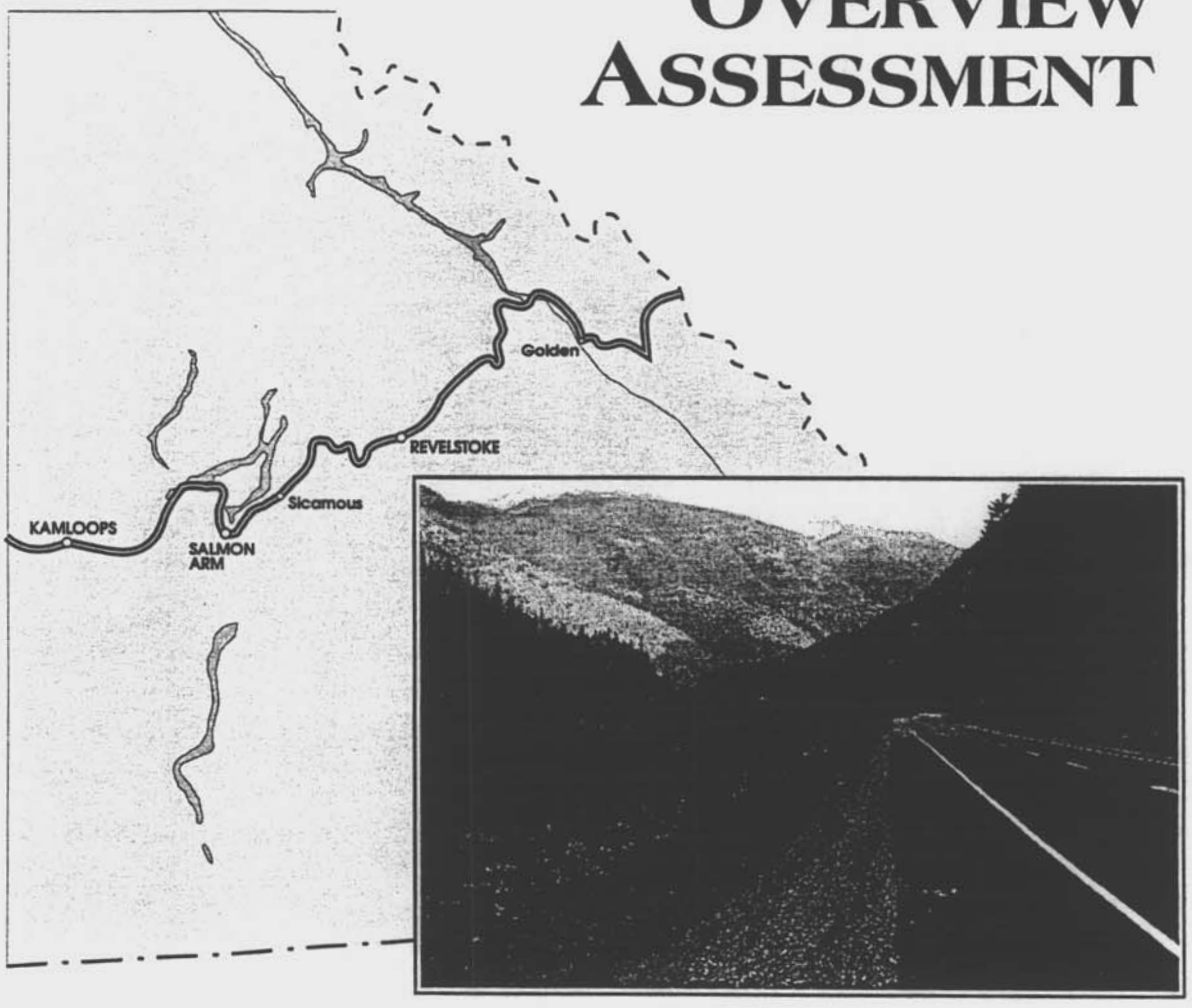
Ministry of Transportation and Highways
Thompson-Okanagan Regional Office

TRANS CANADA HIGHWAY CORRIDOR (KAMLOOPS TO ALBERTA BORDER)

ENVIRONMENTAL OVERVIEW ASSESSMENT



April 1998

Acres International Limited

ACRES

April 8, 1998
P 12190.00

B.C. Ministry of Transportation and Highways
523 Columbia St.
Kamloops, BC V2C 2T9

Attention: Mr. Brent Persello, Regional Environmental Coodinator

Dear Brent:

We are pleased to submit our final report on an Overview Environmental Assessment of the Trans Canada Highway from Kamloops to the Alberta border.

We have incorporated all of your comments from the previous draft and are submitting two hard copies (one bound, one unbound) of this report along with a copy on diskette. Please do not hesitate to contact me or Mr. Tony Wong if you have any questions. We look forward to working with you in the future.

Sincerely,

R. Scott Hanna, M.R.M., R.P.Bio.,
Manager, Environmental and Planning Services

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Executive Summary

Introduction

The Ministry of Transportation and Highways (MoTH) retained Acres International Limited (Acres) to conduct an overview level environmental review of the Trans Canada Highway (TCH) between Kamloops and the Alberta border. MoTH is anticipating upgrading sections of the highway to meet increasing user demand and this study identified potential environmental impacts of future upgrading projects.

MoTH has initiated a Corridor Management Plan (CMP) to develop a long-term investment and management strategy for the Trans Canada Highway between Kamloops and the Alberta border. The two main objectives in this planning process are:
1) to maintain safety and mobility; and
2) to protect the current investment in the highway infrastructure.

The analysis framework for developing the Trans Canada Highway Corridor Management Plan includes a Multiple Accounts Evaluation of economic, social, financial, technical, and environmental factors related to highway upgrading. The Acres study provides information for the environmental components of this multiple accounts analysis.

Methods

The overview study was conducted from October 1997 to March 1998. The methods used in this study include reviewing existing environmental studies, maps, and air photos on the TCH corridor, interviewing provincial and federal regulatory agency staff and conducting an overview-level reconnaissance of the TCH corridor.

MoTH has divided the 441 km TCH corridor between Kamloops and the Alberta border into 33 corridor segments for planning purposes. Each of these segments is further divided into smaller sections called Landmark Kilometre Inventory (LKI) sections. Each LKI section is demarcated by distinct features along the highway such as intersections, overpasses, underpasses, highway signs, rest areas, and bridges.

As a standard for evaluating the possible environmental impacts of highway improvement, we chose to evaluate the environmental constraints and impacts of adding one more lane in each direction to each section of the existing highway. This "measuring stick" of one additional lane on either side of the existing highway allowed us to visualize the environmental constraints to upgrading the highway. We also considered the potential impacts on natural resources located 300 to 500 metres from either side of the highway that could be affected by highway upgrading activities.

The information from the field reconnaissance, interviews, and review of existing information are summarized as environmental ratings for each corridor segment. Each corridor segment is rated as being a *good*, *fair*, or *poor* candidate for highway upgrading.

Corridor Overview and Detailed Findings

Chapter three provides an overview of the natural resources and land uses for each of the 33 corridor segments along the Trans Canada Highway. The subject areas included:

- Terrain and hydrology
- Soils and vegetation
- Fish and aquatic resources
- Wildlife
- Rare and endangered species
- Archaeological resources
- Visual, tourism, and recreational resources

- Land and resource use

Detailed findings

The characteristics and environmental resources of each segment are described under the following headings:

- general description;
- terrain and geology;
- fish and aquatic resources;
- wildlife and wildlife habitat;
- archaeological, cultural, and heritage resources;
- visual, recreational, and tourism resources;
- agricultural lands; and
- mineral and petroleum resources.

Analysis

Ratings of Corridor Segments

Each of the 33 corridor segments was assigned an environmental rating of *good*, *fair*, and *poor* based on environmental constraints to upgrading such as potential impacts to fish bearing waters, fish habitat, wetlands, and vegetation. The environmental ratings are relative rankings of the suitability of each corridor segment for upgrading (Table 1). There are 13 segments rated *good*, 13 rated *fair*, and 7 rated *poor*.

Table 1. Environmental Rating of Corridor Segments for Suitability for Highway Upgrading

Corridor Segment	Segment Beginning Point	Segment Ending Point	Location	Environmental Rating		
				Good	Fair	Poor
10	Afton Overpass	Junction Route 5A	Kamloops		•	
20	Junction Route 5A	Tanager Road	Kamloops	•		
30	Tanager Road	Junction Route 97	Monte Creek	•		
40	Junction Route 97	West Exit to Chase	Chase		•	
50	West Exit to Chase	Squilax Bridge	Chase		•	
60	Squilax Bridge	Cobeaux Road	Shuswap Lake			•
70	Cobeaux Road	Eagle Bay Road	Sorrento	•		
80	Eagle Bay Road	Salmon River Bridge	Salmon Arm	•		
90	Salmon River Bridge	Salmon Arm Hwy	Salmon Arm	•		
100	Salmon Arm Hwy	Canoe Beach Drive	Salmon Arm	•		
110	Canoe Beach Drive	Bruhn Bridge	Sicamous		•	
120	Bruhn Bridge	Junction Route 97A	Sicamous		•	
130	Junction Route 97A	Kerr Road East	Sicamous	•		
140	Kerr Road East	Gravel Pit	Malakwa			•
150	Gravel Pit	Malakwa Dump Rd.	Malakwa		•	
160	Malakwa Dump Rd.	Perry River Bridge	Craigellachie	•		
170	Perry River Bridge	Three Valley Bridge	Griffin Lake			•
180	Three Valley Bridge	Victor L. Picnic site	Three Valley L.			•
190	Victor L. Picnic site	Clanwilliam Overhead	Summit Lake			•
200	Clanwilliam Overhead	Big Eddy Road	Revelstoke	•		
210	Big Eddy Road	Junction Hwy 23 South	Revelstoke	•		
220	Junction Hwy 23 South	Junction Hwy 23 North	Revelstoke		•	
230	Junction Hwy 23 North	Revelstoke City Limit	Revelstoke	•		
240	Revelstoke City Limit	Mt. Revelstoke Nat'l Park - West entrance	Revelstoke	•		
250	Mt. Revelstoke Nat'l Park - West entrance	Mt. Revelstoke Nat'l Park - East entrance	Mt. Revelstoke National Park		•	
260	Mt. Revelstoke Nat'l Park - East entrance	Glacier National Park - West entrance	Glacier National Park			•
270	Glacier National Park - West entrance	Glacier National Park - East entrance	Glacier National Park		•	
280	Glacier National Park - East entrance	Columbia River Bridge	Glacier National Park		•	
290	Columbia River Bridge	Anderson Road	Golden		•	
300	Anderson Road	Junction Highway 95	Golden		•	
310	Junction Highway 95	Golden View Road	Golden	•		
320	Golden View Road	Yoho National Park - West entrance	Golden-Yoho National Park			•
330	Yoho National Park - West entrance	Alberta border	Yoho National Park		•	

Recommendations

The report makes recommendations applicable to both the entire TCH corridor and to specific corridor segments. Recommendations include suggestions for conserving fish habitat, minimizing the impact of a highway upgrade on wildlife, assessing archaeological resources, controlling sediment production, identifying land within the ALR, reducing the accident rate between vehicles and wildlife, and protecting rare and endangered species.

Conclusion

This study provided an overview assessment of the environmental resources along the TCH corridor and rated the individual corridor segments as being *good, fair,* or *poor* candidates for highway upgrading. We make recommendations for minimizing potential negative impacts from highway upgrading.

Gaps in Information

This study was based on the existing information obtained from documents, maps, air photos, the field reconnaissance and interviews with agency staff. There are portions of the TCH for which where there is little documented information on fish habitat, wildlife and archaeological resources. These gaps in information are described in the report with recommendations for further, more detailed studies in high priority corridor segments.

The next steps for MoTH will be:
a) to conduct further studies to fill the gaps in the existing information, particularly with respect to wildlife and archaeological resources, and
b) conduct more detailed environmental studies on those corridor segments given top priority for upgrading by the multiple accounts evaluation.

1

INTRODUCTION

Chapter 1 Introduction

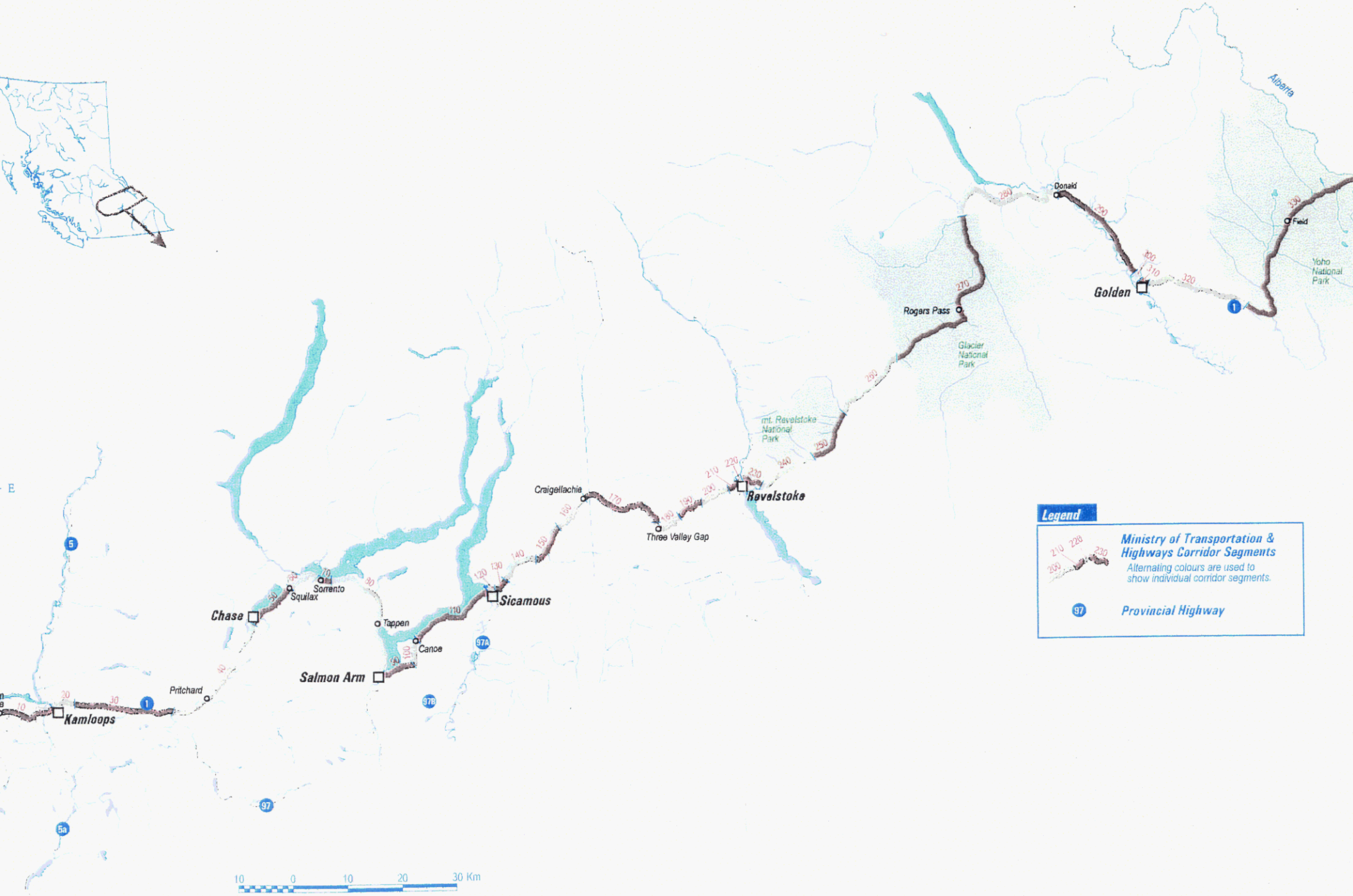
The Ministry of Transportation and Highways (MoTH) retained Acres International Limited (Acres) to conduct an environmental review of the Trans Canada Highway (TCH) between Kamloops and the Alberta border. MoTH is anticipating upgrading sections of the highway to meet growing traffic demands. This report identifies, at an overview level, environmentally sensitive areas along the highway corridor and rates segments of the highway as being *good*, *fair*, and *poor* candidates for upgrading based on the expected impacts on those sensitive areas.

The TCH stretches 441 km between Kamloops and the Alberta border (**Figure 1**). From Kamloops, the highway follows the south bank of the South Thompson River and the southern shores of the Shuswap Lake system. From the Shuswap Lake System, the highway passes through increasingly rugged terrain before reaching Mount Revelstoke and Glacier National Parks, then climbs to an elevation of 1,330 m at Rogers Pass. The highway then descends into the Columbia River Valley from where it climbs to the summit of Kicking Horse Pass (1647 m) before entering Yoho National Park and into Alberta.

The highway is a major transportation route used by long-haul freight truckers, local residents, and tourists. The length of highway reviewed in this study serve the residents of Kamloops, Salmon Arm, Sicamous, Revelstoke, Golden and many other smaller communities along the corridor. The highway passes through three national parks and provides ready access to several provincial parks. The highway is a principal east-west transportation route within the Province of British Columbia and is a major link with the rest of Canada.

1.1 *MoTH Trans Canada Highway Corridor Management Plan*

MoTH has initiated a Corridor Management Plan (CMP) to develop a long-term investment and management plan for the Trans Canada Highway between Kamloops and the Alberta border . The two main objectives of MoTH in this planning process are to maintain the safety and mobility of the



Trans Canada Highway - Kamloops to Albert
Corridor S

public and to protect the current investment in the highway infrastructure (ADI Limited, 1997; MoTH, 1997). The plan will:

- define the role and function of the corridor;
- assess its performance on technical, service, safety, and environmental criteria;
- identify problems;
- develop and evaluate problem solving options;
- develop an investment strategy; and
- implement improvements.

The results of the Acres study described in this report will be incorporated into the Trans Canada Highway Corridor Management Plan (TCH-CMP). The TCH-CMP will then be integrated into regional and provincial highway plans.

1.2 Corridor Management Plan Analysis Framework

MoTH has implemented an analysis framework to assist staff in developing the Trans Canada Highway Corridor Management Plan. The components of the analysis framework include:

- dividing the corridor into planning segments (corridor segments);
- defining and assessing performance measures;
- conducting Benefit-Cost analyses;
- conducting Multiple Accounts Evaluation;
- forecasting population growth; and
- assessing factors for reducing accidents.

This Acres study provides information for the Multiple Accounts Evaluation. The accounts in the MoTH Multiple Accounts Analysis include:

- financial (life cycle cost);
- customer service (travel speed, safety, vehicle operating costs);
- social/community (aesthetics, expropriations, bisection of community, community needs);
- community and provincial economic development; and

- environment (land alienation, noise, energy consumption, emissions, wildlife and fish, water pollution, ecosystems).

Some variables, such as life cycle cost, travel speed, and public safety are expressed in monetary values. Other variables, such as wildlife values and compliance with local community plans, are expressed qualitatively as *good*, *fair*, *poor*. The Multiple Accounts Evaluation summarizes the various accounts and currencies to show decision-makers the various trade-offs of options for improving the highway. This Acres study provides qualitative information for the *environment* account in that evaluation.

1.3 Study objectives

The objectives of the Acres Environmental Overview Assessment were:

- to conduct an overview level reconnaissance of the TCH corridor, noting environmentally sensitive resources that may be affected by upgrading the highway;
- to review existing reports and documents on the TCH corridor;
- to interview regulatory agency staff on specific environmental concerns or sensitivities relevant to their jurisdictions; and
- to apply environmental criteria to rate sections of the highway for suitability of upgrading the highway.

The scope for this project was the existing highway corridor. Alternative highway routes and options outside the existing corridor were not included.

The width of corridor we evaluated depended upon the local topography. In cases where the highway is confined between a rock face and a water course or rail tracks, the width which we evaluated was relatively narrow and limited by the distance between the physical barriers on either side of the highway. In other cases where the topography did not confine the highway, we evaluated the natural resources to a distance of approximately 300 m to 500 m on either side of the centre line of the TCH.

2

METHODS

Chapter 2 Methods

The methods employed in this study include:

- a review of existing environmental information on the Trans Canada Highway Corridor (Kamloops to Alberta border);
- an overview-level reconnaissance of the Trans Canada Highway Corridor; and
- interviews with provincial and federal agency representatives on environmental issues and concerns regarding highway widening.

Acres conducted the study in the fall of 1997, with the field reconnaissance of the corridor and personal interviews with agency representatives occurring from 15 October to 20 October 1997. Weather conditions varied from dry and sunny during the inspection of the western end of the corridor to cloudy with light showers towards the Alberta border. Temperatures were above freezing and there was no snow present at the elevation of the highway during the field reconnaissance.

2.1 Corridor Segments

Observations and findings in this report are described in relation to Ministry of Transportation and Highway planning units called *corridor segments*. Each corridor segment is a length of the TCH that is relatively homogenous in a combination of characteristics such as terrain, surrounding environments, adjacent land use, and highway configuration. There are 33 corridor segments between Kamloops and the Alberta border with segments ranging in length from 1.5 km to 45 km. The corridor segments are numbered "10" through "330" from west to east (Figure 1).

Each corridor segment is further divided into shorter sections with the dividing points corresponding to landmark features along the highway such as intersections, rest stops, highway information signs, culverts, over-passes, and litter barrels. The length of highway between each landmark feature is called a Landmark Kilometre Inventory (LKI) section and there are 689 LKI sections along the study corridor. These range from 10 m to 4,730 m in length. The landmarks and distances are documented in the MoTH Landmark Kilometre

Inventory (MoTH, 1995). Observations in this report are referenced to MoTH corridor segments, LKI sections, and the LKI landmarks.

2.2 Review of Existing Information

Acres environmental specialists reviewed planning studies, resource inventories, environmental impact assessments, maps, and air photos of the corridor. These documents were received from the Ministry of Transportation and Highways, Ministry of Environment, Lands and Parks, Ministry of Employment and Investment (Mining), British Columbia Agricultural Land Commission, Parks Canada, and Fisheries and Oceans Canada. As part of our review, we identified those sections of the TCH for which there is little or no environmental information. These gaps in information are discussed in Chapter 5. The content and findings of the documents are summarized in the annotated bibliography in Appendix A.

2.3 Field Reconnaissance

The primary element of the study was the field reconnaissance of the highway corridor. During the reconnaissance, the study team defined improvements to the highway as projects such as constructing additional lanes, adding passing lanes where needed, realigning short sections, and improving traffic flow and safety at intersections. Each of these options will affect different sized areas along the corridor. As a standard for evaluating the possible environmental impacts of highway improvement, the study team chose to evaluate the effects of adding one more lane in each direction. This "measuring stick" of one additional lane on either side of the highway allowed the study team to visualize the physical area potentially affected and the possible environmental constraints resulting from upgrading. In addition, we observed the natural resources within 300 to 500 metres on either side of the highway (depending upon sight-lines and topography) that could indirectly be affected by upgrading.

The study team drove the TCH from Kamloops to the Alberta border and back to Kamloops to complete the reconnaissance. The following four procedures were employed to gather information on each segment of the highway:

2.3.1 Rapid Environmental Appraisal

The Rapid Environmental Appraisal (REA) of the TCH identified environmental constraints that could limit opportunities to widen the highway to four lanes. During the eastbound traverse of the TCH, two team members documented the physical features of the landscape and the resources that would affect, or be affected by, a widening project. The observations were referenced to landmarks corresponding to features in the MoTH Landmark Kilometre Inventory. Where the environmental constraints appeared significant, the team stopped for a closer inspection and discussed possible mitigation options. The REA provided a preliminary assessment of the environmental constraints to widening the highway in each corridor segment.

2.3.2 Video Recording

An 8 mm video camera, mounted inside the vehicle, recorded highway and environmental features during the east bound traverse of the highway. The study team later used the video tape to review the trip and verify observations and specific features along the route.

2.3.3 Ratings of LKI Sections

The study team assigned a rating on a five-point scale to each of the 689 LKI sections. These ratings formed a preliminary assessment of the environmental constraints that limit the construction of additional lanes in that LKI section of the TCH. These preliminary ratings for individual LKI sections were later combined with information gathered from other sources to develop an overall environmental rating for each corridor segment (see Section 2.5.4 and Chapter 5).

2.3.4 Corridor Segment Characterization

The study team characterized the general terrain, natural features, land development and uses, recreational and visual resources, and other characteristics of each corridor segment. These characterizations form the introductory remarks about each corridor segment in Chapter 4.

2.4 Agency Interviews

Interviews with representatives of provincial and federal agencies provided additional detailed, though sometimes anecdotal, information on environmental concerns and issues related to widening the highway. The Acres team met with representatives of the following agencies.

- Ministry of Transportation and Highways (Kamloops);
- Ministry of Environment Lands and Parks (Kamloops, Cranbrook, Revelstoke);
- Agricultural Land Commission (Burnaby);
- Fisheries and Oceans Canada (Kamloops, Vancouver);
- Parks Canada (Revelstoke); and
- Columbia Basin Fish & Wildlife Compensation Program (Revelstoke).

In addition, Acres conducted telephone interviews with:

- Parks Canada (Radium Hot Springs);
- Ministry of Environment, Lands, and Parks (Nelson, Golden); and
- Fisheries and Oceans (Salmon Arm).

Agency representatives were asked to describe environment-related concerns they had with respect to widening the TCH between Kamloops and the Alberta border. Representatives were also asked for recommendations for mitigating the potential impacts of a highway upgrade and for improving on the environmental performance of the TCH. Information from these interviews is summarized in Chapter 4 and agency contacts are listed in Appendix B.

2.5 Preliminary Rating Scheme Used During Field Reconnaissance of Trans Canada Highway Corridor

This section describes, the application of the five-point rating scale used during the field reconnaissance to rate individual LKI sections.

2.5.1 Five-point Rating Scale

The severity of the environmental constraints in each LKI section was rated using a five point ordinal scale[1] (Table 2.1). A rating of "1" indicated a *low* environmental concern to TCH widening while a rating of "5" indicated a *severe* environmental constraint where mitigating the negative effects might be difficult or costly. A rating of "3" indicated a *moderate* concern with a reasonable opportunity to mitigate the negative effects. Ratings of 2 and 4 were used in rare cases when an LKI section did not clearly fit into a low, moderate, or severe class.

Table 2.1. Scale Used During Field Reconnaissance to Rate Environmental Constraints

Rating for Environmental Concern	Opportunity to expand highway (Environmental)	Relative rating scale*	Description
Severe	Poor	5	Very significant environmental constraints to widening highway. Mitigation of impacts deemed very difficult and costly. Widening unlikely to receive agency approval.
		4	Moderate to significant environmental constraints to widening the highway. Mitigation is possible at a cost, in some cases, compensation programs may be required to augment mitigation measures.
Moderate	Fair	3	Moderate environmental constraints to widening highway. Mitigation of impacts possible at reasonable cost. Widening likely to receive agency approval.
		2	This was the minimum value assessed in National Park Land to reflect the intrinsic value of Parks along the corridor.
Low	Good	1	Low or minor environmental constraints to widening the highway. Mitigation of impacts minimal or not required. Widening likely to receive agency approval.

* Ordinal rate scale indicating relative rating.

[1] The ordinal rating scale indicates relative rankings of environmental constraints. The rating scores do not have quantitative properties and should not be used in mathematical operations.

2.5.2 Physical and Ecological Considerations

In assigning the environmental rating to LKI sections during the field reconnaissance, the team considered the relationship of the highway to physical features and ecological function of the adjacent environment. The physical considerations included the limitations imposed by:

- terrain, geology, and slope stability; and
- proximity and limitations created by other right of ways (e.g., railway).

Ecological considerations included:

- wetlands and floodplains, size and function for flora and fauna;
- riparian area size and function for wildlife and fish; and
- potential fish habitat.

Examples of how the criteria were applied are described below (Tables 2.2 and 2.3). The table describes the conditions for the extreme ends of the scale (1 and 5). Moderate levels of concern (3) fell midway between these extremes.

The smallest unit of highway rated during the reconnaissance was the individual LKI section. The rating for an individual LKI section was the rating of the most serious, environmental concern within that section, even if the constraint was localized to a small part of the LKI section.

The rating system was necessarily qualitative. To minimize the subjectivity of the ratings, all three study team members participated in rating LKI sections. Together the team rated each LKI section, arriving at a consensus before moving onto the next LKI section.

Table 2.2 Examples of Severe and Low Environmental Concerns

Physical issue	Condition for severe concern	Condition for low concern
Slope and length of existing side cast.	Steep sidecast on steep ground. Limited opportunity to increase road bed width by extending sidecast.	Sidecast on bench or otherwise gentle slopes. Extending sidecast unlikely to create negative environmental consequences.
Land use or structures (e.g., railway tracks or floodplain) adjacent to toe of side cast and opportunity to relocate structures.	Existing land use or structures impede expanding extent of sidecast and width of roadbed.	Existing land use does not impede expanding extent of sidecast.
Height and slope of existing cut bank.	High cut bank > 5 -10 m requiring extensive blasting and excavation to increase width of road bed to 4 lanes.	Low cut bank < 5-10 m, relatively easy to increase the width of the roadbed.
Stability and competency of cut bank material.	Unstable with evidence of current erosion or failure.	Stable with little evidence of recent erosion or failure.
Topography above cut bank; will it allow additional side cutting?	Slope above current cut bank at same slope or increases in slope.	Slope above current cut bank eases.
Locations of benches for separate highway lanes.	No benches above or below existing grade for additional lanes.	Benches above or below existing grade for additional lanes.

Table 2.3 Examples of Severe and Low Ecological Concerns

Ecological issue	Condition for severe concern	Condition for low concern
Riparian area	Highway adjacent to riparian area, expansion would encroach on riparian area.	Riparian area at considerable distance from highway, widening would not encroach on riparian area.
Stream or river	Highway adjacent to stream or river. Expanding the highway would add to channelizing stream or river.	Expanding the highway would not affect stream or river channel.
Lakeshore	Highway adjacent to lakeshore. Expansion would in-fill lake, affect shore habitat.	Expanding highway would not affect lakeshore habitat.
Floodplain	Highway adjacent to floodplain. Expansion would encroach further onto floodplain or bisect floodplain.	Expanding highway would not encroach on floodplain or have additional negative impact.
Relative proportion of unique area or natural resource that would be impacted	Significant portion of a locally unique or important habitat will be removed or changed.	Small or insignificant portion of a locally unique or important habitat will be removed or changed, or no locally unique habitat present.

2.5.3 Ratings for Special Cases

In most cases, LKI sections received a rating of, either 1, 3, or 5 on the five-point scale. In special cases a "2" was assigned to certain LKI sections.

Rating of "2" (two)

All ratings of LKI sections through national parks were increased by one to reflect the value of park land to the conservation of nature and the incremental alienation of additional park land if the highway were widened. Any further alienation of park land from a natural state through widening would require some measure of mitigation and/or compensation of habitat and natural function. Hence a minimum rating of "2" in national parks reflects the effort required to mitigate or compensate for the expected loss of lands for conservation.

2.5.4 Use of LKI Rating

The assignment of ratings to LKI sections during the field reconnaissance was one factor in appraising the opportunities and constraints in corridor segments for highway widening. The individual LKI ratings were combined with information from other sources to determine an overall environmental rating (*good, fair, poor*) for each of the 33 corridor segments of the TCH. The overall environmental ratings are summarized in Chapter 5.

3

Overview of Trans Canada Highway Corridor

Chapter 3 Overview of Trans Canada Highway Corridor

The 441 km long study corridor passes through a diverse range of physical and ecological environments between Kamloops and the Alberta border. From an environmental perspective, opportunities to widen the existing highway are limited in places by the ability of the topography to provide for a wider road surface, the capacity of natural habitats to sustain change, and the ability of cultural resources to remain intact in the face of development. Other studies investigated the various aspects of the interaction of the highway with the physical and biological environment. While these studies did not treat the full length of the TCH corridor, they provided detailed information on certain parts of the highway.

This chapter summarizes the available environmental studies of the TCH corridor between Kamloops and the Alberta border. Information from these studies is augmented with observations made by the study team during the field reconnaissance, interviews with agency representatives, and a review of maps, air photos, and databases maintained by the Department of Fisheries and Oceans, the BC Ministry of Environment, Lands and Parks, and the Ministry of Employment and Investment (MEI) . This overview describes the physical and biological setting of the corridor, the various types of land uses to which the TCH provides access, and the interaction between the natural environment, the highway and potential highway upgrade projects.

3.1 Geology and Geological Hazards

3.1.1 Geology

Ryder (1978) describes the geology of the study area. Heading east from Kamloops to Salmon Arm, the highway traverses the Thompson Plateau which is dissected by the South Thompson River and its tributaries. These water courses are flowing in steep sided valleys 600 m to 900 m below the plateau surface. The TCH follows the South Thompson River and the Shuswap Lakes before proceeding across the plateau to Salmon Arm. The

Thompson plateau is mantled with glacial drift in the form of drumlins and fluted tills as well as eskers, kames and meltwater channels. Glaciolacustrine silts, prone to erosion, are present in the South Thompson River valley.

There are extensive upland areas comprised of gently rolling hills located on the erosion resistant bedrock of the Intermontane belt. This belt includes the section of the highway from Kamloops to the western edge of the Monashee Mountains, near Malakwa. The bedrock of this area is composed primarily of marine volcanic and sedimentary rocks. These rocks are overlain by Cretaceous clastic wedges and flat lying Tertiary volcanic and sedimentary rocks. Granitic intrusions, co-magmatic with the various volcanics, are also common.

To the east in the Shuswap Highlands there has been significant geological uplift. As a result, the area has been severely dissected, but also contains some gently sloping erosion surface remnants. Local relief is 600m to 900 m above sea level (a.s.l.) with summits reaching an elevation of 1,500 m to 2,000 m. Glacial erosion has produced rounded ridge crests and steep valley sides. Where the valley slopes are steeper, road building becomes more challenging, particularly near water courses. Where the highway is built on a bench of glacial drift above the valley floor or floodplain, there are opportunities to widen the highway.

Between Kamloops and Sicamous, the TCH follows the course of the South Thompson River, the south shore of Little Shuswap Lake and Shuswap Lake. From Sicamous, the TCH follows the Eagle River to its source at Eagle Pass. The Eagle River, between Sicamous and Taft, meanders through a wide floodplain. Eagle Pass marks the topographic divide between the Fraser Basin to the west and the Columbia Basin to the east.

Between Malakwa and the Rocky Mountain Trench, near Golden, the TCH passes through the Columbia Mountains. These mountains consist of the Monashee, Selkirk and Purcell Ranges. The summits of these mountains are 2,500 m to 3,000 m a.s.l. Ridges and peaks over 2,000 m in elevation were not overridden by glaciers during the Pleistocene Glaciation. As a result, these peaks are sharply serrated while lower peaks are more rounded. Within

the Columbia Mountains, drift is present on the valley floors and on gentler mountain slopes at low elevations. On steeper slopes, bedrock is exposed and is covered, in places, by colluvium. Avalanches occur at all elevations. Generally, the TCH is located on the lower valley slopes and valley floors except at Rogers Pass, where it rises to nearly 1,330 m a.s.l..

The Monashee, Selkirk and Purcell ranges are separated by troughs widened by glaciation. Tills and glaciofluvial gravels are widespread along the bottoms and lower slopes of these troughs. Alluvial terraces also occur along the rivers. From Eagle Pass to Revelstoke, the TCH parallels Tonkawatla Creek which flows east from Clanwilliam Lake into the Columbia River. The next divide east of Revelstoke is Rogers Pass. From Rogers Pass, the Illecillewaet River flows west into the Columbia River while Connaught Creek flows east into the Beaver River, a tributary of the Columbia River. The Beaver River flows into the Columbia River north-west of Donald. The TCH parallels the courses of these drainages from Rogers Pass to the Columbia River.

The Rocky Mountain Trench is a steep sided structural depression lying between the Rocky and Columbia Mountains and is filled with Quaternary and Holocene sediments. The Quaternary sediments occur as drumlins of till, outwash terraces and glaciolacustrine silts, while the Holocene sediments occur as terrace gravels, and floodplain silts, sands and gravels. Between Donald and Golden, the TCH is built on glacial drift and alluvial terraces on the edge of the Columbia River floodplain. This section of the TCH passes through fairly gentle terrain.

The Columbia Mountains (composed of the Monashee, Selkirk and Purcell ranges) and the Rocky Mountain Trench comprise the Omineca Belt. The bedrock geology of the eastern portion is comprised of predominantly middle proterozoic to middle paleozoic miogeoclinal sedimentary rocks. The western portion is comprised mainly of accreted paleozoic and lower mesozoic volcanic and sedimentary rocks. Intensely metamorphosed areas and Jurassic and Cretaceous plutons are common throughout the belt.

The topography of the Rocky Mountains is controlled by the structure of the underlying folded and faulted sedimentary rocks. The summit elevations are approximately 3,500 m and local relief is 1,200 m to 1,500 m. The landforms are the result of alpine and valley glaciation and are commonly asymmetrical due to the moderate to steeply dipping underlying bedrock formations. Due to the rapid disintegration of sedimentary rock, there are thick talus piles overlying bedrock slopes. The TCH between Golden and the Alberta border lies on the Foreland belt (Rocky Mountains). This belt is composed of middle Proterozoic to Upper Jurassic miogeoclinal and platform carbonates, clastics derived from the interior platform, and Upper Jurrasic to Paleogene clastics derived from the Cordillera. The highway follows the Kicking Horse River from its confluence with the Columbia River at Golden to its source at Wapta Lake, near the Alberta border.

3.1.2 Geological Hazards

The portion of the Trans-Canada Highway traversing the Columbia and the Rocky Mountains is subject to a number of geological hazards. These include snow avalanches, debris flows and low magnitude rockfalls.

The Rogers Pass area in the Selkirk Mountains is characterized by frequent avalanches (Evans and Gardner, 1989). The avalanche hazard results from a combination of high snowfall and steep slopes down to the valley floor. Railway operations in the past were periodically interrupted by avalanches until snowsheds were built and snow clearing equipment was used in the early 20th century. Since construction of the TCH, avalanche hazards have been mitigated by route selection, construction of snowsheds, weather monitoring and avalanche forecasting equipment, earthen dams, dikes, avalanche artillery and heavy snow clearing equipment.

Debris flows occur when high quantities of water are mobilized by either excessive precipitation, snowmelt runoff, or catastrophic glacial meltwater outbursts and the rupture of moraine dammed lakes. Large quantities of overland and channel flow will often mobilize debris. Steep slopes and the availability of either colluvium or till will further encourage debris mobilization. There are numerous debris flow sites in Yoho National Park,

near Cathedral Mountain and the Spiral Tunnels. Numerous drainage basins producing debris flows have been identified (Evans and Gardner, 1989). These basins are less than 1 km^2 and begin in the alpine zone where abundant water is available through rainfall and snowmelt. The debris flows move down to lower elevations reaching main valleys and intersecting railways and roads.

Low magnitude rockfall involves the free fall and downslope movement of individual or small groups of rocks and commonly occur on cliffs, scarps and steep slopes, producing talus or scree accumulations. Rockfalls are concentrated during spring thaw and in summer (Evans and Gardner, 1989). Steep rock slopes with northerly, northeasterly and easterly exposures are prone to rockfall. The freeze and thaw processes of bedrock along with intense rainstorms are the driving mechanisms. Low magnitude rockfall is a hazard in places along the highway in both the Columbia and Rocky Mountains (Evans and Gardner, 1989). Rockfalls are less common along the Thompson Plateau, as the bedrock is more resistant to erosion (Ryder, 1978).

The southern interior of British Columbia between Kamloops and the Alberta border has a low seismic hazard. Historically, few earthquakes have occurred within this area with only one measuring six on the Richter scale. All of the other recorded earthquakes had intensities ranging from 3.5 to 4.5 (Basham et al, 1982).

3.2 *Hydrology, Drainage, and Water Quality*

Environment Canada (1991) provided data on the mean annual discharge for each of the major water courses along the TCH route (Table 3.1). The peak and low flows for each of these drainages occur in June and February, respectively. Most of these drainages, with the exception of the South Thompson River, have ice formations during the period of low flow in February.

Table 3.1.: Mean Annual Total Discharge for Major Water Courses within the TCH Corridor

Water course	Mean Annual Total Discharge (m^3/s.)	Mean Maximum Monthly Discharge (m^3/s)	Mean Minimum Monthly Discharge (m^3/s)	Ratio of Mean Monthly Maximum Discharge to Mean Monthly Minimum Discharge
South Thompson River (Chase)[1]	289	855	88.1	10:1
Eagle River (Malakwa)[2]	38.1	151	8.2	18:1
Tonkawatla Creek	N/A	N/A	N/A	N/A
Illecillewaet River (Greeley)[3]	53.2	164	7.82	21:1
Connaught Creek (Rogers Pass)[4]	0.548	1.8	0.062	29:1
Beaver River (jct. with Columbia)[5]	41.5	129	5.98	22:1
Columbia River (Donald)[6]	174	522	31.9	16:1
Kicking Horse River[7]	41.3	130	5.51	24:1

[1] streamflow records from 1911-90
[2] streamflow records from 1913-16, 1955-56, 1965-90
[3] streamflow records from 1963-90
[4] streamflow records from 1980-86
[5] streamflow records from 1985-90
[6] streamflow records from 1944-90
[7] streamflow records from 1912-22, 1974-90.

For the larger rivers, the peak discharge is approximately 10 to 20 orders of magnitude greater than the lowest rate of discharge. For the smaller creeks and streams, the ratio of peak to low discharge is between 20 and 30 orders of magnitude. Peak discharges are important to note as water levels will vary significantly during different times of the year. There are locations where a highway upgrade may encroach upon the floodplain of some of these water courses, the most likely being the Eagle River, the Beaver River, the Kicking Horse River, and to a lesser extent, the Columbia River.

3.2.1 Water quality

Water quality data are not available for any of the major streams in the TCH corridor other than the Lower Thompson River. Data for the Columbia River are only available for reaches outside of the TCH corridor between Keenleyside and Birchbank, and the Upper Columbia River, between Columbia Lake and Edgewater.

Water Quality records for the Thompson River System are recorded at Kamloops Lake. The general water quality of the Lower Thompson River was rated as fair (Ministry of Environment, Lands and Parks, 1996). Potential sources of contamination include discharge from a bleached Kraft mill and from the City of Kamloops. Noted non-point source discharges include agriculture, urban development, forestry and streambank erosion. Contaminants carried by runoff from the highway are not monitored.

3.2.2 Groundwater Resources

There is significant supply and use of groundwater resources along the TCH corridor between Kamloops and the Alberta border. However, MELP does not have an inventory available for the location of individual water wells. What follows is a general description of the aquifers. The relevance to highways construction is potential disruption to groundwater recharge and the interception of significant groundwater courses during highway construction.

The main aquifers on the Thompson Plateau are located in the River Valleys. Approximately 800 of the 1,100 reported wells in the Thompson River Watershed are constructed in unconsolidated aquifers. A total of 90% of these wells have flows sufficient only for domestic needs. There are another 300 wells constructed in bedrock in the Kamloops area. Many of these wells yield 0.1 L/s. There is significant potential for groundwater development on the Thompson Plateau (Zubel, 1996).

The bedrock in the Shuswap Highlands has a low permeability and yields from wells are low. There are few bedrock wells as most of the inhabited areas are located in river valleys where wells are located in sediments. The South Thompson valley is one of the most extensive valleys transecting the Shuswap Highlands that have been glaciated and backfilled with permeable layers of glacial and post glacial sediments. Yields from these aquifers are as high as 150 L/s (Dakin, 1996a).

In the Columbia Mountains, groundwater is present in bedrock masses and valley fill deposits. Groundwater occupies voids and fractures within the bedrock and spatial variations in permeability are common and combined with

topographic relief, determine the direction of groundwater flow. For example, mountain springs occur where the downward movement of groundwater through fractured bedrock is impeded by reduced permeability of the rock, forcing the groundwater to move toward a slope or stream (Parsons and Quinn, 1996).

Infiltration in bedrock in the mountain regions is dependent on the network of rock discontinuities concentrated at depths of less than 100 m. These systems commonly discharge to mountain streams, springs and lakes. In addition, large scale flow systems originate in mountainous recharge areas, penetrate bedrock fracture networks to depths of hundreds to thousands of metres and discharge into major river valleys. Groundwater in the valleys occurs in unconfined aquifers composed of primarily sand and gravel deposits. The groundwater resources of the Rocky Mountain Trench are described by Foweraker (1996).

Within the quaternary and holocene sediments in the Rocky Mountain Trench, there are numerous sand and gravel aquifers. One of the major groundwater sources in the Rocky Mountain Trench is outwash gravel underlying major meltwater channels in the trench floor. Ninety percent of the wells in the South Rocky Mountain Trench are located in unconfined aquifers. The remaining 10% are located in bedrock aquifers.

Near Golden, south of Kinbasket Lake there are several wells with yields over 7 L/s. Groundwater is used extensively at Golden where a thick sequence of Quaternary sediments, more than 45 m thick, has been deposited. At sites near the Kicking Horse River, there are industrial wells less than 30m deep in gravels that yield 13.6 L/s to 151 L/s.

In the Rocky Mountains, aquifers are found in the more permeable zones of bedrock along fault zones or in tight folds. There are few developed bedrock wells in the Rocky Mountains as the population in this area is sparse. Hot springs are common in limestone bedrock where deep seated faults allow heated groundwater to flow rapidly to the surface. The location and quantity of groundwater is difficult to predict in the glaciated u-shaped valleys

backfilled with a variety of sediments ranging from dense fill to permeable sands and gravels (Dakin, 1996b).

Highway expansion can result in groundwater contamination by introducing contaminated runoff carrying herbicide spray and road salt from operations, hydrocarbons from vehicles, and chemicals spilled from carriers in the event of an accident. Groundwater in mountainous terrain is particularly vulnerable to contamination due to limited soil thickness and rapid migration of pollutants through faults in bedrock (Parsons and Quinn, 1996). Areas with shallow water tables and surficial materials composed of coarse sands and gravels are more prone to groundwater contamination as runoff and stream flow are able to infiltrate more readily.

3.3 Vegetation, Soils, and Climate

The Trans Canada Highway intersects a number of ecosystems between Kamloops and the Alberta border. Ecosystems in British Columbia are classified by the Biogeoclimatic Ecosystem Classification system (BEC). BEC describes the ecosystems created by the interaction of climate, soils, and vegetation in an area (Meidenger and Pojar, 1991). The soils are classified according to the Canadian System of Soil Classification and the distribution of the various soil classes traversed by the TCH is described in "The Soil Landscapes of British Columbia" (Valentine et al., 1978).

Along the highway corridor, the biogeoclimatic zones generally trend from arid in the west to wetter in the east. The primary influence on precipitation is topography. The Coast Mountains create a rain shadow in the semi-desert areas near Kamloops where precipitation amounts to 200 mm per year. Weather systems pick up moisture as they travel east and are relieved of this moisture as they rise up the western side of the Columbia Mountains. Hence the western slopes of the Columbia Mountains receive up to 1,200 mm of precipitation annually and support forests of large western redcedar (*Thuja plicata*) and western hemlock (*Tsuga heterophylla*). From west to east, the highway traverses five biogeoclimatic zones; Bunchgrass, Ponderosa Pine, Interior Douglas-fir, Interior Cedar—Hemlock, and Engelmann Spruce—Subalpine Fir. The vegetation changes from predominantly grassland and

parkland in the South Thompson Valley and along Shuswap Lake to forests comprised of cedar/hemlock and Engelmann spruce/subalpine fir in the Columbia and Rocky Mountains.

3.3.1 Bunchgrass, Ponderosa Pine, and Interior Douglas–fir zones

The Bunchgrass (BG) zone comprises grasslands that dominate the lower elevations of the major southern interior valleys of British Columbia. Within the TCH corridor, the Bunchgrass zone extends along the Thompson Valley from Kamloops to Pritchard. This arid zone results from the rainshadow cast by the Coast Mountains. The climate is driest in the deeply incised valleys where tree growth is restricted by lack of water. Grasses are the dominant vegetation here.

Chernozem soils are formed under grassland vegetation and subarid to subhumid climates. The brown chernozems are located under the grasslands in the Thompson River valley and are characteristic of semi-arid to subarid moisture regimes. These soils are found on a wide variety of materials as their distribution is a result of the climatic limitations to tree growth. They occur at lower elevations along terraced river valleys under sparse vegetation. These soils are often vegetated with shallow rooting plants and are more prone to erosion. Chernozems support orchards and cattle ranching along the Thompson River. In areas where these soils are extensively grazed, ravines may form as a result of increased erosion. During high peak flows, the bedloads of streams in this area are increased by the influx of eroded material. This leads to blockages of highway culverts located at the grade break on the Thompson Valley floor (Harding, 1997, pers. comm.).

The Ponderosa Pine (PP) zone occurs along the Thompson Valley at elevations above the Bunchgrass zone and extends along a portion of Shuswap Lake. Within the TCH corridor, it extends from Pritchard to Chase. This zone is the driest and warmest forested zone in British Columbia. The vegetation consists of a mixture of forest and grasslands. The forest stands are dominated by ponderosa pine (*Pinus ponderosa*), but Douglas-fir (*Pseudotsuga menziesii* var. *glauca*) is common on moist sites associated with gullies and streams and as a minor component on drier sites.

The Interior Douglas-fir (IDF) zone is found above the elevation of the Bunchgrass and Ponderosa Pine zones with the lower elevation between 350 m to 600 m and the upper elevation between 900 m to 1,450 m. The IDF extends along the TCH corridor from Chase to Squilax. Open to closed canopy mature Douglas-fir forests cover most of this zone. Pure stands of Douglas-fir with open canopies are common. These are pure stands because the thick bark of Douglas-fir enables it to survive ground fires while the fire kills other thin-barked species. Lodgepole pine (*Pinus contorta* var. *latifolia*) is a common successional species at higher elevations and where crown fires have occurred. Ponderosa Pine is found on drier sites. Western redcedar occurs on wetter sites in transition areas between the IDF and Interior–Cedar Hemlock zones.

Luvisol soils are formed under deciduous, mixed, boreal forest and in the forest–grassland transition zone. Luvisols are found on fine to medium textured sediments, but rarely on coarse textured materials. The parent materials are neutral to slightly alkaline. The gray luvisols of the Thompson Plateau are found on calcareous till under ponderosa pine and Douglas-fir forest with bluebunch wheat grass and pine grass, and occur at higher elevations (1,000m to 1,800 m). In logged areas, these soils are prone to erosion resulting in the formation of gullies and an increased bedload in stream courses that the TCH crosses.

Much of the natural Bunchgrass and Ponderosa Pine ecosystems in the valley bottoms between Afton Interchange and the Monte Creek turnoff (Highway 97) have been developed for agriculture, subdivisions, and commercial uses. In the eastern extents of the Bunchgrass and Ponderosa Pine zones, the highway widening may add to the incremental loss of Bunchgrass ecosystems from any remnant pieces of this zone present adjacent to the existing corridor.

3.3.2 Interior Cedar Hemlock and Engelmann Spruce–Subalpine Fir zones

The Interior Cedar Hemlock (ICH) zone occurs between elevations of 400 m to 1,500 m and occupies the Shuswap Highlands, and the lower slopes of the Columbia Mountains. It extends along the TCH from Squilax to Rogers Pass.

This zone also occupies the Rocky Mountain Trench and the lower elevations of the Rocky Mountains. The cool continental climate is characterized by cool, wet winters and warm, dry summers. Western redcedar and western hemlock dominate mature climax forests; white spruce (*Picea glauca*), Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) form climax stands with either western hemlock or redcedar in areas of cold drainage and ponding.

The Engelmann Spruce—Subalpine Fir (ESSF) zone within the TCH corridor lies below the alpine tundra in the Columbia and Rocky Mountains. The TCH traverses this zone in the higher elevations of the Columbia Mountains and Rocky Mountains. The climate of this zone is cold, moist and snowy. At the lower and middle elevations, this zone is composed of continuous forest, while at higher elevations, subalpine parkland supports clumps of trees with areas of heath, meadow and grassland. The dominant tree species are Engelmann spruce and subalpine fir. Lodgepole pine is common in the drier zones and is an early seral species occurring after fire disturbance. Other species common in this zone include whitebark pine (*Pinus albicaulis*), limber pine (*Pinus flexilus)*, alpine larch (*Larix occidentalis*) and mountain hemlock (*Tsuga mertensiana*). In lower elevations, western white pine, Douglas-fir, western hemlock and western redcedar are common.

