SALMON WATERSHED PLANNING PROFILES
for the Fraser River Basin within the
PRINCE GEORGE
Land and Resource Management Plan

Prepared for:

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1.0 INTRODUCTION

This document presents background information and stream management objectives and strategies for the salmon bearing watersheds within the Fraser River basin portion of the Prince George Land and Resource Management Plan (LRMP) area. The LRMP area is depicted in Fig. 1 in the text and with additional attributes in maps at the back of this document (Fig. 2, 3, and 4). The analysis summarizes salmon escapement information and the status of development activity and physiographic conditions within each watershed. This watershed-based resource information (presented in the appendices), has been compiled from sources including published and unpublished documents as well as the personal experience and professional judgement of Department of Fisheries and Oceans (DFO) staff. This has enabled assessment of the watershed areas within the LRMP as to the current management they require to ensure the conservation and development of fish habitat. Based on these assessments, specific objectives and strategies are prescribed to protect the salmon resources present.

It is intended that the information presented and the management objectives and associated strategies specified in this document be implemented within the LRMP area. The information will be updated, and the objectives and strategies reevaluated, as circumstances dictate. The document is a valuable resource for DFO regional planning and habitat management. In addition, it will benefit provincial Ministries of Environment, Lands and Parks (MoELP), and Forests (MoF) by providing guidance for their management activities as well as provide direction to municipalities, resource development companies, other stakeholders, and First Nations with interests in the LRMP area.

1.1 The Department of Fisheries and Oceans Vision Statement

DFO's Policy for the Management of Fish Habitat sets a long-term policy objective, namely the achievement of an overall **net gain** of the productive capacity of Canada's fish habitats (Department of Fisheries and Oceans 1986). Specifically, the intent of the policy is to "increase the natural productive capacity of habitats for the nation's fisheries resources, to benefit present and future generations of Canadians". It sets out three specific goals: fish habitat conservation, restoration, and development. The Guiding Principal of the fish habitat conservation goal is to achieve **no net loss** of productive capacity in relation to development activities. **No net loss** applies to habitat which:

- currently produces fish that are harvested in a subsistence, commercial or recreational fishery; or
- although not directly supporting fish, provides nutrients and/or supplies food to adjacent or downstream habitats or contributes to water quality for fish; or
- has been identified by DFO as a candidate for enhancement activities.

The second goal, fish habitat restoration, deals with the rehabilitation of the productive capacity of fish habitats in selected areas where economic or social benefits can be achieved through the fisheries resource. The third goal, fish habitat development, deals with the improvement and creation of fish habitats in selected areas where, again, fisheries resources production can be increased for the social or economic benefit of Canadians. These latter goals, restoration and development, will complement conservation efforts and contribute to a **net gain** of habitat.

In addition, DFO has identified seven measurable and achievable goals for sustainable fisheries development (O. Langer, pers. comm. 1994 in Webb et al. 1994). These goals are:

1. **Avoid irreversible human induced alterations to fish habitats.**
   Alterations to fish habitat that reduce its capacity to produce fish populations which cannot be reversed within a human generation are to be avoided.

2. **Maintain the genetic diversity of fish stocks.**
   No fish stock, regardless of its size, will be arbitrarily eliminated and, where possible, efforts to conserve and rebuild small and remnant stocks are to be made.

3. **Maintain the physical and biological diversity of fish habitats.**
   Physical and biological diversity of habitat provides fish with an opportunity to adopt alternative life history strategies, thereby providing protection from natural habitat variation.

4. **Provide a net gain in productive capacity through proper habitat management.**
   Ecological limits control productive capacity of a stream system. Natural and self-sustaining production systems are preferred over semi-natural, artificial or non-self-sustaining systems.

5. **Maximize the value of commercial, sport, and aboriginal fisheries.**
   All market and extra-market values are to be considered, and measured in a way that permits comparison of competing users of the fisheries resources.

