

***CACHE CREEK
TO THE
ROCKIES PROGRAM***

**Trans Canada Highway
Existing Conditions Report**

**APPENDIX 5
FISHERIES**

Fall, 1998



**BRITISH
COLUMBIA**

**Ministry of Transportation
and Highways**

Existing Conditions Report – Fisheries

Table of Contents

Introduction.....	vii
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Section A: Cache Creek to Canoe Creek

Prepared by LGL Environmental Associates Ltd.

1.0	Introduction.....	2
2.0	Methods.....	2
3.0	Results.....	4
3.1	Cache Creek to Monte Creek.....	4
3.2	Monte Creek to Sorrento West	4
3.3	Sorrento West to Balmoral (Ford Road).....	5
3.4	Balmoral to Canoe	5
4.0	References.....	8

Section B: Canoe to Mount Revelstoke National Park West Gate

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B1: Canoe to Taft Road

1.0	Overview.....	2
2.0	Methods and Approach	2
3.0	Preliminary Assessment.....	3
3.1	Section 1: Canoe to Sicamous Narrows.....	3
3.2	Section 2: Sicamous Narrows	4
3.3	Section 3: Sicamous Narrows to the Upgraded Section of Highway Yard Creek	4
3.4	Section 4: Malakwa to Crazy Creek	4
4.0	References.....	9

B2: Taft Road to Victor Lake

1.0	Overview.....	11
2.0	Methods and Approach	12
3.0	Preliminary Assessment.....	13
3.1	Section 1: Crazy Creek to Eagle River Bridge	13
3.2	Section 2: Eagle River Bridge to Enchanted Forest.....	13
3.3	Section 3: Enchanted Forest to West End of Griffin Lake	13
3.4	Section 4: Griffin Lake	14
3.5	Section 5: East End of Griffin lake to Three Valley Lake (West End).14	
3.6	Section 6: Three Valley Lake.....	14
3.7	Section 7: Eagle River Valley to Victor Lake.....	15
4.0	References.....	19

Table of Contents – continued

B3: Victor Lake to Revelstoke Park West Gate

1.0 Overview.....	21
2.0 Methods and Approach.....	21
3.0 Preliminary Assessment.....	22
3.1 Section 1: West end of Victor Lake to Clanwilliam Lake Headwaters.....	22
3.2 Section 2: Headwaters of Tonkawatla Creek to Columbia River	23
3.3 Section 3: Mainstem Columbia River.....	24
3.4 Section 4: Mouth of Illecillewaet River Upstream to West Westgate of Revelstoke Park	24
4.0 References.....	30

**Section C: Mount Revelstoke Park West Gate
to Yoho Park West Boundary**

Prepared by Coast Mountain Environmental Services Ltd.

C1: Mount Revelstoke Park West Gate to Donald

1.0 Introduction.....	2
2.0 Study Area / Background.....	2
3.0 Methods.....	2
3.1 General.....	2
3.2 Fish Habitat Rating Criteria.....	5
4.0 Findings	7
5.0 References.....	18

C2: Donald to Roth Creek

1.0 Introduction.....	21
2.0 Study Area	21
3.0 Methods.....	21
3.1 General.....	21
3.2 Fish Habitat and Other Aquatic Features Rating Criteria.....	23
4.0 Findings	24
5.0 References.....	34

C3: Roth Creek to Brake Check

1.0 Introduction.....	37
2.0 Study Area	37
3.0 Methods.....	37
3.1 General.....	37
3.2 Fish Habitat Rating Criteria.....	39
4.0 Findings	40
5.0 References.....	44

Table of Contents – continued

C4: Brake Check to Yoho Park West Boundary

1.0	Introduction.....	46
2.0	Study Area	46
3.0	Methods.....	46
3.1	General	46
3.2	Fish Habitat Rating Criteria	48
4.0	Findings	49
5.0	References.....	54

List of Tables

Section A: Cache Creek to Canoe

Table A1.	Existing aquatic features along Trans Canada Highway between Cache Creek and Monte Creek	6
Table A2.	Existing aquatic features along Trans Canada Highway between Monte Creek and Sorrento West.....	6
Table A3.	Existing aquatic features along Trans Canada Highway between Sorrento West and Balmoral.....	7
Table A4.	Existing aquatic features along Trans Canada Highway between Balmoral and Canoe Creek	7

Section B: Canoe to Mount Revelstoke National Park West Gate

B1: Canoe to Taft

Table B1.	Listing of aquatic habitat features and preliminary sensitivity ratings for TCH Segment 950 between Canoe (LKI 6.50) and Sicamous (LKI 27.10)	6
Table B2.	Listing of aquatic habitat features and preliminary sensitivity ratings for TCH Segment 960 between Sicamous (LKI 0.00) and Crazy Creek (LKI 32.50)	7

B2: Taft to Victor Lake

Table B3.	Listing of aquatic habitat features and preliminary sensitivity ratings between Crazy Creek (LKI 32.76) and Griffin Lake (LKI 44.61)	16
Table B4.	Listing of aquatic habitat features and preliminary sensitivity ratings between Griffin Lake (LKI 44.61) and the west end of Victor Lake (LKI 56.15).....	17

B3: Victor Lake to Mount Revelstoke National Park West Gate

Table B5.	Listing of aquatic habitat features and preliminary sensitivity ratings between Victor Lake (west end) and the Columbia River at Revelstoke.....	26
-----------	--	----

List of Tables - Continued

Table B6.	Listing of aquatic habitat features and preliminary sensitivity ratings between Columbia River at Revelstoke and the West Gate of Revelstoke National Park	27
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**Section C: Mount Revelstoke National Park West Gate
to Yoho National Park West Boundary**

C1: Mt. Revelstoke Park West Gate to Donald

Table C1.	Corridor Boundaries.....	3
Table C2.	Potential Fish Habitat Rating System for Streams and other Aquatic Features	6
Table C3.	Summary of Streams and MoTH Sensitivity Ratings for Corridor Segments 260 and 280	8
Table C4.	Summary of Point Features and Fisheries Information	12
Table C5.	Summary of Corridor Features and Potential Fish Habitat Sensitivity Rating.....	16
Table C6.	Scientific names and abbreviations for fish species known to occur within streams in Corridor Segments 260 and 280	18

C2: Donald to Kicking Horse Canyon

Table C7.	Number of High, Medium, and Low Sensitivity Streams within each Corridor Segment	25
Table C8.	Summary of Point Features and Fisheries Information	28
Table C9.	Summary of Corridor Aquatic and Riparian Features	31
Table C10.	Scientific Names and Abbreviations for Fish Species Known to Occur within the Upper Columbia River	33

List of Tables - continued

C3: Kicking Horse Canyon to Yoho Park West Boundary

Table C11. Summary of Point Features and Fisheries Information	41
Table C12. Summary of Corridor Features and Potential Fish Habitat Sensitivity Rating.....	42
Table C13. Number of High, Moderate, and Low Sensitivity Streams.....	43

C4: Brake Check to Yoho Park West Boundary

Table C14. Number of High, Moderate and Low Sensitivity Streams within the MoTH Region 3 Design Section.....	49
Table C15. Summary of Point Features and Fisheries Information	50
Table C16. Summary of Corridor Features and Potential Fish Habitat Sensitivity Rating.....	52

Introduction

Three fisheries consultants were retained by the Ministry of Transportation and Highways to provide assessment services for the Cache Creek to Rockies Program. The firms and their areas of responsibility for the program are as follows:

- LGL Ltd. Environmental Research Associates - *Cache Creek to Canoe*
- P. A. Harder and Associates Ltd. – *Canoe to Mt. Revelstoke Park West Gate*
- Coast River Environmental Services Ltd. - *Mt. Revelstoke Park West Gate to Yoho Park West Boundary.*

Their first deliverable was to provide an overview of sensitivities and habitat conditions along this portion of the Trans Canada corridor. This appendix is a compilation of the reports prepared to document existing conditions. The information provided in this appendix is supplemental to the fisheries information presented in the main existing conditions photo-mosaic report.

In this appendix, the fisheries consultants have ranked point-specific sensitivities, such as a stream crossing either high, moderate or low. Ranking criteria for high, moderate and low sensitivity were developed in consultation with recognized standards and with each other, to provide a consistent ranking of sensitivities along the corridor. Any variation in the criteria used to establish a ranking level is attributable to the differing regional fisheries issues and levels of available information regarding the resource. For example, fish resources are relatively well documented in the Cache Creek to Canoe program area, but very little documentation exists for fish resources between Mt. Revelstoke Park and the Columbia River. Therefore, the level of effort in original fieldwork was much higher in the latter area than in the former, and is reflected in the documentation provided in this report.

In the Mt. Revelstoke Park West Gate to Yoho Park West Boundary area, corridor level fisheries sensitivities were also documented. Corridor features were mapped on the basis of general fish habitat sensitivity within 100m of the highway.

Appendix 5

Existing Conditions Report – Fisheries

Section A: Cache Creek to Canoe Creek

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**Existing Conditions Report
Appendix 5 – Fisheries**

Section A: Cache Creek to Canoe Creek

1.0 Introduction

The Thompson River system is a very important salmon producing area and is a major contributor to the total Fraser River salmon production and to genetic diversity of Fraser salmon. Salmon use the watercourses in the North and South Thompson River basins for rearing, migration and spawning. This includes the major river systems and the small tributaries to these larger rivers. Resident fish species are also found throughout the basin.

The Trans Canada Highway between Cache Creek and Canoe Creek is often within 500m of the Thompson River and South Thompson River for most of the highway's length. In several places, the highway is within 100m of the Thompson River, South Thompson River, or Shuswap Lake. There are numerous crossings by the highway of tributary streams to the Thompson or South Thompson, many of which are important fish streams.

This report summarizes existing conditions of fish habitat and aquatic stream environments along the Trans Canada Highway from Cache Creek to Canoe. Sensitivity ratings for these habitats were developed to distinguish sensitive habitats from non-sensitive habitats. The results are portrayed on the 11x17 photomosaics in this Existing Conditions report with supporting information provided in the tables to this appendix. Additional information was collected at important stream crossings and these data are provided in a separate database that is not directly part of this report.

2.0 Methods

A reconnaissance level assessment of important fish and aquatic habitats was undertaken during the week of November 9, 1998. The assessment included a brief field visit and collection of baseline data within a 100m section of each stream, aquatic feature, or shoreline encroachment. This was augmented by a review of existing literature and interviews with Department of Fisheries and Oceans staff and Ministry of Environment, Lands and Parks staff in Kamloops.

The data collected was compiled and synthesized into a table of 5 summary variables: Location Kilometre Inventory (LKI) point, aquatic feature name, road feature, habitat use, and sensitivity rating.

Aquatic Feature Name

The aquatic feature name was obtained from 1:20,000 TRIM mapping and cross-referenced to gazetted names where possible.

Road Feature

The road feature at each stream crossing or encroachment by the alignment was identified as either: bridge (BR), box culvert (BC), round culvert (RC), or none in the case of encroachments. A subscript denoting culvert material (concrete or metal) was also included.

Habitat Use

Habitat use was defined as rearing (R), spawning (S), or migration (M). Habitat use was recorded for either known or potential for each category.

Sensitivity Rating

A simple rating of high (H), Moderate (M) or low (L) was used to describe existing fish values (termed sensitivity) at point features (stream crossing) and corridor features (areas of encroachment parallel to the highway). The sensitivity ratings are defined in the table below.

The category Low includes all non-fish bearing streams, tributary to the Thompson or South Thompson system, that are illustrated on 1:20,000 TRIM maps.

Sensitivity Rating	Definition
High	denotes a well-defined aquatic feature, such as a stream or lake that supports anadromous, resident trout, char, or other provincially significant species, where access is not restricted by a natural barrier, or there is high fisheries potential
Moderate	denotes an aquatic feature that has limited fish use by resident species only (not salmon, trout or char), with limited potential for fish production, but has strong linkages to downstream important fish habitat (i.e. provides food, nutrients, and quality water to downstream habitats)
Low	denotes an aquatic feature that may or may not be well defined, has no fish species present, poor fisheries potential, but may have seasonal linkages to downstream fish habitat

3.0 Results

3.1 Cache Creek to Monte Creek

Eighteen streams (all named on TRIM) were assessed along the section of the highway, between Cache Creek and Monte Creek (Table A1). Of these, eight are known to currently have, or have the potential to support anadromous salmon as well as resident species of fish: Bonaparte River, Cache Creek, Deadman River, Thompson River, South Thompson River, Campbell Creek and Monte Creek. An additional four streams are suspected to support limited resident trout populations. These are Cherry Creek, Peterson Creek, Bathe Creek and Durand Creek.

Along the corridor, eight aquatic features within the highway right-of-way (50m either side of the centreline) were identified as having high fish sensitivity. Six of these are existing stream crossings and two are encroachments by the highway within 50m of the waterbody. Four streams and one encroachment have moderate fish sensitivity because of a suspected but limited presence of small trout populations. The remaining three streams and three "ditches" all have low fish sensitivity as do the numerous other crossings of small water courses by the highway.

Four of the stream crossings have spanning bridges and four have culverts in varying states of conditions. The culverts at Cherry Creek and Monte Creek are perched and not functioning well from a fisheries perspective. The two linear encroachments within 50m of an aquatic feature are along lower Cache Creek (LKI 0.2 to 1.2, west bound) and along Cherry Creek (LKI 59.7 to 60.0 and 62.0 to 64.4, east bound).

3.2 Monte Creek to Sorrento West

Eleven aquatic features (all named on TRIM) were assessed along this section of the highway, between Monte Creek and Sorrento West (Table A2). Of these, two are lakes (Little Shuswap and Shuswap) and three are streams known to support, or have the potential to support anadromous salmon as well as resident species of fish: Harper Creek, Chase Creek and Little River (South Thompson).

Along the corridor, four aquatic features within the highway right-of-way (50m either side of the centreline) were identified as having high fish sensitivity. One of the features is an existing stream crossing and three are encroachments by the highway within 50m of the water body. The stream crossing of Chase Creek is a spanning bridge. Harper Creek was identified as having moderate sensitivity because of the presence of rearing chinook downstream of the crossing. The remaining creeks in this section all received a moderate sensitivity rating due to the suspected presence of resident species, including rainbow trout.

The three linear encroachments within 50m of an aquatic feature include the south shore of Little Shuswap Lake (LKI 34 to 37, west bound), the south shore of Little River (LKI 38 to 41; west bound) and the south shore of Shuswap Lake (LKI 41 to 44.2; west bound).

3.3 Sorrento West to Balmoral (Ford Road)

Four streams (all named on TRIM) were assessed along the section of the highway, between Sorrento West and Balmoral (Ford Road) (Table A3). These four aquatic features within the highway right-of-way (50m either side of the centreline) were identified as having moderate fish sensitivity as they support (or are suspected to support) small populations of resident trout species.

3.4 Balmoral to Canoe

Six streams (all named on TRIM) were assessed along the section of the highway, between Balmoral and the mouth of Canoe Creek (Table A4). All of these are known to support anadromous salmon and/or resident trout

Along the corridor itself, six stream crossings were identified as having high fish sensitivity and two have moderate fish sensitivity. One of the stream crossings has a spanning bridge, two have round culverts and four have box culverts. Two of the box culverts on Canoe Creek are perched. The crossing of White Creek at LKI 66.4 was rated as high sensitivity. The culvert at this crossing is a box culvert in good condition.

Table A1. Existing aquatic features along Trans Canada Highway between Cache Creek and Monte Creek

Segment	LKI	Aquatic Feature	Road Feature	Habitat Use	Sensitivity
920	-0.25-0.15	Bonaparte River	none	M,R,S	H
920	0.1 – 1.2	Cache Creek	none	M,R,S	H
920	15.4	Battle Creek	RCm	M,R,S	M
920	32.3	Deadman River	BR	M,R,S	H
920	36.0	Thompson River	BR	M,R,S	H
920	41.0	Durand Creek	RCc	NONE	M
920	53.1	Brussels Creek	RCc	NONE	L
920	55.4	Duffy Creek	RCc	NONE	L
920.	55.8	Cherry Creek	2RCc	M,R,S	M
920	59.7-60.0, 62.0-64.4	Cherry Creek	None	M,R,S	M
2050	6.0	Guering Creek	BCc	NONE	L
2060	3.2	Peterson Creek	BR	R	M
925	0.5-1.1, 2.4-4.0	South Thompson River	None	S,R,M	H
925	7.0	McCrachen	RCm	NONE	L
925	7.4	McCrachen	RCm	NONE	L
925	8.2	Juniper Ditches	RCm	NONE	L
925	16.5	Campbell Creek	BCc	R,M,S	H
925	25.1	Monte Creek	RCm	R,M,S	H

Table A2. Existing aquatic features along Trans Canada Highway between Monte Creek and Sorrento West

Segment	LKI	Aquatic Feature	Road Feature	Habitat Use	Sensitivity
935	6.5	Dry Creek	RCm	SUSPECTED	M
935	8.2	Neds Creek	RCc	SUSPECTED	M
935	12.8	Martin Creek	RCm	SUSPECTED	M
935	13.8	Laveau Creek	RCm	NONE	L
935	15.7	Harper Creek	RCm	R	M
935	29.5	Chase Creek	BR	M,R,S	H
935	34 - 37	Little Shuswap Lake	None	M,R,S	H
935	37.4	Chum Creek	RCc	SUSPECTED	M
935	38 to 41	Little River	None	M,R,S	H
935	41 – 44.2	Shuswap Lake	none	M,R,S	H
935	45.2	Poster Creek	RCm	SUSPECTED	M

Table A3. Existing aquatic features along Trans Canada Highway between Sorrento West and Balmoral.

Segment	LKI	Aquatic Feature	Road Feature	Habitat Use	Sensitivity
935	46.9	Unnamed Creek	RCc	R	M
935	48.06	McEwan Brook	RCc	R	M
935	60.8	Broderick Creek	RCm	M,R,S	M
935	61.1	White Creek	BCc	M,R,S	M

Table A4. Existing aquatic features along Trans Canada Highway between Balmoral and Canoe Creek.

Segment	LKI	Aquatic Feature	Road Feature	Habitat Use	Sensitivity
935	66.4	White Creek	BCc	R,M,S	H
935	68.1	Tappen Creek	BCc	R,M,S	H
935	72.8	Syphon Creek	RCm	R, M	H
935	78.1	Salmon River	BR	R,M	H
935	85.5	Canoe Creek	RCc	R	M
950	0.8	East Canoe Creek	BCc	R	M
950	2.1	Canoe Creek	BCc	M,R,S	H
950	5.0	Canoe Creek	BCc	M,R,S	H

4.0 References

- Acres, 1998. Trans Canada Highway Corridor (Kamloops to Alberta Border): Environmental Overview Assessment. Prepared for Ministry of Transportation and Highways.
- Aquatic Biophysical Maps: 092P02, 092P07, 092I06, 092I09, 092I14, 092I15, 082L14. Ministry of Environment, Lands and Parks.
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- Knapp, W., MD Nassichuk, et al. 1982. The Thompson River Basin: Pacific Salmon resources and Environmental Issues. Can. MS Rep. Fish. Aquat. Sci. 1668: viii+117p.
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Appendix 5

Existing Conditions Report – Fisheries

Section B: Canoe to Mt. Revelstoke National Park West Gate

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Fall, 1998

**Existing Conditions Report
Appendix 5 – Fisheries**

Section B1: Canoe to Taft Road

1.0 Overview

The study area extends from the eastern municipal boundary of Canoe east along the Trans Canada Highway (TCH) over a distance of approximately 48 km to the Crazy Creek crossing located east of Perry River. The western portion of the highway between Canoe and Sicamous is located high up on the valley wall along the south shore of Shuswap Lake. The remaining segments of the highway parallel the Eagle River. The highway crosses the Eagle River to the north side of the valley near Malakwa. Shuswap Lake and the Eagle River provide highly important fish habitats and are considered Class 1 habitats. The major watercourse crossings along this section of the highway include Sicamous Narrows (LKI 25.75), Owlhead Creek (LKI 2.81), Yard Creek (LKI 15.0), Gorge Creek (LKI 25.32), Perry River (LKI 29.00) and Crazy Creek (LKI 32.50). These are all important fish bearing streams or migration corridors (Sicamous Narrows). There are also a number of unnamed tributaries to the Eagle River which provide moderate to high habitat values.

2.0 Methods and Approach

A preliminary assessment of fish habitat capabilities and environmental sensitivity was made for all of the watercourses crossed by or located within 50 m of the TCH. This preliminary habitat assessment was based on a cursory examination of habitat conditions as observed during October 1998. Existing information was used when available. Watercourses were classified into five stream types based on the following criteria:

- Class 1. Water runs characterized by a poorly defined stream channel and ephemeral flow characteristics. These streams would not be capable of supporting fish and have a minor contribution to downstream habitats.
- Class 2. Small defined stream channels (less than 1 m) which do not provide fish habitat but may contribute significant quantities of nutrients, invertebrates and/or water to downstream habitats.
- Class 3. Small creek channels which may provide low to moderate fish habitat capabilities. Fish access may be limited to high flow conditions.
- Class 4. Aquatic habitats which could support salmonid fish and provide moderate to high habitat capabilities for spawning, rearing and/or over-wintering use. These would include large streams (greater than 10 m wide), rivers, lakes and wetland areas.

- Class 5. Aquatic habitats which support salmonid fish and provide high habitat capabilities for spawning, rearing and/or over-wintering use. These would include large streams (greater than 10 m wide), rivers, lakes and wetland areas.

An environmental sensitivity rating of low, moderate or high was applied to each watercourse. These sensitivity ratings were based on an assessment of habitat capabilities, known or suspected fish use, and a general consideration of erosion potential and sediment transport capabilities and possible aquatic impacts. The criteria used for these sensitivity ratings are described below:

- Low: Typically applied to Class 1 and 2 streams with no significant fish habitat capabilities and low potential for sediment erosion or transport.
- Moderate: Applied to those watercourses which could affect downstream fish habitat due to high erosion or sediment transport potential at the TCH crossing.
- High: Applied to watercourses with high fish habitat values including those systems supporting salmonid species and/or rare or endangered fish species, and/or areas with significant habitat enhancement potential.

Fish Resources

Shuswap Lake and the Eagle River support major populations of sockeye, kokanee, coho and chinook salmon as well as bull trout, west slope cutthroat, rainbow trout and mountain whitefish. There are also a number of non-salmonid species including sculpins, shiner, sucker, dace and carp. The Eagle River is the main spawning area for the Shuswap Lake kokanee population.

3.0 Preliminary Assessment

3.1 Section 1: Canoe to Sicamous Narrows

Highway Segment 960 - LKI 6.51 to 25.73

The TCH route follows the south shore of Shuswap Lake in this segment. The highway crosses a total of 23 unnamed water courses in this section (Table B1). Most of these were classified as water runs with no fish habitat capabilities. There were four unnamed tributaries which may provide limited fish habitat capabilities in this section. The first 4 km of highway to the east of Canoe is located close to the edge of Shuswap Lake. For the rest of the section the highway is located high up on the valley wall and there is a good buffer zone between the highway and the lake shore.

Environmental sensitivities in this section are low to moderate. There are no significant habitat capabilities at the unnamed watercourse crossings. Higher habitat values may exist in the lower reaches (near Shuswap Lake) in some of these watercourses. The Shuswap Lake shoreline provides high value fish habitat. Controlling slope erosion and sediment transport in the unnamed water courses would be important for the protection of these habitat values.

3.2 Section 2: Sicamous Narrows

Highway Segment 960 - LKI 25.73 to 25.83

Sicamous Narrows has an existing highway bridge crossing, plus two other bridges in the same vicinity. The banks of Sicamous Narrows have been modified by previous bridge construction work in the area. Sicamous Narrows is an important migration corridor for salmon en route to their spawning grounds (Table B1).

3.3 Section 3: Sicamous Narrows to the Upgraded Section of Highway near Yard Creek

Highway Segment 960 - LKI 0.00 to 11.65

This section of the TCH is 11.65 km long and is located on the south side of the Eagle River valley. The highway encroaches on the Eagle River in five locations in this section. The river banks are characterized by rip rap fills in these areas. The highway also encroaches on two relic oxbow habitats which provide moderately high fish habitat capabilities. These areas could also provide significant habitat mitigation/compensation opportunities. There are 10 watercourse crossings in this section (Table B2). Seven of these provide significant fish habitat capabilities and have a moderate to high rating for environmental sensitivity. The most important of these water courses are Owlhead Creek (LKI 2.81) and the unnamed tributaries at LKI 3.93, 7.12 and 11.53.

3.4 Section 4: Malakwa to Crazy Creek

Highway Segment 960 - LKI 20.40 to 32.50

This section extends over a distance of 12.10 km from the east end of the recently completed highway upgrade work near Malakwa to the TCH crossing of Crazy Creek. The highway route crosses from the south side of the Eagle River valley to the north side near Malakwa (LKI 20.85). There are 12 tributary crossings in this section (Table B2). The named tributaries include Legerwood and Gorge creeks, Perry River and Crazy Creek. With the exception of Legerwood Creek, all of these systems have high fish habitat values and environmental sensitivity ratings. Fish habitat capabilities are low to moderate in Legerwood Creek. There are four unnamed wetland tributaries which have moderate to high environmental sensitivity ratings. These are located at LKI 20.50, 25.80, 26.00 and 29.40. Adult coho salmon were observed in one of these tributaries (LKI 26.00) during November 1998.

