (Wetted Width (m)							1					
A: Mean Depth (m)												
Mean Velocity (m/s)		-					1					
Discharge (m3/s)	-	-	-		-	_	Wigth Valley Channe	L Stope1	1.		Bed	Malerii
8787 787 Je 1117 121			-				Treatment and treatment	STORY OF	HEV	ISED DEC	87	551

C Specie	4.10	, 1311.30M	MAHYA		STREAM/VALLE	Y CROSS-SECTION
apecie	No.	Size Range(mm)	Life Phase	Use Helppdink	AM (20 (Looking	Downstreami
			0.000-00-		PLANIMETRIC V	IEW
5					- 1 H 1 / 2 +	
M					L 191/35	歩 孝 `
4					L .0 X V. \$ D.	38 3
6	1				Curved (77	- 75 =
						17
7						000
	+				Ste# 16	X-MARCON .
8.4	-				70.10	
					-	
2						
-				A	COMMENTS	
Chann	el Sta	Dility Debris	Manage	ement Concerns] Obstructions [] Riparian Zone []; Va	illey Wall Processes Fic
		1 3 3 5			02	
- 1	Dan	habita [o Br	en this	160	
			0,			
		e deep!	Loses.	does s	ever some soils In de	4) (4)
-	Stand	- Im his	- actor	is fans i	and yes of the an tel	al like = 16
		0	0	٠.		-1 -1
	Ma	my deep	10000	rop .	indirect banks at	ile # 15
-				to the		
-	-110					
- - -	itte	U recenti	al list	- habitat o	t site=15 than at #16	
- -\	dte	u polendi	al fish	- habitat o	site= 5 than ct = 16	
- V	itti	u polendi	d fish	habitat o	1 Site=15 Year ct = 16	Edited by



Photo 1. Debris and exposed bank associated with the slide at the culvert outlet, view from base of slide.

Stream Name: Cooke Creek Site #: 8 Reach #: 2

Coordinates: 49°45.23' 119°20.19' Code: Fb/Fs/Q-C-F-1



Photo 2. Actively eroding deposit (fines/gravels) at the base of the slide, approx. 30 m from the stream. Stream Name: Cooke Creek Site #: 8 Reach #: 2 Coordinates: 49°45.10' 119°20.20' Code: Fb/Fs/Q•C•F•1



Photo 3. Debris jam on the right bank approximately 50 m d/s from the slide, d/s view.

Stream Name: Cooke Creek Site #: 8 Reach #: 2
Coordinates: 49°45.23' 119°20.19' Code: Fb/Fs/Q•C•F•1

APPENDIX X

Brash Creek Stream Information File

MID-SHUSWAP STREAM ASSESSMENT

STREAM:

BRASH CREEK

DATE:

October 13, 1994

TAPE:

