

**Reconnaissance (1:20,000) Fish and Fish  
Habitat Inventory  
of  
Ryan River Watershed**

**WSC: 119-532200**

Prepared for:  
**Terminal Forest Products Ltd.**  
12180 Mitchell Road  
Richmond, BC  
V6V 1M8

Prepared by:  
**Hatfield Consultants Ltd.**  
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Approved by:

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Alan Stockwell, R.P.Bio.

March 22, 2002

## Project Reference Information

<b>MELP Contract Number</b>	N/A
<b>FDIS Project Number</b>	02-LILL-000001582-2001
<b>FRBC Region</b>	Pacific Region
<b>MELP Region</b>	02
<b>FW Management Unit</b>	2-11
<b>Fisheries Planning Unit</b>	Lillooet (P.U. 4)
<b>DFO Sub-District</b>	28
<b>Forest Region</b>	Vancouver Region
<b>Forest District</b>	Squamish District
<b>Forest Licensee and Tenure #</b>	TFL #38, Terminal Forest Products Ltd.
<b>First Nations Claim Area</b>	Mount Currie First Nations

## Watershed Information

<b>Watershed Group</b>	Lillooet Group
<b>Watershed Name</b>	Ryan River
<b>Watershed Code</b>	119-532200
<b>UTM at Mouth</b>	10. 511745. 5578529
<b>Watershed Area</b>	420 km <sup>2</sup> (42,000 ha)
<b>Total of All Stream Lengths</b>	742 km
<b>Stream Order</b>	5 <sup>th</sup> (@ 1:20,000 scale)
<b>NTS Map</b>	92 J/7 and 92 J/6
<b>TRIM Map</b>	092J.034, 092J.035, 092J.036, 092J.043, 092J.044, 092J.045, and 092J.046
<b>BEC Zone</b>	CWH / MH / AT
<b>Airphotos</b>	30 BC 94117: 152-165; 30 BC 94117: 174-177; 30 BC 94118: 60-92; 30 BC 94118: 109-135; 30 BC 94118: 170-198; 30 BC 94119: 15-42; 30 BC 94119: 72-75; 30 BC 94119: 80-97; 30 BC 94119: 140-143; 30 BC 94119: 152-155

## Sampling Design Summary

<b>Total Number of Reaches</b>	1,298
<b>Random Sampling Sites</b>	26
<b>Discretionary Sampling Sites</b>	14
<b>Total Sample Sites</b>	40
<b>Field Sampling Dates</b>	October 1 – October 5, 2001

## Contractor Information

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**Data Entry:**                    *Name:*            Rob Hoogendoorn

**Report Prepared by:**        *Name:*            Alan Stockwell

**Report Edited by:**            *Name:*            Rob Hoogendoorn

**Maps Prepared by:**        *Name:*            Susan Cho and Rob Hoogendoorn  
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                      Hatfield Consultants Ltd.

**Water Chemistry:**        *Name:*            ALS Environmental  
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**Aging sample analysis by:**    No fish aging specified under this project

**Genetic sample analysis by:**    *Name:*            Dr. Eric Taylor  
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## **Disclaimer**

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

## **Acknowledgements**

Funding for this reconnaissance survey was provided through the Strengthening Sustainable Forest Management Component of Forest Renewal BC (FRBC).

The contractors (Hatfield Consultants Ltd.) would like to express their appreciation to the Mount Currie First Nations for their cooperation during the project. Particular appreciation must go to the First Nations fisheries technicians provided by Creekside Resources, Ernie Jim and Terry Peterson for their contribution to the field data collection program. John Clarke at Terminal Forest Products provided much appreciated administrative and logistical assistance during project implementation. Thanks to the Valleaus’ for providing excellent food and accommodation at their guesthouse, as well as road access to the Ryan River valley through their property. Finally, the contractors would also like to thank Mr. Duane Jesson, the MWLAP Fisheries Biologist in the Lower Mainland Region, for his informed technical guidance and administrative assistance during the implementation of this project.

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Appendix A1	FDIS Summary and Photographs (Volume 1)
Appendix A2	Hardcopy Interpretive Map (Volume 2)
Appendix A3	Hardcopy Project Maps (Volume 2)

## LIST OF ATTACHMENTS AVAILABLE AT MELP OFFICE

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### **Attachment 1 – Planning Documents**

Ryan River Fish and Fish Habitat Inventory Prefield Project Planning Report, including Interim Map Sheets: 092J.034, 092J.035, 092J.036, 092J.043, 092J.044, 092J.045, and 092J.046.

Phase Completion Report (Phases 1-3)

Phase Completion Report (Phase 4)

Project Completion Report

### **Attachment 2 – Field Notes**

Original Hardcopy Fish Collection Forms (29)

Original Hardcopy Site Cards (39)

2 Field Books

### **Attachment 3 - Fish Voucher Specimens/DNA Samples and Results**

Voucher Results Table (including original correspondence from Alex Peden)

Voucher Specimens: bull trout – 1 sample (lab disposed)  
coastal cutthroat trout – 2 samples (lab disposed)

DNA Results Table

DNA Samples: bull trout – 5 samples  
cutthroat trout – 4 samples

### **Attachment 4 – Photodocumentation**

6 Kodak Photo CDs (CD No. 3739, 4526, 4527, 4730, 4734, and 4736)

Photo Binder including: Indexed Negatives, Photo Index Form and Photo Survey Form 1 (Equipment Details)

### **Attachment 5 – Digital Data**

Digital Report Files:	Appendix A1 Photos.doc	Appendix A1 Site Table.xls
	Ryan Title Page.doc	Photo Index Form.xls
	Ryan TOC.doc	Photo Survey Form.xls
	Ryan Chap1.doc	
	Ryan Chap2.doc	
	Ryan Chap3.doc	
	Ryan Chap4.doc	
	Ryan Chap5.doc	

FDIS Files: FDISDAT.mdb, FDISSRC.mdb (FDIS Version 7.6)

GIS Data Files: a2200101.dbf and m2200101.dbf

Adobe Acrobat PDF files:

Watershed Report: Ryan\_Report.PDF

Project maps: p\_ryan\_092J.034\_31mar2002.PDF  
p\_ryan\_092J.035\_31mar2002.PDF  
p\_ryan\_092J.036\_31mar2002.PDF  
p\_ryan\_092J.043\_31mar2002.PDF  
p\_ryan\_092J.044\_31mar2002.PDF  
p\_ryan\_092J.045\_31mar2002.PDF  
p\_ryan\_092J.046\_31mar2002.PDF

Interpretive maps: i\_ryan\_31mar2002.PDF

Overview maps: Ryan\_Fig1.PDF  
Ryan\_Fig2.PDF

### **Attachment 6 – FISS Update Material**

FISS Update Forms

Annotated 1:50k map – 92 J/7 and 92 J/6

### **Attachment 7 – Aerial Photography**

Aerial Photographs of the Study Area:

30 BC 94117: 152-165, 30 BC 94117: 174-177; 30 BC 94118: 60-92; 30 BC 94118: 109-135; 30 BC 94118: 170-198; 30 BC 94119: 15-42; 30 BC 94119: 72-75; 30 BC 94119: 80-97; 30 BC 94119: 140-143; 30 BC 94119: 152-155

### **Attachment 8 – Results of Lab. Analysis**

Original Chemical Analysis Report and Chain of Custody Form for Ryan River Water Samples

## 1.0 INTRODUCTION

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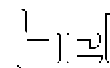
### 1.1 PROJECT SCOPE/OBJECTIVES

The Ryan River watershed has been identified by Terminal Forest Products Ltd. (TFP) and the BC Ministry of Water, Land and Air Protection (MWLAP) as being a priority for fisheries inventory. In this regard, enhanced fish and fish habitat information will strengthen the overall resource database for the watershed, as well as contribute to the planning and implementation of any subsequent watershed restoration activities within the Ryan River drainage. Therefore, TFP secured funding from Forest Renewal BC (FRBC), through its Strengthening Sustainable Forest Management Component, to conduct a reconnaissance (1:20,000) fish and fish habitat inventory of the watershed. This document, as well as the associated maps and attachments, provide a report on the findings of the inventory.

The primary objective of the inventory was to describe watershed-wide fish distributions and habitat characteristics for all watersheds within the project area. This objective was highlighted as a priority in the recommendations resulting from a recent Overview Fish Habitat Assessment Procedure (FHAP) conducted on the Ryan River and its major tributaries by EBA (2001) for TFP. A secondary objective was to provide fisheries personnel from local First Nations with basic training in reconnaissance inventory field data collection methods, as well as a general understanding of all phases of the inventory process. In this regard, two fisheries technicians from the Mount Currie First Nation participated in the field data collection program. Focus was directed towards the stream survey component of the inventory program and therefore, no lake surveying was included as part of the project.

### 1.2 LOCATION

The Ryan River is a 5<sup>th</sup> order system (1:20,000 scale) located approximately 150 km north of Vancouver (Watershed Code: 119-532200). The closest community is Pemberton, which is situated about 5 km to the south of the Ryan River watershed. The river flows east and then south through the Pacific Range of the Coast Mountains and drains into the Lillooet River about 15 km upstream of Lillooet Lake. Approximately 13 km of the lower Ryan parallels the Lillooet River as it flows through the Pemberton Valley. The Ryan River has a watershed area of approximately 420 km<sup>2</sup>, a mainstem length of 57.9 km and a magnitude of 41 (1:50,000 scale). The general location of the Ryan River watershed is shown on the overview map provided in Figure 1. The locations of stream sampling sites included in the inventory are shown on the map in Figure 2.