Forestry is the primary resource based industry in both the Interior Cedar—Hemlock zone and the Engelmann Spruce—Subalpine Fir zone. Most areas in these zones have low potential for agriculture due to climatic and topographic constraints. A highway upgrade is not likely to severely affect the Interior Cedar–Hemlock and Engelmann Spruce—Subalpine Fir ecosystems as most of the area adjacent to the TCH corridor and outside of national parks has already been logged.

The soils of the Columbia and Southern Rocky Mountains are predominantly humo-ferric podzols, dystric and eutric brunisols, gray luvisols and gleysols. Podzols are formed on coarse textured, well drained parent materials. The vegetation is usually coniferous forest. The humo-ferric podzols are found at high elevations in areas characterized by high precipitation in the Columbia Mountains. These soils are the most productive for tree growth and develop

on medium to coarse textured tills, fluvial and colluvial materials. Engelmann spruce, subalpine fir, western red cedar and western hemlock are the dominant vegetation on these soils.

Brunisols are soils that have undergone only moderate development from the parent material. They form in subhumid to subarid areas where the rate of soil weathering is limited. These soils often form on coarse textured materials such as glaciofluvial sands and gravels. The dystric brunisols are formed on middle elevations and steep terraces on non-calcareous fluvial and colluvial materials. Commonly associated trees include Douglas-fir, western redcedar, western hemlock and Engelmann spruce. These soils do not support agriculture. Eutric brunisols are common in the Rocky Mountain Trench, occurring on the valley bottoms and on lower mountain slopes on calcareous parent materials. They occur in areas drier than where dystric brunisols are found. Eutric brunisols are commonly found on coarse textured fluvial, morainal and colluvial deposits.

Both podzols and brunisols are often less than 1 m deep, particularly on steep slopes. These soils are prone to erosion and landslides could occur if the forest cover is removed in order to expand the highway, especially on the steeper slopes.

The Upper Columbia River floodplain is characterized by gleysols. These soils are saturated for long periods of time each year. In many large river floodplains in B.C., saturation develops from a persistent, high groundwater table. These soils support agriculture as the soils are found at low elevation and are easily accessible. Where water is present at the surface, the resulting marshes are important waterfowl habitat. There is a possibility that expanding the highway along a river floodplain will adversely change the flow of water to important wetland habitats.

3.4 *Fish and aquatic habitats*

The western portion of the highway passes through the Thompson/Shuswap system which provides important habitat for anadromous fish (sockeye, chinook, coho and pink salmon), as well as several species of trout and other

fish. The central part of the highway is close to important fish habitat in the Eagle River Valley, Three Valley Gap, and the Summit Lakes (Victor, Clanwilliam, and Griffin). The eastern portion of the highway is located in the Columbia River system. While the rivers in the Columbia system do not support anadromous species, they do support important recreational fisheries for non-anadromous species including rainbow trout and kokanee in the Illecillewaet, Beaver, Columbia and Kicking Horse rivers.

It must be noted that this report provides information on the presence of fish as retrieved from various other data sources. Many of the data sources, including the Fish Information Summary System (FISS) from the Department of Fisheries and Oceans reported that Dolly Varden char were present in many of the water courses east of the Thompson River. However, as indicated in McPhail and Baxter (1996), the specific distinction between Dolly Varden (*Salvelinus malma*) and bull trout (*Salvelinus confluentus*) is still in doubt. In very general terms, Dolly Varden occur on the coast and bull trout are distributed in the interior of B.C. There is an area of overlap which extends up the Fraser River to the South Thompson River. Therefore, in this report, Dolly Varden listed in water courses to the east of the Thompson River are most likely bull trout. However, this report provides the listings as found in the data sources, we have not changed the occurrences of Dolly Varden to bull trout, preferring to provide data as presented in the sources indicated.

Fish Habitat Protection

As very briefly described above, the majority of the highway runs adjacent to, or crosses, water courses which support fish. Therefore, agency representatives identified fish habitat as one of most significant environmental concerns with respect to upgrading the TCH.

The fish habitat provisions of the *Fisheries Act*, and the Land Development Guidelines provide guidance for land development near fish bearing water courses. Section 35(1) of the *Act* prohibits works or developments that result in the harmful alteration, disruption or destruction (HADD) of fish habitat (Winfield, 1997).

The Policy for the Management of Fish Habitat (1986), outlines a standard approach to habitat conservation and protection through the application of the "No Net Loss Guiding Principle" (see Appendix C). This principle states that a proposed development cannot result in net loss of productive capacity of fish habitat. The Department of Fisheries and Oceans Habitat and Enhancement Branch (DFO HEB) preferentially requires that the loss of productive fish habitat be completely avoided during all phases of a project (Winfield 1997). If impacts cannot be avoided, they are to be minimized through the implementation of mitigative measures. For critical Class I habitat (see Habitat Sensitivity Classification System below), avoidance and mitigation are mandatory. For other less critical habitats, residual impacts can be offset by projects which compensate for the loss of productive fish habitat.

When compensation is proposed, authorization under section 35(2) of the *Fisheries Act* would be required. Compensation projects, completed at the expense of the proponent, usually involve the creation of equivalent fish habitat near the site. Compensation measures are seen as a last resort. Only projects affecting Class II and III habitats can be compensated. Projects within Class I habitat must avoid impacts through relocation or redesign, mitigation is seen as a less desirable option, and compensation is not acceptable.

An authorization under section 35(2) of the Fisheries Act triggers the application of the Canadian Environmental Assessment Act (CEAA). For the upgrading of sections of the TCH, a screening level review would be initiated. Under CEAA, DFO would notify other federal authorities, such as Environment Canada, and Heritage Canada and would elicit responses regarding the project from these agencies (Winfield 1997). Any CEAA review would include a cumulative effects assessment.

In all cases, early and ongoing consultation with the DFO HEB will be beneficial to ensure proper compliance, and will assist to establish an early working relationship.

Habitat Sensitivity Classification System

The Department of Fisheries and Oceans classifies shoreline and fish habitat based upon the importance of the productive capacity of areas for spawning, rearing or migrating (Stahlberg, Redden, Hickey, 1997). The classification system as defined in Hatfield (1996) is summarized below:

Class 1 - Areas with high fisheries values requiring a high level of protection. These areas are defined as reaches of shoreline possessing any of the following features:

- observed spawning of salmon, lake char or other fish;
- high potential for rearing/migrating juvenile salmon as defined by Russell et al. (1980); and
- where dense riparian vegetation occurs in foreshore areas.

Class 2 - Areas with fisheries values requiring a moderate level of protection. These areas are defined as reaches of shoreline which do not possess the features which would activate a Class 1 rating, but do possess either of the following features:

- moderate potential for rearing/migrating juvenile salmon as defined by Russell et al (1980); and
- suitable habitat for spawning of lake char.

Class 3 - Areas with fisheries values requiring a minimum level of protection. These areas are defined as reaches of shoreline possessing all of the following features:

- no observed spawning of salmon;
- low potential for rearing/migrating juveniles as defined by Russell et al (1980);
- habitat not suitable for lake char spawning; and
- no dense riparian vegetation in the foreshore area.

The habitat classification system, as defined above, was applied specifically to the Thompson/Shuswap system and is defined in Hatfield Consultants (1996).

Fish Information Summary System (FISS)

Table 3.2 provides a summary of the presence of fish within the corridor from Department of Fisheries and Oceans Fish Habitat Information System (FISS), as well as other sources. The table presents fish distribution data retrieved from the on-line database, and augmented from other sources as indicated. The fish within the Fraser/Thompson/Shuswap systems appear to be well documented in the FISS database. However, there are no entries in the database for water bodies east of the Monashee Summit, such as Tonkawatla Creek, the Illecillewaet River, Beaver River, Columbia River, and Kicking Horse River. Information from agency representative and information provided in other studies indicate that most of these water courses do, in fact, support a range of non-anadromous fish species. The source of the information presented in the table is indicated for each species in each corridor segment.

		F									F			F	F		F	F	F	F			F	
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	1	1	1							1								1							
	1	1	1							1								1							
5"	4	4	4				4			4	4									4	4				
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3.5 Wildlife and Wildlife Habitat

Information on wildlife resources within the study corridor is fragmented. Detailed wildlife studies have tended to focus on populations in the national parks with few studies species in non-park areas. For areas outside parks, the Wildlife Accident Reporting System (WARS) provides some indication of the presence of different species. WARS is a database maintained by MoTH and stores information on the location and species of animal involved in accidents with vehicles (excluding trains). However, the reports underestimate the actual number of accidents because most are not reported. As well, only accidents involving larger animals tend to be reported. Hence, the WARS database does not provide a complete list of the wildlife species present in the corridor. **Table 3.3** summarizes the WARS data for the corridor.

For a general indication of species expected to be found along the corridor, Meidinger and Pojar (1991) enumerate the wildlife species associated with each Biogeoclimatic zone. In the Bunchgrass zone along the TCH corridor, large mammalian species include mule deer, Rocky Mountain elk, California bighorn sheep, and coyote. Common bird species include golden eagle, red-tailed hawk, American kestrel and snowy owl. Various species of larks, meadowlarks and sparrows are also common.

The Ponderosa Pine zone, which has relatively short, snow free winters, provides wintering habitat for a wide variety of wildlife including mule deer, white tailed deer, bighorn Sheep and Rocky Mountain elk. Flocks of passerine birds moving from higher elevations during the winter are also found in this zone.

Winters in the Interior Douglas-fir zone are short and cool. Ungulates, including mule deer, white-tailed deer, bighorn sheep and Rocky Mountain elk use the extensive stands of Douglas-fir as winter range. Other common species in this biogeoclimatic zone are black bears, cougars, bobcats and coyotes. Non-migratory passerine birds move from higher elevations in winter to form mixed species flocks in this zone.

Table 3.3 Number of Animals Killed in Accidents with Vehicles: Trans Canada Highway (Kamloops to Alberta border) 1991 to 1996

Corridor Segment	Count	Species
10		No data
20	9	Deer
	1	Coyote
30	6	Deer
	1	Coyote
	1	Moose
40	8	Deer
	3	Bear
	1	Coyote
	1	Sheep
50	7	Deer
60	2	Deer
70	4	Deer
	1	Bear
80	29	Deer
	7	Bear
	4	Coyote
90	3	Deer
100	10	Deer
	2	Bear
110	2	Bear
120	3	Deer
	1	Bear
130	6	Deer
	1	Moose
140	6	Deer
	1	Coyote
150	11	Deer
	1	Bear
	1	Moose
160	14	Deer
	1	Bear
	1	Moose
	1	Porcupine
170	7	Deer
	1	Beaver
	1	Porcupine
180	2	Deer
190	1	Deer
200	1	Moose
210	1	Deer
	1	Porcupine
220		No Data
230	5	Deer
240	3	Deer
	1	Bear
	1	Porcupine
250	1	Deer
260	3	Bear
	2	Porcupine
	1	Elk
	1	Deer
270	2	Deer
	2	Bear
	1	Porcupine
280	24	Deer
	10	Moose
	8	Elk
	3	Porcupine
	3	Coyote
290	10	Deer
	5	Elk
	5	Porcupine
	3	Moose
	2	Bear
	1	Coyote
	1	Beaver
300	7	Deer
	1	Moose
	1	Elk
	1	Coyote
310	18	Deer
	2	Moose
	1	Elk
	1	Coyote
	1	Porcupine
320	13	Deer
	1	Bear
	1	Coyote
	1	Moose
330		No Data

(Data from MoTH WARS database)

Wildlife inhabiting the Interior Cedar—Hemlock zone are adapted to the cool, long, and snowy winters. Representative species include the grizzly bear and the black bear, species that both hibernate for five to seven months. Ungulates such as mule deer, white-tailed deer and Rocky Mountain elk use this zone mainly in the summer and migrate to the Interior Douglas-fir zone in the winter. Caribou, although not common, are found in this zone in late summer and fall then move up to the Engelmann Spruce—Subalpine Fir zone in the winter. Moose are found throughout the Interior Cedar—Hemlock zone and survive the winters on the abundant food supply.

Summers in the Engelmann Spruce—Subalpine Fir zone are cool and wet while winters are long, snowy, and cold. Wildlife species adapted to these conditions include the grizzly bear, black bear, grey wolf, coyote, lynx, cougar, wolverine and martin. Moose migrate from this zone before winter, while the mountain goat and caribou stay through to spring.

This overview study did not permit a level detail sufficient to identify specific wildlife resources of features such as wildlife trees, bedding areas, or specific habitat of smaller mammals and birds. We did however, attempt to identify key migration corridors, wintering ranges, wetland areas, and other significant wildlife oriented habitats and features.

It must be noted that the best information on wildlife was available for National Parks, where many studies have been conducted. There was a distinct shortage of information regarding the presence and abundance of wildlife along many of the corridor segments.

3.6 *Rare or Endangered Species and Communities*

The BC Conservation Data Centre (CDC) (1998, 1997) identified Red-listed vertebrates and vascular plants and Blue-listed vascular plants observed within 500 m of the TCH corridor[1]. An abridged list of the species and

[1] Acres requested CDC observations for a 30 m to 40 m wide corridor on either side of the existing TCH, but the CDC database was unable to provide information at this resolution and instead applied a corridor width of 500 m.

locations follow (Tables 3.4, 3.5, and 3.6). The complete list is in Appendix D.

Readers should be aware of limitations of this data. The listings of Red- and Blue-listed species are based on observations reported to the CDC and not based on extensive field surveys. Some observations date from 1950 and have not been updated since. The list of Red- and Blue- listed species presented here represent the CDC data at the time of this study. The limitations of the data are described in more detail in Appendix D. Nonetheless, these lists provide an indication of the rare or endangered species that might be found along the corridor.

Only two Red-listed vertebrate species, the Western Grebe and the White Sturgeon are recorded as occurring in the vicinity of the TCH corridor, and neither of these listings would be threatened by an upgrade. However, several Red- and Blue-listed vascular plants species occur along the corridor. These lists of rare or endangered species serve to alert planners of the possible presence of the observed species and more detailed plant and animal surveys will be necessary when planning construction on specific sections of the highway.

Table 3.4 Red-listed Vertebrates

Species	Location	Corridor segments	Last Observed
Western Grebe	Shuswap Lake	90	1994
White Sturgeon*	Columbia River	220, 300, 310	1991

* Occurrences of White Sturgeon, as reported by the CDC, include all of the Columbia mainstem from below the Keenleyside dam to the US border. However, some White Sturgeon may also be present above the Keenleyside.

Table 3.5 Red-listed Vascular Plants

Species	Location	Corridor segment	Last Observed
Big Sage- Bluebunch Wheatgrass	Valleyview Silt Cliffs Kamloops	20	1972
Rough Fescue-Bluebunch Wheatgrass	Valleyview Silt Cliffs Kamloops	20	1972
Purple Blue-Eyed Grass	Little Shuswap Lake	50	1972
Mosquito Fern	White Creek, Tappen	80	1974
Mosquito Fern	Salmon River Mouth	90	1993
Hairy Water Clover	Salmon River Mouth	90	1993
Mosquito Fern	Sicamous	120	1982
Mosquito Fern	Cambie	130	1982
Giant Hyssop	Big Bend Highway	280	1947
Crawes Sedge	2.4 km west of Golden	290	1947
Dark Lamb's Quarters	Golden	300	1058
Dark Lamb's Quarters	23 km west of Field	320	1958

Table 3.6 Blue-listed Vascular plants

Species	Location	Corridor segment	Last Observed
Threadsilk Milk-Vetch	Peterson Creek Park Road	10	1983
Great Basin Nemophila	Little Shuswap Lake	50	1972
Thyne-leaved spurge	Shuswap Lake, Tappen	80	1974
American Sweetflag	Salmon Arm	90	1985
Blunt-Sepaled Starwart	Mount Mara	120 and 130	1971
Orange Touch-Me-Not	Eagle River Canyon	170	1950
Small-Flowered Willowherb	Clanwilliam Lake	190	1950
Macoun's Fringed Gentian	Near Field	330	1958

3.7 Archaeological, Cultural and Heritage Resources

Archaeological Overview Assessment studies have been conducted along certain portions of the TCH between Kamloops and the Alberta border. The purpose of an Archaeological Overview Assessment is to identify and assess the potential presence of archaeological resources. There are 133 known archaeological sites in the vicinity of the TCH (Table 3-7). The Archaeological Review Process in British Columbia applies to projects that

are reviewed under the British Columbia Environmental Assessment Act (BCEAA) (described in Appendix E) as well as smaller projects, not triggered under BCEAA, that may have impacts on archaeological resources. The projects not triggered under BCEAA may be subject to a "heritage inspection" or a "heritage investigation". A heritage inspection determines the presence of archaeological sites warranting protection and a heritage investigation is conducted to recover information that may be lost as a result of site alteration or destruction (Archaeology Branch, 1989).

Table 3.7 Number of known archaeological sites by corridor segment.

Corridor Segment	Number of Known Archaeological Sites	Corridor Segment	Number of Known Archaeological sites
10	1	180	4
20	2	190	3
30	10	200	0
40	30	210	1
50	5	220	0
60	10	230	0
70	0	240	0
80	0	250	0
90	0	260	0
100	0	270	32
110	1	280	0
120	0	290	0
130	0	300	0
140	0	310	0
150	0	320	0
160	4	330	25
170	5	Total	133

The following summarizes the documented archaeology information along the TCH corridor (locations listed west to east).

- I. R. Wilson Consultants (1991) undertook an Archaeological Overview Assessment of the area between Kamloops and Canoe (Corridor Segment 10 - 100). They identified over 60 known archaeological sites along the TCH corridor and 8 ethnographic sites

in close proximity to the corridor. Most of the Wilson study area has unproven heritage value.

- There are no recorded archaeological assessment studies for the Canoe to Malakwa section (Corridor Segment 110 - 150) of the TCH corridor. The archaeological potential of this portion of the TCH is unknown.

- Arcas Associates (1986) identified several heritage sites between Malakwa and Revelstoke (Corridor Segment 160 - 210). Nine heritage sites and nine sites containing remnants of a historic "Tote Road" are located within, or in proximity to, the proposed expanded Trans Canada Highway. The Arcas study was conducted to the survey standards of the time and the survey standards have since been revised. A survey to the standards of today may reveal additional heritage or historic sites.

- There are no recorded archaeological assessment studies for the Revelstoke to Glacier National Park section of the TCH corridor (Corridor Segment 220 - 260) The potential for archaeological sites is unknown.

- Both Glacier National Park (Corridor Segment 270) and Yoho National Park (Corridor Segment 330) contain 32 and 25 archaeological sites, respectively. These are primarily associated with historic railway construction, mining and other colonization and settlement activities of European-Canadians (Arcas Associates, 1979; Reid Crowther and Partners, 1994a,b). There is one identified site, dating to pre-European contact, in a national park. The extent of the archaeological resources in the three parks is not fully known, as the inventory is not yet complete.

- Little or no archaeological assessment work has been completed between Glacier National Park and Donald (Corridor Segment 280). The archaeological potential in this area is unknown.

The area around the town of Golden (Corridor Segment 290-320) has moderate to high archaeological potential (Choquette, 1997a,b). Most of the archaeological sites in, and near, Golden were likely destroyed when the townsite was built. The rest of the eastern section of the TCH corridor does not contain documented archaeological sites, but the archaeological potential of the area has been classified as moderate or high based on the presence of landforms suitable for human use or habitation (Choquette, 1997a,b).

3.8 Air Quality

The information we reviewed did not suggest that air pollution from vehicles was an issue along the corridor. Given the sparse population of the region between Kamloops and the Alberta border, we expect that vehicles did not contribute significantly to air quality problems. The major source of air pollution along the corridor is particulate matter generated by forestry operations such as slash burning and burning debris in beehive burners (MELP, 1995). These sources tend to affect local communities where the burning occurs. While motor vehicles contribute gaseous and particulate pollutants to the atmosphere, we expect that the current level of highway traffic contributes negligibly to air quality problems compared to industrial sources.

3.9 Visual, Recreational and Tourism Resources

The corridor boasts spectacular opportunities for scenic viewing and outdoor recreation. Scenic resources include dramatic views of river valleys, steep mountain sides, glaciers, waterfalls, wetlands, mountain lakes, and wildlife. The combination of scenery and the natural setting offer abundant opportunity for recreation and tourism. The TCH serves the recreation and tourism market by providing ready access to the three national parks and nearby provincial parks. The highway also provides access to logging roads used by recreationalists to reach backcountry areas.

Summer activities in, and accessed by the corridor, include fishing, hunting (outside parks), hiking, viewing, picnicking, kayaking, and canoeing. Winter activities include cross-country, alpine, and backcountry skiing, and snow mobiling. Recreational enthusiasts have a choice of self-guided or commercial

outdoor recreation activities. For accommodations, the corridor offers a variety of resorts, hotels, motels, camp grounds, and wilderness camp sites.

An important function of the TCH is to provide access to the scenic and recreational resources in southwestern British Columbia. Because of the abundance of scenic, recreational, and tourism resources, it was not possible for this overview level study to inventory each occurrence. However, wherever possible, we have indicated the instances of significant recreational resource values meriting special attention (see Chapter 4).

3.10 Land and Resource Use

The land and resource uses along the corridor include agricultural, forestry, recreation (parks), residential, and commercial. Resource based industries, primarily forestry, operate along most of the corridor except within the National Parks. As for conservation, there are no ecological reserves located within 500 m of the TCH (Morrison, 1997, pers. comm.). There are two Ducks Unlimited projects which are close to the highway: the Salmon River estuary at Salmon Arm (Corridor Segment 90), and Moberly marsh near Golden (Corridor Segment 290) (Nontell, 1998, pers. comm.).

The primary land uses which may be affected by the expansion of the TCH are commercial uses in urban and semi-urban areas along sections of the corridor. In some areas, commercial services such as fuel stations, restaurants, and hotels are situated directly adjacent to the highway, and may require relocation if the highway is expanded at these locations. There are also numerous residential properties located in close proximity to the highway.

3.11 Agricultural Resources

Most of the Trans Canada Highway corridor is located within the valley bottoms of major watersheds such as the Thompson, Eagle, Columbia, Illecillewaet and Kicking Horse Rivers. As described in section 3.3, the soils (such as chernozems in the Thompson and gleysols in the Columbia and other floodplains) in the valley bottoms support agricultural activities. Much of the land adjacent to the highway is agricultural land, the majority of which are within the Agricultural Land Reserve (ALR). The ALR lands are

concentrated in the western segments of the corridor in the South Thompson River/Shuswap Lakes valley, and the Eagle River valley. The eastern watersheds support only a small number of ALR parcels near Revelstoke and Donald Station.

The Agricultural Land Commission (ALC) reports that ALR designation is not a severe impediment to highway expansion. Therefore the presence of ALR land within an LKI section or corridor segment did not affect the environmental sensitivity ratings which were applied to that LKI section. However, ALR lands, even if dormant or used only for grazing, should not be viewed as being available for development (Underhill, 1998, pers. comm.). In all cases, early consultation with ALC staff, and the farming community, should occur during planning of the highway upgrade.

3.12 Mineral, Petroleum and Aggregate Resources

There are no documented, significant petroleum or gas resources along the TCH. The TCH corridor is south of the major sedimentary basins of the interior platform, where 99% of the hydrocarbon resources of British Columbia are concentrated (McGee, 1997, pers comm.). The study area is also north of the Kootenay Basin where there is coal based methane and minor quantities of gas. Similarly, the TCH corridor is north of the major coal fields of southeastern British Columbia.

There are a total of 31 mineral occurrences along the TCH corridor listed on MINFILE, a mineral resource database maintained by the Geological Survey Branch of the Ministry of Employment and Investment. A *mineral occurrence* is a site where economic minerals are present. Quantities of minerals to qualify as a mineral occurrence can range from a small in-situ zone of mineralization to an actively (or abandoned) mined deposit. A total of 13 mineral occurrences are noted on the Thompson Plateau, nine in the Columbia Mountains, one in the Rocky Mountain Trench and eight in the Rocky Mountains. In addition, there are between 10 and 15 gravel pits located close to the highway within the corridor.

The mineral resources on the Thompson Plateau are a mix of industrial minerals and base metals. There are several locations with potential copper, lead, zinc and silver deposits. There are also outcrops of limestone and marl. The remaining potential mineral resources include occurrences of fluorite, feldspar, agate and clay. Current mineral claims are located near Kamloops, Sorrento and Canoe.

There are two occurrences of potential lead-zinc-silver deposits located near the TCH in the Columbia Mountains. The remaining mineral occurrences include potential deposits of industrial minerals such as fluorite, beryl, limestone, talc, silica and graphite. A current mineral claim is located between Rogers Pass and Donald.

In the Rocky Mountain Trench, the only mineral occurrence close to the TCH is a potential clay deposit near Golden.

MINFILE reports four occurrences of base metals such as lead, zinc, copper and silver located near the TCH in the Rocky Mountains. These include the Kicking Horse Mine and the Monarch Mine. The other occurrences include abandoned limestone and slate quarries, and potential mercury and uranium, germanium, zircon and platinum deposits.

The presence of Quaternary glaciofluvial materials and Holocene alluvial terraces in the major valleys between Kamloops and Alberta explain the numerous gravel pits along the length of the TCH corridor.

4

FINDINGS BY CORRIDOR SEGMENT

Chapter 4 Findings by Corridor Segment

This chapter describes the characteristics and environmental resources of each of the thirty-three corridor segments of the study corridor. This information was collected during the field reconnaissance of the corridor as well as from interviews with agency representatives and a review of available reports, maps, air photos and on-line databases.

The information is arranged by corridor segment starting from Kamloops in the west and ending at the Alberta border in the east. Descriptions for each corridor segment include the existing configuration of the highway, uses of land adjacent to the corridor, and natural resources that may be affected if the highway is widened.

The beginning and ending points of TCH corridor segment are referenced to features described in the MoTH Landmark Kilometre Inventory (LKI). Segments of the highway in the LKI database are identified by a four digit number (e.g., LKI Segment #2050). Each of the 33 TCH corridor segments are planning units composed of one or more LKI segments. Note that TCH corridor segments do not necessarily correspond with LKI segments. TCH corridor segments are generally shorter and can straddle two LKI segments (e.g., Corridor Segment 10 straddles LKI Segments 2050 and 2060 for a total length of 12.07 km). The beginning and ending points of TCH corridor segments are referenced to points in LKI segments by offset distances from the beginning of the LKI segment.

4.1 Corridor Segment 10–Urban Kamloops

Beginning:	Afton Overpass–LKI Segment #2050 offset 0.00 km
Ending	Junction Route 5A–LKI Segment #2060 offset 5.37 km
Length	12.07 km

The highway in this corridor segment traverses urban Kamloops. It is six lanes wide with overpasses, interchanges, and commercial access frontage roads. It passes through a combination of residential, commercial and industrial land uses.

Terrain

In this corridor segment, the TCH descends from the Thompson Plateau into the Thompson Valley. There is a drop in elevation of 300 m from the beginning of this Corridor Segment at the Afton Interchange to the intersection with Route 5 at the exit to Route 5 northbound. The surficial materials in the Thompson Valley are primarily glaciolacustrine silts and clays. On Thompson Plateau, the surficial materials along the TCH corridor include glaciolacustrine silts and clays overlain by glacial till or glaciofluvial deposits.

From the Afton Interchange (0.0 km, LKI Segment #2050) to 400 m east of the Aberdeen overpass (0.4 km, LKI Segment 2060), there are no major physical constraints to upgrading the highway. Minor environmental considerations include a pond near the Gore exit to the weigh scale (2.1 km, LKI Segment 2050) and a steep road cut along the south side of the TCH near Pacific Way sign bridge (5.2 km, LKI Segment 2050). This portion of the TCH is located on the Thompson Plateau above the Thompson River Valley.

In the remaining five km of this corridor segment, the TCH moves downslope from the Thompson Plateau to the Thompson Valley floor. The surficial materials are primarily glaciolacustrine silts and clays. Between the Aberdeen overpass and the Springhill overpass (LKI Segment 2060, offset 1.9 km), the TCH is located on a steep slope above an industrial park.

Between the Springhill overpass and the access road to a gravel pit (LKI Segment 2060, offset 3.5 km), the TCH is located on a relatively narrow bench on a particularly steep slope above a residential area and crosses Peterson creek, located within a steep gully. The next 1.9 km section of the TCH, ending at the Yellowhead Highway exit, is located on a slope with a moderate gradient. Glaciolacustrine silts and clays are exposed in a steep cut slope.

As this corridor segment of the TCH is built primarily on glaciolacustrine silts and clays, there is an increased possibility of slumping occurring as compared to more permeable materials such as glacial till or glaciofluvial sediments.

Fish and Aquatic Resources

There is one pond within this segment and one just to the west of the Afton interchange (outside the study area). These ponds likely provide aquatic habitat for a range of avian and amphibian species.

The TCH crosses Peterson Creek which flows into the South Thompson River. On Peterson Creek, between the South Thompson River and the highway, there is a barrier which prevents anadromous species from migrating up the creek. However, above the barrier, Peterson Creek supports rainbow trout which have been enhanced with the construction of flow control measures at the outlet of Jacko Lake.

Fish present in the South Thompson include sockeye, chinook and pink salmon, rainbow trout, mountain whitefish, brassy minnow, chubs, sculpins, dace, northern squawfish, suckers and redside shiners (DFO and MELP 1995).

Wildlife

There are no data from the WARS[1] database for this corridor segment, however, the many ponds located to the south of the corridor will likely provide wildlife habitat for a range of avian and amphibian species.

Conservation Data Centre Observations

Red-listed Vertebrates: none listed

Red-listed Vascular Plants: none listed

Blue-listed Vertebrates: none listed

[1] The Wildlife Accident Reporting System maintained by MoTH provides data on accidents between motor vehicles and animals. The database includes observations from other studies where available. While not an inclusive database on all animal/vehicle encounters, the database is an indicator of which species are present in each corridor segment. We also remark on other indicators, such as wetlands, we observed during the field reconnaissance which would suggest the presence of other species.

Blue-listed Vascular Plants:

Species: Threadsilk Milk-Vetch (*Astralalgus filipes*)

Location: Along Road to Peterson Creek Park, on ravine slopes with sagebrush, north of Kamloops. UTM Coordinates 6887m. E. 56156m. N. Last observed 1983. Near Corridor Segment 10. Located several hundred meters from the TCH.

Archaeological, Cultural and Heritage Resources

There is one known archaeological site located on the north side of the TCH near Aberdeen. This archaeological site is a lithic scatter and during an examination in 1988, researchers determined that the site had been previously destroyed. The remainder of this corridor segment has no heritage potential[2] (I. R. Wilson Consultants, 1991).

Visual Recreational and Tourism Resources

The Kamloops area supports a diverse range of tourism and recreational resources and facilities. This corridor segment includes a full range of facilities and services for tourists. The segment also provides access to forest services recreation sites within the Kamloops Forest District. The elevation of the highway provides views of Kamloops, the Thompson River, and the lands to the north of the river valley. It is not anticipated that highway expansion would affect any of these recreational resources.

Agricultural Lands

There are no Agricultural Land Reserve lands close to the highway in this corridor segment.

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[2] I. R. Wilson Consultants (1991) rates archaeological resources as having either *proven potential*, *unproven potential* or *no potential*. Proven potential is identified on the basis of recorded archaeological, historic or ethnographic sites. Each point location of a known heritage resource has a surrounding area of use and a 250 m radius is assumed as an arbitrary area. Unproven potential is identified by the presence of topographic features similar to those containing proven archaeological sites in the same area. Areas of no potential include areas with terrain that is steep, poorly drained or undifferentiated and far from present water bodies.

Mineral, Petroleum and Aggregate Resources

There are no documented mineral occurrences or mineral claims in this corridor segment. There are two gravel pits east of Peterson Creek.

4.2 Corridor Segment 20–Urban Kamloops

Beginning	Junction Route 5A–LKI Segment #0925 offset 0.00 km
Ending	Tanager Road–LKI Segment #0925 offset 4.97 km
Length	4.97 km

This is an urban corridor segment which consists of four lanes with left turn bays, signalized intersections and commercial access frontage roads. The highway in this segment passes through a combination of residential, commercial and industrial land uses.

Terrain

In Corridor Segment 20, the TCH is located entirely within the South Thompson Valley and the surficial materials along the highway corridor are primarily glaciolacustrine silts and clays. The terrain does not impose any serious environmental constraints to upgrading the highway. As a result of the impermeable nature of the glaciolacustrine silts, and clays, there is a possibility of some slumping occurring on the slopes of the South Thompson Valley that could result in an increase in sedimentation and siltation of the tributary streams flowing into the South Thompson River, this environmental hazard should be considered when planning a highway upgrade.

Fish and Aquatic Resources

Portions of this segment are directly adjacent to the South Thompson River which supports a range of anadromous and resident fish including sockeye, coho, pink and chinook salmon, as well as rainbow trout, mountain whitefish, brassy minnow, chubs, sculpins, dace, northern squawfish, suckers and redside shiners (DFO and MELP 1995).

The Department of Fisheries and Oceans reports that 25% of the South Thompson mainstem is Class 1 habitat, and 42% is Class 2. (see chapter 3.4 for explanation of habitat classifications). The South Thompson mainstem

accounts for the majority of Class 1 habitat in the Thompson River System, and much of the spawning takes place at the confluences of the various tributaries (Kosakoski, 1997, pers. comm.).

Wildlife

WARS reports nine deer and one coyote killed on the highway in the five year period 1991 to 1996.

Conservation Data Centre Observations

Red-listed Vertebrates: none listed

Red-listed Vascular Plants:

Species: Big Sage - Bluebunch Wheatgrass (*Artemisia iridentaia - Elymus spicata*)

Location: Valleyview Silt Cliffs, Kamloops, off TCH heading east, turn on to Highland Road. to Valleyview, trails leads to terrace. UTM Coordinates 6940m. E. 56165m. N. Last observed 1972. Near Corridor Segment 20, approximately 500m from highway.

Species: Rough Fescue - Bluebunch Wheatgrass (*Festuca campestris - Elymus spicata*)

Location: Valleyview Silt Cliffs, Kamloops, off TCH heading east, turn on to Highland Road. to Valleyview, trails leads to terrace. UTM Coordinates 6940m. E. 56165m. N. Last observed 1972. Near Corridor Segment 20, approximately 500m from highway

Blue-listed Vertebrates: none listed

Blue-listed Vascular Plants: none listed

Archaeological, Cultural and Heritage Resources

There are two known archaeological sites within this corridor segment. One is a moderately disturbed housepit site west of Valleyview and the other is a largely intact lithic scatter east of Valleyview. The remainder of the segment

was rated as having unproven heritage potential (I. R. Wilson Consultants, 1991).

Agricultural Lands

There no Agricultural Land Reserve Lands close to the highway in this corridor segment.

Mineral, Petroleum and Aggregate Resources

There are no mineral claims, documented mineral occurrences or gravel pits within this corridor segment.

4.3 Corridor Segment 30–Kamloops to Monte Creek

Beginning	Tanager Road–LKI Segment #0925 offset 4.97 km
Ending	Junction Route 97–LKI Segment #0925 offset 25.90 km
Length	20.93 km

The western 17 km of this corridor segment has four lanes before converting to a two-lane section for approximately 5 km. The next 3.5 km consists of a newly constructed four-lane section and the final Kilometre consists of two lanes. The land uses bordering the two-lane sections in this corridor segment include agriculture, ranching, and some commercial and light industrial complexes. Both sides of the highway are lined by power and telephone lines. The CPR tracks are in close proximity to the highway on the north side.

Terrain

This corridor segment follows the course of the South Thompson River, along the valley floor. The surficial materials consist primarily of glaciolacustrine silts and clays that are easily eroded during spring runoff. These deposits are relatively impermeable and are prone to slumping on higher slopes. There are no major constraints imposed by the terrain or natural hazards to upgrading the highway

Fish and Aquatic Resources

The South Thompson River supports a range of anadromous and resident fish including sockeye, coho, pink and chinook salmon, as well as rainbow trout,

mountain whitefish, brassy minnow, chubs, sculpins, dace, northern squawfish, suckers and redside shiners (DFO and MELP 1995).

The Department of Fisheries and Oceans reports that 25% of the South Thompson mainstem is Class 1 habitat, and 42% is Class 2 (see chapter 3.4). The South Thompson mainstem accounts for the majority of Class 1 habitat in the Thompson River System and much of the spawning take place at the confluences of the river with the various tributaries (Kosakoski, 1997, pers. comm.). Campbell Creek, which the highway crosses, provides approximately 1 km of rainbow trout side channel habitat between its confluence with the South Thompson River and a 5 m high waterfall upstream.

Wildlife

WARS reports six deer, one coyote and one moose killed on the highway in the five-year period 1991 to 1996.

Conservation Data Centre Observations

Red-listed Vertebrates: none listed
Red-listed Vascular Plants: none listed
Blue-listed Vertebrates: none listed
Blue-listed Vascular Plants: none listed

Archaeological, Cultural and Heritage Resources

A recent archaeological overview of the TCH corridor between Kamloops and Canoe identified approximately 10 proven archaeological sites and rated the remainder of the corridor segment as having unproven heritage potential. There is a cluster of sites around Campbell Creek and another cluster around Monte Creek (I. R. Wilson Consultants, 1991).

Visual, Recreational and Tourism Resources

This corridor segment follows the scenic Thompson River Valley. There are a number of motels, a water slide, a wildlife park, and a golf course located within this corridor segment.

Agricultural Lands

The eastern sections of this corridor segment pass through several blocks of Agricultural Land Reserve (ALR) lands, specifically near Kamore and Campbell Creek. The last several kilometres of the corridor segment pass through ALR lands west of Monte Creek.

Mineral and Petroleum Resources

There is one mineral claim located within the Trans Canada Highway corridor in this corridor segment. The claim is mostly on the north side of the South Thompson River, but the southeast corner overlaps on the south bank. The claim block is owned by Lafarge Canada Inc. and expires in November 1998. There is also one known mineral occurrence located near Dallas Drive. The main commodity is clay, probably of glaciolacustrine origin. More detailed information on mineral resources is provided in Appendix F.

4.4 *Corridor Segment 40–Monte Creek to Chase*

Beginning	Junction Route 97–LKI Segment #0935 offset 0.00 km
Ending	West Exit Chase–LKI Segment #0935 offset 27.42 km
Length	27.42 km

This segment begins at the Monte Creek junction where the speed limit is 90 km/h and the rail tracks are located near the TCH alignment. The rail tracks are situated between the highway and the South Thompson River and are a constraining factor to highway widening, especially where the tracks are located very close to both the highway and the river. The highway is confined between a steep bedrock outcropping and the railway near Hoffmans Bluff and Willow Road. The south side of the TCH, consisting primarily of agricultural and ranch land, is generally unconfined for the majority of the corridor segment. West of the community of Pritchard there is one four-lane section approximately 2 km long with separated lanes. The remainder of this corridor segment is two lanes wide.

Terrain

This corridor continues to follow the South Thompson River valley. For the first 16.2 km (LKI segment #0935) the highway is approximately 3 to 4 m

above the floodplain. The surficial materials consist primarily of kame terraces and holocene river terraces cut into glaciolacustrine sediments. There is some possibility of slumping occurring in the relatively impermeable glaciolacustrine silts and clays. However, there are relatively few geotechnical constraints to upgrading the Trans Canada Highway within this portion of the corridor segment.

The highway cutslope is relatively steep between 16.2 km and 18.5 km and the surficial materials are likely composed of a veneer or blanket of till overlying bedrock. Between the 16.5 km and the 18.0 km points, the river channel is at the base of the relatively steep south slope of the South Thompson valley. The TCH was built on this slope and there is little space for a highway upgrade given the slope gradient, proximity to the rail line and presence of the South Thompson River at the base of slope. Prior to upgrading this section of the highway, geotechnical studies should be conducted with a focus on mitigating the environmental impacts of upgrading the highway in steep terrain.

Between the 18.0 km mark and the end of the corridor segment at 27.42 km, the highway passes through gentler, forested cutslopes interspersed with wetlands or pasture lands. The surficial materials are most likely glaciolacustrine sediments. Kame terraces are also present as evidenced by the various gravel pits in this corridor segment. It is unlikely that the terrain imposes any major environmental constraints to upgrading the TCH within this section.

Martin, Neds and Dry creeks pass through dry areas that have been logged and are used extensively for grazing. The slopes are not heavily vegetated and the surficial materials are primarily lacustrine sediments, which can be easily eroded, and several ravines have formed along these creeks. Most of the bedload carried by these creeks is deposited on the break of slope near the highway and rail line resulting in frequent blockages of the culvert crossings during major freshet events. These blockages must be cleared on an emergency basis outside the normal fish timing windows, resulting in potential damage from sediment on fish habitat. Canadian Pacific Railway conducted remedial work in 1997 to remedy these problems (Harding, 1997, pers. comm.).

Fish and Aquatic Resources

The South Thompson River supports a wide range of anadromous and resident fish including sockeye, pink and chinook salmon, as well as rainbow trout, mountain whitefish, brassy minnow, chubs, sculpins, dace, northern squawfish, suckers and redside shiners (DFO and MELP 1995).

The Department of Fisheries and Oceans reports that 25% of the South Thompson mainstem is Class 1 habitat, and 42% is Class 2. Class 1 requires a high level of protection, Class 2 requires a moderate level of protection, Class 3 requires minimal protection (Stalberg, et al, 1997). The South Thompson mainstem accounts for the majority of Class 1 habitat in the Thompson River System. Most of the spawning in this river system appears to occur at the confluences of tributaries and the mainstem (Kosakoski, 1997, pers. comm.).

Wildlife

WARS reports eight deer, three bears, one coyote and one sheep killed on the highway between 1991 and 1996. There is a wetland area near the 20 km mark (LKI segment #0935) of the corridor segment that provides valuable wildlife habitat, particularly for waterfowl.

Conservation Data Centre Observations

Red-listed Vertebrates: none listed
Red-listed Vascular Plants: none listed
Blue-listed Vertebrates: none listed
Blue-listed Vascular Plants: none listed

Archaeological, Cultural and Heritage Resources

There are 30 known archaeological sites in this corridor segment located near the South Thompson River. The rest of this corridor segment has unknown heritage potential (I. R. Wilson Consultants, 1991). At the east end of this corridor segment, the TCH passes through the Neskainlith I. R. 2.

Visual, Recreational and Tourism Resources

Visual resources in this corridor segment include views of the South Thompson River Valley with the mountains of the Shuswap Highlands to the

north. Recreational resources include commercial accommodations, local parks and tourist attractions. This segment also provides access to the South Thompson River for recreational fishing and other activities.

Agricultural

This corridor segment passes through ALR lands between Monte Creek and Harper Creek and between the Neskainlith I. R. and the end of the corridor segment. Most of the agricultural land is used for grazing cattle.

Mineral, Petroleum and Aggregate Resources

There are no mineral claims nor are there any documented mineral occurrences present within this corridor segment. Gravel pits are present at Pritchard and near Chase.

4.5 Corridor Segment 50–Chase to Squilax Bridge

Beginning	West Exit Chase–LKI Segment #0935 offset 27.42 km
Ending	Squilax Bridge–LKI Segment #0935 offset 38.60 km
Length	11.18 km

This corridor segment bypasses the community of Chase. An access road to Chase leaves the highway at the beginning of Corridor Segment 50. The west end of the segment consists of a moderately steep two-lane section of the highway. This section is confined on the south side by a rock cliff. The highway passes through communities, areas with scattered homes, agricultural land, and past lake front residences. There is a 1.5 km eastbound passing lane which is bordered on the south side by a rock cliff. East of this eastbound passing lane there is a 4 km long westbound passing lane. Some sections, in the central and eastern part of the corridor segment, are confined between the railway tracks and the lake.

Terrain

For the first 2 km of this corridor segment, the Trans Canada Highway crosses glaciolacustrine materials at Chase and then commences to gain elevation. The surficial materials in the rest of this corridor segment are primarily glacial till overlying bedrock.

Between the Chase Creek bypass bridge (LKI segment #0935, offset 29.5 km) and the west entrance of Jade Mountain Frontage Road (31.2 km), the cutslope is steep and bedrock is exposed in numerous locations in the road cut. The terrain imposes major constraints to a highway upgrade within this section of the corridor segment. Between the litter barrel site (31.2 km) and east entrance (32.3 km) of Jade Mountain Frontage Road, there are no obvious major environmental constraints to upgrading the highway. Between the east entrance to Jade Mountain Frontage Road and the Chase Overhead (34.3 km), a highway upgrade is constrained by a steep slope, and proximity to the railway and Little Shuswap Lake. A major landslide is evident on the air photo (BCC94042, No. 60) near the railway underpass. The slide transported a portion of the highway embankment into Shuswap Lake. Prior to upgrading the difficult sections of this corridor segment, geotechnical studies should be conducted to examine ways of minimizing the environmental impacts of highway improvements.

The terrain in the remainder of Corridor Segment 50 from the Chase overhead to the Squilax Bridge (38.6 km), does not appear impose any major environmental constraints that will impede a highway upgrade.

Fish and Aquatic Resources

Little Shuswap Lake provides extremely important fish habitat. The lake serves as habitat for rearing Adams River sockeye and juvenile coho salmon. There is no in-stream construction window because of the almost constant movement of juveniles into the system over the year (Stahlberg, 1997 pers. comm.). Little Shuswap Lake supports a range of anadromous and resident fish including coho, pink and chinook salmon, as well as Dolly Varden, kokanee, lake trout, mountain whitefish and rainbow trout (DFO and MELP, 1995). In addition, Chase Creek supports pink salmon.

There is currently a 50 m to 100 m wide vegetation buffer along Little Shuswap Lake that MELP wants maintained where possible (MacDonald, 1997, pers. comm.).

Wildlife

WARS reports seven deer killed on the highway from 1991 to 1996. A herd of bighorn sheep is resident above Chase and appear to cross the TCH 6 km east of the Chase townsite and have also been spotted near the highway in Chase (MacDonald, 1997, pers. comm.).

Conservation Data Centre Observations

Red-listed Vertebrates: none listed

Red-listed Vascular Plants:

Species: Purple Blue-Eyed Grass (*Olsyniun douglasii* var. *inflatum*)

Location: Little Shuswap Lake, in the open sandy woods, UTM coordinates 3160m. E. 56352m. N. Last observed 1974. Within Corridor Segment 50, in the Stequmwhulpa I. R. The Trans Canada Highway is very close to this observation.

Blue-listed Vertebrates: none listed

Blue-listed Vascular Plants:

Species: Great Basin Nemophila (*Nemophila brevigflora*)

Location: Little Shuswap Lake on the open sandy beach. UTM Coordinates 3160m. E. 56352m. N. Last observed 1972. Within Corridor Segment 50, in the Stequmwhulpa I. R. The Trans Canada Highway is very close to shore in this location.

Archaeological, Cultural and Heritage Resources

The last 5.6 km of this corridor segment traverses Stequmwhulpa I. R. 5 and Chum Creek I. R. 2. There are approximately 5 heritage sites in this corridor segment, located in the Indian Reserves (I. R.) along the South Thompson River. The archaeological potential of this corridor segment was rated as unproven (I. R. Wilson Consultants, 1991).

Visual, Recreational and Tourism Resources

Visual resources include views of the Little Shuswap Lake and, as the road gains in elevation, the peaks of the Shuswap Highlands to the north. Recreational resources include commercial camping and tourist facilities at Silver Beach Resort located below the highway on the lake shore. The

highway also provides access to Shuswap Lake and Roderick Haig-Brown Provincial Parks.

Agricultural

Corridor Segment 50 contains two small parcels of ALR land. The first is located at the Chase Road intersection, on the north side of the highway between Little Shuswap Park and the pole yard. The second is at the eastern end of the corridor segment by the Chum Creek Indian Reserve.

Mineral and Petroleum Resources

There are no mineral claims or gravel pits within this corridor segment. However, there are two documented mineral occurrences; the TO Occurrence located near the east exit to Chase, and the Squilax Occurrence located 500 m southwest of the Squilax Bridge. The TO Occurrence is a potential fluorite deposit, while the Squilax Occurrence consists of blue agate found in a landslide. More detailed information is provided in Appendix F.

4.6 *Corridor Segment 60–Squilax Bridge to Sorrento*

Beginning	Squilax Bridge–LKI Segment #0935 offset 38.60 km
Ending	Cobeaux Road–LKI Segment #0935 offset 45.55 km
Length	6.95 km

This segment consists entirely of two lanes and for the most part is constrained by the proximity to Shuswap Lake on the north and rock bluffs to the south. However, the existing highway appears to have been constructed on fill placed into the lake as there is no riparian vegetation and the lake shore consists of riprap. The segment includes a marina, some commercial establishments such as a general store, lodges and tourist facilities, and very low density residential settlements. In general, the corridor segment includes a variety of mixed forest, some pasture land and developed land.

Terrain

At the start of this corridor segment, the highway is located on an alluvial fan within the Chum Creek I. R. where the terrain does not impose any major constraints to a highway upgrade.

From 39.9 km to 44.4 km (LKI segment #0935) at Des Fosses Road, the highway is built on a steep slope and bedrock is frequently exposed in the road cut. The surficial materials consist of a veneer or blanket of till overlying bedrock. This section is constrained by the steep cutslope on the south side of the road and the South Thompson River on the north side of the road. The first 2 km of this segment are less confined as there may be some opportunity to expand the highway by excavating into the cutslope. The rest of this segment is characterized by more extreme terrain as bedrock exposure in the road cut is extensive and the slopes are steep. Therefore, it may be very difficult to expand this portion of the highway. Geotechnical studies that focus on minimizing the environmental impacts of upgrading the highway in geotechnically difficult terrain should be conducted.

Between 44.4 km and the end of the corridor segment at 45.6 km, the Trans Canada Highway was built on glacial drift. The terrain does not appear impose any major environmental constraints to upgrading the highway within this section.

Fish and Aquatic Resources

Little River, between the Little Shuswap and Shuswap Lakes, is an extremely important fish passage and habitat area. The virtually constant year round use of Little River by fish means there is no traditional fish timing window for instream construction activities (Kosakoski, 1997, pers. comm.). Little River supports sockeye, chinook and pink salmon, as well as rainbow trout, mountain whitefish, brassy minnows, chubs, sculpins, dace, northern squawfish, suckers, and redside shiners.(DFO and MELP, 1995).

The shores of Shuswap Lake in this region supports shore spawning sockeye salmon, and is rated as Class 1 fish habitat (no disturbance permitted) (Harding, 1997, pers. comm.). The riparian vegetation adjacent to the river is very critical to the health of fish habitat in this area.

Wildlife

WARS reports two deer killed on the highway from 1991 to 1996, which is consistent with the mixed forest habitat which dominates this corridor segment. The backwater area near the Squilax Hostel is apparently used by Tundra Swans, and most likely other wildlife species as well.

Conservation Data Centre Observations

Red-listed Vertebrates: none listed

Red-listed Vascular Plants: none listed

Blue-listed Vertebrates: none listed

Blue-listed Vascular Plants: none listed

Archaeological, Cultural and Heritage Resources

The first 1.7 km of this corridor segment passes through the Chum Creek I. R. Ten known archaeological sites are located near the highway within this corridor segment. The archaeological potential of the rest of this corridor segment was rated as unproven (I. R. Wilson Consultants, 1991).

Visual, Recreational and Tourism Resources

Visual resources on this corridor segment include views of Little Shuswap Lake and the South Thompson Valley. In some locations the lake is immediately next to the highway and a rock face on the other side limits opportunities for view points or access to the water. Tourist facilities and recreational resources in the segment include a marina, a lodge, general store, and some commercial facilities. There are three pull-outs on the north side of the highway offering views of the lake. It is considered very important to maintain recreational access to the Thompson River in this area.

Agricultural

The western and eastern sections of this corridor segment pass through ALR lands, however the central 80 to 85% is not on ALR lands. The highway passes through the continuation of the Chum Creek ALR parcel at the west end of the segment and an additional ALR parcel is located on the south side of the highway at the east end of the segment at Blind Bay Road.

Mineral and Petroleum Resources

There are no documented mineral occurrences or gravel pits. However, there is a current claim block (SB claims) located near the TCH in this corridor segment. These claims are owned by Martin T. Lindberg and expire in January, 2005. More detailed information is provided in Appendix F.