From the Eagle River crossing at LKI 20.85 to a short distance west of the Craigallachie Overhead the highway is located well back from the active portion of the Eagle River floodplain. Environmental sensitivities are low in this section. There is a 200m section immediately east of the Craigallachie Overhead where the highway is close to wetland habitats in the active portion of the Eagle River floodplain. Highway improvement work in this area could affect existing fish habitat production capabilities. The CPR track is located between the Eagle River and the TCH from the Craigallachie Overhead east to the Perry River crossing. The location of the CPR track between the highway and river reduces the risk of direct environmental impact to the Eagle River in this section. The CPR track crosses back to the south side of the valley to the east of Perry River. The section of the TCH located on the north side of the valley to the east of Perry River encroaches on the active portion of the Eagle River floodplain in one location (LKI 30.10 to 30.26). Environmental sensitivities were rated as high in this section.

TABLE B1. Listing of aquatic habitat features and preliminary sensitivity ratings for TCH Segment 950 between Canoe (LKI 6.50) and Sicamous (LKI 27.10) - Existing Conditions Report: Graeme and Murray						
Drainage System	Highway Segment	LKI REFERENCE: Zone Site		Aquatic Habitat Feature	Stream Class	Environmental Sensitivity - Preliminary
Shuswap Lake Shore	950	6.51 to 25.73		Shuswap Lake Shore	5	HIGH: Not directly affected by TCH
Shuswap Lake Tributary	950		6.94	Drainage ditch	1	LOW: Potential sediment source
Shuswap Lake Tributary	950		7.38	Water Run	1	LOW: Potential sediment source
Shuswap Lake Tributary	950		8.34	Drainage ditch and slope erosion	1	LOW: Potential sediment source
Shuswap Lake Tributary	950		9.48	Water Run	1	LOW: Potential sediment source
Shuswap Lake Tributary	950		9.64	Drainage ditch and slope erosion	1	LOW: Potential sediment source
Shuswap Lake Tributary	950		10.54	Water Run	1	LOW: Potential sediment source
Shuswap Lake Tributary	950		11.78	Water Run	1	LOW: Potential sediment source
Shuswap Lake Tributary	950		13.34	Unnamed Tributary	2	LOW: Potential minor habitat concern
Shuswap Lake Tributary	950		13.88	<u>Water Run</u>	1	LOW: Potential sediment source
Shuswap Lake Tributary	950		14.64	Unnamed Tributary	2	LOW: Potential sediment source
Shuswap Lake Tributary	950		14.74	Water Run	1	LOW: Potential sediment source
Shuswap Lake Tributary	950		15.54	Water Run	1	LOW: Potential sediment source
Shuswap Lake Tributary	950		16.04	Water Run	1	LOW: Potential sediment source
Shuswap Lake Tributary	950		16.44	Water Run	1	LOW: Potential sediment source
Shuswap Lake Tributary	950		16.93	Water Run	1	LOW: Potential sediment source
Shuswap Lake Tributary	950		17.24	Water Run	1	LOW: Potential sediment source
Shuswap Lake Tributary	950		17.44	Unnamed Tributary	2	LOW: Potential minor habitat concern
Shuswap Lake Tributary	950		17.74	Unnamed Tributary	2	LOW: Potential minor habitat concern
Shuswap Lake Tributary	950		20.05	Water Run	1	LOW: Potential sediment source
Shuswap Lake Tributary	950		21.18	Water Run	1	LOW: Potential sediment source
Shuswap Lake Tributary	950		21.87	Water Run	1	LOW: Potential sediment source
Shuswap Lake Tributary	950		22.35	Water Run (dry)	1	LOW: Potential sediment source
Shuswap Lake Tributary	950		23.34	Water Run	1	LOW: Potential sediment source
Sicamous Narrows	950	25.73 to 25.83		Sicamous Narrows	5	HIGH: Important fish migration corridor
Shuswap Lake Tributary	950		26.40	Water Run (dry)	1	LOW: Potential sediment source
Eagle River Drainage	950					
Eagle River	950/960	27.16 to 0.050		Eagle River Encroachment #1	5	HIGH: Migration and rearing use

TABLE B2. Listing of aquatic habitat features and preliminary sensitivity ratings for TCH Segment 960 between Sicamous (LKI 0.00) and Crazy Creek (LKI 32.50) - Existing Conditions Report: Graeme and Murray						
Drainage System	Highway Segment	LKI REFERENCE:		Aquatic Habitat Feature	Stream Class	Environmental Sensitivity - Preliminary
		Zone	Site			
<i>Eagle River Drainage</i>	<i>960</i>	<i>00.00 to 32.50</i>		<i>Lower Eagle River Valley</i>		
Eagle River Tributary	960		0.50	Water Run (dry)	1	LOW: Potential sediment source
Eagle River	960	02.10 to 02.44		Eagle River Encroachment #2	5	HIGH: Migration and rearing use
Eagle River Tributary	960		2.81	Owlhead Creek	4/5	HIGH: Good habitat potential
Eagle River	960	03.70 to 04.00		Eagle River Encroachment #3	5	HIGH: Migration and rearing use
Eagle River Tributary	960		3.26	Unnamed Tributary	2	LOW: Potential sediment source
Eagle River Tributary	960		3.93	Unnamed Tributary	4	HIGH: Important habitat values and possible enhancement site
Eagle River	960	04.30 to 04.76		Eagle River Encroachment #4	5	HIGH: Migration and rearing use
Eagle River Tributary	960		4.70	Unnamed Tributary	2	MOD: High potential sediment source; existing erosion
Eagle River Tributary	960		5.45	Unnamed Tributary	2	MOD: Potential sediment source; possible enhancement site
Eagle River	960	06.10 to 06.30		Relic Ox Bow Channel	4	HIGH: Possible enhancement site
Eagle River	960	06.60 to 06.90		Relic Ox Bow Channel	4	HIGH: Possible enhancement site
Eagle River Tributary	960		7.12	Wetland Area in remnant channel	4	HIGH: Possible enhancement site
Eagle River Tributary	960		8.05	Unnamed Tributary	2	LOW: Potential sediment source
Eagle River Tributary	960		8.30	Unnamed Wetland Tributary	3	MOD: Potential sediment source; possible habitat impacts
Eagle River Tributary	960		9.45	Unnamed Tributary	2	LOW: Potential sediment source
Eagle River	960	11.00 to 11.38		Eagle River Encroachment #5	5	HIGH: Migration and rearing use
Eagle River	960		11.53	Wetland Area in remnant channel	4	HIGH: Possible enhancement site
Eagle River Drainage	960	11.65 to 20.40		Completed TCH Upgrade		Not evaluated in this study
Eagle River Tributary	960		20.50	Wetland tributary Channel	2	MOD: Potential habitat impacts
Eagle River	960		20.85	Eagle River Bridge Crossing	5	HIGH: Migration and rearing use
Eagle River Tributary	960		21.32	Unnamed Tributary	2	LOW: Potential sediment source
Eagle River Tributary	960		22.85	Water Run (dry)	1	LOW: Potential sediment source

TABLE B2.

Listing of aquatic habitat features and preliminary sensitivity ratings for TCH Segment 960 between
Sicamous (LKI 0.00) and Crazy Creek (LKI 32.50) - Existing Conditions Report: Graeme and Murray

Drainage System	Highway Segment	LKI REFERENCE:		Aquatic Habitat Feature	Stream Class	Environmental Sensitivity - Preliminary
		Zone	Site			
Eagle River Tributary	960		23.20	Legerwood Creek	2	MOD: Possible impacts.
Eagle River Tributary	960		25.32	Gorge Creek	4	HIGH: Migration, spawning and rearing
Eagle River Tributary	960	Last Spike	25.80	Unnamed Wetland Tributary	4	HIGH: Migration and rearing use
Eagle River Tributary	960	26.00 to 26.47	26.00	Unnamed Wetland Tributary	5	HIGH: Migration, spawning and rearing
Eagle River Tributary	960		29.00	Perry River Crossing	5	HIGH: Migration, spawning and rearing
Eagle River Tributary	960		29.40	Unnamed Wetland Tributary	4	MOD: Potential sediment source; possible habitat impacts
Eagle River	960	30.10 to 30.26		Floodplain habitat	5	HIGH: Fish use data required
Eagle River Tributary	960		30.50	Water Run (dry)	1	LOW: Potential sediment source
Eagle River Tributary	960		30.90	Water Run (dry)	1	LOW: Potential sediment source
Eagle River Tributary	960		32.50	Crazy Creek	5	HIGH: Migration, spawning and rearing

4.0 References

- Acres International Limited. 1991. Environmental and socioeconomic assessment of highway upgrading and realignment: Three Valley, British Columbia. Final Report. Prepared for Ministry of Transportation and Highways. Engineering Branch, Victoria BC. April 1991.
- Acres International Limited. 1998. Trans Canada Highway Corridor (Kamloops to Alberta border) Environmental Overview Assessment. Prepared for Ministry of Transportation and Highways. Thompson Okanagan Regional Office, Kamloops, BC. April 1998.
- Summit Environmental Consultants Ltd. 1998. Final Report Three Valley Lake Fisheries Assessment. Prepared for Ministry of Transportation and Highways. Project No. 655. Kamloops BC. April 1998.
- Urban Systems. 1998. Trans Canada Highway Corridor Management Plan Kamloops to the Alberta Border. Draft options generation and evaluation study. Prepared for Ministry of Transportation and Highways. Kamloops BC. September 1998.

**Existing Conditions Report
Appendix 5 – Fisheries**

Section B2: Taft Road to Victor Lake

1.0 Overview

This section of the project extends over a distance of 23.4 km from Crazy Creek to the west end of Victor Lake. The entire project area is within the upper reaches of the Eagle River watershed. The Eagle River drainage is part of the Shuswap Lake and Thompson/Fraser River system.

The Trans Canada Highway (TCH) is routed through the Eagle River valley from the Crazy Creek crossing upstream to Victor Lake which is located near the headwater divide of the Eagle and Tonkawatla river drainages. There are three major lake systems in this section: Griffin, Three Valley and Victor lakes. Downstream (west) of Griffin Lake, the TCH route alternates from the north side of the Eagle River valley to the south and then back to the north side, crossing the Eagle River twice. The highway route then follows along the north shore of Griffin Lake and the north side of the valley upstream to Three Valley Lake. The highway crosses the Eagle River immediately downstream of the Three Valley Lake and continues along the lakes' south shore. Upstream of Three Valley Lake the highway follows the south side of the river valley for a short distance before crossing over to the north side of the valley at the Three Valley Overhead (LKI 53.70). The highway continues along the north side of the valley past Victor Lake.

2.0 Methods and Approach

A preliminary assessment of fish habitat capabilities and environmental sensitivity was made for all of the watercourses crossed by or located within 50 m of the TCH. This preliminary habitat assessment was based on a cursory examination of habitat conditions as observed during October 1998. Existing information was used when available. Watercourses were classified into five stream types based on the following criteria:

- Class 1. Water runs characterized by a poorly defined stream channel and ephemeral flow characteristics. These streams would not be capable of supporting fish and have a minor contribution to downstream habitats.
- Class 2. Small defined stream channels (less than 1 m) which do not provide fish habitat but may contribute significant quantities of nutrients, invertebrates and/or water to downstream habitats.
- Class 3. Small creek channels which may provide low to moderate fish habitat capabilities. Fish access may be limited to high flow conditions.
- Class 4. Aquatic habitats which could support salmonid fish and provide moderate to high habitat capabilities for spawning, rearing and/or over-wintering use. These would include large streams (greater than 10 m wide), rivers, lakes and wetland areas.

- Class 5. Aquatic habitats which support salmonid fish and provide high habitat capabilities for spawning, rearing and/or over-wintering use. These would include large streams (greater than 10 m wide), rivers, lakes and wetland areas.

An environmental sensitivity rating of low, moderate or high was applied to each watercourse. These sensitivity ratings were based on an assessment of habitat capabilities, known or suspected fish use, and a general consideration of erosion potential and sediment transport capabilities and possible aquatic impacts. The criteria used for these sensitivity ratings are described below:

- Low: Typically applied to Class 1 and 2 streams with no significant fish habitat capabilities and low potential for sediment erosion or transport.
- Moderate: Applied to those watercourses which could affect downstream fish habitat due to high erosion or sediment transport potential at the TCH crossing.
- High: Applied to watercourses with high fish habitat values including those systems supporting salmonid species and/or rare or endangered fish species, and/or areas with significant habitat enhancement potential.

Fish Resources

The Eagle River drainage supports large populations of sockeye (*Onchorynchus nerka*) and coho (*O. kisutch*) salmon as well as several resident fish species including rainbow trout (*O. mykiss*), bull trout (*Salvelinus malma*), mountain whitefish (*Prosopium williamsoni*), and the land locked kokanee salmon (*O. nerka*). Some of the non-salmonid species found in this section of the drainage may include prickly (*Cottus asper*) and slimy sculpin (*C. cognatus*), redbelt shiner (*Richardsoni balteatus*), longnose dace (*Rhinichthys cataractae*), large scale sucker (*Catostomus macrocheilus*), and peamouth chub (*Mylocheilus caurinus*). The mainstem Eagle River is used as a migration corridor for adult and juvenile fish and also provides spawning and rearing habitat. The Department of Fisheries and Oceans (DFO) operates a hatchery near Perry River and routinely releases juvenile coho into this section of the Eagle River. DFO also operates a counting fence on the lower Eagle River.

Griffin and Three Valley lakes serve as migration corridors for adult sockeye and coho salmon en route to upstream spawning areas. The lakes also support resident populations of rainbow trout (stocked on an annual basis), lake trout and kokanee salmon and a number of non-salmonid fish species. Similar fish species are likely present in Victor Lake.

The fisheries database has been organized by these drainage areas and all information has been referenced to the LKI system developed by the B.C. Ministry of Transportation and Highways (MOTH).

3.0 Preliminary Assessment

3.1 Section 1: Crazy Creek to Eagle River Bridge

Highway Segment 170 - LKI 32.76 to 36.35

To the east of Crazy Creek (LKI 32.76), the Trans Canada Highway (TCH) follows along the north side of the Eagle River valley for approximately 5 km before crossing the river to the south side of the valley. The highway encroaches onto the bank of the river in three locations along this section. The CPR track is located up slope of the TCH throughout most of this segment except the first 0.7 km to the east of Crazy Creek. There are three unnamed tributary crossings and one water run in this section (Table B3). These water courses do not provide significant fish habitat capabilities.

Any highway encroachments affecting the mainstem Eagle River or adjacent riparian marsh areas could have a significant impact on fish production capabilities. Any highway work affecting the wetted portion of the river or the riparian areas would likely require habitat mitigation and/or compensation. Highway work affecting the tributary habitats would need to be designed to minimize erosion and sediment transport.

3.2 Section 2: Eagle River Bridge to Enchanted Forest

Highway Segment 170 - LKI 36.35 to 39.51

The TCH route is located on the south side of the Eagle River valley against the toe of the valley wall in this section. The river valley bottom is approximately 160 to 240 m wide with a low gradient, meandering channel. The riparian zone is a well developed wetland marsh with some back channel areas. There are four water runs and two unnamed tributaries which are crossed by the TCH in this section (Table B3). These water courses have low fish habitat capabilities.

Spawning sockeye salmon were observed at the Eagle River bridge immediately upstream of the Enchanted Forest attraction in mid-November 1998.

Any highway encroachments affecting the mainstem Eagle River or adjacent riparian marsh areas could have a significant impact on fish production capabilities. Any highway work affecting the wetted portion of the river or the riparian areas would likely require habitat mitigation and/or compensation. Potential sediment production in the numerous water runs and unnamed tributaries would also be a concern to downstream habitats. Highway work affecting the tributary habitats would need to be designed to minimize erosion and sediment transport.

3.3 Section 3: Enchanted Forest to West End of Griffin Lake

Highway Segment 170 - LKI 39.51 to 43.50

This section of the highway is located on the north side of the valley wall and is situated well back from the Eagle River flood plain. The CPR track is located between the TCH and the river throughout this section except for the last 350 m of the section near the outlet of Griffin

Lake. The highway crosses Camp Creek and one unnamed tributary (Table B3). It is likely that Camp Creek provides significant fish habitat capabilities.

It is unlikely that highway widening work on the existing alignment would have any major impact on the Eagle River due to the wide riparian buffer present. Highway work affecting Camp Creek would have to be designed to allow fish passage and preserve existing habitat capabilities in the creek. Erosion and sediment control would be an important consideration for all highway work in this section.

3.4 Section 4: Griffin Lake

Highway Segment 170 - LKI 43.50 to 45.50

Griffin Lake is approximately 2 km long and 0.5 km wide. Bathymetric data for the lake has not yet been obtained. The Eagle River outlet is located at the south west corner of the lake between the edge of the Camp Creek fan and the toe of the CPR track. The Eagle River inlet is situated on the east end of the lake and there is a well developed network of secondary channels in an extensive wetland marsh. The TCH route is situated along the north shore of the lake. The highway encroaches on the lake shore in two areas. There is a buffer of riparian trees approximately 40 m wide between the TCH and the wetland marsh at the inlet of the lake. The highway crosses an unnamed tributary and two water runs in this section (Tables B3 and B4).

All of the north shore tributaries have low fish habitat capabilities at the TCH crossings. Some habitat capabilities may exist near the outlets of the larger streams. Highway encroachments into Griffin Lake would likely require habitat compensation.

3.5 Section 5: East End of Griffin Lake to Three Valley Lake (West End)

Highway Segment 170 - LKI 45.50 to 47.70

The TCH route is situated on the north side of the valley and is approximately 300 m back from the edge of the active portion of the Eagle River flood plain. There are three unnamed tributary crossings in this section, all of which have low fish habitat capabilities and low environmental sensitivities. There is one crossing of the mainstem Eagle River immediately downstream of Three Valley Lake (Table B4). This is a highly sensitive crossing.

3.6 Section 6: Three Valley Lake

Highway Segment 180 - LKI 47.70 to 51.70

There are two unnamed tributary crossings and a number of small water run crossings in this section, all of which have low environmental sensitivities (Table B4). The TCH crossing of South Pass Creek has a high sensitivity due to spawning and rearing habitat capabilities in this system. East of South Pass Creek, the highway has been built on fill which has encroached into Three Valley Lake over a distance of approximately 2 km. Lake trout are present in Three Valley Lake and there is evidence that spawning occurs along the west shore of the lake between South Pass Creek and the deep "U shaped" bay located approximately 1 km from the outlet of the Eagle River. Other fall spawning fish species which are present

in Three Valley Lake and are known to use lake shore spawning habitats are sockeye and kokanee salmon. Habitat capabilities along the existing lake shore encroachment range from moderate to low.

3.7 Section 7: Eagle River Valley to Victor Lake

Highway Segment 180 - LKI 51.70 to 56.15

There is one potential encroachment to the Eagle River in the lower portion of this section immediately east of the Three Valley Resort. The highway crosses the Eagle River once and there are 11 water course crossings in this section (Table B4).

Most of the tributary streams have low fish habitat capabilities at the TCH crossings. Victor Creek has the most significant tributary habitat potential in this section. Upstream of the existing Eagle River crossing located at LKI 53.26, the TCH is situated on the up-slope side of the CPR and is outside of the active portion of the Eagle River flood plain. Environmental sensitivities are generally low in this area.

TABLE B3. Listing of aquatic habitat features and preliminary sensitivity ratings between Crazy Creek (LKI 32.76) And Griffin Lake (LKI 44.61) - Existing Conditions Report: Associated Engineering Ltd.						
Drainage System	Highway Segment	LKI REFERENCE: Zone	Site	Aquatic Habitat Feature	Stream Class	Environmental Sensitivity – Preliminary
<i>Fraser/Eagle River</i>	170	32.76 to 56.15		<i>Eagle River Drainage</i>	5	Major salmon stream: Extremely sensitive habitats
Eagle River	170	32.76 to 33.50		Eagle River	5	CPR track between TCH and Eagle River
Eagle River Tributary	170		32.76	Crazy Creek	4	HIGH: Fish use data required
Eagle River	170	33.50 to 36.35		Eagle River	5	TCH follows north side of Eagle River valley
Eagle River Tributary	170		34.50	Unnamed Tributary	2	LOW: Potential sediment source
Eagle River Tributary	170		34.86	Water run	1	LOW: Potential sediment source
Eagle River Tributary	170		35.18	Unnamed Tributary	2	LOW: Potential sediment source
Eagle River Tributary	170		35.41	Unnamed Tributary	2	LOW: Potential sediment source
Eagle River Encroachment	170	35.60 to 36.50		Eagle River - encroachments	5	HIGH: Migration, spawning and rearing
Eagle River Crossing	170		36.35	Eagle River - TCH Crossing	5	HIGH: Migration, spawning and rearing
Eagle River	170	36.35 to 39.51		Eagle River	5	TCH follows south side of Eagle River valley
Eagle River Tributary	170		37.11	Water run	1	LOW: Potential sediment source
Eagle River Tributary	170		37.79	Unnamed Tributary	1	LOW: Potential sediment source
Eagle River Tributary	170		38.52	Unnamed Tributary	1	LOW: Potential sediment source
Eagle River Tributary	170		39.03	Water run	1	LOW: Potential sediment source
Eagle River Tributary	170		39.11	Water run	1	LOW: Potential sediment source
Eagle River Tributary	170		39.21	Water run	1	LOW: Potential sediment source
Eagle River	170		39.51	Eagle River - TCH Crossing	5	HIGH: Migration, spawning and rearing
Eagle River	170	39.51 to 43.61		Eagle River	5	TCH follows north side of Eagle River valley
Eagle River Encroachment	170	39.51 to 40.13		Eagle River Encroachment	5	HIGH: Migration, spawning and rearing
	170		41.01	Not Applicable	na	CPR track traverses across valley to south side
Eagle River Tributary	170		42.09	Unnamed Tributary	2	MOD: Potential sediment source; rearing habitats
Eagle River Tributary	170		43.30	Camp Creek	4	HIGH: Fish use data required
Griffin Lake	170		43.61	West end of Griffin Lake	5	HIGH: Fish use data required
Griffin Lake	170	43.61 to 45.48		Griffin Lake	5	HIGH: Fish use data required
Griffin Lake	170	43.61 to 43.96		Griffin Lake Encroachment	5	HIGH: Fish use data required
Griffin Lake Tributary	170		43.96	Water run	1	LOW: Potential sediment source

TABLE B3. Listing of aquatic habitat features and preliminary sensitivity ratings between Crazy Creek (LKI 32.76) And Griffin Lake (LKI 44.61) - Existing Conditions Report: Associated Engineering Ltd.						
Drainage System	Highway Segment	LKI REFERENCE:		Aquatic Habitat Feature	Stream Class	Environmental Sensitivity - Preliminary
Griffin Lake Tributary	170		44.22	Water run	1	LOW: Potential sediment source
Griffin Lake	170	44.22 to 44.61		Griffin Lake encroachment	5	HIGH: Fish use data required

TABLE B4. Listing of aquatic habitat features and preliminary sensitivity ratings between Griffin Lake (LKI 44.61) And the west end of Victor Lake (LKI 56.15) - Existing Conditions Report: Associated Engineering Ltd.						
Drainage System	Highway Segment	LKI REFERENCE:		Aquatic Habitat Feature	Stream Class	Environmental Sensitivity - Preliminary
Eagle River Drainage	170	44.61 to 45.32		Griffin Lake riparian zone	3	MOD: Vegetated buffer between TCH and lake.
Eagle River Tributary	170		44.72	Unnamed Tributary	1	LOW: Potential sediment source
Eagle River Tributary	170		45.94	Unnamed Tributary	1	LOW: Potential sediment source; flows into wetland
Eagle River Tributary	170		46.76	Unnamed Tributary	1	LOW: Potential sediment source
Eagle River Tributary	170		46.94	Unnamed Tributary	1	LOW: Potential sediment source
Eagle River	170		47.69	Eagle River - TCH Crossing	5	HIGH: Migration corridor; spawning and rearing
Three Valley Lake	180	47.69 to 48.40		West end of Three Valley Lake	5	HIGH: Lake trout spawning area
Three Valley Lake Tributary	180		48.32	Unnamed Tributary	2	LOW: Seasonal flow; rearing in lower reach
Three Valley Lake Tributary	180		48.40	Unnamed Tributary	2	LOW: Seasonal flow; rearing in lower reach
Three Valley Lake	180	49.71 to 51.69		Three Valley Lake - Encroachment	5	MODERATE TO HIGH: known fish use
Three Valley Lake Tributary	180		49.71	South Pass Creek	5	HIGH: Spawning and rearing habitats
Three Valley Lake Tributary	180		51.69	Water run - avalanche track	1	LOW: Potential sediment source
Eagle River	180	51.69 to 53.26		Eagle River on north side of TCH	5	HIGH: Migration, spawning and rearing habitats
Eagle River Tributary	180		52.48	Unnamed Tributary	1	LOW: Potential sediment source
Eagle River Tributary	180		52.78	Unnamed Tributary	1	LOW: Potential sediment source
Eagle River	180		53.26	Eagle River - TCH Crossing	5	HIGH: Migration, spawning and rearing habitats
	180	53.26 to 55.20		CPR between TCH and Eagle River	5	LOW: TCH expansion constrained by CPR
Eagle River Tributary	180		53.71	Water run	1	LOW: Potential sediment source

TABLE B4.