### 1.3 ACCESS

The Ryan River is readily accessible via the provincial road system. Directions for watershed access from Pemberton, BC are as follows:

- After reaching Pemberton via Hwy. 99 proceed into the centre of town and turn right at the only stop sign on the main street onto Pemberton Meadows Road.
- Travel along Pemberton Meadows Road for approximately 17 km until locating the Valleau Guest House, which can be identified by a sign on the left side of the road. This facility was used to accommodate the two HCL members of the field crew. The two Creekside Resources field team members used their homes in Mount Currie as a base when working on the field component of the project.
- Turn left onto the Valleau Guest House road and travel for approximately 1 km before meeting the Ryan Main forest access road. Permission must be granted by the landowners before traveling along the Valleau road.
- At the time of the inventory field program (October 2001) it was possible to travel by four-wheel drive vehicle up the Ryan Main to about km 21. There is a washout located at this point, which precludes further travel by road upstream in the watershed.

A combination of road and helicopter support was used to access the stream sample sites within the Ryan River watershed. Approximately one-half of the sites were completed using road access. Pemberton Helicopters Ltd. provided the necessary air support to complete the samples sites that were not road accessible.

Figure 1 Overview of the Ryan River watershed project area.

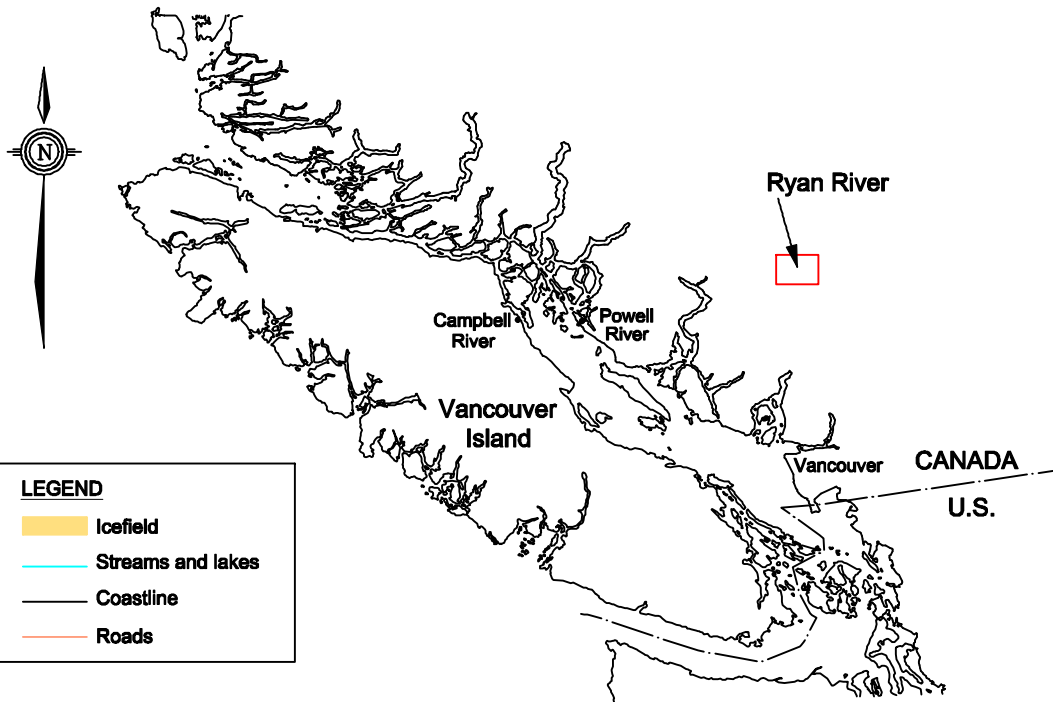
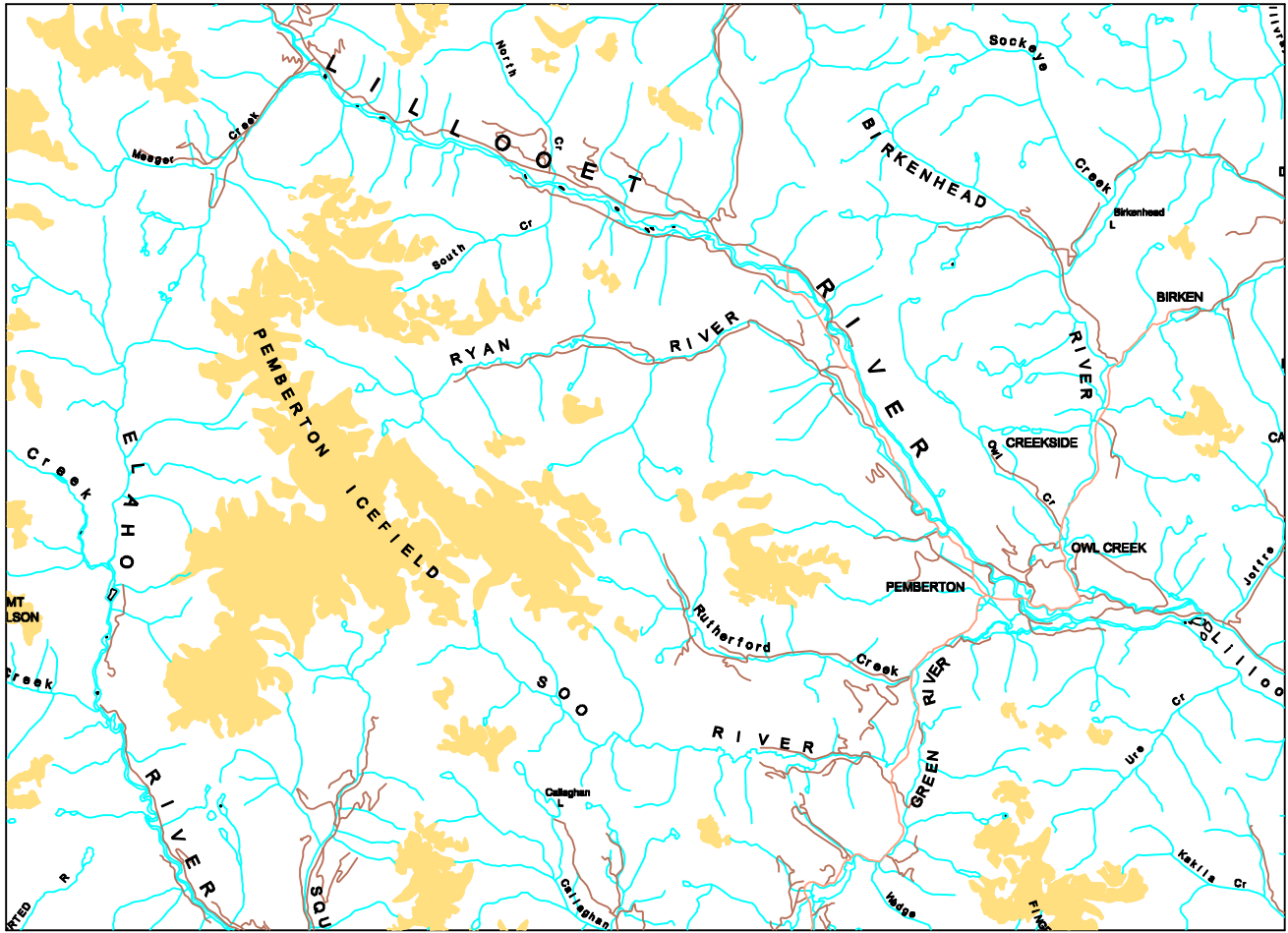


Figure 2 Ryan River Fish and Fish Habitat Inventory Sampling Site Locations.

**OVERVIEW MAP**

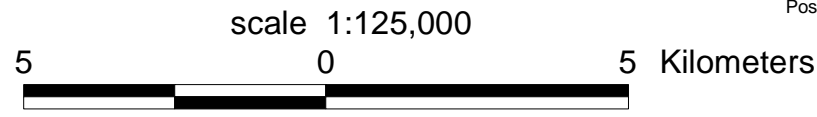
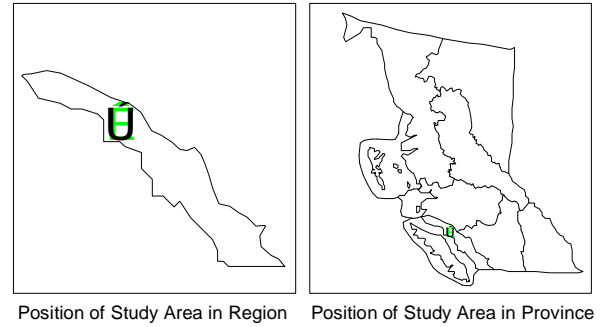
Ryan River Watershed: 119-532200  
 Project Code: 02-LILL-00001582-2001  
 Projection: UTM Zone 10  
 Date: 2002/03/25  
 Inventory Company: Hatfield Consultants Ltd.