4.7 Corridor Segment 70–Urban Sorrento

Beginning	Cobeaux Road –LKI Segment #0935 offset 45.55 km
Ending	Eagle Bay Road–LKI Segment #0935 offset 49.01 km
Length	3.46 km

This short two-lane urban segment passes through the community of Sorrento. The highway speed limit is 60 km/hr at the east section and there are left turn bays and merge lanes. Confinements include residential and commercially owned properties, some agricultural and pasture uses, and some community uses such as a school and associated facilities.

Terrain

The highway within this corridor segment was constructed on glacial drift and the terrain does impose any major environmental constraints that may impede a highway upgrade within this corridor segment.

Fish and Aquatic Resources

While the highway is several hundred meters from Shuswap Lake in this segment, the shores of Shuswap Lake in this region provide shore spawning habitat for sockeye salmon and lake char, and rearing salmon habitat. Shuswap Lake also supports chinook and pink salmon, rainbow trout, lake trout, Dolly Varden char, kokanee, mountain whitefish, lake whitefish, peamouth chubs, northern squawfish, suckers, shiners, burbot and carp (DFO and MELP 1995) .

Wildlife

WARS reports include four deer, and one bear killed on the highway from 1991 to 1996.

Conservation Data Centre Observations

Red-listed Vertebrates: none listed

Red-listed Vascular Plants: none listed

Blue-listed Vertebrates: none listed

Blue-listed Vascular Plants: none listed

Archaeological, Cultural and Heritage Resources

Based on the presence of suitable landforms, indicating pre-colonial human habitation and use along the Trans Canada Highway, this corridor segment was rated as having unproven archaeological potential (I. R. Wilson Consultants, 1991).

Visual, Recreational and Tourism Resources

This corridor segment of the Trans Canada Highway provides access to services such as hotels and motels, and gas stations. There is access to Shuswap Lake and a campsite near the waterfront.

Agricultural

The western end (the first 0.5 km) of Corridor Segment 70 is within ALR land at Blind Bay road. The entire south side of the highway from Sorrento to the end of the segment is also within an ALR. However, the boundaries of the ALR lands are perhaps one hundred meters from the highway edge. There is only one location at Notch Hill Road where the highway is immediately adjacent to the ALR lands.

Mineral and Petroleum Resources

There are no mineral claims or documented mineral occurrences, however there is one gravel pit within this corridor segment. It is located west of Sorrento.

4.8 Corridor Segment 80–East End Sorrento to West Border Salmon Arm

Beginning	Eagle Bay Road–LKI Segment #0935 offset 49.01 km
Ending	Salmon River Bridge–LKI Segment #0935 offset 78.04 km
Length	29.03 km

This segment supports a diversity of commercial land uses including a saw mill, tourist accommodations, agriculture and others. The CPR railway tracks continue on the north side but there are few confinements on the south, save for a few areas where a rock bluff may constrain expansion. A significant proportion of the segment consists of three-lane sections with passing lanes generally provided in the uphill directions. Some passing sections are almost wide enough to support four lanes. This corridor segment is generally semi-urban supporting extensive agriculture, residential, community and commercial uses.

Terrain

The only apparent terrain related constraints to upgrading the highway are located in a 0.6 km stretch at Tappen Bay (LKI segment #0935, offset 70.1 km to 70.7 km) where the highway is situated along the lakeshore. The highway was cut into a steep slope and bedrock is exposed in the road cut at the Kault Hill viewpoint. The Trans Canada Highway in this corridor segment passes over rolling terrain, likely glacial drift.

White Creek has been degraded by sedimentation caused by cattle disturbing stream banks on dairy farms. MELP views this as an opportunity for habitat enhancement (MacDonald, 1997, pers. comm.). The Syphon Creek culvert is frequently blockages by bedload and the culvert must be cleared on an emergency basis outside the normal fish timing window to the detriment of fish in the area (Harding, 1997, pers. comm.). MELP views the replacement of the Syphon Creek culvert as an opportunity for habitat enhancement (MacDonald, 1997, pers. comm.)

Fish and Aquatic Resources

Tappen Bay supports sockeye, chinook and coho salmon, as well as rainbow trout and lake trout, kokanee, Dolly Varden, burbot, mountain and lake whitefish, northern squawfish, shiners, peamouth chubs, suckers and carp. Tappen Creek supports rainbow trout, sockeye and coho salmon, and White Creek supports rainbow trout (DFO and MELP, 1995). The highway crosses White and Broderick creeks, both of which supported coho spawning in the past, but the creeks have been affected by various developments (Kosakoski, 1997, pers. comm.).

Wildlife

WARS reports include 29 deer, seven bears and four coyotes killed on the highway from 1991 to 1996. The combination of mixed forest, and proximity to the lake provides extensive wildlife habitat. In addition, a small wetland area near the 56 km mark (LKI Segment #0935) provides wildlife habitat for smaller species and birds. Ponds and other areas around the Shuswap Estates subdivision also provide waterfowl habitat.

Conservation Data Centre Observations

Red-listed Vertebrates: none listed

Red-listed Vascular Plants:

Species: Mosquito Fern (*Azolla mexicana*)

Location: Tappen, in the lower reaches of White Creek. UTM coordinates 3359m. E. 56287m. N. Last observed 1974. Within Corridor Segment 80, in the North Bay I. R., quite close to the Trans Canada Highway.

Blue-listed Vertebrates: none listed

Blue-listed Vascular Plants:

Species: Thyne-leaved spurge (*Euphorbia serpyllifolia*)

Location: Tappen , on the stoney beach shore of Shuswap Lake. UTM Coordinates 3365m. E. 56281m. N. Last observed 1974. Near Corridor Segment 80, almost 1 km from the Trans Canada Highway.

Archaeological, Cultural and Heritage Resources

The first 12.79 km of this corridor segment extending from Sorrento to White Lake Road were rated as having no heritage potential. The remainder of this corridor segment was rated as having unproven potential based on the presence of suitable features indicating pre-colonial human habitation or use within the corridor (I. R. Wilson Consultants, 1991). There are no proven archaeological sites in this corridor segment (I. R. Wilson Consultants, 1991); however, the highway traverses three Indian Reserves: Switsemalph I. R. 6, Switsemalph I. R. 3, and North Bay I. R. 5

Visual, Recreational and Tourism Resources

Tourist and recreational resources include commercial camping facilities and tourist accommodations, as well as commercial activities associated with the community of Tappen. A new subdivision, the Shuswap Estates, includes a golf course and the associated club house, driving range and other facilities. The corridor segment provides access to the Sunnybrae Provincial Recreation Area, White Lake and Herald Provincial Parks, and to Shuswap and White Lakes.

Agricultural

The entire length of this corridor segment is located within ALR lands which exist on both sides of the highway from Santabin Lake to the end of the segment at the Salmon River Bridge. The main type of agricultural land use appears to be as pasture land.

Mineral and Petroleum Resources

There are no mineral claims or gravel pits in this corridor segment. The one known mineral occurrence, the Sorrento Limestone, is a limestone outcrop. More detailed information on this is provided in Appendix F.

4.9 Corridor Segment 90–Salmon Arm

Beginning	Salmon River Bridge–LKI Segment #0935 offset 78.04 km
Ending	West access to Hwy 97B–LKI Segment #0935 offset 85.72 km
Length	7.68 km

This corridor segment passes through the community of Salmon Arm. With the exception of a 1 km long, two-lane section at the west end of the segment, the segment is four lanes wide with left turn bays and stop lights providing access to a range of commercial facilities. At the time of the reconnaissance, highway construction was under way at the east end of the segment. After Kamloops, Salmon Arm is the second largest community within the study area.

Terrain

The TCH crosses the mouth of the Salmon River valley, which is filled with glacial drift including glaciofluvial gravels as indicated by several gravel pits located in Salmon Arm.

Fish and Aquatic Resources

The Salmon River provides extremely important fish habitat for sockeye, coho, chum, pink and chinook salmon, as well as Dolly Varden, kokanee, mountain whitefish, rainbow trout, sculpins, dace, suckers, shiners and burbot (DFO and MELP, 1995). In addition, the Salmon River provides a range of off-channel habitat (Harding, 1997, pers. comm.).

The Salmon Arm of Shuswap Lake supports sockeye, chinook and coho salmon, as well as rainbow trout and lake trout, kokanee, Dolly Varden, burbot, mountain and lake whitefish, northern squawfish, shiners, peamouth chubs, suckers, and carp. DFO staff have reported that the Salmon River bridge is too low to safely pass all debris and bed loads during major freshet events. Logjams frequently form at the bridge (Harding, 1997, pers. comm.). Further, because the bridge is on a curve in the highway, accidents are frequent and any spills from vehicles threaten fish and fish habitat.

Wildlife

WARS reports include three deer from 1991 to 1996. However, the area to the north of Salmon Arm, between the community and the lake, includes an extensive low-lying floodplain that provides significant wildlife habitat. Salmon Arm Bay is an excellent waterfowl habitat area and is on a migratory route of shorebirds (MacDonald, 1997, pers. comm.). The Salmon River estuary includes a Ducks Unlimited project to enhance wildlife habitat of the area (Nontell, 1998, pers. comm.).

Conservation Data Centre Observations

Red-listed Vertebrates:

Species: Western Grebe (*Aechmophorus occidentalis*)

Location: Salmon Arm, immediately to the west of the Marina on the shores of Shuswap lake. Nesting occurs in areas of emergent vegetation and reed canary grass around the mouth of the

Salmon River. UTM coordinates 3388m. E. 56193m. N. Last Observed 1994 (however, annual sightings have been reported). Near Corridor Segment 90, approximately 500 meters from the Trans Canada Highway.

Red-listed Vascular Plants

Species: Mosquito Fern (*Azolla mexicana*)

Location: 2 km west of Salmon Arm along railway line at Salmon River Mouth. UTM coordinates 3375m. E. 56187m. N. Last observed 1993. Near Corridor Segment 90, several hundred meters from the TCH.

Species: Hairy Water Clover (*Narsilea vestita*)

Location: Mouth of Salmon River, Salmon Arm. Along inner edge of silt terrace and especially from the bank up to grassed field. UTM coordinates 3370m. E. 56196m. N. Last observed 1993. Near Corridor Segment 90, several hundred meters from Trans Canada Highway.

Blue-listed Vertebrates: none listed

Blue-listed Vascular Plants:

Species: American Sweetflag (*Acorus americanus*)

Location: Salmon Arm. UTM Coordinates 3375m. E. 56186m. N. Last observed 1985. Within Corridor Segment 90. Located very close to the highway.

Archaeological, Cultural and Heritage Resources

This corridor segment passes through a predominantly urban area. There are no known archaeological sites and any existing ones were likely destroyed when the community of Salmon Arm was developed. This corridor segment was rated as having unproven archaeological potential based on the presence of suitable features indicating pre-contact human use and habitation (I. R. Wilson Consultants, 1991).

Visual, Recreational and Tourism Resources

The segment includes a variety of tourist and recreational facilities such as hotels, motels, a water slide, restaurants, and other facilities.

Agricultural

The western 2 km to 3 km of this corridor segment, from the Salmon River Bridge to west of the Salmon Arm fairgrounds, pass through ALR lands.

Mineral and Petroleum Resources

There are no mineral claims, documented mineral occurrences, or gravel pits close to the highway in this corridor segment.

4.10 Corridor Segment 100–Salmon Arm to Canoe

Beginning	West access Hwy 97B–LKI Segment #0950 offset 0.00 km
Ending	Canoe Beach Drive East–LKI Segment #0950 offset 5.86 km
Length	5.86 km

This corridor segment extends from Salmon Arm to Canoe Beach Drive. The TCH is almost at lake level and includes a saw mill at the east end, residential housing, agricultural and ranching land uses. The segment has few environmental constraints to expansion. However, there are commercial and residential land uses directly adjacent to the highway.

Terrain

The terrain does not impose any apparent major environmental constraints to upgrading the Trans Canada Highway within this corridor segment. The surficial materials are predominantly glacial drift.

Fish and Aquatic Resources

This corridor segment crosses one major creek, Canoe Creek which provides sockeye and coho salmon habitat at its mouth. The coho stocks in Canoe Creek and others in this system are approaching critical (low) levels (Harding, 1997, pers. comm.). Rainbow trout are resident in the creek. The highway does not come in close proximity to any riparian areas in the segment.

Wildlife

WARS reports include ten deer and one bear killed on the highway from 1991 to 1996. There is a small wetland area near the 2 km point of the segment which provides wildlife habitat.

Conservation Data Centre Observations

Red-listed Vertebrates: none listed

Red-listed Vascular Plants: none listed

Blue-listed Vertebrates: none listed

Blue-listed Vascular Plants: none listed

Archaeological, Cultural and Heritage Resources

This corridor segment was rated as having unproven archaeological potential based on the presence of suitable features indicating pre-colonial habitation and use. There are no known archaeological sites located in this corridor segment (I. R. Wilson Consultants, 1991).

Visual, Recreational and Tourism Resources

Recreational resources include a range of tourist facilities such as a trailer park, commercial establishments, a golf course, and easy access to the lake.

Agricultural

This entire corridor segment is within ALR lands in the Canoe Creek valley.

Mineral and Petroleum Resources

There are no mineral claims, documented mineral occurrences or gravel pits within this corridor segment.

4.11 Corridor Segment 110–Canoe to Bruhn Bridge (west end of Sicamous)

Beginning	Canoe Beach Drive East–LKI Segment #0950 offset 5.86 km
Ending	Bruhn Bridge–LKI Segment #0950 offset 25.65 km
Length	19.79 km

In this corridor segment, the TCH is comprised entirely of two lanes with some passing sections but no passing lanes. There is a 2 km section of

westbound passing lane currently under construction. The west sections of the corridor segment are constructed across steep terrain. The highway is confined by steep bedrock outcrops and residential properties to the south, and the lake shore and the CPR tracks to the north. The central sections traverse fairly level terrain with fewer slope-related constraints. These sections contain many curves and provide limited opportunities for faster traffic to pass slower traffic. A severe constraint to expansion exists near the Shuswap view point and rest area as the terrain is quite steep with exposed bed rock on the south and steep slopes leading down to the lake on the north.

Terrain

This corridor segment passes within 250 m of Shuswap Lake. The section between 70th St. N.E and the Co-op Logging Road (LKI segment #0950, offset 7.0 km to 10.9 km) is moderately constrained by the railway line, the proximity to Shuswap Lake and a 15 m high bluff exposing bedrock underlain by sandy till. The railway limits expansion of the highway towards the lake. Therefore, any highway expansion will likely involve further excavation into bedrock.

Between the Co-op Logging Road and Old Sicamous Road (17.5 km), the terrain does not impose any environmental constraints to upgrading the highway. The next section of the TCH, between Old Sicamous Road and the Shuswap Lake viewpoint (19.46 km) has a steep cutslope.

Between the Shuswap Lake viewpoint and the west end of the Bruhn Bridge (25.65 km), the highway is confined as the road was cut into a steep bedrock slope above Shuswap Lake. The surficial materials are primarily glacial till overlying bedrock. Below the highway, there is a steep slope with a grade of 45° leading directly to Shuswap Lake. The railway line is located at the base of slope.

Prior to upgrading the more difficult sections of the TCH in this corridor segment, geotechnical studies that examine the impacts of highway improvement on erosion potential of the surficial materials should be conducted.

Fish and Aquatic Resources

Shuswap Lake supports sockeye, chinook and coho salmon, as well as Dolly Varden, kokanee, and mountain whitefish. The shores of Shuswap Lake are rated a Class 1 fish habitat and support shore spawning sockeye salmon. The highway crosses one unnamed creek, the mouth of which is potential fish habitat.

Wildlife

WARS reports two bears killed on the highway from 1991 to 1996. Much of the segment passes through mixed and coniferous forests which provide habitat for other species.

Conservation Data Centre Observations

Red-listed Vertebrates: none listed
Red-listed Vascular Plants: none listed
Blue-listed Vertebrates: none listed
Blue-listed Vascular Plants: none listed

Archaeological, Cultural and Heritage Resources

There is one known archaeological site near Annis Bay located at the 18.1 km mark of LKI segment #0950. It appears that very little past archaeological assessment work was conducted. Therefore, an Archaeological Overview Assessment may be required prior to the commencement of any highway expansion work.

Visual, Recreational and Tourism Resources

The Shuswap Lake rest area is frequently used by tourists as elevation and steep terrain provide excellent views of the lake to the north and mountains beyond. This segment provides access to Mara Point Provincial Park.

Agricultural

There are no ALR lands within this corridor segment.

Mineral and Petroleum Resources

The Trans Canada Highway passes through the Millennium 1, 2, and 3 claim blocks owned by Henry James Awmack. Millennium 1 expires in October, 2004 and Millennium 2 and 3 expire in October 2003.

Four of the documented mineral occurrences (Annis Main, Annis 5, Annis 8 and Annis 11) are located in the Millennium 3 claim block. These mineral prospects are part of a potential deposit containing lead, zinc, copper and silver. The Canoe Occurrence, located approximately 1.5 km east of Kangaroo Road and 250 m south of the TCH, is a potential feldspar deposit occurring within a ceramic pegmatite. The Roadside Occurrence, located 100 m south of the Trans Canada Highway in the Larch Hills, contains high concentrations of copper, lead and zinc. More detailed information is provided in Appendix F.

4.12 Corridor Segment 120–Urban Sicamous

Beginning	Bruhn Bridge–LKI Segment #0950 offset 25.65 km
Ending	Junction Route 97A–LKI Segment #0950 offset 27.19 km
Length	1.54 km

This very short 1.5 km segment is quite close to the Eagle River to the north. The segment also includes a wetland important to wildlife. The proximity of the railway to the TCH is a potential constraint to a highway upgrade. The eastern sections of the segment are located within the Eagle River Floodplain.

Terrain

There are no major environmental constraints in this corridor segment, other than an upgrade of the Bruhn Bridge. To expand the TCH, the Bruhn Bridge must be widened to accommodate additional lanes. This will involve construction of either a new bridge or an upgrade of the existing bridge in Sicamous Narrows where there is important fish habitat.

Fish and Aquatic Resources

Sicamous Narrows provides extremely important fish habitat, primarily for sockeye, coho, pink and chinook salmon, Dolly Varden, kokanee, lake trout,

mountain whitefish, and rainbow trout (DFO and MELP, 1995). The Narrows is a migration corridor for spawning chinook salmon on their way to the Mara and Mabel Lake systems. In addition, the area is used as a staging and feeding area by rearing juvenile salmon. The Sicamous Narrows is rated as Class 1 fish habitat (Harding, 1997, pers. comm.).

Wildlife

WARS reports include three deer and one bear killed on the highway from 1991 to 1996.

Conservation Data Centre Observations

Red-listed Vertebrates: none listed

Red-listed Vascular Plants:

Species: Mosquito Fern (*Azolla mexicana*)

Location: Sicamous, 300m west of Silver Sands Resort on south side of Trans Canada Highway, in shallow water of Oxbow Lake. UTM coordinates 3601m. E. 56335m. N. Last observed 1982. Within Corridor Segment 120, quite close to the highway.

Blue-listed Vertebrates: none listed

Blue-listed Vascular Plants:

Species: Blunt-Sepaled Starwart (*Stellaria obtusa*)

Location: Mount Mara. (No other information available.) UTM Coordinates 3625m. E. 56303m. N. Last observed 1971. Near Corridor Segments 120 & 130. Several hundred meters from the Trans Canada Highway.

Archaeological, Cultural and Heritage Resources

There are no known archaeological sites within this corridor segment. It appears that very little past archaeological assessment work was done and that an Archaeological Overview Assessment may be required.

Visual, Recreational and Tourism Resources

Recreational facilities are abundant as Sicamous is one of the most popular locations from which to rent a house-boat on the Shuswap Lakes. Tourist brochures advertise that over 1000 house-boats are available for rent in the Sicamous area. Tourists are well served by lake-side accommodations, a recreational vehicle parks, restaurants, and a golf course. This segment provides access to Highway 97A which provides access to tourist facilities on Mara Lake and Vernon to the south.

Agricultural

There are no ALR lands within this corridor segment.

Mineral and Petroleum Resources

There are no mineral claims, documented mineral occurrences or aggregate resources in this corridor segment.

4.13 Corridor Segment 130–Jct Hwy 97A (Sicamous) to Kerr Road

Beginning	Junction Route 97A–LKI Segment #0960 offset 0.00 km
Ending	Kerr Road East–LKI Segment #0960 offset 3.25 km
Length	3.25 km

This 3.25 km two-lane segment is located primarily within an urban environment, with frontage roads providing access to commercial establishments ranging from gas stations to hotels and restaurants within the community of Sicamous. This segment is located within the western portions of the Eagle River valley.

Terrain

In this corridor segment, the TCH is located on the floodplain of the Eagle River. In the first 220 m of this corridor segment, the TCH is constrained by its proximity to the mainstem of the Eagle River. Within the remainder of this corridor segment, there are no apparent major environmental constraints to upgrading the highway.

Fish and Aquatic Resources

The corridor segment begins at the western end of the Eagle River valley. The Eagle River supports sockeye, coho, and chinook salmon, Dolly Varden, kokanee, westslope cutthroat, mountain whitefish, rainbow trout, sculpins, dace, suckers, shiners and carp (DFO and MELP, 1995). The Ministry of Environment Lands and Parks has undertaken enhancement activities for kokanee in this area. One major tributary, Owlhead Creek, has supported coho spawning in the past, but has since been affected by logging activities, gravel operations and other developments. Owlhead Creek is capable of supporting kokanee and chinook and coho salmon which are severely depleted and approaching extinction in the system. The Owlhead Creek culvert crossing is also subject to periodic ice dams which must be removed under emergency approval outside normal fish timing windows (Harding, 1997, pers. comm.).

Wildlife

WARS reports include six deer, and one moose killed on the highway from 1991 to 1996.

Conservation Data Centre Observations

Red-listed Vertebrates: none listed

Red-listed Vascular Plants:

Species: Mosquito Fern (*Azolla mexicana*)

Location: Cambie, 2.7 km along Trans Canada Highway opposite Solsqua Road intersection, in shallow water of an oxbow lake. UTM coordinates 3661m. E. 56384m. N. Last observed 1982. Within Corridor Segment 130, very close to the Trans Canada Highway.

Blue-listed Vertebrates: none listed

Blue-listed Vascular Plants:

Species: Blunt-Sepaled Starwart (*Stellaria obtusa*)

Location: Mount Mara. (No other information available.) UTM Coordinates 3625m. E. 56303m. N. Last observed 1971.

Near Corridor Segments 120 & 130. Several hundred meters from the Trans Canada Highway.

Archaeological, Cultural and Heritage Resources

There are no known archaeological sites within this corridor segment. It appears that very little past archaeological assessment work was done. Therefore, prior to any highway upgrades, an Archaeological Overview Assessment may be required.

Visual, Recreational and Tourism Resources

Recreational facilities are abundant as Sicamous is one of the most popular locations from which to rent a house-boat on the Shuswap Lakes. There are over 1000 house-boats are available for rent in the Sicamous area. Tourists are well served by lake-side accommodations, a recreational vehicle parks, restaurants, beaches, and a golf course.

Agricultural

The vast majority of the Corridor Segment 130 passes through ALR lands as the highway enters the Eagle River valley.

Mineral and Petroleum Resources

There are no mineral claims or gravel pits within this corridor segment. There are two mineral occurrences listed in the MINFILE database. A 3 m thick layer of marl is exposed in a pit, approximately 1 km northwest of the Owlhead Creek crossing on the TCH. There is an outcrop of limestone exposed 450 m south of the Bruhn Bridge, indicating a potential for deposits large enough for industrial use. More detailed information is provided in Appendix F.

4.14 Corridor Segment 140–Kerr Road to Start of Four Lanes

Beginning	Kerr Road East–LKI Segment #0960 offset 3.25 km
Ending	Gravel Pit 1.2 km East of Mylinemi Rd–LKI Segment #0960 offset 11.79 km
Length	8.54 km

This short, diverse segment contains several constraints to highway expansion. While much of the natural environment is heavily disturbed by activities such as residential use, a saw mill and logging operations, it contains important wildlife values within wetlands, and low lying riparian areas and floodplains. Many of the important wildlife areas are confined between the highway and the rail tracks or are already very close to the highway. The size of the wetland areas have already been reduced by agricultural activities and have been affected by commercial activities. There are several constrictions between bedrock cliffs, the CPR tracks or, in some cases, commercial establishments.

Terrain

This corridor segment was built on the Eagle River Floodplain at the base of a relatively steep valley slope. The slope is comprised of glacial till overlying bedrock.

Between Kerr Road (LKI Segment #0960, offset 3.3 km) and the west entrance of Arnold Frontage Road (4.8 km), the TCH is confined by the main channel of the Eagle River and a 10 m high outcrop of bedrock. Expanding this section of the highway may be quite difficult.

Between Arnold Frontage Road and Mylinemi Road (10.6 km), the terrain does not impose any major environmental constraints to upgrading the highway.

Between Mylinemi Road and the end of the corridor segment (11.8 km), the TCH is confined by a steep bedrock bluff and the railway tracks. It may also be very difficult to expand this section of the TCH.

Geotechnical studies should be conducted prior to upgrading the highway in this corridor segment, especially in the difficult sections. These studies should be focused on gaining a greater understanding of the geological conditions and explore means of improving the highway while minimizing the risk of erosion and sedimentation into the Eagle River.

Fish and Aquatic Resources

The Eagle River supports sockeye, coho, and chinook salmon, Dolly Varden, kokanee, westslope cutthroat, mountain whitefish, rainbow trout, sculpins, dace, suckers, shiners, and carp (DFO and MELP, 1995). There are no tributaries in this corridor segment, however, in many locations the highway is directly adjacent to the river, and no net loss of fish habitat on the river will be acceptable to DFO (Harding, 1997, pers. comm.). Opportunities to restore the historic oxbows should be explored if possible.

Wildlife

WARS reports include six deer, one bear and one moose killed on the highway from 1991 to 1996. In addition, there are wetland areas located near the 7 km and 9 km points (LKI Segment 0960) and a low lying pasture at the 12 km point that provide wildlife habitat. Heron rookeries and an oxbow lake, with an introduced fresh water hyacinth, are located near an old Chevron gas station near Cambie (MacDonald, 1997, pers. comm.).

Conservation Data Centre Observations

Red-listed Vertebrates: none listed
Red-listed Vascular Plants: none listed
Blue-listed Vertebrates: none listed
Blue-listed Vascular Plants: none listed

Archaeological, Cultural and Heritage Resources

There are no known archaeological sites within this corridor segment. It appears that very little past archaeological assessment work was done and an Archaeological Overview Assessment may be required.

Visual, Recreational and Tourism Resources

In this corridor segment, the highway follows the scenic Eagle River valley. There is an recreational vehicle resort located near the Trans Canada Highway within this corridor segment.

Agricultural

This entire corridor segment is within ALR lands in the Eagle River valley.

Mineral and Petroleum Resources

There are no mineral claims, documented mineral occurrences or gravel pits in this corridor segment.

4.15 Corridor Segment 150–Four Lane Section of Malakwa Road

Beginning	Gravel Pit 1.2 km East of Mylinemi Rd–LKI Segment #0960 offset 11.79 km
Ending	Malakwa Dump Road–LKI Segment #0960 offset 20.55 km
Length	8.76 km

This corridor segment consists of a four-lane divided highway with frontage roads providing access to ranches, farms, and large residential properties. The segment includes some commercial facilities such as a gas station, a general store and a commercial campground.

Terrain

Within this corridor segment, the TCH is located on the Eagle River floodplain. The surficial materials are fluvial sediments.

Between the beginning of the four-lane section (LKI Segment 0960, offset 11.8 km) and Yard Creek Loop, a highway upgrade will be constrained by the proximity of the TCH to the Eagle River channel. The terrain does not impose any major constraints to upgrading the TCH between Yard Creek Loop and Yard Creek Bridge. There is an oxbow lake 250 m north of the TCH in this section.

Between Yard Creek Bridge and Erickson Frontage Road (LKI segment 0960, offset 16.7 km), the TCH is confined by its proximity to the Eagle River as it is located on the floodplain within 100 m from the mainstem. Approximately 100 m east of Yard Creek, there is an oxbow lake beside the TCH.

Between the west and east entrances to Malakwa Loop Road (LKI Segment 0960, offsets 16.8 km to 17.8 km), the TCH is again located within 100 m of the mainstem of the Eagle River. There are no major environmental

constraints in the remainder of this corridor segment, ending at Malakwa Dump road (LKI Segment 0960, offset 20.55 km).

Fish and Aquatic Resources

This segment is located adjacent to the Eagle River floodplain, which supports sockeye, coho, and chinook salmon, as well as Dolly Varden, kokanee, westslope cutthroat, mountain whitefish, rainbow trout, sculpins, dace, suckers, shiners, and carp (DFO and MELP, 1995). The highway crosses Yard Creek which supports coastal and westslope cutthroat trout, Dolly Varden and steel head (DFO and MELP 1995). The westslope cutthroats are naturally occurring up Yard Creek and the coastal cutthroats have been observed above the Blue Lake tributary.

Wildlife

WARS reports 11 deer, one bear and one moose killed on the highway in the five year period 1991 to 1996. The oxbow lakes in the area likely support a diverse variety of wildlife.

Conservation Data Centre Observations

Red-listed Vertebrates: none listed
Red-listed Vascular Plants: none listed
Blue-listed Vertebrates: none listed
Blue-listed Vascular Plants: none listed

Archaeological, Cultural and Heritage Resources

No known archaeological sites were noted within this corridor segment during a 1986 study by Arcas Associates. Apart from this study, it appears that very little past archaeological assessment work has been done. An Archaeological Overview Assessment may be required.

Mineral, Petroleum and Aggregate Resources

There are no documented mineral occurrences or mineral claims within this corridor segment. Two gravel pits are locate near Malakwa.

4.16 Corridor Segment 160–Malakwa Road to Perry River Bridge (Craigallachie)

Beginning	Malakwa Dump Road –LKI Segment #0960 offset 20.55 km
Ending	Perry River Bridge–LKI Segment #0960 offset 28.97 km
Length	8.42 km

This 8 km segment is a two-lane highway through a semi-developed agricultural area with scattered residences and a large pole storage yard. The railway line continues on the north side and agricultural areas are interspersed with mixed forests on both sides of the alignment. The TCH consists entirely of two lanes in this segment.

Terrain

This corridor segment is built on the Eagle River Floodplain. There are no apparent major geotechnical constraints to upgrading this corridor segment of the highway. The north side of the highway is confined by the Eagle River, but there is still adequate space to widen the TCH to the south.

Fish and Aquatic Resources

This corridor segment is within the Eagle River valley which supports sockeye, coho, and chinook salmon, Dolly Varden, kokanee, westslope cutthroat, mountain whitefish, rainbow trout, sculpins, dace, suckers, shiners, and carp (DFO and MELP, 1995).

DFO staff report that the Eagle River channel changes significantly upstream of the Perry River Bridge (Harding, 1997, pers. comm.). Downstream of the confluence with the Perry, the Eagle is a meandering channel with low velocities. Valuable fish habitat exists both above and below the Perry River confluence. Upstream of the confluence, the Eagle channel is more defined and incised. The discharge characteristics of the Perry River likely have a significant influence on the stream dynamics of the Eagle River by introducing glacial fed silt, and cooler water.

Wildlife

WARS reports include 14 deer, one bear, one moose and one porcupine killed on the highway from 1991 to 1996. The segment also includes several

wetland areas near the 25 km mark (LKI segment #0960) that provide excellent wildlife habitat.

Conservation Data Centre Observations

Red-listed Vertebrates: none listed

Red-listed Vascular Plants: none listed

Blue-listed Vertebrates: none listed

Blue-listed Vascular Plants: none listed

Archaeological, Cultural and Heritage Resources

There are three known archaeological sites and a historic Tote Road section within this corridor segment. Their heritage value was assessed by Arcas Associates (1986). The heritage value of a small, buried lithic scatter near Kelch Road was assessed as low as was the Briggs homestead located 900 m west of the Perry River Bridge. The heritage value of the Boyes site, located 600 m west of the Perry River bridge, was rated high as it is the only known intact pre-contact site in the Eagle River Valley. The heritage value of Section 1 of the Tote Road received a low rating (Arcas Associates, 1986).

Visual, Recreational and Tourism Resources

Gorge Creek at Craigallachie is located in this segment, however the feature is not visible from any view points from the highway. The highway passes near an important historic landmark, the last spike at Craigallachie, where the last spike was driven signifying completion of the Canadian Pacific Railway in 1885. Tourist and recreational services include a trailer park and commercial campground.

Agricultural

The entire corridor segment (with the exception of approximately 0.5 km at the sawmill) passes through ALR lands in the Eagle River valley.

Mineral and Petroleum Resources

There are no mineral claims, documented mineral occurrences or gravel pits in this corridor segment.

4.17 Corridor Segment 170–Eagle River Floodplain

Beginning	Perry River Bridge–LKI Segment #0960 offset 28.97 km
Ending	Three Valley Overpass–LKI Segment #0960 offset 47.67 km
Length	18.70 km

This two-lane segment traverses the Eagle River valley which is a braided river channel with very high fish and wildlife habitat values. The west end of the alignment is bordered by residences and agricultural lands. The highway is located 10 m to 50 m from the railway line.

Terrain

This corridor segment of the Trans Canada Highway follows the floodplain of the Eagle River to the western corner of Three Valley Lake. A section of the highway between the Taft overhead (LKI segment 0960, 33.5 km) and Taft Road (34.1 km), is confined by the Eagle River on one side and the CPR tracks on the other side. Between Taft Road and Kay Falls (36.3 km), there are no apparent major environmental constraints to upgrading the highway. Between the bridge at Kay Falls and the bridge near the Enchanted Forest (39.5 km), the highway was constructed against the base of steep valley slopes on the Eagle River floodplain. This section of the highway is located directly adjacent to either the mainstem of the Eagle River or significant wetland habitat. The highway is constrained by the Eagle River and the CPR tracks between the bridge near the Enchanted Forest and the Eagle River floodplain. There is not much space to expand the highway in this section.

The length of highway along Griffin Lake (44.1 to 45.8 km) was constructed on a steep bedrock slope. The highway is confined by a steep till slope on one side of the road and the lake on the other.

Prior to upgrading this corridor segment of the TCH, geotechnical investigations should be carried out to determine if the highway can be designed, during and after the construction of an upgrade, to minimize the risk of the erosion of the surficial materials and the discharge of sediment into the Eagle River or Griffin Lake.

Fish and Aquatic Resources

This corridor segment is within the Eagle River valley which supports sockeye, coho, and chinook salmon, Dolly Varden, kokanee, westslope cutthroat, mountain whitefish, rainbow trout, sculpins, dace, suckers, shiners, and carp (DFO and MELP, 1995). In addition, tributaries in this area support sockeye, coho and chinook salmon, Dolly Varden, rainbow trout, mountain whitefish, and kokanee. The Eagle River is considered to be the primary producer of kokanee for the Shuswap system.

Griffin Lake supports rainbow trout, suckers, Dolly Varden, lake trout, mountain whitefish, and northern squawfish. MELP staff report that it has been stocked with rainbow and lake trout (Harding, 1997, pers. comm.). The outlet of the lake supports rainbow trout, and tributaries such as Crazy Creek may support rainbow trout in the lower reaches.

A range of enhancement projects have been completed in this system, including the construction of a hatchery one mile west of Crazy Creek, construction of ponds and planting riparian vegetation in compensation for highway construction, stocking activities, and construction of rearing troughs.

Discussions with DFO staff revealed that innovative solutions will be required to expand the TCH in the sections of the corridor segment between the Taft Road and the Enchanted Forest (Harding, 1997, pers. comm).

Wildlife

WARS reports include seven deer, one beaver and one porcupine killed on the highway from 1991 to 1996. The entire river valley in this corridor segment consists of a braided channel that includes extensive wetland complexes. These areas provide valuable wildlife as well as fish habitat.

Conservation Data Centre Observations

Red-listed Vertebrates: none listed

Red-listed Vascular Plants: none listed

Blue-listed Vertebrates: none listed

Blue-listed Vascular Plants:

Species: Orange Touch-Me-Not (*Impatiens aurella*)

Location: Eagle River Canyon. UTM Coordinates 3871m. E. 56482m. N. Last observed 1950. Near or within Corridor Segment 170. Located close to the Trans Canada Highway.

Archaeological, Cultural and Heritage Resources

A total of three archaeological sites and two sections of a historic Tote Road are located within this corridor segment (Arcas Associates, 1986). The heritage values of the Three Valley townsite, the Johnson homestead and CPR Station of Endiver, and sections 2 and 3 of the Tote Road were given a low rating. As a result, no work is required to mitigate the impacts of any highway expansion (Arcas Associates, 1986). The Taft townsite received a moderate rating as it is one of the earliest, major historical communities established in the Eagle Valley. The impacts of the highway expansion could be mitigated by compiling a historical account of the townsite (Arcas Associates, 1986).

Visual, Recreational and Tourism Resources

Visual Resources include Crazy Creek, a scenic cascading waterfall that is not visible from any viewpoint or pull-out. Recreational and tourist attractions and facilities include the enchanted forest which is elevated on the south side of the highway and provides a viewpoint of this floodplain area. This segment also provides access to the Edelweiss Lodge. Griffin Lake is located immediately next to the highway, and the edge of the lake has been filled in with riprap to provide a shelf for the highway.

Many sections of the two lanes traversing this valley have appropriately wide shoulders. A pull-out which is located almost at water level, provides access for viewing the area, but may raise concerns from environmental agencies.

Along the east end of this segment and the west end of Corridor Segment 180, there are no apparent restrictions to expansion.

Agricultural and Forested Land Reserves

There are no ALR lands within this corridor segment as it passes through the eastern end of the Eagle River Valley to Griffin Lake. However, between

Griffin Lake and Three Valley Lake, the highway passes through the only area designated as a Forest Land Reserve (FLR) lands in the entire corridor.

Mineral and Petroleum Resources

There are no mineral claims, documented mineral occurrences or aggregate resources in this corridor segment. A small mineral reserve zone (Mineral Reserve OIC 1310, 87-07-07) located near Taft was established due to the presence of a federal fish hatchery. No mineral claims may be staked within the reserve which does not have an expiration date.

4.18 Corridor Segment 180–Three Valley Gap

Beginning	Three Valley Overpass–LKI Segment #0960 offset 47.67 km
Ending	1 km West of Victor Lake Picnic Site–LKI Segment #0960 offset 54.96 km
Length	7.29 km

The western section of this corridor segment consists of alternating three-lane sections, with a short four-lane section occurring at the overlap. Approximately 1 km of this 7 km segment is constructed on fill that was placed in Three Valley Lake on the north side of the highway. A steep and sometimes unstable rock cliff constricts the highway to the south. The fill in the lake consists of coarse rock material which does not provide a littoral zone or riparian habitat for the lake shore. Expansion into the rock cliff on the south is technically difficult and expansion into the lake will be limited by the fish habitat values of the lake.

To the east of the resort, there is a floodplain that provides important wildlife values. This floodplain is also the location of a tourist attraction and works areas. While the area has been heavily disturbed in the past, much of it has regenerated, and now provides important wildlife habitat as well as a tourist attraction. A frontage road provides access to the floodplain and the tourist resort. In this segment, the floodplain and river valley are bordered on the north side by the railway and the highway on the south.

Terrain

The section of the TCH within this corridor segment between the pull-out on Three Valley Lake and the Woods Overpass (LKI segment #0960, offset 49.1 km - 53.3 km) is cut into a steep slope in which bedrock is exposed in the road cut. The bedrock is overlain by a mantle of glacial till. An upgrade involving the expansion of the TCH in this section will be extremely difficult and will likely involve the placement of the roadbed into Three Valley Lake. Numerous debris flow and avalanche chutes were noted on the air photo within this section (BCC 94088 No 201-204).

Between the Woods Overpass and the end of this corridor segment (55.0 km), the valley slope to the Eagle River floodplain is quite steep and there is some potential for erosion of the slope in the event of a highway upgrade.

An upgrade involving the widening of the highway in this corridor segment will be extremely difficult. Prior to upgrading this corridor segment, geotechnical studies should be conducted to determine the best options for improving the highway, given the active slope movement processes occurring in the area as well as the proximity of the TCH to Three Valley Lake and the Eagle River.

Fish and Aquatic Resources

Three Valley Lake supports sockeye and coho salmon, Dolly Varden, cutthroat lake and rainbow trout, mountain whitefish, northern squawfish, sculpins, peamouth chubs, suckers, and shiners, (DFO and MELP, 1995). Tributaries in this area support sockeye, and coho salmon, Dolly Varden, rainbow trout, mountain whitefish, lake trout, and cutthroat trout and other fish species. The areas between Three Valley, Victor and Clanwilliam Lakes are especially important fish habitat. All three lakes are stocked with rainbow trout from the Kootenay Trout Hatchery (Brade, 1997, pers. comm.). Clanwilliam Lake (also called Summit Lake) is the eastern end of the Fraser Basin in the TCH corridor. A detailed fish habitat inventory is underway which will be completed in mid-March 1998.

Department of Fisheries and Ocean representatives indicated that this area may provide options for habitat compensation, since the current shoreline is

not productive habitat (Rowland and Winfield, 1997, pers. comm.). The riprap along the fill slope of the highway does not provide a littoral zone at the lake edge. It may be possible and desirable to augment the highway with an additional lane into the lake, if a new edge which is more fish-habitat friendly is created. Any construction along the lake in this corridor segment, may provide opportunities to terrace the shoreline, add riparian vegetation or otherwise enhance the existing features to improve the productivity of habitat for fish. Nevertheless, DFO will apply the guiding principle of "no net loss" of fish habitat. Currently, there are no provisions for compensating reduced area of fish habitat by increasing productivity, hence habitat area will be the measure for assessing impacts from highway upgrading.

Wildlife

WARS reports include two deer killed on the highway from 1991 to 1996. A herd of mountain goats is resident in the area (MacDonald, 1997, pers. comm.). While there is a lack of formal information about the wildlife in the area, the floodplain area undoubtedly provides excellent wildlife habitat.

Conservation Data Centre Observations

Red-listed Vertebrates: none listed
Red-listed Vascular Plants: none listed
Blue-listed Vertebrates: none listed
Blue-listed Vascular Plants: none listed

Archaeological, Cultural and Heritage Resources

This segment contains three known archaeological sites and one section of the historic Tote Road. All of the archaeological sites are located on the west side of Three Valley Lake. The heritage values of the Mundy Company Lumber Mill, the China Gardens and Rutherford Homestead, the Dahalberg Homestead, and Section 5 of the Tote Road were all given a low rating by Arcas Associates (1986).

Visual, Recreational and Tourism Resources

The Three Valley Resort dominates the central section of the segment, and provides a beach, boat launching ramp, and tourist facilities. A large unofficial pull-out area on the shore of the lake appears to be used for fishing,

viewing, and access to the lake. The pull-out area is used to temporarily store avalanche slide debris in winter. The segment provides access to Frog Falls and Wap Lake campsites as well as backcountry areas.

Agricultural

There are no ALR lands within this corridor segment.

Mineral and Petroleum Resources

There are no mineral claims, documented mineral occurrences or gravel pits in this corridor segment.

4.19 Corridor Segment 190–Woods Overhead to Clanwilliam Overhead

Beginning	1 km West of Victor Lake Picnic Site–LKI Segment #0960 offset 54.96 km
Ending	0.5 km East of Clanwilliam Overhead–LKI Segment #0960 offset 60.02 km
Length	5.06 km

In this corridor segment, there are two crossings of the Eagle River. At the western end, the highway is located on the north side of the Valley and is separated from the CPR railway tracks by Victor Lake and the river. Near the centre of the corridor segment, the highway passes over the creek and rail tracks and passes to the south of Clanwilliam Lake. To the east of Clanwilliam Lake the highway passes over the creek again, and then both the railway tracks and the highway are on the north side of the creek. In general terms, this corridor segment is characterized by steep slopes as it passes through Eagle Canyon. The rail tracks, lakes and the creek in combination create a series of constraints to expansion except at the eastern end of the corridor segment.

Terrain

There are major geotechnical constraints to upgrading the TCH in this corridor segment, between Victor Creek and the Clanwilliam Overpass (LKI segment #0960, 56.1 km - 59.5 km). The highway is located in a narrow valley and is confined by steep valley slopes and Victor and Clanwilliam

Lakes on the Eagle River floodplain. The valley slopes are comprised of a veneer of till and colluvium overlying bedrock as observed within several road cuts. A considerable number of debris flows and avalanche tracks were noted in the field during the rapid appraisal and on the air photos (BC84077, No. 170-171).

Prior to upgrading this corridor segment, geotechnical studies should be conducted to determine the best options for improving the highway, given the active slope movement processes occurring in the area as well as the proximity of the TCH to the major watercourses.

Fish and Aquatic Resources

The highway within this corridor segment passes close to Victor and Clanwilliam Lakes at the Monashee summit, and close to Tonkawatla creek. These water bodies support cutthroat, bull, rainbow, and lake trout, kokanee, mountain whitefish, peamouth chub, sculpins, northern squawfish, suckers and Dolly Varden (DFO and MELP, 1995; Mirkwood Ecological Consultants 1996). The area between the Three Valley, Victor and Clanwilliam Lakes is especially important fish habitat. All three of those lakes are stocked with rainbow trout from the Kootenay Trout Hatchery (Brade, 1997, pers. comm.).

Wildlife

WARS reports include one deer killed on the highway from 1991 to 1996.

Conservation Data Centre Observations

Red-listed Vertebrates: none listed

Red-listed Vascular Plants: none listed

Blue-listed Vertebrates: none listed

Blue-listed Vascular Plants:

Species: Small-Flowered Willowherb (*Epilobium leptocarpum*)

Location: South side of Clanwilliam Lake, on moist shady rock ledge on almost perpendicular cliffs: rare. UTM Coordinates 4040m. E. 56466m. N. Last observed 1953. Within Corridor Segment 190. Located very close to highway.

Archaeological, Cultural and Heritage Resources

This corridor segment contains three sections of the historical Tote Road. The heritage value of Sections 7 and 8 of the Tote Road were given low ratings, while Section 6 at Victor Lake was given a moderate rating (Arcas Associates, 1986).

Visual, Recreational and Tourism Resources

Victor Lake Provincial Park has a road side picnic site. Tourists use the area extensively during the summer season with approximately 10,000 visitors recorded annually. The segment also provides access to backcountry areas and campsites. There is also a pull-out offering a view of the lake.

Agricultural

There are no ALR lands in this segment.

Mineral, Petroleum and Aggregate Resources

There are no current mineral claims or gravel pits, however there are three mineral occurrences (Three Gs, Clanwilliam Lake and the Victor Lake Quartzite) within this corridor segment. The main commodity of the Three Gs Occurrence, near the beginning of Corridor Segment 190, is graphite. There are potential silica deposits near Clanwilliam Lake and Victor Lake. More information is provided in Appendix F.

4.20 Corridor Segment 200–Clanwillian Overhead to Big Eddy Road

Beginning	5 km East of Clanwilliam Overhead–LKI Segment #0960 offset 60.02 km
Ending	Big Eddy Road–LKI Segment #0960 offset 67.52 km
Length	7.50 km

This 6 km corridor segment passes through the Tonkawatla Creek valley, along with the CPR rail tracks. There are several passing lane sections in this segment. Industrial land uses include a large pole storage area. The slopes on both sides of the alignment are not steep and support a second growth coniferous forest. There are no major environmental constraints to highway expansion.

Terrain

In this corridor segment, the terrain induces no major environmental constraints as the TCH follows the Tonkawatla Creek valley which is wider than the Eagle River valley and there is more room in which to expand the highway. The highway is located at the base of a steep valley slope composed of colluvium and till overlying bedrock.

Fish and Aquatic Resources

There are no listings for Tonkawatla Creek in DFO's FISS database, however, MELP staff (Brade, 1997, pers. comm.) report that Tonkawatla Creek (locally known as the Tum Tum Creek) is an issue of discussion, as it produces a run of rare yellow-fin rainbow trout. This creek is the only known spawning area for yellow fin rainbow, and the creek is undergoing rehabilitation under the Watershed Restoration Program of Forest Renewal B.C. (FRBC).

Tonkawatla creek is also known to support rainbow, bull and brook trout, kokanee, and sculpins (Mirkwood Ecological Consultants, 1996). Large numbers of Kokanee have been observed spawning below the barrier. Eastern brook trout were captured above the barrier at the outlet of Wetask Lake. Any highway expansion should be carried out so as to minimize disturbance to the riparian zone of the creek.

Wildlife

WARS reports include one moose killed on the highway from 1991 to 1996. Mirkwood Ecological Consultants (1996) report that ungulate use of the Tonkawatla watershed is limited by the steep nature of the terrain and the high snowfall in the area. Small populations of moose and white-tailed deer have been observed along the highway during the winter by local residents. Ongoing studies of Caribou in the region indicate that herds are transient and do not winter in the same location every year. The area is frequented by black and grizzly bears and the Tonkawatla Creek watershed has been classified by MELP as moderate to high grizzly bear habitat. There is evidence that 17 species of birds breed in the Tonkawatla Creek watershed. No herpetology studies have been conducted in this area.

Conservation Data Centre Observations

Red-listed Vertebrates: none listed

Red-listed Vascular Plants: none listed

Blue-listed Vertebrates: none listed

Blue-listed Vascular Plants: none listed

Archaeological, Cultural and Heritage Resources

A previous Archaeological Overview Assessment (Arcas Associates, 1986) did not identify any archaeological resources within this corridor segment. However, there is some potential due to the following factors as described by Minni (1997). Historic and ethnographic data refer to the existence of an aboriginal trail through the Tonkawatla Creek Valley to Eagle Pass. The study area is located parallel to Tonkawatla Creek and water sources that are important in the location of archaeological resources. Ethnological and archaeological evidence indicates the presence of a nearby village at the mouth of Tonkawatla Creek for which there may be peripheral sites.

Visual, Recreational and Tourism Resources

Tonkawatla Creek provides fishing opportunities for rainbow trout.

Agricultural

There are no ALR lands in this corridor segment.

Mineral, Petroleum and Aggregate Resources

There are no mineral claims, documented mineral occurrences or aggregate resource extraction operations in this corridor segment.

4.21 Corridor Segment 210–Big Eddy Road to JCT. Hwy 23 South (Revelstoke)

Beginning	Big Eddy Road–LKI Segment #0960 offset 67.52 km
Ending	Junction Route 23 S–LKI Segment #0960 offset 70.15 km
Length	2.63 km

This very short segment contains one passing lane section, and one area where the highway is constrained between the CPR and rock cliff. With the

exception of this short section, there are no topographic constraints to highway expansion.

Terrain

At Big Eddy, the highway traverses an outwash fan at the mouth of the Tonkawatla Creek before proceeding on to the Columbia River floodplain.

The main environmental constraint in this corridor segment is located between 68.8 km and 69.8 km of LKI segment #0960. This section of the TCH is confined by bedrock exposure on the north side and the CPR railway tracks, located immediately adjacent to the highway, on the south side. Other constraints imposed by terrain are likely to be relatively minor.

Fish and Aquatic Resources

Tonkawatla creek supports rainbow, bull and brook trout, kokanee, and sculpins (Mirkwood Ecological Consultants 1996). The Columbia River in this corridor segment supports bull trout, rainbow trout, kokanee, mountain whitefish, westslope cutthroat, northern squawfish, and sculpins (Enkon Environmental Ltd. 1997).

Wildlife

WARS reports include one deer and one porcupine killed on the highway from 1991 to 1996.

Conservation Data Centre Observations

Red-listed Vertebrates: none listed
Red-listed Vascular Plants: none listed
Blue-listed Vertebrates: none listed
Blue-listed Vascular Plants: none listed

Archaeological, Cultural and Heritage Resources

There is one known archaeological site within this corridor segment. Section 9 of a historic Tote Road located near Big Eddy has a low heritage value (Arcas Associates, 1986).

Visual, Recreational and Tourism Resources

Revelstoke provides a range of tourist related facilities including hotels, motels, restaurants and retail outlets. Revelstoke is also a base for Heli-skiing operations. The community also provides a ski hill, primarily for local use, a railway museum, a boat launch on the Columbia River, and access to a range of recreational activities within Mount Revelstoke National Park and crown lands in the vicinity.

Agricultural

There are no ALR lands in this corridor segment

Mineral, Petroleum and Aggregate Resources

There are no mineral claims or documented mineral occurrences in this corridor segment. There is a gravel pit at Big Eddy, near the mouth of Tonkawatla Creek.