**Listing of aquatic habitat features and preliminary sensitivity ratings between Griffin Lake (LKI 44.61)
And the west end of Victor Lake (LKI 56.15) - Existing Conditions Report: Associated Engineering Ltd.**

Drainage System	Highway Segment	LKI REFERENCE:		Aquatic Habitat Feature	Stream Class	Environmental Sensitivity - Preliminary
		Zone	Site			
Eagle River Tributary	180		52.48	Unnamed Tributary	2	LOW: Potential sediment source; rearing use?
Eagle River Tributary	180		52.78	Unnamed Tributary	2	LOW: Potential sediment source; rearing use?
Eagle River Tributary	180		53.71	Water run	1	LOW: Potential sediment source
Eagle River Tributary	180		54.50	Unnamed Tributary	2	LOW: Potential sediment source; rearing use?
Eagle River Tributary	180		54.79	Water run	1	LOW: Potential sediment source
Eagle River Tributary	180		54.90	Water run	1	LOW: Potential sediment source
Eagle River	180	55.20 to 56.15		Eagle River between TCH and CPR	5	HIGH: Migration, spawning and rearing habitats
Eagle River	180	55.20 to 55.41		Eagle River Encroachment	5	HIGH: Migration, spawning and rearing habitats
Eagle River Tributary	180		55.41	Unnamed Tributary - "Victor Creek"	3	MOD: Potential sediment source; rearing habitats
Victor Lake Tributary	180		56.15	Distributary Channel of Victor Creek	2	LOW: Potential sediment source
Victor Lake	180		56.15	West end of Victor Lake	5	HIGH: Fish use data required

4.0 References

- Acres International Limited. 1991. Environmental and socioeconomic assessment of highway upgrading and realignment: Three Valley, British Columbia. Final Report. Prepared for Ministry of Transportation and Highways. Engineering Branch, Victoria BC. April 1991.
- Acres International Limited. 1998. Trans Canada Highway Corridor (Kamloops to Alberta border) Environmental Overview Assessment. Prepared for Ministry of Transportation and Highways. Thompson Okanagan Regional Office, Kamloops, BC. April 1998.
- Summit Environmental Consultants Ltd. 1998. Final Report Three Valley Lake Fisheries Assessment. Prepared for Ministry of Transportation and Highways. Project No. 655. Kamloops BC. April 1998.
- Urban Systems. 1998. Trans Canada Highway Corridor Management Plan Kamloops to the Alberta Border. Draft options generation and evaluation study. Prepared for Ministry of Transportation and Highways. Kamloops BC. September 1998.

**Existing Conditions Report
Appendix 5 – Fisheries**

Section B3: Victor Lake to Revelstoke Park (West Gate)

1.0 Overview

This section of the project extends over a distance of 30.5 km from the west end of Victor Lake to the west gate of Revelstoke National Park. The project area affects the headwaters of the Eagle River which flows into Shuswap Lake and the Thompson/Fraser River system. From the headwater divide, located to the east of Clanwilliam (Summit) Lake, the existing Trans Canada Highway (TCH) route parallels the north side of the Tonkawatla Creek valley. Tonkawatla Creek flows east into the Columbia River at Revelstoke. To the east of Revelstoke the TCH is routed across the north side of the Illecillewaet River valley. The Illecillewaet River flows into the Columbia River at Revelstoke.

The fisheries database has been organized by these drainage areas and all information has been referenced to the LKI system developed by the B.C. Ministry of Transportation and Highways (MOTH).

2.0 Methods and Approach

A preliminary assessment of fish habitat capabilities and environmental sensitivity was made for all of the watercourses crossed by or located within 50 m of the TCH. This preliminary habitat assessment was based on a cursory examination of habitat conditions as observed during October 1998. Existing information was used when available. Watercourses were classified into five stream types based on the following criteria:

- | | |
|----------|--|
| Class 1. | Water runs characterized by a poorly defined stream channel and ephemeral flow characteristics. These streams would not be capable of supporting fish and have a minor contribution to downstream habitats. |
| Class 2. | Small defined stream channels (less than 1 m) which do not provide fish habitat but may contribute significant quantities of nutrients, invertebrates and/or water to downstream habitats. |
| Class 3. | Small creek channels which may provide low to moderate fish habitat capabilities. Fish access may be limited to high flow conditions. |
| Class 4. | Aquatic habitats which could support salmonid fish and provide moderate to high habitat capabilities for spawning, rearing and/or over-wintering use. These would include large streams (greater than 10 m wide), rivers, lakes and wetland areas. |

- Class 5. Aquatic habitats which support salmonid fish and provide high habitat capabilities for spawning, rearing and/or over-wintering use. These would include large streams (greater than 10 m wide), rivers, lakes and wetland areas.

An environmental sensitivity rating of low, moderate or high was applied to each watercourse. These sensitivity ratings were based on an assessment of habitat capabilities, known or suspected fish use, and a general consideration of erosion potential and sediment transport capabilities and possible aquatic impacts. The criteria used for these sensitivity ratings are described below:

- Low: Typically applied to Class 1 and 2 streams with no significant fish habitat capabilities and low potential for sediment erosion or transport.
- Moderate: Applied to those watercourses which could affect downstream fish habitat due to high erosion or sediment transport potential at the TCH crossing.
- High: Applied to watercourses with high fish habitat values including those systems supporting salmonid species and/or rare or endangered fish species, and/or areas with significant habitat enhancement potential.

3.0 Preliminary Assessment

3.1 Section 1: West end of Victor Lake to Clanwilliam Lake Headwaters

Highway Segment 960 - LKI 56.16 to 59.45

The existing TCH route follows the north shore of Victor Lake and then continues east along the base of the north wall of the Eagle River valley up to the Clanwilliam Overhead. The highway then parallels the south side of Clanwilliam Lake and the headwater divide of the Eagle River. The Canadian Pacific Railroad (CPR) is located on the opposite side of the Eagle River valley throughout this section. There are two highway crossings of unnamed tributaries and one crossing of the mainstem Eagle River in this section. Habitat capabilities in the tributaries are low to moderate while there are high habitat capabilities in the Eagle River (Table B5).

This portion of the Eagle River drainage supports large populations of sockeye (*Onchorynchus nerka*) and coho (*O. kisutch*) salmon as well as several resident fish species including rainbow trout (*O. mykiss*), bull trout (*Salvelinus malma*), lake trout (*Salvelinus namaycush*), mountain whitefish (*Prosopium williamsoni*), and the land locked kokanee salmon (*O. nerka*). Some of the non-salmonid species found in this section of the drainage include prickly (*Cottus asper*) and slimy sculpin (*C. cognatus*), redbelt shiner (*Richardsoni*

balteatus), longnose dace (*Rhinichthys cataractae*), large-scale sucker (*Catostomus macrocheilus*), and peamouth chub (*Mylocheilus caurinus*). The mainstem Eagle River is used as a migration corridor for adult and juvenile fish and also provides spawning and rearing habitat. Adult coho and sockeye salmon have been reported in the headwater sections of the system upstream of Clanwilliam Lake. The Department of Fisheries and Oceans (DFO) routinely releases juvenile coho into the Eagle River and consider the headwater areas of Clanwilliam Lake as an important nursery area for coho salmon. The Ministry of Environment Lands and Parks (MoELP) releases rainbow trout (fry and yearling stages) into Victor and Clanwilliam lakes on an annual basis. These fish support important recreational fisheries in the area.

Any highway encroachments into Victor or Clanwilliam Lakes or the wetland marshes found along the Eagle River could have a significant impact on fish habitat production capabilities. Tributary crossing work in this section would need to be designed to ensure channel and bank stability so as to minimize sediment production to downstream habitats.

3.2 SECTION 2. Headwaters of Tonkawatla Creek to Columbia River

Highway Segment 960 - LKI 59.45 to 70.15

To the east of the Clanwilliam Lake divide, the TCH follows along the north side of the Tonkawatla Creek valley. With the exception of the headwater portion (LKI 60.00 to 62.00) the highway is situated well back from the mainstem Tonkawatla Creek. The CPR track is located between the TCH and Tonkawatla Creek throughout this section. The TCH crosses 11 water courses between the Tonkawatla Creek headwaters and the Columbia River. Four of these water courses were classified as water runs with seasonal flow characteristics and no direct fish habitat values. The other 7 water courses were unnamed tributaries to Tonkawatla Creek. Four of the unnamed tributaries have low fish habitat values and low environmental sensitivity ratings. Three other of the unnamed tributaries (LKI 62.41, 62.86 and 63.34) have moderate fish habitat capabilities and environmental sensitivities (Table B5).

Fish species found in the Tonkawatla Creek drainage include rainbow, bull and eastern brook trout (*Salvelinus fontinalis*) and kokanee salmon. A rare variety of yellow fin rainbow trout is also found in the Tonkawatla drainage. Sculpin are also found in the drainage. Stream habitat restoration and enhancement work has occurred in the drainage. Some of this work has been funded through the Watershed Restoration Program of Forest Renewal BC. (FRBC).

The above fish species could be expected in the lower reaches of some of the larger tributary streams crossed by the TCH. A preliminary assessment of habitat capabilities suggest that there would be little or no fish use in most, if not all, of the tributary streams upstream of the TCH in this section. Higher habitat capabilities exist downstream of the TCH.

The presence of the CPR track between the mainstem Tonkawatla Creek and the TCH will largely limit the potential for direct impacts to the active portion of the Tonkawatla Creek floodplain. However, any de-stabilization of the steep embankment slopes or disturbances to the tributary habitats could affect fish habitat capabilities in the lower reaches of some of the larger tributaries. Potential sediment production in the numerous water runs and unnamed tributaries would also be a concern to downstream habitats.

3.3 SECTION 3. Mainstem Columbia River

Highway Segment 960 - LKI 70.15 to 71.13

This section encompasses the mainstem crossing of the Columbia River at Revelstoke (Table B5). The river is confined to a single channel with a wetted width of approximately 370 m.

There are three existing bridge crossings at this location; the TCH bridge is located on the upstream side of the CPR and secondary road bridges. The TCH bridge has three piers in the river. The right bank is characterized by shallow shoal area with extensive marsh and riparian plant growth while the left bank has been modified by rip rap.

The Columbia River supports populations of bull and rainbow trout, west slope cutthroat trout, kokanee salmon and mountain whitefish. White sturgeon are present in the lower reaches of the Columbia River downstream of the Keenleyside Dam and it is possible that remnant populations are present in the upper reaches of the watershed, including the Revelstoke area. However, the presence of sturgeon in this area has not been confirmed. Non-salmonid species reported in the area include northern squawfish (*Ptychocheilus oregonensis*), suckers, and sculpin (Enkon 1997 and Acres 1998). Habitats in the Columbia River are highly productive and would be sensitive to environmental impacts.

Any highway work affecting the wetted portion of the river or the riparian areas would likely require habitat mitigation and/or compensation.

3.4 SECTION 4. Mouth of Illecillewaet River upstream to West Gate of Revelstoke Park

Highway Segments 230 and 240 - LKI 00.00 to 15.24

After crossing the Columbia River at Revelstoke, the TCH follows the north side of the Illecillewaet River valley upstream past the West Gate of Revelstoke National Park. From the Columbia River upstream to LKI 7.00 the CPR track is situated between the highway and the Illecillewaet River. Between LKI 7.00 and 15.50 the CPR track is situated opposite of the TCH on the south side of the river valley. The highway does not cross the Illecillewaet River in this section of the project. The TCH encroaches onto or near to the Illecillewaet River floodplain in three areas (refer to photo mosaic in the main report). These areas would be highly sensitive to highway upgrade work.

Twelve unnamed tributary streams and 11 water runs are crossed by the TCH in this section (Table B6). Nine of the 12 unnamed tributaries were rated as moderately sensitive to environmental disturbance. In most cases, fish habitat capabilities are restricted to the portion of the drainage located downstream of the TCH on the Illecillewaet River floodplain.

The Illecillewaet River supports bull and rainbow trout, west slope cutthroat trout and mountain whitefish. The only non-salmonid species reported in the Environmental Overview Assessment report (Acres 1998) was sculpin. These fish are found in the mainstem of the Illecillewaet River and could be found in the lower reaches of the some of the larger tributary streams in this section.

Recent highway upgrade work at the east of end of this section (LKI 15.00) has affected back channel habitat of the Illecillewaet River.

TABLE B5. Listing of aquatic habitat features and preliminary sensitivity ratings between Victor Lake (west end) and the Columbia River at Revelstoke - Existing Conditions Report: Delcan Engineering Corporation.						
Drainage System	Highway Segment	LKI REFERENCE:		Aquatic Habitat Feature	Stream Class	Environmental Sensitivity - Preliminary
		Zone	Site			
<i>Fraser/Eagle River</i>	960	52.48 to 59.50		<i>Eagle River Drainage</i>	5	Major salmon stream: sockeye and coho salmon
Eagle River Tributary	960		52.48	Unnamed Tributary	3	MOD: Potential sediment source/habitat impacts
Eagle River Tributary	960		52.78	Unnamed Tributary	3	MOD: Potential sediment source/habitat impacts
Eagle River Tributary	960		53.71	Water Run	1	LOW: Potential sediment source
Eagle River Tributary	960		54.50	Unnamed Tributary	2	LOW: Potential sediment source
Eagle River Tributary	960		54.79	Water Run	1	LOW: Potential sediment source
Eagle River Tributary	960		54.90	Water Run	1	LOW: Potential sediment source
	960	55.70 to 55.80		Eagle River floodplain	5	HIGH: River channel is close to TCH
Eagle River Tributary	960		55.80	Victor Creek	3	MOD: Potential sediment source/habitat impacts
Victor Lake	960	56.15 to 56.79		Victor Lake	5	HIGH: Spawning, rearing; overwintering
Eagle River	960	56.79 to 57.83		Eagle River - south of TCH	5	HIGH: Multiple channels in wetland marsh
Eagle River Tributary	960		57.43	Unnamed Tributary	1	LOW: Intermittent flows; high gradient; high energy
Eagle River	960		57.83	Eagle River - TCH crossing	5	HIGH: Migration corridor: spawning and rearing habitat
Eagle River	960	57.83 to 58.07		Eagle River - north of TCH	5	HIGH: Migration and rearing; possibly spawning
Clanwilliam Lake	960	58.07 to 59.13		Clanwilliam Lake - north of TCH	5	UNDETERMINED: High to Moderate
Clanwilliam Tributary	960		58.15	Unnamed Trib to Clanwilliam	2	MOD: Intermittent; seasonal rearing
Clanwilliam Tributary	960		58.57	Unnamed Trib to Clanwilliam	2	LOW: Potential sediment source
Eagle River	960	59.13 to 59.50		Eagle River headwater marsh	4	HIGH: Salmon spawning reported in some years
<i>Columbia/Tonkawatla</i>	960	59.50 to 70.15		<i>Tonkawatla Creek Drainage</i>	5	Resident trout stream: rare yellow fin rainbow present
Tonkawatla Tributary	960		60.01	Unnamed Tributary	2	LOW: Potential sed. source; high energy; seasonal
Tonkawatla Tributary	960		60.73	Water Run	1	LOW: Potential sediment source
Tonkawatla Tributary	960		61.08	Water Run	1	LOW: Potential sediment source
Tonkawatla Tributary	960		61.30	Wetask Lake	5	MOD: Located on opposite side of CPR track.
Tonkawatla Tributary	960		62.41	Unnamed Tributary	2	MOD: Potent. sed. source/habitat impacts; d/s of TCH
Tonkawatla Tributary	960		62.54	Water Run	1	LOW: Potential sediment source

TABLE B5. Listing of aquatic habitat features and preliminary sensitivity ratings between Victor Lake (west end) and the Columbia River at Revelstoke - Existing Conditions Report: Delcan Engineering Corporation.						
Drainage System	Highway Segment	LKI REFERENCE:		Aquatic Habitat Feature	Stream Class	Environmental Sensitivity - Preliminary
		Zone	Site			
Tonkawatla Tributary	960		62.86	Unnamed Tributary	2	MOD: Potent. sed. source/habitat impacts;avalanche
Tonkawatla Tributary	960		63.34	Unnamed Tributary	2	MOD: Potential sediment source/habitat impacts
Unnamed Lake	960	63.63 to 63.79		Unnamed Lake south of TCH	3	UNDETERMINED: between TCH and CPR
Tonkawatla Tributary	960		63.74	Water Run	1	LOW: Potential sediment source
Tonkawatla Tributary	960		64.49	Water Run	1	LOW: Potential sediment source
Tonkawatla Tributary	960		65.86	Unnamed Tributary	1	LOW: Potential sediment source; flows into wetland
Tonkawatla Tributary	960		66.57	Unnamed Tributary	1	LOW: Potential sediment source
Tonkawatla Tributary	960		68.77	Unnamed Tributary	1	LOW: Potential sediment source
Columbia River	960	70.15 to 70.88		Columbia River at TCH crossing	5	HIGH: Migration corridor; spawning and rearing

TABLE B6. Listing of aquatic habitat features and preliminary sensitivity ratings between Columbia River at Revelstoke and the West Gate of Revelstoke National Park - Existing Conditions Report: Delcan Engineering Corporation.						
Drainage System	Highway Segment	LKI REFERENCE:		Aquatic Habitat Feature	Stream Class	Environmental Sensitivity - Preliminary
		Zone	Site			
Columbia/Illecillewaet		00.00 to 15.50		Illecillewaet River Valley	5	Resident trout stream
Illecillewaet River	230	00.00 to 7.00		CPR track between river and TCH	5	LOW: No potential for direct impact to river
Illecillewaet Tributary	230		1.34	Unnamed Tributary	1	MOD: Potential habitat impacts
Illecillewaet Tributary	230		2.06	Water Run	1	LOW: Potential sediment source
Illecillewaet Tributary	230		3.46	Water Run	1	LOW: Potential sediment source
Illecillewaet Tributary	230		3.76	Unnamed Tributary	1	MOD: Potential sediment source/habitat impacts
Illecillewaet Tributary	230		4.26	Unnamed Tributary	2	LOW: Possible habitat impacts

TABLE B6. Listing of aquatic habitat features and preliminary sensitivity ratings between Columbia River at Revelstoke and the West Gate of Revelstoke National Park - Existing Conditions Report: Delcan Engineering Corporation.						
Drainage System	Highway Segment	LKI REFERENCE:		Aquatic Habitat Feature	Stream Class	Environmental Sensitivity – Preliminary
Illecillewaet Tributary	230		4.75	Wetland Marsh Area - KOA	3	MOD: Could serve as a water treatment site
Illecillewaet Tributary	230		5.75	Water Run	1	LOW: Potential sediment source
Illecillewaet Tributary	230		6.55	Water Run	1	LOW: Potential sediment source
Illecillewaet River	240	08.30 to 09.50		River in close proximity to TCH	5	HIGH: Important habitat values
Illecillewaet Tributary	240		7.17	Unnamed Tributary	2	MOD: Potential habitat impacts
Illecillewaet Tributary	240		8.62	Water Run	1	LOW: Potential sediment source/habitat impacts
Illecillewaet Tributary	240		8.72	Unnamed Tributary	2	MOD: Potential sediment source/habitat impacts
Illecillewaet Tributary	240		9.24	Unnamed Tributary	2	MOD: Potential sediment source/habitat impacts
Illecillewaet River	240	09.80 to 10.53		River in close proximity to TCH	5	HIGH: Important habitat values
Illecillewaet Tributary	240		9.81	Unnamed Tributary	2	MOD: Potential sediment source/habitat impacts
Illecillewaet Tributary	240		10.13	Hamilton Creek	2	MOD: Potential sediment source/habitat impacts
Illecillewaet Tributary	240		11.11	Water Run	1	LOW: Potential sediment source
Illecillewaet Tributary	240		11.16	Water Run	1	LOW: Potential sediment source
Illecillewaet Tributary	240		11.31	Unnamed Tributary	2	LOW: Potential sediment source/habitat impacts
Illecillewaet Tributary	240		11.58	Water Run	1	LOW: Potential sediment source
Illecillewaet Tributary	240		12.27	Water Run	1	LOW: Potential sediment source
Illecillewaet Tributary	240		12.81	Water Run	1	LOW: Potential sediment source
Illecillewaet River	240	13.32 to 13.98		River in close proximity to TCH	5	HIGH: Important habitat values
Illecillewaet Tributary	240		13.64	Water Run	1	LOW: Potential sediment source
Illecillewaet Tributary	240		13.86	Unnamed Tributary	2	MOD: Potential sediment source/habitat impacts
Illecillewaet Tributary	240		14.08	Unnamed Tributary	2	LOW: Potential sediment source/habitat impacts
Illecillewaet River	240	14.50 to 15.50		River in close proximity to TCH	5	HIGH: Important habitat values
Illecillewaet Tributary	240		14.63	Unnamed Tributary	2	LOW: Potential sediment source
Illecillewaet Back Channel	240		15.24	Back Channel of Illecillewaet River	1	HIGH: Previous TCH work has affected a back channel of the Illecillewaet River
Hanner Lake Tributary	240		16.00	Tributary to Hanner Lake	3	MOD: Potential sediment source/habitat impacts

TABLE B6. Listing of aquatic habitat features and preliminary sensitivity ratings between Columbia River at Revelstoke and the West Gate of Revelstoke National Park - Existing Conditions Report: Delcan Engineering Corporation.						
Drainage System	Highway Segment	LKI REFERENCE: Zone	Site	Aquatic Habitat Feature	Stream Class	Environmental Sensitivity – Preliminary
Hanner Lake Tributary	240		16.29	Tributary to Hanner Lake	3	MOD: Potential sediment source/habitat impacts
Illecillewaet Tributary	240		17.90	Clachnacudainn Creek	4	HIGH: Previous TCH work has affected a back

4.0 References

- Acres International Limited. 1991. Environmental and socioeconomic assessment of highway upgrading and realignment: Three Valley, British Columbia. Final Report. Prepared for Ministry of Transportation and Highways. Engineering Branch, Victoria BC. April 1991.
- Acres International Limited. 1998. Trans Canada Highway Corridor (Kamloops to Alberta border) Environmental Overview Assessment. Prepared for Ministry of Transportation and Highways. Thompson Okanagan Regional Office, Kamloops, BC. April 1998.
- Summit Environmental Consultants Ltd. 1998. Final Report Three Valley Lake Fisheries Assessment. Prepared for Ministry of Transportation and Highways. Project No. 655. Kamloops BC. April 1998.
- Urban Systems. 1998. Trans Canada Highway Corridor Management Plan Kamloops to the Alberta Border. Draft options generation and evaluation study. Prepared for Ministry of Transportation and Highways. Kamloops BC. September 1998.

Appendix 5

Existing Conditions Report – Fisheries

Section C: Mt. Revelstoke National Park West Gate to Yoho Park West Boundary

Prepared for:

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**Existing Conditions Report
Appendix 5 – Fisheries**

Section C1: Revelstoke Park (West Gate) to Donald

1.0 Introduction

Coast River Environmental Services Ltd. (Coast River) was retained by the Ministry of Transportation and Highways (MoTH) to undertake an overview assessment of potential fish habitat and watercourse sensitivities along a portion of the Trans Canada Highway (TCH). This fisheries overview information is intended to assist the planning and early design phases of the proposed functional upgrade to portions of the TCH between Mt. Revelstoke Park and Yoho National Park in British Columbia. Specific study sections assigned to Coast River are indicated in Table C1.

This report provides an overview of the existing fisheries habitat conditions and sensitivities for these project sections. It will be likely appended to a formal existing conditions report to be prepared by the respective design engineering firms.

2.0 Study Area

The linear extent of our study area is briefly summarized in Table C1. These corridor segments are defined in the MoTH's Corridor Management Plan for the Cache Creek to Rockies Highway Improvement Program. It should be noted that as directed by the MoTH, fisheries assessment work was not conducted along the TCH within any national parks. For the purposes of the existing conditions report, the MoTH asked the consultants to confine their examination to the highway right-of-way along the existing alignment of the TCH. In the study area, the TCH right-of-way between Revelstoke and Yoho National Park averages about 100 m in total width, with some four-lane or three-lane sections already in place.

3.0 Methods

3.1 General

The assessment of fish habitat sensitivity along these corridor segments is largely based on existing background information and reports, much of which was provided by the MoTH. In addition, several other information sources were used to complete this overview fisheries assessment, including:

- Initial contacts with regional resource agency personnel
- Airphotos, TRIM maps, MoTH alignment drawings, MoTH culvert crossing lists
- A drive-through and video reconnaissance of these corridor segments
- Brief site inspections at significant watercourses in areas immediately adjacent to the highway.