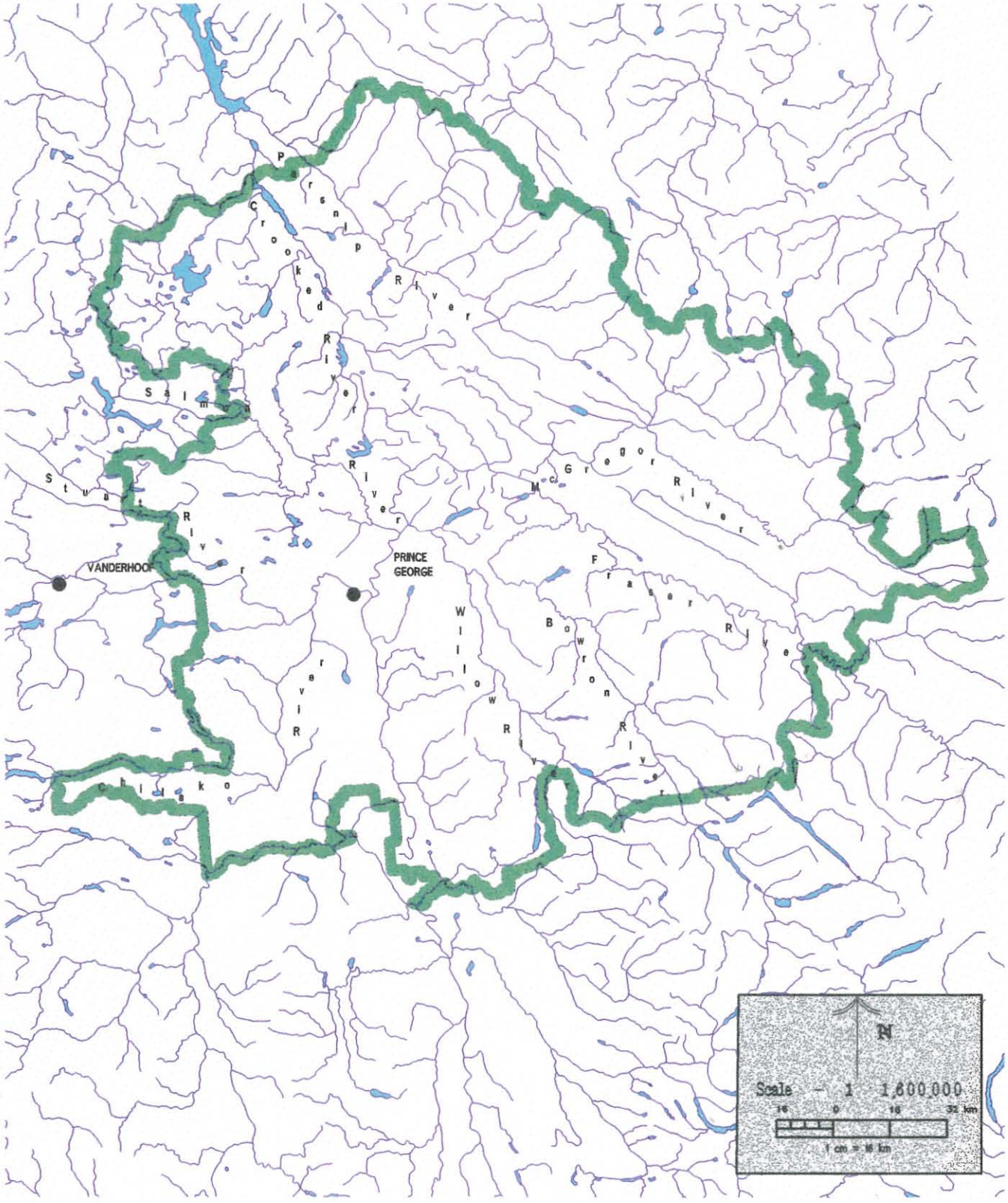
6. **Maximize the non-consumptive values of the fisheries resources.**
   Intangible and cultural values associated with fishery resources are to be given due consideration in decision making.

7. **Distribute fishery net benefits in a fair and equitable manner.**
   Local communities are to be involved in the decision-making process pertaining to habitat conservation, enhancement, and restoration, and particularly who is to benefit and who is to pay.

In order to aid in assessing the potential impacts of development proposals within the Prince George LRMP area on the salmon resource, the Northern Fraser River Habitat Management Unit of DFO has partitioned the area into Watershed Planning Units (WPUs). DFO has also developed a procedure to assess WPUs based on the sensitivity of the existing habitat and fisheries resources, the fisheries enhancement potential, and other unique features. The term **"sensitivity"** used in this document is applied in a broad sense to refer to a level of concern for those aspects of watershed features that can affect fish habitat and be altered by human activities. The watershed-based analyses presented in this document describe: i) watershed geographic and hydrologic information, ii) the historic and present status of salmon escapements, iii) present or proposed development, iv) existing biophysical conditions, v) sensitive watershed features, vi) areas of specific concern, and finally vii) recent watershed planning and/or project initiatives. The analyses then present specific management objectives and prescribe specific management strategies consistent with sustainable land, water and other resource use prevalent within a given WPU. The requirement for the acquisition of additional information is also prioritized by WPU within the LRMP area.

Figure 1. The Prince George Land and Resource Management Plan (LRMP) area

Figure 1 : The Prince George Land and Resource Management Plan Area



1.2 General Objectives and Strategies for Salmon Resources

Table 1 presents management objectives and strategies intended to satisfy the goal of protecting the salmon resource by ensuring that a net gain in the productive capacity of fish habitat is achieved.

Table 1. General objectives and strategies for salmon resources.

Objectives	Strategies
• Maintain, rebuild and/or enhance salmon stocks. • Maintain and/or enhance water quality and water quantity for instream uses. • Maintain and restore watershed and stream channel integrity and stability. • Ensure that the cumulative rate of development within specified watersheds (forestry, urbanization, agriculture, mining, etc.) does not adversely impact fish habitat. • Ensure consistency in resource planning in: - administrative boundaries - hierarchial plans (strategic, operational) - management goals, objectives, strategies, and indicators. • Protect streamside and riparian areas by providing adequate buffer zones and through proper riparian management. • Provide an adequate level of monitoring that will ensure proper compliance and provide an evaluation tool for refinement of management strategies, prescriptions and resource targets. • Maintain existing "No Staking Placer Reserve" designations. • Ensure Forest Practises Code provisions are applied as a <u>minimum</u> standard in all watersheds. • Ensure other development guidelines such as the Land Development Guidelines, Placer Mining Regulations and Guidelines, Guidelines for Mineral Exploration and Reclamation, and Agriculture Guidelines are followed. (See Appendix 14.) • Maintain the natural diversity of aquatic habitat elements.	• Apply sustainable fish harvest strategies. • Conduct fish habitat inventories to identify fisheries sensitive/critical areas that require protection and site specific management actions. • Assess present and potential development impacts in fisheries watersheds (Watershed Assessment Procedure) and implement integrated watershed management plans to minimize the cumulative impacts of land use activities. • Identify watersheds or stream reaches that require enhanced management prescriptions. • Determine adequate instream flows for fish. • Restore degraded stream habitats through promotion of improved land management practices and through bank stabilization, revegetation and other stream restoration techniques. • Monitor and enforce compliance to environmental standards/guidelines and evaluate their effectiveness. • Enhance salmon habitat and stocks through specifically identified projects or activities.