WRP Tape 5

米九二	LOCATION SYMBOL	CODE	COMMENTS	TIME	COORDI	NATES
VI>-01					North	West
	1		► mouth of the stream	02:08	50.33,18	119.01.79
	2	Fs/Q-C-Hw-1	► bridge	02:20	50.33.27	119.01.83
	3	Fs/Q-S-A-2	 agricultural fields on the left 	02:38	50.33.40	119.01.90
16/04/95 R	~	F 6/Q-S-F-1 110 code	In logging operation (mill) ~10m from the stream bank on the left side - might have potential water and problems but not at present - see field notes		50.33.6 8 ≤3	119.02.87
26/04/95 RK	¥ 5	F s/Q-C-F- 1 9-C-F-1	bridge, bank erosion on both sides	05/04/25	₽£ 50.33.₹2 82.	119.02.42
	7	Fs/Q-F-F-2 Fb-W-R-1	→ road on the right side	04:27	50.33.89	119.02.60
06/04/95	037	ro-m-n-1 ro code fb/0-0-1-1	 dam/weir (15 x 50m pool impoundment) 	04:51	50.34.05	119.02.59
0/01/13	9	Fs/Q-S-N-2	2 NOCALLY NE 21-1841-4-	07:44	50.35.25	119.01.海
		15/Q-5-N-Z	 eroding bank of till material on the left side entering the stream @ ~2700' elevation 	07:55	50.35.33	119.01.68
	10	Fs/Q-S-N-2	 eroding bank on the right side & left side with a succession of slides 	09:36	50.35.85	119.00.71
	11	Fb-W-N-3	 waterfall (4-5m) on tributary entering from the left side 	10:55	50.36.32	119.00.05
5-06-15 DA/MG	¥ 12	Fs/Q-C-F-1	 bridge crossing with road material entering the stream 	11:24	5 0.36.31	118.59.91
5-06-15 } DH/M6.	(13	Fs/Q-C-F-1	 road crossing (bridge) → unmarked branch of the stream 	11:50	50.36.403 50.36.24	118.59.72
	14		 branch of Brash Creek, to the left of the unnamed branch 	12:45	50.36.35	119.00.04
8	15		► return to the main branch of Brash Creek	13:43	50.36.47	118.59.95
	16		► headwaters of the stream @ ~5000' elevation	16:20	50.37.66	119.00.13

NOTE: 1-11: Map 82 L/11 1:50,000 12-16: Map 82 L/10 1:50,000 DFO/MOEP FISH HABITAT INVENTORY AND INFORMATION PROGRAM STREAM INFORMATION SUMMARY

Watershed Code: 03-5400-000-000-000-000-991 Streem Name: SHUSWAP RIVER

Page: 1

A. DESCRIPTION

SHUSWAP RIVER

Stream Mame: Local Mame:

LOWER SHUSWAP RIVER

Watershed Code: 03-5400-000-000-000-991

O.F.O. Division: District: Subdistrict: Statistical Subarea:

FRASER RIVER 1 KANLOOPS 29K SALMON ARM

M.O.E. Region: Management Unit:

OKANAGAN 25

Tributaries Code

Topographic (1:50k) Map: 87L/11 8.C.G.S. (1:20k) Map: U.T.M. Mouth: Lat./Long. Mouth: Mainstem Length: Watershed Area:

11.3556.56208

50 DG. 43' 0' 119 DG. 3' 0' 88.5 km Ref. Mo.: 29J-61

LOCATION: FLOWS FROM MASEL LAKE INTO THE SOUTH END OF MARA LAKE, KANLOOPS DISTRICT. SISS TRIBUTARIES TO MARA L AND LOWER SHUSWAP R. HAVE WATERSHED CODES FROM DID TO SID. (SEE SHISMAP RIVER, 03-5400, FOR LISTING).

2x 2 - 5x	5 - 101 >10*	Comment	.1
1 LABLE	>101		
11			

Barrier (Type)	Height (meters)	Location (km U/S)	Impassable	
NO BARRIER	100000	(** 0/2)	to (species)	Comments
v				ACCESS TO MABEL LAKE. (REF. 29K-46)

C. FLOW

Water Survey of Canada (WSC) Flow Gauge: Y	
UPSTREAM; AREA - 59 1 ST PM. RES	Na. 4;
	Water Survey of Canada (WSC) Flow Gauge: Y No. 2: No. 3: UPSTREAM; AREA - 59.1 SQ.KM; PERIMETER - 77.8 KM. (RE