Table C1. Corridor Boundaries

Corridor Segment Name	Beginning	Ending	Design Engineering Company	Length
260 - Mt. Revelstoke National Park to Glacier National Park	Mt. Revelstoke Park East Boundary - LKI Segment #0975, offset 30.55 km	Glacier Nat. Park West Boundary - LKI Segment #0975, offset 48.35 km	UMA	17.80 km
280 - Glacier National Park to Columbia River Bridge	Glacier Nat. Park E. Boundary - LKI Segment #0985, offset 0.00 km	Columbia River Bridge - LKI Segment #0985, offset 29.66 km	UMA	29.66 km
290 - Donald to Anderson Road (West of Golden)	Columbia River Bridge - LKI Segment #0985, offset 29.66 km	Anderson Road - LKI Segment #0985, offset 53.85 km	SNC ¹	24.19 km
300 - Anderson Rd to Jct. Highway 95 (Golden)	Anderson Road - LKI Segment #0985, offset 53.85 km	Junction Route 95 - LKI Segment #0985, offset 56.06 km	SNC	2.21 km
310 - Jct Highway 95 to Golden View Road	Junction Route 95 - LKI Segment #0990, offset 0.00 km	Golden View Road - LKI Segment #0990, offset 2.4 km	SNC	2.4 km
320 - Golden View Rd to Yoho National Park West Boundary	Golden View Road - LKI Segment #0990, offset 2.4 km	Yoho National Park West Boundary - LKI Segment #0990, offset 25.93 km	SNC/ ND Lea ² ND Lea/MoTH ³	23.53 km

1 As the boundary between the UMA and SNC project sections are not finalized, several streams just east of the Columbia River Bridge at Donald are included in both the UMA and SNC Existing Conditions Reports for Fisheries.

2 The boundary between the SNC and ND Lea project sections falls within this corridor segment and is situated near Roth Creek (approximately LKI 11.7 km), just east of Yoho (5 Mile) Bridge.

3 The eastern portion of this section between the Brake Check truck stop (LKI 16.74) and the Yoho Park West Boundary may be advanced through the design phases by Region 3 of the MoTH.

Coast River personnel, in association with a fisheries biologist from Mirkwood Ecological Consultants Ltd. conducted the field work for this fisheries overview assessment along the TCH right-of-way between the eastern boundary of Mt. Revelstoke National Park and the western boundary of Yoho National Park, during the November 8 - 13, 1998 period. This assessment included an examination of potential fish habitat along each of the three major design sections (i.e., UMA, SNC-Lavalin, and ND Lea/MoTH Region 3).

The overall fisheries sensitivity of each highway corridor segment was prepared on the basis of our review of available fisheries information, a drive along the highway to note obvious stretches with fisheries sensitivities, and a brief site inspection at significant stream crossings. Existing information was collected from local resource managers, and from the MELP FISS database. Major fisheries constraints were assessed by driving the highway corridor segments and mapping areas of apparent high, moderate, and low fisheries sensitivities. Existing fisheries information and TRIM maps were used to prioritize stream crossings for assessment. Significant stream crossings were visited within each corridor segment. We also inspected any significant stream crossings that were encountered while driving along the highway even if they were not indicated on existing maps or reports. In many cases, watercourse crossings are not readily evident as one drives along the TCH. In order to locate a known watercourse crossing in the field, we had to rely on the following sources:

- TRIM mapping (1:20,000 scale) and engineering drawings
- MoTH culvert lists
- Fisheries reports (e.g., MoTH 1997 and MoTH 1998b)
- MoTH Landmark Kilometer Inventory (LKI) with identified features referenced by distances from known points along the TCH.

During the field trip, distances recorded on the vehicle odometer were used in conjunction with the culvert and LKI lists to locate known aquatic features along the TCH, such as wetlands or watercourses. Some of the major fisheries-related features, such as bridges were identified in a MoTH report (1998a). In addition, during the field trip, Coast River and Mirkwood staff identified many other fisheries-related features while driving along the TCH.

The following information was collected at each stream crossing: corridor segment number, LKI segment number, LKI, stream number within each corridor segment (as assigned by Coast River), feature description (i.e., bridge, culvert or wetland), location (LKI), potential fish habitat rating, potential for providing fish habitat immediately upstream and downstream of the crossing, and general stream characteristics (i.e., stream width, gradient, condition of crossing, and preferred side of the highway for widening). This information was compiled after the field trip and is presented in the attached summary of point features and fisheries information Table C4. In addition, a detailed photographic catalogue of all visited watercourses was assembled. To facilitate our data

reporting and to collate photographs with each fisheries-related feature, each was given a unique feature identifier number (i.e., corridor segment, LKI segment, I.D. number).

Once the tables were initially drafted, the general corridor and point features were transferred onto maps provided by the design engineers. Corridor features were mapped on the basis of general fish habitat sensitivity in areas adjacent to each side of the highway within approximately 100 m of the highway. The sensitivities for broad areas (i.e. corridor features) are represented graphically on a bar at the bottom of the photo mosaics and are summarized in Table C5. Point features are indicated on the bar as symbols, which represent sensitivity values.

3.2 Fish Habitat Rating Criteria

Aquatic features such as watercourses and wetlands within our study area were assessed on the basis of potential fish habitat and then given a classification of 1 to 5, with 5 being assigned to the highest value features in terms of fish habitat potential and 1 being assigned to lowest value features, such as a dry swale with no habitat potential. The classification criteria for this assignment was devised on the basis of the DFO/MoELP classification system for lower mainland region watercourses, which was originally developed by the City of Surrey and Envirowest Consultants Limited. The lower mainland classification system was modified to reflect differences in the nature of the stream systems and the composition of fish species in the interior/central portion of B.C. The potential fish habitat classification system was based on several key factors, such as the quality of fish habitat, the accessibility of the stream to migrating fish, and general stream characteristics. The wetted width, stream gradient, channel characteristics and relative flow volume of each stream also influenced our classification.

The MoTH required that environmental sensitivities for each environmental discipline be ranked as high, moderate, low or nil. Table C2 presents our aquatic feature rating system and the criteria used to classify aquatic features. For MoTH planning purposes, class 1 and 2 fish habitat features were generally assigned a rating of "low" sensitivity (in terms of potential fish habitat values), class 3 features were rated as "moderate", and class 4 or 5 features were rated as "high" sensitivity. Since almost all of the drainages in the study area flow into major fish-bearing systems, and the existing TCH is located in close proximity to those major systems, a "nil" rating was not deemed applicable in the rating of aquatic features in this portion of the study area.

It should be emphasized that the fish habitat rating system was developed specifically for this fisheries overview assessment. It proved to be a useful tool to ensure that the study area watercourses were rated consistently. The criteria we used are appropriate given the nature of the streams encountered during the field work, the limited amount of existing information about the systems and our inability to conduct detailed stream walks or direct fish sampling.

Table C2. Potential Fish Habitat Rating System for Streams and other Aquatic Features⁴

Fish Habitat Class	Potential Fish Habitat Classification Criteria	MoTH Environmental Sensitivity Rating
5	<ul style="list-style-type: none"> Inhabited by salmonids and/or other provincially significant fish species year-round or potentially inhabited year-round with access enhancement Large well defined stream channel, side channels may be common Stream width greater than 10 m or high potential fish productivity Provides high value fish habitat Fish access generally not restricted 	High
4	<ul style="list-style-type: none"> Likely inhabited by salmonids and/or other provincially significant fish species year-round or potentially inhabited year-round with access enhancement Well defined stream channel present Stream widths less than 10 m or lower fish productivity than level 5 class stream Provides moderate to high value potential fish habitat Fish access generally not restricted Significant source or potentially significant source of water, food and nutrients to downstream fish communities 	
3	<ul style="list-style-type: none"> Inhabited by salmonids on a seasonal basis, such as during the overwintering period, or potentially inhabited on a seasonal basis with access enhancement Fish usage may be restricted by obstruction, temperature and/or dissolved oxygen levels Stream channel present but may be small (< 1.0 m wide) Fish habitat potential low to moderate Fish access may be limited to periods of high flow levels Significant source or potentially significant source of clean water, food and nutrients to downstream fish communities 	Moderate
2	<ul style="list-style-type: none"> No documented fish presence and no reasonable potential for fish presence through flow or access enhancement Stream channel present but may be poorly developed Limited fish habitat potential Fish access unlikely at any flow levels Likely contains natural or man-made barriers to upstream or downstream migration May provide clean water, food and nutrients to downstream fish communities 	Low
1	<ul style="list-style-type: none"> No documented fish presence and no reasonable potential for fish presence through flow or access enhancement No defined stream channel Generally inadequate flows to support fish species No fish habitat potential and/or lack of adequate flow to support fish species No fish access at any flow levels Limited benefits to lower reaches - insignificant water, food and nutrients to downstream fish communities 	

4 Adapted from the MoELP/DFO Classification System for Lower Mainland Region Watercourses, initially developed by the City of Surrey and Envirowest Consultants Limited. We have added some additional criteria to reflect attributes of watercourses in central and southeastern BC.

Our initial assessment of fish habitat sensitivity of the study area watercourses was based on limited background information and brief site visits. Due to the limited period for field reconnaissance and inclement weather conditions, few streams were inspected beyond the edge of the existing highway right-of-way. As a result, stream habitat within the highway right-of-way was examined in isolation of its upstream and downstream characteristics. Important aquatic features such as downstream obstructions to fish passage, upstream lakes with resident or stocked fish populations, other physical habitat constraints or enhancement opportunities remain undetermined for many of these systems. Therefore, the sensitivity assessment was based on our present preliminary knowledge of the systems. As a result, specific sensitivity ratings may change during the course of the present assignment, following more thorough stream sampling in the spring.

4.0 Findings

As noted previously, Table C4 summarizes fisheries information regarding point-specific features, such as watercourse crossings, that were identified and examined within the study area. Table C5 provides a preliminary summary of corridor aquatic and riparian features within the study area. An overview regarding fisheries information for corridor segments within the study area, as well as our initial results from a preliminary investigation of the corridor segments, is provided below.

CORRIDOR SEGMENT 260 (LKI Segment #0975: LKI 30.55 to 48.35)

Background/Existing Fisheries Information

Corridor Segment 260 parallels the mid to upper reaches of the Illecillewaet River. The Illecillewaet River is a 4th order stream⁵ with an average gradient of approximately 5% (Alger and Donald 1984). The Illecillewaet drainage is characterized by cold, low productivity streams that support low to moderately productive fish populations. The Illecillewaet River flows into the Columbia River at Revelstoke and is known to support the following species: bridgelip sucker (*Catostomus columbianus*), bull trout (*Salvelinus confluentus*), kokanee (*Oncorhynchus nerka*), lake chub (*Couesius plumbeus*), mountain whitefish (*Prosopium williamsoni*), rainbow trout (*Oncorhynchus mykiss*), torrent sculpin (*Cottus rhotheus*), and westslope cutthroat trout (*Oncorhynchus clarki lewisi*) (Alger and Donald 1984, MELP, 1998). Bull trout are reported to be the most widely distributed species in Revelstoke and Glacier National Parks frequenting the upper reaches of Illecillewaet River tributaries (Alger and Donald 1984).

⁵ Based on 1:50,000 NTS maps.

Results

There are at least 26 stream crossings along the Trans Canada Highway in Corridor Segment 260. Table C3 summarizes the total number of streams examined during the field reconnaissance in terms of MoTH sensitivity ratings. The majority of these streams are small order streams that have steep gradients, poorly defined channels, ephemeral flows, and provide no or limited fish habitat. Through most of Corridor Segment 260, the highway is situated on a narrow bench above the Illecillewaet River and stream gradients north and south of the highway often exceed 30-40%.

In summary, eight stream crossings (examined during the field visit) in this section appear to have moderate to high sensitivity. Three of these are bridge crossings over the Illecillewaet River mainstem (LKI 33.76, 35.47, 48.35⁶), one is a bridge crossing over Woolsey Creek (30.55), and three unnamed streams cross through culverts (LKI 33.5, 42.08, ~42.4) (Table C4).

Table C3. Summary of Streams and MoTH Sensitivity Ratings for Corridor Segments 260 and 280

Corridor Segment	Number of Streams by Sensitivity Rating			Total
	Low*	Moderate	High	
260	18	3	5	26
280	12	13	5	30
Total	30	16	10	56

* Note: Due to time constraints and inclement weather, we only sampled a portion of the low sensitivity stream crossings (4 in Corridor Segment 260 and 6 in Corridor Segment 280). The count in this table represents a combination of stream crossings that were inspected in the field and stream crossings that were noted during highway surveys and from maps).

Pool/riffle and run habitat dominates at the three Illecillewaet River crossings, providing a combination of suitable potential spawning, rearing and overwintering habitat for all life stages of resident fish species, particularly adult salmonids. The Illecillewaet River crossing at LKI 35.47 appears particularly sensitive to disturbance as the confluence with Tangiers Creek is only 100 m downstream of the crossing. Tangiers Creek is one of the larger tributaries to the Illecillewaet River and is known to have resident populations of

6 The bridge at approximately LKI 48.35 is just within Glacier National Park (Corridor Segment 270). However, for planning purposes this bridge site is included in our study as part of Corridor 260 because work on the adjacent section of highway just west of the park boundary may influence what is done at the bridge crossing site.

bull trout and west slope cutthroat trout (MELP 1998). The habitat at the Woolsey Creek crossing is cascading and provides good rearing and overwintering habitat for juvenile salmonids.

The unnamed streams in this corridor segment judged to offer potential fish habitat have low to moderate flows and high gradients (>40%) upstream of the highway. Downstream from the highway their gradients are more moderate (< 20%) and fish habitat potential of these streams is highest near their confluence with the Illecillewaet. The lower reaches of these streams likely provide good feeding areas and offer high water refuge to fish from the Illecillewaet River during high water events.

CORRIDOR SEGMENT 280

(LKI Segment #0985: LKI 0 to 29.66)

Background/Existing Fisheries Information

The Corridor Segment 280 study section begins at the eastern boundary of Glacier National Park and follows the eastern side of the Beaver River valley for approximately 5 to 6 km. The Beaver River is a 5th order feeder stream for the Kinbasket Reservoir, meandering through a wide valley for most of its length, except for the lower 2.0 km where it enters a canyon. The Beaver River's watershed is characterized by cold, low nutrient streams that offer low to moderate productivity for their fish populations. The Beaver River is known to support the following species: bull trout, eastern brook trout (*Salvelinus fontinalis*), longnose sucker (*Catostomus catostomus*), mountain whitefish, and slimy sculpin (*Cottus cognatus*) (Alger and Donald 1984, MELP, 1998).

The TCH enters the Columbia River valley at approximately LKI 5.0 to 6.0 and is situated on a wide bench approximately 200 to 300 m above the Columbia River. Numerous wetlands and small ponds are perched on the bench along this section of highway offering good potential fish habitat and high wildlife values. The Columbia River is the third largest drainage in BC and originates from Columbia Lake near Canal Flats and has the highest number of introduced and endemic fish species of any river system in BC (McPhail and Carveth 1992).

Corridor Segment 280 is situated in the "upper" Columbia River. The upper Columbia River and its major tributaries arise from glacially fed systems in the Purcell and Rocky mountain ranges and are typically cold, turbulent, and silt-laden streams supporting fewer fish species than the lower Columbia River reflecting their harsher, less productive conditions. This section of the upper Columbia River can be periodically influenced by the Kinbasket Reservoir at high storage levels.

The following 18 fish species are reported to occur in the upper Columbia River: bull trout, burbot (*Lota lota*), chiselmouth (*Acrocheilus alutaceus*), eastern brook trout, kokanee, largescale sucker (*Catostomus macrocheilus*), longnose dace (*Rhinichthys cataractae*), longnose sucker (*Catostomus catostomus*), mountain whitefish, northern

squawfish (*Ptychocheilus oregonensis*), peamouth (*Mylocheilus caurinus*), pygmy whitefish (*Prosopium coulteri*), rainbow trout, redbelt shiner (*Richardsonius balteatus*), slimy sculpin, small mouth bass (*Micropterus dolomieu*), torrent sculpin, and westslope cutthroat trout (McPhail and Carveth 1992, MoTH 1998b, MELP 1998).

Results

There are at least 30 stream crossings along the Trans Canada Highway in the Corridor Segment 280 study area (see Table C4). The majority of these streams are small 2nd and 3rd order streams that have moderate gradients, moderate to well defined stream channels, year round flow, and good potential fish habitat. Streams from LKI 0.00 to 5.45 flow into the Beaver River. Gradients north of the highway exceed 40% which likely prevents upstream migration from the Beaver River. However, streams #2, 3, 5, and 6 appear large enough to support resident populations and should be sampled to confirm presence / absence of fish above the highway.

The streams crossing the highway from LKI 5.45 to 29.66 flow into the Columbia River. No fish inventories are known to have been conducted on these streams, however, local resource managers and consultants report bull trout and west slope cutthroat trout in Quartz Creek and eastern brook trout in Wiseman Lake, which lies at the headwaters of stream #21 (LKI 23.9) (T. Dods, Pers. Comm., P. Corbett, Pers. Comm.). Streams #8, 9, 10 (Heather Creek), and 11 are tributaries to Quartz Creek and cross the highway in the area LKI 9.95 to 12.6. These streams have moderate gradients, good flow, and appear to offer good potential fish habitat and it is assumed that fish can migrate into them from Quartz Creek.

Wiseman Creek crosses the highway at about LKI 16.0, where the creek displays good cascading habitat. The lower reaches of Wiseman are steep where it enters a canyon before flowing into the Columbia River. Wiseman Creek appears large enough to support a resident fish population in its upper lower gradient reach and is therefore assumed to be fish bearing. The highway culvert, which is approximately 75-100 m long with a gradient of 15%, may present a barrier to upstream migration.

Eight streams with moderate to high sensitivity cross the highway between LKI 17.2 to 23.9. Most of these watercourses have low gradients, good flows, and good physical fish habitat characteristics, particularly streams #19 (Oldman Creek), 20, and 21. Streams #19 and 20 join stream 21 approximately 200 m and 500 m north of the highway, respectively. We assume that fish are present in streams #19 and 20 since Wiseman Lake, at the headwaters of stream 21, is stocked with eastern brook trout and the gradients of all three streams north and south of the highway are < 5%. Other fish species may be present in all three streams as the gradient of stream 21 does not appear to exceed 20% downstream of the highway to its confluence with the Columbia River, which would undoubtedly allow adfluvial fish (from Columbia River and Kinbasket Reservoir) to access the upper reaches of these streams.

Between LKI 23.9 and 29.3 stream gradients north and south of the highway increase dramatically. As a result, only one "moderate" sensitivity stream crossing was encountered among the several steep ravine systems typified by poorly developed stream channels and no potential to offer meaningful fish habitat. At LKI 29.66 the highway crosses the upper Columbia River, which is rated as a high fisheries value feature. The river provides excellent spawning, rearing and overwintering habitat for a wide variety of fish species and life history stages.

Table C4. Summary of Point Features and Fisheries Information

Corridor	LKI Segment	LKI (Offset km) ¹	Project	Feature I.D. No. ¹	Point Feature - Description	Fish Habitat Class ²	MoTH Sensitivity Rating	Fish Species - Potentially Present ⁴	Source ³	Comments ⁴	Photo Roll / Frame
Start 260	0975	30.55 - 48.35	UMA	not applicable (na)	Mt. Revelstoke National Park to Glacier National Park (comment refers to entire corridor segment).					Segment Length 17.80 km. Rated in MoTH report ¹ (MoTH 1998) as poor candidate for upgrading on the basis of overall environmental sensitivity.	
260	0975	30.55	UMA	1	Mt. Revelstoke National Park - East Boundary. Woolsey Creek bridge; clear span over Woolsey Creek; 1.5 km E. of Giant Cedars Rest area.	5	High	BT, WCT	MELP ⁴	<ul style="list-style-type: none"> 20 m+ wide stream, cascading habitat providing good rearing and spawning habitat Prefer highway expansion to S. to minimize span width 	R3/8-9
260	0975	~33.29	UMA	2	Culvert - crossing location undetermined, obscured by snow and potential blockage (may be obstructed by highway fill), ~2.8 km E. of Woolsey Creek.	3	Moderate	unknown		<ul style="list-style-type: none"> Stream channel to N. of highway disturbed by clearcut Riparian forest of Aspen and Cottonwood to NW. Illecillewaet River within 50 m on south side of highway Prefer highway expansion to N. but need to mitigate for infringement on riparian forest 	R3/10-11
260	0975	33.76	UMA	3	Albert Canyon Bridge West - West End 1546. Clear span bridge over Illecillewaet River 3.15 km E. of Woolsey Creek	5	High	BT, BSU, CRH, KO, LKC, MW, RB, WCT	MELP	<ul style="list-style-type: none"> 50 m+ wide stream, good pool riffle habitat Prefer highway expansion to S. to minimize impact on riparian vegetation 	R3/12-13
260	0975	35.47	UMA	4	Albert Canyon Bridge East - West End 1545. Clear span bridge over Illecillewaet River, ~4.9 km E. of Woolsey Creek	5	High	BT, BSU, CRH, KO, LKC, MW, RB, WCT	MELP	<ul style="list-style-type: none"> 50 m+ wide stream, good pool riffle habitat Prefer highway expansion to S. to minimize impact on Tangiers River, which flows into Illecillewaet River 100 m downstream of bridge site 	R3/14-15
260	0975	~39.21	UMA	5	Culvert - 1200 mm Corrugated Steel Pipe (CSP), ~8.9 km E. of Woolsey Creek	2	Low	unknown		<ul style="list-style-type: none"> 1.5 m wide stream with good flow observed but inaccessible due to steep channel gradient (70% to N. and 45% to S.) May provide downstream fish habitat (e.g., high water refuge habitat) Prefer highway expansion to N. due to proximity to Illecillewaet River 	R3/16-18
260	0975	~42.08	UMA	6	Culvert - 1800 mm CSP, ~11.45 km E. of Woolsey Creek	3	Moderate	unknown		<ul style="list-style-type: none"> 2.0 m wide stream with good flow observed 70% channel gradient on N. limits fish access but channel gradient on S. < 20% Good fish habitat potential S. of highway Culvert outlet perched, with ~1.5 m drop Prefer highway expansion to N. due to proximity to Illecillewaet River 	R3/19-21
260	0975	~42.35	UMA	7	Culvert - 900 mm CSP, ~11.8 km E. of Woolsey Creek (culvert # 607)	3	Moderate	unknown		<ul style="list-style-type: none"> 1.5 m wide stream with moderate flow observed 50% stream channel gradient to N. but moderate fish habitat potential to S., <10% channel gradient Prefer highway expansion to N. due to proximity to Illecillewaet River and fish habitat potential to S. 	R3/22-23
260	0975	~43.92	UMA	8	Culvert - 1500 mm CSP, 13.4 km E. of Woolsey Creek (culvert # 610)	1	Low	/		<ul style="list-style-type: none"> Poorly developed stream channel, 75% stream channel gradient N. and S. May be significant water source to wetland habitat in valley bottom highway expansion preferred to N. due to proximity to Illecillewaet River and wetland habitat to S. 	R3/24-25
260	0975	~44.78	UMA	9	Culvert - 900? mm CSP, ~14.25 E. of Woolsey Creek (culvert # 616)	2	Low	/		<ul style="list-style-type: none"> < 1.0 m wide stream, not accessible to fish because of 75%+ gradients N. and S. May provide some high water refuge habitat at the confluence with Illecillewaet River and clear water feeding sources Prefer highway expansion to N. to minimize encroachment on Illecillewaet River 	R4/1-2
260	0975	~46.00	UMA	10	Culvert and stream under MacDonald Snowshed; 15.25 km E. of Woolsey Creek	2	Low	/		<ul style="list-style-type: none"> Steep and narrow drainage / debris torrent Likely inaccessible to fish May provide some high water refuge habitat at the confluence with Illecillewaet River and clear water feeding sources Prefer highway expansion to N. to minimize encroachment on Illecillewaet River 	R4/3-7
260	0975	48.35	UMA	na	Glacier National Park West Boundary - End Corridor 260 Segment						
270	0980	0.0	UMA Section to W.	na	Glacier National Park West Boundary - Start Corridor Segment 270					Segment Length 43.81 km.	