1.3 Monitoring Strategy

The development and implementation of a strategy for monitoring resource development and operational activities is crucial to ensuring that the effectiveness of fish habitat management policies is realized. Monitoring programs can be used to i) establish the baseline biophysical conditions within a watershed from which comparisons of the effects of future development can be made, ii) gauge both the effectiveness of management recommendations and the degree to which compliance with stated guidelines is attained, iii) provide the information required to evaluate the response of biophysical conditions within watersheds to various management prescriptions, and iv) provide direction for future planning.

DFO will employ compliance auditing of guidelines, standards and regulations and synoptic monitoring of management objectives, strategies and indicators in designated watershed planning units. Table 2 presents the specific monitoring strategies to be applied and the indicators to be used in measuring the success of the strategies.

2.0 OVERVIEW OF SALMON RESOURCES

The Fraser River basin portion of the Prince George LRMP area supports chinook (*Oncorhynchus tshawytscha*), sockeye (*O. nerka*) and pink (*O. gorbuscha*) salmon (Hopwo 1994). The major fish habitat types present in the LRMP area are spawning, migration, incubation and rearing habitat provided by the area's rivers, tributary streams and lakes. Chinook and sockeye have the greatest economic value of salmon in this area and make a significant contribution to the Pacific Coast commercial, Fraser River aboriginal, and, in the case of chinook, Straight of Georgia and Fraser River sport fishery (Fraser River Action Plan [FRAP] 1994,1995).

With respect to stock management policy for the Fraser River watershed, it has been known for some time that the basin has the potential to support more salmon than is presently the case. To restore all Fraser River salmon stocks to full potential, DFO proposes the following management strategies (DFO 1991):

- Increased escapement to spawning grounds through an intricate formula of fishing times and opportunities will be a primary tool.

- Resource enhancement techniques such as artificial spawning channels and small hatcheries will augment wild stock rebuilding. In some cases, enhancement will "kick-start" small fish populations to levels where they can be further increased through more conservative fishing management, eventually becoming self-sustaining.

- Vigorous protection of habitat and, wherever possible, rehabilitation of degraded habitat.

Species specific information, including current management strategies, for salmon present in the Prince George LRMP are outlined below. Specific escapement targets are not given; stating a static target for a particular stream would not be appropriate given the variation in stock, cycle year, and expected returns. (A. MacDonald, pers. comm. 1995)

Table 2. Monitoring Strategies and Indicators.

Monitoring Strategies	Monitoring Indicators
• Monitor and assess management goals, objectives and strategies for the development activities identified. • Coordinate monitoring, compliance, enforcement and regulation of placer mining activities with the Ministry of Energy, Mines and Petroleum Resources. • Monitor application of Forest Practices Code (FPC) standards and field guides. • Monitor and evaluate mine development proposals to ensure water quality of salmon habitat is maintained. • Monitor application of the Land Development Guidelines with respect to urban development. • Monitor application of guidelines associated with agricultural activities. • Monitor other proposed development activities such as linear, hydro, etc. and conduct routine audits of performance compliance. • Monitor biophysical conditions such as soils, channel and terrain stability, and hydrology. • Monitor salmon population levels and distribution. • Monitor salmon habitat quality and quantity. • Monitor cumulative impacts of development using ECA, riparian condition, etc. • Monitor identified critical watershed features such as condition of non-natal tributaries. • Provide an assessment of watershed riparian condition to determine if the FPC riparian standards are adequate to maintain existing riparian attributes. • Cooperate with scientific research programs (i.e. Fish/Forestry interaction) in the LRMP area. • Cooperate with Watershed Restoration Program (WRP) monitoring programs.	• Habitat capacity, quality and quantity. • Compliance with environmental standards and guidelines. • Status of cumulative impacts. • Status of critical environmental variables such as flow, water temperature, sediment input, water quality, water demand/use. • Riparian condition. • Number, type and effectiveness of watershed restoration projects. • Restoration project comparative reviews. • Salmon escapement trends. • Catch levels (harvest rates).