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**MAP SOURCE INFORMATION BOX**

BASE: NTS STR SYM: INV  
 LOC: FDG LK SYM: N/A  
 HAB: INV  
 FISH: INVD  
 DATE INV: 2001/10/01 to 2001/10/05  
 INV MGNT: OTH

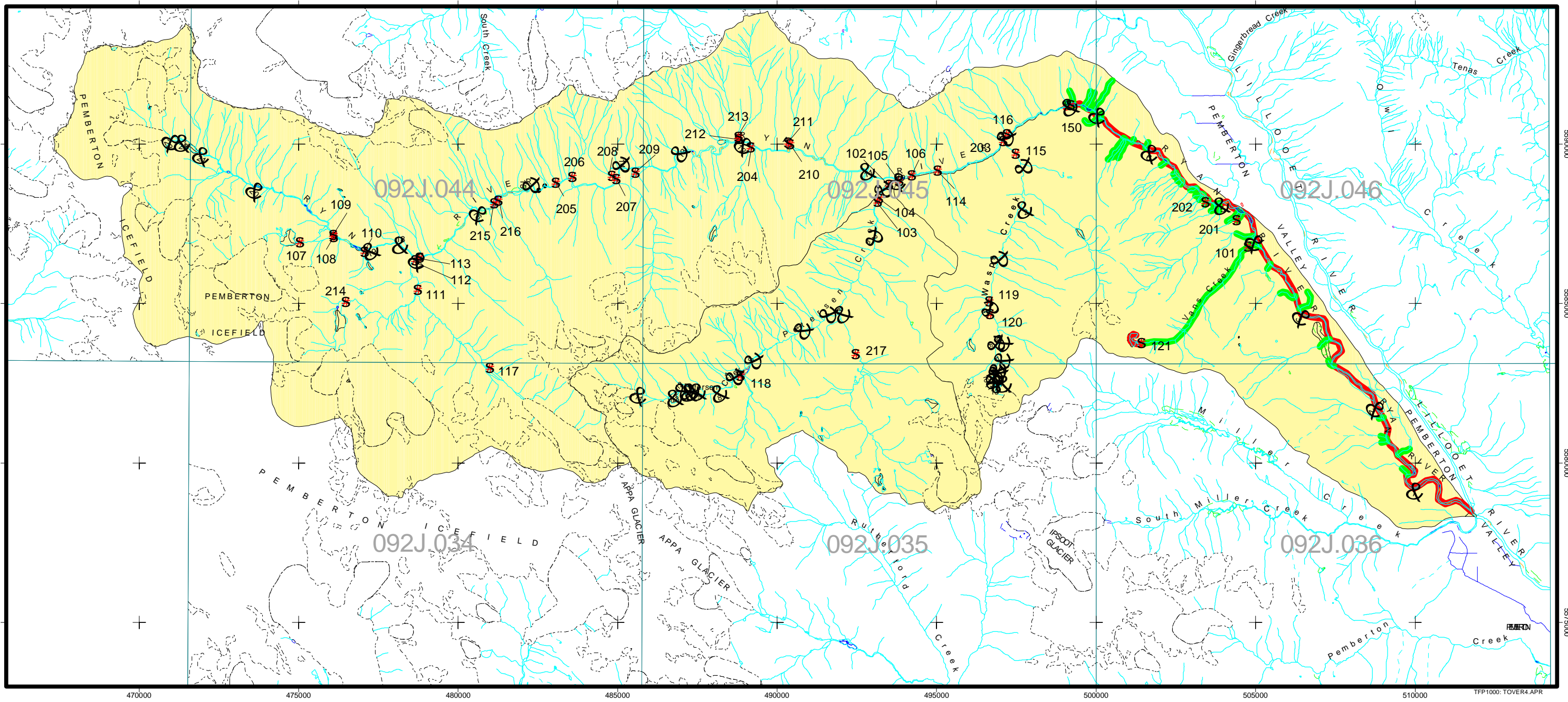
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 "This product has been accepted as being in accordance with approved standards within the limits of Ministry quality assurance procedures. Users are cautioned that interpreted information on this product developed for the purposes of the Forest Practices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



**LEGEND**

- sample site and number
- reach break and number
- fish presence based on current inventory results
- implied fish presence (first reaches of tributaries that flow into fish bearing streams) and Vans Creek mainstem downstream of headwater lake

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## 2.0 RESOURCE INFORMATION

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### 2.1 FIRST NATIONS ISSUES AND INTERESTS

The Ryan River watershed is located within the Mount Currie First Nation traditional territories. Members of the Mount Currie First Nation use the watershed for traditional food/herbal medicine gathering, and are involved in monitoring anadromous fish populations, salmonid enhancement, and forest development activities in several watersheds throughout the area.

### 2.2 DEVELOPMENT AND LAND USE

The primary development and land use activity in the project area is forestry. Forest harvesting began in the 1940s and intensified during the 1970s and 1980s, with the majority of the logging occurring between 1972 and 1998 (EBA 2001). Terminal Forest Products (TFP) is the current forest licensee in the Ryan River watershed where logging has been carried out by TFP and its predecessor L&K Lumber since 1972 (J. Clark, *pers. comm.* 2001). Approximately 2230 ha (5.3% of the watershed) of mostly valley bottom forest has been harvested (EBA 2001). With the exception of some limited helicopter logging, which will be completed within the next year or two, forest harvesting activities have ceased in the Ryan River watershed for the foreseeable future.

Other land use activities occurring within the Ryan River watershed include a limited amount of sports fishing in the lower reaches of the mainstem, as well as sporadic large mammal hunting in the mid to upper watershed. Parts of the mainstem Ryan are occasionally used by whitewater kayakers, and several special use permits have been issued to heli-ski companies in the Whistler-Pemberton area that allow them to operate in parts of the Ryan watershed. One factor that tends to limit recreational use of the Ryan watershed is that at present the only road access in the Ryan River valley is through private land. Finally, much of the lower Ryan River (alluvial fan in Pemberton Valley) flows through private land, which has been dyked and developed for agriculture. In this regard, several water licenses have been issued for extraction of water from the Ryan River and several of its tributaries for irrigation and domestic use.

### 2.3 OTHER DEVELOPMENTS

In recent years there has been growing interest in the development of small-scale hydroelectric projects in British Columbia. Particular interest has been focused on watersheds located in the southern Coast Mountain Range. In this regard, Summit Power Corporation has an application on file with the Water Management Branch in Victoria (Water License No. Z102125) for the development of a small-scale hydroelectric project in the Ryan River watershed. EBA 2001 reports that the project is currently at the feasibility stage and it is unlikely to proceed further in

the near future. A second water license (No. Z116064) has been issued to LEDCOR Power Inc. in connection with another proposed small-scale hydro development on the Ryan River.

## 2.4 IMPACTS AND USES BY WILDLIFE

Wildlife populations in the project area are expected to be consistent with those found in Coastal Western Hemlock (CWH), Mountain Hemlock (MH) and Alpine Tundra (AT) biogeoclimatic ecosystem zones (Meidinger and Pojar 1991). The District Forest Ecosystem Specialist (J. Roberts, *pers. comm.* 2001) provided the following information concerning wildlife species in the Ryan River watershed.

Common Name	Scientific Name	Provincial CDC Listing	Status in Ryan Watershed
rubber boa	<i>Charina bottae</i>	Blue	No records, but likely present (rocky sites up to 1,500 m elevation).
tailed frog	<i>Ascaphus truei</i>	Blue	No records, but likely present (perennially stable natal streams at elevations of up to 1,750 m elevation, which are utilized by rearing tadpoles).
spotted Owl	<i>Strix occidentalis</i>	Red	No records, but may be present (old forest dependent species, generally at elevations below 1,400 m elevation). Lost and fragmented habitat due to forest harvesting.
bald eagle	<i>Haliaeetus leucocephalus</i>	Yellow	Regionally important species. Expect some potential for year-round use by small numbers, especially in lower 8 km of the Ryan mainstem where fish are present.
American peregrine falcon	<i>Falco peregrinus anatum</i>	Red	No records, but likely present (nest on steep cliffs up to 1,500 m, a habitat that is relatively abundant in the Ryan watershed).
northern goshawk	<i>Accipiter gentilis</i>	Yellow	Regionally important species. No records, but almost certainly present (mature to old forest habitat up to 1,200 m). Lost and fragmented habitat due to forest harvesting.
American bittern	<i>Botaurus lentiginosus</i>	Blue	No records, but may be present (especially in association with any wetland habitats in wide floodplain areas, where nesting could occur).
great blue heron	<i>Ardea herodias fannini</i>	Blue	No records, but definitely present (especially in association with any wetland habitats in wide floodplain areas, where nesting could occur).
green heron	<i>Butorides virescens</i>	Blue	No records, but may be present (especially in association with any wetland habitats in wide floodplain areas, where nesting could occur).