Table C4. Summary of Point Features and Fisheries Information (continued)

Corridor	LKI Segment	LKI (Offset km) ¹	Project	Feature I.D. No. ²	Point Feature - Description	Fish Habitat Class ³	MoTH Sensitivity Rating	Fish Species - Potentially Present ⁴	Source ⁵	Comments ⁶	Photo Roll / Frame
270	0980	0.3	Within Glacier Nat. Park	11	Upper Bridge over Illecillewaet River, 0.3 km inside Glacier National Park Boundary	5	High	BT, BSU, CRH, KO, LKC, MW, RB, WCT	MELP	<ul style="list-style-type: none"> 50 m+ wide stream Good riffle, pool, and run habitat highway expansion constrained because bridge crossing at an 'S' in river 	R4/8-10
270	0980	43.81	UMA to E.	na	Glacier National Park East Boundary - End Corridor 270 Segment						
280	0985	0.00	UMA	na	Glacier National Park East Boundary - Begin Corridor Segment 280 (Glacier National Park to Columbia River Bridge)					<ul style="list-style-type: none"> Segment Length 29.66 km. Rated in MoTH report (MoTH 1998) as fair candidate for upgrading, based on overall environmental values (location within Beaver River valley). 	
280	0985	-0.01	UMA	1	Culvert - 1500 mm CSP, 0.01 km E. of Glacier Park E. Boundary	1	Low			<ul style="list-style-type: none"> Poorly defined stream channel and almost no flow observed Very limited fish habitat potential 75%+ stream channel gradient N. and S. Prefer highway expansion to S. 	R4/11-12
280	0985	-2.25	UMA	2	Culvert - 1000 mm concrete pipe, ~2.25 km E. of Glacier Park E. Boundary	3	Moderate	unknown		<ul style="list-style-type: none"> 1.5 m wide stream with good flow observed Good fish habitat potential. < 10% channel gradient to N. and < 20% channel gradient to S.; high value riparian forest to N. Prefer highway expansion to S. to avoid potential fish habitat and riparian forest 	R4/13
280	0985	-3.25	UMA	3	Culvert - 1200 mm CSP, 3.25 km E. of Glacier Park E. Boundary	3	Moderate	unknown		<ul style="list-style-type: none"> 1.0 m wide stream with low flow observed, good fish habitat potential Lower reach may be gradient barrier Prefer highway expansion to S. 	R4/14-15
280	0985	-3.8	UMA	4	Culvert - 1000 mm CSP, 3.8 km E. of Glacier Park E. Boundary	2	Low	unknown		<ul style="list-style-type: none"> 1.0 m wide stream with low flow observed during field reconnaissance Not accessible to fish and poor habitat, 45% channel gradient N. and S. Prefer highway expansion to S. 	R4/16
280	0985	-4.85	UMA	5	Unknown crossing structure, ~4.85 km E. of Glacier Park E. Boundary	3	Moderate	unknown		<ul style="list-style-type: none"> 1.5 m wide stream with good flows observed Good potential fish habitat but may not be accessible due to gradient barriers in lower reach, good riparian habitat on S. Prefer highway expansion to N. to avoid riparian habitat 	R4/17
280	0985	-5.45	UMA	6	Culvert - 1800 mm concrete pipe, ~5.45 km E. of Glacier Park E. Boundary	3	Moderate	unknown		<ul style="list-style-type: none"> 2.0 m wide stream with good flow observed Good fish habitat potential, joins with stream 5 - 500 m downstream Potential barrier to upstream migration at N. end of culvert Prefer highway expansion to S. 	R4/18-19
280	0985	-8.6	UMA	7	Unknown crossing structure, ~8.6 km E. of Glacier Park E. Boundary	na	High	unknown		<ul style="list-style-type: none"> No stream identified but a receiving site observed on the N. side of highway Potentially high wetland value including several cottonwood snags Prefer highway expansion to south side 	R4/20
280	0985	-9.95	UMA	8	Culvert 1200 mm concrete pipe, ~9.95 km E. of Glacier Park E. Boundary	4	High	unknown		<ul style="list-style-type: none"> 3-4 m wide stream with good flow observed Low channel gradient N. and S. (< 5%) and good spawning and rearing habitat Streams flows into Quartz Creek Prefer symmetrical lane additions 	R4/21-23
280	0985	-10.45	UMA	9	Culvert - 1200 mm concrete pipe, ~10.45 km E. of Glacier Park E. Boundary	4	High	unknown		<ul style="list-style-type: none"> 2.0 m wide stream with no flow observed Good habitat potential; flows into Quartz Creek Prefer symmetrical lane additions 	R4/24-25
280	0985	-10.85	UMA	10	Heather Creek. Culvert - 1500 mm concrete pipe, ~10.85 km E. of Glacier Park E. Boundary	4	High	unknown		<ul style="list-style-type: none"> 3-4 m wide stream with good flow observed Good fish habitat and low channel gradient N. and S.; stream flows into Quartz Creek Prefer symmetrical lane additions 	R5/1-2
280	0985	-12.63	UMA	11	Culvert - 1500 mm concrete pipe, ~12.6 km E. of Glacier Park E. Boundary	4	High	unknown		<ul style="list-style-type: none"> 2-3 m wide stream with low flow observed Good fish habitat and low channel gradient N. and S., flows into Quartz Creek Prefer symmetrical lane additions 	R5/3-4
280	0985	13.28	UMA	12	Quartz Creek Bridge West End 1607. Clear span bridge.	5	High	unknown		<ul style="list-style-type: none"> 5-7 m wide stream with good flow observed Good cascading fish habitat < 15% channel gradient 	R5/5-7

Table C4. Summary of Point Features and Fisheries Information (continued)

Corridor	LKI Segment	LKI (Offset km) ¹	Project	Feature I.D. No. ²	Point Feature - Description	Fish Habitat Class ³	MoTH Sensitivity Rating	Fish Species - Potentially Present ⁴	Source ⁵	Comments ⁶	Photo Roll / Frame
280	0985	~16.0	UMA	13	Wiseman Creek. Culvert - 2.0 m + CSP; ~16.0 km E. of Glacier Park E. Boundary	4	High	unknown		<ul style="list-style-type: none"> 3-5 wide stream with good flow observed Good fish habitat and moderate channel gradient, 15% to S. and 10% to N. Culvert likely prevents upstream fish migration due excessive length and channel gradient; slight preference for expansion to the S. 	R5/8-10
280	0985	~17.2	UMA	14	Culvert - 900 mm concrete pipe, ~17.2 km E. of Glacier Park E. Boundary	4	High	unknown		<ul style="list-style-type: none"> 2.0 m wide stream with low flow observed; 5% channel gradient N. and S. May be accessible to fish at higher flows May provide significant water flow to wetland 200 m downstream Prefer highway expansion to S. 	R5/11
280	0985	~18.25	UMA	15	Culvert - 900 mm concrete pipe, ~18.25 km E. of Glacier Park E. Boundary	4	High	unknown		<ul style="list-style-type: none"> 2.0 m wide stream with low flow observed, 5% channel gradient N. and S. May be accessible to fish at higher flows May provide significant water flow to wetland 100 m downstream; prefer highway expansion to S. 	R5/12-13
280	0985	~19.4	UMA	16	Culvert - 900 mm CSP, ~19.4 km E. of Glacier Park E. Boundary	3	Moderate	unknown		<ul style="list-style-type: none"> 1.0 m wide stream with low flow observed Poorly defined channel, steep channel gradient to S. prevents fish access Prefer highway expansion to S. 	R5/14-15
280	0985	~20.78	UMA	17	Culvert - 1500 mm CSP, ~20.78 km E. of Glacier Park E. Boundary	4	High	unknown		<ul style="list-style-type: none"> 1.5 m wide stream with low flow observed May have seasonal use by fish 70 m + culvert length likely prevents upstream migration Prefer highway expansion to S. 	too dark for photo
280	0985	~21.3	UMA	18	Culvert - 600 mm CSP, ~21.3 km E. of Glacier Park E. Boundary	4	High	unknown		<ul style="list-style-type: none"> 1.5 m wide stream with good flow observed Good potential fish habitat Not marked on the TRIM map Wetland areas to N. Prefer highway expansion to S. 	R5/16-17
280	0985	~22.92	UMA	19	Oldman Creek crossing, 3.5 m pipe arch with open bottom?, ~22.92 km E. of Glacier Park E. Boundary	4	High	unknown		<ul style="list-style-type: none"> 3-5 m wide stream 20 m upstream 35-40% channel gradient; downstream < 10% channel gradient Good fish habitat; wetland areas to N. Prefer highway expansion to S. 	R6/1-3
280	0985	~23.65	UMA	20	Culvert - 600 mm CSP, ~23.65 km E. of Glacier Park E. Boundary	4	High	unknown		<ul style="list-style-type: none"> 3-5 m wide stream with good flow observed Excellent fish habitat potential Flows into stream no. 21 about 200 to 300 m downstream of highway High constraints on both sides of highway due to riparian and fish habitat 	R5/18-20
280	0985	~23.9	UMA	21	Culvert - approx. 2.5 to 3.0 m wide pipe arch multi-plate, ~23.9 km E. of Glacier Park E. Boundary	5	High	unknown		<ul style="list-style-type: none"> 3-5 m wide stream with good flow observed 50 m + floodplain and wetland habitat associated with stream Excellent fish habitat potential; high value wildlife movement corridor and riparian habitat Consider installing bridge in upgrading this area High constraints on both sides of highway due to riparian and fish habitat 	R5/21-23
280	0985	~24.5	UMA	22	Culvert - 600 mm CSP, ~24.5 km E. of Glacier Park E. Boundary	1	Low	unknown		<ul style="list-style-type: none"> Ravine/gully system, poorly defined channel No flow observed during field inspection Fish habitat unlikely Prefer symmetrical lane additions 	R5/24-25
280	0985	~28.97	UMA	23	Culvert - 900 mm concrete pipe, ~28.97 km E. of Glacier Park E. Boundary	2	Low	unknown		<ul style="list-style-type: none"> 1.5 wide stream with poorly defined channel No flow observed during field inspection 60% channel gradient to S., 10% channel gradient to N. Low potential for fish habitat Prefer highway expansion to S. to avoid effects on habitat close to Columbia River 	R6/4-5
280	0985	~29.26	UMA	24	Culvert - 900 mm concrete pipe, ~29.26 km E. of Glacier Park E. Boundary	3	Moderate	unknown		<ul style="list-style-type: none"> 1.5 wide stream with poorly defined channel and no flow observed Low fish habitat potential S. but moderate to N. Prefer highway expansion to S. to avoid effects on habitat close to Columbia River 	R6/6-7

Table C4. Summary of Point Features and Fisheries Information (continued)

Corridor	LKI Segment	LKI (Offset km) ¹	Project	Feature I.D. No. ²	Point Feature - Description	Fish Habitat Class ³	MoTH Sensitivity Rating	Fish Species - Potentially Present ⁴	Source ⁵	Comments ⁶	Photo Roll / Frame
280/290	0985	29.66	UMA	25	Columbia River Bridge West End 1605 - End 280 Segment, end 3 lane section; Clear span bridge over Columbia River End of Corridor Segment 280. Start of new Corridor Segment 290.	5	High	BB, BSU, BT, CAS, CCG, CP, CRH, CSU, EB, KO, LDC, LKC, LNC, LSU, LW, MW, NSC	MELP	<ul style="list-style-type: none"> Columbia River mainstem observed at low flow during field inspection 2 piers in the river channel Prefer highway expansion to S. to minimize span width and reduce disturbance of riparian vegetation (west bank) 	R6/8-12
Start 290	0985	29.66 - 53.85		na	Start of new Corridor Segment 290 at Columbia River Bridge West End 1605 (Donald to Anderson Road, West of Golden)					Segment Length 24.19 km. Rated in MoTH report (1998) as fair candidate for upgrading in terms of overall environmental values (route traverses Columbia River valley).	
290	0985	~31.448	UMA/ SNC ⁹	1	Culvert - 600 mm CSP, 0.458 km E. of DeJordie Rd.	2	Low	unknown		<ul style="list-style-type: none"> 1.0 m wide stream with low flow observed and poorly defined channel, especially N. of highway Channel gradient 2.0% with moderate fish habitat potential at high flows Railway stream crossing may be obstructing upstream fish passage Lower reach may provide mainstem refuge habitat Some iron oxide staining observed at stream area Prefer highway expansion to N. to avoid loss of river valley vegetation 	R1/6-7
290	0985	~31.945	UMA/ SNC	2	Culvert - 900 mm CSP, 0.955 km E. of DeJordie Rd.	2	Low	unknown		<ul style="list-style-type: none"> 1.0 m wide stream with no flow observed and poorly defined channel, especially N. of highway. Channel gradient 4.0% and moderate fish habitat potential at high flows Railway stream crossing may be obstructing upstream fish passage Lower reach may provide mainstem refuge habitat. Some iron oxide staining at stream area Prefer highway expansion to N. to avoid loss of river valley vegetation 	R1/8-9
290	0985	~32.106	UMA/ SNC	3	Culvert - 600 mm CSP, 1.116 km E. of DeJordie Rd.	2	Low	unknown		<ul style="list-style-type: none"> 1.0 m wide stream with low flow observed and poorly defined channel, especially N. of highway Channel gradient 4.0% with moderate fish habitat potential at high flows Railway stream crossing may be obstructing upstream fish passage Lower reach may provide mainstem refuge habitat Some iron oxide staining at stream area Prefer highway expansion to N. to avoid loss of river valley vegetation 	R1/10-12

End Notes:

¹ Please note that most point and corridor feature LKIs are not exact except where referenced to bridges or other major landmarks in the LKI inventory listed provided by design engineer. LKIs were determined in the field by extrapolation from maps and by using vehicle odometer readings in conjunction with estimates of distances from known LKI landmarks.

² Refers to point or site-specific landmarks examined in the field. Such features may include culverts, bridges, or wetlands.

³ Sensitivity rating is from 1 (lowest potential value fish habitat) to 5 (highest).

⁴ See attached Table C6 for fish species abbreviations.

⁵ Reference source for fish presence information.

⁶ Comments regarding attributes of aquatic features, such as flow conditions, were based on observations from our preliminary field reconnaissance, which was conducted during seasonal low flow conditions between November 8 to 13, 1998.

⁷ Ministry of Transportation and Highways (MoTH). 1998. Environmental Overview Assessment: Trans Canada Highway Corridor (Kamloops to Alberta Border). Report prepared by Acres International Limited. Kamloops, B.C.

⁸ MELP - Ministry of Environment, Lands and Parks.

⁹ Note: Since the actual boundary between the UMA and SNC design sections is not finalized, we have provided information regarding three culverts in the section of highway between the Columbia River Bridge and Big Bend Highway in both the UMA and SNC existing conditions reports for fisheries information.

Table C5. Summary of Corridor Features and Potential Fish Habitat Sensitivity Rating

Corridor	LK1 Segment	Zones (LK1 Offsets) ¹	Corridor Feature - Description	MoTH Sensitivity Rating ²	More Sensitive Side of Highway	Comments Regarding Sensitivity and Fish Habitat Issues
260	0975	30.55 - 34.00	South side of highway parallels Illecillewaet River.	High	South	<ul style="list-style-type: none"> Close proximity of Illecillewaet River to south side of existing highway Important riparian and fish habitat values This section includes approaches to and crossing of the Illecillewaet River via the Alberta Canyon West Bridge
260	0975	34.00 - 35.4	Minor drainages along the TCH.	Low	North	<ul style="list-style-type: none"> Potential erosion and sediment control Prefer expansion to the south to retain existing vegetation and forest
260	0975	35.4 - 42.85	TCH crosses the Illecillewaet River and remains close to the river along this section of highway.	High	South	<ul style="list-style-type: none"> Close proximity of Illecillewaet River to south side of existing highway In portions of this section, TCH built on narrow bench with steep slopes above and below; steep drop-off to Illecillewaet River Section includes approaches to and crossing of the Illecillewaet River via the Alberta Canyon East Bridge Prefer expansion to the north side of highway
260	0975	42.85 - 43.27	Illecillewaet River meanders away from the TCH on the south side of highway.	Moderate	South	<ul style="list-style-type: none"> Potential impacts to Illecillewaet River valley bottom and riparian vegetation Prefer expansion to the north
260	0975	43.27- 44.12	TCH is located adjacent to Illecillewaet River and floodplain.	High	South	<ul style="list-style-type: none"> Close proximity of Illecillewaet River to south side of existing highway TCH built on narrow bench with steep slopes above highway, steep drop-off to Illecillewaet River Important habitat values Prefer expansion to the north
260	0975	44.12 - 44.47	Illecillewaet River meanders away from the TCH in this section.	Moderate	South	<ul style="list-style-type: none"> Potential impacts to Illecillewaet River valley bottom, wetland area and riparian vegetation Prefer expansion to the north
260	0975	44.47 - 48.35	Highway is located adjacent to Illecillewaet River.	High	South	<ul style="list-style-type: none"> Close proximity of Illecillewaet River to south side of existing highway TCH built on narrow bench with steep slopes above highway, steep drop-off to Illecillewaet River Prefer expansion to the north
260	0975	48.35	Glacier National Park West Boundary - End 260 Segment.			
270	0980	0.0	Glacier National Park West Boundary - Start Corridor Segment 270.			Segment Length 43.81 km.
280	0985	0.00	Glacier National Park East Boundary - Start Corridor Segment 280 (Glacier National Park to Columbia River Bridge).			<ul style="list-style-type: none"> Segment Length 29.66 km. Rated in MoTH report (MoTH 1998) as fair candidate for upgrading, based on overall environmental values (location within Beaver River valley).
280	0985	0.00 to 1.30	Beaver River parallels north side of TCH.	High	North	<ul style="list-style-type: none"> Close proximity of Beaver River to north side of existing highway Prefer expansion to the south
280	0985	1.30 to 2.87	Beaver River is situated further away from the TCH in this section. TCH traverses a wide valley bench at this point.	Moderate	North	<ul style="list-style-type: none"> TCH situated on a wide bench with TCH further away from Beaver River Potential wetland and riparian forest values to the north Prefer expansion to the south
280	0985	2.87 - 6.05	Beaver River parallels north side of TCH.	High	Both	<ul style="list-style-type: none"> Proximity of Beaver River to north side of existing highway. Steep, well-vegetated slope down to Beaver River Valley on N. side of highway Highway expansion from LK1 2.87 to 4.1 preferred to the south to avoid potential fish habitat, wetland area and riparian forest Highway expansion from 4.1 to 6.05 preferred to be symmetrical with wildlife wetland sensitivity on south side of highway and proximity of highway to Beaver River on north side
280	0985	6.05 - 8.14	TCH traverses the bottom of a wide valley in an area well separated from the Beaver River.	Low	North	<ul style="list-style-type: none"> Potential erosion and sediment concerns Potential encroachment into wetlands on south side Prefer expansion to the south to avoid disturbance of wetlands

Table C5. Summary of Corridor Features and Potential Fish Habitat Sensitivity Rating (continued)

Corridor	LKI Segment	Zones (LKI Offsets) ¹	Corridor Feature - Description	MoTH Sensitivity Rating ²	More Sensitive Side of Highway	Comments Regarding Sensitivity and Fish Habitat Issues
280	0985	8.14 - 11.15	Approaching Quartz Creek wetland and stream complex immediately adjacent to north side of TCH.	High	Both	<ul style="list-style-type: none"> Highway expansion from LKI 8.14 to 8.75 preferred to the north. Large wetland situated immediately adjacent to south side of highway. LKI 8.75 - 11.15 section - wetland habitat sensitivity on both sides of highway. Prefer symmetrical expansion in this section.
280	0985	11.15 - 12.85	TCH alignment traverses a broad, relatively flat river valley bench, some distance from Quartz Creek.	Moderate	North	<ul style="list-style-type: none"> Prefer expansion to the south to avoid disturbance of wetland areas Major realignment of the highway through this section would be of concern
280	0985	12.85 - 13.80	Quartz Creek crossing with adjacent wetland and riparian habitats in this section.	High	Both Sides	<ul style="list-style-type: none"> High value potential fish habitat at Quartz Creek on N. and S. side of highway Significant fisheries concerns
280	0985	13.8 - 15.6	TCH traverses a broad, flat valley bottom bench through this section.	Low	Neither	<ul style="list-style-type: none"> Potential erosion and sediment control Maintenance of existing drainage patterns
280	0985	15.6 - 16.4	Stream, wetland riparian complex on south side of highway. Section includes Wiseman Creek crossing.	High	Both	<ul style="list-style-type: none"> Significant potential high value fisheries habitat adjacent to Wiseman Creek on north side in this short section Prefer symmetrical widening or expansion to the south.
280	0985	16.4 - 22.2	TCH traverses very long stretch along valley bottom with streams, wetlands and riparian features.	High	North	<ul style="list-style-type: none"> Area contains large complex of streams and wetland riparian areas on both sides of highway Most important habitat values likely on the north side of TCH Prefer expansion to the south
280	0985	22.2 - 24.24	Very large stream, wetland, riparian complex on both sides of highway.	High	Both	<ul style="list-style-type: none"> Important habitat values on both sides of TCH Critical wetlands and riparian vegetation
280	0985	24.24 - 27.5	Large wetland complex on the south side of the TCH.	Moderate	South	<ul style="list-style-type: none"> Prefer expansion to the north, although section likely contains steep downhill slopes to Columbia River Potential erosion and sediment concerns with proximity of Columbia River
280	0985	27.5 - 29.24	TCH alignment approaches Columbia River.	Moderate	North	<ul style="list-style-type: none"> Prefer expansion to the south Steep downhill slopes towards the Columbia River on the north side
280	0985	29.24 - 29.61	Riparian area adjacent to Columbia River Bridge crossing on north side of highway.	High	North	<ul style="list-style-type: none"> Valuable riparian habitat Significant habitat values Prefer new bridge on south side of existing bridge to reduce disturbance of riparian vegetation
280	0985	29.61 - 30.26	Riparian area adjacent to Columbia River Bridge crossing on south side of highway.	High	Both	<ul style="list-style-type: none"> Valuable riparian habitat Significant habitat values Prefer new bridge on south side of existing bridge to reduce disturbance of riparian vegetation
Start 290	0985	29.66 - 53.85	Columbia River Bridge West End 1605 - Start Corridor Segment 290 (Donald to Anderson Road, West of Golden).			Segment Length 24.19 km. Rated in MoTH report (1998) as fair candidate for upgrading in terms of overall environmental values (route traverses Columbia River valley).
290	0985	30.26 - 31.3	Minor drainages along TCH. Columbia River located near the TCH on south side of highway.	Low	South	<ul style="list-style-type: none"> Potential erosion and sediment concerns Maintenance of existing drainage patterns Prefer highway expansion to north to avoid loss of biofiltration buffer between railway and highway
290	0985	31.3 - 35.5	Columbia River located near the TCH on the south side of the highway, with river valley vegetation on south side of highway.	Moderate	South	<ul style="list-style-type: none"> Fisheries sensitivity alternates from one side of the highway to the other In general, prefer highway expansion to north to avoid loss of biofiltration buffer between railway and TCH, river valley vegetation and downstream vegetative buffer Potential habitat impact and sediment source

End Notes:

¹ Please note that most point and corridor feature LKIs are not exact except where referenced to bridges or other major landmarks in the LKI inventory listed provided by design engineer. LKIs were determined in the field by extrapolation from maps and by using vehicle odometer readings in conjunction with estimates of distances from known LKI landmarks.

² It is important to note that these ratings are based on preliminary information and may be changed as more information and field sampling data become available. These ratings were applied from an overview perspective and apply to areas within 100 m of the existing TCH.

Table C6. Scientific names and abbreviations for fish species known to occur within streams in Corridor Segments 260 and 280

COMMON NAME	SCIENTIFIC NAME	CODE	CORRIDOR	
			260	280
bridgelip sucker	<i>Catostomus columbianus</i>	BSU	x	x
bull trout	<i>Salvelinus confluentus</i>	BT	x	x
burbot	<i>Lota lota</i>	BB		x
eastern brook trout	<i>Salvelinus fontinalis</i>	EB		x
kokanee	<i>Oncorhynchus nerka</i>	KO	x	x
lake chub	<i>Couesius plumbeus</i>	LKC	x	x
largescale sucker	<i>Catostomus columbianus</i>	LSU		x
longnose dace	<i>Rhinichthys cataractae</i>	LNC		x
longnose suckers	<i>Catostomus catostomus</i>	LSU		x
northern squawfish	<i>Ptychocheilus oregonensis</i>	NSC		x
Mountain whitefish	<i>Prosopium williamsoni</i>	MW	x	x
Rainbow trout	<i>Oncorhynchus mykiss</i>	RB	x	x
Slimy sculpin	<i>Cottus cognatus</i>	CCG		x
Torrent sculpin	<i>Cottus rhotheus</i>	CRH	x	x
Westslope cutthroat trout	<i>Oncorhynchus clarki lewisi</i>	WCT	x	x

5.0 References

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Ministry of Transportation and Highways. 1998a. Environmental Overview Assessment: Trans Canada Highway Corridor (Kamloops to Alberta Border). Report prepared by Acres International Limited. Kamloops, B.C.

Ministry of Transportation and Highways. 1998b. Fisheries Assessment of the Kicking Horse River and Tributaries: Golden to Yoho National Park. Report prepared by ENKON Environmental Ltd., Kamloops, B.C.

**Existing Conditions Report
Appendix 5 – Fisheries**

Section C2: Donald to Roth Creek

1.0 Introduction

Coast River Environmental Services Ltd. (Coast River) was retained by the Ministry of Transportation and Highways (MoTH) to undertake an overview assessment of potential fish habitat and watercourse sensitivities along a portion of the Trans Canada Highway (TCH). This fisheries overview information is intended to assist the planning and early design phases of the proposed functional upgrade to portions of the TCH between Mt. Revelstoke Park and Yoho National Park in British Columbia. Specific study sections assigned to Coast River are indicated in Table C1.