Chinook Salmon

Escapement records (Hopwo 1994) show that chinook salmon spawn in almost all the watersheds draining into the Fraser River in the Prince George LRMP. The Bowron River watershed has the largest chinook escapement in the upper Fraser River. The Salmon and Willow rivers and Slim, Torpy and Seebach creeks are major chinook spawning systems as well. Other watersheds, although perhaps less significant in terms of absolute escapement numbers, are essential for the maintenance of genetic diversity of chinook stocks. It should be emphasized that chinook salmon juveniles rear in these systems for up to two years after emerging from the gravel (Hickey and Lister 1981). In particular, juvenile chinook utilize the tributary streams entering the mainstem rivers (including the Fraser River) and seasonally flooded areas for rearing. These areas are therefore critical to the early life stages of the area's chinook salmon (Lister et al. 1981).

The 1985 Pacific Salmon Treaty committed management agencies in Canada and the United States to halt the decline of chinook spawning escapments and attain, by 1998, spawning escapement goals established by each nation. For Fraser River chinook, the current rebuilding goal (established in 1984) is a doubling of base period (1979-1982) escapement goals by 1998. This goal serves as an interim objective of the rebuilding plan (FRAP 1995).

Sockeye Salmon

Escapement records (Hopwo 1994) indicate that sockeye salmon spawn in the Bowron River and, to a much lesser degree, Seebach Creek watersheds of the Fraser River basin portion of the Prince George LRMP. The sockeye escapement to the Bowron watershed is large; the 1981-1992 average annual escapement was approximately 6,000; the maximum to date is 35,000. The average and maximum escapement for Seebach Creek in the same time periods are 29 and 230 respectively.

DFOs current management strategy for the upper Fraser River sockeye stocks in the Prince George LRMP follow the general stock management policies and objectives for the Fraser basin. The interim escapement goal for this stock is an escapement of 45,000 on the dominant (all) cycle (FRAP 1994b).

Pink Salmon

In general, pink salmon distribution in the Fraser Basin is concentrated well downstream of Prince George. However, escapement records (Hopwo 1994) indicate that a small run of pink salmon spawn in the Naver Creek (also called Canyon Creek) watershed, which is at the most southerly (i.e. downstream) extreme of the Fraser River basin portion of the Prince George LRMP. The 1981-1992 average annual pink escapement to Naver Creek was 14; the maximum escapement to date is 100. Pink salmon were also noted in the Nechako River in 1989.

No specific stock management policy is in place for pink salmon in this area. Since the Fraser River Panel manages the fisheries targeting on both pink and sockeye salmon returning the Fraser River, fishery management strategies for these two species are similar (FRAP 1994a). The total escapement

goal for Fraser River pink stocks has been set at six million spawners and harvest management strategies have been devoted to achieving this goal by reducing exploitation rates (Harrison 1994).

It is evident that the fish habitat present in the Prince George LRMP area is both highly productive and extensive. The habitat also supports a significant proportion of the Fraser River basin's salmon production, which is harvested by commercial, sport, and aboriginal fisheries. As a result, prudent management of development activities in the LRMP area is a high priority with DFO.

3.0 METHODOLOGY

The following sections describe the preparation of the Prince George LRMP Salmon Watershed Planning Profiles.

3.1 Delineation of Watershed Planning Units

The delineation of watershed boundaries as planning units is crucial from a fish habitat management perspective. The use of watersheds as planning units permits the assessment of potential land and resource use impacts on hydrology and fish habitat. The watershed boundary provides a logical planning unit from which relevant data can be collected, and inventory and land use information can be evaluated. In this way, the assessment of potential impacts of land and resource use activities on fish habitat and productivity can be based on a discrete physical drainage area and the biophysical processes which occur within a particular physiographic location.

The WPUs used in this analysis are usually based on individual watershed boundaries since each watershed typically supports at least one salmon species and contains specific biophysical attributes. However, where similar features such as terrain, water sources, micro-climate, geology, development activity, and fish life histories occur in adjacent, relatively small watersheds, these watersheds were amalgamated to form larger units also referred to as WPUs. In cases where several similarities existed but at least one significant difference was noted, such as an increased level of concern for a particular watershed feature or activity, a separate WPU was assigned. Figures 2 to 4 show the WPU boundaries as well as specific information outlined in Section 3.2 below. In addition to the 13 WPUs documented in appendices 1 to 13, small portions of the Nechako River, Ahbau Creek (a tributary of the Cottonwood River) and the West Road (Blackwater) River are located in the Prince George LRMP. These salmon-bearing systems are discussed in companion documents; the Nechako River in the Vanderhoof LRMP document (MacDonald et al. 1995) and the Ahbau and West Road River in the Cariboo-Chilcotin CORE Salmon Watershed Planning Profiles (DFO in prep.) and the provincial Cariboo-Chilcotin Land Use Plan (British Columbia 1994).

DFO has divided the Fraser Basin into 15 planning units termed Habitat Management Areas (HMAs), based on major watershed boundaries, salmon stocks and physiographic features. HMAs are also "units of salmon production" for planning purposes, and much of DFO's stock and habitat specific information is compiled relative to HMAs. The Fraser basin watersheds within the Prince George LRMP are primarily in the Upper Fraser River HMA; of the 13 WPUs presented in Appendices 1 to 13, 11 (including the Fraser River itself) are in this HMA while the remainder are in the Quesnel (1)

and Nechako (1) HMAs.