4.22 Corridor Segment 220–Jct Hwy 23 South to Jct. Hwy North (Revelstoke)

Beginning	Junction Route 23 S–LKI Segment #0960 offset 70.15 km
Ending	Junction Route 23 N–LKI Segment #0975 offset 0.29 km
Length	1.32 km

This is an urban segment through the outskirts of Revelstoke, providing access to highway related commercial services such as gas stations, motels and restaurants.

Terrain

In this corridor segment, the TCH leaves the Columbia River floodplain and proceeds onto a bench, likely composed of glaciofluvial gravels. The only environmental constraint is the Columbia River Bridge. In the event of a highway upgrade, this bridge may require widening and the Columbia River contains significant fish habitat.

Fish and Aquatic Resources

The Columbia River in this corridor segment supports bull trout, rainbow trout, kokanee, mountain whitefish, westslope cutthroat, northern squawfish

and suckers (Enkon Environmental Ltd. 1997). In addition, the Conservation Data Centre reports that White Sturgeon are present in the Columbia River system. While the occurrence reported by the CDC is between the Keenleyside Dam and the US border, some Sturgeon may also be present above the Keenleyside.

Wildlife

The WARS system does not indicate any incidences in this segment.

Conservation Data Centre Observations

Red-listed Vertebrates:

Species: White Sturgeon (*Acipenser transmontanus*)

Location: Present in the Columbia River system between the Keenleyside Dam and the US border, but some sturgeon may also be present above the Keenleyside. UTM Coordinates 444220m. E. 5465510m. N., 454621m. E. 5428110m. N. Last observed 1991.

Red-listed Vascular Plants: none listed

Blue-listed Vertebrates: none listed

Blue-listed Vascular Plants: none listed

Archaeological, Cultural and Heritage Resources

The archaeological potential is unknown. It is possible that some archaeological resources may still be present, even after the highway and the accompanying service facilities were constructed. An Archaeological Overview Assessment may therefore, be required to evaluate the archaeological potential within this corridor segment.

Visual, Recreational and Tourism Resources

Revelstoke provides facilities for travellers and a gateway to outdoor activities on the waterways and in the mountains. There is a railway museum in Revelstoke.

Agricultural

There are no ALR lands in this corridor segment.

Mineral, Petroleum and Aggregate Resources

There are no mineral claims, documented mineral occurrences or gravel pits in this corridor segment.

4.23 Corridor Segment 230–East Revelstoke

Beginning	Junction Route 23 N–LKI Segment #0975 offset 0.29 km
Ending	Revelstoke City Limits–LKI Segment #0975 offset 4.98 km
Length	4.69 km

This segment contains two eastbound passing lane sections, both proceeding uphill. Secondary or frontage roads provide access to homes, Mount Revelstoke National Park, water storage tanks, and a commercial campground. In this segment the highway enters the Illecillewaet River valley, considered important fish habitat by the Ministry of Environment Lands and Parks staff (Brade, 1997, pers. comm.).

Terrain

This corridor segment is located within the city limits of Revelstoke, above the Illecillewaet River floodplain. The highway is likely built on glaciofluvial deposits. No major environmental constraints were identified in this corridor segment.

Fish and Aquatic Resources

The Illecillewaet River supports bull, rainbow and cutthroat trout, sculpins, mountain whitefish, and Dolly Varden (Reid Crowther and Partners, 1994a). In addition, several tributaries could provide additional off-channel fish habitat if culverts were designed to permit fish passage (Brade, 1997, pers. comm.).

Wildlife

WARS reports include five deer killed on the highway from 1991 to 1996.

Conservation Data Centre Observations

Red-listed Vertebrates: none listed

Red-listed Vascular Plants: none listed

Blue-listed Vertebrates: none listed

Blue-listed Vascular Plants: none listed

Archaeological, Cultural and Heritage Resources

The archaeological potential is unknown as few, if any, past archaeological assessments have been done. Therefore, an Archaeological Overview Assessment may be required.

Visual, Recreational and Tourism Resources

This corridor segment provides access to a commercial campground and the alpine area of Mount Revelstoke National Park.

Agricultural

There is one parcel of ALR land in this segment, located on the south side of the highway between the eastern border of Revelstoke and the Illecillewaet River canyon.

Mineral, Petroleum and Aggregate Resources

There are no mineral claims, documented mineral occurrences or gravel pits in this corridor segment.

4.24 Corridor Segment 240–Revelstoke to Mount Revelstoke National Park Border

Beginning	Revelstoke City Limits–LKI Segment #0975 offset 4.98 km
Ending	Clachnacudainn Creek–LKI Segment #0975 offset 17.90 km
Length	12.92 km

This corridor segment skirts the southern border of Mount Revelstoke National Park, and parallels the Illecillewaet River. The highway is comprised primarily of three- and four-lane sections. An additional four-lane section is currently under construction for the eastern 3.5 km of the corridor segment. The Illecillewaet River, located downslope from the highway, is important fish habitat. The terrain in this corridor segment is rugged and the highway crosses several steep ravines and cutslopes.

Terrain

This corridor segment of the TCH follows the Illecillewaet River on the north side of the valley. The cutslope is moderate and composed of a mantle of till and minor colluvium overlying bedrock. Scattered outcrops of bedrock 3-5 m high are exposed in road cuts, however, these do not pose serious problems. In places, the highway is within 50 m of the Illecillewaet River. However, it can be expanded by excavating into the cutslope. Given that most of this corridor segment is comprised of either three- or four-lane sections, there is still room to expand the highway even though the terrain is fairly rugged.

Fish and Aquatic Resources

The Illecillewaet River supports bull, rainbow and cutthroat trout, sculpins, mountain whitefish, and Dolly Varden (Reid Crowther and Partners, 1994a). While tributaries such as Hamilton, Clachnacudainn, and Twin Creeks have steep gradients, some of the lower areas could provide fish habitat if the culverts allowed fish passage and were not frequently blocked by debris (Brade, 1997, pers. comm.).

Wildlife

While this corridor segment is not within Mount Revelstoke National Park, it can be anticipated that wildlife occurrences are similar to that described in the next corridor segment (see Corridor Segment 250).

WARS reports include three deer, one bear and one porcupine killed on the highway from 1991 to 1996.

Conservation Data Centre Observation

Red-listed Vertebrates: none listed
Red-listed Vascular Plants: none listed
Blue-listed Vertebrates: none listed
Blue-listed Vascular Plants: none listed

Archaeological, Cultural and Heritage Resources

The archaeological potential is unknown as few, if any, past archaeological assessments have been done. An Archaeology Overview Assessment may be required.

Visual, Recreational and Tourism Resources

Visual assets include views of the Illecillewaet River valley, and Mount Revelstoke National Park to the north. There is a picnic site located at the 13 km point (LKI segment 0975).

Agricultural

There are no ALR lands in this corridor segment.

Mineral, Petroleum and Aggregate Resources

There are no mineral claims, documented mineral occurrences in this corridor segment. There is a gravel pit near the west boundary of Mount Revelstoke National Park.

4.25 Corridor Segment 250–Mount Revelstoke National Park

Beginning	Clachnacudainn Creek–LKI Segment #0975 offset 17.90 km
Ending	Mount Revelstoke National Park East Boundary–LKI Segment #0975 offset 30.55 km
Length	12.65 km

This segment is located just within the boundaries of the Mount Revelstoke National Park. There are two sections with passing lanes, one heading east and one heading west. Access to the Big Cedars Boardwalk and Laureate picnic and rest area are popular and important tourist attractions within the park. Near the Laureate rest stop, a wetland area provides important wildlife habitat. Some short sections within the segment are constrained by steep cliffs and the Illecillewaet River. Several avalanche chutes were noted during the rapid appraisal and from a review of the air photos. The Illecillewaet River, located downslope from the highway, is important fish habitat (Brade, 1997, pers. comm.).

Terrain

There are no apparent major geotechnical constraints to upgrading the highway. However, there is a section (LKI Segment 0975, 22.71 km -29.11 km) where the Illecillewaet River meanders within 50 m of the road. The

valley side slopes are quite steep and the surficial materials consist of a veneer or blanket of till and colluvium overlying bedrock. There are some bedrock exposures in the road cut.

There is also considerable avalanche activity within this corridor segment as noted during the rapid appraisal and from a review of the air photos (BCB 91149 No. 33-35., BCB 91149 No. 254-257, BCB 91149 No. 94-97, BCB 91149 No. 116-119). Geotechnical studies, examining the environmental impacts of highway improvement in steep terrain where there are a high number of mass movements, should be conducted.

Fish and Aquatic Resources

The Illecillewaet River supports bull, rainbow and cutthroat trout, sculpins, mountain whitefish, and Dolly Varden (Reid Crowther and Partners, 1994a).

Wildlife

WARS reports include one deer killed on the highway from 1991 to 1996. The wildlife in Mount Revelstoke National Park is described by Reid Crowther and Partners (1994a). Wildlife species that most commonly come in contact with the TCH include moose, mountain goat, mule deer, black bear and coyote. Mule deer mortality rates from 1970 to 1987 are highest in the western half of the corridor segment. The "hotspot" for moose and mountain goat mortalities is near the Clachnacudainn Cliffs area (LKI Segment 0975, 18 km). Black bears and coyotes have been killed along the entire length of the corridor segment. The impacts of the existing TCH on species occurring in lower numbers within Mount Revelstoke National Park such as wolverine, grizzly bear, woodland caribou and lynx are not fully understood. There is little information available on the impacts of the existing TCH on smaller mammals, birds and herpetofauna. As the territories of many of these animals are small, there is a concern that upgrading the TCH could result in the elimination of habitat.

Conservation Data Centre Observations

Red-listed Vertebrates: none listed

Red-listed Vascular Plants: none listed

Blue-listed Vertebrates: none listed

Blue-listed Vascular Plants: none listed

Archaeological, Cultural and Heritage Resources

Few, if any, archaeological assessment studies have been conducted for this area. Therefore, the archaeological potential is largely unknown. A recent study by Bussey and Alexander (1994), predicts that Mount Revelstoke National Park will contain a low density of prehistoric sites due to the predominance of forested mountain slopes, natural physical processes (glacial, fluvial and colluvial) acting to destroy archaeological sites, low ungulate and salmon populations, excessive snow cover and a lack of ethnographic villages on the western portion of the Columbia River. Parks Canada will be commissioning further archaeological studies (Reid Crowther and Partners, 1994a).

Visual, Recreational and Tourism Resources

Recreational resources include access to the Laureate Rest and Picnic Area of the Mount Revelstoke National Park, and the Big Cedars picnic area and boardwalk trail. The avalanche areas include steep slopes which provide natural vistas of several waterfalls on the south side of the highway.

Agricultural

There are no ALR lands in this corridor segment.

Mineral, Petroleum and Aggregate Resources

There are no mineral claims, documented mineral occurrences, or ongoing aggregate resource extraction operations in this corridor segment.

4.26 Corridor Segment 260–Revelstoke National Park to Glacier National Park

Beginning	Mount Revelstoke National Park East Boundary–LKI Segment #0975 offset 30.55 km
Ending	Glacier National Park West Boundary–LKI Segment #0975 offset 48.35 km
Length	17.80 km

This corridor segment lies between Mount Revelstoke and Glacier National Parks. The segment is primarily two lanes with two eastbound passing lane sections. Fairly wide shoulders provide reasonable safety in an area with steep and sometimes unstable slopes on both sides of the highway. The western sections of the corridor segment have wide lanes and shoulders, with more stable slopes up- and down-slope from the highway. The eastern 10 km of the corridor segment is characterized by steep and sometimes unstable slopes that may create environmental and technical constraints to expansion. The Illecillewaet River, located below the highway, is important fish habitat. The eastern portion of the corridor segment contains avalanche protection snowsheds that do not separate the east and westbound traffic.

Terrain

This segment of the TCH between Mount Revelstoke National Park and Glacier National Park follows the Illecillewaet River valley. The highway is located on the lower slopes of the valley north of the Illecillewaet River. The surficial materials are comprised of a mantle of till and colluvium overlying bedrock. Between the Woolsey Creek Forest Service Road (LKI segment #0975, offset 30.7 km), and the Albert Canyon Bridge (33.8 km), the TCH is confined by steep bedrock on the cutslope and the Illecillewaet River below the road.

Between the Albert Canyon bridge and the retaining wall (38.10 km), the terrain does not impose any major constraints that will impede a highway upgrade.

Between the retaining wall and 44.40 km, the slopes on the north side of the Illecillewaet River valley are steep. Scattered outcrops of bedrock 5-10 m high are exposed in the road cut. Erosion from exposed cut and fill slopes as a result of widening the TCH could result in the discharge of sediment into the Illecillewaet River. There is a small portion between 42.08 km and 44.40 km where the highway is built on a narrow bench with steep slopes located upslope and downslope from the road.

Between 44.40 km and 48.35 km, the TCH passes through a snow avalanche zone. The highway is built on a narrow bench on a steep, lower valley slope. There are three snowsheds located within this section of the corridor segment.

Prior to upgrading the difficult sections of the TCH in this corridor segment, geotechnical studies that examine the implications, related to erosion control and slope stability, of upgrading a highway in areas where there are frequent mass movement and the terrain is steep.

Fish and Aquatic Resources

The Illecillewaet River supports bull, rainbow and cutthroat trout, sculpins, mountain whitefish, and Dolly Varden (Reid Crowther and Partners, 1994a). In addition, the highway crosses several streams and while the steep terrain may preclude potential for fish habitat in the creeks which flow down to the Illecillewaet, other values such as the input of nutrients to the Illecillewaet, may be important to consider during any expansion project (Brade, 1997, pers. comm.).

Wildlife

WARS reports include three bears, two porcupines, one elk and one deer killed on the highway from 1991 to 1996. MELP staff report that Albert Canyon at the western end of this corridor segment contains important mountain goat wintering range along the Tangier River to the north (Brade, 1997, pers. comm.). There is a small wetland area near the 34 km point (LKI segment 0975) that also provides wildlife habitat. The grass sedges and shrubs located in the avalanche tracks provide habitat for grizzly bears (Martin, 1997, pers. comm.).

Conservation Data Centre Observations

Red-listed Vertebrates: none listed
Red-listed Vascular Plants: none listed
Blue-listed Vertebrates: none listed
Blue-listed Vascular Plants: none listed

Archaeological, Cultural and Heritage Resources

The archaeological potential of this corridor segment is unknown as few, if any, past archaeological assessment studies have been done. Therefore, an Archaeological Overview Assessment may be required.

Visual, Recreational and Tourism Resources

A viewpoint of the Illecillewaet River canyon can be accessed from the TCH as can the Canyon Hot Springs. Several other pull-out areas also provide views of the canyon and avalanche chutes.

Agricultural

There are no ALR lands in this corridor segment.

Mineral, Petroleum and Aggregate Resources

There are no mineral claims, however there are six mineral occurrences listed in the MINFILE database that are located within approximately 1 km of the TCH. Given that the accuracy in locating these occurrences ranges from an envelope of 500 m to 5 km, it is conceivable that any future mineral claims could intersect the TCH right of way.

A potential fluorite deposit is located near the east boundary of Mount Revelstoke National Park. Three hundred meters north of the east boundary of the Park, a potential beryl deposit is exposed. An abandoned limestone and marble quarry is located in Albert Canyon, on the Illecillewaet River. A potential deposit of talc and asbestos is exposed in a pit 700 m northeast of the Jumping Creek Forest Service Road exit. Lead-zinc-silver prospects are located 1.3 km southeast of the MacDonald Snowshed and 1.2 km northeast of the MacDonald Snowshed. More detailed information is provided in Appendix F.

4.27 Corridor Segment 270–Glacier National Park (Roger's Pass)

Beginning	Glacier National Park West Boundary–LKI Segment #0980 offset 0.00 km
Ending	Glacier National Park East Boundary–LKI Segment # 0980 offset 43.81 km

Length 43.81 km

This corridor segment is entirely within Glacier National Park. It includes eight passing lane sections, some of which overlap to create two four-lane sections. The western sections of the corridor segment pass near the Illecillewaet River which has important fish habitat. Several unnamed tributaries draining the Hermit Range, pass through culverts under the highway. These tributaries provide important nutrients to the Illecillewaet River as well as habitat for fish. When these culverts are blocked by debris, fish and fish habitat are affected. The highway also passes through an active avalanche area and there are several avalanche gun emplacements located along the alignment. These avalanche areas are probably the most striking visual feature of this segment, as they stretch along the western 36 km of the segment.

The western sections of the corridor segment have several passing and four-lane sections. An important historic site, located to the west of the summit at Loop Creek, is composed of old railway support pilings and merits protection by Heritage Canada.

The Summit area at Rogers Pass includes park headquarters, a summit monument, visitor information centre, a lodge, fuel station, and tourist-related services. At the summit, the highway elevation is 1330 m, approximately 200 m below the tree-line. To the east of the summit, several short passing lane sections are provided and snowsheds direct frequent avalanche flows over the highway at strategic locations. As the elevation of the highway descends, the alignment passes through the environmentally significant and sensitive Beaver River valley. There is evidence of frequent rock falls, and Parks Canada staff report that a fatality resulting from falling rock prompted the recent realignment.

Terrain

This corridor segment is located entirely within Glacier National Park. The TCH follows the Illecillewaet River to Rogers Pass. Beyond Rogers Pass, the TCH follows Connaught Creek to its confluence with the Beaver River. There are no apparent major geotechnical constraints on the section between the

Park Boundary and Rogers Pass (LKI Segment #0980, offset 0.0 km to 24.1 km). This portion of Corridor Segment 270 was built on a wide bench near the valley bottom, therefore any geotechnical constraints to upgrading the highway are likely to be minor. A number of avalanche tracks and debris chutes were noted in this portion of the corridor segment during the rapid appraisal and from a review of the air photos (BCB 91174 No. 192-194, No 202-205; BCB 91175 No 61-70, No. 80-82; BCB91197 No. 74-77). In areas where the risk of avalanches is high, new lanes could be used for summer traffic until winter traffic volumes merit the extension of the snowsheds.

Along Connaught Creek, the section of this corridor segment from 24.1 km to 28.4 km contains considerable geotechnical constraints to upgrading the TCH. The highway is located on a steep slope above Connaught Creek and an upgrade will be difficult due to the risk of erosion of the cut and fillslopes and sediment discharge into the creek. An expanded highway also increases the possibility that it may be hit by an avalanche. New lanes could be used for summer traffic until winter traffic volumes merit the extension of the snowsheds, however in this section there is not much room to expand the highway. Numerous debris chutes and avalanche tracks were noted in this section during the rapid appraisal.

Between 28.4 km and 29.8 km, the TCH is built on a bench above Connaught Creek. Assuming that proper mitigation techniques to control sedimentation and erosion (resulting from exposed cut and fill slopes) are implemented, this section of the TCH could be expanded. The following 400 m section is more difficult to upgrade as bedrock is exposed on both sides of the highway. Between 30.2 km and 32.2 km, the highway is confined by the Beaver River floodplain and bedrock exposed in the cutslope. This section could be expanded as well, assuming that techniques to control erosion and prevent sediment loading into the Beaver River are utilized. Between 32.2 km and 34.2 km, there are no apparent major geotechnical constraints.

A section of the TCH, located between 34.2 km and 38.1 km, was realigned to move the roadway away from a hazardous rockfall. The highway, initially built on a bench above the Beaver River, was realigned to create a wider shoulder by moving the roadway away from the cutslope and closer to the

floodplain. This section already has three lanes and there does not appear to be enough room to construct an additional lane on the edge of this bench.

The remainder of the corridor segment is located on the lower slope of the Beaver River valley, just above the floodplain. The surficial materials are comprised primarily of a blanket of glacial till and minor colluvium overlying bedrock There are no major environmental constraints to expanding the highway through the rest of this corridor segment.

Geotechnical studies should be conducted for the difficult sections of the TCH to determine the most appropriate means of upgrading the highway while minimizing the erosion potential of the surficial materials within the highway corridor.

Fish and Aquatic Resources

The Illecillewaet River supports bull, rainbow and cutthroat trout, sculpins, mountain whitefish, and Dolly Varden (Reid Crowther and Partners, 1994a). As the highway gains in elevation, it leaves the Illecillewaet River valley. After the highway crosses Rogers Pass, it traverses the Connaught Creek valley. No listings are provided in the DFO fish habitat information summary, or in the FISS database for Connaught Creek. However, Parks Canada reports that Connaught Creek may support fall spawning runs of Dolly Varden, bull trout, mountain whitefish and slimy sculpin (Eddy, 1997 pers. comm.).

The eastern sections of the corridor segment traverse the Beaver River valley. The Beaver River in this area supports bull, rainbow and cutthroat trout, as well as Dolly Varden, mountain whitefish and sculpins (Reid Crowther and Partners, 1994a). Some habitat enhancement measures have been completed to provide better access for bull trout (Eddy, 1997, pers. comm.). In addition, Parks Canada reports that the Beaver River supports spring spawning runs of cutthroat and rainbow trout, and slimy sculpin, and fall spawning runs of bull trout, Dolly Varden, brook trout, and mountain whitefish (Eddy, 1997, pers. comm.).

Wildlife

WARS reports include two deer, two bears and one porcupine killed on the highway from 1991 to 1996. The wildlife in Glacier National Park is described by Reid Crowther and Partners (1994a). Wildlife that most frequently come in contact with the existing TCH corridor include moose, mule deer, white-tailed deer, mountain goat, black bear, grizzly bear, and coyote. There is little information on other mammals indigenous to the park. While no specific number of encounters with animals are provided, Reid Crowther and Partners provide locations of "hot spots". The hotspot for moose mortality is along the Beaver River (LKI segment #0985, offset 32 km to 43.8 km). Mountain goat mortality hotspots are near the Tupper snowsheds (26 km), near Cougar Creek bridge (13 km to 15 km) and near Heather Hill (42 km). Areas of high black bear mortality include Rogers Pass (20 km to 24 km), Illecillewaet (13 km to 17 km) and Flat Creek (2 km to 5 km). The Reid Crowther study (1994a) concluded that any highway expansion should be designed such that large stretches of highway do not present barriers to movement of large mammals within the park.

There is little information on the impacts of the TCH on smaller mammals, herpetofauna and birds within the park. As the territories of many of these animals are small, there is a concern that upgrading the TCH could result in the elimination of habitat.

Conservation Data Centre Observations

Red-listed Vertebrates: none listed
Red-listed Vascular Plants: none listed
Blue-listed Vertebrates: none listed
Blue-listed Vascular Plants: none listed

Archaeological, Cultural and Heritage Resources

This corridor segment is located entirely within Glacier National Park. In an Archaeological Inventory and Assessment conducted by ARESCO Ltd. (1979) and required as part of a project designed to reduce the grade of the CPR line in Glacier National Park, no significant archaeological resources were found in Glacier National Park along the transportation corridor. This area was

marginally utilized due to rugged topography, extreme climate, lack of game populations, poor fish habitat and lack of adequate transportation corridors.

In 1988, an inventory of historic features associated with the CPR abandoned 1885 rail alignment resulted in the assessment of 108 historic sites. In the early 1990s, several archaeological surveys were conducted in the park. These surveys focused on the location of topographical features along the TCH and the rail line. Subsurface testing was conducted on these topographical features. However, no new archaeological sites were noted. Nearly all of the 32 archaeological sites located within 100 m of the TCH are rail features having low archaeological significance. A few rail features have moderate archaeological significance, and a few other sites related to bridges, structural remains and warden stations are of low or moderate archaeological significance. According to Reid Crowther and Partners (1994a), the archaeological resource inventory of the Park is not complete.

Visual, Recreational and Tourism Resources

The steep terrain in some sections along the TCH create excellent viewing opportunities of the mountains and alpine environment within the park. The rest area and visitors interpretative centre at the top of Rogers Pass are important tourist and recreational resources. The high elevation facilitates the provision of trail heads to access the alpine area. Within the eastern sections of the corridor segment, the highway passes next to the Beaver River. The Beaver Pit, the Beaver Picnic Site and the Mountain Creek Campsite are all accessed from the TCH.

Agricultural

There are no ALR lands in this corridor segment.

Mineral, Petroleum and Aggregate Resources

There are no mineral claims, documented mineral occurrences or gravel pits in this corridor segment.

4.28 Corridor Segment 280–Glacier National Park to Columbia River Bridge (Donald)

Beginning	Glacier National Park East Boundary–LKI Segment #0985 offset 0.00 km
Ending	Columbia River Bridge–LKI Segment #0985 offset 29.66 km
Length	29.66 km

At the beginning of this corridor segment, the highway leaves the Beaver River valley, and generally follows the 1067 m contour along the north slope of the Dogtooth Range of the Purcell Mountains. Approximately two-thirds of this corridor segment consists of straight two-lane sections with good visibility and wide shoulders. The rest of this corridor segment consists of sections with passing lanes. The western sections (Heather Hill Lookout to the Big Lake Resort access) are bounded by some steep slopes with exposed bedrock which may pose constraints to expansion. Some older growth coniferous forest provides wildlife habitat along the edge of the segment. There are several forestry access roads in the area primarily around the Quartz Creek Watershed.

Terrain

This corridor segment extends from the Glacier National Park boundary to the Columbia River bridge. The TCH follows the Beaver River to a point 1.5 km south of the Columbia River, where it curves east and follows the Columbia Valley into the Rocky Mountain Trench. The surficial materials are most likely glacial tills overlying bedrock. The first 1.77 km of the TCH (LKI Segment 0985, offset 0.00 km to 1.77 km) traverses steep terrain. Between offsets 5.4 km and 12.9 km, occasional steep outcrops of bedrock are exposed in the cutslope, however there are still opportunities to expand the highway without too much difficulty. The terrain in the rest of this corridor segment does not appear to contain any major environmental constraints to upgrading this highway.

Fish and Aquatic Resources

This corridor segment is located on a side slope, and crosses several streams, including Quartz, Wiseman and Oldman creeks, that flow into the Columbia Reach. The FISS database from DFO and MELP indicates that the Quartz

and Oldman creeks support rainbow trout (DFO and MELP, 1995). There may also be kokanee and bull trout in these tributaries (Martin, 1997, pers. comm.) as well as cutthroat trout, Dolly Varden, mountain whitefish, and sculpins (Reid Crowther and Partners, 1994a).

Wildlife

WARS reports include 24 deer, ten moose, eight elk, three porcupines and three coyotes killed on the highway from 1991 to 1996. This area is used by moose and caribou as a migration corridor. There are several migration routes near Donald, but the corridor is not well defined (Martin, 1997, pers. comm.). Glacier National Park supports an abundance of wildlife species including black and grizzly bear, wolf, and ungulates such as moose, caribou, mountain goats, elk, and mule- and white-tailed deer. Other wildlife present in the Park include otter, mink, meadow vole, lynx, red squirrel, and amphibians.

The area between the east gate and km 11 is the site of the majority of moose kills (Woods, 1990). The Beaver River floodplain provides important moose habitat, and encroachment from highway expansion should minimize impacts to this area. There appears to be a mountain goat travel corridor between Mount Tupper (Hermit Range) and Mount MacDonald (Sir Donald Range) which may be affected by highway expansion (Reid Crowther and Partners, 1994a). A remnant caribou travel corridor is believed to cross the highway in the vicinity of Flat Creek. Highway designs which do not deter caribou movements should be considered in this area so that this corridor could be re-established (Woods, 1990).

Conservation Data Centre Observations

Red-listed Vertebrates: none listed

Red-listed Vascular Plants:

Species: Giant Hyssop (*Agastache foeniculum*)

Location: 28.8 km west of Golden along the Big Bend Highway, lined both sides of highway for 50 meters. UTM coordinates 4861m. E. 57040m. N. Last observed 1947. Within Corridor Segment 280, very close to TCH.

Blue-listed Vertebrates: none listed

Blue-listed Vascular Plants: none listed

Archaeological, Cultural and Heritage Resources

The archaeological potential along this segment is presently unknown. Therefore, an Archaeological Overview Assessment should be conducted before widening the TCH.

Visual, Recreational and Tourism Resources

There are several forestry roads leading off the TCH that may provide access to off-road recreational opportunities. The western sections of the segment include the Heather Lookout and access to the Big Lake Resort. Access is also provided to the Columbia Reach (McNaughton Lake), the Beaver Bay Campsite, Heather Mountain Lodge, and Kinbasket Lake. A rest area is provided at km 19 (LKI 0980).

Agricultural

There are no ALR lands in the corridor segment.

Mineral, Petroleum and Aggregate Resources

There are two mineral claim blocks in this corridor segment south of the TCH. Red Rock 1 and Red Rock 2 are owned by Elizabeth Ann Grady and expire on May 4, 1998. There are no documented mineral occurrences or gravel pits located within this corridor segment.

4.29 Corridor Segment 290–Donald to Anderson Rd (West of Golden)

Beginning	Columbia River Bridge–LKI Segment #0985 offset 29.66 km
Ending	Anderson Road–LKI Segment #0985 offset 53.85 km
Length	24.19 km

For the entire length of this corridor segment, the TCH consists of only two-lanes as it traverses the Columbia River Valley between Donald Station and Golden. The TCH in this corridor segment passes through an area which supports some farming and very low density residential settlements. Mixed forest with a few wetland areas, that provide important wildlife habitat, are intermixed with the lightly developed residential and farming areas. The highway is built on a side slope, but there are no steep sections or major rocky outcrops. There are several gravel pit operations within this corridor segment

and the CPR rail tracks parallel the highway on the south side. A wetland area is located on the south side of the highway, at the eastern end of the corridor segment near Edelweiss Creek.

Terrain

This corridor segment of the TCH is located within the Rocky Mountain Trench. The Rocky Mountain Trench is filled with quaternary sediments such as glacial till, outwash terraces and glaciolacustrine silts. Holocene fluvial terraces occupy extensive areas and consist of terrace gravels and floodplain silts, sands and gravels. The TCH follows the Columbia River floodplain and crosses several alluvial fans including the Waitabit Creek fan at Donald, the Blaeberry River fan and the Kicking Horse fan at Moberley. The TCH also traverses Moberley Marsh. It is anticipated that the terrain within the TCH corridor will only impose minor constraints to improving the highway. Any excavation to upgrade the highway will be restricted to the cutslope to the east as the Columbia River and the railway tracks are the confining factors to the west.

Fish and Aquatic Resources

The Columbia River in this segment supports bull and rainbow trout, mountain whitefish, westslope cutthroat, kokanee, northern squawfish and suckers (Enkon Environmental 1997). The river channel is braided in this corridor segment, and provides a variety of habitat including riparian vegetation and off channel habitats for rearing. In addition, the Conservation Data Centre reports that White Sturgeon are present in the Columbia River system. While the occurrence reported by the CDC is between the Keenleyside Dam and the US border, some sturgeon may also be present above the Keenleyside.

Wildlife

The Blaeberry River is a major wildlife corridor for moose, elk and coyotes. The south side of the Blaeberry River support known concentrations of mule and white- deer. Migration patterns for ungulates are not well defined., but generally follow creek and river beds. It is thought that deer, elk and moose migrate between the Columbia floodplain and upland areas in the spring and fall (Enkon Environmental 1997).

The winter range for moose is located in the Columbia River wetlands, and the summer range is on the southwest benchlands above the wetlands. They are also known to cross from Hunter Creek to Yoho National Park (Fenco-Lavalin 1991).

Elk appear to concentrate above the Upper Donald Road from Ford Station to Road to the Blaeberry River. Other herds of elk have been noted on the western benches south of Holt Creek (Fenco-Lavalin 1991).

Moberley Marsh, located in Gasden Provincial Park, is heavily used by migrating waterfowl in the spring and fall, and also support beaver . Moberley Marsh is a Ducks Unlimited project designed to enhance wildlife habitat. The project is funded by federal and provincial wildlife agencies (Nontell, 1998, pers. comm.).

The Columbia River from Blaeberry to Golden is classified as water fowl habitat with moderately high capability. Other wetlands located adjacent to the highway were also considered to be important for waterfowl and other birds.

WARS reports include ten deer, five elk, five porcupines, three moose, two bears, one coyote and one beaver killed on the highway from 1991 to 1996.

In the spring of 1997, the Columbia Wetland Wildlife Management Area was established to protect the Red- and Blue-listed species present in the wetlands. The Management Area comprises the Columbia Valley between Donald Station and Canal Flats. Corridor segments 290, 300 and 310 come in close proximity to the protected area. Any highway expansion plans should include consultation with the managers of this program at the Ministry of Environment Lands and Parks.

Conservation Data Centre Observations

Red-listed Vertebrates:

Species: White Sturgeon (*Acipenser transmontanus*)

Location: Present in the Columbia River system between the Keenleyside Dam and the US border, but some sturgeon may also be present above the Keenleyside. UTM Coordinates 444220m. E. 5465510m. N., 454621m. E 5428110m. N. Last observed 1991.

Red-listed Vascular Plants:

Species: Crawe's Sedge (*Carex crawei*)

Location: 2.4 km west of Golden, abundant in clay wetland by side of highway. UTM coordinates 5014m. E. 56858m. N. Last observed 1947. Near Corridor Segment 290, several hundred meters from TCH.

Blue-listed Vertebrates: none listed

Blue-listed Vascular Plants: none listed

Archaeological, Cultural and Heritage Resources

This corridor segment contains no known archaeological sites. However, in a previous study (Choquette, 1997a) three sections of the road having archaeological potential were identified. These sections contained numerous landforms often associated with archaeological sites. These landforms in this corridor segment include numerous disturbed terraces and alluvial aprons. There are some undisturbed sections within these landforms that may contain archaeological resources.

Visual, Recreational and Tourism Resources

Recreational activities include opportunities for fishing in the Columbia River, camping, and hunting. At Donald Station, access is provided to the Marl Creek Provincial Park, and numerous forestry service campsites along the Blackwater Creek Valley. A rest area is provided at the 38.7 km point (LKI segment 0985). The segment also provides access to Burges and James Gasden Provincial Park.

Tour operators in Golden offer guided canoe and kayak tours of the Columbia Wetland Wildlife Management Area. Visitors can expect to spot up to 200 different species of song birds on a one-day field trip.

Agricultural

In this section of the Columbia River valley there are significant ALR lands between Donald Station and Burges and James Gasden Provincial Park. However, all these ALR lands are located on the south side of the Columbia River, whereas, the highway is located on the north side. Prior to entering Golden, the highway passes through one additional parcel of ALR land at the eastern end of the corridor segment between Edelweiss Creek and the Columbia River.

Mineral, Petroleum and Aggregate Resources

There are no mineral claims, documented mineral occurrences or gravel pits located within this corridor segment.

4.30 Corridor Segment 300–Anderson Rd to Jct. Highway 95 (Golden)

Beginning	Anderson Road–LKI Segment #0985 offset 53.85 km
Ending	Junction Route 95–LKI Segment #0985 offset 56.06 km
Length	2.21 km

This short segment is located mostly within an urban area, although there is a wetland area on the south side of the highway at the west end of the corridor segment around Edelweiss Creek. Through the community of Golden, the highway is four lanes wide, and has signalized intersections, left turn bays and frontage roads to provide access to community and tourist services. The community of Golden is situated at the confluence of the Kicking Horse and Columbia Rivers

Terrain

This corridor segment is located at the west end of Golden and most of it is four lanes wide. However, within the first 600 m of this corridor segment (LKI Segment 0985, 54.3 km to 54.9 km), the highway is confined by a bedrock cliff on the east side of the highway and a wetland on the west side. The highway can still be upgraded provided that measures are taken to mitigate the impacts to the wetland of excavating a road cut into bedrock. The highway is located at the margin of the floodplain.

Fish and Aquatic Resources

The Columbia River in this segment supports bull and rainbow trout, mountain whitefish, westslope cutthroat, kokanee, northern squawfish and suckers (Enkon Environmental 1997). The river channel is braided in this corridor segment, and provides a variety of habitats including riparian areas and off channel rearing habitats for fish. In addition, the Conservation Data Centre reports that white sturgeon are present in the Columbia River system. While the occurrence reported by the CDC is between the Keenleyside Dam and the US border, some sturgeon may also be present above the dam.

Wildlife

This short segment has the capability to support wildlife similar to that described in the Corridor Segment 290. However, because of the urban nature of the segment, the interactions may be reduced due to human disturbances. WARS reports include seven deer, two moose, one elk, one coyote and one porcupine killed on the highway from 1991 to 1996.

In the spring of 1997, the Columbia Wetland Wildlife Management Area was established to protect the Red- and Blue-listed species present in the wetlands. The Management Area comprises the Columbia Valley between Donald Station and Canal Flats. Corridor segments 290, 300 and 310 come in close proximity to the protected area. Any highway expansion plans should include consultation with the managers of this program at the Ministry of Environment Lands and Parks.

Conservation Data Centre Observations

Red-listed Vertebrates:

Species: White Sturgeon (*Acipenser transmontanus*)

Location: Present in the Columbia River system between the Keenleyside Dam and the US border, but some sturgeon may also be present above the Keenleyside. UTM Coordinates 444220m. E. 5465510m. N., 454621m. E 5428110m. N. Last observed 1991.

Red-listed Vascular Plants

Species: Dark Lamb's Quarters (*Chenopodium atrovirens*)

Location: Outskirts of Golden B.C., over 5' tall, other small plants, along the dry roadside. UTM coordinates 5023m. E. 56838m. N. Last observed 1958. Within Corridor Segment 300 quite close to TCH.

Blue-listed Vertebrates: none listed

Blue-listed Vascular Plants: none listed

Archaeological, Cultural and Heritage Resources

There are no known archaeological resources within this corridor segment. However, it is likely that in the constructing the town of Golden, archaeological sites could have been destroyed. Undisturbed sections of fan terrace complexes and alluvial aprons may contain archaeological resources (Choquette, 1997a).

Visual, Recreational and Tourism Resources

The community of Golden provides a range of tourist facilities such as restaurants, accommodations and other facilities. A downhill ski area provides recreational opportunities primarily for community use, and cross country skiing is possible in a variety of areas near Golden. This corridor segment provides access to the Forest Service campsite at Cedar Lake on the west side of the Columbia River valley.

Tour operators in Golden offer guided canoe and kayak tours of the Columbia Wetland Wildlife Management Area. Visitors can expect to spot up to 200 different species of song birds on a one-day field trip.

Agricultural

There are no ALR lands in this corridor segment

Mineral, Petroleum and Aggregate Resources

No mineral claims are located near the TCH within this corridor segment. A gravel pit is located near Edelweiss.

There is one known mineral occurrence in this corridor segment located 1 km southwest of the Frontage Road exit. There are floodplain deposits of clay that can be used to construct bricks or majolica.

4.31 Corridor Segment 310–Jct Hwy 95 to Golden View Rd

Beginning	Junction Route 95–LKI Segment #0990 offset 0.00 km
Ending	Golden View Road–LKI Segment #0990 offset 2.40 km
Length	2.40 km

For the first 200 m of this corridor segment, the highway is four lanes wide as it leaves the Columbia River valley and enters the Kicking Horse River canyon. As the highway gains elevation, a passing lane allows eastbound traffic to overtake slow traffic for an additional 1.4 km. For the remaining 800 m of this 2.4 km corridor segment, the TCH is 2 lanes wide. The elevation gain is significant, as this corridor segment links Corridor Segment 300 with Corridor Segment 320 in the Lower Kicking Horse River canyon.

Terrain

The Town of Golden is located on an alluvial delta fed by the Kicking Horse River at its confluence with the Columbia River. In the western portion of this Corridor Segment, the TCH is located on this alluvial delta. Near the east boundary of Golden, the TCH climbs onto the south facing wall of the Kicking Horse River canyon where the surficial materials are glaciolacustrine deltaic sediments. The terrain does not impose any major constraints that might significantly impede an upgrade of this section of the highway.

Fish and Aquatic Resources

The Columbia River in this segment supports bull trout, mountain whitefish, whitefish and rainbow trout (DFO and MELP, 1995). The tributaries crossing the highway are in very steep terrain and do not likely support fish. However, other values such as the input of nutrients to the Columbia River may be important to consider during highway expansion.

DFO staff indicated that rainbow trout, Dolly Varden, and cutthroat trout are present in the Kicking Horse system and its tributaries (Rowland, 1997, pers. comm.). Reid Crowther and Partners (1994b) indicated that trout species, bulltrout, and pygmy whitefish are present in the Kicking Horse River.

Wildlife

The environment surrounding the highway to the east of Golden supports a range of wildlife species. Some residents in the community of Golden have assisted a herd of 14 bighorn sheep through the winter by, among other measures, providing antibiotics to treat Lung Worm disease (Fenco-Lavalin 1991). Bighorn sheep and mountain goats use the TCH corridor from Golden to Glenogle Creek to migrate from summer to winter ranges.

Mule and white-tailed deer winter in the Dart Creek area east of Golden, and migrate between the eastern bench of the Columbia River valley to the wetlands during fall and the reverse route in the winter. They also move back and forth across the TCH from Hunter Creek to the Yoho National Park boundary.

WARS reports include 18 deer, two moose, one elk, one coyote and one porcupine killed on the highway from 1991 to 1996.

In the spring of 1997, the Columbia Wetland Wildlife Management Area was established to protect Red- and Blue-listed species in the wetlands. The Management Area comprises the Columbia River valley between Donald Station and Canal Flats. Corridor segments 290, 300 and 310 come in close proximity to the protected area. Any highway expansion plans should include consultation with the managers of this program at the Ministry of Environment Lands and Parks.

Conservation Data Centre Observations

Red-listed Vertebrates: none listed
Red-listed Vascular Plants: none listed
Blue-listed Vertebrates: none listed
Blue-listed Vascular Plants: none listed

Archaeological, Cultural and Heritage Resources

There are no known archaeological sites within this corridor segment, however there is potential, particularly on alluvial fans and terraces near the confluence of the Columbia and Kicking Horse Rivers. These potential sites are likely to

have been destroyed during the construction of the various developments near the TCH corridor in Golden (Choquette, 1997b).

Visual, Recreational and Tourism Resources

Within the community of Golden there are recreational facilities at the community centre, and the sportsplex compound on the other side of the Kicking Horse River, away from the Highway. Two commercial campsites exist on either side of the highway at the eastern town limits.

Tour operators in Golden offer guided canoe and kayak tours of the Columbia Wetland Wildlife Management Area. Visitors can expect to spot up to 200 different species of song birds on a one-day field trip.

Agricultural

There are no ALR lands in this corridor segment.

Mineral, Petroleum and Aggregate Resources.

There are documented mineral occurrences, mineral claims within this corridor segment. There is one gravel pit located near the junction with Highway 23.

4.32 Corridor Segment 320–Golden View Rd to Yoho National Park

Beginning	Golden View Road–LKI Segment #0990 offset 2.40 km
Ending	Yoho National Park West Boundary–LKI Segment #0990 offset 25.93 km
Length	23.53 km

At the time of the field reconnaissance, MoTH was undertaking construction on the first several kilometres of the corridor segment to minimize potential danger from very unstable slopes up- and downslope from the highway. At the time of the reconnaissance, rock fall curtains were being installed, and some sections of unstable road were being repaired. One passing lane section was closed as the slope under it had recently failed. Beyond this 3 km or 4 km section of very steep terrain, the highway becomes a four lanes wide and descends towards the Kicking Horse River. The east end of the highway segment is situated on more level terrain and has wide shoulders with several

passing lane sections and one stretch with four lanes. In general terms, the TCH is built on steep terrain in the western portion and on the valley floor in the eastern portion.

Terrain

This corridor segment of the TCH follows the Kicking Horse River and extends from Golden to the west boundary of Yoho National Park. The next 6.8 km (LKI segment #0990, 2.9 km - 9.7 km) follows the Kicking Horse River through the Lower Canyon. The highway was built by blasting a road cut into a bedrock slope comprised primarily of sedimentary and metasedimentary rocks including limestone, schist, quartzite and slate. The slope gradient from the highway down to the Kicking Horse River commonly exceeds 45° within this section. Numerous rockslide scars and debris chutes were noted on the air photos (BCB 96080 No 273-276, No. 48-51). Upgrading the highway in this area will be extremely difficult as the road is confined by steep outcrops of bedrock on the cutslope and a steep fillslope over 100 m above the Kicking Horse River. The bedrock in this section is thinly bedded and readily disintegrates. A highway upgrade within this section will be extremely difficult, if not impossible given the slope stability issues and likelihood of sediment delivery into the Kicking Horse River during road construction.

Between the Yoho Bridge (9.7 km) and the Park Bridge (14.2 km), the highway is built on a wider bench on a steep bedrock slope. Therefore, upgrading it may be less difficult than in the previous section. Between the Park Bridge and the truck stop (16.7 km), the bench narrows and improving the TCH will be more difficult.

Prior to upgrading the TCH, geotechnical studies should be conducted to determine the type of highway improvement activities that may be feasible from both a geotechnical and environmental perspective. It should be noted that the sections of this corridor segment characterized by steep terrain and frequent mass movements are likely to be very difficult to upgrade.

The remainder of this corridor segment (16.7 km - 25.9 km) is located on gentler slopes in the Kicking Horse River valley. Any existing environmental

constraints to upgrading the highway appear to be relatively minor. The surficial materials in this section are primarily glacial till overlying bedrock.

Fish and Aquatic Resources

The DFO database and other data sources yielded no information regarding fish presence/absence in the Kicking Horse River. However, DFO staff indicated that rainbow trout, bull trout, and cutthroat trout are present in the system and its tributaries (Rowland, 1997, pers. comm.). Reid Crowther and Partners (1994b) indicated that trout species, bulltrout, and pygmy whitefish are present in the Kicking Horse River.

Wildlife

WARS reports include 13 deer, one bear, one coyote and one moose killed on the highway from 1991 to 1996.

The Kicking Horse River valley supports a wide variety of mammalian species including white-tailed deer, mule deer, Rocky Mountain elk, moose, Rocky Mountain bighorn sheep, mountain goat, grizzly bear, black bear, grey wolf, coyote, cougar, lynx, bobcat, wolverine and marten (LGL Ltd., 1997).

White-tailed deer and mule deer are abundant where the Kicking Horse River valley merges with the Columbia valley. The eastern area of the corridor segment contains habitat most suitable for elk, as the terrain is too steep in the western half. This corridor segment has a low capability to support moose. A herd of 26 bighorn sheep were counted in early 1997 and were seen as far east as the Yoho Bridge (LKI segment 0990, 9.5 km). A total of 216 mountain goats were observed between Yoho Bridge and Park Bridge (LKI segment 0990, 14.2 km) during the late spring and early summer. Grizzly bears are thought to use the entire corridor segment, especially the eastern half, as a movement corridor. Black bears were noted on both sides of the Kicking Horse River throughout the entire corridor segment.

There is some evidence that the range for a pack of wolves located primarily within Yoho National Park also covers the eastern half of this corridor segment. Wolves are located on both sides of the Kicking Horse River. However, the main crossing appears to be within Yoho National Park.

Cougars, lynx and bobcats are able to move easily through rugged terrain and therefore it is expected that they can move freely within the Kicking Horse River valley.

Conservation Data Centre Observations

Red-listed Vertebrates: none listed

Red-listed Vascular Plants:

Species: Dark Lamb's Quarters (*Chenopodium atrovirens*)

Location: 23 miles west of Field, on mountainside scree, and scree of built up road. UTM coordinates 5179m. E. 56793m. N. Last observed 1958. Within Corridor Segment 320, very close to TCH.

Blue-listed Vertebrates: none listed

Blue-listed Vascular Plants: none listed

Archaeological, Cultural and Heritage Resources

Between Golden and Yoho National Parks there are no known archaeological resources. In an Archaeological Overview Assessment by Choquette (1997b), the polygons identified in this corridor segment were classified as having medium potential.

Visual, Recreational and Tourism Resources

There are several pull-outs and view points along the TCH along the steeper sections of this corridor segment. Logging roads in the Palliser area may provide recreational access into the Beaverfoot Range.

Agricultural

There are no ALR lands in this corridor segment.

Mineral, Petroleum and Aggregate Resources

There are no current mineral claims or gravel pits within this corridor segment.

Two mineral and placer reserve zones are located along the Kicking Horse River. The first one, established in March, 1994, was requested by B.C. Hydro and extends from Golden to a point approximately 6 km to the east.

Mineral claims must be staked so as to minimize interference with transmission lines. The mineral reserve status expires March 1, 1999. The second mineral reserve was established in January, 1997. This mineral reserve was requested by MoTH and extends from Golden to Yoho. It was probably established to preserve a right of way in the event of highway expansion. No mineral claim staking can be done until November 1, 2001.

There are three mineral occurrences listed in the MINFILE database. The King David Occurrence is located 500 m south of the TCH and 4 km from the west boundary of the corridor segment. This is a possible deposit of uranium, germanium, zirconium and platinum. The Glenogle quarry is an abandoned dolomite quarry that was operated by the CPR to supply railway ballast in the 1940s. It is located 300 m south of the 10.0 km point of LKI segment #0990 on the TCH. The Glenogle Slate, located 250 m south of the 13 km point of LKI segment #0990, is an abandoned quarry containing a 100 m long and 5 m wide exposure of slate.

4.33 Corridor Segment 330–Yoho National Park

Beginning	Yoho National Park West Boundary–LKI Segment #0995 offset 0.00 km
Ending	Alberta Border–LKI Segment #0995 offset 45.30 km
Length	45.30 km

This corridor segment is constructed along the valley bottom of the Kicking Horse River and characterized by wide shoulders. There are several three-lane sections totalling approximately 20 km, and one four-lane section. The highway provides access to several campsites, picnic grounds, water-fall view points, and the very popular viewpoint which overlooks the Spiral Tunnel. To accommodate tourist traffic, the highway widens at many of these intersections to provide left turn bays, merge lanes, and safe wide shoulders. Several locations such as the Ottertail and Kicking Horse bridges (immediately west of the access road to Emerald Lake), the Spiral Tunnel view point and the Sherbrook Creek culvert are constrained. As the highway approaches the community of Field, it is situated within the floodplain of the

Kicking Horse River. A section of the floodplain on the north side of the TCH was cut off from main floodplain by the construction of the highway.

Terrain

In this corridor segment, the TCH follows the Kicking Horse River floodplain to the east boundary of Yoho National park at the Alberta Border. From 0.0 km to 4.8 km (LKI Segment #0995), the highway traverses thin morainal and glaciolacustrine deposits which overlie bedrock (Reid Crowther and Partners, 1994b). Any existing geotechnical constraints to upgrading the highway are expected to be minor.

Between 4.8 km and 5.1 km, there is a wetland complex on the floodplain preventing any expansion of the highway to the south, however it could still be shifted to the north.

Between 5.1 km and 9.0 km, the TCH is situated on the Kicking Horse River floodplain at the fringe of several alluvial fans (Reid Crowther and Partners, 1994b). The constraints imposed by the terrain towards the expansion of the highway appear to be relatively minor.

The TCH was built on shale and limestone bedrock overlain by glacial till between 9.0 km and 12.4 km. From 12.4 km to 15.6 km, the highway passes several colluvial fans fed by debris flows. From 15.6 km to 19.5 km, the terrain within the TCH corridor is a veneer of till overlying bedrock comprised primarily of calcareous slates (Reid Crowther and Partners, 1994b).

The main constraint to upgrading the TCH within these sections is its confinement of between 10 m to 12 m high outcrops of bedrock and the Kicking Horse River floodplain. Road cuts made into glacial till and colluvial fans will be even deeper. This will result in an increase in the amount of soil exposed. There is also the possibility of debris flows moving onto the highway causing blockages (Reid Crowther and Partners, 1994b).

The TCH continues to follow the edge of the Kicking Horse River floodplain from 19.5 km to 20.5 km. This section is prone to debris flows draining from Mount Hurd (Reid Crowther and Partners, 1994b).

Between 20.5 km and 26.0 km, the TCH traverses a low relief section where the surficial materials are composed of floodplain deposits and basal till (Reid Crowther and Partners, 1994b). Any constraints imposed by terrain and the surficial materials are likely to be minor.

In the next section between 26.0 km and 27.3 km, the topography has moderate relief and is bedrock controlled. The TCH crosses the Kicking Horse River in this section. The highway is constrained by the floodplain and a steep cutslope.

Between 27.3 km and 34.3 km, the TCH follows the edge of a braided channel floodplain. The northwestern portion of the floodplain has been cut off by the highway. This alienated floodplain is an area for possible habitat rehabilitation in compensation for any riparian habitat lost as a result of upgrading the TCH. This section of the road could be re-routed closer to the base of slope and cut into the colluvial fans, expanding the floodplain. The Mount Stephen avalanche/debris flow path is located within this section. Debris flows rarely reach the road, but avalanches do. However, Parks Canada has developed mitigation procedures for dealing with avalanches that involve triggering controlled avalanche blasts. The constraints to highway expansion imposed by the terrain and surficial materials in this section are relatively minor.