D. DISTRIBUTION SUMMARY

Watershed Distribution
ASHTON CREEK TO MABEL LAKE: HEAVIEST JUST BELOW HUPEL (REF. 29K-2, REF. 29K-30)
SAME AS SOCKEYE (REF. 29K-Z, REF. 29K-30)
PRESENCE MOTED (REF. 29K-1)
JUVENILE REARING DISTRIBUTION SIMILAR TO ADULT SPANNING DISTRIBUTION; FLOODED PASTURES, BACKWATE AND SLOUGHS ADJACENT TO SPANNING AREAS ARE THE PREFERRED REARING HABITATS. FOR THE PREFER PARTING HABITATS.
AND SLOUGHS ADJACENT TO SPANNING AREAS ARE THE PREFERRED REARING HABITATS. (REF. 29K-26) SAME AS SOCKEYE (REF. 29K-2, REF. 29K-30)
PRESENCE THROUGHOUT (REF. 29K-53)
SWIE AS SUCKEYE (REF. 29K-30)
PRESENCE THROUGHOUT (REF. 29K-S3) PRESENCE THROUGHOUT (REF. 29K-S3)

Watershed Code: 03-5400-000-000-000-000-991 Stream Mase: SREESWAP RIVER

E. ESCAPENENT SURKARY

Species		Escapement					
	Kean	Period of Record		Maximum Recorded		Management	
SK SUCKEYE SALMON	133997		Ref. No.	Escapement	Ref. No.	Target Escapement	
NOMCINZ CHOO CO	123331	1978 - 1987	28A-18	600495	ASPERIORE SECTION	- supporting	Ref. N
100	310	1978 - 1987	28A-18		28A-18		
PK PINK SALMON	5			150	284-18		
CH CHINOOK SALMON		1979 - 1987	28A-18	13	28A-18		
- Charles Control Control	7892	1978 - 1987	28A-18	17000	2773 385335		
Comments: SOCKEYE DOM	MANT CYCLE	1978 1982 1005 1005		12000	28A-18		

Species	Activity	Jan	Feb	Har									
SK SOCKEYE SALMON	Migration	2388	1 60	nar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Spawning Incubation Rearing									I	rı	r	
MDW.JAZ. DHDD DD	Migration Spawning			-	-								
	incubation Rearing										1	11	
H CHENOR SALMON	Migration	+-	-	-	_								
	Spawning Incubation Rearing							II	11	1 1	r r	x	
CERCENCE OF CHANCE	AND SUCKEYE TIME										- 1		

EMERGENCE OF CHINOOK FRY MID APRIL TO EARLY MAY (REF. 29K-26)

G. ENHANCEMENT/MANAGEMENT ACTIVITIES IN WATERSHED

Type of Activity	Species	Location	Control	
-		(km U/S)	Comments	Period of
FS FISH SAMPLING	SK SOCKEYE SALMON		Dispers	Operation Start/Finish
FS FISH SAMPLING	SK SOCKEYE SALHON		DOWNSTREAM FRY TRAPPING. (REF. 291-100)	1987/1987
MR MARK RECOVERY	THE PARTY OF THE P		DOWSTREAM FRY TRAPPING. (REF. 291-100)	
	CH CHI NOOK SALMOK	0.0	72,000 DOWSTDEAM CHEMONE CON	1979/1979
£2 mm.			RELEASED -PART OF A FEASIBILITY STUDY FOR ENHANCEMENT POSSIBILITIES (REF. 29K-22)	1979/1981
FP MULTIPLE STRATEGY	CH CHI MOOK SALMON	0.0		
KR MARK RECOVERY			EGG TAKES AND OUTPLAKTING FROM SHUSWAP RIVER HATCHERY (REF. 29K-20, REF. 29K-46)	1984/
AT THE REAL PROPERTY.	CH CHI MOOK SALMON	0.0		
NR MARK RECOVERY	en e		PETERSON DISC. SHUSWAP FALLS HATCHERY CREW. (REF. 29K-55)	1989/
	CH CHI HOOK SALHOK	0.0	CODED WIRE ING RECOVERY: SPAWNING ESCAPEMENT	
			ESTIMATES: AGE. LENGTH AND SEX COMPOSITION. (REF. 29K-65, REF. 29K-66)	1983/1985
A HATCHERY	MONIAZ MOOK IND HD	79.6		
		11.707.00	O.SIN DOWNSTREAM OF COOKE CREEK. KINGFISHER HAICHERY (KINGFISHER COMMUNITY CLUB), EGG FARGET 150,000. RELOCATED TO CONFLUENCE OF COOKE C. (1989). (REF. 29K-55)	1981/