Common Name	Scientific Name	Provincial CDC Listing	Status in Ryan Watershed
harlequin duck	<i>Historionicus historionicus</i>	Yellow	Regionally important species. No records, but almost certainly present. Nesting and brood rearing on low to high elevation (up to 3,000 metres elevation) perennial streams.
mule deer	<i>Odocoileus hemionus</i>	Yellow	Known to be present. Year-round use, with large expanses of critical winter range present on lower, south-facing slopes within the lower portion of the watershed (south-side of the Camel's Back landform).
mountain goat	<i>Oreamnos americanus</i>	Yellow	Known to be present (approx. 50-60 individuals). Year-round use, with large expanses of critical winter ranges present in various locations through the watershed, Majority is on mid to high elevation, south-facing slopes associated with the mainstem. Additional areas include southeast facing slopes in the lower portion of the Peterson sub-basin along with smaller areas distributed throughout the remainder of the drainage.
moose	<i>Alces alces</i>	Yellow	Known to be present. Watershed is primarily utilized in the summer months. Some winter use possible, especially in the lower reaches in association with the Lillooet River floodplain, but agricultural development has impacted these habitat values to a large extent.
black bear	<i>Ursus americanus</i>	Yellow	Regionally important. Expect year-round use (including winter denning).
grizzly bear	<i>Ursus arctos horribilis</i>	Blue	Known to be present, at least seasonally (Ryan River watershed appears to be an important drainage for grizzly bears, which likely make use of slidetrack and riparian foraging habitats throughout the spring/summer months). Suspect some year-round use.
wolverine	<i>Gulo gulo luscus</i>	Blue	No known records but definitely present. Requires large areas of diverse habitat at all elevations.
fisher	<i>Martes pennanti</i>	Blue	No known records but likely present. Requires relatively large expanses of mature and old forests, at elevations up to 2,000 m.
Keen's long-eared myotis	<i>Myotis keenii</i>	Red	No records, but may be present, particularly in lower watershed.
Townsend's big-eared bat	<i>Plecotus townsendii</i>	Blue	No records, but may be present, particularly in lower watershed.

Wildlife observations during the field data collection component of the inventory were limited and included black bear, mule deer, and several shrews (*Sorex* sp).

## 2.5 EXISTING WATER QUALITY DATA

Existing water quality data recorded for the Ryan River watershed are limited to temperature measurements carried out in Peterson Creek by NES (1995). A temperature of 8 °C was recorded on July 13, 1995 for all mainstem reaches. No other existing water quality information was discovered in the literature or through other sources.

## 2.6 EXISTING FISH INFORMATION

The majority of existing fish and fish habitat information compiled for the Ryan River watershed came from the BC Environment, Resource Analysis Branch Biophysical Maps, and the maps and information contained in the FISS database. Two other documents, NES (1995) and EBA (2001), provided site-specific fish and fish habitat information about the Ryan River and several of its larger tributaries.

According to information provided in the FISS database there are confirmed reports of two anadromous salmon species using the Ryan River, coho (*Oncorhynchus kisutch*) and sockeye (*Oncorhynchus nerka*). Local anecdotal information also provides some support for the existence of small numbers of chinook (*Oncorhynchus tshawytscha*) and sea-run cutthroat (*Oncorhynchus clarki*) spawners using the lower reaches of the Ryan River mainstem (H. Naylor, *pers. comm.* 2001). EBA (2001) reports that pink salmon (*Oncorhynchus gorbuscha*) spawners do or did historically enter the Ryan River.

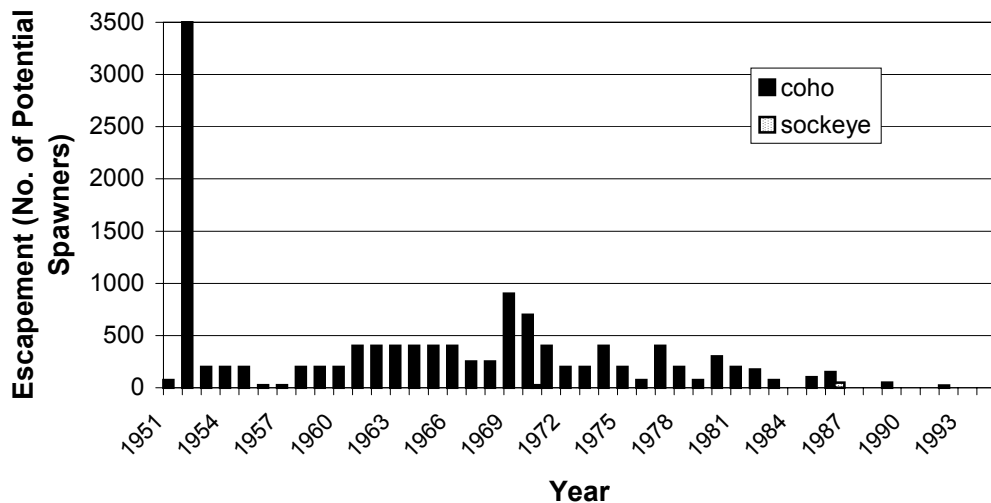
Due to a number of factors, including high turbidity in the lower reaches of the Ryan mainstem and a late-run coho stock, salmon escapement estimates are considered unreliable; however, it is generally believed that escapements for all species are significantly depressed when compared to historical numbers. Figure 3 displays coho and sockeye escapement data for the Ryan River for the years between 1951 and 1994 from the DFO SEDS database. Sockeye counts are provided for only two years (1970 and 1986) and were recorded at less than 50 fish on both occasions. The peak coho escapement was recorded in 1952 at 3,500 fish. Recent coho escapements to the Ryan River are estimated at less than 20 fish.

Factors that may be contributing to the decline in salmon escapements to the Ryan system include, dyking and agricultural development in the lower watershed, which may have had a negative impact in spawning and rearing habitat, as well as forest harvesting activities in the watershed. Heavy fishing pressure by all components of the fisheries sector has undoubtedly reduced the number of anadromous salmon escapements to the Ryan River.

Resident fish species present in the Ryan River watershed include the coastrange sculpin (*Cottus aleuticus*), coastal cutthroat trout, as well as bull trout (*Salvelinus confluentus*). The presence of bull trout versus Dolly Varden (*Salvelinus malmo*) was confirmed during the present study based on the results of DNA analysis. The presents of rainbow trout (*Oncorhynchus mykiss*) and

mountain whitefish (*Prosopium williamsoni*) is also suspected based on anecdotal information (J. Roberts, *pers. comm.* 2001). In this regard, a small headwater lake system (WID 00407LILL) on a tributary (WSC 119-532200-22000- locally known as Vans Creek) to the Ryan River was stocked with about 1,000 rainbow trout fry in 1990. Local volunteers in the Pemberton area were involved in assessing lake habitat and the subsequent fish stocking activities. Follow-up monitoring has not been carried out but observations during the current study confirmed the presence of rainbow trout in the lake system. The habitat downstream of the lake is generally high gradient, with a confined stream channel, and unsuitable for rainbow trout.

**Figure 3**  
**Ryan River Salmon Escapement Estimates (1951-1994)**



With respect to fish distribution in the Ryan River watershed, all species listed above are either known or are suspected to occur in the first reach of the river. Spawning and rearing habitat for coho, sockeye and chinook salmon, and possibly sea-run cutthroat, appears to be limited to the lower mainstem reaches located in the Lillooet River floodplain.

Upstream of the floodplain the Ryan mainstem becomes confined and gradients increase to an average of between 2% and 17% (EBA 2001). There is anecdotal evidence that coho spawn in the first reach above the floodplain section of the river. No fish have been found above this point. In several lower gradient reaches there are areas of off-channel and side-channel habitat that may be suitable for coho and resident salmonid rearing. A 5-10 m high waterfall located about 34 km from the mouth of the Ryan River has been identified as a barrier to upstream migration of all fish species.

The main Ryan River tributaries are Wasp Creek and Petersen Creek. The Wasp Creek stream channel is generally confined with mean gradients of 18% to 23 % and limited potential fish habitat. Petersen Creek has a somewhat wider channel width with lower gradients and some salmonid fish habitat in its lower reaches. Fish and fish habitat sampling was carried out in

Petersen Creek by NES (1995). No fish were caught or observed during any of the sampling efforts.

## 3.0 METHODS

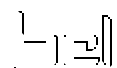
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### 3.1 INVENTORY METHODS

The inventory was carried out in accordance with the current versions of the Resources Inventory Committee (RIC) standards and procedures, which included the following documents. These documents are cited in the Bibliography section of this report.

1. Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Standards and Procedures. Version 2.0, RIC April 2001.
2. Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Reach Information Guide. Version 1.0, RIC, 2000.
3. Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Site Card Field Guide. Version 1.0, RIC 1999; Errata March 2000.
4. Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Fish Collection Form Field Guide. Version 1.0, RIC 1999; Errata March 2000.
5. Fisheries Information Summary System (FISS): Data Compilation and Mapping Procedures. Federal/Provincial Fish Habitat Inventory and Information Program. Draft 3 October 1997.
6. User Guide to the British Columbia Watershed/Waterbody Identifier System, Version 2.2, RIC March 2001.
7. Fish Collection Methods and Standards, Version 4.0, RIC January 1997. Errata March 1999.
8. Field Key to the Fresh Water Fishes of British Columbia, RIC 1994.
9. A Guide to Photodocumentation for Aquatic Inventory, RIC March 1996.
10. Standards for Fish and Fish Habitat Maps, Version 3.0, RIC May 2001.
11. Ambient Fresh Water and Effluent Sampling Manual, RIC July 1994.
12. Collection and Preserving Aquatic Plants, RIC 1994.
13. Identification Keys to the Aquatic Plants of British Columbia, RIC Draft 1994.
14. BC Standards, Specifications and Guidelines for Resource Surveys Using GPS Technology, RIC Draft 1995.
15. Freshwater Biological Sampling Manual, RIC 1997.

Additional detail on inventory methods is provided in the Prefield Project Planning Report submitted to TFP and MWLAP at the end of Phase 3 (HCL 2001), and in Schedule A of the MWLAP Service Contract. There was no significant deviation from RIC standards and procedures during the field data collection program.



In addition to the standard inventory procedures, there were a number of additional tasks specified by the Ministry Representative as follows.

❑ **Fish Sampling**

- a minimum of two (2) fish sampling methods are required at each fish sampling site;
- fish species, life stage and fork length will be determined for all fish captured; and
- downstream stop nets should be used when electrofishing glacial stream systems.