The highway is situated on the floodplain between 34.3 km and 35.6 km. As a result of the confinement of the highway by the bedrock exposed in the road cut to the south and the floodplain to the north, there is a risk of an influx of sediment into the Kicking Horse River as a result of highway upgrading activities.

Between 36.5 km and 40.1 km, the highway is built on a bench cut into a short bedrock canyon. Next, it traverses several glacial fluvial terraces interspersed with outcrops of bedrock. The highway is confined by bedrock on one side and the Kicking Horse River floodplain on the other.

From Wapta Lake (40.1 km) to the end of Corridor Segment 330 (45.3 km) at the Alberta border, the highway follows the valley bottom. Any constraints to upgrading the highway imposed by the terrain are likely to be minor. Avalanche tracks were noted during the rapid appraisal and on the air photos (BCB 96084 No. 1-9).

Fish and Aquatic Resources

The DFO database and other data sources yielded no information regarding fish presence/absence in the Kicking Horse River. However, DFO staff indicated that rainbow trout, Dolly Varden, and cutthroat trout are present in the system and its tributaries (Rowland, 1997, pers. comm.). Reid Crowther and Partners (1994b) indicated that trout species, bulltrout, and pygmy whitefish are present in the Kicking Horse River.

Some large sections of fish habitat on the north side of the highway have been isolated from the mainstem. It may be possible to hydraulically reconnect some of these areas to the mainstem.

Wildlife

There are no WARS report data for this corridor segment. However, this corridor segment passes through excellent wildlife habitat, and conditions are similar to those in the previous corridor segment. Wetland areas are present near Wapta Falls (LKI Segment #0995, offset 6 km), Misko Viewpoint (10 km), Ottertail viewpoint (17 km) and the area between the 27 km mark and the West Louise Lodge (41 km).

Ungulates observed near the highway in this corridor segment include elk, moose, mule deer, white-tailed deer, and mountain goats. Over 60% of wildlife mortality resulting from collisions with motor vehicles were elk. Significant numbers of mule deer, moose and white-tailed-deer have also been killed. Elk are killed in high numbers throughout the entire park. Mule deer are killed in mortality "hotspots" at Wapta Lake, near the Field townsite and near the Leanchoil marsh. High numbers of moose were killed near the Ottertail bridge, near the Leanchoil marsh and near the Leanchoil siding (Reid Crowther and Partners, 1994b).

Large carnivores frequently observed near the highway include black bear, grizzly bear and coyotes. Coyotes are killed at a number of hotspots throughout the park, while there are no hotspots for black bears. High numbers of grizzly bears have been seen near Wapta Lake, in the Field townsite, near the Ottertail drainage and near the west gate. Mortality hotspots for grizzly bear include the Cathedral siding, and near the Leanchoil marsh (Reid Crowther and Partners, 1994b).

There is very little information on the potential impacts of upgrading the TCH on small mammals, herptiles and birds. However, it is quite possible that highway upgrading activities could eliminate critical habitat for these animals.

Conservation Data Centre Observations

Red-listed Vertebrates: none listed

Red-listed Vascular Plants: none listed

Blue-listed Vertebrates: none listed

Blue-listed Vascular Plants:

Species: Macoun's Fringed Gentian (*Gentianella crinita* ssp. *macounii*)

Location: Near Field on the west bench of the kicking horse river. UTM Coordinates 5354m. E. 56938m. N. Last observed 1958. Near or within Corridor Segment 330. Located almost 1 km from the TCH.

Archaeological, Cultural and Heritage Resources

Reid Crowther and Partners (1994b) identified 25 archaeological sites within 100 m of the TCH. Most of these sites are related to either mining activity, railway construction, warden stations and other events related to Euro-Canadian history. Only one site is prehistoric and it is the only site rated as having a high archaeological significance.

Visual, Recreational and Tourism Resources

The Spiral Tunnel Viewpoint is a popular rest stop which is well utilized by tourists. The access to the rest area is very well designed with safety in mind, with left turn access and long merge lanes. Other amenities include picnic

sites and campsites with views of the mountains around the Kicking Horse River. In and around Field, visitors can find accommodations and restaurants. There is a tourist information centre in Field.

The segment of the Kicking Horse River within Yoho National Park was nominated by Parks Canada and designated to the Canadian Heritage Rivers System by its board in 1989. The river was also suggested for inclusion into the B.C. Heritage River System, but was not selected because of the deemed greater significance of other proposed rivers (B.C. Heritage Rivers Board, 1997).

Agricultural

There are no ALR lands in this corridor segment

Mineral, Petroleum and Aggregate Resources

Within this corridor segment, there are no mineral claims or any aggregate resource operations. There are, however a number of documented mineral occurrences. The Empire Occurrence is exposed by an adit 100 m south of the Ottertail River. This is a potential deposit of copper and lead. The Sunday prospect is located 900 m southwest of the Ottertail Bridge on the TCH. This is a potential deposit of lead, zinc, copper and silver. The Field Occurrence, located approximately 500 m south of the Field exit, consists of trace quantities of native mercury in the gravels of the Kicking Horse River. The mercury source is unknown. The Mount Stephen Occurrence is a potential copper deposit located 3.5 km southeast of the Field exit. Two abandoned mines are located near the Yoho Valley Campground. Both the Monarch and Kicking Horse mines contained deposits of lead, zinc, silver, cadmium and copper. The Monarch Mine operated from 1890 to 1957 while the Kicking Horse Mine was open from 1942 to 1951.

5

ANALYSIS

Chapter 5 Analysis

The chapter presents the following:

- the ratings of environmental sensitivities as they relate to the expansion of each corridor segment;
- the anticipated cumulative effects of upgrading the highway;
- a discussion of some general, and specific design deficiencies of the existing highway corridor; and
- the information gaps discovered in the course of undertaking the study.

5.1 Ratings of Corridor segments

This section of the report rates the environmental suitability of upgrading the highway corridor segments. The ratings presented in this chapter are a combination of the initial ratings applied during the field reconnaissance (i.e., rapid environmental appraisal) with subsequent refinement based upon documentation and existing studies, and agency interviews. During the reconnaissance, the environmental sensitivity of each LKI section was rated on a scale of 1 to 5 with 1 indicating low environmental sensitivity, and 5 high sensitivity. See Appendix G for preliminary ratings. After augmenting the ratings with additional information, the five point rating system, described in section 3 of this report, was collapsed into three categories to define suitability for upgrading. The three categories are simply called *good*, *fair* and *poor*.

For the purposes of this chapter, the low sensitivity ratings (1) were grouped into a *good* category, environmental sensitivities of "2's and 3's were combined into a *fair* category; and the "4's and 5's" were combined to create a *poor* category. The percentage of length of LKI sections within the corridor segments which are in the various categories were then determined. Those Corridor Segments in which no LKI sections received high environmental sensitivity ratings were placed into the *good candidate* category. Corridor Segments for which significant lengths of LKI sections received high environmental sensitivity ratings were placed into the "Poor Candidates" category. The remaining corridor segments were placed into the fair category

by default. Tables 5.1 to 5.3 summarize this analysis. The environmental ratings of all of the corridor segments are summarized in Figure 2.

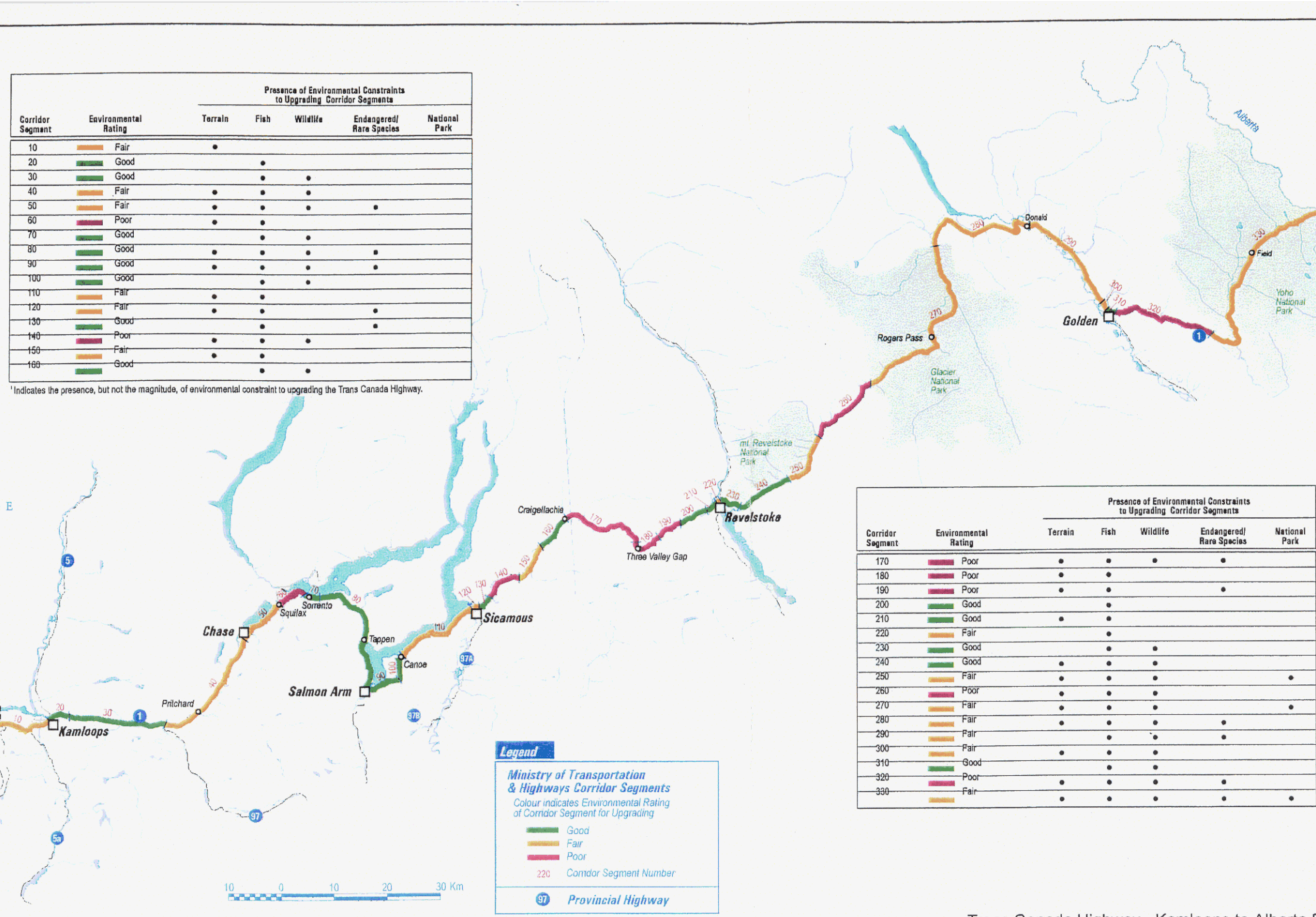
Table 5.1 Corridor Segments Rate *Good* Candidates for Upgrading

Corridor Segment	Corridor Segment Length	Length Good (1)	Length Fair (2&3)	Length Poor (4&5)
20	4.97	100%	0%	0%
30	20.93	100%	0%	0%
70	3.46	100%	0%	0%
80	29.03	98%	2%	0%
90	7.68	100%	0%	0%
100	5.86	100%	0%	0%
130	3.25	93%	7%	0%
160	8.42	100%	0%	0%
200	6.52	100%	0%	0%
210	2.63	62%	38%	0%
230	4.69	100%	0%	0%
240	12.92	92%	8%	0%
310	2.40	100%	0%	0%

The corridor segments listed above had no LKI sections with high environmental sensitivities, few in the moderate range, and the majority received low environmental sensitivity ratings. They are all rated as good candidates for upgrading. Corridor Segment 210, on the western outskirts of Revelstoke, is an exception. In this Corridor Segment 38% of the LKI lengths received moderate ratings. However, it is a very short segment with only 4 LKI sections. The central section is constrained between a rock cliff and the CPR rail tracks, and the cutslope is fairly steep and will have to be excavated in order to upgrade this stretch of the highway. Measures to control the erosion of recently exposed cut and fill surfaces and reduce the risk of a sediment discharge into Tonkawatla Creek should be implemented.

Corridor Segment	Environmental Rating	Presence of Environmental Constraints to Upgrading Corridor Segments: Terrain	Fish	Wildlife	Endangered/ Rare Species	National Park
10	Fair	•				
20	Good		•			
30	Good		•	•		
40	Fair	•	•	•		
50	Fair	•	•	•	•	
60	Poor	•	•			
70	Good		•	•		
80	Good	•	•	•	•	
90	Good	•	•	•	•	
100	Good		•	•		
110	Fair	•	•			
120	Fair	•	•		•	
130	Good		•		•	
140	Poor	•	•	•		
150	Fair	•	•			
160	Good		•	•		

[1] Indicates the presence, but not the magnitude, of environmental constraint to upgrading the Trans Canada Highway.



Corridor Segment	Environmental Rating	Presence of Environmental Constraints to Upgrading Corridor Segments: Terrain	Fish	Wildlife	Endangered/ Rare Species	National Park
170	Poor	•	•	•	•	
180	Poor	•	•			
190	Poor	•	•		•	
200	Good		•			
210	Good	•	•			
220	Fair		•			
230	Good		•	•		
240	Good	•	•	•		
250	Fair	•	•	•		•
260	Poor	•	•	•		
270	Fair	•	•	•		•
280	Fair	•	•	•	•	
290	Fair		•	•	•	
300	Fair	•	•	•		
310	Good		•	•		
320	Poor	•	•	•	•	
330	Fair	•	•	•	•	•

Trans Canada Highway - Kamloops to Alberta E
Environmental Rating of Corridor Segments for Upg

Table 5.2 Corridor Segments Rated *Fair* Candidates for Upgrading

Corridor Segment	Corridor Segment Length	Length Good (1)	Length Fair (2&3)	Length Poor (4&5)
10	12.07	48%	36%	16%
40	27.42	76%	7%	17%
50	11.18	32%	52%	15%
110	19.79	39%	51%	9%
120	1.54	45%	38%	18%
150	8.76	46%	54%	0%
220	1.32	72%	0%	28%
250	12.65	3%	97%	0%
270	43.81	0%	80%	20%
280	29.66	69%	31%	0%
290	24.19	53%	47%	0%
300	2.21	53%	47%	0%
330	45.30	0%	90%	10%

The corridor segments, which were not *good* or *poor* candidates for expansion, were placed into the *fair* category by default. Some of the primary characteristics of these corridor segments are briefly summarized below:

Corridor Segment 10 (Urban Kamloops)

The highway in this corridor segment traverses urban Kamloops. In this corridor segment, the TCH descends from the Thompson Plateau into the Thompson Valley. Between the Aberdeen overpass and the Yellowhead exit, the TCH is located on a steep slope above a residential area and an industrial park. The highway crosses Peterson Creek which is located in a steep gully located in fine textured soils. Construction activities should include mitigative measures to prevent sediment from reaching Peterson Creek.

Corridor Segment 40 (Monte Creek to Chase)

The highway within this Corridor Segment passes through Agricultural Land Reserve lands within the South Thompson River valley. The valley is shared by the CPR rail tracks, the TCH, and the river. In some locations, specifically near Hoffmans Bluff, the river and rail tracks are very close to one another, and the highway is constrained by a rock face on the south side. In most cases, expansion may be possible onto agricultural lands to the south. This

Corridor Segment also contains 30 proven archaeological sites, and the rest of the entire segment has been rated as having unproven heritage potential.

Corridor Segment 50 (Chase to Squilax Bridge)
The western sections of this Corridor Segment are built in an area of fairly steep slopes, with several of the central and eastern sections constrained between rock bluffs on one side and the Little Shuswap Lake and the CPR line on the other. The lake provides important fish habitat, and observations of Red- and Blue-listed plant species have been reported in this segment. It also contains eight heritage sites within the Stemqumwhulpa I. R. 5.

Corridor Segment 110 (Canoe to Bruhn Bridge)
The eastern third of this Corridor Segment near the Shuswap viewpoint is built through steep terrain with exposed bedrock upslope of the TCH and a steep embankment that slopes down to the lake. The western LKI sections have similar constraints though they are not quite as severe. Shuswap Lake provides very important fish habitat Mitigation techniques should focus on erosion control and slope stabilization to prevent sediment discharge into Shuswap Lake.

Corridor Segment 120 (Sicamous)
This Corridor Segment is very short, but includes a constraint at the eastern end where the highway is very close to a rock bluff, the CPR rail tracks and the Eagle River. There is also a wetland that probably supports a diversity of wildlife. Because this is a short Corridor Segment, with only 4 LKI sections, those sections with high ratings have a greater influence in the evaluation.

Corridor Segment 150 (Malakwa)
This Corridor Segment consists of a four-lane divided highway with frontage roads providing access to ranches, farms, and very low density residential lots. There are locations where the highway is close to the Eagle River floodplain, and there are several oxbow lakes that provide wildlife habitat. This segment is located adjacent to the Eagle River floodplain, which supports sockeye, coho, and chinook salmon, Dolly Varden, kokanee, westslope cutthroat, mountain whitefish, rainbow trout, sculpins, dace, suckers, shiners, and carp (DFO and MELP, 1995). The highway crosses Yard Creek which supports

coastal and westslope cutthroat trout, Dolly Varden and steel head (DFO and MELP 1995).

Corridor Segment 220 (Revelstoke)
This is an urban segment through the outskirts of Revelstoke. The only environmental constraint is the Columbia Bridge. In the event of a highway upgrade, this bridge may require widening and the Columbia River contains significant fish habitat.

Corridor Segment 250 (Mount Revelstoke National Park)
This Corridor Segment is within a National Park and we accorded a slightly higher sensitivity rating to reflect the intrinsic value of park land. Nevertheless, there are some areas with steep slopes and avalanche chutes which may constrain expansion of the highway. The highway varies in proximity to the Illecillewaet River, which provides fish habitat. In the locations where the highway is close to the river, environmental considerations of working near a fish bearing water course, will apply during highway upgrading.

Corridor Segment 270 (Glacier National Park)
As a matter of course, all ratings applied in National Parks were increased by one level to account for the increased environmental values of park land. Therefore, no LKI sections received ratings below "2" even if there were minimal environmental constraints. In fact, only 20% of the LKI lengths received high sensitivity ratings, and the remainder were moderate. However, the proximity to the Illecillewaet River and the Beaver River, and the combination of several areas with steep slopes and avalanche chutes will pose constraints to expansion.

Corridor Segment 280 (Glacier National Park to Donald Station)
The western sections of this Corridor Segment are within the environmentally significant Beaver River valley, and include some steep slopes with exposed bedrock. In general terms however, none of the sections received high environmental sensitivity ratings and the majority of LKI sections received low sensitivity ratings.

Corridor Segment 290 (Donald Station to Anderson Road)
This segment is exclusively two lanes, and traverses the Columbia River valley. The land uses within the segment include some agriculture, low density residential settlements, mixed forest and several wetland areas. While there are no sections in this segment which were rated high environmental sensitivity, the number of sections with fair ratings placed this segment into the fair category.

Corridor Segment 300 (Anderson Road to Jct. Highway 95, Golden)
Approximately 65% of the LKI lengths within this segment are comprised of four-lane highway, all located within the community of Golden. The remaining sections, were rated *fair* due to proximity to wetlands, and confinement of the highway between the wetlands and a rock bluff.

Corridor Segment 330 (Yoho National Park)
This Corridor Segment follows the Kicking Horse River valley, and in some locations, an associated floodplain. While only 8% of the LKI section lengths were given a high environmental sensitivity rating, the remaining sections in Yoho National Park were given ratings which reflect the higher value of park land. LKI sections between km 10.5 and 13 and the sections at either end of the four-lane sections (at km 36) were given moderate ratings because of constrictions created by a rock bluff and proximity to the water course.

Table 5.3 Corridor Segments Rated *Poor* Candidates for Upgrading

Corridor Segment	Corridor Segment Length	Length Good (1)	Length Fair (2&3)	Length Poor (4&5)
60	6.95	16%	48%	36%
140	8.54	42%	26%	32%
170	18.70	45%	16%	40%
180	7.33	23%	24%	53%
190	6.00	34%	0%	66%
260	17.80	24%	20%	56%
320	23.53	42%	13%	45%

The corridor segments listed above had significant lengths rated in the high environmental sensitivity category and hence were rated *poor* candidates, based on environmental criteria, for highway upgrading. In most cases, these corridor segments do not have sections with four lanes. However, 1% to 2% of the length of Corridor Segments 270 and 320 are comprised of four lanes. Most of the sensitivities are the result of confinements of the highway between rock cliffs or bedrock outcroppings, water courses and rail tracks. The specific sensitivities of each Corridor Segment in this category are outlined below:

Corridor Segment 60 (Squilax Bridge to Sorrento)
Much of Corridor Segment 60 is constrained by rock bluffs located to the south and the South Thompson River to the north of the TCH respectively. A portion of the highway has been constructed on riprap fill, that was placed in the watercourse. There is no riparian vegetation or littoral zone on this riprap fill. The South Thompson River provides very important fish habitat for sockeye, coho, pink and chinook salmon as well as Dolly Varden char, kokanee and other fish species.

Corridor Segment 140 (Cambie)
This Corridor Segment is quite diverse, but contains several environmental constraints to further TCH expansion. There are several wetlands and low lying pasture areas that have been disturbed in the past, but which now provide diverse and important wildlife habitat. There are several constrictions between bedrock cliffs and the CPR rail tracks and, in some locations, commercial establishments. The entire segment is located within ALR lands, and is within the Eagle River valley which supports a diversity of fish species.

Corridor Segment 170 (Eagle River Floodplain)
This Corridor Segment is immediately adjacent to the braided Eagle River channel which provides important fish and wildlife habitat. The highway is constrained in the central sections by proximity to the river channel and riparian vegetation on the north and a steep unstable bedrock cliff to the south. Environmental agencies have singled out this area for its importance and would be reluctant to allow a net loss of fish habitat. This corridor segment is likely to be very difficult to upgrade.

Corridor Segment 180 (Three Valley Gap)

Much of this Corridor Segment is constructed on riprap fill that was placed in the lake on the north side of the highway. The highway is constricted on the south by a steep and sometimes unstable rock cliff. The riprap in the lake does not support riparian vegetation or a littoral zone, therefore, even though this segment is placed in the poor category, opportunities for habitat enhancement may exist by terracing the fill and planting riparian vegetation to create a littoral zone. While this may be possible, detailed discussions with regulatory agencies will be required and a long-term planning horizon can be anticipated. Given the dynamic geological conditions in the area, this corridor segment may be extremely difficult to upgrade.

Corridor Segment 190 (Monashee Summit)

The highway in this area is adjacent to the Tonkawatla Creek and passes near Victor, Clanwillian and Griffin Lakes. The watercourse between the lakes provides very important fish habitat. The highway is constrained between Clanwilliam Lake, and a rock cliff at the eastern end of the segment. There are two options for expanding the highway, both with a potential for causing an increase in sedimentation into Victor or Clanwilliam Lakes and the Eagle River. One option involves expanding the highway by excavating into the hill slope, increasing the erosion potential of recently exposed cut and fill slopes. The other option is to expand the highway by placing roadbed fill into the watercourse. It should be noted that due to the above constraints and the dynamic geological conditions, upgrading this corridor segment may be extremely difficult.

Corridor Segment 260 (Mount Revelstoke National Park to Glacier National Park)

The eastern 10 km of this corridor segment is characterized by steep and sometimes unstable slopes. The highway varies in proximity to the Illecillewaet River (contains fish habitat), and areas which are close to the river may provide an additional sensitivity to expansion.

Corridor Segment 320 (Golden to Yoho)

The western portion of this corridor segment, which is situated within the Kicking Horse River canyon may be the most challenging of any of the sections in the entire corridor. At the time of the field reconnaissance, work crews were installing rock fall curtains to minimize the danger to highway users from falling rocks. Several slopes located both up- and down-slope to the highway have failed and one passing lane was closed as the result of such a failure. While the eastern LKI sections are located in more forgiving valley bottom terrain, the severe problems in the western sections place this Corridor Segment in the *poor* category.

5.2 *Cumulative Effects of Highway Widening*

Cumulative effects result from a series of incremental and usually negative changes caused by past, current, and anticipated projects. Cumulative effects can be additive such that the consequences of each incremental change is not significant, but the sum of the changes over time can have considerable impacts. In addition, the incremental effects of one project, such as highway widening, can interact with other projects, such as forestry or commercial developments, resulting in aggregated consequences which can amplify over time. Cumulative effects generally do not directly affect the project which initiated the change but, instead, often indirectly affect other environmental or resource values in the vicinity of the project.

The identification of cumulative effects is generally not expected to be as detailed as the assessment of direct environmental impacts of a project. They are frequently qualitative, rather than quantitative, especially at an overview level. As part of this overview study, the potential cumulative effects related to highway widening were identified using information obtained during the course of the study, and the best professional knowledge and judgement of the study team. It should be noted that at an overview level assessment, it is not possible to identify a comprehensive list of all cumulative effects. The cumulative effects identified by the study team are presented by subject area below:

5.2.1 Terrain

In areas where the road is constructed as a cut and fill road, there may be a greater likelihood of slope failure from an increase in the size of the road cuts. An expanded highway will also result in an incremental increase in road run-off and may raise the likelihood of slope failures below the road. In addition, the increased amount of run-off from a larger impermeable surface of a wider highway will result in more water being diverted to ditches and culverts.

5.2.2 Vegetation

Highway improvements, specifically expansion, will result in the loss of existing road-side vegetation. Sometimes this vegetation can be replaced or perhaps enhanced. In other cases, the loss of vegetation may include portions of forest stands that provide wildlife habitat and forest environments. In areas near watercourses, the loss of riparian vegetation may result from highway expansion.

5.2.3 Fish

The corridor crosses numerous creeks and streams through the use of traditional culverts. A wider highway will result in longer culverts and could, therefore, pose a more significant barrier to fish migration than a two-lane highway. The addition of more lanes may also result in the incremental loss of existing habitat at river and stream crossings and along streams, rivers, and lakes that parallel the TCH.

5.2.4 Wildlife

Wider highways create a more significant barrier for wildlife to cross than narrower highways. There are two possible effects: Firstly the wider barrier may be so significant that some species will be reluctant to cross the highway, cutting them off from some of their traditional grounds. Secondly, a wider facility may increase the incidences of vehicle/animal encounters due to the larger crossing distances and potentially higher vehicle speeds. Wildlife fencing may serve to mitigate accident rates involving wildlife.

The increased width of a highway in some locations may result in the loss of riparian areas which frequently provide transportation corridors for wildlife migration.

A wider highway will require the application of additional de-icing salt during winter months. The added salt may attract more ungulates, potentially resulting in an incremental increase in vehicle/animal accidents.

5.2.5 Land Use

A wider highway has increased land requirements when compared to a two- or three-lane facility. This is especially true when modern standards are applied: wider lanes; better sight-lines and shying distances; left turn bays; longer merge lanes; and larger shoulders. Several agency representatives who were interviewed noted that wide divided highways are not aesthetically pleasing. Therefore, they wanted to minimize the width of the corridor to the greatest extent possible, especially within parks. Loss of park land to highway construction is seen as an inappropriate use of park land by many agency representatives.

Much of the corridor is within the bottom of river valleys where soils with high agricultural capability are found. In many cases, the highway is adjacent to rail tracks or watercourses on one side and agricultural land on the other. Consequently, any expansion may necessarily take place on agricultural land. This land requirement for a widened highway amounts to approximately one hectare per 2.5 km of additional lane (not counting shoulders, merge lanes or turning bays). When placed on agricultural land this amounts to a significant incremental land requirement, particularly since much of the ALR land in the valleys is already confined by steep slopes, water courses, the railway tracks, the existing highway, and residential and commercial developments.

The existing corridor also includes extensive residential developments in a full range of configurations. The corridor services the full spectrum of communities, ranging from municipalities to retirement communities, or many smaller communities which may or may not be incorporated, to individual isolated houses and homesteads. Many of the homes are located directly

adjacent to the highway, and a wider highway may require obtaining some land which is currently privately owned. Similarly, the land requirements for highways in communities results in cumulative loss commercial land.

5.2.6 Visual

The increased size of the highway and right-of-way as viewed from points away and above the highway may result in a less attractive viewscape. Also, opportunities to view vistas that are currently seen from two-lane sections of highway, may be diminished by highway widening if pull-outs or viewpoints are sacrificed to provide room for a additional lanes.

5.2.7 Conclusion

Over the decades, incremental increases in the rates of development of natural resources, commercial, and urban areas along the corridor, in concert with continuous improvements to the highway, have combined to reduce the area and quality of wildlife habitat. No one class of development is responsible for the adverse impacts to the environment, but it has been the cumulative effect of a continuous series of projects and related impacts. When widening the TCH, there are opportunities to curb additional cumulative effects, reverse some negative effects of past activities and mitigate some of the impacts to wildlife and fish habitat in the vicinity of the corridor. Recommendations that will assist in reversing some past impacts and mitigating some of the additional impacts of widening are described in section 5.3 and Chapter 6 respectively.

5.3 Highway Design Shortcomings

The planning framework used by MoTH for the TCH includes measures to gauge various aspects of how the highway performs (see Section 1.2 of this report). One of the performance measures is environmental sustainability which evaluates how well the highway meets environmental criteria in terms of land alienation, noise, energy consumption, emissions, wildlife, fish, water pollution and ecosystem function. A shortcoming is identified when the TCH does not meet the desired performance on one of those measures.

The completion of this study revealed general and specific design shortcomings of the highway with respect to environmental sustainability and concerns. Some of these are generalized across the length of the corridor, while others are specific to individual corridor segments. There are opportunities for MoTH, in conjunction with regulatory agencies, to mitigate the existing design shortcomings with the upgrading of the TCH.

5.3.1 General Highway Design Shortcomings

The general highway design shortcomings, with respect to the environment, within the corridor can be placed into the following categories: stream crossings, riparian zones, wetland isolation, and sedimentation potential, as outlined below:

Stream Crossings: The Trans Canada Highway crosses dozens of streams and many of these crossings are culverted. If a culvert is undersized, or if the volume of run-off since construction of the culverts has increased due to logging or urban development activities, they could be overtaxed during high flow periods. If blockages occur, clearing will require emergency in-stream work permits to be issued outside of normal fish timing windows. Clearing culverts during times when fish are migrating or spawning, eggs are incubating, or young are rearing is harmful to fish populations. Therefore, fisheries agencies consider these undersized culverts as a significant environmental problem.

Many culverts also block fish access to small streams which could provide off-channel habitat for species such as coho and rainbow trout. Culverts in these locations should be replaced with large open bottom structures, or otherwise constructed to permit fish passage. In other cases, the smaller streams may not provide fish habitat, but will contribute nutrients to fish habitat areas and must be functional.

In cases where the stream corridor also acts as a wildlife migration route, the preferred crossing is a clear span bridge which is wide enough to accommodate wildlife movements under the highway along the banks of the

stream. Wildlife crossing under- and over-passes are in the experimental stages and are experiencing mixed results.

Riparian Zone: Several sections of the highway were constructed directly adjacent to watercourses and in some cases the banks of the watercourse was replaced with riprap fill as foundation for part of the highway. This is evident in locations such as Shuswap Lakes, Three Valley Lake, Griffin Lake, the Kicking Horse valley, and others. The riprap shoreline is not a productive habitat, it does not include a littoral zone, nor riparian vegetation which provides shelter, shade, cover and nutrients for fish.

In areas where the shoreline is composed of riprap fill, significant fish habitat enhancement or upgrading opportunities are possible. If highway expansion involves filling in a portion of a watercourse which is already a riprap shore, environmental agencies will be reluctant to permit the loss of additional water surface to highway expansion with a similar shoreline. However, if the expansion were to include the addition of complexity to the shoreline habitat with terracing and riparian planting, the loss of water surface may be offset by the addition of more favourable habitat conditions. While the guiding principle of no net loss of fish habitat will still apply, each case would be dealt with on an individual basis by the agencies.

Wetland Isolation: In the past, some sections of the highway were constructed through wetland or floodplain areas, thereby hydraulically disconnecting some sections from the main complex. For example, in the Kicking Horse valley near the West Louise Lodge a substantial section of the floodplain has been cut-off from the main area. By hydraulically reconnecting the isolated area, the habitat capacity of the entire complex could be expanded.

MELP staff have commented that any remnant wetland areas which have been isolated from the main body by the highway or rail tracks could be re-activated by excavating to groundwater or otherwise hydraulically reconnecting the isolated portion (Brade, 1997, pers. comm.). These could be compensation options in some locations and could significantly augment

important habitat for chinook, coho, sockeye, kokanee, rainbow, whitefish and other fish species.

Sedimentation Potential: In areas where excavation has exposed soils, heavy rainfall could result in sedimentation of water courses. This was evident in the Beaver River valley, the Illecillewaet River and other locations where highway construction has exposed erodable soils. Sediment must be kept out of fish-bearing watercourses during construction and operation of a highway.

Other: Other deficiencies which are not necessarily environmental include lack of pull-outs at areas which could provide viewpoints, vistas, or stops of interest.

5.3.2 Specific Highway Design Shortcomings Within Corridor Segments

This overview study did not permit the assembly of a comprehensive listing of all design shortcomings of an environment nature within the entire corridor. However, the following listing includes those specific items noted by the study team members or those mentioned by agency contacts.

Corridor Segment 40

Culverts at Martin, Neds and Dry Creeks could be enlarged to deal with the frequent blockages occurring at the grade break in the South Thompson valley. The bedload in the creeks has increased due to soil erosion caused by ranching activities in the uplands. The blockages have required clearing outside the normal fish timing windows.

Corridor Segment 80

The highway crosses White and Broderick creeks. Both creeks supported coho spawning in the past, but have since been affected by agricultural developments. The Syphon Creek culvert commonly experiences blockages and must be cleared outside of the normal fish timing window. There is an opportunity to restore lost habitat for stocks of coho which are severely depleted in this system, in part by improving fish passage.

Corridor Segment 90

Highway expansion may provide the opportunity to increase the clearance under the Salmon River Bridge to reduce the likelihood of logjams. Accidents are also common on this bridge and present the possibility of releasing fluids and liquid cargo from vehicles into the water course. Measures which make the bridge safer for traffic will also reduce the environmental risks.

Corridor Segment 100

The coho stocks in Canoe Creek and others in this system are approaching critical levels. Any activities or projects which repair lost habitat or can enhance existing fish habitat in the area will be looked upon favourably by DFO.

Corridor Segment 130

One major tributary, of the Eagle River is the Owlhead Creek which has supported coho spawning in the past, but has since been affected by logging activities, gravel operations and other developments. The Owlhead Creek culvert is also subject to periodic ice dams which must be removed subject to obtaining emergency approval outside of normal fish timing windows. This segment provides an opportunity for MoTH to participate in stream habitat restoration and increase the culvert size.

Corridor Segment 180

The riprap along the fill slope of the highway does not provide a littoral zone at the edge of Three Valley Lake. It may be possible to expand the highway by placing fill in the lake, if a new edge which is more fish-habitat friendly is created. Any construction along the lake in this Corridor Segment, may provide opportunities to terrace the shoreline, add riparian vegetation or otherwise enhance the existing features to improve the productivity of fish habitat. Any upgrades in this corridor segment are likely to be very difficult and very costly.

Corridor Segment 240

While steep gradients exist, apparently some of the tributaries of the Illecillewaet River could provide fish habitat if the crossings were designed to prevent blockages or were replaced with single span bridges.

Corridor Segment 270

Within the Beaver River valley, a section of the highway has recently been realigned to provide increased clearance between an unstable slope and the highway. The soils on this slope are exposed to potential erosion forces and sediment could be washed into the Beaver River during high rain-fall or run-off events.

Corridor Segment 330

Within the Kicking Horse valley some areas of the floodplain on the north side of the highway have been isolated from the main complex by highway construction. Hydraulically reconnecting isolated areas of floodplain could improve the productivity of the system.

5.3.3 Summary

These design shortcomings do not currently affect the interaction between the TCH and the travelling public, but rather, the interaction between the TCH and the natural environment. Remedying these potential problems during the construction of the TCH expansion, will reduce the impacts of the highway on the environment.

5.4 Information Gaps

This study was based on the information obtained from documented sources, the field reconnaissance and interviews with agency staff. There are portions of the TCH for which there is no documented information on fish habitat, wildlife and archaeological resources.

The available documented information on fish habitat is fairly comprehensive throughout most of the corridor. However, there are a few areas were the information is not entirely complete. The documented information on Three Valley Lake, the Kicking Horse River and the various tributaries to the Columbia River is incomplete. Therefore, the study team had to rely on anecdotal information obtained from MELP and DFO and staff.

The documented information on wildlife, apart from the WARS data, within the study area is quite limited. The only areas for which detailed environmental studies have been undertaken are the national parks, the portion of the TCH corridor between Donald and Yoho National Park and the Tonkawatla Creek watershed. The study team has relied on WARS data and anecdotal information obtained from MELP staff for information on wildlife for the remainder of the study area.

Archaeological Overview Assessments have been conducted for the portion of the TCH from Kamloops to Canoe, Malakwa to Revelstoke and Donald to Yoho National Park. Archaeological inventories are currently ongoing in Mount Revelstoke, Glacier and Yoho National Parks. Archaeological assessment studies have not been documented for the remainder of the TCH corridor, therefore the archaeological potential remains unknown. The study team has relied upon the documented Archaeological Overview Assessment studies for information on the archaeological resources of the study area.

The ratings for the corridor segments were based on the available documented information, the field reconnaissance and the interviews with agency staff. The gaps in information for each Corridor Segment identified are summarized in Table 5.4. It should be noted that, at an overview level assessment, this information is not comprehensive.

Table 5. 4 Summary by Corridor Segment of Gaps in Data

Corridor Segment	Fish	Wildlife	Archaeology	Environmental Rating	Description
10		✓		Fair	Kamloops
20		✓		Good	Kamloops
30		✓		Good	South Thompson River
40		✓		Fair	South Thompson River
50		✓		Fair	Little Shuswap Lake
60		✓		Poor	Shuswap Lake
70		✓		Good	Shuswap Lake
80		✓		Good	Shuswap Lake
90		✓		Good	Salmon Arm
100		✓		Good	Salmon Arm-Canoe
110		✓	✓	Fair	Shuswap Lake
120		✓	✓	Fair	Sicamous
130		✓	✓	Good	Eagle River
140		✓	✓	Poor	Eagle River
150		✓		Fair	Eagle River
160		✓		Good	Eagle River
170		✓		Poor	Eagle River
180				Poor	Three Valley Lake
190		✓		Poor	Victor and Clanwilliam Lakes
200				Good	Tonkawatla Creek
210		✓		Good	Big Eddy
220		✓		Fair	Revelstoke
230		✓	✓	Good	Revelstoke
240		✓	✓	Good	Illecillewaet River
250				Fair	Mount Revelstoke National Park
260		✓	✓	Poor	Illecillewaet River
270				Fair	Glacier National Park
280	✓	✓	✓	Fair	Glacier National Park to Donald.
290				Fair	Columbia River
300				Fair	Golden
310				Good	Golden
320	✓			Poor	Kicking Horse River
330		✓		Fair	Yoho National Park

✓ Indicates more information is required.

5.5 Conclusion

Upgrading those corridor segments rated as "good candidates" will likely result in fewer environmental difficulties than lesser ranked segments. While all upgrade activities will require environmental agency consultations, and

more detailed environmental reconnaissance, it can be anticipated that pre-planning activities will be most successful with the *good* candidate corridor segments.

The corridor segments rated as *fair* candidates will likely require more detailed and longer term advanced planning, while some sections of the *poor* candidate segments will require long planning horizons and, in some cases, creative solutions to overcome or mitigate environmental constraints and problems.

The upgrading of some specific corridor segments of the highway may provide opportunities to correct design shortcomings which resulted when some sections of the TCH were originally constructed at a time when environmental sensitivities were not as well understood as they are today. Upgrade activities can make use of the presence of construction crew and equipment to correct undersized culverts, create riparian zones in fish bearing waters, improve clearances under bridges and reduce or eliminate the amount of sediment entering fish-bearing watercourses. In some cases, compensatory activities, (e.g., hydraulically reconnecting isolated wetland areas, excavating groundwater-fed fish rearing channels, etc.), may assist in gaining agency approval in areas where mitigation may be difficult or very costly.

6

RECOMMENDATIONS

Chapter 6 Recommendations

This chapter presents recommendations for minimizing or mitigating the potential environmental impacts from upgrading the TCH.

The recommendations below are derived from our observations during the Rapid Environmental Appraisal, suggestions from government agency staff, and from our synthesis of existing environmental and archaeological assessment studies of the corridor. Given the overview level of this project, the following recommendations are necessarily generalized and will need to be based on more detailed studies in the next stages of MoTH planning. The recommendations below serve to alert MoTH about issues and resources identified in this study that require further attention.

The recommendations are presented in two parts. The first part (6.1) describes general recommendations applicable to the entire TCH corridor. The second part (6.2) provides specific recommendations for individual corridor segments.

6.1 *Corridor-wide Recommendations*

These recommendations include general mitigation measures that could be utilized to minimize the environmental impacts of upgrading the highway. These recommendations have general applicability to the entire TCH corridor.

6.1.1 Terrain

Geotechnical studies should be conducted prior to upgrading any portion of the TCH, regardless of the environmental rating of the corridor segment. However, there are numerous sections where the highway was constructed on steep terrain and geotechnical investigations should focus on preventing the erosion of the surficial materials and an accompanying sediment discharge into a watercourse. It will likely be extremely difficult to upgrade the highway along its existing alignment in areas such as Three Valley Gap (Corridor Segments 170 - 190) and the Kicking Horse River (Corridor Segment 320). In such areas with steep and limiting terrain, geotechnical investigations

should compare the feasibility of upgrading the existing alignment with constructing alternative alignments.

6.1.2 Hydrology and Water Quality

In watersheds where logging activities have resulted in harvesting significant areas of forest, the loss of mature forest cover may result in increased surface and subsurface flows. Indices from a Watershed Assessment (Forest Practices Code), including Equivalent Clear Cut Area (ECA) give an indication of the proportion of natural forest removed. Highway culverts should be designed to accommodate increased water flows in watersheds where forest harvesting has, or will, create high ECA indices.

The paved highway surface acts as a storage surface for hydrocarbons, road salt, and other contaminants during dry weather. Rain fall then delivers a pulse of accumulated debris, heavy metals, and petroleum products into watercourses. Biofiltration of highway runoff should be considered in environmentally sensitive areas such as wetlands and where there are high fish habitat values. This will involve diverting the runoff into a marsh environment vegetated with native wetland plants that will filter out the contaminants. Common species used to vegetate biofiltration ponds include cattails and rushes.

6.1.3 Fish Habitat

Most corridor segments are adjacent to important fish habitat. In the western section of the corridor, the Fraser watershed supports important anadromous and nonanadromous fish species. In the eastern section, the Columbia watershed is important habitat for non-anadromous species including a variety of trout species, whitefish, char, kokanee and, in some locations, the endangered white sturgeon. Therefore, any work which is undertaken near a watercourse must include measures that reduce or mitigate the possible detrimental effects of sediment entering the water.

Any highway expansion that requires the alteration of the shoreline, or reduction of fish habitat areas will require approval from DFO. By initiating contact with appropriate staff at an early stage, regulatory agency input can

be considered in the design of the upgrade. The agencies can then provide assistance with mitigation or compensation measures. In many instances, specific characteristics of different habitat areas may require different mitigation measures. Regulatory staff reported that they are willing to consider and assist with projects on a site by site basis. If mitigation is not possible, DFO generally requires compensation in the form of habitat replacement, on a "two-for-one" basis (e.g., 2 m^2 replacement for each 1 m^2 of lost habitat).

Highway construction activities provide opportunities to correct existing shortcomings to fish and wildlife habitats along the corridor. For example, undersized culverts can be replaced, during highway widening, with larger diameter pipes more suitable for fish passage. Another example is modification of an existing road fill in a waterbody to create a more productive shoreline environment. If reducing the width of a stream or lake is deemed the most feasible means of widening the highway, it may be possible to increase overall productivity of the ecosystem in two parts. First, by placing appropriately sized and sloped riprap, and second, by planting riparian vegetation on a narrow terrace. In other instances compensation projects may involve the excavation of a groundwater-fed side channel, the re-establishment of an isolated portion of floodplain or wetland, or other similar projects. Co-ordination between MoTH and agencies responsible for wildlife and fish during planning of highway widening will lead to fiscal efficiencies as equipment and crew will be onsite for highway construction. The only costs incurred in remedying these shortcomings will be incremental costs.

6.1.4 Riparian Buffers for Rivers and Streams.

Riparian areas have an important role in maintaining biodiversity. Riparian vegetation protects and stabilizes stream banks, moderates water temperatures, and provides nutrients from litter drop for aquatic organisms and large material for stabilizing channels and for creating a variety of aquatic habitats. Riparian areas are also diverse in plant and animal species with animals often using riparian corridors as travel corridors. The TCH follows or intersects numerous rivers and streams between Kamloops and the Alberta

border. Where riparian areas exist, planning and construction of highway improvement projects should protect and retain the expanse and function of these areas.

As a general guideline, where there are natural riparian areas, highway construction activities should be kept a minimum of 30 to 50 m from wetland areas and watercourses (except at crossings) that support fish, or drain into fish bearing waters. Within this riparian buffer, construction activities and discharges such as runoff from the highway should be carefully managed to protect the integrity and function of the riparian areas. With riparian areas along major rivers, the riparian buffer should be increased to a width of 100 m. Where fish are not present, the width of the riparian buffer can be reduced, but a riparian buffer of 10 to 30 m is still required to maintain stream bank stability and water quality. More site specific field surveys will be required to mark out riparian protection areas in the field prior to the start of construction activities. The buffer widths suggested here are based on the widths recommended by Department of Fisheries and Oceans, the B.C. Ministry of Forests and Ministry of Environment, Lands, and Parks for forestry and urban developments (British Columbia 1995; Department of Fisheries and Oceans, 1994, 1997).

In many cases, the TCH borders major watercourses and the riparian area is very narrow or no longer exists. Where possible, highway construction and maintenance activities (e.g. mowing) should allow natural vegetation to grow and riparian areas to become established.

6.1.5 Wildlife Interactions

The data are inconclusive on the relationship between vehicle collisions with wildlife and widening the TCH (Woods, 1997, pers. comm.). Singer (1975) predicted no increase in elk mortality after the expansion of a highway in Glacier National Park, Montana. He noted that most elk crossings took place at night when traffic is reduced and that four lanes may create a barrier that elk are unwilling to cross. Falk et al. (1978) suggested that an increase in traffic volume from a four-lane highway may frighten away white-tailed deer, and deter them from crossing. This will reduce the need for fencing. Other

studies (Reilley and Green, 1974) have shown increases in wildlife kills of up to 500% after a two-lane highway is expanded to four lanes. However, after several years the rate of road kill may diminish and stabilize, but at a rate still higher than the rate of kill for two lanes (Woods, 1990). There is no consensus in the studies reviewed on the effect of highway widening on vehicle collisions with wildlife.

It appears that those species which travel alone or in small groups, such as white-tailed and mule deer, are less vulnerable to road kill than those which travel in larger groups. A herd of elk for example, will be vulnerable if they are crossing a highway and individuals are separated by traffic. Observations by John Woods (1990) indicate that separated animals may become highly agitated and "bolt" through traffic to join the remainder of the herd.

In specific corridor segments or LKI sections where road kills of elk and other wildlife are very common, some measures to reduce the problem should be considered, especially if the highway intersects a known migration route. Observations by Woods (1997, pers comm.) suggest designing bridge crossings to accommodate animal movements. When designing crossings, MoTH should consider making the span long enough so that there is space between the water course and the abutment for animals to walk.

Wildlife crossings and underpasses have been implemented in a variety of locations and applications. While the data regarding the success of wildlife crossing structures are still inconclusive, in very general terms, it appears that open spans are more likely to be used successfully than culverts and that large culverts are more successful than small ones. It also appears that elk and deer are more likely to use underpasses than moose and sheep (Woods, 1990).

Wildlife fencing has been use extensively along the Coquihalla, and in the Banff National Park. Fencing projects have had varied success rates as there have been instances of wildlife gaining access through the fence and then becoming trapped inside the corridor, leading to extreme agitation for the animal. Therefore, fences must be well sealed at the "ends", and be regularly maintained to ensure integrity. In some instances, one-way exits from within corridors were provided with mixed success (Woods, 1997, pers. comm.).

Additional wildlife studies should be conducted throughout most of the study area, particularly outside of the national parks and west of the Rocky Mountain Trench.

6.1.6 Archaeological Resources

Detailed Archaeological Impact Assessment studies are required prior to upgrading the TCH in the following corridor segments:

- Kamloops to Canoe (Corridor Segments 30-100);
- Malakwa to Revelstoke (Corridor Segments 160-210); and
- Glacier National Park east boundary to Yoho National Park west boundary (Corridor Segments 290-320).

Archaeological Impact Assessments for Mount Revelstoke National Park, Glacier National Park, and Yoho National Park (Corridor Segments 250, 270 and 330) are ongoing and should be completed prior to the commencement of any expansion of the TCH in the national parks. Archaeological Impact Assessments are generally required to further define the potential archaeological resources identified in the Archaeological Overview Assessment.

Archaeological overview assessments are required for the following sections of the TCH where there is very little knowledge of the archaeological potential:

- Canoe to Malakwa (Corridor Segments 110-150);
- Revelstoke to Mount Revelstoke National Park (Corridor Segments 220-240);
- Mount Revelstoke National Park to Glacier National Park (Corridor segment 260); and
- Glacier National Park to Donald (Corridor segment 280).

6.1.7 Agricultural Resources

The ALR land, in close proximity to the TCH, that could be affected by a highway upgrade should be identified. ALR land is present in the following sections of the study area:

- Kamloops to Canoe (Corridor Segments 30-100);
- Sicamous to the Perry River Bridge (Corridor Segments 130-160);
- Revelstoke (Corridor segment 230); and
- Donald to Golden (Corridor segment 290).

6.1.8 Air Quality

The air quality problems in the larger urban areas on the TCH should be assessed. MELP does not currently collect data on air pollution from vehicles along the TCH corridor. As traffic volumes build, the contribution from vehicles to air pollution will increase and the air pollution from motor vehicles should be monitored. Otherwise, widening the TCH is not expected to have a significant effect, positive or negative, on air quality along the corridor.

6.2 *Recommendations by Corridor Segments*

The following recommendations describe measures for minimizing or mitigating expected impacts to the environment from highway widening in specific corridor segments. The corridor segments are grouped by the rating of suitability for widening; *good*, *fair*, and *poor*.

6.2.1 Recommendations for Corridor Segments Rated *Good* Candidates for Widening

6.2.1.1 Corridor Segment 20 (Urban Kamloops)

1. Design a highway upgrade to conserve salmonid habitat along the South Thompson River mainstem and its tributaries.

2. Determine the distribution of the Red-listed Big Sage-Bluebunch Wheatgrass and the Rough Fescue-Bluebunch Wheatgrass plant communities.

6.2.1.2 Corridor Segment 30 (Kamloops to Monte Creek)

1. Design the highway upgrade to conserve salmonid habitat along the South Thompson mainstem, and its tributaries.
2. Conserve rainbow trout habitat in Campbell Creek.
3. Investigate methods of preventing wildlife/vehicle collisions.
4. Determine if widening the TCH will impact the existing LaFarge Canada Inc. mineral claim in this corridor segment. This corridor segment also contains a documented mineral occurrence (potential clay deposit) that could be a target for future claim staking.

6.2.1.3 Corridor segment 70 (Urban Sorrento)

1. Design the highway upgrade to conserve the salmonid habitat in the South Thompson mainstem, and in Shuswap and Little Shuswap Lakes.
2. Ensure safe public access to the campsite on Shuswap Lake and associated nearby service facilities.
3. Minimize the disruption to the gravel pit operations near Sorrento.