OFG/MOEP FISH MABITAT INVENTORY AND INFORMATION PROGRAM STREAM INFORMATION SUMMARY

Matershed Code: 03-5400-000-000-000-000-991 Stream Name: SHUSWAP RIVER

Page: 3

H. LAND USE/WATER USE/WATER QUALITY

0

Activity	
6 AGRICULTURE	Description/Location
	ALFALFA CULTIVATION, DAIRY FARMING, AND HAY PRODUCTION THROUGHOUT (REF. 29K-22)
D LINEAR DEVELOPMENT	CPR, HIGHMAY 97A FOLLOW THE RESERVED COM-
Q WATER QUALITY	CPR, HIGHMAY 97A FOLLOW THE RIVER FROM EXDERBY TO MARA LAKE (REF. 29K-22)
The state of the s	CITY OF ENDERBY DISCHARGES CHLORINATED SEWAGE INTO THE RIVER (REF. 29K-22)
D LIMEAR DEVELOPMENT	REVELSTOKE TRANSMISSION LINE FOLLOWS AND CROSSES RIVER EAST FROM ENDERBY. (REF. 29K-46)

1. FISH PRODUCTION POTENTIAL/CONSTRAINTS/GENERAL COMMENTS

FEASIBILITY OF A PROPOSED HATCHERY SITE FOR CHINOOK AND COHO IMMEDIATELTY DOWNSTREAM OF MABEL LAKE HAS BEEN EXAMINED AND APPEARS PROMISING. (REF. 29K-22)

REARING SURVEYS INDICATED THAT COHO SALMON SHOLTS WERE MORE ABUNDANT THAN IN MIDDLE SHUSWAP RIVER, (REF. 29K-28) WATER QUALITY DISCUSSED (REF. 29K-27)

J. FISHERY OFFICER MARRATIVE

Date Prepared: 1988/04/01 Prepared By: B. KURTZ, OP. FRANCHORK

K. SIS COMPLETED BY

Completed by:	GEORGE FARRELL	Bate: 1986/	09/26
Checked by:	LIDIA JAREMOVIC	Date: 1988/	
Last updated by:	L. JAREMOVIC	Date: 1990/	
Last checked by:	L. JAREMOVIC	Date: 1990/	

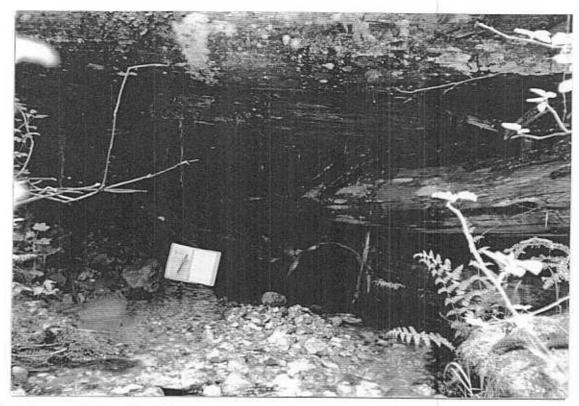


Photo 1.

Culvert inlet with overlaying rotting wood and accumulation of gravel, d/s view.