3.2 Development of Assessment Criteria

For each watershed profile, the focus of the assessment was on development types and associated attributes (e.g. industrial development [type], extent thereof [attribute]) and biophysical features (e.g. terrain). Human development activities and biophysical conditions play a key role in fisheries habitat; documentation thereof is a crucial step towards an assessment of habitat resource conditions. Specifically, the analysis considered:

1. General **watershed information** and **hydrology**. The primary source of general watershed and hydrologic information for this report is Rood & Hamilton 1995, and readers can refer to that document for an explanation of the methods used to derive the hydrologic data. All flow data are related to the stream mouth. The winter (November 1 to April 30) and summer (May 1 to October 31) months in which mean 7 day low flows occur most frequently are presented if the information is available. Selected hydrologic characteristics of WPUs, extracted from Rood and Hamilton (1995) are shown in Figure 2, map sleeve 1.

2. The **presence of salmon** within the watershed planning unit, and if present, the species, an assessment of the population trends including the historic maximum (and year, if available), the 1981 to 1992 average and maximum escapement, the 1969 to 1980 average escapement, and a comparison of the 1981 to 1992 average to the 1969 to 1980 average. The comparison was used as an indicator as to whether the population is static, increasing, decreasing, or if there is no trend. The rebuilding potential for the stock is presented as low, medium or high. The measure of rebuilding potential, developed by Hopwo (1994), is based on changes in escapement over time. "Low" indicates that the historic maximum is less than the recent (81-92) maximum by 50% and production levels are being realized. "Medium" indicates historic and recent maximums are within 50% of each other and limited production increases will be realized. "High" indicates that the historic maximum is greater than the recent (81-92) maximum by 50% and significant potential to increase production exists. The extent of known (to 1994) salmon spawning distribution is presented in Figure 3, map sleeve 2. Migration and rearing areas, extensive throughout the LRMP, are not shown.

   It should be noted that the number of salmon spawners estimated for a particular watershed planning unit was ***not*** significant to the analysis, only their presence. The escapement numbers are, therefore, presented for information only.

3. Past, present or proposed **developments** (e.g. forestry) within the watershed , including attributes typically associated with the particular development (e.g. percent logging). The development types and associated attributes considered were:
   a) *Forestry* - percent logging[1], equivalent clearcut area (ECA)[2] status, riparian condition/stream

[1] Percent logging is defined here as the total area of the watershed that has been logged i.e all cutblocks including those blocks with some hydrologic recovery (See Rood and Hamilton 1995). Figure 4, map sleeve 3, presents percent logging in each WPU. **N.B.** This information has been compiled to assist DFO staff in 'flagging' watersheds that have forest harvesting at a level (e.g. > 20% logging) that warrants

length impacted;

b) *Agriculture* - extent, riparian condition/stream length impacted, water withdrawal, water quality;

c) *Urbanization* - population level, extent, riparian condition/stream length impacted, water withdrawal, water quality;

d) *Placer mining* - extent, water quality, riparian condition/stream length impacted;

e) *Other mining* - extent, water quality;

f) *Industrial development* - extent, water quality, stream/riparian impacts;

g) *Linear development* - extent, stream/riparian impacts;

h) *Hydro development* - extent, stream/riparian impacts;,

i) *Other developments* - extent, stream/riparian impacts, and;

g) *Cumulative developments* - consideration of the impact of all development activities.

4. **Biophysical conditions** within the watershed were determined by assessing the following biophysical features:

   a) *Soils*;
   b) *Terrain*;
   c) *Resistance to change*[3];
   d) *Hydrology*;
   e) *Channel stability*; and,
   f) *Significant environmental variables* - e.g. biophysical conditions resulting from impoundment, nutrient enrichment.

5. The presence of **sensitive watershed features** which would require site or area specific attention such as:

   a) *Sensitive physical features*;
   b) *Sensitive biological features*; and,
   c) *Unique features*.

6. The occurrence of, or the potential for, **special considerations** which may have present or future impacts on development activities including:

   a) *Stock management* initiatives - i.e. manipulation of fisheries or escapement levels;

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particular attention. This in no way replaces a full watershed assessment procedure as provided for under the Forest Practices Code.

[2] Equivalent clearcut area (ECA) is a forest management term used to describe the total area within a watershed which functions in a similar fashion hydrologically to a clearcut opening, accounting for a recovery factor based on the stage(s) of forest regeneration.

[3] Watersheds vary in their ability to resist environmental changes resulting from human activities. The variability results from factors such as soil erodibility and watercourse hydrology. In the watershed profiles, a high level of concern was assigned to a watershed with little ability to resist change and conversely a low level was assigned to a watershed with good ability to resist change.

b) Existing or potential fish habitat or fish population *enhancement activities*;
c) Fish habitat or fish population *restoration activities*; and,
d) Presence of a *native, recreational* or *commercial fishery* and its locale.

7. The undertaking of **recent watershed planning/project initiatives** by government agencies and/or other stakeholders.

3.3 Assignment of 'Levels of Concern' for Development Type and Attributes and Biophysical Features

After the available information was compiled and reviewed, a level of concern for fish and fish habitat, as it related to the potential for salmon resource impacts, was assigned to each development type and attribute, and each biophysical feature. The level of concern was rated either **low** or **high.**

A **low** level of concern served to indicate that, based on the available information, and assuming that ***standard management practises*** are applied, minimal impact to salmon populations or their habitat would be expected to occur. ***Standard management practice*** assumes that an acceptable level of protection for stream habitat and water quality will be provided. This will include, where applicable, standard practices such as the Forest Practices Code (range, timber, etc.), the Land Development Guidelines, placer mining regulations and guidelines, and Guidelines for Mineral Exploration and Reclamation. Appendix 14 lists relevant environmental guideline publications. It is also assumed that routine auditing of development activities will be performed to ensure compliance with the prescribed standards.