6.2.1.4 Corridor segment 80 (East End Sorrento to West Border Salmon Arm)

1. Conduct geotechnical investigations that evaluate options to minimize the risk of erosion and prevent a sediment discharge from entering Shuswap Lake when widening the highway at the Kault Hill viewpoint.
2. Enlarge the Syphon Creek culvert to prevent blockages from occurring outside of the normal fish timing window.
3. Consider rehabilitating White and Broderick Creeks in conjunction with other agencies (DFO, MELP and MoF) when upgrading this portion of the TCH.
4. Design the highway upgrade to conserve the Class 1 fish habitat at Shuswap Lake.

5. Investigate means of preventing wildlife/vehicle collisions and design the highway upgrade to protect a small wetland at offset 56 km (LKI segment #0935).
6. Determine the distribution of the Red-listed Mosquito Fern and the Blue-listed Thyne-leaved Spurge.
7. Ensure safe public access to Herald Provincial Park, White Lake Provincial Park, Sunnybrae Provincial Recreation Area, Shuswap Lake, and White Lake.
8. Note that this corridor segment contains a documented mineral occurrence that could provide a target for future claim staking.

6.2.1.5 Corridor segment 90 (Salmon Arm)

1. Investigate the feasibility of increasing the clearance under the Salmon River Bridge to reduce the likelihood of log jams.
2. Design the TCH upgrade to conserve salmonid habitat in the Salmon River and the Salmon Arm of Shuswap Lake.
3. Design the TCH upgrade to conserve the waterfowl and shore bird habitat areas on the Salmon River Floodplain and at Salmon Arm Bay.
4. Determine the distribution of the Red-listed Western Grebe, Mosquito Fern and Hairy Water Clover, as well as the distribution of the Blue-listed American Sweetflag.
5. Ensure safe public access from the TCH to tourist and recreational facilities.

6.2.1.6 Corridor segment 100 (Salmon Arm to Canoe)

1. Consider restoring salmonid habitat in Canoe Creek where coho stocks are near extinction levels. Work with other agencies (DFO, MELP and MoF) when upgrading this portion of the TCH.
2. Investigate methods to prevent wildlife/vehicle collisions and design the highway upgrade to protect a small wetland at the 2 km mark of the corridor segment.
3. Maintain safe public access from the TCH to Shuswap Lake.

6.2.1.7 Corridor segment 130 (Jct. Hwy. 97A to Kerr Road).

1. Design the highway upgrade to conserve the salmonid habitat of the Eagle River.
2. Consider working jointly with other agencies (DFO, MELP and MoF) to rehabilitate the coho spawning habitat in Owlhead Creek degraded by logging activities, gravel operations and development when upgrading this corridor segment.
3. Enlarge the Owlhead Creek culvert crossing to reduce the risk of ice dams outside of normal fish timing windows.
4. Investigate methods to prevent wildlife/vehicle collisions.
5. Determine the distribution of the Red-listed Mosquito Fern.
6. Note the presence of two documented mineral occurrences that could possibly be targets for staking mineral claims.

6.2.1.8 Corridor segment 160 (Malakwa Road to Perry R Bridge)

1. Design the highway upgrade to conserve the salmonid habitat of the Eagle River.
2. Investigate methods to prevent wildlife/vehicle collisions.
3. Ensure safe public access to Gorge Creek, the historic monument at Craigallachie, a trailer park and commercial camp ground with some bedrock exposure,.

6.2.1.9 Corridor segment 200 (Clanwilliam Overhead to Big Eddy Road)

1. Design the highway upgrade to conserve fish habitat in Tonkawatla Creek as it is the only spawning area for yellow-fin rainbow trout.

6.2.1.10 Corridor segment 210 (Big Eddy Road to JCT. Hwy. 23 South)

1. Conduct geotechnical investigations to determine the most effective means of minimizing the risk of erosion and preventing a sediment discharge into Tonkawatla Creek when expanding the TCH where it is constrained by railway tracks and exposed bedrock.
2. Design the highway upgrade to conserve fish habitat in the Columbia River and in Tonkawatla Creek.

6.2.1.11 Corridor segment 230 (East Revelstoke)

1. Re-design culverts on tributaries to the Illecillewaet River to allow for fish passage.
2. Design the highway upgrade to conserve salmonid habitat in the Illecillewaet River.
3. Investigate methods to prevent wildlife/vehicle collisions.
4. Ensure safe public access from the TCH to the KOA campground and the Alpine area of Mount Revelstoke National Park.

6.2.1.12 Corridor Segment 240 (Revelstoke City Limits to Mount Revelstoke National Park Border

1. Conduct geotechnical studies focused on controlling erosion and preventing a sediment discharge from entering the Illecillewaet River when expanding the highway where it is confined by steep slopes and the Illecillewaet River.
2. Design the highway upgrade to conserve the salmonid habitat in the Illecillewaet River and its various tributaries.
3. Investigate methods to prevent wildlife/vehicle collisions.
4. Ensure that the design of the highway upgrade includes pullouts and rest areas to allow public access viewpoints of the Illecillewaet River Valley, and Mount Revelstoke National Park in a safe manner.

6.2.1.13 Corridor Segment 310 (Golden)

1. Design the highway upgrade to conserve fish habitat in the Kicking Horse River and the Columbia River.
2. Design the highway upgrade to prevent wildlife/vehicle collisions and preserve the Columbia Wildlife Management Area.
3. Determine the distribution of the presence of the Red-listed white sturgeon.
4. Ensure the highway upgrade does not interfere with the operations at the gravel pit.

6.2.2 Corridor Segments Rated *Fair* Candidates for Widening

The following recommendations should be carried out when upgrading the TCH within the following corridor segments. These corridor segments have greater environmental sensitivities than the ones rated *good* and widening the highway will be more difficult in these segments.

6.2.2.1 Corridor Segment 10 (Urban Kamloops)

1. Conduct geotechnical studies prior to upgrading the steep sections of this corridor segment to determine the most effective erosion control methods and prevent a sediment discharge into Peterson Creek.
2. Determine the distribution of the Blue-listed Threadsilk Milk-Vetch
3. Ensure that a highway upgrade does not impede access to the two gravel pits located near Peterson Creek.

6.2.2.2 Corridor segment 40 (Monte Creek to Chase)

1. Conduct geotechnical studies focused on controlling erosion and preventing a sediment discharge from entering the South Thompson River prior to upgrading the section confined by steep slopes, the railway line and the South Thompson River.
2. Enlarge the culverts on Martin, Neds and Dry creeks to reduce the risk of blockage, which would require emergency actions outside of normal fish timing windows.
3. Design the highway upgrade to conserve salmonid habitat in the South Thompson mainstem.
4. Investigate methods of preventing wildlife/vehicle collisions and conserve a wetland area near the 20 km offset (LKI Segment #0935).
5. Ensure safe public access from the TCH to the pullouts and viewpoints within this corridor segment.
6. Minimize the disruption on the two existing gravel pit operations in this corridor segment.

6.2.2.3 Corridor segment 50 (Chase to Squilax Bridge)

1. Conduct geotechnical investigations, prior to upgrading the steep sections of the highway between offsets 29.5 km and 31.2 km (LKI segment #0935), focused on erosion control and minimizing the risk of a sediment discharge into Little Shuswap Lake.
2. Design the highway upgrade to conserve the extremely sensitive fish habitat that supports sockeye and coho salmon juveniles.
3. Investigate methods of preventing wildlife-vehicle collisions.
4. Determine the distribution of the Red listed Purple-Eyed Grass and Blue-listed Great Basin Nemophila.
5. Ensure safe public access from the TCH to Silver Beach Resort, Shuswap Lake, and Roderick Haig Brown Provincial Park, as well as access to viewpoints of Little Shuswap Lake.
6. Note that there are two documented mineral occurrences within this corridor segment that could be targets for future claim staking.

6.2.2.4 Corridor segment 110 (Canoe to Bruhn Bridge)

1. Conduct geotechnical studies to evaluate options for controlling erosion and preventing a sediment discharge from entering Shuswap Lake when upgrading a steep section near Canoe and another near the Bruhn Bridge.
2. Design the highway upgrade to conserve the salmonid habitat in Shuswap Lake.
3. Ensure that there is safe public access from the TCH to Mara Point Provincial Park.
4. Determine the impacts of the TCH upgrade on the three existing mineral claim blocks.
5. Note that there are seven documented mineral occurrences that could be future targets for mineral claim staking.

6.2.2.5 Corridor segment 120 (Urban Sicamous)

1. Design the TCH upgrade to conserve the salmonid habitat in the Sicamous Narrows. Note that a highway upgrade will involve widening the Bruhn Bridge.

2. Determine the distribution of the Red-listed Mosquito Fern and the Blue-listed Blunt-Sepaled Starwart.

6.2.2.6 Corridor Segment 150 (Malakwa)

1. Preserve the salmonid habitat in the Eagle River.
2. Preserve the oxbow lakes on the Eagle River floodplain.
3. Ensure access to the gravel pits near Malakwa.

6.2.2.7 Corridor Segment 220 (Jct. Hwy. 23 South to Jct. Hwy. 23 North)

1. Design the highway upgrade to conserve fish habitat in the Columbia River

6.2.2.8 Corridor segment 250 (Mount Revelstoke National Park)

1. Conduct geotechnical studies to determine the most effective measures to control erosion given that the slopes are moderately steep throughout this entire corridor segment.
2. Design the highway upgrade to protect the fish habitat in the Illecillewaet River.
3. Investigate means of mitigating vehicle/wildlife collisions as this corridor segment contains mortality "hotspots" for moose and mountain goats near the Clachnachudainn Cliffs area (LKI segment #0975, 18 km).
4. Note that this corridor segment is located entirely within Mount Revelstoke National Park and that any highway expansion activities are subject to the environmental assessment procedures established by Parks Canada.
5. Ensure safe public access from the TCH to the Laureate Picnic Area and the Big Cedars Picnic Area and Trail.

6.2.2.9 Corridor segment 270 (Glacier National Park)

1. Conduct geotechnical investigations prior to upgrading the steep or confined sections of this corridor segment. The focus of these studies should be on controlling erosion and preventing a sediment discharge into Connaught Creek and the Beaver River.

2. Design the TCH upgrade to conserve the fish habitat in the Illecillewaet River, Connaught Creek and the Beaver River.
3. Investigate methods to prevent vehicle/wildlife accident collisions as this corridor segment contains mortality "hotspots" for moose, mountain goats and black bears.
4. Note that this corridor segment is located entirely within Glacier National Park and any highway expansion work is subject to the environmental assessment procedures established by Parks Canada.
5. Ensure safe public access from the TCH to the visitor centre at the top of Rogers Pass, the Beaver Picnic Site and the Mountain Creek Campsite.

6.2.2.10 Corridor segment 280 (Glacier National Park to Columbia River Bridge)

1. Design the highway upgrade process to conserve fish habitat in Quartz, Wiseman and Oldman creeks.
2. Investigate methods to mitigate the extremely high wildlife/vehicle accident rate as this area is used by moose and caribou as a migration corridor.
3. Determine the distribution of old growth forest in this corridor segment and design the highway upgrade to conserve as much of it as possible.
4. Determine the distribution of the Red-listed Giant Hyssop
5. Ensure safe public access from the TCH to forestry recreation areas, existing rest areas and lookouts, Big Lake Resort, Heather Mountain Lodge and Kinbasket Lake.
6. Determine the impact of a potential highway upgrade on the two current mineral claims within this corridor segment.

6.2.2.11 Corridor segment 290 (Donald to Anderson Rd)

1. Design the highway upgrade to conserve fish habitat in the Columbia River, particularly off-channel rearing habitat.
2. Investigate methods of preventing wildlife/vehicle collisions as the highway traverses a major wildlife migration corridor.
3. Design the TCH upgrade to protect the wetlands on the Columbia River floodplain.
4. Determine the distribution of the Red-listed Crawe's Sedge.

5. Ensure safe public access from the TCH to Burgess and James Gadsen Provincial Park, Marl Creek Provincial Park, numerous forestry service campsites along Blackwater Creek Valley and a rest area at 38.7 km offset (LKI segment #0985).
6. Minimize the disruption to the two existing gravel pit operations in this corridor segment.

6.2.2.12 Corridor segment 300 (Anderson Rd to Junction Highway 95 Golden)

1. Conduct geotechnical investigations to determine the most effective measures of controlling erosion when upgrading the section of highway, confined by a bedrock cliff and a wetland.
2. Design the highway upgrade to conserve fish habitat in the Columbia River.
3. Investigate methods of mitigating the high wildlife/vehicle accident rate as the highway traverses a major wildlife corridor and ensure that measures are implemented to protect the wetland.
4. Note that this corridor segment contains one documented mineral occurrence that could be a future target in claim staking.
5. Minimize the disruption to the existing gravel pit operations near Edelweiss.

6.2.2.13 Corridor segment 330 (Yoho National Park)

1. Conduct geotechnical investigations, for areas where the TCH is confined by floodplain and steep valley slopes, to determine the most effective measures to control erosion and prevent a sediment discharge from entering the Kicking Horse River.
2. Design the culverts and other drainage structures to accommodate debris flows.
3. Design the highway expansion to conserve the fish habitat in the Kicking Horse River and in Wapta Lake.
4. Investigate methods of minimizing the wildlife/vehicle accident rate as this corridor segment traverses excellent wildlife habitat.
5. Determine the distribution of the Blue-listed Macoun's Fringed Gentian.

6. Note that this corridor segment is located entirely within Yoho National Park and any highway expansion work is subject to the environmental assessment procedures established by Parks Canada.
7. Note that this corridor segment contains 6 known mineral occurrences including 2 past producing mines. These are not likely to be targets for claim staking as it is unlikely that any future mineral extraction activities will be occurring within a national park.

6.2.3 Corridor Segments Rated *Poor* Candidates for Widening

The following are recommendations when upgrading the TCH within corridor segments rated *poor*. In these segments, the highway may be difficult to upgrade and, in some cases, it may not be possible to widen the TCH along its existing alignment without serious environmental risk .

6.2.3.1 Corridor segment 60 (Squilax Bridge to Sorrento)

1. Conduct geotechnical investigations examining the feasibility of upgrading the steep sections of the highway. Note that highway improvements may be difficult and costly.
2. Design the highway upgrade to conserve the valuable salmonid habitat in the South Thompson River.
3. Ensure that there is safe public access from the TCH to the existing pullouts and viewpoints where the TCH is right beside Shuswap Lake and the South Thompson River.
4. Determine if the TCH upgrade will have any impacts on the one existing mineral claim within the corridor segment.

6.2.3.2 Corridor segment 140 (Kerr Road to Start of Four Lanes)

1. Conduct geotechnical investigations prior to upgrading the steep or confined sections of the TCH to evaluate the options for erosion control and prevention of a sediment discharge into the Eagle River.
2. Design the TCH upgrade to conserve the salmonid habitat in the Eagle River.
3. Investigate methods of mitigating the high vehicle/wildlife accident rate and preserving two wetland areas near the 7 km and 9 km offsets (LKI Segment #0960).

6.2.3.3 Corridor segment 170 (Eagle River Floodplain)

1. Conduct geotechnical investigations to determine the means to control erosion and prevent a sediment discharge into the Eagle River or Griffin Lake by upgrading the highway along the steep sections. Note that it may be very difficult to upgrade the TCH along its existing alignment.
2. Design the TCH upgrade to conserve the high salmonid habitat values of the Eagle River.
3. Investigate methods of preventing vehicle/wildlife collisions.
4. Determine the distribution of the Blue-listed Orange Touch-Me-Not.
5. Provide safe public access from the TCH to Crazy Creek, the Enchanted Forest, Edelweiss Lodge and Griffin Lake.

6.2.3.4 Corridor segment 180 (Three Valley Gap)

1. Conduct geotechnical investigations to determine the feasibility of upgrading this corridor segment, particularly in the steeper confined areas. Upgrading the highway in this Corridor Segment may be extremely difficult, given the dynamic geological conditions.
2. Upgrade the TCH only if the salmonid habitat of the upper Eagle River system can be conserved.
3. Provide safe public access from the TCH to Three Valley Resort and a large pull-out area at Three Valley Lake.

6.2.3.5 Corridor segment 190 (Woods Overhead to Clanwilliam Overhead)

1. Conduct geotechnical investigations to determine the feasibility of upgrading this corridor segment, particularly in the steeper confined areas. Upgrading the highway in this Corridor Segment may be extremely difficult, given the dynamic geological conditions.
2. Design the highway upgrade to conserve important fish habitat between Three Valley, Victor and Clanwilliam Lakes.
3. Determine the distribution of the Blue-listed Small-Flowered Willowherb.
4. Ensure there is safe public access from the TCH to Victor Lake Provincial Park.

5. Note that there are three known mineral occurrences that could become future targets for mineral claim staking.

6.2.3.6 Corridor segment 260 (Mount Revelstoke National Park to Glacier National Park)

1. Conduct geotechnical investigations prior to upgrading the steep or confined sections of this corridor segment. The focus of these studies should be on controlling erosion and preventing a sediment discharge into Illecillewaet River.
2. Design the TCH upgrade to protect the salmonid habitat in the Illecillewaet River.
3. Investigate methods of preventing wildlife/vehicle collisions in this corridor segment , as the TCH passes through a mountain goat wintering range.
4. Note there are six mineral occurrences located within this corridor segment that could be targets for future claim staking.
5. Ensure the TCH upgrade provides safe public access to viewpoints of the Illecillewaet Canyon and to Canyon Hot Springs.

6.2.3.7 Corridor segment 320 (Golden View Road to Yoho National Park)

1. Conduct geotechnical studies to determine the feasibility of upgrading the steep or confined sections in the first half of this corridor segment. An upgrade may be extremely difficult along the existing alignment.
2. Design the highway upgrade to conserve fish habitat in the Kicking Horse River.
3. Investigate methods to prevent vehicle/wildlife collisions as the TCH traverses a heavily used wildlife migration corridor.
4. Determine the distribution of the Red-listed Dark Lamb's Quarters.
5. Note that this corridor segment contains three documented mineral occurrences, however they cannot be targets for future claim staking until after November 2001 when the Mineral Reserve Zone status of the Kicking Horse Valley, established at the request of MoTH, expires.
6. Ensure safe public access to existing pull-outs and viewpoints from the TCH.

6.3 *Remarks*

These recommendations will minimize or mitigate the potential environmental impacts which are likely to accrue as a result of increasing the width of the TCH. These recommendations were prepared from our overview level reconnaissance of the 441 km corridor and, therefore, more detailed studies will be required when upgrading specific sections of corridor segments.

7

CONCLUSION

Chapter 7 Conclusion

Acres International Limited evaluated the environmental issues related to widening the Trans Canada Highway, between Kamloops and the Alberta border. We inspected the physical and environmental characteristics of the corridor and reviewed available reports, maps, and air photos. This information was synthesized to yield environmental ratings (*good*, *fair*, or *poor*) of each of the corridor segments of the highway for suitability for widening. Of the 33 segments, 13 were rated as *good* candidates, 12 rated *fair*, and 8 rated as *poor*. Topography limits opportunities to widen the highway because in many places, the highway is confined between a rock wall on one side and a watercourse, wetland area or other confinement on the other. Options for widening the highway are limited in these situations. The environmental ratings will be used by the Ministry of Transportation and Highways in a Multiple Accounts Evaluation to develop a cost effective approach for improving the highway.

This report also provides recommendations for minimizing or mitigating potential environmental impacts associated with widening the highway. The study identified fish and fish habitat as the major resource value constraining highway widening. Much of the highway corridor parallels regionally important fish bearing waters. Not only are the mainstem rivers important, but also the numerous streams which serve as spawning and rearing habitats. Recommendations are provided for minimizing or mitigating environmental impacts to fish habitats during any proposed upgrading of the highway. The report includes recommendations for improving current shortcomings of the existing highway that can be remedied during a highway upgrade project.

This study identified portions of the TCH which have not been the subject of environmental and cultural studies, notably studies of archaeological resources and wildlife populations and habitat quality. More detailed studies are required in those corridor segments deemed *good* candidates for highway widening.

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APPENDICES

Appendix A

Annotated Bibliography

Appendix A Annotated Bibliography

The annotated bibliography provides a summary of the previous environmental and planning studies for the TCH corridor, prepared for MoTH. These studies were used as references by the Acres Study Team in preparing the environmental overview assessment of the TCH corridor between Kamloops and the Alberta border.

Acres International Ltd., 1990. Environmental and Socio-economic Assessment of Highway Upgrading and Realignment - Three Valley, B.C. Prepared for the B.C. Ministry of Transportation and Highways, Victoria B.C.

This report identifies the significant issues related to the environmental and social aspects of highway design, construction and operation in the Three Valley area. Inventory information is presented at an overview level and most of the information in the report was obtained from secondary sources. The main issues identified in this report include preservation of fish habitat in the Eagle River, ensuring recreational access to the lakes along the highway, ensuring highway construction does not adversely impact tourism opportunities and reducing the likelihood of a debris slides or avalanche blocking the highway and restricting the access of the local residents to Revelstoke.

ADI Ltd., 1997. Analysis Framework for the Trans Canada Highway Corridor Management Plan (Kamloops to Alberta Border). Prepared for B.C. Ministry of Transportation and Highways, Planning Department, Thompson/Okanagan Region, Kamloops B.C.

This study was developed as a tool for the TCH Kamloops to Alberta Border corridor management plan and was designed to assist MoTH in the development of its planning process and products. This report describes the roles of performance measurement, deficiency analysis, multiple account evaluation, benefit/cost analysis and public consultation in prioritizing provincial and corridor level highway improvements.

Arcas Associates, 1986. Highway 1 - Four Laning Project - Cambie to Revelstoke, B.C. Detailed Heritage Resource Inventory and Impact Assessment. Prepared for the B.C. Ministry of Provincial Secretary and Government Services, Heritage Conservation Branch and B.C. Ministry of Transportation and Highways, Victoria B.C.

The purposes of this study were to identify, record and evaluate the significance of all heritage sites in the proposed development corridor, assess all impacts of expanding the highway on heritage sites and recommend viable options for managing adverse impacts on heritage sites. Several heritage sites as well as a number of additional sites of a historic "tote road" will be impacted by an upgrade of the TCH.

Aresco Ltd., 1979. Archaeological Inventory and Assessment: CP Rail Project, Rogers Pass, British Columbia. Prepared for Parks Canada.

The purpose of this study was to identify potential archaeological sites in Glacier National Park along the CPR right-of way. The conclusions are that Glacier National Park was marginally utilized in prehistoric times due to rugged topography, extreme climate, lack of suitable game populations and fishing resources, and lack of good transportation routes.

Choquette, Wayne T., 1997a. Archaeological Overview Assessment of Portions of the Trans Canada Highway Between Golden and Donald, B.C. Prepared for B.C. Ministry of Transportation and Highways.

The purposes of this study were to identify existing archaeological resources adjacent to the existing Trans Canada Highway, archaeological impacts from a proposed upgrade, areas requiring further archaeological assessment, and recommend a means of mitigating adverse archaeological impact of the proposed developments. While there are no known archaeological sites along this stretch of the highway, the landforms indicate that the environment was suitable for past human use. Due to the extent of development along the east side of the Columbia River, any remaining archaeological resources will have a high value. More detailed archaeological assessment studies should be conducted prior to upgrading the TCH.

Choquette, Wayne T., 1997b. Archaeological Overview Assessment of a Portion of the Trans Canada Highway Between Yoho National Park and Golden, South-eastern British Columbia. Prepared for B.C. Ministry of Transportation and Highways.

The purposes of this study were to identify existing archaeological resources adjacent to the existing Trans Canada Highway between Golden and Yoho National Park, archaeological impacts from a proposed upgrade, areas requiring further archaeological assessment, and recommend a means of mitigating adverse archaeological impacts. The archaeological potential of most of the study area was rated medium, with the remainder rated as high.

Enkon Environmental, 1997. Fish and Wildlife Assessment for the Proposed Highway #1 Upgrade: Donald to Golden. Prepared for B.C. Ministry of Transportation and Highways, March 1997, Kamloops, B.C.

The purpose of this study was to conduct a fish and wildlife assessment of the proposed highway upgrade between Golden and Donald. Potential impacts to fish populations include losses to riparian vegetation and can be mitigated through culvert design, restoration of previously impacted habitat and replanting of riparian habitat. Impacts to wildlife include losses to wetland habitat and increased roadkills. These can be reduced by

avoiding or minimizing impacts on wetlands, maintaining natural drainages, using retaining walls and fencing, and installing open-bottomed culverts.

Harvey Research Ltd., 1994. Wildlife Habitat Mapping, Trans Canada Highway Corridor. Prepared for B.C. Ministry of Transportation and Highways, November 1994.

This study examines wildlife habitats and populations in the Trans Canada Highway corridor between Golden and Yoho National Park. The study also reviewed a proposed site for a weigh station on the Trans Canada Highway between Moberly Branch Road and the Blaeberry River. The study area is a high quality wildlife habitat for game animals, furbearers and small animals.

Hatfield Consultants Ltd, September 1996. Shoreline Inventory and Fisheries Sensitivity Classification of Main Arm of Shuswap Lake. Prepared for Department of Fisheries and Oceans, Kamloops, B.C.

Hatfield Consultants Ltd. was contracted to spatially map and classify various habitat types and habitat uses along the shoreline of Main Arm, Shuswap Lake. Using air photos, a database cataloguing specific information on all identifiable features and habitats within these zones was compiled. This database, combined with the existing information on salmonid use of littoral areas of the main arm, allowed the development of a habitat sensitivity ranking for the shoreline areas of the main arm of Shuswap Lake.

I. R. Wilson Consultants, 1991. Archaeological Overview - Highway 1 Corridor Study - Kamloops to Canoe. Prepared for the Archaeological Branch, Ministry of Municipal Affairs, Recreation and Culture and the Ministry of Transportation and Highways, March, 1991.

The objectives of this study were to identify the anticipated impacts to heritage resources resulting from seven alternative corridors, including the four laning of the existing Highway 1 route. Most of this route contain areas with known and assumed heritage potential. Field investigations will be necessary if any other corridor options are selected.

LGL, 1997. Wildlife Tracking Project: Golden to West Boundary of Yoho National Park. Final Report. Prepared for B.C. Ministry of Transportation and Highways, October, 1997, Victoria, B.C.

The objectives of this study were to obtain baseline information on patterns of habitat use and overall population trends for ungulates and large carnivores, identify wildlife migration and movement corridors along the existing highway corridor and determine means of impact avoidance and mitigation likely to reduce roadkills. The study concluded that four-laning the highway will have significant impacts on local wildlife in terms of habitat fragmentation and increased road kills. Recommended mitigation actions are discussed.

Minni, Sheila, 1997. Archaeological Overview Assessment. Trans Canada Highway West of Revelstoke Passing Lanes Project. Prepared for Highway Environment, B.C. Ministry of Transportation and Highways, April 1997.

An archaeological overview assessment was conducted for a 6 km section of the TCH, west of Revelstoke. The study concluded that a highway upgrade will have a low potential to adversely impact archaeological or heritage sites, provided the upgrade remain within the existing right-of-way. If the final upgrade option were to extend beyond the existing right-of-way, there is medium potential for the location of archaeological resources. Therefore, an archaeological impact assessment is required only if any of the highway upgrade options extend beyond the existing alignment.

Mirkwood Ecological Consultants, 1996. Fisheries/Wildlife Habitat Assessment of the Trans Canada Highway Upgrade West of Revelstoke: Final Report. Prepared for the Ministry of Transportation and Highways; Victoria, B.C.; February, 1996

The objectives of this study were to conduct a fisheries/wildlife habitat assessment of a 6 km length of the Highway 1 corridor in the Tonkawatla Creek watershed to determine the environmental impacts of upgrading this section. The report concluded that none of the proposed highway upgrade options will have significant impacts on fish or wildlife habitat, provided that the proper mitigation strategies are implemented, unless the highway corridor is expanded to a four lane expressway.

Parks Canada and Columbia Mountains Institute of Applied Ecology, 1997. Proceedings of the Second Roads, Rails and the Environment Workshop, April 9-10, 1997. Clevenger, A.P and Wells, K., editors. Revelstoke, B.C.

The three key themes of this workshop included research, monitoring and modelling for mitigating transportation impacts on wildlife; transportation-related wildlife mortality and performance evaluations of measures to reduce it; and means of improving the quality of information used to make decisions regarding transportation effects on the environment. This document contains the transcripts of all of the presentations made during this workshop.

Reid Crowther and Partners, 1994a. Conceptual Study of Trans Canada Highway Twinning through Glacier and Mount Revelstoke National Parks. Prepared for Parks Canada.

The objectives of this study were to indicate where additional lanes might be located relative to the existing highway, identify access point and turn-arounds for service vehicles, conduct an environmental scoping, prepare a geotechnical overview to identify problem areas, and identify opportunities to improve or maintain roadside amenities and

visitor access. The two sections of the TCH through Mount Revelstoke National Park and Glacier National Park are broken down into smaller segments. Constraints concerning environmental and historical resources, geotechnical conditions and roadside amenities and visitor access are identified.

Reid Crowther and Partners, 1994b. Conceptual study of Trans Canada Highway Twinning through Yoho National Park. File No: 24072. Prepared for Parks Canada.

The objectives of this study were to indicate where additional lanes might be located relative to the existing highway, identify access points and turn-arounds for service vehicles, conduct an environmental scoping, prepare a geotechnical overview to identify problem areas, and identify opportunities to improve or maintain roadside amenities and visitor access. The 45 km section of the TCH through Yoho National Park is broken down into smaller segments and constraints concerning environmental resources, historical resources, geotechnical conditions, roadside amenities, and visitor access are identified.

Stahlberg, H., Redden, R.J., and Hickey, D.G., 1997. Thompson River Salmonid Habitat Classification in the Vicinity of Kamloops, B.C. Department of Fisheries and Oceans, Fraser River Action Plan, Vancouver, B.C.

The purposes of this study were to compile an inventory of fish habitat and an understanding of its uses by salmonids in the mainstems and tributaries of the North and South Thompson Rivers in the Kamloops area. Homogenous stream sections were classified based on a field assessment of the shorelines within the study area in the fall of 1995, the DFO 1996 chinook salmon spawning distribution data for the South Thompson River, and the biophysical data collected by ECL Envirowest Consultants Ltd. Each stream section was classified as 1, 2 or 3 according to the DFO Habitat Conservation and Protection guidelines.

Westland Resource Group, 1993. Ministry of Transportation and Highways - Pritchard-Tappen Highway Planning Study - Environmental Scoping Study. Prepared for Urban Systems Ltd., Project No: 92-066, Victoria, B.C.

The objectives of this study were to identify the potential environmental impacts of improving the TCH between Pritchard and Tappen. Two options were considered; upgrading the existing route, and realigning the highway through the Turtle Valley. This study contains overview information on vegetation and wildlife, aquatic resources, and agricultural lands and grazing. Land use information such as B.C. Parks recreation reserves and proposed assessment areas, MOF recreation sites, trails and reserve lands, and B.C. Environment Wildlife Branch guiding and trapping territories were also collected. Environmental constraints were identified and evaluated for each of the options.

Withler, Ira L., 1995. Observations on Drainages Within M.O.T.H. Project NO. 31018 - Park Gate Passing Lanes and Recommendations for Preservation of Fish Habitat.

This study examines the impacts on watercourses and fish populations from widening a 2.4 km stretch of the Trans Canada Highway immediately west of the entry to Mount Revelstoke National Park. Recommendations on mitigating the impacts were made for each stream crossing.

Withler, Ira L., 1995. Observations and Recommendations for Environmental Considerations at Park Gate Passing Lane Project, Revelstoke B.C., July and September, 1995.

This report describes the results of evaluating the implementation of the recommendations on mitigating the environmental impacts of widening the 2.4 km stretch of the Trans Canada Highway, immediately west of Mount Revelstoke National Park.

Appendix B

List of Contacts

Appendix B List of Contacts

The following is a list of the various regulatory agency staff contacted and interviewed by the study team.

Agricultural Land Commission
Mr. Brian Underhill, Director of Regional Operations, Burnaby, B.C.

B.C. Ministry of Environment, Lands, and Parks
Mr. Bob Brade, Forest Ecosystem Specialist, Revelstoke, B.C.
Mr. Sandy MacDonald, Habitat Section Head, Kamloops, B.C.
Mr. Doug Martin, Habitat Protection Biologist, Cranbrook, B.C.
Mr. Ken Morrison, Senior Park/ER Planner, B.C. Parks, Victoria, B.C.
Mr. Robert Marsh, Monitoring and Standards Section Head, Air Resources Branch, Victoria, B.C.

B.C. Ministry of Employment and Investment
Mr. Colin McGee, Manager, Land Administration, Petroleum Titles Branch, Victoria, B.C.

B.C. Ministry of Small Business, Tourism, and Culture
Mr. Ray Kenny, Director, Archaeology Branch, Victoria, B.C.

Canadian Heritage - Parks Canada
Mr. Roger Eddy, Environmental Assessment Officer, Revelstoke, B.C.
Mr. John Woods, Wildlife Biologist, Revelstoke, B.C.

Columbia Basin Fish and Wildlife Compensation Program
Ms. Karen Bray, Fisheries Biologist, Revelstoke, B.C.

Department of Fisheries and Oceans
Mr. Bob Harding, Salmon Arm, B.C.
Mr. Gordon Kosakoski, Section Head, Habitat Management Unit, Kamloops, B.C.
Mr. Doug Rowland, Habitat Biologist and Nick Winfield, Biologist, Major Projects Review Unit, Vancouver B.C.
Ms. Heather Stalberg, Fisheries Biologist, Habitat Management Unit, Kamloops, B.C.

Ducks Unlimited
Mr. Dan Nontell, Kamloops B.C.

Appendix C

Department of Fisheries & Oceans Policy Issues

Appendix C Department of Fisheries and Oceans Policy Issues

The following is a summary of the DFO Habitat and Enhancement Branch proponent application requirements for works or undertakings that can impact fish or fish habitats (DFO, 1997).

DFO has a legal obligation to protect fish and fish habitat under the *Fisheries Act* for any project that could cause a harmful alteration, disruption or destruction of fish habitat by chemical, physical or biological means. DFO preferentially requires the loss of productive fish habitat be completely avoided during all phases of the project. If impacts cannot be avoided, then impacts to the fisheries resource are to be minimized and residual impacts offset.

If DFO Habitat Enhancement Branch's (DFO-HEB) review of a proposal determines that there is the potential for harmful alteration disruption or destruction (HADD) of fish habitat, an authorization under subsection 35(2) of the *Fisheries Act* will be required. This requirement also triggers the Canadian Environmental Assessment Act (CEAA). It is hoped that project design and mitigation measures will make such an authorization unnecessary.

In general, the DFO encourages proponents to subscribe to their 5 point Planning Principles, which are briefly described below.

1. Fisheries Resource Values - describe the existing fisheries resource values of the area that could be affected by the proposed works, including the species of fish that frequent the stream, fish habitat present (spawning, rearing or overwintering) and riparian vegetation;
2. Describe Proposed Activities - a detailed description of the proposed works and site plan that indicate how the works are to be carried out including all machinery and material to be used. A time schedule of activities and applicable instream work windows that may apply must be provided;
3. Impacts to the Fisheries Resources - anticipated impacts to fisheries values should be discussed including the identification of the nature, magnitude, and location of potential impacts, and effects on fish and fish in downstream areas. All anticipated changes to fish habitat as a result of construction and installation should be stated. Justification for any changes in the natural stream boundary, such as diversion of placement of fill or riprap, should be provided as well as any predicted changes to downstream flows, bars, and stream banks;
4. Mitigation Proposal - a description of all actions and contingencies that will be taken to avoid, reduce or eliminate the impacts outlined in Point 3. It should include a discussion of any proposed habitat compensation works which may be legally required in *a Fisheries Act* authorization in order to achieve "No Net Loss" of fish habitat; and
5. Environmental monitoring - actions to be taken to ensure all of the proposed activities as outlined are completed to the satisfaction of environmental agencies granting approval for the works. This commonly involves an environmental monitor who reports directly to the regulatory agency and who acts at "arms-length" from the proponent and proponents contractors.

Appendix D

Rare or Endangered Species

Appendix D Rare or Endangered Species

Data on rare or endangered species were provided by the Conservation Data Centre (CDC) in Victoria, B.C.. This appendix provides information on the definition of the various categories of rare and endangered species, the limitations and resolution of the CDC data, and an inventory of the rare and endangered species within the TCH corridor between Kamloops and the Alberta border.

Definitions

The CDC has the following classification scheme for rare and endangered species (Conservation Data Centre, 1998; 1997).

- The Red-listed category includes any indigenous species or subspecies (taxa) considered to be extirpated, endangered or threatened in the province. Extirpated taxa no longer exist in the wild in British Columbia, but do occur elsewhere. Endangered taxa are facing imminent expiration or extinction. Threatened taxa are likely to become endangered if limiting factors are not reversed. Red-listed taxa include those that have been, or are being evaluated for these designations.

- The Blue-listed category includes any indigenous (taxa) considered to be vulnerable in the province. Vulnerable taxa are of special concern because of characteristics that make them particularly sensitive to human activities or natural events. Blue-listed taxa are at risk, but are not extirpated, endangered or threatened.

- The Yellow-listed category includes any indigenous taxa that is not at risk in B.C.. The CDC tracks some Yellow-listed taxa which are vulnerable during times of seasonal concentration such as breeding colonies.

- Excluded taxa include marine reptiles and mammals that are not within the Ministry of Environment's mandate, but CDC does track rare taxa in these groups. They are assigned global and provincial rarity ranks, and their list status appears in CDC reports as N/A.

Limitations

It must also be noted that the CDC was not able to provide information regarding occurrences within 30-40 m of the centre line of the corridor. The finest resolution available was 500 m to either side of the centre line. Therefore, many of the listings provided below may not necessarily be affected by highway expansion. If a Red- or Blue-listed plant is several hundred meters from the highway, a detailed investigation is required prior to, or, during planning activities.

It must be noted that the CDC database is dynamic and records are added or amended on a daily basis. Therefore, the list provided in this report summarizes the information at the

time of the request (October 28 1997 and March 12, 1998). This list should not be interpreted as a comprehensive or definitive list of occurrences. It cannot be substituted for environmental assessments of core individual segments because many of the listings were last observed up to several decades ago. This list can be used to identify the corridor segments where there may be rare or endangered species. If any highway upgrades are planned within these corridor segments, then detailed environmental assessment work must address the presence of the rare and endangered species.

Rare or Endangered Species within the TCH Corridor

Red-listed Vertebrates

Species: Western Grebe (*Aechmophorus occidentalis*)
Location: Salmon Arm- immediately to the west of the Marina on the shores of Shuswap lake. Nesting occurs in areas of emergent vegetation and reed canary grass around the mouth of the Salmon River. UTM co-ordinates 3388m. E. 56193m. N. Last Observed 1994. Near corridor segment 90, approximately 500 meters from TCH.

Species: White Sturgeon (*Acipenser Transmontanus Pop2*)
Location: Present in the Columbia River system between the Keenleyside Dam and the US border, but some Sturgeon may also be present above the Keenleyside. UTM co-ordinates 444220m. E. 5465510m. N., 454621m. E. 5428110m. N. Last observed 1991. Near corridor segments 220, 290, 300.

Red-listed Vascular plants

Species: Big Sage - Bluebunch Wheatgrass (*Artemisia iridentaia - elymus spicata*)
Location: Valleyview Silt Cliffs Kamloops. Off TCH heading east, turn on to Highland Road. to Valleyview, trail leads to terrace. UTM co-ordinates 6940m. E. 56165m. N. Last observed 1972. Near corridor segment 20, approximately 500m from TCH.

Species: Rough Fescue-Bluebunch Wheatgrass (*Festuca campestris - elymus spicata*)
Location: Valleyview Silt Cliffs Kamloops. Off TCH heading east, turn on to Highland Road. to Valleyview, trail leads to terrace. UTM co-ordinates 6940m. E. 56165m. N. Last observed 1972. Near corridor segment 20, approximately 500m from TCH.

Species: Purple Blue-eyed Grass (*Olsyniun douglasii var. inflatum*)
Location: Little Shuswap Lake, in the open sandy woods. UTM co-ordinates 3160m. E 56352m. N. Last observed 1974. Within corridor segment 50, in the Stequmwhulpa I.R. Highway is very close to this location.

Species: Mosquito Fern (*Azolla mexicana*)
Location: Tappen, in the lower reaches of White Creek. UTM co-ordinates 3359m. E. 56287m. N. Last observed 1974. Within corridor segment 80, in the North Bay I.R., quite close to TCH.

Species: Mosquito Fern (*Azolla mexicana*)
Location: 2 km west of Salmon Arm along railway line at Salmon River Mouth. UTM co-ordinates 3375m. E. 56187m. N. Last observed 1993. Near corridor segment 90, several hundred meters from TCH.

Species: Hairy Water Clover (*Narsilea vestita*)
Location: Mouth of Salmon River, Salmon Arm. Along inner edge of silt terrace and especially from the bank up to grassed field. UTM co-ordinates 3370m. E. 56196m. N. last observed 1993. Near corridor segment 90, several hundred meters from TCH.

Species: Mosquito Fern (*Azolla mexicana*)
Location: Sicamous 300m west of Silver Sands Resort on south side of TCH, in shallow water of Oxbow Lake. UTM co-ordinates 3601m. E. 56335m. N. Last observed 1982. Within corridor segment 120, quite close to highway.

Species: Mosquito Fern (*Azolla mexicana*)
Location: Cambie, 2.7 km along TCH opposite Sosqua Rd. intersection, in shallow water of oxbow lake. UTM co-ordinates 3661m. E. 56384m. N. Last observed 1982. Within corridor segment 130, very close to TCH.

Species: Giant Hyssop (*Agastache foeniculum*)
Location: 28.8 km west of Golden along the Big Bend Highway, lined both sides of highway for 50 metres. UTM co-ordinates 4861m. E. 57040m. N. Last observed 1947. Within corridor segment 280, very close to TCH.

Species: Crawe's Sedge (*Carex crawei*)
Location: 2.4 km west of Golden, abundant in clay wetland by side of highway. UTM co-ordinates 5014m. E. 56858m. N. Last observed 1947. Near corridor segment 290, several hundred meters from TCH.

Species: Dark Lamb's Quarters (*Chenopodium atrovirens*)
Location: Outskirts of Golden B.C., over 5' tall, other small plants, along the dry roadside. UTM co-ordinates 5023m. E. 56838m. N. Last observed 1958. Within corridor segment 300 quite close to TCH.

Species: Dark Lamb's Quarters (*Chenopodium atrovirens*)
Location: 23 miles west of Field, on mountainside scree, and scree of built up road. UTM co-ordinates 5179m. E. 56793m. N. Last observed 1958. Within corridor segment 320, very close to TCH.

Blue-listed Vertebrates

None listed

Blue-listed Vascular Plants

Species: Threadsilk Milk-Vetch (*Astralalgus filipes*)
Location: Along road to Peterson Creek Park, on ravine slopes with sagebrush, north of Kamloops. UTM co-ordinates 6887m. E. 56156m. N. Last observed 1983. Near corridor segment 10. Located several hundred meters from TCH.

Species: Great Basin Nemophila (*Nemophila brevigflora*)
Location: Little Shuswap Lake on the open sandy beach. UTM co-ordinates 3160m. E. 56352m. N. Last observed 1972. Within corridor segment 50, in the Stequmwhulpa IR. Highway is very close to shore in this location.

Species: Thyne-leaved spurge (*Euphorbia serpyllifolia*)
Location: Tappen , on the stoney beach shore of Shuswap Lake. UTM co-ordinates 3365m. E. 56281m. N. Last observed 1974. Near corridor segment 80. Located almost 1 km from TCH.

Species: American Sweetflag (*Acorus americanus*)
Location: Salmon Arm. UTM co-ordinates 3375m. E. 56186m. N. Last observed 1985. Within corridor segment 90. Located very close to highway.

Species: Blunt-Sepaled Starwart (*Stellaria obtusa*)
Location: Mount Mara. (no other information available). UTM co-ordinates 3625m. E. 56303m. N. Last observed 1971. Near corridor segments 120 & 130. Several hundred meters from TCH.

Species: Orange Touch-Me-Not (*Impatiens aurella*)
Location: Eagle River Canyon. UTM co-ordinates 3871m. E. 56482m. N. Last observed 1950. Near or within corridor segment 170. Located close to TCH.

Species: Small-Flowered Willowherb (*Epilobium leptocarpum*)
Location: South side of Clanwilliam Lake, on moist shady rock ledge on almost perpendicular cliffs: rare. UTM co-ordinates 4040m. E. 56466m. N. Last

observed 1953. Within corridor segment 190. Located very close to highway.

Species: Macoun's Fringed Gentian (*Gentianella crinita ssp macounii*)

Location: Near Field on the west bench of the kicking horse river. UTM co-ordinates 5354m. E. 56938m. N. Last observed 1958. Near or within corridor segment 330. Located almost 1 kilometre from the TCH.

Appendix E

The Archaeological Impact Assessment Process

Appendix E The Archaeological Impact Assessment Process

MoTH provided the study team with maps showing known archaeological sites along the entire TCH corridor. The study team was advised by the Archaeology Branch of the British Columbia Ministry of Small Business, Tourism and Culture that these maps may be out of date (Kenney, 1997, pers. comm.). Most of the archaeological assessment work was conducted in the late 1970s and the 1980s. During this time, the required survey levels were not as stringent as they are now and additional archaeological assessments may be required in areas that were previously assessed (Minni, 1997). All 33 corridor segments within the TCH corridor will likely require archaeological studies prior to upgrading portions of the highway within these segments.

The archaeological impact assessment process is outlined in the British Columbia Archaeological Impact Assessment Guidelines (Archaeology Branch, 1989).

Proponents of a project may have to conduct three levels of archaeological impact assessment:

- An archaeological resource overview that determines if further archaeological assessment is required;
- An archaeological impact assessment that gains a full understanding of the archaeological resources that can be affected by the project; and
- An archaeological impact management study where means of mitigating adverse impacts on archaeological resources are examined.

Archaeological Overview Studies

Archaeological overview studies should include the following:

- A background search of ethnographic, archaeological and historical document search;
- A statement of archaeological resource potential and distribution in the study area;
- A preliminary assessment of anticipated impacts resulting from proposed development; and
- Recommendations concerning the need for further archaeological impact assessment studies.

Archaeological Impact Assessments

An archaeological impact assessment is required where potential archaeological resources are identified in the overview study. The objectives of the impact assessment are to:

- Identify and evaluate archaeological resources within the project area;
- Identify and assess all impacts on archaeological resources that may result from the project; and
- Recommend measures to deal with adverse impacts;

There are two components to an impact assessment; an inventory, and an impact identification and assessment. The inventory involves a field survey of archaeological

resources as defined by the results of the overview study. The impact assessment is required where conflicts have developed between archaeological resources and a proposed development. These studies require an evaluation of the archaeological resource to be impacted as well as an assessment of project impacts.

Archaeological Impact Management

The are several components of archaeological impact management including:

- Mitigation
- Compensation
- Surveillance
- Monitoring
- Emergency Impact Management

Mitigation refers to measures that reduce, prevent or avoid adverse impacts of project construction, operation and maintenance on archaeological resource values. Compensation for losses in archaeological resources due to adverse project impacts can be in the form of a direct monetary payment or in-kind. Surveillance is done to ensure compliance with and execution of proper mitigation measures. Monitoring is done to ensure that unexpected adverse project impacts are addressed. Emergency Impact Management is used where mitigation efforts are ineffective and may involve project redesign or relocation, application of site protection measures, salvage and emergency excavation.

Appendix F

MINERAL RESOURCES

Appendix F Mineral Resources

Introduction

Appendix G provides an inventory, for each corridor segment, of the current mineral claims filed with the Mineral Land Titles Office and the known mineral occurrences listed on the MINFILE data base. The information on the current mineral claims was obtained from the Mineral Titles Database, accessed via the internet. The MINFILE database has information on nearly 12,000 known mineral occurrences in British Columbia. This information includes location, commodities, mineralogy and deposit type, local geology and geological setting, work history and references and publications for each mineral occurrence. Corridor segments not listed did not contain any mineral claims or documented mineral occurrences.

Definitions

The status of a mineral occurrence classifies its economic potential. A mineral occurrence can be classified into four possible categories; showing, prospect, producer and past producer. There were no producers within the TCH corridor between Kamloops and the Alberta border. A showing is a mineral occurrence hosting minor in-situ mineralization. A prospect is an occurrence documented as containing mineralization warranting further exploration. A producer is a deposit from which minerals can be extracted economically. A past producer is a deposit from which minerals are no longer being extracted.

Inventory of Mineral Claims and Mineral Occurrences by Corridor Segment

Corridor Segment 30

Mineral Claims

Claim Name: LCI 7
Claim Number: 218209
Claim Holder: LaFarge Canada Inc.
1200 10655 Southport Road S.W.
Calgary AB T2W 4Y1
Claim Status: Expires November 24, 1998.

Mineral Occurrences

MINFILE number: 092I159
Name: Kamloops
Mapsheet: 092I/9NE
Location: 750 m southwest of the Dallas Drive exit.
UTM coordinates: 5616289 (N), 698105 (E)
Status: Showing
Location accuracy: within 1 km.

Description: The main commodity is clay, likely glaciolacustrine. No other information is available.

Corridor Segment 50

Mineral Occurrences

MINFILE number: 082L034
Name: TO
Mapsheet: 082L/13
Location: Near the TCH, near the east exit to Chase
(LKI Segment #0935, 29.9 km).
UTM coordinates: 5633460 (N), 311820 (E)
Status: Showing
Location accuracy: within 500 m.
Description: This is a fluorite showing located in amphibolite and granite gneiss and associated with fractures either as a constituent within quartz veins or as a coating on fracture surfaces. The fluorite mineralization is associated with a northwest striking, steeply dipping fracture system over a distance of 485 m.

MINFILE number: 082L077
Name: Squilax
Mapsheet: 082L/13
Location: Near the TCH, 500 m southwest of the Squilax Bridge (LKI Segment # 0935, 29.9 km)
UTM coordinates: 5637120 (N), 317140 (E)
Status: Showing
Location accuracy: within 500 m.
Description: Blue agate was found 8 km east of Chase in a slide that meets the TCH at little river fishing camp beside Little Shuswap Lake.

Corridor Segment 60

Mineral Claims

Claim Name: SB 1
Claim Number: 217731
Claim Holder: Martin T. Lindberg
R.R. # 1 Site 5, Comp 1.
Sorrento BC
V0E 2W0
Claim Status: Expires 01/05 2002.

Corridor Segment 80

Mineral Occurrences

MINFILE number: 082L075
Name: Sorrento Limestone
Mapsheet: 082L/14
Location: Near the TCH (LKI Segment # 0935, 52.0 km)
UTM coordinates: 5638819 (N), 329299 (E)
Status: Showing
Location accuracy: within 1 km.
Description: Limestone outcrop. No other information available.

Corridor Segment 110

Mineral Claims

Claim name: Millennium 1-3
Claim number: 351629-351631
Claim holder: Henry James Awmack
207, 675 West Hastings St.
Vancouver BC V6B 1N2
Claim status: Millennium 1 expires October 7, 2004.
Millennium 2 expires October 8, 2003
Millennium 3 expires October 9, 2003.

Mineral Occurrences

MINFILE number: 082L083
Name: Canoe
Mapsheet: 082L/14
Location: 250 m south of the TCH, (LKI Segment # 0950, 12.36 km)
UTM coordinates: 5627750 (N), 347761 (E)
Status: Showing
Location accuracy: within 1 km.
Description: The main commodity here is feldspar for use as an industrial mineral. It appears to occur within a ceramic pegmatite. No other information was available.

MINFILE number: 082L061
Name: Roadside
Mapsheet: 082L/14
Location: 100 m south of the TCH, in the Larch Hills.
UTM coordinates: 5628386 (N), 350924 (E)
Status: Showing
Location accuracy: within 1 km.
Description: The minerals in this occurrence are copper, lead, and zinc and occur within pelitic schists and quartzite.

MINFILE number: 082L021
Name: Annis Main
Mapsheet: 082L/14NW
Location: Approximately 1.7 km northeast of the Annis gravel pit (LKI Segment # 0935, 17.4 km).
UTM coordinates: 5628700 (N), 355250 (E)
Status: Prospect
Location accuracy: within 500 m.
Description: The main commodities in this prospect are lead, zinc, silver, copper. The host rock is a biotite schist containing quartzite bands and massive to semi massive sulphide mineralization including galena, sphalerite, chalcopyrite, pyrrhotite. Main showing is exposed by a 48 m long adit.