Stream Name: Brash Creek Site #: 12 Reach #:

Site #: 12

Reach #: 2

Coordinates:

49°45.23°

119°20.19'

Code: Fs/Q+C+F+1

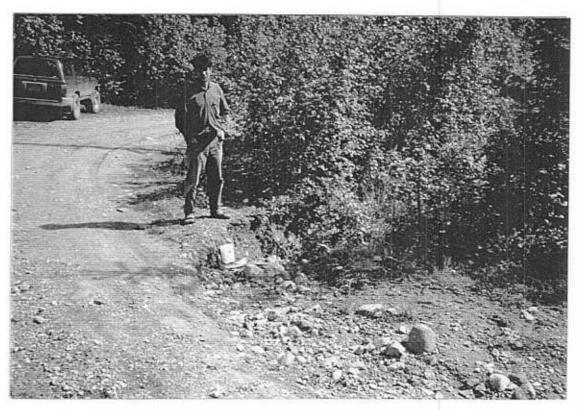


Photo 2.

Erosion of the road surface adjacent to the d/s end of the culvert, d/s view.

Stream Name: Brash Creek

Site #: 12

Reach #: 2

Coordinates:

49°45.10'

119°20.20'

Code: Fs/Q+C+F+1



Photo 3. Culvert outlet with overlaying logs and restrictions on stream width and peak flow, u/s view.

Stream Name: Brash Creek Site #: 13 Reach #: 2
Coordinates: 49°45.23' 119°20.19' Code: Fs/Q•C•F•1



Photo 4. Restricted flow and partial blockage of the culvert inlet, d/s view.

Stream Name: Brash Creek Site #: 13

Coordinates: 49°45.10' 119°20.20'

Reach #: 2 Code: Fs/Q*C*F*1

APPENDIX XI

Biogeoclimatic Zone/Subzone Codes Appendix XI Key to Biogeoclimatic Zone, Subzone and Variant Unit Symbols in the Mid-Shuswap Watershed.

Biogeoclimatic unit symbols are arranged by zone/subzone/variant/phase. For example, ICHwk1 indicates:

Zone

Interior Cedar Hemlock

Subzone

wet (precipitation) cool (temperature)

Variant

1 (Wells Gray)

Zones

ICH

Interior Cedar-Hemlock

ESSF

Engelmann Spruce - Subalpine fir

Subzones

Precipitation

m

moist

w

wet

V

very wet

Temperature

W

warm

m k mild

.

cool

С

cold

Variants

ICHmw2

Shuswap

ICHwk1

Wells Gray

ICHvk1

Mica

ESSFwcp

Parkland

Source:

B.C. Ministry of Forests. 1989. Biogeoclimatic Units maps. Kamloops Forest Region,

January 1989.

APPENDIX XII

Fish Species Codes and Middle Shuswap River Watershed Fish Species Summary Table Appendix XII

Fish species codes.

Code	Species
CM	Chum salmon
СН	Chinook salmon
PK	Pink salmon
SK	Sockeye salmon
KO	Kokanee
CT	Cutthroat trout
RB	Rainbow trout
DV	Dolly Varden
BB	Burbot
MW	Mountain whitefish
RSC	Redside shiner
STC	Spottail shiner
ESC	Emerald shiner
CBC	Chub, general
PCC	Peamouth chub
DC	Dace, general
LNC	Longnose dace
SU	Sucker, general
LSU	Longnose sucker
CSU	Coarsescale sucker
	(Largescale sucker)
CAS	Prickly sculpin
CCG	Slimy sculpin
	01

Note: * indicates that the species spawns in the stream system.