A **high** level of concern would indicate that the particular watershed has a high probability for significant impacts on fish or fish habitat from present or proposed development activities or biophysical features.

It should be noted that the level of concern assigned was based on the best available information. Reclassification may be necessary as new information becomes available, or changes in either the physical habitat, rate of development, or status of the salmon populations occur.

4.0 RESULTS AND DISCUSSION

A total of thirteen salmon bearing Watershed Planning Units were delineated for the portion of the Fraser River drainage located within the Prince George LRMP area. Detailed analyses, prepared by watershed, are presented in Appendices 1 through 13. Table 3 presents a summary of these WPUs and any individual watershed delineated within the WPU. In the 'development concerns' and 'biophysical concerns' columns, the numbers present the sum of high levels of concern that have been assigned to the development types and biophysical features. These values could be a maximum 10 and 6 respectively. In the case of sensitive watershed features and special considerations, the values could be a maximum 3 and 6 respectively. The significance of the last column is discussed in Section 4.1.

Table 3. Results of the Salmon Resource Analyses by Watershed Planning Unit.

Watershed Planning Unit and Watersheds	Salmon Present	Development Concerns	Biophysical Concerns	Sensitive Watershed Features	Special Considerations	$\sum$ col 3-6*
1. Fraser River	✓	1	1	2	5	9
2. Naver (Canyon) Creek	✓	4	4	2	5	15
3. Chilako River	✓	4	3	2	5	14
4. Salmon River	✓	2	2	2	5	11
5. Willow River	✓	4	4	2	6	16
6. McGregor River	✓	2	4	2	4	12
7. Seebach/Otter/Captain						
Seebach Creek	✓	0	2	1	4	7
Otter Creek	✓	0	3	1	5	9
Captain Creek	✓	0	3	2	5	10
8. Herrick Creek	✓	0	4	2	5	11
9. Bowron/Kenneth						
Bowron River	✓	3	6	3	6	18
Kenneth Creek	✓	3	5	1	5	14
10. Hungary Creek	✓	1	6	1	5	13
11. Slim Creek	✓	2	3	2	4	11
12. Dome/Ptarmigan						
Dome Creek	✓	1	6	1	6	14
Ptarmigan Creek	✓	1	6	1	5	13
13. Torpy River	✓	3	6	2	5	16

* $\sum$ col 3-6 = the arithmetic sum of columns 3 to 6.

4.1 Prioritization of Watersheds

Prioritization of watersheds was determined based on the sum of high levels of concerns for development types and biophysical features, identified sensitive watershed features, and identified special considerations. The sum is presented in column 7, Table 3 above. This method is an appropriate first effort to prioritize the watersheds in that it combines development and biophysical conditions, sensitive watershed features and special considerations that are considered to require special attention. Table 4 presents, in decreasing order, the seven watersheds that have the highest number of concerns and features. It is envisioned that Tables 3 and 4 will assist in defining an implementation strategy for the Prince George LRMP as well as assist the various stakeholders in

allocating effort and resources in their planning processes. ***It must be stressed, however, that each watershed identified in this salmon habitat management plan, regardless of its ranking in Table 3 or appearance in Table 4, contains characteristics that require specific attention.***

Specific strategies have been assigned for each watershed based on the specific objectives identified, in addition to the general objectives and strategies for salmon resources (Table 1). Implementing a monitoring strategy which includes utilizing monitoring indicators (Table 2) will enable auditing and evaluation of both specific and general strategies for a given watershed or local area within a watershed.

It is recognized that unforeseen conditions may arise either during or following the LRMP process such as insect infestation, fire, floods, significant changes in salmon escapement or development plans which may necessitate reevaluation of both the priority of and appropriate management prescriptions for a particular watershed. If necessary, these occurrences will be dealt with by more detailed plans.

Table 4. Prioritization of Watersheds Requiring Additional Assessments or Inventories.

Priority	Watersheds	Rationale
1 (Σ= 18)	Bowron River	Extensive biophysical sensitivity, forestry and cumulative development concerns , many sensitive watershed features and special considerations
2 (Σ= 16)	Willow Creek	Extensive biophysical sensitivity, forestry, placer mining, linear and cumulative development concerns, and many sensitive watershed features and special considerations.
3 (Σ= 16)	Torpy River	Extensive biophysical sensitivity, forestry and cumulative development concerns, several sensitive features and special considerations
4 (Σ= 15)	Naver (Canyon) Creek	Forestry, placer mining, linear and cumulative development concerns, several biophysical sensitivities, sensitive features and special considerations
5 (Σ=14)	Dome Creek	Extensive biophysical sensitivity, forestry concern, and several sensitive features and special considerations
6 (Σ=14)	Kenneth Creek	Extensive biophysical sensitivity, forestry and cumulative development concerns , and many special considerations.
7 (Σ=14)	Chilako River	Logging, agriculture, linear and cumulative development, some biophysical concern, several sensitve features and special considerations.