❑ **Fish Voucher Specimens**

- fish voucher specimens are required for all abnormal fish, unidentifiable fish or fish outside of its normal range of distribution;
- fish voucher specimens are required for all species sampled up to three (3) samples per species for the project area;
- preservation, handling and labeling of voucher specimens are to follow RIC standards, only specimens delivered in leak-proof polyethylene containers will be accepted;
- accidental mortalities should be given preference in the selection of individual voucher specimens;
- avoid submitting large specimens (>20 cm forklength) unless the fish is abnormal, unidentifiable or outside of its normal range of distribution;
- the contractor is responsible for arrangements and payment for expert voucher specimen identification services as per the attached note and submission form, and will incorporate results into final reporting; and
- dispose of voucher specimens following expert analysis.

❑ **Fish DNA Samples**

- fish tissue samples for DNA analysis will be collected from char (bull trout/Dolly Varden), rainbow trout and coastal cutthroat trout;
- for char species, collect up to fifteen (15) tissue samples from a minimum of three (3) sites within the project area;
- for coastal cutthroat species, collect up to ten (10) tissue samples from a minimum of two (2) sites within the project area;
- samples will be collected, preserved, labeled and reported as per Ministry specifications;
- exception to Ministry specifications: include fish less than 10 cm forklength if larger fish are not available to meet collection quotas; and
- the contractor is responsible for arrangements and payment for expert DNA analytical services, and will incorporate results into final reporting.

### □ **Stream Water Sampling for Laboratory Analysis**

- water samples for laboratory analysis were collected from two (2) sites as specified in the Prefield Project Plan, one in the Ryan River mainstem and a second in Peterson Creek;
- the purpose of the lab analysis was to verify field measurements, therefore, samples were delivered to the lab within the specified safe storage time limit;
- samples were analyzed for pH, specific conductance, total dissolved solids (TDS), total alkalinity, and acidity (to pH 4.5)
- the Ministry Representative generated Environmental Monitoring System (EMS) numbers based on site information supplied by the Contractor

## **3.2 DEVIATIONS FROM THE PROJECT PLAN**

A total of 39 stream sampling sites were included in the Ryan River reconnaissance fish and fish habitat inventory. The location of each site is shown on the map in Figure 2. The original prefield plan specified 40 sampling sites (26 random, 14 bias or discretionary), however, in consultation with the Ministry Representative a number of changes were made to the original sampling plan while in the field to a meet the overall project objective (i.e. to obtain a clear understanding of fish distribution in the watershed). In particular, a number of sites that were located in dry stream channels were moved to streams where flowing water was present, and extraordinary fishing efforts were conducted at most sites. These changes resulted in one less sampling site being completed during the field program. Details on the modifications to the sampling plan are provided below in Table 1.

Replacement sites were selected based on their physical similarity to the original sites specified in the Project Plan. In particular, efforts were made to match-up basin type, gradient and channel characteristics.

In addition to the inventory sites surveyed, one additional fish card was completed for Reach 8 of Vans Creek (WSC 119-532200-22000). This reach is one of several small lakes at the headwater of Vans Creek. Fish were observed in this lake while completing the site card for Reach 7 of the creek.

At the time of final report production watershed codes to replace ILPs assigned during the prefield planning phase of the inventory had not been generated by MWLAP. Once watershed codes are assigned the FDIS database for the project can be updated.

**Table 1 Modification to the sampling plan for the Ryan River inventory.**

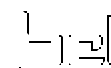
Site No.	Original Site	Replacement Site	Map No.	Comments
114	119-532200, Reach 11	119-532200, reach 10	092J.045	Better fish sampling opportunities
215	-	119-532200, reach 16	092J.044	New site (field determined) to increase fish sampling effort in Ryan mainstem
109	119-532200, Reach 21	119-532200, reach 20	092J.044	Better fish sampling opportunities
	119-532200-06900, Reach 1		092J.036	Eliminated due to access problem
202	ILP 61, Reach 1	ILP 60, Reach 1	092J.036	Changed due to access problem
107	119-532200-87000, Reach 3	119-532200-87000, Reach 2	092J.044	Better fish sampling opportunities
204	119-532200-51000, Reach 1	119-532200-57600, Reach 1	092J.045	Original site dry
211	ILP 338, Reach 1	ILP 297, Reach 1	092J.045	Original site dry
	ILP 338, Reach 2		092J.045	Eliminated due to dry stream channel

### 3.3 SAMPLING EQUIPMENT

Specifications for the major equipment items used during the field data collection phase of the inventory is provided below in Table 2. A number of other smaller equipment items, such as measuring tapes, hip chains, fish measuring boards, and metre sticks were also used during the field data collection component of the inventory.

**Table 2 Major equipment items used during field data collection program.**

Equipment Item	Model	Specifications
Four-Wheel Drive Trucks	Ford F-350	
Electrofishing Units	Smith Root Model 12-b POW	100 to 1000 V DC
Global Positioning System (GPS)	Garmin 45XL	12 Channel
Hand-Held Radios	Motorola	Programmed with appropriate local frequencies
Fish Traps	Gee Minnow Traps	Standard Mesh Size (1/8 ")
Angling Gear		Fly and casting rods, and various tackle
Thermometers	Alcohol	Temperature Range -35 to 50 °C



Equipment Item	Model	Specifications
pH Measurement	LaMotte Comparator Test Kit	pH Range of 4.5 to 9.5
Clinometer	Suunto Model PH-5/360 PC	
Camera	Pentax Zoom 90-WR	Automatic Range Finder with 35-90 mm Zoom
Conductivity Meter	TDS Testr 3 Waterproof	0 to 1990 microsiemens per cm
DNA Sampling Kit	Standard MWLAP Issue	95% Ethanol used for sample preservation

## 4.0 RESULTS AND DISCUSSION

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### 4.1 LOGISTICS

Few logistical problems occurred during implementation of the field data collection program. The problems encountered were generally minor and did not affect the original study design drastically. As a result of these problems, a number of minor changes to the original field sampling plan were made as summarized in Section 3.2. A total of 39 of the planned 40 sampling sites were completed during the field program. One site was eliminated due to access problems but was not replaced.

### 4.2 WATER QUALITY AND HYDROLOGY

#### 4.2.1 Water Quality

Water quality parameters measured at each sampling site included temperature, pH, specific conductance and turbidity (water clarity). In addition to the *in situ* measurements, two water samples (one from the Peterson Creek and one from Ryan River) were analyzed in the laboratory for specific conductance, total dissolved solids, pH, total alkalinity, and acidity (to pH 4.5). The laboratory analysis was carried out to satisfy quality assurance (QA) requirements. The original chemical analysis report and the chain of custody/analytical request form are provided as Attachment 8. The average *in situ* water quality values for all sample sites are presented below in Table 3 along with the results of the *in situ* measurements and laboratory analysis for the Peterson and Ryan samples collected for QA purposes.

**Table 3 Water quality in the Ryan River watershed.**

Parameter	Average <i>In Situ</i> Value (Max/Min)	Peterson Creek Reach #1 (EMS# E245841)		Ryan River Reach #8 (EMS# 245840)	
		Lab.	<i>In situ</i>	Lab.	<i>In situ</i>
Temperature (°C)	5 (13 / 1)	-	4	-	5
pH	7.0 (7.5 / 6.0)	7.62	6.5	7.66	7.00
Specific Conductance (µS/cm)	33 (130 / 10)	47	40	45	30
Turbidity	Most sites clear to lightly turbid	-	Lightly turbid	-	Moderately turbid
Total Dissolved Solids (mg/L)	-	28	-	35	-
Total Alkalinity (mg/L)	-	13	-	13	-
Acidity (to pH 4.5)	-	< 1	-	< 1	-

In general, there was good agreement between the *in situ* values and those generated from the laboratory analysis. Throughout the watershed the highest water temperature of 13 °C occurred in 119-532200-57600 Reach 1, which is a high gradient 3<sup>rd</sup> order tributary to the Ryan River. At the time of sampling this stream was flowing intermittently, which explains the comparatively high water temperature recorded at the sampling site. The lowest temperature of 1 °C was recorded in Reach 16 of the Ryan River. In general, water temperatures were low throughout the watershed, a factor which can contribute to low biological productivity.

Specific conductance was low throughout the watershed at an average of approximately 33 µS/cm. Low specific conductance values can limit the effectiveness of some electrofishing gear but the Smith Root Model 12-b POW units used in this inventory can operate effectively at low conductivity levels (Smith-Root, Inc., 1997).

Very little variance in pH values was recorded, as almost all pH values measured in the Ryan River watershed were 6.5 to 7.0. A slightly acidic pH is to be expected given the geology of the study area, which is comprised of igneous rock (e.g. quartz monzonite and granodiorite) of the Coast Plutonic Complex (Bellefontaine and Alldrick 1994).