MINFILE number: 082L023
Name: Annis 8
Mapsheet: 082L/14NW
Location: Approximately 1.7 km northeast of the Annis gravel pit (LKI Segment # 0935, 17.4 km).
UTM coordinates: 5628960 (N), 355050 (E)
Status: Prospect
Location accuracy: within 500 m.
Description: The main commodities in this prospect are lead, zinc, silver, copper. The host rock is a biotite schist containing quartzite bands and massive to semi massive sulphide mineralization including galena, sphalerite, chalcopyrite, pyrrhotite. This mineral occurrence consists of three trenches north of the adit.

MINFILE number: 082L024
Name: Annis 5
Mapsheet: 082L/14NW
Location: Approximately 1.7 km northeast of the Annis gravel pit (LKI Segment # 0935, 17.4 km).
UTM coordinates: 5628520 (N), 355320 (E)
Status: Prospect
Location accuracy: within 500 m.
Description: The main commodities in this prospect are lead, zinc, silver, copper. The host rock is a biotite schist containing quartzite bands and massive to semi massive sulphide mineralization including galena, sphalerite, chalcopyrite, pyrrhotite. This occurrence is located 122 m north of Annis 11.

MINFILE number: 082L025
Name: Annis 11
Mapsheet: 082L/14NW
Location: Approximately 1.7 km northeast of the Annis gravel pit (LKI Segment # 0935, 17.4 km).

UTM coordinates: 5628385 (N), 355290 (E)
Status: Prospect
Location accuracy: within 500 m.
Description: The main commodities in this prospect are lead, zinc, silver, copper. The host rock is a biotite schist containing quartzite bands and massive to semi massive sulphide mineralization including galena, sphalerite, chalcopyrite, pyrrhotite. This prospect is located 300 m south of the adit.

Corridor Segment 130

Mineral Occurrences

MINFILE number: 082L043
Name: Marlime
Mapsheet: 082L/15
Location: 1 km northwest of the Owlhead Creek crossing on the TCH (LKI Segment # 0960, 2.5 km).
UTM coordinates: 5635910 (N), 362779 (E)
Status: Past Producer
Location accuracy: within 500 m.
Description: A 3 m thick layer of marl, contaminated by soil is exposed in a pit near the village of Solsqua. Travertine is associated with the marl and is deposited by ground water seeping to the surface after passing through calcareous rocks.

Corridor Segment 190

Mineral Occurrences

MINFILE number: 082L018
Name: Three Gs
Mapsheet: 082L
Location: 250 m north of the beginning of Corridor Segment 190 (LKI Segment # 0960, 55.0 km).
UTM coordinates: 5645100 (N), 401000 (E)
Status: Showing
Location accuracy: within 1 km.
Description: This is a graphite-monazite showing. Monazite is the main ore for cerium and thorium. The mineralization occurs within a sequence of gneisses and schists of the Shuswap metamorphic complex.

MINFILE number: 082L016
Name: Clanwilliam Lake
Mapsheet: 082L
Location: 190 m northeast of the Clanwilliam overhead (LKI Segment # 0960, 59.5 km).
UTM coordinates: 5646982 (N), 403566 (E)

Status: Showing
Location accuracy: within 1 km.
Description: The main commodity is silica. This showing is comprised of an outcrop of crystalline quartzite containing no iron bearing minerals. It is white and translucent and contains no impurities.

MINFILE number: 082L017
Name: Victor Lake Quartzite
Mapsheet: 082L
Location: 650 m, north of the Victor Lake picnic site (LKI Segment # 0960, 56.0 km).
UTM coordinates: 5646461 (N), 401683 (E)
Status: Showing
Location accuracy: within 1 km.
Description: The main commodity is silica. This showing is comprised of an outcrop of coarsely crystalline quartzite free of iron bearing minerals and is devoid of bedding or lamination.

Corridor Segment 260

Mineral Occurrences

MINFILE number: 082N068
Name: Silver Creek
Mapsheet: 082N
Location: 1.3 km northwest of the east boundary of Mount Revelstoke National Park (LKI Segment # 0975, 30.6 km)
UTM coordinates: 5663915 (N), 436715 (E)
Status: Showing
Location accuracy: within 500 m.
Description: The main commodity is fluorite. This showing is comprised of a plutonic host rock containing disseminated fluorite and underlain by quartzites and bands of crystalline limestone cut by dikes and sills composed of a granitic gneiss..

MINFILE number: 082N078
Name: Woolsey Creek
Mapsheet: 082N
Location: 300 m north of the east boundary of Mount Revelstoke National Park (LKI Segment # 0975, 30.6 km)
UTM coordinates: 5663275 (N), 437600 (E)
Status: Showing
Location accuracy: within 5 km.
Description: The main commodity is beryl. In this showing, beryl is associated with tourmaline disseminated within a pegmatite host rock underlain by quartzite, orthogneiss, quartz-mica schists and cut by Devonian granitic gneiss, granite and pegmatite dykes and sills.

MINFILE number: 082N072
Name: Albert Canyon
Mapsheet: 082N
Location: In Albert Canyon on the Illecillewaet River, 150 m south of the TCH (LKI Segment # 0975, 37.1 km).
UTM coordinates: 5666767 (N), 442064 (E)
Status: Past producer.
Location accuracy: within 500 m
Description: The main commodity was limestone and marble. There is a 15 m thick bed of limestone on either side of the Illecillewaet River in Albert Canyon. The limestone was used to produce lime in a pot kiln on the south side of the CPR track.

MINFILE number: 082N063
Name: Illecillewaet
Mapsheet: 082N
Location: 700 m northwest of the Jumping Creek Forest Service Road exit on the TCH (LKI Segment # 0975, 43.3 km)
UTM coordinates: 5670605 (N), 449550 (E)
Status: Showing
Location accuracy: within 500 m.
Description: The main commodities are talc and asbestos. Talc and asbestos occur as shear zone replacements in slates and limestone as exposed in a 1m by 5 m pit. The shear zone is exposed in outcrops over a length of 600 m.

MINFILE number: 082N061
Name: Silver Bell
Mapsheet: 082N
Location: 1.3 km southeast of the MacDonald Snowshed (LKI Segment # 0975, 45.9 km).
UTM coordinates: 5671200 (N), 448775 (E)
Status: Prospect
Location accuracy: Within 500 m.
Description: This a lead-zinc-silver prospect, located approximately 750 m east of the TCH. The geology is composed of parallel quartz veins containing galena, sphalerite and pyrite. This prospect is exposed by an underground adit.

MINFILE number: 082N049
Name: North Star
Mapsheet: 082N
Location: 1.2 km, northeast of the MacDonald Snowshed (LKI Segment # 0975, 45.9 km)
UTM coordinates: 5672494 (N) 446787 (E)
Status: Showing
Location accuracy: within 5 km.
Description: The commodities here are lead and silver. A 42 m long adit intersects a vein containing argentiferous galena located in a slate host rock.

Corridor Segment 280

Mineral Claims

Claim Names: Red Rock 1 and Red Rock 2
Claim Number: 352640-352641
Claim Holder: Elizabeth Ann Grady
RR1 S6 C1
Golden BC V0A 1H0
Claim Status: Claim expires May 4, 1998.

Corridor Segment 300

Mineral Occurrences

MINFILE number: 082N070
Name: Golden
Mapsheet: 082N
Location: 1 km southwest of the Frontage road exit off the TCH (LKI Segment # 0985, 55.1 km)
UTM coordinates: 5684400 (N), 501000 (E)
Status: Showing
Location accuracy: within 5 km.
Description: The commodity is clay. The clays are floodplain deposits and can be used for either cheap majolica and common brick.

Corridor Segment 320

Mineral Occurrences

MINFILE number: 082N044
Name: King David
Mapsheet: 082N
Location: 500 m south of the TCH, 4 km from the west boundary of the corridor segment (LKI Segment # 0990, 6.5 km)
UTM coordinates: 5683283 (N), 507939 (E)
Status: Showing
Location accuracy: within 500 m.
Description: The main commodities are uranium, germanium, zirconium and platinum occurring within carbonaceous shells containing disseminated pyrite, marcasite, and graphite. This showing is located in the Kicking Horse valley near the TCH.

MINFILE number: 082N076
Name: Glenogle

Mapsheet: 082N
Location: 300 m south of the TCH (LKI Segment # 0990, 10.0 km)
UTM coordinates: 5681837 (N), 511234 (E)
Status: Past producer
Location accuracy: within 500 m.
Description: This is a dolomite quarry exposed on the TCH in Kicking Horse Canyon. The dolomite is massive, but in some places is thinly bedded. The quarry was operated by the CPR to supply railway ballast in the 1940s.

MINFILE number: 082N083
Name: Glenogle Slate
Mapsheet: 082N
Location: 250 m south of the TCH (LKI Segment # 0990, 13 km)
UTM coordinates: 5681250 (N) 512625 (E)
Status: Past producer
Location accuracy: within 1 km.
Description: This is a quarry on the CPR mainline along the Kicking Horse River and it contains a 100 m by 5 m exposure of slate. The quarry was worked around the turn of the century, but was abandoned due to the hardness of the slate and the presence of pyrite.

Corridor Segment 330

Mineral Occurrences

MINFILE number: 082N062
Name: Empire
Mapsheet: 082N
Location: 1 km southwest of the Ottertail bridge on the TCH (LKI Segment # 0995, 20.5 km)
UTM coordinates: 5686372 (N), 531759 (E)
Type of mineral occurrence: Showing
Location accuracy: within 500 m.
Description: This showing was exposed by an adit 100 m south of the Ottertail River. The host rocks are fractured argillites and calcareous slates. Quartz-carbonate veins infill fractures and contain copper and lead bearing minerals such as galena, bornite, chalcopyrite and tetrahedrite.

MINFILE number: 082N053
Name: Sunday
Mapsheet: 082N
Location: 900 m southwest of the Ottertail Bridge on the TCH (LKI Segment # 0995, 20.5 km)
UTM coordinates: 5686404(N), 531914 (E)
Status: Prospect
Location accuracy: within 500 m.

Description: The host rocks are calcareous slates and argillites dissected by podiform veins of fluorite and calcite with lead, zinc, copper and silver bearing minerals.

MINFILE number: 082N077
Name: Field
Mapsheet: 082N
Location: 500 m south of the Field exit on the TCH (LKI Segment # 0995, 29.1 km)
UTM coordinates: 5693740(N), 535390 (E)
Status: Showing
Location accuracy: within 5 km.
Description: Trace quantities of native mercury have been found in the gravels of the Kicking Horse River. The source of the mercury is unknown.

MINFILE number: 082N074
Name: Mount Stephen
Location: 3.5 km southeast of the Field exit (LKI Segment # 0995, 29.1 km).
Mapsheet: 082N
UTM coordinates: 5692640 (N), 538500 (E)
Status: Showing
Location accuracy: within 5 km.
Description: This showing is composed of chalcopyrite bearing quartz veins in fissures of dolomite and limestone.

MINFILE number: 082N019
Name: Monarch Mine
Mapsheet: 082N
Location: 900 m southeast of the Yoho Valley Campground exit (LKI Segment # 0995, 32.8 km).
UTM coordinates: 5695975(N), 539177 (E)
Status: Past producer
Location accuracy: within 500 m.
Description: The Monarch Mine is located on a north facing cliff, south of the TCH. The deposit was located in 1884 and mined between 1890 and 1957 for zinc, lead, silver, cadmium, and copper. The geology of the deposit is composed of massive to thin bedded limestone and dolomite with zones of massive to brecciated mineralization.

MINFILE number: 082N020
Name: Kicking Horse
Mapsheet: 082N
Location: 650 m northeast of the Yoho Valley Campsite exit on the TCH (LKI Segment # 0995, 32.8 km).
UTM coordinates: 5696900(N), 538515 (E)
Status: Past Producer
Location accuracy: within 500 m.

Description: The Kicking Horse Mine was mined between 1941 and 1952 for lead, zinc, silver, cadmium and copper. The geology of the deposit is composed of massive to thin bedded limestone and dolomite with zones of massive to brecciated mineralization.

Appendix G

Preliminary Ratings of Corridor Segments

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating			Description	LKI Boundaries
				Low	Moderate	High		
10	2050	0.00	0.00					BEGIN SEGMENT
				•			No major environmental constraints	
10	2050	0.00	0.00					AFTON O/P 2876E
				•			No major environmental constraints	
10	2050	0.42	0.42					EXIT TO RTE 1 W/B
				•			No major environmental constraints	
10	2050	0.54	0.54					IRON MASK SIGN BRIDGE 2055
				•			No major environmental constraints	
10	2050	1.07	1.07					ENTR TO RTE 1 E/B
				•			No major environmental constraints	
10	2050	1.31	1.31					CATTLE CROSSING MULTIPLATE
					•		Confined by lake on south side of the TCH.	
10	2050	2.06	2.06					GORE EXIT TO WEIGH SCALE
				•			No major environmental constraints.	
10	2050	3.04	3.04					GORE ENTR FROM WEIGH SCALE
				•			No major environmental constraints.	
10	2050	3.95	3.95					EXIT TO COPPERHEAD DR
				•			No major environmental constraints.	
10	2050	4.23	4.23					COPPERHEAD U/P 2878
				•			No major environmental constraints.	
10	2050	4.66	4.66					ENTR TO RTE 1 E/B
					•		Steep bluff along the south side of the TCH.	
10	2050	5.20	5.20					PACIFIC WAY SIGN BRIDGE 8858
				•			No major environmental constraints.	
10	2050	5.47	5.47					EXIT TO PACIFIC WAY
				•			No major environmental constraints.	
10	2050	5.91	5.91					PACIFIC WAY U/P 2879
				•			No major environmental constraints.	
10	2050	6.07	6.07					ENTR TO RTE 1 E/B
				•			No major environmental constraints.	
10	2050	6.44	6.44					EXIT TO RTE 5A S/B
				•			No major environmental constraints.	
10	2050	6.70	6.70					JCT. RTE 5A
				•			No major environmental constraints.	
10	2050	6.70	6.70					ABERDEEN U/P 2854
				•			No major environmental constraints.	
10	2050	6.70	6.70					END OF SEGMENT
				•			No major environmental constraints.	
10	2060	0.00	6.70					BEGIN SEGMENT
				•			No major environmental constraints.	
10	2060	0.00	6.70					JCT. RTE 5A
				•			No major environmental constraints.	
10	2060	0.00	6.70					ABERDEEN U/P 2854
				•			No major environmental constraints.	
10	2060	0.40	7.10					ENTR TO RTE 1 E/B

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
						•			Steep road cut, glaciolacustrine silts and clays, steep drop on north side of TCH.	
10	2060	0.57	7.27							ABERDEEN SIGN BRIDGE 8857
						•			Steep road cut, glaciolacustrine silts and clays, steep drop on north side of TCH.	
10	2060	0.95	7.65							EXIT TO COLUMBIA ST
						•			Steep road cut, glaciolacustrine silts and clays, steep drop on north side of TCH.	
10	2060	0.95	7.65							SAGEBRUSH SIGN BRIDGE 8856
						•			Steep road cut, glaciolacustrine silts and clays, steep drop on north side of TCH.	
10	2060	1.30	8.00							SAGEBRUSH O/P 2344S
						•			Steep roadcut, glaciolacustrine silts and clays.	
10	2060	1.88	8.58							SPRINGHILL O/P 2220
							•		Very steep roadcut, glaciolacustrine silts and clays.	
10	2060	3.05	9.75							PETERSON CREEK BRIDGE W ABUT 2319
							•		Very steep roadcut, glaciolacustrine silts and clays; ravine.	
10	2060	3.25	9.95							PETERSON CREEK BRIDGE E ABUT 2319
							•		Very steep roadcut, glaciolacustrine silts and clays.	
10	2060	3.52	10.22							ACCESS TO GRAVEL PIT
						•			Glaciolacustrine silts and clays in cutslope.	
10	2060	3.69	10.39							ACCESS TO RUN AWAY LANE
						•			Glaciolacustrine silts and clays.	
10	2060	4.57	11.27							ACCESS TO GRAVEL PIT
							•		Very steep roadcut, glaciolacustrine silts and clays.	
10	2060	4.88	11.58							EXIT TO RTE 5 N/B
						•			Steep roadcut, glaciolacustrine silts and clays.	
10	2060	5.37	12.07							YELLOWHEAD F/O 2379
						•			Steep roadcut, glaciolacustrine silts and clays.	
10	2060	5.37	12.07							END OF SEGMENT

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
20	0925	0.00	0.00							BEGIN SEGMENT
				•					No major environmental constraints.	
20	0925	0.00	0.00							YELLOWHEAD F/O 2379
				•					No major environmental constraints.	
20	0925	0.15	0.15							EXIT TO RTE 5 N/B
				•					No major environmental constraints.	
20	0925	0.30	0.30							ENTR TO RTE 1 W/B
				•					No major environmental constraints.	
20	0925	0.39	0.39							VALLEYVIEW O/P 2386
				•					No major environmental constraints.	
20	0925	0.44	0.44							ENTR TO RTE 1 E/B
				•					No major environmental constraints.	
20	0925	0.46	0.46							VALLEYVIEW O/P 2386
				•					No major environmental constraints.	
20	0925	0.69	0.69							EXIT TO COLUMBIA ST
				•					No major environmental constraints.	
20	0925	0.78	0.78							ENTR TO RTE 1 E/B
				•					No major environmental constraints.	
20	0925	1.00	1.00							COMAZETTO RD
				•					No major environmental constraints.	
20	0925	1.64	1.64							VICARS RD
				•					No major environmental constraints.	
20	0925	1.86	1.86							VICARS SIGN BRIDGE 8863
				•					No major environmental constraints.	
20	0925	2.48	2.48							ORIOLE RD
				•					No major environmental constraints.	
20	0925	3.30	3.30							HIGHLAND RD
				•					No major environmental constraints.	
20	0925	4.03	4.03							RIVER RD
				•					No major environmental constraints.	
20	0925	4.97	4.97							TANAGER RD

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
30			0.00							Tanager Road
				•					No major environmental constraints.	
30	0925	5.57	0.60							TRAFFIC COUNT STATION 56300 (21-003 E) (2 LOOPS)
				•					No major environmental constraints.	
30	0925	5.57	0.60							TRAFFIC COUNT STATION 56301 (21-003 W) (2 LOOPS)
				•					No major environmental constraints.	
30	0925	7.45	2.48							HOLMAN RD
				•					No major environmental constraints.	
30	0925	8.65	3.68							DALLAS DR
				•					No major environmental constraints.	
30	0925	8.65	3.68							START 4 LANES
				•					No major environmental constraints.	
30	0925	9.03	4.06							KIPP RD
				•					No major environmental constraints.	
30	0925	9.71	4.74							HARPER ST
				•					No major environmental constraints.	
30	0925	10.40	5.43							CATTLE CROSSING MULTIPLATE FOR PED USE
				•					No major environmental constraints.	
30	0925	10.71	5.74							MOUNTVIEW DR
				•					No major environmental constraints.	
30	0925	11.53	6.56							DALLAS DR
				•					No major environmental constraints.	
30	0925	11.64	6.67							ACCESS TO DALLAS STORE & SUPER SAVE GAS ON RIG
				•					No major environmental constraints.	
30	0925	11.77	6.80							PAT RD
				•					No major environmental constraints.	
30	0925	12.22	7.25							ORCHARD RIDGE TRAILER PARK
				•					No major environmental constraints.	
30	0925	12.87	7.90							O'CONNER RD
				•					No major environmental constraints.	
30	0925	13.27	8.30							TRAFFIC COUNT STATION 56410 (21-015 E/W) (4 LOOPS)
				•					No major environmental constraints.	
30	0925	14.68	9.71							PEERLESS RD
				•					No major environmental constraints.	
30	0925	15.62	10.65							CAMPBELL CREEK IND PK N BRIDGE 2801N
				•					No major environmental constraints.	
30	0925	16.40	11.43							CAMPBELL CREEK BRIDGE NO 1 1226
				•					No major environmental constraints.	
30	0925	16.63	11.66							KAMLOOPS WATERSLIDES
				•					No major environmental constraints.	
30	0925	17.05	12.08							EXIT TO LAFARGE RD
				•					No major environmental constraints.	
30	0925	17.05	12.08						**End 4 lane section.**	END 4 LANES
				•					No major environmental constraints.	
30	0925	17.30	12.33							ENTR TO RTE 1 W/B

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating Low	Moderate	High	Description	LKI Boundaries
				•			No major environmental constraints.	
30	0925	17.35	12.38					TUMBLEWEED F/O 2471
				•			No major environmental constraints.	
30	0925	17.46	12.49					ENTR TO RTE 1 E/B
				•			No major environmental constraints.	
30	0925	17.68	12.71					CN/CP RAILWAY U/P
				•			No major environmental constraints.	
30	0925	17.87	12.90					EXIT TO LAFARGE RD
				•			No major environmental constraints.	
30	0925	18.61	13.64					ENTR TO CATTLEMEN'S ASSOCIATION
				•			No major environmental constraints.	
30	0925	19.21	14.24					END OF KAMLOOPS CITY LIMITS
				•			No major environmental constraints.	
30	0925	19.21	14.24					KAMLOOPS CITY POLICE
				•			No major environmental constraints.	
30	0925	19.21	14.24					BEGIN CHASE HWY PATROL
				•			No major environmental constraints.	
30	0925	19.21	14.24					END ARTERIAL 829R
				•			No major environmental constraints.	
30	0925	19.31	14.34					ACCESS TO SMALL AIR FIELD
				•			No major environmental constraints.	
30	0925	19.59	14.62					WITTNER RD
				•			No major environmental constraints.	
30	0925	19.71	14.74					CATTLE CROSSING MULTIPLATE
				•			No major environmental constraints.	
30	0925	20.93	15.96					SONORA RD
				•			No major environmental constraints.	
30	0925	23.18	18.21				**Begin 4 lane section.**	ENTR GROWER'S MARKET
				•			No major environmental constraints.	
30	0925	24.42	19.45					REST AREA LAY BY & DIRECTIONAL MAP
				•			No major environmental constraints.	
30	0925	24.90	19.93				**End 4 lane section.**	MONTE CREEK RD
				•			No major environmental constraints.	
30	0925	25.08	20.11					MONTE CREEK
				•			No major environmental constraints.	
30	0925	25.13	20.16					ENTR FROM RV PARK PETRO CANADA & RESTAURANT
				•			No major environmental constraints.	
30	0925	25.55	20.58					BOSTOCK RD
				•			No major environmental constraints.	
30	0925	25.70	20.73					ACCESS TO BC TEL BLDG
				•			No major environmental constraints.	
30	0925	25.90	20.93					JCT. RTE 97
				•			No major environmental constraints.	
30	0925	25.90	20.93					END KAMLOOPS RURAL POLICE BNDRY
				•			No major environmental constraints.	
30	0925	25.90	20.93					END THOMPSON DIST

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
30	0925	25.90	20.93	●					No major environmental constraints.	END OF SEGMENT

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating			Description	LKI Boundaries
				Low	Moderate	High		
40	0935	0.00	0.00					BEGIN SEGMENT
				•			No major environmental constraints.	
40	0935	0.00	0.00					END THOMPSON DIST
				•			No major environmental constraints.	
40	0935	0.00	0.00					START OKANAGAN/SHUSWAP DIST
				•			No major environmental constraints.	
40	0935	0.00	0.00					JCT. RTE 97 MONTE CREEK
				•			No major environmental constraints.	
40	0935	0.00	0.00					BEGIN CHASE POLICE DEPARTMENT
				•			No major environmental constraints.	
40	0935	0.33	0.33					TRANS CANADA CATTLE TUNNEL 8813
				•			No major environmental constraints.	
40	0935	0.60	0.60					TRAFFIC COUNT STATION 56360 (21-010 E/W)
				•			No major environmental constraints.	
40	0935	1.45	1.45					EVERETT CATTLE BOX 8511
				•			No major environmental constraints.	
40	0935	2.80	2.80					BOSTOCK RD ENTR TO RIO VISTA RANCH
				•			No major environmental constraints.	
40	0935	3.36	3.36					CATTLE U/P
				•			No major environmental constraints.	
40	0935	3.86	3.86					ENTR TO ROCKY POINT FARMS
				•			No major environmental constraints.	
40	0935	4.51	4.51					CATTLE U/P
				•			No major environmental constraints.	
40	0935	7.06	7.06					CATTLE U/P
				•			No major environmental constraints.	
40	0935	7.73	7.73					ENTR TO NEDS CREEK RANCH
				•			No major environmental constraints.	
40	0935	10.96	10.96					HUTCHINSONS FRONTAGE RD #700-2
				•			No major environmental constraints.	
40	0935	10.96	10.96					PRITCHARD POST OFFICE
				•			No major environmental constraints.	
40	0935	11.03	11.03					STONEY FLATS RD #266 W ENTR
				•			No major environmental constraints.	
40	0935	11.03	11.03					PINANTAN RD #227
				•			No major environmental constraints.	
40	0935	11.79	11.79					CATTLE U/P
				•			No major environmental constraints.	
40	0935	15.37	15.37					STONEY FLATS RD #262 E ENTR
				•			No major environmental constraints.	
40	0935	16.03	16.03					TRAFFIC COUNT STATION 56590 (22-018 E/W)
				•			No major environmental constraints.	
40	0935	16.23	16.23					WILLOW RD #266
					•		TCH confined by the South Thompson River, the C.P.R. line and a steep cutslope.	

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating			Description	LKI Boundaries
				Low	Moderate	High		
40	0935	18.03	18.03					HOFFMANS BLUFF PULLOUT
						•	TCH confined by the South Thompson River, the C.P.R. line and a steep cutslope.	
40	0935	22.76	22.76					MANUELS RODEO GROUNDS
				•			No major environmental constraints.	
40	0935	22.86	22.86					GAS STATION ACCESS TEXACO
				•			No major environmental constraints.	
40	0935	23.60	23.60					ACCESS SHUSWAP HALL
				•			No major environmental constraints.	
40	0935	24.95	24.95					HARPER LAKE RD #197
				•			No major environmental constraints.	
40	0935	25.26	25.26					SHUSWAP CHASE CREEK RD #202
				•			No major environmental constraints.	
40	0935	25.60	25.60					THE CORN FARM
				•			No major environmental constraints.	
40	0935	25.62	25.62					V.L.A. RD #204
				•			No major environmental constraints.	
40	0935	26.34	26.34					GOLDEN EARS FARM
				•			No major environmental constraints.	
40	0935	26.94	26.94					GRUBE PIT P2224
				•			No major environmental constraints.	
40	0935	27.42	27.42					CHASE W EXIT BUSINESS RTE

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating			Description	LKI Boundaries
				Low	Moderate	High		
50		27.42	0.00					Chase West exit
				•			No major environmental constraints.	
50	0935	27.88	0.46					LITTER BARREL SITE W ENTR
				•			No major environmental constraints.	
50	0935	28.20	0.78					LITTER BARREL SITE E ENTR
				•			No major environmental constraints.	
50	0935	29.28	1.86					START 2 LANE E/B
				•			No major environmental constraints.	
50	0935	29.42	2.00					CHASE CREEK BYPASS BRIDGE W END 2257
				•			No major environmental constraints.	
50	0935	29.45	2.03					CHASE CREEK BYPASS BRIDGE E END 2257
				•			No major environmental constraints.	
50	0935	29.46	2.04					COBOURN ST (L/R)
						•	TCH on steep slopes above C.P.R tracks and a residential area.	
50	0935	29.46	2.04					CHASE YARD/PIT P2226
						•	TCH on steep slopes above C.P.R tracks and a residential area.	
50	0935	29.49	2.07					CHASE CREEK REST AREA
						•	TCH on steep slopes above C.P.R tracks and a residential area.	
50	0935	29.72	2.30					CHASE E EXIT
						•	TCH on steep slopes above C.P.R tracks and a residential area.	
50	0935	29.87	2.45					EXIT TO CHASE W/B
						•	TCH on steep slopes above C.P.R tracks and a residential area.	
50	0935	30.70	3.28					ENTR TO MATTEYS
						•	TCH on steep slopes above C.P.R tracks and a residential area.	
50	0935	31.17	3.75					LITTER BARREL SITE
					•		Steep slopes above the TCH.	
50	0935	32.17	4.75					JADE MTN FRONTAGE RD #700-1 W ENTR
					•		Steep slopes above the TCH.	
50	0935	32.33	4.91					JADE MTN FRONTAGE RD #700-1 E ENTR
						•	TCH on steep slope above CPR tracks and Little Shuswap Lake.	
50	0935	34.35	6.93					CHASE O/H W END 1510
					•		TCH confined between Little Shuswap Lake and CPR tracks.	
50	0935	34.48	7.06					CHASE O/H E END 1510
					•		TCH confined between Little Shuswap Lake and CPR tracks.	
50	0935	37.02	9.60					SILVERY BEACH FISHING CAMP
				•			No major environmental constraints.	

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
50	0935	38.17	10.75							TRAFFIC COUNT STATION 56470 (22-005 E/W)
				●					No major environmental constraints.	
50	0935	38.60	11.18							SQUILAX BRIDGE O/H 0481

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
60		38.60	0.00							Squilax bridge
					•				TCH confined between CPR tracks and South Thompson River.	
60	0935	38.77	0.17							SQUILAX TURTLE VALLEY RD #447 W ENTR
					•				TCH confined between CPR tracks and South Thompson River.	
60	0935	38.77	0.17							TRUNK RTE 922 SEGMENT 0944 KM 0.00
					•				TCH confined between CPR tracks and South Thompson River.	
60	0935	39.01	0.41							SQUILAX TURTLE VALLEY RD #447 E ENTR
					•				TCH confined between CPR tracks and South Thompson River.	
60	0935	39.11	0.51							ENTR TO RTE 1 E/B
					•				TCH confined between CPR tracks and South Thompson River.	
60	0935	39.27	0.67							ACCESS SQUILAX TRADING POST
					•				TCH confined between CPR tracks and South Thompson River.	
60	0935	39.87	1.27							TRAFFIC COUNT STATION 56480 (22-006 E/W)
						•			TCH confined by South Thompson River and some steep bedrock sections above the hwy.	
60	0935	40.26	1.66							LITTER BARREL SITE AT THE MOUTH OF LITTLE RIVER W
						•			TCH confined by South Thompson River and some steep bedrock sections above the hwy.	
60	0935	40.36	1.76							LITTER BARREL SITE AT THE MOUTH OF LITTLE RIVER E
						•			TCH confined by South Thompson River and some steep bedrock sections above the hwy.	
60	0935	41.64	3.04							LITTLE RIVER RD #744 W ENTR
						•			TCH confined by South Thompson River and some steep bedrock sections above the hwy.	
60	0935	41.91	3.31							LITTLE RIVER RD #744 E ENTR
								•	TCH confined between steep bedrock outcrops in the cut slope, and the south Thompson River.	
60	0935	42.47	3.87							LINDBURG RD #745 HOUSES ON HILLSIDE
								•	TCH confined between steep bedrock outcrops in the cut slope, and the south Thompson River.	
60	0935	43.25	4.65							LITTER BARREL SITE W ENTR
								•	TCH confined between steep bedrock outcrops in the cut slope, and the south Thompson River.	
60	0935	43.35	4.75							LITTER BARREL SITE E ENTR
								•	TCH confined between steep bedrock outcrops in the cut slope, and the south Thompson River.	
60	0935	44.13	5.53							SQUILAX MTN LOOKOUT BOAT LAUNCH W ENTR
								•	TCH confined between steep bedrock outcrops in the cut slope, and the south Thompson River.	

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating			Description	LKI Boundaries
				Low	Moderate	High		
60	0935	44.21	5.61					SQUILAX MTN LOOKOUT BOAT LAUNCH E ENTR
						•	TCH confined between steep bedrock outcrops in the cut slope, and the south Thompson River.	
60	0935	44.43	5.83					DES FOSSES RD #90
				•			No major environmental constraints.	
60	0935	44.43	5.83					END OF CHASE FOREMAN AREA/BEGIN OF SALMON ARM
				•			No major environmental constraints.	
60	0935	44.60	6.00					WAVERLY PARK FRONTAGE RD #700-7 W ENTR
				•			No major environmental constraints.	
60	0935	45.16	6.56					WAVERLY PARK FRONTAGE #700-7 E ENTR
				•			No major environmental constraints.	
60	0935	45.55	6.95					COBEAUX RD #102 (L/R)

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating			Description	LKI Boundaries
				Low	Moderate	High		
70		45.55	0.00					Cobeaux road
				•			No major environmental constraints.	
70	0935	46.36	0.81					ELSON RD #104
				•			No major environmental constraints.	
70	0935	46.47	0.92					DILLWORTH RD #98
				•			No major environmental constraints.	
70	0935	46.47	0.92					BUCKLEY RD #101
				•			No major environmental constraints.	
70	0935	46.88	1.33					GARROWAY RD #65
				•			No major environmental constraints.	
70	0935	46.88	1.33					KINGHORN RD #107 W ENTR
				•			No major environmental constraints.	
70	0935	47.16	1.61					CARSON RD #111
				•			No major environmental constraints.	
70	0935	47.31	1.76					COATES RD #89
				•			No major environmental constraints.	
70	0935	47.51	1.96					KINGHORN RD #107 E ENTR
				•			No major environmental constraints.	
70	0935	47.52	1.97					PACHENDALE RD #133 W ENTR
				•			No major environmental constraints.	
70	0935	47.96	2.41					PACHENDALE RD #133 E ENTR
				•			No major environmental constraints.	
70	0935	48.17	2.62					CAEN RD #135
				•			No major environmental constraints.	
70	0935	48.17	2.62					NOTCH HILL RD #410 W ENTR
				•			No major environmental constraints.	
70	0935	48.28	2.73					CASSINO RD #170
				•			No major environmental constraints.	
70	0935	48.40	2.85					ARNHEIM RD #171
				•			No major environmental constraints.	
70	0935	48.68	3.13					HENSTRIDGE RD #130
				•			No major environmental constraints.	
70	0935	48.72	3.17					FALAISE RD #698
				•			No major environmental constraints.	
70	0935	49.01	3.46					SORRENTO/EAGLE BAY RD #67
				•			No major environmental constraints.	
70	0935	49.01	3.46					CHASE RCMP E BNDRY
				•			No major environmental constraints.	
70	0935	49.01	3.46					SALMON ARM RCMP W BNDRY

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
80		49.01	0.00							Salmon Arm rcmp
				•					No major environmental constraints.	
80	0935	49.13	0.12							SPEED ZONE CHANGE 60 KMH TO 90 KMH
				•					No major environmental constraints.	
80	0935	49.57	0.56						**Begin 3 lane section.**	START OF 2 LANES E/B
				•					No major environmental constraints.	
80	0935	52.84	3.83							HILLTOP RD #403
				•					No major environmental constraints.	
80	0935	53.04	4.03							HILLTOP RD #403
				•					No major environmental constraints.	
80	0935	53.80	4.79							LITTER BARREL SITE
				•					No major environmental constraints.	
80	0935	54.10	5.09							CEDAR DR #368
				•					No major environmental constraints.	
80	0935	54.10	5.09							END 2 LANES W/B
				•					No major environmental constraints.	
80	0935	54.25	5.24							END 2 LANES E/B
				•					No major environmental constraints.	
80	0935	54.94	5.93							CENTENIAL DR #706
				•					No major environmental constraints.	
80	0935	55.06	6.05							START 2 LANES W/B
				•					No major environmental constraints.	
80	0935	55.58	6.57							GREER RD #70
				•					No major environmental constraints.	
80	0935	57.78	8.77							NOTCH HILL RD #410 E ENTR
				•					No major environmental constraints.	
80	0935	57.83	8.82							PETERSON RD #75
				•					No major environmental constraints.	
80	0935	57.83	8.82							BALMORAL RD #70
				•					No major environmental constraints.	
80	0935	57.83	8.82							WHITE LAKE RD #56 W ENTR
				•					No major environmental constraints.	
80	0935	58.26	9.25							END TWO LANES W/B
				•					No major environmental constraints.	
80	0935	59.71	10.70							LITTER BARREL SITE
				•					No major environmental constraints.	
80	0935	59.79	10.78							WUORI RD #57
				•					No major environmental constraints.	
80	0935	60.31	11.30							BEGIN 2 LANES W/B
				•					No major environmental constraints.	
80	0935	60.75	11.74						**End 3 lane section.**	CATTLE U/P
				•					No major environmental constraints.	
80	0935	60.88	11.87							CARLIN RD #24
				•					No major environmental constraints.	
80	0935	61.10	12.09							WHITE CREEK CULVERT

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating: Low	Moderate	High	Description	LKI Boundaries
				•			No major environmental constraints.	
80	0935	61.80	12.79					WHITE LAKE RD #56 (L)E ENTR
				•			No major environmental constraints.	
80	0935	62.19	13.18					CALHOUN RD #39
				•			No major environmental constraints.	
80	0935	62.36	13.35					START 2 LANES E/B
				•			No major environmental constraints.	
80	0935	62.37	13.36					CARLIN SCHOOL
				•			No major environmental constraints.	
80	0935	63.43	14.42					FRONTAGE RD W ENTR
				•			No major environmental constraints.	
80	0935	63.49	14.48				**Begin 3 lane section.**	END 2 LANES E/B
				•			No major environmental constraints.	
80	0935	63.53	14.52					FRONTAGE RD E ENTR
				•			No major environmental constraints.	
80	0935	63.85	14.84					FORD RD #36
				•			No major environmental constraints.	
80	0935	63.97	14.96				**End 3 lane section.**	PULLOUT FOR MAILBOXES W ENTR
				•			No major environmental constraints.	
80	0935	64.05	15.04					PULLOUT FOR MAILBOXES E ENTR
				•			No major environmental constraints.	
80	0935	64.83	15.82					KIRKPATRICK RD #337
				•			No major environmental constraints.	
80	0935	65.00	15.99					END 2 LANES W/B
				•			No major environmental constraints.	
80	0935	65.25	16.24					JAMES RD #23
				•			No major environmental constraints.	
80	0935	65.95	16.94					START 2 LANES W/B
				•			No major environmental constraints.	
80	0935	66.20	17.19					SUNNYBRAE/CANOE POINT RD #28
				•			No major environmental constraints.	
80	0935	66.52	17.51					TAPPEN STORE & POST OFFICE
				•			No major environmental constraints.	
80	0935	66.66	17.65					CALHOUN RD #39
				•			No major environmental constraints.	
80	0935	66.66	17.65					TAPPEN STATION RD #40
				•			No major environmental constraints.	
80	0935	66.89	17.88					TAPPEN O/H W END 1383
				•			No major environmental constraints.	
80	0935	66.96	17.95					TAPPEN O/H E END 1383
				•			No major environmental constraints.	
80	0935	67.02	18.01					TAPPEN VALLEY RD #33
				•			No major environmental constraints.	
80	0935	68.26	19.25					TAPPEN ESSO
				•			No major environmental constraints.	
80	0935	68.35	19.34					BOLTON RD #21

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				•					No major environmental constraints.	
80	0935	68.96	19.95							TAPPEN BEACH RD #15 (FRASER BEACH)
				•					No major environmental constraints.	
80	0935	69.11	20.10							LITTER BARREL SITE
				•					No major environmental constraints.	
80	0935	69.39	20.38							START 2 LANES E/B
				•					No major environmental constraints.	
80	0935	70.07	21.06						**Begin 3 lane section.**	END 2 LANES W/B
						•			Bedrock in cutslope, TCH built on a steep slope above Shuswap Lake.	
80	0935	70.12	21.11							END 2 LANES E/B
						•			Bedrock in cutslope, TCH built on a steep slope above Shuswap Lake.	
80	0935	70.40	21.39							KAULT HILL VIEWPOINT W ENTR
						•			Bedrock in cutslope, TCH built on a steep slope above Shuswap Lake.	
80	0935	70.69	21.68						**End 3 lane section.**	KAULT HILL VIEWPOINT E ENTR
				•					No major environmental constraints.	
80	0935	71.25	22.24							START 2 LANES W/B
				•					No major environmental constraints.	
80	0935	71.39	22.38							GLEN ECHO RESORT
				•					No major environmental constraints.	
80	0935	71.53	22.52							65TH AVE NW
				•					No major environmental constraints.	
80	0935	72.73	23.72							GLENEDEN RD 50TH AVE NW
				•					No major environmental constraints.	
80	0935	72.74	23.73							PIERRES POINT RD
				•					No major environmental constraints.	
80	0935	73.23	24.22							SANDY POINT RD 46TH AVE NW
				•					No major environmental constraints.	
80	0935	77.35	28.34							GLENEDEN RD TO HWY MAINTENANCE YARD
				•					No major environmental constraints.	
80	0935	77.35	28.34							1ST AVE SW
				•					No major environmental constraints.	
80	0935	77.62	28.61							TRAFFIC COUNT STATION 56430 (22-001 E/W)
				•					No major environmental constraints.	
80	0935	77.82	28.81							SALMON ARM/GRAMD PRAIRIE CLASSIFIED RD #217B
				•					No major environmental constraints.	
80	0935	78.02	29.01							TRAFFIC COUNT STATION 56490 (22-007 E/W)
				•					Suburban, no major environmental constraints.	
80	0935	78.04	29.03							SALMON RIVER BRIDGE W END 1187

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating			Description	LKI Boundaries
				Low	Moderate	High		
90		78.04	0.00				Begin 4 lanes	
				•			Urban area, no major environmental constraints.	
90	0935	78.07	0.03					SALMON RIVER BRIDGE E END 1187
				•			Urban area, no major environmental constraints.	
90	0935	78.22	0.18					ENTR TO DEMILLES
				•			Urban area, no major environmental constraints.	
90	0935	78.79	0.75					30TH ST SW SALMON ARM READY-MIX
				•			Urban area, no major environmental constraints.	
90	0935	78.98	0.94					ACCESS TO PETTY'S MEATS
				•			Urban area, no major environmental constraints.	
90	0935	79.26	1.22					ENTR TO W FRASER BLDG SUPPLIES
				•			Urban area, no major environmental constraints.	
90	0935	79.45	1.41					ROTTEN ROW/10TH AVE SW W ENTR
				•			Urban area, no major environmental constraints.	
90	0935	79.48	1.44					ROTTEN ROW/10TH AVE SW E EXIT
				•			Urban area, no major environmental constraints.	
90	0935	79.95	1.91					17TH ST SW
				•			Urban area, no major environmental constraints.	
90	0935	80.30	2.26					ENTR TO BRABY MOTORS
				•			Urban area, no major environmental constraints.	
90	0935	80.32	2.28					END 2 LANES W/B
				•			Urban area, no major environmental constraints.	
90	0935	80.45	2.41					4TH AVE SW VALLEY TIRE
				•			Urban area, no major environmental constraints.	
90	0935	80.51	2.47					START 2 LANES E/B
				•			Urban area, no major environmental constraints.	
90	0935	80.57	2.53					PICADILLY RD 10TH ST SW
				•			Urban area, no major environmental constraints.	
90	0935	81.00	2.96					POWER ST 5TH ST SW
				•			Urban area, no major environmental constraints.	
90	0935	81.21	3.17					ARENA RD 3RD ST SW
				•			Urban area, no major environmental constraints.	
90	0935	81.48	3.44					SHUSWAP ST
				•			Urban area, no major environmental constraints.	
90	0935	81.55	3.51					MCLEOD ST 1ST ST SE
				•			Urban area, no major environmental constraints.	
90	0935	81.74	3.70					ALEXAMDER ST 2ND ST SE
				•			Urban area, no major environmental constraints.	
90	0935	81.84	3.80					ROSS ST 3RD ST SE
				•			Urban area, no major environmental constraints.	
90	0935	81.94	3.90					JACOBSON'S TRUCK LOT LANE
				•			Urban area, no major environmental constraints.	
90	0935	81.96	3.92					4TH ST NE GULF & 7/11
				•			Urban area, no major environmental constraints.	
90	0935	82.08	4.04					6TH ST NE MOHO

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating			Description	LKI Boundaries
				Low	Moderate	High		
				●			Urban area, no major environmental constraints.	
90	0935	82.08	4.04					START 2 LANES W/B
				●			Urban area, no major environmental constraints.	
90	0935	82.20	4.16				**End 4 lane section.**	10TH ST NE HOSPITAL
				●			No major environmental constraints.	
90	0935	82.75	4.71				**Begin 3 lane section.**	14TH ST NE SCHOOL
				●			No major environmental constraints.	
90	0935	83.31	5.27					18TH ST NE
				●			No major environmental constraints.	
90	0935	83.44	5.40					20TH ST NE
				●			No major environmental constraints.	
90	0935	83.53	5.49					21ST ST NE BOWLING ALLEY
				●			No major environmental constraints.	
90	0935	83.86	5.82					22ND ST NE ROBIN HOOD TOYOTA
				●			No major environmental constraints.	
90	0935	83.96	5.92					EGAN'S ACCESS
				●			No major environmental constraints.	
90	0935	84.11	6.07					28TH ST NE CURLING RINK
				●			No major environmental constraints.	
90	0935	84.26	6.22				**End 3 lane section.**	BRD VIEW 30TH ST NE
				●			No major environmental constraints.	
90	0935	85.10	7.06				**Begin 3 lane section.**	40TH ST NE STARDUST MOTEL
				●			No major environmental constraints.	
90	0935	85.52	7.48					TRAFFIC COUNT STATION 56510 (22-009 E/W)
				●			No major environmental constraints.	
90	0935	85.72	7.68				**End 3 lane section.**	10TH AVE NE W ACCESS TO 97B (GRINDROD)
				●			No major environmental constraints.	
90	0935	85.72	7.68					SALMON ARM HWY #655R
				●			No major environmental constraints.	
90	0935	85.72	7.68					END OF SEGMENT

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating			Description	LKI Boundaries
				Low	Moderate	High		
100	0950	0.00	0.00					BEGIN SEGMENT
				●			No major environmental constraints.	
100	0950	0.00	0.00					10TH AVE NE W ACCESS TO 97B GRINDROD/SALMON ARM
				●			No major environmental constraints.	
100	0950	0.12	0.12					ACCESS RESTAURANT
				●			No major environmental constraints.	
100	0950	0.27	0.27					E ACCESS TO 97B GRINDROD/SALMON ARM HWY 655R
				●			No major environmental constraints.	
100	0950	0.47	0.47					TRAFFIC COUNT STATION 56500 (22-008 E/W)
				●			No major environmental constraints.	
100	0950	0.87	0.87					HARPER RD 20TH AVE NE
				●			No major environmental constraints.	
100	0950	1.37	1.37					FARM GARDEN MARKET
				●			No major environmental constraints.	
100	0950	2.52	2.52					40TH AVE NE
				●			No major environmental constraints.	
100	0950	3.02	3.02					END OF TWO LANES W/B
				●			No major environmental constraints.	
100	0950	3.13	3.13				**Begin 3 lane section.**	PEACHY HILL FRONTAGE RD W ENTR CAL VAN MOTEL
				●			No environmental constraints.	
100	0950	3.54	3.54					PEACHY HILL FRONTAGE RD E ENTR
				●			No environmental constraints.	
100	0950	3.65	3.65					SHANNONS RECREATION PARK ENTR
				●			No environmental constraints.	
100	0950	4.15	4.15					60TH AVE NE
				●			No environmental constraints.	
100	0950	4.30	4.30				**Begin 3 lane section.**	50TH ST NE W JCT. FROM CANOE FOR W/B TRAFFIC
				●			No major environmental constraints.	
100	0950	4.44	4.44					50TH ST NE W JCT. TO/FROM CANOE FOR E/B TRAFFIC
				●			No major environmental constraints.	
100	0950	4.45	4.45					63RD AVE NE
				●			No major environmental constraints.	
100	0950	5.04	5.04					LYMAN HILL RD 70TH AVE NE
				●			No major environmental constraints.	
100	0950	5.13	5.13					E ENTR TO 70TH AVE NE FOR W/B TRAFFIC
				●			No major environmental constraints.	
100	0950	5.84	5.84					CANOE BEACH DR E JCT. TO CANOE W ENTR
				●			No major environmental constraints.	
100	0950	5.86	5.86					CANOE BEACH DR E ENTR

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating			Description	LKI Boundaries
				Low	Moderate	High		
110		5.86	0.00					
				•			No major environmental constraints.	
110	0950	6.39	0.53					SAWMILL OFFICE ENTR
				•			No major environmental constraints.	
110	0950	6.74	0.88					MILL ENTR
				•			No major environmental constraints.	
110	0950	7.00	1.14					70TH ST NE
					•		TCH on slope above Shuswap Lake.	
110	0950	8.93	3.07					LITTER BARREL SITE
					•		TCH on slope above Shuswap Lake, occasional bedrock outcrop in cutslope.	
110	0950	10.60	4.74					KANGAROO RD
					•		TCH on slope above Shuswap Lake.	
110	0950	10.90	5.04					CO-OP LOGGING RD
				•			No major environmental constraints.	
110	0950	11.05	5.19					LITTER BARREL SITE
				•			No major environmental constraints.	
110	0950	11.98	6.12					BEACH ACCESS
				•			No major environmental constraints.	
110	0950	13.16	7.30					LOGGING RD
				•			No major environmental constraints.	
110	0950	14.61	8.75					PICNIC SITE
				•			No major environmental constraints.	
110	0950	16.96	11.10					BERNIE RD #10
				•			No major environmental constraints.	
110	0950	17.11	11.25					LITTER BARREL SITE
				•			No major environmental constraints.	
110	0950	17.35	11.49					ANNIS PIT P2210
				•			No major environmental constraints.	
110	0950	17.50	11.64					OLD SICAMOUS RD #11
					•		Steep cutslope.	
110	0950	19.46	13.60					VIEWPOINT LAKE OF THE SHUSWAP
						•	Short distance on steep slope between the TCH and Shuswap Lake, steep cutslope.	
110	0950	21.32	15.46					SHUSWAP REST AREA
					•		TCH on steep slope above Shuswap Lake, steep cutslope.	
110	0950	23.05	17.19					LITTER BARRELS
					•		TCH on steep slope above Shuswap Lake, steep cutslope.	
110	0950	24.32	18.46					TRAFFIC COUNT STATION 56560 (22-014 E/W)
					•		TCH on steep slope above Shuswap Lake, steep cutslope.	
110	0950	25.18	19.32					OLD SICAMOUS RD #11

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
						•			TCH on steep slope above Shuswap Lake, steep cutslope.	
110	0950	25.62	19.76							OLD SPALLUMCHEEN RD #4
						•			TCH on steep slope above Shuswap Lake, steep cutslope.	
110	0950	25.65	19.79							RW BRUHN BRIDGE W END 0897 (SICAMOUS NARROWS)

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
120		25.65	0.00							
							•		Significant fish habitat in Sicamous Narrows.	
120	0950	25.92	0.27							RW BRUHN BRIDGE E END 0897 (SICAMOUS NARROWS)
				•					No major environmental constraints.	
120	0950	26.13	0.48							GILL AVE #172
				•					No major environmental constraints.	
120	0950	26.61	0.96							SILVER SANDS RD #68
					•				TCH close to the Eagle River.	
120	0950	27.19	1.54							RTE 97A VERNON/SICAMOUS
					•				TCH close to the Eagle River.	
120	0950	27.19	1.54							END OF SEGMENT

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
130	0960	0.00	0.00						Begin 4 lanes.	BEGIN SEGMENT
					•				TCH close to the Eagle River.	
130	0960	0.00	0.00							VERNON/SICAMOUS RTE 97A
					•				TCH close to the Eagle River.	
130	0960	0.22	0.22							SOLSQUA/SICAMOUS RD #663
				•					No major environmental constraints.	
130	0960	0.55	0.55							RAUMA AVE #237 (L/R)
				•					No major environmental constraints.	
130	0960	0.67	0.67							MACLEAN/MACPHERSON RD #650
				•					No major environmental constraints.	
130	0960	0.89	0.89							ACCESS TO SEED FRONTAGE #700-20
				•					No major environmental constraints.	
130	0960	1.10	1.10							GREEN RD #628 (L/R)
				•					No major environmental constraints.	
130	0960	1.19	1.19							SIGN BRIDGE
				•					No major environmental constraints.	
130	0960	1.49	1.49							MAIER RD #174
				•					No major environmental constraints.	
130	0960	1.56	1.56							MAIER RD #174
				•					No major environmental constraints.	
130	0960	1.80	1.80							TRAFFIC COUNT STATION 56580 (22-017 E/W)
				•					No major environmental constraints.	
130	0960	1.83	1.83							STADNICKI RD #665 (L/R)
				•					No major environmental constraints.	
130	0960	2.00	2.00							SPEED ZONE CHANGE 60 KMH TO 90 KMH
				•					No major environmental constraints.	
130	0960	2.11	2.11							WEIGH SCALES (ABANDONED)
				•					No major environmental constraints.	
130	0960	2.43	2.43							KERR RD #636 W ENTR
				•					Agricultural Land	
130	0960	3.25	3.25							KERR RD #636 E ENTR