This report provides an overview of the existing fisheries habitat conditions and sensitivities for Donald to the Kicking Horse Canyon.

2.0 Study Area

The linear extent of our study area is briefly summarized in Table C1. These corridor segments are defined in the MoTH's Corridor Management Plan for the Cache Creek to Rockies Highway Improvement Program. It should be noted that as directed by the MoTH, fisheries assessment work was not conducted along the TCH within any national parks. For the purposes of the existing conditions report, the MoTH asked the consultants to confine their examination to the highway right-of-way along the existing alignment of the TCH. The TCH right-of-way between Revelstoke and Yoho National Park averages about 100 m in total width, with some four-lane or three-lane sections already in place.

3.0 Methods

3.1 General

The assessment of fish habitat sensitivity along these corridor segments is largely based on existing background information and reports, much of which was provided by the MoTH. In addition, several other information sources were used to complete this overview fisheries assessment, including:

- Initial contacts with regional resource agency personnel
- Airphotos, TRIM maps, MoTH alignment drawings, MoTH culvert crossing lists
- A drive-through and an 8 mm video reconnaissance of these corridor segments during an eastbound traverse of the highway
- Brief site inspections at significant watercourses in areas immediately adjacent to the highway.

Coast River personnel, in association with a fisheries biologist from Mirkwood Ecological Consultants Ltd. conducted the field work for this fisheries overview assessment along the TCH right-of-way between the eastern boundary of Mt. Revelstoke National Park and the western boundary of Yoho National Park, during the November 8 - 13, 1998 period. This assessment included an examination of potential fish habitat along each of the three major design sections (i.e., UMA, SNC-Lavalin, and ND Lea/MoTH Region 3).

The overall fisheries sensitivity of each highway corridor segment was prepared on the basis of our review of available fisheries information, a drive along the highway to note obvious stretches with fisheries sensitivities, and a brief site inspection at significant stream crossings. Existing information was collected from local resource managers, and from the MELP FISS database. Major fisheries constraints were assessed by driving the highway corridor segments and mapping areas of apparent high, moderate, and low fisheries sensitivities. Existing fisheries information and TRIM maps were used to prioritize stream crossings for assessment. Significant stream crossings were visited within each corridor segment. We also inspected any significant stream crossings that were encountered while driving along the highway even if they were not indicated on existing maps or reports. In many cases, watercourse crossings are not readily evident as one drives along the TCH. In order to locate a known watercourse crossing in the field, we had to rely on the following sources:

- TRIM mapping (1:20,000 scale) and engineering drawings
- MoTH culvert lists
- Fisheries reports (MoTH 1998b)
- MoTH Landmark Kilometer Inventory (LKI) with identified features referenced by distances from known points along the TCH.

During the field trip, distances recorded on the vehicle odometer were used in conjunction with the culvert and LKI lists to locate known aquatic features along the TCH, such as wetlands or watercourses. Some of the major fisheries-related features, such as bridges were identified in a MoTH report (1998a). In addition, during the field trip, Coast River and Mirkwood staff identified many other fisheries-related features while driving along the TCH.

The following information was collected at each stream crossing: corridor segment number, LKI segment number, LKI, stream number within each corridor segment (as assigned by Coast River), feature description (i.e., bridge, culvert or wetland), location (LKI), fish habitat rating, potential for providing fish habitat immediately upstream and downstream of the crossing, and general stream characteristics (i.e., stream width, gradient, condition of crossing, and preferred side of the highway for widening). This information was compiled after the field trip and is presented in the findings. In addition, a detailed photographic catalogue of all visited watercourses was assembled. To facilitate our data reporting and to collate photographs with each fisheries-related feature, each was

given a unique feature identifier number (i.e., corridor segment, LKI segment, I.D. number).

Once the data tables were initially drafted, the general corridor and point features were transferred onto maps and/or photo mosaics provided by the design engineers. Corridor features were mapped on the basis of general fish habitat sensitivity in areas adjacent to each side of the highway within approximately 100 m of the highway. The sensitivities for broad zones of corridor features are represented graphically as a bar at the bottom of the photo mosaic maps and are summarized in the findings. Point features are indicated on the bar as symbols, which represent sensitivity values.

3.2 Fish Habitat and Other Aquatic Features Rating Criteria

Aquatic features such as watercourses and wetlands within our study area were assessed on the basis of potential fish habitat and then given a classification of 1 to 5, with 5 being assigned to the highest value features in terms of fish habitat potential and 1 being assigned to lowest value features, such as a dry swale with no habitat potential. The classification criteria for this assignment was devised on the basis of the DFO/MoELP classification system for lower mainland region watercourses, which was originally developed by the City of Surrey and Envirowest Consultants Limited. The lower mainland classification system was modified to reflect differences in the nature of the stream systems and the composition of fish species in the interior/central portion of B.C. The potential fish habitat classification system was based on several key factors, such as the quality of fish habitat, the accessibility of the stream to migrating fish, and general stream characteristics. The wetted width, stream gradient, channel characteristics and relative flow volume of each stream also influenced our classification.

The MoTH required that environmental sensitivities for each environmental discipline be ranked as high, moderate, low or nil. Table C2 presents our aquatic feature rating system and the criteria used to classify aquatic features. For MoTH planning purposes, class 1 and 2 fish habitat features were generally assigned a rating of "low" sensitivity (in terms of potential fish habitat values), class 3 features were rated as "moderate", and class 4 or 5 features were rated as "high" sensitivity. Since almost all of the drainages in the study area flow into major fish-bearing systems, and the existing TCH is located in close proximity to those major systems, a "nil" rating was not deemed applicable in the rating of aquatic features.

It should be emphasized that this fish habitat rating system was developed specifically for this fisheries overview assessment. It proved to be a useful tool to ensure that the study area watercourses were rated consistently. The criteria we used seem appropriate given the nature of the streams encountered during the field work, the limited amount of existing information about the systems and our inability to conduct detailed stream walks or direct fish sampling.

Our initial assessment of fish habitat sensitivity of the study area watercourses is based on limited background information and brief site visits. Due to the limited period for field reconnaissance and inclement weather conditions, few streams were inspected beyond the edge of the existing highway right-of-way. As a result, stream habitat within the highway right-of-way was examined in isolation of its upstream and downstream characteristics. Important aquatic features such as downstream obstructions to fish passage, upstream lakes with resident or stocked fish populations, other physical habitat constraints or enhancement opportunities remain undetermined for many of these systems. Therefore, the sensitivity assessment is based on our present preliminary knowledge of the systems. As a result, specific sensitivity ratings may change during the course of the present assignment, following more thorough stream sampling in the spring.

4.0 Findings

Table C8 summarizes fisheries information regarding point-specific features, such as watercourse crossings, that were identified and examined within the study area. Table C9 provides a preliminary summary of corridor aquatic and riparian features within the study area. An overview regarding fisheries information for corridor segments within the study area, as well as our initial results from a preliminary investigation of the corridor segments, is provided below.

CORRIDOR SEGMENT 290 (LKI Segment #0985: LKI 29.66 to 53.85)

Background/Existing Fisheries Information

Corridor Segment 290 is a 24.19 km long section of the TCH that follows the eastern side of the upper Columbia River. The highway is situated on a relatively narrow bench approximately 2 to 20 m above the valley bottom through this corridor section which extends from Donald Road to Anderson Road (LKI 29.66 to 53.85). The upper Columbia River in this area meanders through a relatively wide floodplain, which contains numerous wetlands, beaver ponds, and side channels. The railway lies between the highway and the Columbia River from Donald Station to Golden and presents a severe constraint to further expansion of the highway towards the Columbia River. The slopes above the highway are generally steep (> 20% gradient), rocky and forested with mature conifers.

The Columbia River is the third largest drainage in BC and originates from Columbia Lake near Canal Flats (McPhail and Carveth 1992). The Columbia River is documented to have the highest number of introduced and endemic fish species of any of river system in BC (McPhail and Carveth 1992). The upper Columbia River and its major tributaries, which arise from glacially fed systems in the Purcell and Rocky mountains, and are typically cold, turbulent and silt-laden, supporting fewer fish species than the lower Columbia River due to their harsh, nutrient poor conditions. The following 18 species are reported to occur in the upper Columbia River in the vicinity of Corridor Segment

290: bull trout, burbot (*Lota lota*), chiselmouth (*Acrocheilus alutaceau*), eastern brook trout, kokanee, largescale sucker (*Catostomus macrocheilus*), longnose dace (*Rhinichthys cataractae*), longnose sucker (*Catostomus catostomus*), mountain whitefish, northern squawfish (*Ptychocheilus oregonensis*), peamouth (*Mylocheilus caurinus*), pygmy whitefish (*Prosopium coulteri*), rainbow trout, redbelt shiner (*Richardsonius balteatus*), slimy sculpin (*Cottus cognatus*), small mouth bass (*Micropterus dolomieu*), torrent sculpin, and westslope cutthroat trout (Alger and Donald 1984, McPhail and Carveth 1992, MoTH 1997, MELP 1998).

Results

In collecting data for the existing conditions report, Coast River was asked to rely primarily on existing fish assessment information to assist in the initial identification of significant streams (i.e., those with potential fish habitat). Therefore, our field work focused mainly on those streams previously identified as possibly fish-bearing. As noted in a previous fish assessment report (MoTH 1997), of the total 75 culverts under the TCH and one clear span bridge over the Blaeberry River in the section from Donald to Golden, there were 11 streams were identified or expected to contain fish at the highway crossing. During our field inspection, we observed at least 11 stream crossings along the TCH in Corridor Segment 290 (see Table C7). Six low to moderate sensitivity 2nd and 3rd order streams cross the highway from between LKI 29.66 to approximately LKI 35.705. These streams have steep gradients and/or poorly defined stream channels with ephemeral flows, and offer limited fish habitat potential. Five high sensitivity streams cross the highway between LKI 37.705 and LKI 53.85 including the Blaeberry River, Doyle Creek, Moberly Creek, Neale Creek and one unnamed creek. At all of these high sensitivity crossings, the railway and Columbia River constrain expansion opportunities along the south side of the highway and the steep, rocky, relatively unstable slopes may constrain expansion opportunities along the north side of the highway.

Table C7. Number of High, Medium, and Low Sensitivity Streams within each Corridor Segment

Corridor Segment	Number of Streams by Sensitivity Rating			Total
	Low*	Medium	High	
290	5	1	5	11
300	/	/	3	3
310	/	/	/	0
320	5	/	1	6
Total	10	1	9	20

* We only sampled a portion of the low sensitivity stream crossings in the corridor segments along the TCH. The count in this table represents a combination of stream crossings that were sampled and stream crossings that were noted during highway surveys or on maps.

CORRIDOR SEGMENT 300
(LKI Segment #0985: LKI 53.85 to 56.06)

Background/Existing Fisheries Information

Corridor Segment 300 is a 2.21 km section of the TCH that roughly parallels the Columbia River from Anderson Road to the junction of Highway 95 in Golden (LKI 53.85 to LKI 56.06). Corridor Segment 300 follows the eastern side of the upper Columbia River along a relatively narrow bench close to the valley bottom. The same fish species listed as present in our description of the Columbia River along Corridor Segment 290 of the TCH occur in this Corridor Segment (see discussion above).

Results

There are at least 3 stream crossings along Corridor Segment 300 of the TCH (see Table C7 above). Three high sensitivity streams cross the highway between LKI 53.897 and LKI 54.083. This section of highway is severely constrained by high value wetlands to the south of the highway and somewhat constrained by the steep slopes to the north of the highway. Eastern brook trout in bright spawning coloration were observed below highway culvert outlets in streams 10 and 11 (LKI 53.897 and LKI 54.032 respectively). The very high value of the wetland, beaver pond, stream system complex associated with these three stream crossings pose as a major constraint, from a fish habitat perspective, to highway improvement on the south side of the TCH in this area.

CORRIDOR SEGMENT 310
(LKI Segment #0990: LKI 0.00 to 2.40)

Background/Existing Fisheries Information

Corridor Segment 310 is a 2.4 km section of the TCH that extends through the town of Golden from the junction of Highway 95 to Golden View Road (LKI 0.00 to LKI 2.40). No significant stream crossings were observed in this section.

CORRIDOR SEGMENT 320
(LKI Segment #0990: LKI 2.4 to ~11.7)

Background/Existing Fisheries Information

The entire study area for Corridor Segment 320 extends from LKI 2.4 to LKI 25.93. Within this corridor segment, the SNC-LAVALIN design section is situated between LKI 2.4 and approximately LKI 11.7. This 9.3 km section of the TCH follows the Kicking Horse River from Golden View Road to a pullout near Roth Creek. The western portion of the highway in Corridor Segment 320 (i.e., west of the Yoho or 5 Mile bridge) is perched along the northern side of the lower Kicking Horse River on a road cut high above the river. The valley slopes are steep and very rocky with patchy forest cover. Gradients north and south of the highway often exceed 75% with rock falls common along this section of highway.

The Kicking Horse River is a major tributary to the Columbia River that enters the Columbia at Golden, B.C. The Kicking Horse River originates in the Wapta and Waputik Icefields of the Rocky Mountains which generate very turbid, cold, and nutrient poor waters resulting in relatively slow production for fish populations in these conditions. The following fish species are reported to occur in the Kicking Horse River: bull trout, eastern brook trout, mountain whitefish, pygmy whitefish, slimy sculpin, and torrent sculpin (MoTH 1998b, MELP 1998).

Results

Six stream crossings were examined along the TCH in the SNC-LAVALIN section of Corridor Segment 320 (Table C9). There are three low sensitivity 2nd and 3rd order streams, including Dart Creek, which cross the highway between LKI 2.62 and LKI 6.23. These streams have steep gradients, poorly defined stream channels, ephemeral flows, and offer limited fish habitat potential. However, all three streams may provide off-channel refuge habitat at their confluence with the Kicking Horse River.

The highway crosses over the Kicking Horse River at LKI 9.45 (Yoho/5 Mile Bridge). This site is considered to be sensitive from a fish habitat perspective because the valley is narrow (< 150 m) and there is high potential for highways expansion to adversely affect the existing stream channel through further encroachment. There are two more low sensitivity 2nd and 3rd order streams that cross the highway between LKI ~10.21 to LKI ~10.9. These streams have steep gradients, poorly defined stream channels, ephemeral flows, and offer limited fish habitat potential. These streams do not provide refuge habitat potential in their lower reaches as their stream gradients exceed 40% at their confluence with the Kicking Horse River.

Table C8. Summary of Point Features and Fisheries Information

Corridor	LKI Segment	LKI (Offset km) ¹	Project	Feature I.D. No. ²	Feature - Description	Fish Habitat Rating ³	MoTH Sensitivity Rating ⁴	Fish Species - Potentially Present ⁵	Source ⁶	Comments	Photo Roll / Frame
Start 290	0985	29.66 – 53.85			Start of new corridor segment 290 at Columbia River Bridge West End 1605 (Donald to Anderson Road, West of Golden)					Segment Length 24.19 km. Rated in MoTH report ⁷ (1998a) as fair candidate for upgrading (route traverses Columbia River valley).	
290	0985	~31.448	UMA/ SNC ⁸	1	Culvert - 600 mm CSP, 0.458 km E. of Dejordie Rd.	2	Low	unknown		<ul style="list-style-type: none"> • 1.0 m wide stream with low flow and poorly defined channel, especially N. of highway • Gradient 2.0% with moderate fish habitat potential at high flows • Railway stream crossing may be obstructing upstream fish passage • Lower reach may provide mainstem refuge habitat • Some iron oxide staining observed at stream area • Prefer highway expansion to N. to avoid loss of river valley vegetation 	R1/6-7
290	0985	~31.945	UMA/ SNC	2	Culvert - 900 mm CSP, 0.955 km E. of Dejordie Rd.	2	Low	unknown		<ul style="list-style-type: none"> • 1.0 m wide stream with no flow observed and poorly defined channel, especially N. of highway. • Gradient 4.0% and moderate fish habitat potential at high flows. • Railway stream crossing may be obstructing upstream fish passage. • Lower reach may provide mainstem refuge habitat. • Some iron oxide staining at stream area • Prefer highway expansion to N. to avoid loss of river valley vegetation 	R1/8-9
290	0985	~32.106	UMA/ SNC	3	Culvert - 600 mm CSP, 1.116 km E. of Dejordie Rd.	2	Low	unknown		<ul style="list-style-type: none"> • 1.0 m wide stream with low flow and poorly defined channel, especially N. of highway • Gradient 4.0% with moderate fish habitat potential at high flows • Railway stream crossing may be obstructing upstream fish passage • Lower reach may provide mainstem refuge habitat • Some iron oxide staining at stream area • Prefer highway expansion to N. to avoid loss of river valley vegetation 	R1/10-12
290	0985	~33.831	SNC	4	Culvert - 600 mm CSP, 1.031 km E. of Big Bend highway.	1	Low	unknown		<ul style="list-style-type: none"> • Dry cross ditch drainage • Fish habitat unlikely upstream from highway (N. of hwy) • Very limited fish habitat potential within right-of-way at any flow level • Joins stream #5 about 50 m downstream • Prefer highway expansion to S. in area of existing disturbance 	
290	0985	~33.833	SNC	5	Culvert - 600 mm CSP, 1.033 km E. of Big Bend highway.	3	Moderate	unknown		<ul style="list-style-type: none"> • 2.0 m wide stream channel with low flow observed • 5% gradient S. of highway and 12% to N. • Good fish habitat potential • Lower reach provides mainstem refuge habitat • Wide railway grade downstream from highway (on S. side) may obstruct upstream fish migration • Prefer highway expansion to S. in area of existing disturbance 	R1/13-14
290	0985	~34.773	SNC	19	Culvert - 600 mm CSP with drop structure to south of highway	2	Low	unknown		<ul style="list-style-type: none"> • 1.5 m wide stream channel with low flow observed • Highly disturbed stream channel to S. of highway with outlet drop structure obstructing upstream fish migration • Potential mainstem high water refuge habitat • Prefer highway expansion to S. in area of existing disturbance 	
290	0985	~37.705	SNC	20	Culvert - 1800 mm CSP. Neale Creek stream crossing.	4	High	unknown	MoTH 1997	<ul style="list-style-type: none"> • Identified in MoTH report as fish-bearing • Not included in sampled streams in MoTH report, consequently not examined during initial field reconnaissance • Further fish habitat investigation required during subsequent field sampling program in 1999 	
290	0985	~38.405	SNC	6	Culverts - Doyle Cr., 600 mm and 900 mm CSP, 0.175 km E. of Doyle Cr. rest area.	4	High	unknown		<ul style="list-style-type: none"> • 2-3 m wide stream with low flow observed • Gradient 4% to S. and 15% to N. of highway • Mature riparian forest to S. of highway • Railway stream crossing may be a barrier to upstream fish migration S. of highway • Prefer highway expansion to N. to avoid riparian loss 	R1/15-16

Table C8. Summary of Point Features and Fisheries Information (continued)

Corridor	LKI Segment	LKI (Offset km) ¹	Project	Feature I.D. No. ²	Feature - Description	Fish Habitat Rating ³	MoTH Sensitivity Rating ⁴	Fish Species - Potentially Present ⁵	Source ⁶	Comments	Photo Roll / Frame
290	0985	40.60	SNC	7	Blueberry River Bridge North End 1394 - Clear span bridge.	5	High	BT, CC, KO, MW, RB	MELP 1998, MoTH 1997	<ul style="list-style-type: none"> 40+ m wide stream channel with moderate flow observed Gradient 2% to S. and 4% to N. of highway Excellent spawning and rearing habitat, especially for salmonids 4 kokanee salmon in spawn coloration observed holding in a pool under the bridge Prefer highway expansion to S. to avoid riparian loss 	R1/17-19
290	0985	~46.226	SNC	8	Moberly Cr. - Culvert: 900 mm concrete pipe, 0.006 km E. of Hartley Rd.	4	High	unknown		<ul style="list-style-type: none"> 1.5 m wide stream with moderate flow observed 5-10% gradient N. and S. of highway Moderate fish habitat value S. of highway Poorly defined channel to N. Culvert in highway likely obstructing fish passage Possible sediment source from clay bank to NW of crossing may be a concern during construction Prefer highway expansion to N. to avoid loss of riparian vegetation and pocket wetland areas 	R1/21-23
290	0985	~47.533	SNC	9	Culvert - 600 mm CSP; 1.313 km E. of Hartley Rd.	4	High	unknown		<ul style="list-style-type: none"> 1.0 m wide stream with moderate flow observed 5-10% gradient N. and S. of highway Moderate fish habitat potential Highway culvert likely obstructing fish passage Good riparian habitat to S. Prefer highway expansion to N. to avoid loss of riparian vegetation 	R1/24-25
290	0985	53.85	SNC		Anderson Road - End 290 Segment						
300	0985	53.85	SNC		Anderson Road - Begin 300 Segment (Anderson Road to Highway 95 Junction at Golden)					Segment Length 2.21 km. Rated in MoTH report (1998a) as fair candidate for upgrading (proximity of wetlands and confinement of highway between wetlands and highway).	
300	0985	~53.897	SNC	10	Culvert - 600 mm CSP, 0.04 km E. of Anderson Rd.	5	High	EB		<ul style="list-style-type: none"> <1.0 m wide stream channel with moderate flow observed Gradient > 20% N. of highway and 1% S. Excellent wetland/beaver pond habitat to S. 50+ adult EB seen in side channels Prefer highway expansion to N. to avoid wetlands Major constraint to highway improvement to the south side of existing TCH in this area 	R2/1-3
300	0985	~54.032	SNC	11	Culvert - 900 mm CSP, 0.182 km E. of Anderson Rd.	5	High	EB		<ul style="list-style-type: none"> 3.0 m wide stream channel with moderate flow observed Gradient > 20% N. of highway and 2% S. Excellent spawning gravel and wetland/beaver pond habitat to S. 35+ adult EB seen in spawning coloration S. of highway just downstream of culvert outlet in stream area of gravel/shale substrate Prefer highway expansion to N. to avoid critical wetlands and spawning areas Major constraint to highway improvement to the S. side of existing TCH in this area 	R2/4-8
300	0985	~54.083	SNC	12	Culvert - 1200 mm concrete pipe, 0.233 km E. of Anderson Rd.	5	High	unknown		<ul style="list-style-type: none"> 3-5 m wide stream channel with moderate flow observed Gradient > 20% N. of highway and 2% S. Excellent wetland/beaver pond habitat to S. Spawning potential low just downstream of TCH crossing at present due to lack of suitable substrate Prefer highway expansion to N. to avoid wetlands Major constraint to highway improvement to the S. side of existing TCH in this area 	R2/9-11
300	0985	56.06	SNC		Junction of Route 95/Route 1 Golden - End 300 Segment						
310	0990	0.00	SNC		Junction of Route 95/Route 1 Golden - Begin 310 Segment (highway 95 Junction to Golden View Road)					Corridor Segment Length 2.40 km. Rated in MoTH report (1998a) as good candidate for upgrading.	

Table C8. Summary of Point Features and Fisheries Information (continued)

Corridor	LKI Segment	LKI (Offset km) ¹	Project	Feature I.D. No. ²	Feature - Description	Fish Habitat Rating ³	MoTH Sensitivity Rating ⁴	Fish Species - Potentially Present ⁵	Source ⁶	Comments	Photo Roll / Frame
310	0990	2.40	SNC		Golden View Road East End - End 310 Segment					Corridor Segment Length 23.53 km. Rated in MoTH (1998a) report as poor candidate for upgrading (route within Kicking Horse canyon may prove most challenging section of corridor segments to upgrade - significant environmental concerns, particularly in western section).	
320	0990	2.4	SNC		Golden View Road East End - Begin 320 Segment (Golden View Road to Yoho National Park)						
320	0990	~2.62	SNC	13	Culvert - 600 mm CSP, 2.62 km E. of Junction of Route 95/Route 1 Golden	2	Low	unknown		<ul style="list-style-type: none"> 1.0 m stream with no flow observed Gradient 5% on N. and 80% + on S. of highway Prefer expansion to N. to avoid encroaching into Kicking Horse River 	R6/13-14
320	0990	~4.75	SNC	14	Culvert - 600 mm CSP, 4.75 km E. of Junction of Route 95/Route 1 Golden	2	Low	unknown		<ul style="list-style-type: none"> Undefined channel/drainage area No flow observed Erosion scars observed S. of highway Gradient >30% N. and S. of highway Prefer highway expansion to N. to avoid encroaching into Kicking Horse River 	R6/15-17
320	0990	6.23	SNC	15	Culvert - Dart Creek: two 600 mm CSPs	2	Low	unknown		<ul style="list-style-type: none"> 1-2 m wide stream channel with moderate flow observed > 40% gradient N. and S. of highway 100 m downstream may be accessible to fish and likely provides high water mainstem refuge Significant erosion scars observed S. of highway Prefer highway expansion to N. to avoid encroaching into Kicking Horse River 	R6/18-19
320	0990	9.45	SNC	16	Yoho (Five Mile) Bridge West End 1358 - Clear span 2 lane bridge over Kicking Horse R.	5	High	BT, CCG, CRH, EB, MW, PW	MELP 1998, MoTH 1998b ¹⁰	<ul style="list-style-type: none"> 20-25 m wide river channel at moderate stage observed > 5% gradient N. and S. of highway Good overwintering and spawning habitat for adults Large pools likely offer cover for adult residents Velocity obstruction or barrier to upstream migration present under bridge Valley narrows and highway will likely have to be realigned to avoid encroachment on river channel 	R6/20-21
320	0990	~10.21	SNC	17	Culvert - 1200 mm CSP, ~10.21 km E. of Junction of Route 95/Route 1 Golden	2	Low	unknown		<ul style="list-style-type: none"> Braided stream channels S. of highway Gradient 60% S. of highway and 80% to N. No refuge potential at confluence with Kicking Horse R. Prefer highway expansion to S. to avoid encroachment on Kicking Horse River 	R6/22-24
320	0990	~10.87	SNC	18	Culvert - 1200 mm CSP, ~10.87 km E. of Junction of Route 95/Route 1 Golden	2	Low	unknown		<ul style="list-style-type: none"> 2-3 m wide channel stream with good flow observed Gradient 15% S. of highway Culvert outlet perched 2 m No refuge potential in lower reach May be resident trout population S. of highway Prefer highway expansion to S. to avoid encroachment on Kicking Horse River 	R6/25 R7/1
320	0990	~11.7	SNC/ND Lea		Roth Creek Pullout Note: Boundary between SNC and ND Lea sections.						