1000000		TOP I TO A SECURE A S			
Map Sheet	Stream	Location	Reference No.	Fish Species	Comments
82 172	Bessette	confluence w Creighton & Duteau		CO, CH, CH*, RB, MW, RB, SK DC, RSC, SU	locations unclear on man
	Dessette	5 km ws Lumby	03-5400-350	CO, CH, RB, SK, MW, DC, CC, RSC, SU	
82173	Bessette	at steep reach 4 km u/s mouth	03-5400-350-060	CO, CH, RB, CC, DC	
82 L/I	Bessette	at Lumby	03-5400-350-040	CO, CH, MW, RB	
	Bessette	at mouth	03-5400-350	CO, CH, MW, RB, SK, DC, CC, RSC, SU, KO	
82 L/7	Bessette	at Vance Cr.	128-8355-541-352	- KB	
	Bill Fraser	near confinence with Spectrum	128-8355-758-453	RB	
	Brash	at mouth	128-8355-234	RB	0.00 e 0.00 m Charles a 1.00 m charles a
82.L/2	Cherry	at Cherryville	128-8355-618	RB, CCG	CO a CO. III Strawdp Just above & Delow Brash, CO. Life
	Cherry	1 km u/s Shuswap	128-8355-618	RB, CCG	
	Cherry				no avian
82 L/10	Cooke				the mother: KO* in Ohammer hart site of the
	Creighton	lowest 4 km reach		8	and an interest of the continue of the continu
82 1.72	Creighton	Dennison L. near headwaters		RB	
	Currie		Control of the Contro		and and an
	Duteau		03-5400-350-040	CO, CO., CH.	CO. Cut. in Apportunity and a contract of
	Duteau	headwaters		RB, RB*	Output Database account to the country
	Gates	200 m u/s/ Shuswap	The second second	RB, DV, CC, FS	The rest of the small tribs and takes
	Gates	unnamed take at 5000'	128-8355-690	RB, RB*	
	Greenbush	at inlet to Greenbush L.		RB* DV* MW* LSU* CSU* RSC*	TO DI INKE THE - N BUG
	Greenbush	near mouth	128-8355-936	RB, DV, MW, LSU, CSU, RSC	
82 L/16	Greenbush L.				
	Hams	3 km u/s McAuley Cr.	128-8355-541-736-		The second secon
	Harris	at W. edge of map sheet	128-8355-541-736		anian aves at readwarers have He-
-	Heckman				no notes
	Hound				DO TOTAL - Page Territor On
	Kate	on floodplain	128-8355-751	RB	TO COOR TO CO.
	Kate	Pete Lake	8016	RB, RB*	RR at lake outlot
	Kate	at confl. w unnamed cr. from Pete L.	128-8355-751-752	RB, SP	Tanna manual man
82 L/B	Kate L			RB	
	Kinglisher			•00	
	Kinghisher	94	03-5400-210	CO, CO., RB	CO* along lowest 1.5 km
	Anglisher/Danfort	Kinglisher/Danfort Danforth - 1.5 km reach u/s Kinglish.	133	CO, CO*, RB	a Kindisher tolkutası
ad C	Latewhos	100	100		no notes
×	Mabel L	lake		SK CO, CH, DV, KO, LT, MW, RB, LNC, CSU, NSC, PCC, RSC, CC	
4	Monashee				no doles
4	Monashee pass				000000000000000000000000000000000000000
9	Outlet	500 m u/s Sugar L	128-8355-683	FS	0000
9	Outlet		Company of the Control of the Contro		000000
a	Peters L		128-8355-758-816 RB, RB*	RB, RB*	DD+ at smooth faller to let
O)	Severide				NO OLUMEN MIELS TO TAKE
60	Shuswap	4.5 km d/s Joss Pass	128-8355-965	RB	III DOMES
(J)	Shuswap	lust w's Greenbush		RB DV KO CC	
(J)	Shuswap	ek		SK CO KO CH IN BB WW IT INC COLUNC DOC CO.	
0)	Shuswan		330	CO OK DO CO, NO. MAY, LI, LIVE, COL, NO. P.C., ROC, CC.	
00	Shirewan		T	CO. OT OF THE PART	
U.	Shurwan		478 9366 GIE	DD COO THO	
U	Shirewan	openio.	T	NE COS LINC	
0	Chicken	All Objects Falls		AB CCC	
0 0	dawani	d/s onuswap rails		SK, CO,CH, KO	
0	dawanus	mn		RB, DV, KO, CC	
O			03-5400	RB, DV, KO, CC	
Shuswap	Shuswap			GS 65	