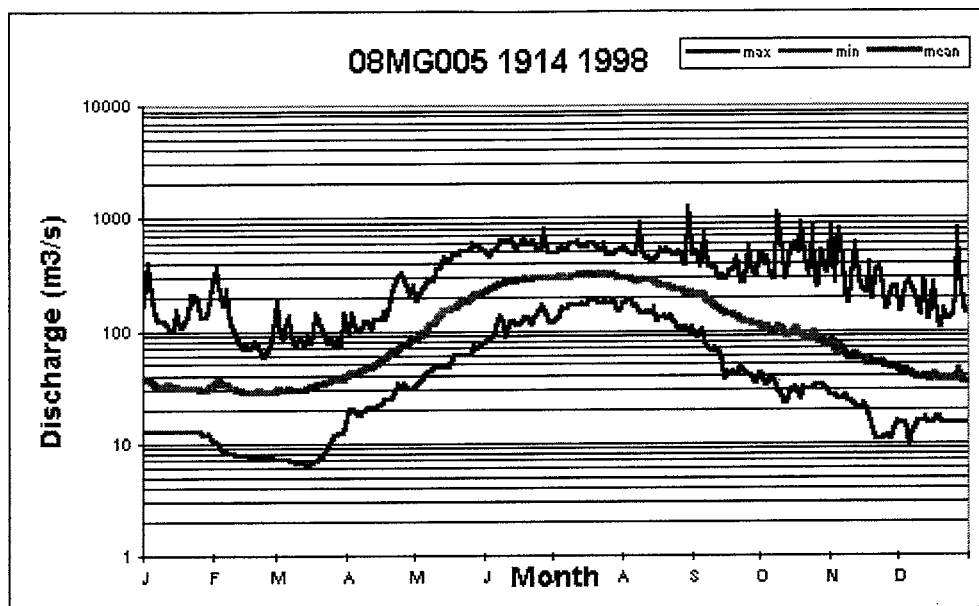
All Ryan River water quality parameters were within the approved and working criteria for aquatic life established by the Water Quality Section of BC Ministry of Environment, Lands and Parks (BC Environment 1998).

#### **4.2.2 Hydrology**

Mean daily discharge patterns in the Ryan River watershed are typical of medium to large size BC coastal rivers where climatic conditions are dominated by relatively long and cold winters, and short, moderate summers. Although flows are not measured on the Ryan River, the annual discharge patterns are typical of the data presented in Figure 4 for the Lillooet River system. These data were collected at the Water Survey of Canada Station No. 08MG005 located near the mouth of the Lillooet River (UTM 10. 514276. 5575793).

Mean flow generally peaks between June and September, followed by a gradual decline until winter base-flow conditions are reached, usually in November or December. Base-flow conditions generally persist until around the middle of April when spring freshet usually begins. By prorating the flow according to basin area EBA (2001) estimated the mean annual discharge of the Ryan River to be between 16.8 and 24.8 m<sup>3</sup>/s.

**Figure 4 Mean daily flows for the Lillooet River, 1914 to 1998.**



## 4.3 HABITAT AND FISH DISTRIBUTION

### 4.3.1 Fish Habitat

A total of 39 stream sampling sites were included in the Ryan River reconnaissance fish and fish habitat inventory. The location of each site is shown on the map in Figure 2. The original prefield plan specified 40 sampling sites, however, in consultation with the Ministry Representative a number of changes were made to the original sampling plan while in the field to meet the overall project objective (i.e. to obtain a clear understanding of fish distribution in the watershed). In particular, a number of sites that were located in dry stream channels were moved to streams where flowing water was present, and extraordinary fishing efforts were conducted at most sites. These changes resulted in one less sampling site being completed during the field program.

Specific habitat characteristics recorded for the 39 sampling sites in the Ryan River watershed are shown in the FDIS printouts provided in Appendix 1. General habitat features are as follows:

- The lower Ryan River (Reaches 1-5), which extends upstream from the mouth for approximately 13 km, is confined within the overall Lillooet River floodplain. The stream channel in this section of the river has an average gradient of less than 1% and is confined to the east by flood control dykes that were constructed during the 1940s, and by the west by the slopes of the Pemberton Valley. Fish habitat in this section is considered of moderate value with no apparent migration barriers and small amounts of instream large woody debris.

An important observation is that access to much of the off-channel habitat has been limited by the above-mentioned dykes (EBA 2001).

- Upstream of the floodplain, between Reaches 6 and 10, the Ryan mainstem becomes confined and gradients increase to an average of approximately 4%. This section of the river ascends through a series of cascades for approximately 12 km, which extends to near the Ryan River-Petersen Creek confluence. Based on the results of the fish sampling it appears as though these cascade features act as a velocity barrier to upstream fish movement. Fish habitat in these reaches is limited due to the confined nature of the stream channel as well as fast flows for much of the year.
- Between Reaches 11 and 13 on the Ryan mainstem, a length of approximately 9 km, the average gradient drops again to less than 1%. Riffle-pool morphology is dominant with gravel-cobble substrate. These reaches offer the highest quality fish habitat in the system, with abundant off-channel areas and considerable amounts for potential spawning and rearing habitat for salmonids. The 5-10 m high rock falls located at the upstream end of Reach 13 is a definite barrier to all upstream fish passage.
- Upstream of the falls the channel becomes more confined and average gradient increases to about 7% at the upper part of the mainstem. Substrate size generally increases in this section of the river and off-channel habitat and large woody debris are lacking.
- The main Ryan River tributaries are Wasp Creek and Petersen Creek. The Wasp Creek stream channel is generally confined with mean gradients of 18% to 23 % and limited potential fish habitat. Petersen Creek has a somewhat wider channel width with lower gradients and some salmonid fish habitat in its lower reaches.
- Water temperature and specific conductance are comparatively low throughout the Ryan River watershed, particularly in the upper portion of the drainage. These factors can have a negative effect on biological production, and may be contributing to the limited distribution of fish in the watershed.

#### **4.3.2 Fish Distribution**

Fish sampling was carried out at 35 of the 39 sites. The four sites excluded from the fish sampling program were located in dry channels. Sampling sites were well distributed throughout the Ryan River watershed and included a number of sites in the Ryan mainstem and the main tributaries Wasp and Petersen Creeks, as well as in a number of smaller tributaries. Consideration was given to the placement of sampling sites above and below barriers to fish passage, and the determination of the upstream extent of fish presence. Less emphasis was placed on fish sampling in the lower reaches of the Ryan River (in the Pemberton Valley) since reliable information on fish distribution in this area is available from previous studies.

The results of fish sampling efforts carried out under the Ryan River fish and fish habitat inventory are summarized below in Table 4. The extent of Forest Practices Code (FPC) fish species distribution based on previous data and the results of the inventory is shown on the

interpretative map provided in Appendix A2. Hardcopy project maps of the inventory area showing detailed site and reach information are provided in Appendix A3.

Fish were either caught or observed at only four of the 39 sites sampled during the field program. Only two species, field identified as coastal cutthroat trout and char, were captured during the sampling program. As discussed below, follow-up DNA analysis confirmed the presence of coastal cutthroat trout and bull trout. Both species are considered vulnerable (Conservation Data Centre Blue listing) and of regional significance by the BC Ministry of Water Land and Air Protection (MWLAP).

Salmonids that were observed in the Vans Creek headwater lake system were assumed to be rainbow trout since this species was stocked in lake in 1990. Fish sampling downstream of the lakes in Reach 2 of Vans Creek resulted in no fish being caught. Therefore, it is tentatively concluded that the fish distribution in the Vans Creek watershed is limited to the lake, its inflow streams and a short section of the outlet stream. However, given that salmonids are present in the headwater lake system, all of Vans Creek downstream of the lakes must be considered potentially fish bearing. It is important to note that almost immediately downstream of the lake system the outlet channel gradient becomes extreme and very little potential fish habitat is present until Reach 1. These upstream reaches may however serve as a migration corridor or provide some holding or rearing habitat.

No fish were caught anywhere in the Ryan River watershed above Reach 8 of the mainstem. This location corresponds to approximately km 10 on the Ryan main access road. A series of cascades is present in Reach 9, which may act as a velocity barrier to the upstream movement of fish in the watershed. Prior to this study the 5-10 m high rock falls situated at the break between Reaches 13 and 14 on the Ryan mainstem was assumed to be the upstream limit of fish distribution the watershed. The comparatively cold and turbid glacial waters of the Ryan River may also be a factor in limiting fish distribution in the system. It should be noted that what appears to be good salmonid rearing and spawning habitat is present in Reaches 10 through 13 of the Ryan River mainstem.

The upstream extent of fish distribution in the Ryan River watershed is highlighted in red on the map in Figure 2.

**Table 4 Summary of fish capture results for the Ryan River watershed.**

Stream Name	Watershed Code / ILP	Map	Reach	Site	Species Captured
Unnamed	ILP 60	92J.046	1	202	bull trout and coastal cutthroat trout
Ryan River	119-532200	92J.045	8	150	bull trout
Vans Creek	119-532200-22000	92J.046	7	121	rainbow trout – salmonids observed in lake, which is Reach 8
Unnamed	119-532200-23100	92J.046	2	201	coastal cutthroat trout

A total of five char tissue samples were submitted to the University of British Columbia for analysis to determine whether specimens collected were either Dolly Varden, bull trout or a cross. Each individual was assessed at 2 nuclear loci (growth hormone and metallothionine) which have alleles diagnostic for Dolly Varden and bull trout. The results of DNA testing, which are provided in Attachment 3, confirmed all char samples to be bull trout. Additionally, four tissue samples were collected from trout captured in the Ryan watershed and submitted for DNA analysis. All trout were field identified as cutthroat, which was confirmed by the DNA testing.

Voucher specimens were collected for char (bull trout) and cutthroat trout captured in the watershed. The resulting identifications confirmed field identifications made and are provided as Attachment 3. The voucher specimen identifications have been incorporated into the FDIS database.