End Notes:

¹ Please note that most of the LKIs for point features are not exact except where referenced to bridges or other major landmarks in the LKI inventory listed provided by design engineer. LKIs were determined in the field by extrapolation from maps and by using vehicle odometer readings in conjunction with estimates of distances from known LKI landmarks.

² Refers to point or site-specific landmarks examined in the field. Such features may include culverts, bridges, or wetlands.

³ Rating system is from 1 (lowest potential value fish habitat) to 5 (highest value).

⁴ It is important to note that these ratings are based on preliminary information and may be changed as more information and field sampling data become available.

⁵ See Table C10 for fish species abbreviations.

⁶ Reference source for fish presence information.

⁷ Ministry of Transportation and Highways. 1998a. Environmental Overview Assessment: Trans Canada Highway Corridor (Kamloops to Alberta Border). Report prepared by Acres International Limited. Kamloops, B.C.

⁸ Note: Since the actual boundary between the UMA and SNC sections is not finalized, we have provided information regarding three culverts in the section of highway between the Columbia River Bridge and Big Bend Highway in both the UMA and SNC existing conditions reports for fisheries information.

Table C8. Summary of Point Features and Fisheries Information (continued)

⁹ Ministry of Transportation and Highways. 1997. Fish and Wildlife Assessment for the Proposed Highway #1 Upgrade: Donald to Golden. Report prepared by ENKON Environmental Limited. Kamloops, B.C.

¹⁰ Ministry of Transportation and Highways. 1998b. Fisheries Assessment of the Kicking Horse River and Tributaries: Golden to Yoho National Park. Report prepared by ENKON Environmental Limited. Kamloops, B.C.

Table C9. Summary of Corridor Aquatic and Riparian Features

Corridor	LK1 Segment	Zone (LK1 Offsets) ¹	Feature - Description	MoTH Sensitivity Rating ¹	More Sensitive Side of Highway	Comments Regarding Aquatic and Riparian Issues
280/290	0985	29.24 - 30.26	Riparian area adjacent to Columbia River Bridge crossing, on north side of TCH.	High	North	<ul style="list-style-type: none"> Valuable riparian habitat Significant habitat values
280/290	0985	29.61 - 30.26	Riparian area adjacent to Columbia River Bridge crossing, on south side of TCH.	High	South	<ul style="list-style-type: none"> Valuable riparian habitat Significant habitat values
290	0985	30.26 - 31.3	Minor drainages along TCH. Columbia River located near the TCH on the south side of highway.	Low	South	<ul style="list-style-type: none"> Potential erosion and sediment control concerns Maintenance of existing drainage patterns Prefer highway expansion to north to avoid loss of biofiltration buffer between railway and TCH
290	0985	31.3 - 35.5	Columbia River located near the TCH on south side of highway; river valley vegetation on south side of highway.	Moderate	South	<ul style="list-style-type: none"> Fisheries sensitivity alternates from one side of the highway to the other. In general, prefer highway expansion to north to avoid loss of biofiltration buffer between railway and TCH, river valley vegetation and downstream vegetative buffer Potential habitat impact and sediment source
290	0985	35.5 - 37.4	Columbia River adjacent to TCH on south side of highway.	High	South	<ul style="list-style-type: none"> Proximity of TCH to the Columbia River Potential loss of riparian vegetation and wetlands, as well biofiltration strip between TCH and railway Significant habitat values
290	0985	37.4 - 38.5	Columbia River near the TCH on south side of highway; river valley vegetation on south side of highway.	Moderate	North	<ul style="list-style-type: none"> Prefer highway expansion to south to enable construction in disturbed areas along TCH and reduce loss of existing vegetation Potential habitat impact and sediment source
290	0985	38.5 - 39.8	Columbia River adjacent to TCH on south side of highway.	High	South	<ul style="list-style-type: none"> Proximity of TCH to the Columbia River Potential loss of riparian vegetation and wetlands, as well biofiltration strip between TCH and railway Significant habitat values
290	0985	39.8 - 40.5	Columbia River near the TCH on south side of highway; river valley vegetation on south side of highway.	Moderate	South	<ul style="list-style-type: none"> Prefer highway expansion to north to avoid loss of river valley vegetation and downstream vegetative buffer Potential habitat impact and sediment source
290	0985	40.5 - 40.75	Riparian area adjacent to Blaeberry River Bridge crossing.	High	Both	<ul style="list-style-type: none"> Riparian and stream channel sensitivities when approaching Blaeberry River Valuable riparian habitat Significant habitat values
290	0985	40.75 - 41.8	Vegetation area along south side of TCH.	Moderate	South	<ul style="list-style-type: none"> Prefer highway expansion to north to avoid loss of vegetation and disturbance of wetlands on south side of highway Potential habitat impact and sediment source
290	0985	41.8 - 44.0	Extensive wetland adjacent to the south side of the TCH with majority of wetland south of the railway.	High	South	<ul style="list-style-type: none"> TCH parallels an extensive wetland complex, which is the site of the Ducks Unlimited habitat enhancement project A narrow strip of wetland between the TCH and the railway serves as a biofiltration swale Prefer expansion to north to retain biofiltration vegetative strip Significant habitat values in this area
290	0985	44.0 - 46.0	Wetland area adjacent to south side of TCH	Moderate	South	<ul style="list-style-type: none"> TCH parallels wetland area, most of which is situated south of the highway and railway Prefer expansion to north to retain biofiltration vegetative strip Potential habitat impact and sediment source
290	0985	46.0 - 47.8	Columbia River adjacent to TCH on south side of highway.	High	South	LK1 46.0 to 47.0 area: <ul style="list-style-type: none"> Proximity of TCH to the Columbia River Potential loss of riparian vegetation, as well as biofiltration strip between TCH and railway Significant habitat values LK1 47.0 to 47.8 area: <ul style="list-style-type: none"> Concern with loss of riparian vegetation, pocket wetlands and biofiltration features between TCH and railway Significant habitat values Prefer expansion to the north

Table C9. Summary of Corridor Aquatic and Riparian Features (continued)

Corridor	LKI Segment	Zone (LKI Offsets) ¹	Feature - Description	MoTH Sensitivity Rating ¹	More Sensitive Side of Highway	Comments Regarding Aquatic and Riparian Issues
290	0985	47.8 - 48.15	Columbia near the TCH on south side of highway.	Moderate	South	<ul style="list-style-type: none"> Prefer expansion to the north to retain biofiltration vegetative strip Potential habitat impact and sediment source
290	0985	48.15 - 52.6	Columbia River in close proximity to TCH on south side of highway.	High	South	<ul style="list-style-type: none"> Prefer expansion to the north Concern with loss of riparian vegetation and pocket wetlands and biofiltration features between TCH and railway Significant habitat values
290/300	0985	52.6 - 54.5	Major wetland complex lies immediately south of the TCH along this section.	High	South	<ul style="list-style-type: none"> Prefer expansion to the north Concern with loss of riparian vegetation, pocket wetlands and biofiltration features between TCH and railway Major wetland immediately adjacent to the TCH along the south side near the town of Golden is considered highly sensitive to encroachment. This valuable wetland complex likely supports a variety of fish species. Highway encroachment into this wetland area may not be granted approval by the environmental agencies. Very significant habitat values
300	0985	54.5 - 56.06	Minor drainages along TCH	Low	Both	<ul style="list-style-type: none"> Potential erosion and sediment control concerns Maintenance of existing drainage patterns
310/320	0990	0 - 2.30	Minor drainages along TCH	Low	Both	<ul style="list-style-type: none"> Potential erosion and sediment control concerns Maintenance of existing drainage patterns Preference to expand to north at eastern end of this section to avoid loss of river valley vegetation
310/320	0990	2.3 - 9.45	TCH is located on a high bench through the Kicking Horse Canyon with steep slopes down to the Kicking Horse River.	High	South	<ul style="list-style-type: none"> Prefer expansion to the north Concern with loss of vegetation within the Kicking Horse Canyon Potential sediment and erosion concerns Potential encroachment into the river Significant habitat values
320	0990	9.45 - 13.00 (End of SNC Map Sheet 13)	The Kicking Horse River is situated just north of the TCH through this section.	High	North	<ul style="list-style-type: none"> Prefer expansion to the south Close proximity of the Kicking Horse River to the north side of the TCH in this section Kicking Horse River would be sensitive to any encroachment or loss of riparian vegetation Potential sediment and erosion concerns which may result from creation of new cut and fill slopes Significant habitat values

End Notes:

¹ Please note that most of the LKIs for corridor and point features are not exact except where referenced to bridges or other major landmarks in the LKI inventory listed provided by design engineer. LKIs were determined in the field by extrapolation from maps and by using vehicle odometer readings in conjunction with estimates of distances from known LKI landmarks.

² It is important to note that these ratings are based on preliminary information and may be changed as more information and field sampling data become available. These ratings were applied from an overview perspective and refer to areas within 100 m of the existing TCH.

Table C10 Scientific Names and Abbreviations for Fish Species Known to Occur within the Upper Columbia River

COMMON NAME	SCIENTIFIC NAME	CODE
bull trout	<i>Salvelinus confluentus</i>	BT
burbot	<i>Lota lota</i>	BB
chiselmouth	<i>Acrocheilus alutaceau</i>	CMC
eastern brook trout	<i>Salvelinus fontinalis</i>	EB
kokanee	<i>Oncorhynchus nerka</i>	KO
largescale sucker	<i>Catostomus columbianus</i>	LSU
longnose dace	<i>Rhinichthys cataractae</i>	LNC
longnose sucker	<i>Catostomus catostomus</i>	LSU
northern squawfish	<i>Ptychocheilus oregonensis</i>	NSC
mountain whitefish	<i>Prosopium williamsoni</i>	MW
peamouth	<i>Mylocheilus caurinus</i>	PCC
Pygmy whitefish	<i>Prosopium coulteri</i>	PW
Redside shinner	<i>Richardsonius balteatus</i>	RSC
Rainbow trout	<i>Oncorhynchus mykiss</i>	RB
Slimy sculpin	<i>Cottus cognatus</i>	CCG
Small mouth bass	<i>Micropterus dolomieu</i>	SMB
Torrent sculpin	<i>Cottus rhotheus</i>	CRH
Westslope cutthroat trout	<i>Oncorhynchus clarki lewisi</i>	WCT

5.0 References

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- Ministry of Transportation and Highways. 1997. Fish and Wildlife Assessment for the Proposed Highway #1 Upgrade: Donald to Golden. Report prepared by ENKON Environmental Limited. Kamloops, BC.

Ministry of Transportation and Highways. 1998a. Environmental Overview Assessment: Trans Canada Highway Corridor (Kamloops to Alberta Border). Report prepared by Acres International Limited. Kamloops, BC.

Ministry of Transportation and Highways. 1998b. Fisheries Assessment of the Kicking Horse River and Tributaries: Golden to Yoho National Park. Report prepared by ENKON Environmental Ltd., Kamloops, BC.

**Existing Conditions Report
Appendix 5 – Fisheries**

Section C3: Roth Creek to Brake Check

1.0 Introduction

Coast River Environmental Services Ltd. (Coast River) was retained by the Ministry of Transportation and Highways (MoTH) to undertake an overview assessment of potential fish habitat and watercourse sensitivities along a portion of the Trans Canada Highway (TCH). This fisheries overview information is intended to assist the planning and early design phases of the proposed functional upgrade to portions of the TCH between Mt. Revelstoke Park and Yoho National Park in British Columbia. Specific study sections assigned to Coast River are indicated in Table C1.

This report provides an overview of the existing fisheries habitat conditions and sensitivities for these project sections. It will be likely appended to a formal existing conditions report to be prepared by the respective design engineering firms.

2.0 Study Area

The linear extent of our study area is briefly summarized in Table C1. These corridor segments are defined in the MoTH's Corridor Management Plan for the Cache Creek to Rockies Highway Improvement Program. It should be noted that as directed by the MoTH, fisheries assessment work was not conducted along the TCH within any national parks. For the purposes of the existing conditions report, the MoTH asked the consultants to confine their examination to the highway right-of-way along the existing alignment of the TCH. In the study area, the TCH right-of-way between Revelstoke and Yoho National Park averages about 100 m in total width, with some four-lane or three-lane sections already in place.

3.0 Methods

3.1 General

The assessment of fish habitat sensitivity along these corridor segments is largely based on existing background information and reports, much of which was provided by the MoTH. In addition, several other information sources were used to complete this overview fisheries assessment, including:

- Initial contacts with regional resource agency personnel
- Airphotos, TRIM maps, MoTH alignment drawings, MoTH culvert crossing lists
- A drive-through and an 8 mm video reconnaissance of these corridor segments during an eastbound traverse of the highway
- Brief site inspections at significant watercourses in areas immediately adjacent to the highway.

Coast River personnel, in association with a fisheries biologist from Mirkwood Ecological Consultants Ltd. conducted the field work for this fisheries overview assessment along the TCH right-of-way between the eastern boundary of Mt. Revelstoke National Park and the western boundary of Yoho National Park, during the November 8 - 13, 1998 period. This assessment included an examination of potential fish habitat along each of the three major design sections (i.e., UMA, SNC-Lavalin, and ND Lea/MoTH Region 3).

The overall fisheries sensitivity of each highway corridor segment was prepared on the basis of our review of available fisheries information, a drive along the highway to note obvious stretches with fisheries sensitivities, and a brief site inspection at significant stream crossings. Existing information was collected from local resource managers, and from the MELP FISS database. Major fisheries constraints were assessed by driving the highway corridor segments and mapping areas of apparent high, moderate, and low fisheries sensitivities. Existing fisheries information and TRIM maps were used to prioritize stream crossings for assessment. Significant stream crossings were visited within each corridor segment. We also inspected any significant stream crossings that were encountered while driving along the highway even if they were not indicated on existing maps or reports. In many cases, watercourse crossings are not readily evident as one drives along the TCH. In order to locate a known watercourse crossing in the field, we had to rely on the following sources:

- TRIM mapping (1:20,000 scale) and engineering drawings
- MoTH culvert lists
- Fisheries reports (MoTH 1998b)
- MoTH Landmark Kilometer Inventory (LKI) with identified features referenced by distances from known points along the TCH.

During the field trip, distances recorded on the vehicle odometer were used in conjunction with the culvert and LKI lists to locate known aquatic features along the TCH, such as wetlands or watercourses. Some of the major fisheries-related features, such as bridges were identified in a MoTH report (1998a). In addition, during the field trip, Coast River and Mirkwood staff identified many other fisheries-related features while driving along the TCH.

The following information was collected at each stream crossing: corridor segment number, LKI segment number, LKI, stream number within each corridor segment (as assigned by Coast River), feature description (i.e., bridge, culvert or wetland), location (LKI), fish habitat rating, potential for providing fish habitat immediately upstream and downstream of the crossing, and general stream characteristics (i.e., stream width, gradient, condition of crossing, and preferred side of the highway for widening). This information was compiled after the field trip and is presented in our findings below. In addition, a detailed photographic catalogue of all visited watercourses was assembled. To facilitate our data reporting and to collate photographs with each fisheries-related

feature, each was given a unique feature identifier number (i.e., corridor segment, LKI segment, I.D. number).

Once the data tables were initially drafted, the general corridor and point features were transferred onto maps and/or photo mosaics provided by the design engineers. Corridor features were mapped on the basis of general fish habitat sensitivity in areas adjacent to each side of the highway within approximately 100 m of the highway. The sensitivities for broad areas are represented graphically on a bar at the bottom of the photo mosaic maps and are summarized in our findings below. Point features are indicated on the bar as symbols, which represent sensitivity values.

3.2 Fish Habitat Rating Criteria

Aquatic features such as watercourses and wetlands within our study area were assessed on the basis of potential fish habitat and then given a classification of 1 to 5, with 5 being assigned to the highest value features in terms of fish habitat potential and 1 being assigned to lowest value features, such as a dry swale with no habitat potential. The classification criteria for this assignment was devised on the basis of the DFO/MoELP classification system for lower mainland region watercourses, which was originally developed by the City of Surrey and Envirowest Consultants Limited. The lower mainland classification system was modified to reflect differences in the nature of the stream systems and the composition of fish species in the interior/central portion of B.C. The potential fish habitat classification system was based on several key factors, such as the quality of fish habitat, the accessibility of the stream to migrating fish, and general stream characteristics. The wetted width, stream gradient, channel characteristics and relative flow volume of each stream also influenced our classification.

The MoTH required that environmental sensitivities for each environmental discipline be ranked as high, moderate, low or nil. Table C2 presents our aquatic feature rating system and the criteria used to classify aquatic features. For MoTH planning purposes, class 1 and 2 fish habitat features were generally assigned a rating of "low" sensitivity (in terms of potential fish habitat values), class 3 features were rated as "moderate", and class 4 or 5 features were rated as "high" sensitivity. Since almost all of the drainages in the study area flow into major fish-bearing systems, and the existing TCH is located in close proximity to those major systems, a "nil" rating was not deemed applicable in the rating of aquatic features.

It should be emphasized that the fish habitat rating system was developed specifically for this fisheries overview assessment. It proved to be a useful tool to ensure that the study area watercourses were rated consistently. The criteria we used seem appropriate given the nature of the streams encountered during the field work, the limited amount of existing information about the systems and our inability to conduct detailed stream walks or direct fish sampling.

Our initial assessment of fish habitat sensitivity of the study area watercourses is based on limited background information and brief site visits. Due to the limited period for field reconnaissance and inclement weather conditions, few streams were inspected beyond the edge of the existing highway right-of-way. As a result, stream habitat within the highway right-of-way was examined in isolation of its upstream and downstream characteristics. Important aquatic features such as downstream obstructions to fish passage, upstream lakes with resident or stocked fish populations, other physical habitat constraints or enhancement opportunities remain undetermined for many of these systems. Therefore, the sensitivity assessment is based on our present preliminary knowledge of the systems. As a result, specific sensitivity ratings may change during the course of the present assignment, following more thorough stream sampling in the spring.

4.0 Findings

As noted previously, Table C11 summarizes fisheries information regarding point-specific features, such as watercourse crossings, that were identified and examined within the study area. Table C12 provides a preliminary summary of corridor aquatic and riparian features within the study area. An overview regarding fisheries information for corridor segments within the study area, as well as our initial results from a preliminary investigation of the corridor segments, is provided below.

CORRIDOR 320 (ND Lea Section)

LKI Segment #0990: LKI ~11.7 to ~17.2

Background/Existing Fisheries Information

The entire study area for Corridor Segment 320 extends from LKI 2.4 to LKI 25.93. Within this corridor segment, the ND Lea design section is situated from approximately LKI 11.7 to 17.2, and includes a design/build area at the 10 Mile bridge crossing. This 5.5 km stretch of the TCH runs adjacent to the Kicking Horse River from the western end of the ND Lea section to an area just east of the Brake Check truck stop.

Highway expansion of the TCH in the first 2.5 km of the ND Lea/Highways section (from about LKI 11.7 to LKI 14.2 - just east of 10 Mile bridge) is constrained because the highway is located alongside the Kicking Horse River with steep, somewhat unstable slopes above the highway. The remainder of TCH in the ND Lea section traverses the northern side of the lower Kicking Horse River on moderately steep to steep south-facing slopes, 500-1000 m back from the Kicking Horse River on a mid-slope bench.

The Kicking Horse River is a tributary to the Columbia River flowing into the Columbia in Golden. The source of the Kicking Horse River is the Wapta and Waputik Icefields in the Rocky Mountains, which results in the river being very turbid, cold, and limited in fish productivity. The following fish species are known to occur in the Kicking Horse: bull trout (*Salvelinus confluentus*), eastern brook trout (*Salvelinus fontinalis*), mountain whitefish (*Prosopium williamsoni*), pygmy whitefish (*Prosopium coulteri*), rainbow trout

(*Onchorhynchus mykiss*), slimy sculpin (*Cottus cognatus*), and torrent sculpin (*Cottus rhotheus*) (MoTH 1998b, MELP 1998).

Results

We examined three stream crossings along the TCH in the ND Lea section (Table C13). Two low sensitivity streams were surveyed (i.e., at LKI ~13.84 and ~16.84). These streams have steep gradients, poorly defined stream channels, ephemeral flows, and limited fish habitat where they cross the highway. However, both these streams may provide valuable refuge habitat in their lower reaches.

There is one high sensitivity crossing in the ND Lea section, located where the highway crosses the Kicking Horse River at LKI 14.20. The 10 Mile bridge is considered a high sensitivity crossing because the valley is narrow (< 100 m), there are steep unstable slopes above the river, there is important fish habitat at this site, and there is a high potential for highways expansion to encroach on the existing river channel.

Table C11. Summary of Point Features and Fisheries Information

Corridor	LKI Segment	LKI (Offset km) ¹	Project	Feature I.D. No. ²	Point Feature - Description	Fish Habitat Class ³	MoTH Sensitivity Rating ⁴	Fish Species - Potentially Present ⁵	Source ⁶	Comments	Photo Roll / Frame
320	0990	~11.7	SNC / ND Lea	na	Approximate boundary between end of SNC section and start of ND Lea.						
320	0990	~13.84	ND Lea	1	Culvert - 1800 mm CSP ~13.84 km E. of Junction of Route 95/Route 1 Golden.	2	Low	unknown		<ul style="list-style-type: none"> • 3-5 m wide stream channel with moderate flow observed • Gradient 60% to S. and 45% to N. • No refuge habitat potential in lower reach and not accessible to fish • Prefer highway expansion to S. to avoid encroachment into the Kicking Horse River 	R7/2-6
320	0990	14.20	ND Lea	2	Park (10 Mile) Bridge West End 1357 - Clear span 2 lane bridge over Kicking Horse River	5	High	BT, CCG, CRH, EB, MW, PW, RB	MELP ⁷ 1998, MoTH ⁸ 1998	<ul style="list-style-type: none"> • 20-25 m wide stream channel with moderate flow observed • > 5% gradient N. and S. of Hwy • Good overwintering and spawning habitat potential for adult salmonids • Valley narrows and highway will likely have to be realigned to avoid encroachment on stream channel 	R7/7-10
320	0990	~16.84	ND Lea	3	Culvert - 900 mm CSP, ~2.84 km E. of 10 Mile bridge.	2	Low	unknown		<ul style="list-style-type: none"> • 2 m wide stream channel with no flow observed • Gradient to N. and S. > 10% • Lower reach likely presents a barrier to upstream fish migration • Prefer highway expansion to N. to avoid encroachment or loss of stream and/or riparian vegetation downhill from TCH. • Note: Creek 5 in MoTH 1998 report. 	R2/14-16
320	0990	~17.2			Approximate Boundary between end of ND Lea Section and start of MoTH Region 3 Section						

End Notes:

¹ Please note that most point feature LKIs are not exact except where referenced to bridges or other major landmarks in the LKI inventory lists provided by design engineer. LKIs were determined in the field by extrapolation from maps and by using vehicle odometer readings in conjunction with estimates of distances from known LKI landmarks.

² Refers to point or site-specific landmarks examined in the field. Such features may include culverts, bridges, or wetlands.

³ Sensitivity rating system is from 1 (lowest potential value fish habitat) to 5 (highest value).

⁴ It is important to note that these ratings are based on preliminary information and may be changed as more information and field sampling data become available.

⁵ Fish species abbreviations: BT – bull trout, CCG – slimy sculpin, CRH – torrent sculpin, EB – eastern brook trout, MW – mountain whitefish, PW – pigmy whitefish, RB – rainbow trout.