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low	Moderate		High			
140		3.25	0.00							Kerr road
							•		TCH confined between bedrock outcrops in the cut slope and the Eagle River.	
140	0960	3.93	0.68							LITTER BARRELS
								•	TCH confined between bedrock outcrops in the cut slope and the Eagle River.	
140	0960	4.78	1.53							ARNOLD FRONTAGE RD #700-11 HOLIDAY HOMESTEAD W
				•					No major environmental constraints.	
140	0960	5.02	1.77							ARNOLD FRONTAGE RD #700-11 HOLIDAY HOMESTEAD E
				•					No major environmental constraints.	
140	0960	6.42	3.17							ENQUIST SAWMILL FRONTAGE W ENTR
				•					No major environmental constraints.	
140	0960	6.63	3.38							ENQUIST SAWMILL FRONTAGE E ENTR
					•				Highway confined by bedrock outcrop in cut slope, Eagle River and wetland.	
140	0960	7.99	4.74							SOLSQUA RD #663
				•					No major environmental constraints.	
140	0960	9.74	6.49							FORESTRY ACCESS RD
					•				TCH close to Eagle River channel.	
140	0960	10.39	7.14							CAMBIE SOLSQUA RD #618
					•				Bedrock in highway cut slope.	
140	0960	10.61	7.36							MYLINEMI RD #648
								•	TCH confined by CPR tracks, bedrock in cutslope and the Eagle River channel.	
140	0960	11.79	8.54							GRAVEL PIT

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
150		11.79	0.00						**Begin 4 lane section.**	
					•				TCH close to Eagle River channel.	
150	0960	13.87	2.08							YARD CREEK LOOP RD #678 W ENTR
				•					No major environmental constraints.	
150	0960	14.38	2.59							YARD CREEK PROV CAMPSITE W ENTR
				•					No major environmental constraints.	
150	0960	14.70	2.91							YARD CREEK PROV CAMPSITE E ENTR
				•					No major environmental constraints.	
150	0960	15.00	3.21							YARD CREEK BRIDGE W/B 1275
					•				TCH close to Eagle River Channel.	
150	0960	16.70	4.91							ERICKSON FRONTAGE #700-23 W ENTR MALAKWA FRUIT
				•					No major environmental constraints.	
150	0960	16.80	5.01							ERICKSON FRONTAGE #700-23 E ENTR MALAKWA FRUIT S
				•					No major environmental constraints.	
150	0960	16.80	5.01							YARD CREEK LOOP RD #678 E ENTR
				•					No major environmental constraints.	
150	0960	16.80	5.01							MALAKWA LOOP RD #643 W ENTR
					•				TCH located between marshy areas and is close to the Eagle River Channel.	
150	0960	17.50	5.71							BERTHOLM RD #613 W ENT TO MIX FRONTAGE
					•				TCH located between marshy areas and is close to the Eagle River Channel.	
150	0960	17.79	6.00							IMBEAU RD #632 E ENTR TO MIX FRONTAGE
					•				TCH located between marshy areas and is close to the Eagle River Channel.	
150	0960	17.79	6.00							MALAKWA LOOP RD #643 E ENTR
				•					No major environmental constraints.	
150	0960	18.20	6.41							MALAKWA RD #640 W ENTR
				•					No major environmental constraints.	
150	0960	18.67	6.88							JOHNSON/HOWARD RD #633 (L/R)
				•					No major environmental constraints.	
150	0960	19.02	7.23							MALAKWA PIT P2256
				•					No major environmental constraints.	
150	0960	19.68	7.89							SEDERBERG RD #657
				•					No major environmental constraints.	
150	0960	20.08	8.29							MALAKWA RD #640 E ENTR
				•					No major environmental constraints.	
150	0960	20.55	8.76						**End of 4 lane section.**	MALAKWA DUMP RD #642

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating			Description	LKI Boundaries
				Low	Moderate	High		
160		20.55	0.00					
				•			No major environmental constraints.	
160	0960	20.79	0.24					MALAKWA BRIDGE 0871
				•			No major environmental constraints.	
160	0960	20.85	0.30					MALAKWA BRIDGE 0871
				•			No major environmental constraints.	
160	0960	21.52	0.97					LERCHE FRONTAGE RD #700-16 COUNTRY INN
				•			No major environmental constraints.	
160	0960	22.01	1.46					HICKSON RD #630
				•			No major environmental constraints.	
160	0960	22.12	1.57					DELANEY RD #622
				•			No major environmental constraints.	
160	0960	22.12	1.57					ACKERMAN RD #925
				•			No major environmental constraints.	
160	0960	22.12	1.57					CUNNINGHAM FRONTAGE RD #700-12
				•			No major environmental constraints.	
160	0960	24.31	3.76					KELCH RD #635
				•			No major environmental constraints.	
160	0960	24.40	3.85					CRAIGALLACHIE O/H 1427
				•			No major environmental constraints.	
160	0960	24.52	3.97					CRAIGALLACHIE O/H 1427
				•			No major environmental constraints.	
160	0960	24.75	4.20					LYBARGER RD #639
				•			No major environmental constraints.	
160	0960	25.32	4.77					GORGE CREEK BRIDGE 1517
				•			No major environmental constraints.	
160	0960	25.52	4.97					PERM COUNT STATION P-22-1
				•			No major environmental constraints.	
160	0960	25.55	5.00					CRAIGALLACHIE HISTORICAL MONUMENT SITE
				•			No major environmental constraints.	
160	0960	27.07	6.52					PROSH FRONTAGE RD #700-19 W ENTR
				•			No major environmental constraints.	
160	0960	27.84	7.29					STRAGA RD #667
				•			No major environmental constraints.	
160	0960	28.16	7.61					AVOCA W RD #612
				•			No major environmental constraints.	
160	0960	28.97	8.42					N FORK EAGLE RIVER BRIDGE W END 0824 (PERRY RIVE
				•			No major environmental constraints.	
160	0960	28.97	8.42					END OKANAGAN/SHUSWAP DIST

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
170		28.97	0.00							
				•					No major environmental constraints.	
170	0960	28.97	0.00							START SELKIRK DIST
				•					No major environmental constraints.	
170	0960	29.03	0.06							REVELSTOKE RCMP DETACHMENT
				•					No major environmental constraints.	
170	0960	29.03	0.06							REVELSTOKE FOREMAN AREA C
				•					No major environmental constraints.	
170	0960	29.13	0.16							PRIVATE ACCESS RD BEARDALE CASTLE
				•					No major environmental constraints.	
170	0960	29.25	0.28							PRIVATE ACCESS RD SHINGLE MILL
				•					No major environmental constraints.	
170	0960	29.32	0.35							PULLOUT TURNAROUND
				•					No major environmental constraints.	
170	0960	29.43	0.46							ACCESS RD
				•					No major environmental constraints.	
170	0960	29.82	0.85							PRIVATE ACCESS RD
				•					No major environmental constraints.	
170	0960	30.15	1.18							PRIVATE ACCESS RD
				•					No major environmental constraints.	
170	0960	30.38	1.41							AVOCA RD
				•					No major environmental constraints.	
170	0960	30.84	1.87							PRIVATE ACCESS RD EDELWIES LODGE
				•					No major environmental constraints.	
170	0960	30.95	1.98							CRAZY CREEK FOREST SERVICE RD
				•					No major environmental constraints.	
170	0960	31.00	2.03							FERGUSON FRONTAGE RD
				•					No major environmental constraints.	
170	0960	31.17	2.20							FERGUSON FRONTAGE RD
				•					No major environmental constraints.	
170	0960	32.03	3.06							TAFT RD
				•					No major environmental constraints.	
170	0960	32.55	3.58							PRIVATE ACCESS RD TAFT STATION CPR
				•					No major environmental constraints.	
170	0960	32.76	3.79							CRAZY CREEK BRIDGE W END 1524
				•					No major environmental constraints.	
170	0960	33.48	4.51							TAFT O/H W END 1527
								•	Confined by Eagle River and steep cut slopes.	
170	0960	34.11	5.14							TAFT RD
				•					No major environmental constraints.	
170	0960	34.23	5.26							PRIVATE ACCESS RD (L/R)
								•	Hwy infringes on Eagle River floodplain and wetlands.	
170	0960	36.33	7.36							EAGLE RIVER BRIDGE W END 1202 (KAY FALLS)

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
								•	Hwy infringes on Eagle River floodplain and wetlands.	
170	0960	38.62	9.65							MITIKAN CREEK CULVERT
								•	Hwy infringes on Eagle River floodplain and wetlands.	
170	0960	39.11	10.14							ENCHANTED FOREST FRONTAGE RD
								•	Hwy infringes on Eagle River floodplain and wetlands.	
170	0960	39.26	10.29							CREEK CULVERT 24"
								•	Hwy infringes on Eagle River floodplain and wetlands.	
170	0960	39.47	10.50							ENCHANTED FOREST FRONTAGE RD
								•	Hwy infringes on Eagle River floodplain and wetlands.	
170	0960	39.54	10.57							EAGLE RIVER BRIDGE W END 0400 (ENCHANTED FOREST
							•		Constrained by CPR tracks and the Eagle River.	
170	0960	41.01	12.04							NINETEEN MILE O/H W END 0356
				•					No major environmental constraints.	
170	0960	41.41	12.44							PRIVATE ACCESS RD
				•					No major environmental constraints.	
170	0960	41.89	12.92							NINETEEN MILE RD
				•					No major environmental constraints.	
170	0960	42.34	13.37							PRIVATE ACCESS RD
				•					No major environmental constraints.	
170	0960	42.81	13.84							CAMP CREEK RD
				•					No major environmental constraints.	
170	0960	43.31	14.34							CAMP CREEK BRIDGE W END 1299
				•					No major environmental constraints.	
170	0960	43.37	14.40							PULLOUT
				•					No major environmental constraints.	
170	0960	44.07	15.10							PULLOUT
						•			TCH confined by bedrock outcrop and the Eagle River Floodplain.	
170	0960	44.80	15.83							START PASSING LANE (GRIFFIN LAKE HILL)
						•			TCH confined by bedrock outcrop and the Eagle River Floodplain.	
170	0960	45.82	16.85						**Begin 3 lane section**	PRIVATE ACCESS RD TOP OF GRIFFIN LAKE HILL
						•			TCH confined by bedrock outcrop and the Eagle River Floodplain.	
170	0960	47.01	18.04						**End three lane section.**	PRIVATE ACCESS RD
				•					No major environmental constraints.	
170	0960	47.38	18.41							PRIVATE ACCESS RD
				•					No major environmental constraints.	
170	0960	47.60	18.63							THREE VALLEY SIDING RD
				•					No major environmental constraints.	
170	0960	47.67	18.70							THREE VALLEY BRIDGE W END 0357

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
180		47.67	0.00							
				•					No major environmental constraints.	
180	0960	48.35	0.68							PRIVATE ACCESS RD
				•					No major environmental constraints.	
180	0960	48.87	1.20							PULLOUT
				•					No major environmental constraints.	
180	0960	48.98	1.31							MABEL LAKE/THREE VALLEY RD
				•					No major environmental constraints.	
180	0960	49.07	1.40							PULLOUT LITTER BARREL
							•		Confined by Three Valley Lake and steep valley sidewalls.	
180	0960	49.61	1.94							THREE VALLEY REST AREA W END
							•		Confined by Three Valley Lake and steep valley sidewalls.	
180	0960	49.66	1.99							RESORT ACCESS
							•		Confined by Three Valley Lake and steep valley sidewalls.	
180	0960	49.75	2.08							S PASS CREEK
							•		Confined by Three Valley Lake and steep valley sidewalls.	
180	0960	49.88	2.21							THREE VALLEY BOAT LAUNCH RAMP
							•		Confined by Three Valley Lake and steep valley sidewalls.	
180	0960	51.57	3.90							PULLOUT
							•		Confined by Three Valley Lake and steep valley sidewalls.	
180	0960	51.84	4.17							THREE VALLEY GAP MOTEL/RESTAURANT ACCESS
							•		Confined by Three Valley Lake and steep valley sidewalls.	
180	0960	52.55	4.88							THREE VALLEY FRONTAGE RD
							•		Confined by the Eagle River floodplain and steep valley sidewalls.	
180	0960	52.88	5.21							PRIVATE LOGGING ACCESS RD (VICTOR MAIN)
							•		Confined by the Eagle River floodplain and steep valley sidewalls.	
180	0960	52.96	5.29							TALMAN RD
						•			Confined by the Eagle River floodplain and steep valley sidewalls.	
180	0960	53.30	5.63							WOODS O/H W END 1432
						•			Confined by the Eagle River floodplain and steep valley sidewalls.	
180	0960	53.67	6.00							ACCESS RD CPR
						•			Confined by the Eagle River floodplain and steep valley sidewalls.	
180	0960	54.40	6.73							TRAFFIC COUNT STATION 58910 (38-006 E/W)

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
						•			Confined by the Eagle River floodplain and steep valley sidewalls.	
180	0960	54.70	7.03							CREEK CULVERT
				•					No major environmental constraints.	
180	0960	54.96	7.29							CREEK CULVERT

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
190		54.96	0.00							
				•					No major environmental constraints.	
190	0960	55.93	0.97							CREEK CULVERT
				•					No major environmental constraints.	
190	0960	56.03	1.07							VICTOR LAKE PROV PICNIC SITE
				•					No major environmental constraints.	
190	0960	56.12	1.16							VICTOR CREEK
								•	Confined by steep valley sidewalls and Victor Lake.	
190	0960	56.29	1.33							VIEWPOINT
								•	Confined by steep valley sidewalls and Victor Lake.	
190	0960	57.48	2.52							CREEK CULVERT
								•	Confined by steep valley sidewalls and Victor Lake.	
190	0960	57.69	2.73							SUMMIT LAKE O/H W END 1522
								•	Confined by steep valley sidewalls and Victor Lake.	
190	0960	58.06	3.10							CREEK CONCRETE CULVERT
								•	Confined by steep valley sidewalls and Victor Lake.	
190	0960	59.26	4.30							ACCESS RD
								•	Confined by steep valley sidewalls and Victor Lake.	
190	0960	59.45	4.49							CLANWILLIAM O/H W END 0354
				•					No major environmental constraints.	
190	0960	59.83	4.87							PULLOUT
				•					No major environmental constraints.	
190	0960	60.02	5.06							CREEK CULVERT

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating			Description	LKI Boundaries
				Low	Moderate	High		
200		60.02	0.00					
				●			No major environmental constraints.	
200	0960	62.41	2.39					CREEK CULVERT
				●			No major environmental constraints.	
200	0960	62.44	2.42					ACCESS RD OLD MICA DAM SAWMILL
				●			No major environmental constraints.	
200	0960	62.84	2.82					CREEK CULVERT
				●			No major environmental constraints.	
200	0960	63.78	3.76					BOULDER HILL WIDENING W END
				●			No major environmental constraints.	
200	0960	64.11	4.09				**Begin 3 lane section.**	ACCESS RD
				●			No major environmental constraints.	
200	0960	64.65	4.63					ACCESS RD OLD BEAUMONT SAWMILL
				●			No major environmental constraints.	
200	0960	65.43	5.41					BACK RD
				●			No major environmental constraints.	
200	0960	65.59	5.57				**End 3 lane section.**	ALLEN FRONTAGE RD
				●			No major environmental constraints.	
200	0960	65.88	5.86					POLE YARD RD
				●			No major environmental constraints.	
200	0960	65.88	5.86					PINE RD
				●			No major environmental constraints.	
200	0960	66.27	6.25					ACCESS RD OLD HELI-PORT
				●			No major environmental constraints.	
200	0960	67.02	7.00					JORDAN FOREST SERVICE RD
				●			No major environmental constraints.	
200	0960	67.02	7.00					PERRIN RD
				●			No major environmental constraints.	
200	0960	67.41	7.39					RD
				●			No major environmental constraints.	
200	0960	67.52	7.50					BIG EDDY RD

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
210		67.52	0.00							Big Eddy
				•					No major environmental constraints.	
210	0960	68.04	0.52							REVELSTOKE HWY DIST W YARD
				•					No major environmental constraints.	
210	0960	68.07	0.55							REVELSTOKE CITY BNDRY
				•					3 Lanes, no major environmental constraints.	
210	0960	68.77	1.25							PULLOUT
						•			Confined by steep bedrock outcrop, CPR tracks and Tonkawatla Creek.	
210	0960	69.77	2.25							PULLOUT WITH MAP
				•					No major environmental constraints.	
210	0960	70.15	2.63							JCT. RTE 1/RTE 23 S NAKUSP/MICA CREEK

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
220		70.15	0.00						**Begin 4 lane section.**	Through Revelstoke
				●					No major environmental constraints.	
220	0960	70.36	0.21							ACCESS RD
				●					No major environmental constraints.	
220	0960	70.51	0.36							TRAFFIC COUNT STATION 58590 (38-001 E/W)
				●					No major environmental constraints.	
220	0960	70.51	0.36							COLUMBIA RIVER BRIDGE W END 1532
							●		Bridge crosses the Columbia River, fish habitat.	
220	0960	70.88	0.73							COLUMBIA RIVER BRIDGE E END 1532
				●					No major environmental constraints.	
220	0960	70.98	0.83							FRONTAGE RD ACCESS
				●					No major environmental constraints.	
220	0960	71.01	0.86							VICTORIA RD TURN
				●					No major environmental constraints.	
220	0960	71.13	0.98							JCT. RTE 1/VICTORIA RD (REVELSTOKE)
				●					No major environmental constraints.	
220	0960	71.13	0.98							END OF SEGMENT
				●					No major environmental constraints.	
220	0975	0.00	0.98							BEGIN SEGMENT
				●					No major environmental constraints.	
220	0975	0.00	0.98							JCT. RTE 1/VICTORIA RD (REVELSTOKE)
				●					No major environmental constraints.	
220	0975	0.05	1.03						**End of 4 lane section.**	ENTR FROM VICTORIA DR
				●					No major environmental constraints.	
220	0975	0.29	1.32							JCT. RTE 1/RTE 23 N NAKUSP/MICA CREEK

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating			Description	LKI Boundaries
				Low	Moderate	High		
230		0.29	0.00					
				•			No major environmental constraints.	
230	0975	0.37	0.08					REVELSTOKE HWY DIST MAINTENANCE YARD
				•			No major environmental constraints.	
230	0975	0.50	0.21					ACCESS FRONTAGE RD
				•			No major environmental constraints.	
230	0975	1.26	0.97					ENTR TO RTE 1 W/B FROM REVELSTOKE RD
				•			No major environmental constraints.	
230	0975	1.34	1.05					MT REVELSTOKE RD I/C O/H BRIDGE W END
				•			No major environmental constraints.	
230	0975	1.52	1.23					EXIT TO MT REVELSTOKE RD W/B
				•			No major environmental constraints.	
230	0975	1.54	1.25					EXIT TO RD
				•			No major environmental constraints.	
230	0975	1.72	1.43					ENTR FROM RD
				•			No major environmental constraints.	
230	0975	2.17	1.88					WATER TANK CITY OF REVELSTOKE
				•			No major environmental constraints.	
230	0975	2.57	2.28					ALPINE LANE
				•			No major environmental constraints.	
230	0975	2.94	2.65					PRIVATE ACCESS RD
				•			No major environmental constraints.	
230	0975	3.39	3.10					ALPINE LANE
				•			No major environmental constraints.	
230	0975	4.16	3.87				**Begin 3 lane section.**	JCT. RTE 1/EERN ACCESS RD REVELSTOKE
				•			No major environmental constraints.	
230	0975	4.23	3.94				**End 3 lane section.**	O/H LIGHTED MESSAGE SIGN BRIDGE
				•			No major environmental constraints.	
230	0975	4.30	4.01					TRAFFIC COUNT STATION 58620 (38-004 E/W)
				•			No major environmental constraints.	
230	0975	4.93	4.64					ACCESS RD
				•			No major environmental constraints.	
230	0975	4.98	4.69					REVELSTOKE CITY BNDRY

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
240		4.98	0.00							
					•				Steep bedrock outcrop.	
240	0975	5.04	0.06							PULLOUT LITTER BARREL
				•					No major environmental constraints.	
240	0975	7.20	2.22							WIDENING
				•					No major environmental constraints.	
240	0975	8.85	3.87							REST AREA
				•					No major environmental constraints.	
240	0975	10.01	5.03							PULLOUT LITTER BARREL
				•					No major environmental constraints.	
240	0975	10.26	5.28							GREELY RD
				•					No major environmental constraints.	
240	0975	11.31	6.33						**Begin 3 lane section.**	HAMILTON CREEK
				•					No major environmental constraints.	
240	0975	12.11	7.13						**End 3 lane section, begin 4 lane section.**	WIDENING
				•					No major environmental constraints.	
240	0975	13.96	8.98							PICNIC AREA & CREEK
				•					No major environmental constraints.	
240	0975	16.13	11.15							ILLECILLEWAET REST AREA W END
				•					No major environmental constraints.	
240	0975	16.29	11.31							CREEK CULVERT
					•				TCH on escarpment above the Illecillewaet River.	
240	0975	17.28	12.30							CLACHNACUDAINN GRAVEL PIT ACCESS RD
				•					No major environmental constraints.	
240	0975	17.90	12.92							CLACHNACUDAINN CREEK

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
250		17.90	0.00							
					•				No major environmental constraints.	
250	0975	18.28	0.38						**End 4 lane section, begin 3 lane section.**	MT REVELSTOKE NATIONAL PARK W GATE
					•				No major environmental constraints.	
250	0975	21.24	3.34							CREEK & ACCESS RD
					•				No major environmental constraints.	
250	0975	22.71	4.81							ACCESS RD
						•			Short distance downslope from the TCH to the Illecillewaet River.	
250	0975	23.95	6.05						**End 3 lane section.**	CREEK CULVERT
						•			Short distance downslope from the TCH to the Illecillewaet River.	
250	0975	25.07	7.17						**Begin 3 lane section.**	PAVED ACCESS RD
						•			Short distance downslope from the TCH to the Illecillewaet River.	
250	0975	25.94	8.04							CREEK CULVERT
						•			Short distance downslope from the TCH to the Illecillewaet River.	
250	0975	26.44	8.54							LAURETTA REST/PICNIC AREA NATIONAL PARK
						•			Short distance downslope from the TCH to the Illecillewaet River.	
250	0975	26.59	8.69						**End 3 lane section.**	CREEK CULVERT
						•			Short distance downslope from the TCH to the Illecillewaet River.	
250	0975	29.11	11.21							BIG CEDARS REST/PICNIC AREA NATIONAL PARK
					•				No major environmental constraints.	
250	0975	30.55	12.65							WOOLSEY CREEK BRIDGE W END 6923
					•				No major environmental constraints.	
250	0975	30.55	12.65							MT REVELSTOKE NATIONAL PARK E BNDRY

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
260		30.55	0.00							
					•				No major environmental constraints.	
260	0975	30.74	0.19							WOOLSEY CREEK FOREST SERVICE RD
								•	Rockfall area, steep drop to the Illecillewaet River.	
260	0975	31.83	1.28							WIDENING W END
						•			Rockfall area, steep drop to the Illecillewaet River.	
260	0975	33.76	3.21							ALBERT CANYON BRIDGE W W END 1546
				•					No major environmental constraints.	
260	0975	33.92	3.37							HWY MAINTENANCE YARD @ ALBERT CANYON
				•					No major environmental constraints.	
260	0975	34.35	3.80							ALBERT CANYON RD
				•					No major environmental constraints.	
260	0975	34.97	4.42							WAVERLEY TRAIL
				•					No major environmental constraints.	
260	0975	35.47	4.92							ALBERT CANYON BRIDGE E W END 1545
				•					No major environmental constraints.	
260	0975	35.69	5.14						**Begin 3 lane section.**	TANGIERS FOREST SERVICE RD
				•					No major environmental constraints.	
260	0975	38.10	7.55						**End 3 lane section**	RETAINING WALL
							•		Steep dropoff to the Illecillewaet River, bedrock exposed in cutslope.	
260	0975	38.63	8.08							CREEK CULVERT
							•		Steep dropoff to the Illecillewaet River, bedrock exposed in cutslope.	
260	0975	39.21	8.66							CREEK CULVERT
							•		Steep dropoff to the Illecillewaet River, bedrock exposed in cutslope.	
260	0975	42.08	11.53							CREEK CULVERT
							•		Steep dropoff to the Illecillewaet River, bedrock exposed in cutslope.	
260	0975	42.97	12.42							TRUCK STOP @ ILLECILLEWAET W END
						•			TCH built on narrow bench with steep slopes above and below, steep dropoff to the Illecillewaet River.	
260	0975	43.27	12.72							JUMPING CREEK FOREST SERVICE RD ILLECILLEWAET
						•			TCH built on narrow bench with steep slopes above and below, steep dropoff to the Illecillewaet River.	
260	0975	44.01	13.46							CREEK CULVERT
						•			TCH built on narrow bench with steep slopes above and below, steep dropoff to the Illecillewaet River.	
260	0975	44.40	13.85							CREEK SMALL FALLS

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate	High			
							•		Steep dropoff to the Illecillewaet River, bedrock exposed in cutslope.	
260	0975	44.78	14.23							CREEK SMALL FALLS
							•		Steep dropoff to the Illecillewaet River, bedrock exposed in cutslope.	
260	0975	44.99	14.44						**Begin 3 lane section.**	CREEK CULVERT
								•	Avalanche tracks, TCH built on a steep slope above the Illecillewaet River.	
260	0975	45.92	15.37						**End 3 lane section.**	MACDONALD SNOWSHED W END
								•	Avalanche tracks, TCH built on a steep slope above the Illecillewaet River.	
260	0975	46.75	16.20							TWIN SLIDE SNOWSHED W END
								•	Avalanche tracks, TCH built on a steep slope above the Illecillewaet River.	
260	0975	47.45	16.90							LANARK SNOWSHED W END 1696
								•	Avalanche tracks, TCH built on a steep slope above the Illecillewaet River.	
260	0975	48.35	17.80							GLACIER NATIONAL PARK
								•	Avalanche tracks, TCH built on a steep slope above the Illecillewaet River.	
260	0975	48.35	17.80							E BNDRY REVELSTOKE HWY DIST/W BNDRY GLACIER NA
								•	Avalanche tracks, TCH built on a steep slope above the Illecillewaet River.	
260	0975	48.35	17.80							END OF SEGMENT

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low	Moderate			High		
270	0980	0.00	0.00							BEGIN SEGMENT
					•				No major environmental constraints.	
270	0980	0.00	0.00							GLACIER NATIONAL PARK W BNDRY
					•				No major environmental constraints.	
270	0980	0.12	0.12							WIDENING W END
					•				No major environmental constraints.	
270	0980	0.30	0.30							ILLECILLEWAET UPPER BRIDGE W END 2267
					•				No major environmental constraints.	
270	0980	0.48	0.48							GLACIER NATIONAL PARK SIGN
					•				No major environmental constraints.	
270	0980	0.73	0.73							REST/PICNIC SITE
					•				No major environmental constraints.	
270	0980	0.89	0.89							GUN POSITION
					•				No major environmental constraints.	
270	0980	1.33	1.33							BOSTOCK CREEK BRIDGE
					•				No major environmental constraints.	
270	0980	2.30	2.30							CREEK CULVERT
					•				No major environmental constraints.	
270	0980	2.61	2.61							GUN POSITION
					•				No major environmental constraints.	
270	0980	3.80	3.80							RANGER STATION ACCESS RD FLAT CREEK
					•				No major environmental constraints.	
270	0980	4.07	4.07							W ENTR WIDENING
					•				No major environmental constraints.	
270	0980	4.22	4.22							CREEK CULVERT
					•				No major environmental constraints.	
270	0980	4.89	4.89						**Begin 3 lane section.**	W ENTR WIDENING
					•				No major environmental constraints.	
270	0980	6.18	6.18						**End 3 lane section.**	PICNIC SITE ACCESS RD
					•				No major environmental constraints.	
270	0980	6.82	6.82							GUN POSITION
					•				No major environmental constraints.	
270	0980	8.48	8.48							GUN POSITION
					•				No major environmental constraints.	
270	0980	10.19	10.19							GUN POSITION
					•				No major environmental constraints.	
270	0980	11.19	11.19							CPR TUNNEL
					•				No major environmental constraints.	
270	0980	11.88	11.88							GUN POSITION
					•				No major environmental constraints.	
270	0980	12.63	12.63							COUGAR CREEK BRIDGE 0421
					•				No major environmental constraints.	
270	0980	13.58	13.58							PICNIC ACCESS RD
					•				No major environmental constraints.	
270	0980	13.80	13.80							ILLECILLEWAET UPPER BRIDGE 2267

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating Low	Moderate	High	Description	LKI Boundaries
					•		No major environmental constraints.	
270	0980	14.11	14.11					CPR O/H BRIDGE
					•		No major environmental constraints.	
270	0980	14.23	14.23					GUN POSITION
					•		No major environmental constraints.	
270	0980	14.41	14.41					LOOP ACCESS RD
					•		No major environmental constraints.	
270	0980	14.55	14.55					LOOP CREEK BRIDGE
					•		No major environmental constraints.	
270	0980	15.85	15.85					GLACIER STATION ACCESS RD
					•		No major environmental constraints.	
270	0980	17.05	17.05					GUN POSITION
					•		No major environmental constraints.	
270	0980	17.27	17.27				**Begin 4 lane section.**	ILLECILLEWAET RIVER CULVERT
					•		No major environmental constraints.	
270	0980	17.43	17.43					ILLECILLEWAET CAMPGROUND ACCESS RD
					•		No major environmental constraints.	
270	0980	17.67	17.67				**End of 4 lane section.**	GUN POSITION
					•		No major environmental constraints.	
270	0980	19.18	19.18					ACCESS RD
					•		No major environmental constraints.	
270	0980	19.75	19.75					GUN POSITION
					•		No major environmental constraints.	
270	0980	19.77	19.77					MONUMENT ACCESS
					•		No major environmental constraints.	
270	0980	19.85	19.85					SUMMIT MONUMENT
					•		No major environmental constraints.	
270	0980	20.94	20.94					GUN POSITION
					•		No major environmental constraints.	
270	0980	20.97	20.97					LODGE ACCESS
					•		No major environmental constraints.	
270	0980	21.15	21.15					GLACIER LODGE ACCESS
					•		No major environmental constraints.	
270	0980	21.15	21.15					PARK HEADQUARTERS ACCESS
					•		No major environmental constraints.	
270	0980	21.69	21.69					GUN POSITION
					•		No major environmental constraints.	
270	0980	22.97	22.97					RD
					•		No major environmental constraints.	
270	0980	23.61	23.61					PICNIC SITE ACCESS RD
					•		No major environmental constraints.	
270	0980	23.68	23.68					GUN POSITION
					•		No major environmental constraints.	
270	0980	24.05	24.05					BENCH SNOWSHED W END

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
								•	TCH located on steep slope above Connaught Creek, avalanche tracks and debris chutes were noted upslope of the highway.	
270	0980	24.05	24.05							END REVELSTOKE RCMP BNDRY
								•	TCH located on steep slope above Connaught Creek, avalanche tracks and debris chutes were noted upslope of the highway.	
270	0980	24.05	24.05							START GOLDEN RCMP BNDRY
								•	TCH located on steep slope above Connaught Creek, avalanche tracks and debris chutes were noted upslope of the highway.	
270	0980	24.81	24.81						**Begin 3 lanes.**	GUN POSITION
								•	TCH located on steep slope above Connaught Creek, avalanche tracks and debris chutes were noted upslope of the highway.	
270	0980	24.97	24.97						**End 3 lane section.**	LEN'S SNOWSHED W END
								•	TCH located on steep slope above Connaught Creek, avalanche tracks and debris chutes were noted upslope of the highway.	
270	0980	25.57	25.57							TUPPER #1 SNOWSHED W END
								•	TCH located on steep slope above Connaught Creek, avalanche tracks and debris chutes were noted upslope of the highway.	
270	0980	26.06	26.06							TUPPER #2 SNOWSHED W END
								•	TCH located on steep slope above Connaught Creek, avalanche tracks and debris chutes were noted upslope of the highway.	
270	0980	26.82	26.82							TUPPER TIMBER SNOWSHED W END
								•	TCH located on steep slope above Connaught Creek, avalanche tracks and debris chutes were noted upslope of the highway.	
270	0980	27.15	27.15							RD
								•	TCH located on steep slope above Connaught Creek, avalanche tracks and debris chutes were noted upslope of the highway.	
270	0980	27.52	27.52							BEAVER RIVER & CPR PORTAL OF CONNAUGHT TUNNEL
								•	TCH located on steep slope above Connaught Creek, avalanche tracks and debris chutes were noted upslope of the highway.	
270	0980	28.21	28.21							PULLOUT
								•	TCH located on steep slope above Connaught Creek, avalanche tracks and debris chutes were noted upslope of the highway.	
270	0980	28.43	28.43							GUN POSITION

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
						•			TCH built on a bench above Connaught Creek, avalanche tracks were noted upslope of the highway.	
270	0980	29.40	29.40							REST AREA W ACCESS
						•			TCH built on a bench above Connaught Creek, avalanche tracks were noted upslope of the highway.	
270	0980	29.60	29.60							ACCESS RD
						•			TCH built on a bench above Connaught Creek, avalanche tracks were noted upslope of the highway.	
270	0980	29.80	29.80							GUN POSITION
							•		Bedrock exposed in roadcuts on both sides of the TCH.	
270	0980	30.20	30.20							RD LOOKS LIKE RUNAWAY LANE E/B
						•			TCH confined by the Beaver River floodplain and bedrock exposed in the cut slope.	
270	0980	30.77	30.77							ACCESS RD
						•			TCH confined by the Beaver River floodplain and bedrock exposed in the cut slope.	
270	0980	30.98	30.98						**Begin 3 lane section.**	VIEWPOINT W END
						•			TCH confined by a wetland on the Beaver River floodplain and bedrock exposed in the cut slope.	
270	0980	32.19	32.19							ACCESS RD
					•				No major environmental constraints.	
270	0980	33.25	33.25							CREEK CULVERT
					•				No major environmental constraints.	
270	0980	34.08	34.08							PICNIC SITE ACCESS RD
					•				No major environmental constraints.	
270	0980	34.22	34.22							BEAVER RIVER BRIDGE
								•	Re-aligned section, unstable bluff, steep fill slope to floodplain.	
270	0980	38.05	38.05							RD
					•				No major environmental constraints.	
270	0980	38.44	38.44							GLACIER NATIONAL PARK E GATE
					•				No major environmental constraints.	
270	0980	39.58	39.58							PICNIC SITE
					•				No major environmental constraints.	
270	0980	41.03	41.03							MOUNTAIN CREEK CAMPGROUND ACCESS
					•				No major environmental constraints.	
270	0980	41.65	41.65							CREEK CULVERT
					•				No major environmental constraints.	
270	0980	43.75	43.75							CREEK CULVERT
					•				No major environmental constraints.	
270	0980	43.81	43.81							SELKIRK HWY'S DIST
					•				No major environmental constraints.	

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating			Description	LKI Boundaries
				Low	Moderate	High		
270	0980	43.81	43.81					GLACIER NATIONAL PARK BNDRY
					•		No major environmental constraints.	
270	0980	43.81	43.81					END OF SEGMENT

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
280	0985	0.00	0.00							BEGIN SEGMENT
						•			TCH buil on steep slopes above the Beaver River. .	
280	0985	0.00	0.00							GLACIER NATIONAL PARK BNDRY
						•			TCH buil on steep slopes above the Beaver River. .	
280	0985	0.12	0.12							HEATHER HILL LOOKOUT W END
						•			TCH buil on steep slopes above the Beaver River. .	
280	0985	1.77	1.77							CPR PUSHER STATION ACCESS
				•					No major environmental constraints.	
280	0985	5.37	5.37						**End three lane section.**	RD
					•				Bedrock exposed in road cut.	
280	0985	8.14	8.14							BIG LAKE RESORT ACCESS
					•				Bedrock exposed in road cut.	
280	0985	12.85	12.85							ACCESS
				•					No major environmental constraints.	
280	0985	13.03	13.03							QUARTZ CREEK PIT
				•					No major environmental constraints.	
280	0985	13.28	13.28							QUARTZ CREEK BRIDGE W END 1607
				•					No major environmental constraints.	
280	0985	15.12	15.12							QUARTZ CREEK FOREST SERVICE RD
				•					No major environmental constraints.	
280	0985	19.08	19.08							REDGRAVE REST AREA E SIDE W ENTR
				•					No major environmental constraints.	
280	0985	19.34	19.34						**Begin 3 lane section.**	REDGRAVE REST AREA W SIDE
				•					No major environmental constraints.	
280	0985	24.04	24.04							FORESTRY RD
				•					No major environmental constraints.	
280	0985	27.10	27.10							FORESTRY RD
				•					No major environmental constraints.	
280	0985	29.61	29.61							WISEMAN RD
				•					No major environmental constraints.	
280	0985	29.66	29.66						**End 3 lane section.**	COLUMBIA RIVER BRIDGE W END 1605

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
290	0985	29.66	0.00							COLUMBIA RIVER BRIDGE W END 1605
				•					No major environmental constraints.	
290	0985	30.24	0.58							DONALD O/P W END 1606
				•					No major environmental constraints.	
290	0985	30.61	0.95							DONALD RD
				•					No major environmental constraints.	
290	0985	30.99	1.33							DEJORDIE RD
				•					No major environmental constraints.	
290	0985	32.80	3.14							BIG BEND HWY
				•					No major environmental constraints.	
290	0985	35.99	6.33							FORDE STATION RD
					•				Minor slumping and soil erosion in steep cut slope.	
290	0985	38.23	8.57							DOYLE CREEK REST AREA N ENTR
				•					No major environmental constraints.	
290	0985	38.52	8.86							DOYLE CREEK PULLOFFN END
				•					No major environmental constraints.	
290	0985	39.60	9.94							BLAEBERRY SCHOOL RD
				•					No major environmental constraints.	
290	0985	39.83	10.17							BLAEBERRY RIVER RD N END
				•					No major environmental constraints.	
290	0985	40.60	10.94							BLAEBERRY RIVER BRIDGE N END 1394
				•					No major environmental constraints.	
290	0985	41.15	11.49							SEWARD FRONTAGE RD
				•					No major environmental constraints.	
290	0985	41.67	12.01							BLAEBERRY RIVER RD S END
				•					No major environmental constraints.	
290	0985	43.46	13.80							PULLOUT LITTER BARRELS
					•				TCH encroaches on wetland.	
290	0985	45.02	15.36							MOBERLY BRANCH RD
				•					No major environmental constraints.	
290	0985	46.22	16.56							HARTLEY RD
					•				TCH constrained by proximity to Columbia River Channel.	
290	0985	47.75	18.09							HENRY PIT ENTR
					•				TCH constrained by proximity to Columbia River Channel.	
290	0985	49.65	19.99							PULLOFF
					•				TCH constrained by proximity to Columbia River Channel.	
290	0985	52.86	23.20							TRAFFIC COUNT STATION 58540 (37-012 E/W)
					•				TCH constrained by proximity to Columbia River Channel.	
290	0985	53.85	24.19							ANDERSON RD

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating			Description	LKI Boundaries
				Low	Moderate	High		

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
300	0985	53.85	0.00							ANDERSON RD
						•			TCH confined between bedrock exposure in cut slope and the Columbia River floodplain.	
300	0985	54.27	0.42							TOWN OF GOLDEN W BNDRY
						•			TCH confined between bedrock exposure in cut slope and the Columbia River floodplain.	
300	0985	54.62	0.77							RD CROSSES
						•			TCH confined between bedrock exposure in cut slope and the Columbia River floodplain.	
300	0985	54.89	1.04						**Begin 4 lane section.**	SIGN BRIDGE
				•					No major environmental constraints.	
300	0985	54.90	1.05							OTTASON RD
				•					No major environmental constraints.	
300	0985	55.10	1.25							RD CROSSES TO FRONTAGE RD
				•					No major environmental constraints.	
300	0985	55.17	1.32							RD TO FRONTAGE RD
				•					No major environmental constraints.	
300	0985	55.23	1.38							RD CROSSES TO FRONTAGE RD
				•					No major environmental constraints.	
300	0985	55.35	1.50							RD TO FRONTAGE RD
				•					No major environmental constraints.	
300	0985	55.39	1.54							RD TO FRONTAGE RD
				•					No major environmental constraints.	
300	0985	55.45	1.60							(L) TO FRONTAGE RD
				•					No major environmental constraints.	
300	0985	55.53	1.68							END FRONTAGE RD CLOSED
				•					No major environmental constraints.	
300	0985	55.54	1.69							SCALE ENTR
				•					No major environmental constraints.	
300	0985	55.89	2.04							SCALE ACCESS E MOST ENTR
				•					No major environmental constraints.	
300	0985	55.98	2.13							EXIT TO RTE 95
				•					No major environmental constraints.	
300	0985	56.06	2.21							JCTN RTE 1/RTE 95 KOOTENAY COLUMBIA HWY
				•					No major environmental constraints.	
300	0985	56.06	2.21							END OF SEGMENT

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
310	0990	0.00	0.00							BEGIN SEGMENT
				●					No major environmental constraints.	
310	0990	0.00	0.00							JCTN OF RTE 95/RTE 1 GOLDEN
				●					No major environmental constraints.	
310	0990	0.97	0.97						**End of 4 lane section, begin 3 lane section.**	GOLDEN VIEWPOINT W END
				●					No major environmental constraints.	
310	0990	1.43	1.43							GOLDEN DONALD UPPER
				●					No major environmental constraints.	
310	0990	1.55	1.55							RD
				●					No major environmental constraints.	
310	0990	1.77	1.77							LAFONTAINE RD
				●					No major environmental constraints.	
310	0990	1.90	1.90							TRAFFIC COUNT STATION 58560 (37-014 E/W)
				●					No major environmental constraints.	
310	0990	2.40	2.40							GOLDEN VIEW RD E END
									No major environmental constraints.	

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
320	990	2.40	0.00							GOLDEN VIEW RD E END
				•					No major environmental constraints.	
320	0990	2.46	0.06							RD CLOSURE GATES
				•					No major environmental constraints.	
320	0990	2.50	0.10							PERM COUNT STATION P-37-1
				•					No major environmental constraints.	
320	0990	2.92	0.52						**End 3 lane section.**	TOWN OF GOLDEN E BNDRY
								•	TCH located on a steep slope above the Kicking Horse River and bedrock is extensively exposed in the cut slope.	
320	0990	2.93	0.53							PULLOUT
								•	TCH located on a steep slope above the Kicking Horse River and bedrock is extensively exposed in the cut slope.	
320	0990	3.75	1.35							VIEWPOINT
								•	TCH located on a steep slope above the Kicking Horse River and bedrock is extensively exposed in the cut slope.	
320	0990	6.23	3.83							DART CREEK
								•	TCH located on a steep slope above the Kicking Horse River and bedrock is extensively exposed in the cut slope.	
320	0990	7.95	5.55							PULLOUT
								•	TCH located on a steep slope above the Kicking Horse River and bedrock is extensively exposed in the cut slope.	
320	0990	8.00	5.60							TOP OF 5 MILE HILL
						•			TCH built on a wide bench than the previous section, still extensive exposure of bedrock in cut slope.	
320	0990	9.45	7.05						**Begin mixed 3 and 4 lane section.**	YOHO BRIDGE W END 1358
								•	TCH located on a steep slope above the Kicking Horse River and bedrock is extensively exposed in the cut slope.	
320	0990	9.65	7.25							YOHO BRIDGE E END 1358
							•		TCH located on a steep slope above the Kicking Horse River and bedrock is extensively exposed in the cut slope.	
320	0990	12.53	10.13							YOHO REST AREA W ENTR
						•			Confined by rock bluff and river.	
320	0990	14.20	11.80						**Being 3 lane section.**	PARK BRIDGE W END 1357
								•	TCH located on a steep slope above the Kicking Horse River and bedrock is extensively exposed in the cut slope.	
320	0990	14.68	12.28							RUNAWAY LANE

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
								•	TCH located on a steep slope above the Kicking Horse River and bedrock is extensively exposed in the cut slope.	
320	0990	16.74	14.34							EXIT W/B TRUCK STOP NO ENTRY E/B
				•					No major environmental constraints.	
320	0990	16.90	14.50							TRUCK CHECK STOP ENTR
				•					No major environmental constraints.	
320	0990	19.61	17.21							MT HUNTER BRIDGE W END 1356
				•					No major environmental constraints.	
320	0990	21.08	18.68							TRAFFIC COUNT STATION 58570 (37-015 E/W)
				•					No major environmental constraints.	
320	0990	21.88	19.48							RD
				•					No major environmental constraints.	
320	0990	21.98	19.58							VACATION CREEK
				•					No major environmental constraints.	
320	0990	23.04	20.64							VIEWPOINT W END
				•					No major environmental constraints.	
320	0990	24.73	22.33							WAPTA RD W END
				•					No major environmental constraints.	
320	0990	25.40	23.00							BEAVERFOOT
				•					No major environmental constraints.	
320	0990	25.74	23.34							WAPTA RD E END
				•					No major environmental constraints.	
320	0990	25.87	23.47							RD CLOSURE GATES
				•					No major environmental constraints.	
320	0990	25.93	23.53							YOHO NATIONAL PARK BNDRY
				•					No major environmental constraints.	
320	0990	25.93	23.53							END SELKIRK HWY DIST
				•					No major environmental constraints.	
320	0990	25.93	23.53							END OF SEGMENT

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
				Low		Moderate		High		
330	0995	0.00	0.00							BEGIN SEGMENT
330	0995	0.00	0.00							YOHO NATIONAL PARK W GATE
					•				No major environmental constraints.	
330	0995	0.34	0.34						**Begin 3 lane section.**	RD
					•				No major environmental constraints.	
330	0995	1.03	1.03						**End 3 lane section.**	INFORMATION CENTRE ENTR
					•				No major environmental constraints.	
330	0995	1.18	1.18							E ENTR TO INFORMATION CENTRE
					•				No major environmental constraints.	
330	0995	3.05	3.05						**Begin 3 lane section.**	ACCESS
					•				No major environmental constraints.	
330	0995	3.74	3.74							CPR O/P W END
					•				No major environmental constraints.	
330	0995	4.77	4.77						**End 3 lane section.**	WAPTA FALLS ACCESS
					•				No major environmental constraints.	
330	0995	5.68	5.68							CHANCELLOR PEAK CAMPSITE ACCESS
					•				No major environmental constraints.	
330	0995	5.91	5.91							KICKING HORSE RIVER BRIDGE W END
					•				No major environmental constraints.	
330	0995	6.88	6.88							HOODOOS CREEK CAMPSITE
					•				No major environmental constraints.	
330	0995	7.70	7.70						**Begin 3 lane section.**	AVALANCHE TABLES
					•				No major environmental constraints.	
330	0995	8.32	8.32							FAEDER LAKE TABLES
					•				No major environmental constraints.	
330	0995	10.30	10.30							MISKO VIEWPOINT S ENTR
						•			TCH confined by a bedrock exposures in the cut slope and the Kicking Horse flood plain.	
330	0995	10.31	10.31							MISKO VIEWPOINT N ENTR
						•			TCH confined by a bedrock exposures in the cut slope and the Kicking Horse flood plain.	
330	0995	11.83	11.83						**Begin 3 lane section.**	VIEWPOINTS END
						•			TCH confined by a bedrock exposures in the cut slope and the Kicking Horse flood plain.	
330	0995	13.00	13.00							FINN CREEK CAMPGROUND
						•			TCH confined by a bedrock exposures in the cut slope and the Kicking Horse flood plain.	
330	0995	17.47	17.47						**End 3 lane section.**	OTTERTAIL VIEWPOINT S ENTR
					•				No major environmental constraints.	
330	0995	19.79	19.79							OTTERTAIL CAMPGROUND
					•				No major environmental constraints.	
330	0995	20.49	20.49						**Begin 3 lane section.**	OTTERTAIL BRIDGE S END
							•		Ottertail creek prone to debris flows, narrow crossing of TCH corridor.	

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating			Description	LKI Boundaries
				Low	Moderate	High		
330	0995	20.87	20.87					OTTERTAIL FIRE R
					•		3 lanes, no major environmental constraints.	
330	0995	21.71	21.71					FIELD DUMP RD
					•		3 lanes, no major environmental constraints.	
330	0995	24.42	24.42				**End 3 lane section.**	BOULDER CREEK COMPOUND ACCESS RD
					•		No major environmental constraints.	
330	0995	25.75	25.75					ACCESS
					•		No major environmental constraints.	
330	0995	26.16	26.16					ACCESS
						•	Confined by a steep cut slope and the Kicking Horse River floodplain.	
330	0995	26.36	26.36					KICKING HORSE RIVER BRIDGE CPR O/P E END
					•		No major environmental constraints.	
330	0995	26.52	26.52					EMERALD LAKE ACCESS
					•		No major environmental constraints.	
330	0995	27.85	27.85					RD
					•		No major environmental constraints.	
330	0995	27.91	27.91					PICNIC TABLES
					•		No major environmental constraints.	
330	0995	29.12	29.12					ACCESS TO FIELD
					•		No major environmental constraints.	
330	0995	29.56	29.56					RD
					•		No major environmental constraints.	
330	0995	30.37	30.37					MAINTENANCE BLDG ACCESS
					•		No major environmental constraints.	
330	0995	32.80	32.80					YOHO VALLEY CAMPSITE ACCESS
					•		No major environmental constraints.	
330	0995	33.28	33.28					KICKING HORSE RIVER BRIDGE S END
					•		No major environmental constraints.	
330	0995	34.28	34.28					VIEWPOINT
						•	TCH confined by steep cut slope and the Kicking Horse River flood plain.	
330	0995	34.72	34.72					CPR O/P S END
						•	TCH confined by bluff and the Kicking Horse River floodplain.	
330	0995	35.67	35.67				**Begin 4 lane section.**	CPR ACCESS
						•	TCH confined by bluff and the Kicking Horse River floodplain.	
330	0995	36.17	36.17					BRIDGE
						•	TCH confined by bluff and the Kicking Horse River floodplain.	
330	0995	36.45	36.45				**Begin 4 lane section.**	SPIRAL TUNNEL VIEWPOINT EXIT
						•	TCH confined by bluff and the Kicking Horse River floodplain.	
330	0995	36.76	36.76					SPIRAL TUNNEL VIEWPOINT ENTR

Preliminary Ratings of Corridor Segments

Core Segment	LKI Segment #	Offset	Km Eastbound	Environmental Rating					Description	LKI Boundaries
							•		TCH confined by bluff and the Kicking Horse River floodplain.	
330	0995	37.73	37.73							WAPTA CREEK CULVERT
							•		TCH confined by bluff and the Kicking Horse River floodplain.	
330	0995	37.86	37.86							PULLOUT
							•		TCH confined by bluff and the Kicking Horse River floodplain.	
330	0995	38.71	38.71							SHERBROOKE CREEK CULVERT
						•			TCH confined by bluff and the Kicking Horse River floodplain.	
330	0995	40.10	40.10							PICNIC TABLES
					•				No major environmental constraints.	
330	0995	40.47	40.47							LOUISE W LODGE/SERVICE ENTR
					•				No major environmental constraints.	
330	0995	40.90	40.90							PULLOUT
					•				No major environmental constraints.	
330	0995	42.35	42.35							JCTN RTE 1/RTE 1A LAKE O'HARA
					•				No major environmental constraints.	
330	0995	42.38	42.38							JCTN RTE 1/RTE 1A LAKE O'HARA E EXIT
					•				No major environmental constraints.	
330	0995	43.82	43.82							RD SIDE TABLES W ENTR
					•				No major environmental constraints.	
330	0995	45.30	45.30							BC/ALBERTA BORDER (THE GREAT DIVIDE)
					•				No major environmental constraints.	
330	0995	45.30	45.30							GOLDEN RCMP BNDRY
					•				No major environmental constraints.	
330	0995	45.30	45.30							END OF SEGMENT