Although timing of the field program corresponded in general with timing for adult salmon spawning migration, no anadromous salmonids were captured or observed at sampling locations within the watershed. Field crews made casual observations for spawning or migrating salmon at various times during the inventory. However, no fish were noted during these efforts. FISS information indicates that anadromous salmonids (e.g. chinook, coho, sea-run cutthroat trout) use the Ryan River system for spawning and incubation but this has only been recorded within the lower floodplain section of the mainstem. As previously indicated, these lower stream reaches were not included in the inventory sampling plan.

A summary of historic and new barriers to fish migration in the Ryan River watershed is provided below in Table 5. Although a number of features were noted from FISS and RAB records, only a few were actually verified in the field.

**Table 5 Summary of historic and new barriers to fish migration found in Ryan River watershed.**

Stream Name	Watershed Code / ILP	TRIM Map	Reach	Barrier Type	Barrier Height (m)	Verified in Field (Y / N)	Comments
Unnamed	ILP 11, 092J.036	92J.036	1	Beaver Dam	-	N	FISS / RAB Feature
Unnamed	ILP 157, 92J.045	92J.045	1	Cascade	0.3	Y	-
Ryan River	119-532200	92J.045	10	Fall	2	Y	-
Ryan River	119-532200	92J.045	10	Cascade	10	Y	Downstream of Peterson confluence
Ryan River	119-532200	92J.045	13	Log Jam	-	N	FISS / RAB Feature
Ryan River	119-532200	92J.045	13	Fall	10	Y	FISS / RAB Feature
Ryan River	119-532200	92J.045	14	Fall	10	Y	FISS / RAB Feature

Stream Name	Watershed Code / ILP	TRIM Map	Reach	Barrier Type	Barrier Height (m)	Verified in Field (Y / N)	Comments
Ryan River	119-532200	92J.045	14	Cascade	5	N	FISS / RAB Feature
Ryan River	119-532200	92J.044	15	Cascade	-	N	FISS / RAB Feature
Ryan River	119-532200	92J.044	15	Fall	8	N	FISS / RAB Feature
Ryan River	119-532200	92J.044	16	Log Jam	-	N	FISS / RAB Feature
Ryan River	119-532200	92J.044	18	Cascade	70	N	FISS / RAB Feature
Ryan River	119-532200	92J.044	20	Fall	10	Y	Barrier at downstream end of reach
Unnamed	119-532200-22000	92J.046	2	Fall	3	Y	u/s barrier to fish 50 m d/s of UTM above.
Wasp Creek	119-532200-40600	92J.045	1	Cascade	10	Y	Approximately 40 m upstream of confluence
Wasp Creek	119-532200-40600	92J.045	1	Fall	2	Y	Mouth of Wasp
Wasp Creek	119-532200-40600	92J.045	1	Cascade	6	Y	Mouth of Wasp
Wasp Creek	119-532200-40600	92J.045	1	Fall	2	Y	Side channel at mouth of Wasp
Wasp Creek	119-532200-40600	92J.045	1	Fall	20	Y	Upstream of road crossing
Petersen Creek	119-532200-47100	92J.045	2	Landslide	-	Y	FISS / RAB Feature
Petersen Creek	119-532200-47100	92J.045	3	Landslide	-	Y	FISS / RAB Feature
Petersen Creek	119-532200-47100	92J.045	4	Cascade	-	Y	FISS / RAB Feature
Petersen Creek	119-532200-47100	92J.035	9	Cascade	-	Y	FISS / RAB Feature
Unnamed	119-532200-74600	92J.044	1	Cascade	1.5	Y	15 m upstream of confluence
Unnamed	119-532200-74600	92J.044	1	Cascade	1.5	Y	20 m upstream of confluence.
Unnamed	119-532200-81300	92J.044	1	Cascade	-	N	FISS / RAB Feature
Unnamed	119-532200-81300	92J.044	3	Cascade	100	N	FISS / RAB Feature
Unnamed	119-532200-81300-50000	92J.044	1	Cascade	70	N	FISS / RAB Feature

Stream Name	Watershed Code / ILP	TRIM Map	Reach	Barrier Type	Barrier Height (m)	Verified in Field (Y / N)	Comments
Unnamed	119-532200-87000	92J.044	3	Fall	30	Y	-

With the exception of the series of small lakes on Vans Creek there are no records of fish presence in any of the lake systems in the Ryan River watershed. Many of the lakes in the watershed are at high elevations and glacier-fed, which make them poor candidates for fish stocking programs.

#### 4.4 FISH SIZE, AGE AND LIFE HISTORY

##### 4.4.1 Life History Information

No detailed life history information on Ryan River fish species was gathered during the inventory. However, some inferences can be made based on historical information (e.g. FISS references). Available life history information for fish species in the Ryan watershed is summarized below in Table 6.

**Table 6 Life history information for Ryan River fish species.**

Fish Species	Life History Information
Rainbow Trout	<ul style="list-style-type: none"> <li>Rainbow trout were stocked in the headwater lakes of Vans Creek in 1990. The continued presence of these fish was confirmed during the current inventory. It is assumed that these fish are spring spawners, which utilize the small lake inlet streams. Rearing most likely occurs primarily in the lake system.</li> </ul>
Coastal Cutthroat Trout	<ul style="list-style-type: none"> <li>Coastal cutthroat trout are present in the lower reaches of the Ryan mainstem, most likely up to and including Reach 8, as well as the lower reaches of some tributaries to these reaches.</li> <li>Spawning in coastal cutthroat generally occurs in the late winter or spring between February and May.</li> </ul>
Sea-Run Cutthroat Trout	<ul style="list-style-type: none"> <li>There is anecdotal evidence that sea-run cutthroat spawn in the lower reaches of the Ryan mainstem.</li> <li>These fish likely return to freshwater from the marine environment in late fall or early winter to spawn.</li> </ul>
Bull Trout	<ul style="list-style-type: none"> <li>Bull trout are present in the lower reaches of the Ryan mainstem up to and including Reach 8, as well as the lower reaches of some tributaries to these reaches.</li> <li>DNA analysis of char from the Ryan River watershed showed that these fish are bull trout, not Dolly Varden.</li> <li>Resident bull trout are fall spawners, and spawning is assumed to take place between August to November</li> </ul>

Fish Species	Life History Information
Chinook Salmon	<ul style="list-style-type: none"> <li>Chinook have been observed spawning in Reach 1 of the Ryan River.</li> <li>Spawning migration may start as early as July and end mid-Nov. with a peak around mid to late Sept.</li> <li>Chinook may rear in off-channel habitat in the lower Ryan River.</li> <li>It is assumed that juvenile chinook spend one year in the Ryan/Lillooet system prior to migration to the marine environment.</li> </ul>
Coho Salmon	<ul style="list-style-type: none"> <li>Coho have been observed spawning the Reaches 3 and 4 of the Ryan River.</li> <li>According to FISS records coho spawning migration occurs in October and spawning takes place between the beginning of November and the end of January.</li> <li>Coho may rear in off-channel habitat in the lower Ryan River.</li> <li>It is assumed that juvenile coho spend one year in the Ryan/Lillooet system prior to migration to the marine environment.</li> </ul>
Chum Salmon	<ul style="list-style-type: none"> <li>Chum salmon may use the lower reaches of the Ryan mainstem for spawning.</li> <li>Spawning migration may start in late August and continue into November. Spawning activity most likely peaks in late October.</li> </ul>
Pink Salmon	<ul style="list-style-type: none"> <li>Pink salmon may use the lower reaches of the Ryan mainstem for spawning.</li> <li>Spawning migration may start in late July or early August and continue until early Oct. with spawning activity most likely peaking in late September and early October.</li> </ul>
Sockeye Salmon	<ul style="list-style-type: none"> <li>A small sockeye run may use the lower reaches of the Ryan River for spawning.</li> <li>Juvenile sockeye may utilize Lillooet Lake for rearing (generally one year).</li> <li>Spring out-migration after one year of lake rearing.</li> </ul>

#### 4.4.2 Fish Size

A total of 13 fish were captured or observed at the four sites in the Ryan River watershed where fish sampling efforts were successful. Total fork length was recorded for each fish captured and estimates of length were made for fish observed (i.e. Vans Creek/Lake). Length data are presented below in Table 7.

**Table 7 Length data for fish caught in the Ryan River Watershed, October 1 to October, 2001.**

Stream Name	Watershed Code / ILP	Reach	Site #	Species	Length (mm)
Unnamed	ILP 61	1	202	bull trout	66
Unnamed	ILP 61	1	202	coastal cutthroat trout	156
Unnamed	ILP 61	1	202	coastal cutthroat trout	203
Unnamed	ILP 61	1	202	coastal cutthroat trout	205
Ryan River	119-532200	8	150	bull trout	70
Ryan River	119-532200	8	150	bull trout	107
Ryan River	119-532200	8	150	bull trout	113

Stream Name	Watershed Code / ILP	Reach	Site #	Species	Length (mm)
Ryan River	119-532200	8	150	bull trout	175
Vans Creek / Lake	119-532200-22000	7 / 8	121	rainbow trout	100
Vans Creek / Lake	119-532200-22000	7 / 8	121	rainbow trout	150
Vans Creek / Lake	119-532200-22000	7 / 8	121	rainbow trout	250
Vans Creek / Lake	119-532200-22000	7 / 8	121	rainbow trout	350
Unnamed	119-532200-23100	2	201	coastal cutthroat trout	112

The collection of fish weight and age data was not required under the terms of reference for the inventory.