⁶ Reference source for fish presence information.

⁷ MELP - Ministry of Environment, Lands and Parks

⁸ Ministry of Transportation and Highways. 1998. Fisheries Assessment of the Kicking Horse River and Tributaries: Golden to Yoho National Park. Report prepared by ENKON Environmental Limited. Kamloops, B.C.

Table C12. Summary of Corridor Features and Potential Fish Habitat Sensitivity Rating

Corridor	LKI Segment	Zone (LKI Offsets) ¹	Corridor Feature - Description	MoTH Sensitivity Rating ²	More Sensitive Side of Highway	Comments Regarding Sensitivity and Fish Habitat Issues
320	0990	12.00 - 14.2 (Start of ND Lea Map Sheet)	Kicking Horse River is situated just north of the TCH along this section.	High	North	<ul style="list-style-type: none"> This section is confined by rock bluffs to the south and the Kicking Horse River to the north High sensitivity along the N. side of the highway due to potential encroachment in river and loss of riparian vegetation Close proximity of the Kicking Horse River to the TCH in this section Potential sediment and erosion concerns, which may result from creation of new cut and fill slopes Significant habitat values Riparian vegetation as one approaches the 10 Mile (Park) Bridge crossing Prefer expansion to the south to avoid encroachment into Kicking Horse River, loss of river valley vegetation or disturbance of vegetative buffer
320	0990	14.2 - 14.3	Riparian area adjacent to 10 Mile (Park) Bridge.	High	Both	<ul style="list-style-type: none"> This section is confined by steep bluffs and the Kicking Horse River High sensitivity along the both sides of the highway Riparian and stream channel sensitivities when approaching Kicking Horse River Significant habitat values
320	0990	14.3 - 14.8	Kicking Horse River is situated just south of the TCH along this section. Steep downhill slopes from south side of TCH down to Kicking Horse River.	High	South	<ul style="list-style-type: none"> This section is confined by steep slopes to the north and the Kicking Horse River to the south High sensitivity along the S. side of the highway due to potential encroachment in river and loss of riparian vegetation Close proximity of the Kicking Horse River to the TCH in this section Potential sediment and erosion concerns, which may result from creation of new cut and fill slopes, particularly at the western end of this section Significant habitat values Riparian vegetation as one approaches the 10 Mile (Park) Bridge crossing Prefer highway expansion to the north to avoid river encroachment, loss of river valley vegetation, disturbance of downslope vegetative buffer
320	0990	14.8 - 15.7	Kicking Horse River near the TCH on the south side of the highway; river valley vegetation on south side of highway	Moderate	South	<ul style="list-style-type: none"> Prefer highway expansion to the north to avoid loss of river valley vegetation and downslope vegetative buffer Potential habitat impact and sediment source Potential concerns with loss of riparian vegetation and/or fill encroachment into river or onto floodplain
320	0990	15.7 - 16.5	Steep highway fill slope on south side of TCH with toe encroaching on the Kicking Horse River channel.	High	South	<ul style="list-style-type: none"> This steep fill slope may be a potential sediment and erosion source for discharge into the Kicking Horse River Remaining riparian and valley wall vegetation should be retained, and if possible, this area should be rehabilitated Widening on the south side of the highway would be severely constrained by the risk of adversely affecting fish habitat in the Kicking Horse River
320	0990	16.5 - 17.2	Minor drainages along TCH.	Low	Neither	<ul style="list-style-type: none"> Potential erosion and sediment control concerns Maintenance of existing drainage patterns
320	0990	17.2 - 17.9	Kicking Horse River located near the TCH on south side of highway in this section; river valley vegetation on south side of highway.	Moderate	South	<ul style="list-style-type: none"> Prefer highway expansion to the north to avoid loss of river valley vegetation and downslope vegetative buffer Potential habitat impact and sediment source

End Notes:

¹ Please note that most of the LKIs for point features are not exact except where referenced to bridges or other major landmarks in the LKI inventory listed provided by design engineer. LKIs were determined in the field by extrapolation from maps and by using vehicle odometer readings in conjunction with estimates of distances from known LKI landmarks.

² It is important to note that these ratings are based on preliminary information and may be changed as more information and field sampling data become available. These ratings were applied from an overview perspective and apply to areas within 100 m of the existing TCH.

Table C13. Number of High, Moderate, and Low Sensitivity Streams

Corridor Segment (ND Lea Section)	Number of Streams by Sensitivity Rating			Total
	Low*	Moderate	High	
320	2	/	1	3

* We only sampled a portion of the low sensitivity stream crossings in the corridor segments along the TCH. The count in this table represents a combination of stream crossings that were sampled and stream crossings that were noted during highway surveys or on maps.

5.0 References

MELP, 1998. Fisheries Information Summary System, Ministry of Environment, Lands and Parks, Kootenay Region, Nelson, BC.

Ministry of Transportation and Highways. 1998a. Environmental Overview Assessment: Trans Canada Highway Corridor (Kamloops to Alberta Border). Report prepared by Acres International Limited. Kamloops, BC.

Ministry of Transportation and Highways. 1998b. Fisheries Assessment of the Kicking Horse River and Tributaries: Golden to Yoho National Park. Report prepared by ENKON Environmental Ltd., Kamloops, BC.

**Existing Conditions Report
Appendix 5 – Fisheries**

Section C4: Brake Check to Yoho Park West Boundary

1.0 Introduction

Coast River Environmental Services Ltd. (Coast River) was retained by the Ministry of Transportation and Highways (MoTH) to undertake an overview assessment of potential fish habitat and watercourse sensitivities along a portion of the Trans Canada Highway (TCH). This fisheries overview information is intended to assist the planning and early design phases of the proposed functional upgrade to portions of the TCH between Mt. Revelstoke Park and Yoho National Park in British Columbia. Specific study sections assigned to Coast River are indicated in Table C1.

This report provides an overview of the existing fisheries habitat conditions and sensitivities for these project sections. It will be likely appended to a formal existing conditions report to be prepared by the respective design engineering firms.

2.0 Study Area

The linear extent of our study area is briefly summarized in Table C1. These corridor segments are defined in the MoTH's Corridor Management Plan for the Cache Creek to Rockies Highway Improvement Program. It should be noted that as directed by the MoTH, fisheries assessment work was not conducted along the TCH within any national parks. For the purposes of the existing conditions report, the MoTH asked the consultants to confine their examination to the highway right-of-way along the existing alignment of the TCH. In the study area, the TCH right-of-way between Revelstoke and Yoho National Park averages about 100 m in total width, with some four-lane or three-lane sections already in place.

3.0 Methods

3.1 General

The assessment of fish habitat sensitivity along these corridor segments is largely based on existing background information and reports, much of which was provided by the MoTH. In addition, several other information sources were used to complete this overview fisheries assessment, including:

- Initial contacts with regional resource agency personnel
- Airphotos, TRIM maps, MoTH alignment drawings, MoTH culvert crossing lists
- A drive-through and an 8 mm video reconnaissance of these corridor segments during an eastbound traverse of the highway
- Brief site inspections at significant watercourses in areas immediately adjacent to the highway.

Coast River personnel, in association with a fisheries biologist from Mirkwood Ecological Consultants Ltd. conducted the field work for this fisheries overview assessment along the TCH right-of-way between the eastern boundary of Mt. Revelstoke National Park and the western boundary of Yoho National Park, during the November 8 - 13, 1998 period. This assessment included an examination of potential fish habitat along each of the three major design sections (i.e., UMA, SNC-Lavalin, and ND Lea/MoTH Region 3).

The overall fisheries sensitivity of each highway corridor segment was prepared on the basis of our review of available fisheries information, a drive along the highway to note obvious stretches with fisheries sensitivities, and a brief site inspection at significant stream crossings. Existing information was collected from local resource managers, and from the MELP FISS database. Major fisheries constraints were assessed by driving the highway corridor segments and mapping areas of apparent high, moderate, and low fisheries sensitivities. Existing fisheries information and TRIM maps were used to prioritize stream crossings for assessment. Significant stream crossings were visited within each corridor segment. We also inspected any significant stream crossings that were encountered while driving along the highway even if they were not indicated on existing maps or reports. In many cases, watercourse crossings are not readily evident as one drives along the TCH. In order to locate a known watercourse crossing in the field, we had to rely on the following sources:

- TRIM mapping (1:20,000 scale) and engineering drawings
- MoTH culvert lists
- Fisheries reports (MoTH 1998b)
- MoTH Landmark Kilometer Inventory (LKI) with identified features referenced by distances from known points along the TCH.

During the field trip, distances recorded on the vehicle odometer were used in conjunction with the culvert and LKI lists to locate known aquatic features along the TCH, such as wetlands or watercourses. Some of the major fisheries-related features, such as bridges were identified in a MoTH report (1998a). In addition, during the field trip, Coast River and Mirkwood staff identified many other fisheries-related features while driving along the TCH.

The following information was collected at each stream crossing: corridor segment number, LKI segment number, LKI, stream number within each corridor segment (as assigned by Coast River), feature description (i.e., bridge, culvert or wetland), location (LKI), fish habitat rating, potential for providing fish habitat immediately upstream and downstream of the crossing, and general stream characteristics (i.e., stream width, gradient, condition of crossing, and preferred side of the highway for widening). This information was compiled after the field trip. In addition, a detailed photographic catalogue of all visited watercourses was assembled. To facilitate our data reporting and

to collate photographs with each fisheries-related feature, each was given a unique feature identifier number (i.e., corridor segment, LKI segment, I.D. number).

Once the data tables were initially drafted, the general corridor and point features were transferred onto maps and/or photo mosaics provided by the design engineers. Corridor features were mapped on the basis of general fish habitat sensitivity in areas adjacent to each side of the highway within approximately 100 m of the highway. The sensitivities for broad areas are represented graphically as a bar at the bottom of the photo mosaic maps and are summarized in our findings below. Point features are indicated on the fisheries bar as symbols, which represent sensitivity values.

3.2 Fish Habitat Rating Criteria

Aquatic features such as watercourses and wetlands within our study area were assessed on the basis of potential fish habitat and then given a classification of 1 to 5, with 5 being assigned to the highest value features in terms of fish habitat potential and 1 being assigned to lowest value features, such as a dry swale with no habitat potential. The classification criteria for this assignment was devised on the basis of the DFO/MoELP classification system for lower mainland region watercourses, which was originally developed by the City of Surrey and Envirowest Consultants Limited. The lower mainland classification system was modified to reflect differences in the nature of the stream systems and the composition of fish species in the interior/central portion of BC. The potential fish habitat classification system was based on several key factors, such as the quality of fish habitat, the accessibility of the stream to migrating fish, and general stream characteristics. The wetted width, stream gradient, channel characteristics and relative flow volume of each stream also influenced our classification.

The MoTH required that environmental sensitivities for each environmental discipline be ranked as high, moderate, low or nil. Table C2 presents our aquatic feature rating system and the criteria used to classify aquatic features. For MoTH planning purposes, class 1 and 2 fish habitat features were generally assigned a rating of "low" sensitivity (in terms of potential fish habitat values), class 3 features were rated as "moderate", and class 4 or 5 features were rated as "high" sensitivity. Since almost all of the drainages in the study area flow into major fish-bearing systems, and the existing TCH is located in close proximity to those major systems, a "nil" rating was not deemed applicable in the rating of aquatic features.

It should be emphasized that the fish habitat rating system was developed specifically for this fisheries overview assessment. It proved to be a useful tool to ensure that the study area watercourses were rated consistently. The criteria we used seem appropriate given the nature of the streams encountered during the field work, the limited amount of existing information about the systems and our inability to conduct detailed stream walks or direct fish sampling.

Our initial assessment of fish habitat sensitivity of the study area watercourses is based on limited background information and brief site visits. Due to the limited period for field reconnaissance and inclement weather conditions, few streams were inspected beyond the edge of the existing highway right-of-way. As a result, stream habitat within the highway right-of-way was examined in isolation of its upstream and downstream characteristics. Important aquatic features such as downstream obstructions to fish passage, upstream lakes with resident or stocked fish populations, other physical habitat constraints or enhancement opportunities remain undetermined for many of these systems. Therefore, the sensitivity assessment is based on our present preliminary knowledge of the systems. As a result, specific sensitivity ratings may change during the course of the present assignment, following more thorough stream sampling in the spring.

4.0 Findings

CORRIDOR 320 (MoTH Region 3 Section) LKI Segment #0990: LKI ~17.2 to ~25.93

Background/Existing Fisheries Information

The entire study area for Corridor Segment 320 extends from LKI 2.4 to LKI 25.93. Within this corridor segment, the MoTH Region 3 design section extends from an area just east of the Brake Check truck stop (i.e., at approximately LKI 17.2) to the western boundary of Yoho National Park at LKI 25.93. This 8.73 km portion of the TCH runs along the northern side of the lower Kicking Horse River, with the highway situated on moderately steep south facing slopes, 200 to 1000 m away from the Kicking Horse River. The Kicking Horse River is a major tributary of the Columbia River, and flows into the Columbia River at Golden. The source of the Kicking Horse River is the Wapta and Waputik Icefields in the Rocky Mountains, which results in the river being very turbid, cold, and limited in fish productivity. The following fish species are known to occur in the Kicking Horse River: bull trout (*Salvelinus confluentus*), eastern brook trout (*Salvelinus fontinalis*), mountain whitefish (*Prosopium williamsoni*), pygmy whitefish (*Prosopium coulteri*), rainbow trout (*Onchorhynchus mykiss*), slimy sculpin (*Cottus cognatus*), and torrent sculpin (*Cottus rhotheus*) (MoTH 1998b, MELP 1998).

Results

There are at least eight stream crossings along the TCH in this design section (Table C14). One low sensitivity stream was assessed at approximately LKI 24.6. This stream had a steep gradient, poorly defined stream channel, ephemeral flow, and limited fish habitat where it crossed the highway. However, this stream may provide valuable refuge habitat in lower reaches. Table C15 summarizes the preliminary stream and fisheries information for the MoTH Region 3 design section.

We examined three high sensitivity crossings in the MoTH Region 3 design section, located at about LKI 19.61 (Mt. Hunter Creek), LKI 21.8 (Vacation Creek) and LKI 25.39 (Wiedenman Creek). The high rating for these streams was attributed to the value of potential fish habitat in the systems, the proximity of the Kicking Horse River to the streams, and the potential for loss of riparian habitat with highway improvement. Table C16 summarizes corridor features and potential fish habitat sensitivity ratings.

Table C14. Number of High, Moderate and Low Sensitivity Streams within the MoTH Region 3 Design Section

Corridor Segment (MoTH Region 3 Section)	Number of Streams by Sensitivity Rating			Total
	Low*	Moderate	High	
320	1	4	3	8

- * We only sampled a portion of the low sensitivity stream crossings in the corridor segments along the TCH. The count in this table represents a combination of stream crossings that were sampled and stream crossings that were noted during highway surveys or on maps.

Table C15. Summary of Point Features and Fisheries Information

Corridor	LKI Segment	LKI (Offset km) ¹	Project	Feature I.D. No. ²	Point Feature - Description	Fish Habitat Class ³	MoTH Sensitivity Rating ⁴	Fish Species - Potentially Present	Source ⁵	Comments	Photo Roll / Frame
320	0990	~17.2	MoTH Region 3	not applicable (na)	Approximate Boundary between end of ND Lea Section and start of MoTH Region 3 Section						
320	0990	19.61	MoTH Region 3	4	Mt. Hunter Creek Bridge West End 1356, clear span bridge, ~5.4 km E. of 10 Mile bridge.	4	High	BT, EB, RB ⁶	MoTH 1998 ⁷	<ul style="list-style-type: none"> 3-5 m wide stream channel with low flow observed Channel gradient < 15% to S. and N. Moderate spawning and rearing habitat potential Prefer highway expansion to parallel existing TCH alignment, rather than major realignment in this section Note: Creek 6 in MoTH report (ENKON maps). A clear span bridge will likely be required by the environmental agencies Prefer new stream crossing to the north of existing bridge 	R2/17-18
320	0990	~21.8	MoTH Region 3	5	Vacation Creek - Culvert, 1200 mm concrete pipe, ~7.6 km E. of 10 Mile bridge	4	High	unknown	MoTH 1998	<ul style="list-style-type: none"> 3-5 m wide stream channel with low flow observed Channel gradient < 15% to N. and S. Good cascading/cobble boulder fish habitat Culvert outlet perched 1.5 m to S. preventing fish passage Prefer highway expansion to N. as area already disturbed Note: Creek 7 in MoTH 1998 report (ENKON maps) 	R2/19-22
320	0990	~23.1	MoTH Region 3	6	Culvert - 600 mm CSP.	3	Moderate	unknown	MoTH 1998	<ul style="list-style-type: none"> 1.5-2.0 m wide stream channel with no flow observed Channel gradient < 20% to N. and S. Low to moderate fish habitat potential Culvert outlet perched 1.0 m to S. Lower reach likely provides mainstem refuge habitat Prefer highway expansion to N. to avoid loss of stream and riparian vegetation downstream from TCH. Note: Creek 8 in MoTH report (ENKON maps) 	R2/23-24
320	0990	~23.94	MoTH Region 3	7	Culverts - two 600 mm CSP (600 mm CSP with overflow), ~9.74 km E. of 10 Mile bridge.	3	Moderate	unknown	MoTH 1998	<ul style="list-style-type: none"> 3-4 m wide stream channel with no flow observed Channel gradient < 10% to S. and < 15% to N. Moderate fish habitat potential Culvert outlet perched 1.0 m to S. Lower reach likely provides mainstem refuge habitat Prefer highway expansion to N. to avoid loss of stream and riparian vegetation downhill from TCH Note: Creek 9 in MoTH report (ENKON maps) 	R2/25 R3/1-2
320	0990	~24.6	MoTH Region 3	8	Culvert - 600 mm CSP, ~10.4 km E. of 10 mile bridge.	1	Low			<ul style="list-style-type: none"> Poorly defined stream channel < 1.0 m wide drainage; fish habitat potential unlikely Culvert outlet perched 2.0 m to S. Lower reach likely provides mainstem refuge habitat Prefer highway expansion to N. to avoid loss of stream and riparian vegetation downhill from TCH Not sampled in MoTH report (1998) 	R3/3-4
320	0990	~24.7	MoTH Region 3	9	Culvert - 600 mm CSP, ~1.23 km W. of Yoho National Park western boundary; ~10 m E. of Wapta Rd. west entrance.	3	Moderate	unknown	MoTH 1998	<ul style="list-style-type: none"> 1.5-2.0 m wide stream channel with low flow observed Channel gradient < 10% to S. and < 15% to N. Moderate potential for fish habitat to S. Lower reach likely provides mainstem refuge habitat Prefer highway expansion to N. to avoid loss of stream and riparian vegetation downhill from TCH Note: Creek 10 in MoTH report (ENKON maps) 	too dark

Table C15. Summary of Point Features and Fisheries Information - continued

Corridor	LKI Segment	LKI (Offset km) ¹	Project	Feature I.D. No. ²	Point Feature - Description	Fish Habitat Class ³	MoTH Sensitivity Rating ⁴	Fish Species - Potentially Present	Source ⁵	Comments	Photo Roll / Frame
320	0990	~25.39	MoTH Region 3	10	Wiedenman Creek - two 600 mm CSPs, ~11.19 km E. of 10 Mile Bridge; just W. of Beaverfoot Rd.	4	High	unknown	MoTH 1998	<ul style="list-style-type: none"> 3-5 m wide stream channel with low flow observed Channel gradient to N. and S. < 5% Moderate to high fish habitat potential; significant downstream fish habitat, particularly on valley bottom Railway stream crossing S. of highway may be obstructing upstream fish migration Note: Creek 11 MoTH report (ENKON maps) Care must be taken in designing any re-alignment to preserve and/or improve existing drainage patterns in this area; good potential to improve or enhance fish access and habitat in this area 	R3/5-6
320	0990	~25.62	MoTH Region 3	11	Culvert - 600 mm CSP, ~11.42 km E. of 10 Mile bridge, ~90 m W. of E. end of Wapta Rd	3	Moderate	unknown		<ul style="list-style-type: none"> 1.5-2.0 m wide stream channel with low flow observed Channel gradient <15% to S. and >20% to N. Moderate potential for fish habitat to S. Lower reach likely provides mainstem refuge habitat Culvert between highway and Wapta Rd. is broken and likely obstructing upstream fish migration Prefer highway expansion to N. to avoid loss of stream and riparian vegetation downhill from TCH Not sampled in MoTH report 	R3/7
320	0990	25.93	MoTH Region 3	na	Yoho National Park Boundary - End 320 Segment. End of MoTH Region 3 section.						

End Notes:

1 Please note that most point feature LKIs are not exact except where referenced to bridges or other major landmarks in the LKI inventory lists provided by design engineer. LKIs were determined in the field by extrapolation from maps and by using vehicle odometer readings in conjunction with estimates of distances from known LKI landmarks.

2 Refers to point or site-specific landmarks examined in the field. Such features may include culverts, bridges, or wetlands.

3 Sensitivity rating system is from 1 (lowest potential value fish habitat) to 5 (highest value).

4 It is important to note that these ratings are based on preliminary information and may be changed as more information and field sampling data become available.

5 Reference source for fish presence information.

6 Fish species abbreviations: BT – bulltrout, EB – eastern brooktrout, RB – rainbow trout.

7 Ministry of Transportation and Highways. 1998. Fisheries Assessment of the Kicking Horse River and Tributaries: Golden to Yoho National Park. Report prepared by ENKON Environmental Limited. Kamloops, B.C.

Table C16. Summary of Corridor Features and Potential Fish Habitat Sensitivity Rating

Corridor	LKI Segment	Zone (LKI Offsets) ¹	Corridor Feature - Description	MoTH Sensitivity Rating ²	More Sensitive Side of Highway	Comments Regarding Sensitivity and Fish Habitat Issues
320	0990	17.2 - 17.9	Kicking Horse River located near the TCH on south side of highway in this section; river valley vegetation on south side of highway.	Moderate	South	<ul style="list-style-type: none"> Prefer highway expansion to the north to avoid loss of river valley vegetation and downslope vegetative buffer Potential habitat impact and sediment source
320	0990	17.9 - 19.5	Minor drainages along TCH. Kicking Horse River veers south further away from the TCH along this section.	Low	South	<ul style="list-style-type: none"> Prefer highway expansion to the north to avoid loss of river valley vegetation and downslope vegetative buffer Potential erosion and sediment control concerns Maintenance of existing drainage patterns
320	0990	19.5 - 19.7	Bench and steep slopes adjacent to Mt. Hunter Creek within stream ravine	High	Both sides	<ul style="list-style-type: none"> Surface water management concerns along approach area to Hunter Creek bridge Loss of riparian vegetation within the ravine area Past evidence of debris torrent in creek, in area just upstream from the existing bridge Prefer expansion to the north
320	0990	19.7 - 20.7	Kicking Horse River located near south side of TCH along this section with steep slopes leading down to river.	High	South	<ul style="list-style-type: none"> Section of TCH east of Mt. Hunter Creek bridge is in close proximity to Kicking Horse River with somewhat steep slopes on south side of highway Prefer expansion to the north to avoid loss of river valley vegetation and downslope vegetative buffer
320	0990	20.7 - 23.0	Minor drainages along TCH. Kicking Horse River veers south further away from the TCH along this section.	Low	South	<ul style="list-style-type: none"> Potential erosion and sediment control concerns Maintenance of existing drainage patterns Prefer highway expansion to the north to avoid loss of river valley vegetation and downslope vegetative buffer
320	0990	23.0 - 25.93	Close proximity of TCH to Kicking Horse River along south side of highway. Major reach break evident on Kicking Horse River.	High	South	<ul style="list-style-type: none"> Kicking Horse River changes in character in this section to a braided, sinuous channel form with numerous vegetated islands Section of river provides high value habitat with possible spawning and overwintering habitats River in this area is relatively low gradient with a wide valley floor profile (about 0.5 km wide) Prefer highway expansion to the north to protect sensitive valley fish habitat features, particularly in the mainstem of the Kicking Horse River

End Notes:

- 1 Please note that most of the LKIs for point features are not exact except where referenced to bridges or other major landmarks in the LKI inventory listed provided by design engineer. LKIs were determined in the field by extrapolation from maps and by using vehicle odometer readings in conjunction with estimates of distances from known LKI landmarks.
- 2 It is important to note that these ratings are based on preliminary information and may be changed as more information and field sampling data become available. These ratings were applied from an overview perspective and apply to areas within 100 m of the existing TCH.

5.0 References

- MELP, 1998. Fisheries Information Summary System, Ministry of Environment, Lands and Parks, Kootenay Region, Nelson, BC.
- Ministry of Transportation and Highways. 1998a. Environmental Overview Assessment: Trans Canada Highway Corridor (Kamloops to Alberta Border). Report prepared by Acres International Limited. Kamloops, BC.
- Ministry of Transportation and Highways. 1998b. Fisheries Assessment of the Kicking Horse River and Tributaries: Golden to Yoho National Park. Report prepared by ENKON Environmental Ltd., Kamloops, BC.