## 4.5 SIGNIFICANT FEATURES AND FISHERIES OBSERVATIONS

### 4.5.1 Fish and Fish Habitat

During the field data collection program no new critical habitats such as large spawning aggregations, staging areas, or other instances where special protection, enforcement, or management measures might be applicable were identified. The presence of both bull trout and coastal cutthroat trout in the Ryan River watershed has been confirmed. These species are considered vulnerable (blue listed) in British Columbia and as such warrant particular attention from a management perspective.

### 4.5.2 Habitat Protection Concerns

#### 4.5.2.1 Fisheries Sensitive Zones

No specific fisheries sensitive zones were observed during the field data collection program in the Ryan watershed. However, in the floodplain section of the Ryan (i.e. Reaches 1-5) access to off-channel areas has been limited to a large extent by the dyking work carried out in the 1940s. In this regard, EBA (2001) has recommended further formulation and possible implementation of several off-channel habitat development projects in these reaches. Upstream of the floodplain section good existing off-channel habitat was observed in Reaches 6, 7, 14, 15 and 16. No fish are present in reaches 14-16, which eliminates the development of any in-stream fish enhancement project under the Watershed Restoration Program. However, since fish are present in the Ryan mainstem up to Reach 8 there may be some potential enhancement work, particularly targeting bull trout, in Reaches 6 and 7.

#### 4.5.2.2 Fish Above 20% Gradients

Of 39 sample sites surveyed, three were found to have gradients exceeding 20%. Only two of these sites could be sampled for fish (Sites 101 and 209). However, fishing efforts were unsuccessful in each case.

#### 4.5.2.3 Restoration and Rehabilitation Opportunities

No specific restoration or rehabilitation options are recommended based on the results and observations generated during the inventory. However, the Ryan River mainstem and its major tributaries are analyzed and opportunities for restoration are discussed in a Watershed Restoration Plan prepared by EBA (2001) for Terminal Forest Products Ltd. Based on the results of the EBA study there may be opportunities for the development of several off-channel habitat projects on the lower Ryan River (Reaches 1-5).

## 4.6 FISH BEARING STATUS

### 4.6.1 Fish Bearing Reaches

Information concerning the four fish bearing reaches identified during the inventory site surveys is listed below in Table 8. Based on these fish sampling results it has been assumed that all Ryan River mainstem reaches downstream of and including Reach 8 are fish bearing, and that the first reach of all tributary streams flowing into these reaches are also potentially fish bearing. Furthermore, the mainstem of Vans Creek, from the headwater lakes to its confluence with the Ryan, must be considered fish bearing given the presence of rainbow trout in the lakes.

**Table 8 Summary of data from surveyed fish bearing reaches in the Ryan River Watershed.**

Stream Name	Watershed Code / ILP	Reach	Site	Species	Channel Width (m)	Field Site Gradient (%)	Follow-up Sampling	Comments
Unnamed	61	1	202	CCT, BT	4.6	0.5	N	First reach of small tributary to the Ryan.
Ryan River	119-532200	8	150	BT	38.2	2	N	Upstream limit of fish bearing reaches in watershed.
Vans Creek	119-532200-22000	7 / 8	121	RB	4.7	1	Y	Fish observed in headwater lake
Unnamed	119-532200-23100	2	201	CCT	4.1	11	N	Fish sampled upstream of dry stream channel section.

### 4.6.2 Non-Fish Bearing Reaches

Information on non-fish bearing reaches surveyed during the Ryan River inventory is summarized below in Table 9.

### **4.6.3 Follow-up Sampling Required**

No high-priority follow-up fish sampling of non-fish bearing reaches in the Ryan River watershed is recommended. The fish sampling program implemented under the inventory, along with the results of previous fish sampling efforts, have provided sufficient information to adequately defined fish distribution within the watershed. One possible low-priority follow-up sampling initiative could be to determine the status of fish populations in the Vans Creek headwater lakes. As previously indicated, these lakes were stocked with rainbow trout in 1990 and fish were observed in the lakes during the current inventory field program. A late spring sampling program may provide useful information about the extent of spawning as well as overall fish populations in the lakes.

**Table 9 Summary of data from surveyed non-fish bearing reaches in the Ryan River Watershed.**

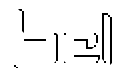
Stream Name	Watershed Code / ILP	Reach	Site	Site Gradient (%)	Electrofishing Specifications				Other Methods		Comments
					Dist. (m)	Time (s)	Cond. ( $\mu\text{S}/\text{cm}$ )	Temp (C)	Type	Mtd	
Ryan River	119-532200	10	106	3	180	680	30	6	MT	5	Upstream of suspected velocity barrier in R. 9
Ryan River	119-532200	10	114	14	200	519	30	3	MT	5	Cascades and small falls in this part of reach
Ryan River	119-532200	12	210	2	400	890	10	3	MT	4	Upstream of suspected velocity barrier in R. 9
Ryan River	119-532200	13	212	1	200	592	70	6	MT	4	10 m falls at break between Reaches 13 & 14
Ryan River	119-532200	15	207	2	300	896	20	4	MT	4	Upstream of barrier falls in Ryan Reach 13
Ryan River	119-532200	16	215	2	200	528	10	1	MT	4	Upstream of barrier falls in Ryan Reach 13
Ryan River	119-532200	17	113	2	150	918	20	5	MT	3	Upstream of barrier falls in Ryan Reach 13
Ryan River	119-532200	20	109	1	120	498	10	5	MT	3	Upstream of barrier falls in Ryan Reach 13
Vans Creek	119-532200-22000	2	101	28	150	306	30	8	MT	5	Steep gradient and falls present in this reach
Vans Creek	119-532200-22000	7	121	34	-	-	20	4	-	-	Steep gradient – no fish sampling
Wasp Creek	119-532200-40600	1	203	15	100	773	20	6	MT	5	Upstream of suspected velocity barrier in R. 9 of Ryan River
Wasp Creek	119-532200-40600	2	115	12	100	151	20	5	MT	3	Upstream of barrier falls and cascades in R. 1
Wasp Creek	119-532200-40600	4	119	4	100	413	20	4	MT	4	Upstream of barrier falls and cascades in R. 1
Wasp Creek	119-532200-40600	5	120	4	100	272	20	3	MT	4	Upstream of barrier falls and cascades in R. 1
Petersen Creek	119-532200-47100	1	102	2	200	923	40	4	MT	5	Upstream of suspected velocity barrier in R. 9 of Ryan River
Petersen Creek	119-532200-47100	2	104	5	100	356	30	5	MT	5	Upstream of suspected velocity barrier in R. 9 of Ryan River
Petersen Creek	119-532200-47100	7	118	2	150	366	10	3	MT	3	Upstream of suspected velocity barrier in R. 9 of Ryan River
Unnamed	119-532200-47100-43200	2	217	11	100	640	10	2	-	-	Upstream of suspected velocity barrier in R. 9 of Ryan River
Unnamed	119-532200-40000	1	116	19	-	-	-	-	-	-	Dry stream channel at time of sampling

Stream Name	Watershed Code / ILP	Reach	Site	Site Gradient (%)	Electrofishing Specifications				Other Methods		Comments
					Dist. (m)	Time (s)	Cond. ( $\mu$ S/cm)	Temp (C)	Type	Mtd	
Unnamed	119-532200-56700	1	204	13	100	394	30	5	MT	2	Upstream of suspected velocity barrier in R. 9 of Ryan River
Unnamed	119-532200-57600	1	213	13	-	-	70	13	-	-	Not sufficient water for fish sampling
Unnamed	119-532200-65400	1	209	11	150	533	30	5			Upstream of barrier falls in Ryan Reach 13
Unnamed	119-532200-70300	1	206	12	-	-	50	5	-	-	Not sufficient water for fish sampling
Unnamed	119-532200-74600	1	216	16	200	387	10	4	-	-	Upstream of barrier falls in Ryan Reach 13
Unnamed	119-532200-81300	1	112	2	100	584	20	6	MT	3	Upstream of barrier falls in Ryan Reach 13
Unnamed	119-532200-81300	2	111	4	120	374	20	5	MT	3	Upstream of barrier falls in Ryan Reach 13
Unnamed	119-532200-81300	6	214	12	100	360	10	2	MT	4	Upstream of barrier falls in Ryan Reach 13
Unnamed	119-532200-81300-26800	4	117	1	150	299	40	2	MT	3	Upstream of barrier falls in Ryan Reach 13
Unnamed	119-532200-84600	1	110	1	100	459	10	5	MT	3	Upstream of barrier falls in Ryan Reach 13
Unnamed	119-532200-87000	1	108	4	100	349	10	4	MT	3	Upstream of barrier falls in Ryan Reach 13
Unnamed	119-532200-87000	2	107	6	100	219	10	2	MT	3	Upstream of barrier falls in Ryan Reach 13
Unnamed	157	1	105	1	40	112	130	7			Upstream of suspected velocity barrier in R. 9 of Ryan River
Unnamed	158	1	103	17	-	-	30	7	-		Not sufficient water for fish sampling
Unnamed	297	1	211	6	100	340	90	5			Upstream of suspected velocity barrier in R. 9 of Ryan River
Unnamed	395	1	208	2	100	294	90	5	-	-	Upstream of barrier falls in Ryan Reach 13
Unnamed	414	1	205	7	100	226	20	3	MT	4	Upstream of barrier falls in Ryan Reach 13

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