5.0 ACKNOWLEDGEMENTS

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APPENDIX 1. Watershed Profile for the Fraser River Watershed Planning Unit

Streams located within the Fraser River Watershed Planning Unit include:

GENERAL WATERSHED INFORMATION:

Watershed:	***Fraser River***	**SISS Code:**	00
Physiographic Area(s):	Nechako Plain/ Rocky Mountain Trench		
Drainage Area (ha):	Corridor	**Biogeoclimatic Zone(s):**	Sub-Boreal Spruce/ Interior Cedar Hemlock
HMA:	Corridor		

WATERSHED HYDROLOGY:

Stream Flows:	Mean Annual	Mean Flood	Mean 7-day low flow			
			Winter		Summer	
(m^3/s)	814	NA	NA	NA	NA	NA
Comments:	Reference for above data is WSC Stn 08KB001 - Fraser River at Shelly. Period of record 1950- 1989.					

SALMON ESCAPEMENT:

Species	**Historical Max. (yr)**	**1981-92 Ave.**	**1981-92 Max.**	**1969-80 Ave.**	**Population trend**	**Rebuilding potential**
Chinook	9,000 (NA)	4,363	6,500	1,833	Increasing	Medium
NB. The above data apply to migration of chinook to the upper reaches of the Fraser River above the Prince George LRMP. Spawning occurs upstream in the Robson Valley area; these numbers refer to Fraser River at Tete Jaune and do not include tributary spawning.						

DEVELOPMENT ACTIVITY:

Type	**Level of Concern**	**Comments**	**Ref.***
Forestry	***High***		7
- percent logging		Not available for Fraser corridor	7
- ECA status	High	Some logging in subdrainages	7
- riparian condition/stream length impacted	High	Pertains to tributaries throughout their length	3,7

Watershed:	*Fraser River*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Agriculture	***Low***	Throughout the corridor; concentrated in Robson Valley, Dome Creek, Prince George, and south of Prince George	7
- extent	Low		7
- riparian condition/stream length impacted	Low		7
- water withdrawal	Low		7
- water quality	Low		7
Urbanization	***Low***	Concentrated at Prince George	7
- population level	Low	80,000	7
- extent	Low	Nechako/Fraser confluence	7
- riparian condition/stream length impacted	Low	Localized, site specific impacts	7, 8
- water withdrawal	Low	Concentrated at Prince George; municipal and industrial	7
- water quality	High	2 pulp mills, urban runoff & sewage, snow disposal into side channels and back channels	7
Placer Mining	***Low***	Some on Fraser River gravel bars	7
- extent	Low		7
- water quality	Low		7
- riparian condition/stream length impacted	Low		7
Other Mining	***Low***	Localized gravel removal for construction, etc.	7
- extent	Low	None	7
- water quality	Low		7

Watershed:	*Fraser River*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Industrial Development	***Low***		7
- extent	Low	Concentrated in Prince George	7, 8
- water quality	Low	Pulp mills, refining, hydrogen peroxide plant, sawmills, manufacturing and service industries	7
- stream/riparian impacts	Low	site specific related to above	7, 8
Linear Development	***Low***	Highway, railway, gas line and transmission line rights-of-way and crossings,	7
- extent	Low	Concentrated at Prince George	7
- stream/riparian impacts	Low	Site specific e.g. side channels alienated, riparian loss, channelization	7
Hydro Development	***Low***		7
- extent	Low	None	7
- stream/riparian impacts	Low		7
Other Development	***Low***		7
- extent	Low	None	7
- stream/riparian impacts	Low		7

CUMULATIVE DEVELOPMENT ACTIVITY:

Cumulative Development	***Low***		7

* See report section 6.0 References Cited

Watershed:	*Fraser River*

BIOPHYSICAL CONDITIONS:

Type	Level of Concern	Comments	Ref.*
Soils	***Low***		7
- types		Glacial and some lacustrine deposits along 3-15 km wide floodplain	12
Terrain	***Low***		7
- type		Floodplain	7,12
Resistance to Change	***Low***	Large, dynamic river	7
Hydrology	***Low***	Small tributaries may be of high concern as a result of extremely variable flow regime	7
Channel Stability	***Low***	Large gravel bars, bank and channel instability (except tributaries, see above)	7
- type			
Significant Environmental Variables	***High***	High suspended sediments during high flow	7

SENSITIVE WATERSHED FEATURES:

Type	Present	Comments	Ref.*
Sensitive Physical Features	✓	Large eroding stream banks	7, 13
Sensitive Biological Features	✓	Tributaries are critical chinook rearing habitat	7, 13
Unique Features			

* See report section 6.0 References Cited

Watershed:	*Fraser River*

SPECIAL CONSIDERATIONS:

Type	Present	Comments	Ref.*
Stock Management	✓		
Enhancement Activity/Opportunity		not assessed	7
Restoration Activity	✓	Side channel restoration at Prince George - Cottonwood Island, more restoration sites proposed	7
Native Fishery	✓	Occurs in Fraser River	7
Recreational Fishery	✓	Ocean sport fishery	
Commercial Fishery	✓	Ocean fishery	

RECENT WATERSHED PLANNING/PROJECT INITIATIVES:

Type	Comments	Ref.*
ROC review	Rate of Cut review on Stone Creek, downstream of Prince George at Stoner.	7
OCP	Prince George Official Community Plan and identification of fisheries sensitive zones	7
Lands Branch	Fraser River Corridor land development plan	7

* See report section 6.0 References Cited

SUMMARY OF HABITAT CONCERNS (no. of high ratings):

Salmon Present	Development Concerns	Biophysical Concerns	Sensitive Watershed Features	Special Considerations
✓	✓	✓	✓(2)	✓(5)

Watershed:	*Fraser River*

SPECIFIC OBJECTIVES AND STRATEGIES:

Specific Objectives	Specific Strategies
• Maintain natural watershed hydrologic characteristics and stream flow regime. • Maintain the natural stream temperature regime. • Maintain the structural and functional integrity of riparian areas. • Maintain slope stability. • Maintain or improve water quality. • Protect stream channels and floodplains from influences of development activities. • Ensure the protection of headwater, ephemeral and intermittent channels; recognizing their influence on watershed stability, hydrology and water quality. • Ensure protection of critical aquatic habitats including: floodplain, off-channel sites, non-natal tributaries and other areas of biological significance. • Ensure that the intensity of development activities does not negatively impact the natural watershed ecological processes through site specific or cumulative development. • Ensure the inventory, assessment and implementation of stream restoration and enhancement programs. • Ensure adequate stream flows are present to maintain fisheries productive capacity. • Improve inventories of aquatic resources. • Support existing fisheries enhancement programs and activities. • Improve fish passage in the watershed.	• Apply FPC riparian guidelines to agricultural and range use of crown land. • Apply riparian guidelines for new placer mines that are consistent with FPC standards. • Apply the Watershed Assessment Procedures (WAP) to assess past and potential for future impacts of lands use activities in tributary watersheds. • Apply the Land Development Guidelines to residential and industrial developments. • Conduct a stream channel assessment on tributaries to identify potential barriers to fish migration and remove or facilitate access where appropriate. • Conduct and maintain fisheries, habitat(critical) and enhancement inventories. • Conduct detailed gully assessments on tributaries for specified sensitive channels identified in development plans. • Design high elevation forest cutblocks in tributary watersheds to optimize snow accumulation and retention similar to unharvested or undisturbed areas. • Distribute timber harvesting opportunities in tributary watersheds throughout the available range in elevation to maintain natural hydrologic conditions. • Ensure that rate of development (forestry, urban, agriculture, etc.) in tributary watersheds is balanced against hydrologic recovery to maintain cumulative ECA at or below 25% (total watershed drainage area). • Maintain designated "NO STAKING PLACER RESERVES" for placer mining where identified. • Implement a water drainage management plan for sensitive soils, stream crossings or other areas specified in development plans.

Watershed:	*Fraser River*

SPECIFIC OBJECTIVES AND STRATEGIES (continued):

Specific Objectives	Specific Strategies
	• Initiate a watershed restoration assessment and inventory for development of a Watershed Restoration Plan. • Implement watershed restoration plan recommendations from assessment and inventory reports. • Initiate restoration, revegetation and stabilization measures on linear developments. • Identify and request complete reclamation of past, present and new placer mining development sites. • Restrict or control development within or along tributary confluences, alluvial fans, floodplains or areas of slope instability (e.g. valley walls). • Retain riparian reserves along specified S4-S6 (FPC riparian class) stream channel reaches in high sensitivity areas or channels identified as having stream temperature concerns. • Review and document potential habitat improvement, habitat development and habitat restoration opportunities. • Review resource development plans for compatibility with sensitive habitats in terms of hydrology, water quality, channel stability and riparian condition.

APPENDIX 2. Watershed Profile for the Naver (Canyon) Creek Watershed Planning Unit

Streams located within the Naver Creek Watershed Planning Unit include:

GENERAL WATERSHED INFORMATION:

Watershed:	*Naver Creek*	SISS Code:	00-5400
Physiographic Area(s):	Cariboo Plateau		
Drainage Area (ha):	89,600	Biogeoclimatic Zone(s):	Sub-Boreal Spruce
HMA:	Quesnel		

WATERSHED HYDROLOGY:

Stream Flows:	Mean Annual	Mean Flood	Mean 7-day low flow			
			Winter		Summer	
(m^3/s)	6.4	48.1	1.15	NA	0.91	NA
Comments:	Reference for above data is the stream mouth. See Ref # 11 p. 10, Table 4 and Appendix B.					

SALMON ESCAPEMENT:

Species	Historical Max. (yr)	1981-92 Ave.	1981-92 Max.	1969-80 Ave.	Population trend	Rebuilding potential
Pink	100 (NA)	14	100	NA	Static	Medium
Chinook	400 (NA)	171	400	NA	Static	Medium

NB. Naver Creek listed as Canyon Creek in Hopwo 1994.

DEVELOPMENT ACTIVITY:

Type	Level of Concern	Comments	Ref.*
Forestry	***High***		7
-percent logging	High	30%	6
- ECA status	High	ECA agriculture plus other harvest	7
- riparian condition/stream length impacted	High	Localized riparian removal, bank damage	7, 11

Watershed:	*Naver Creek*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Agriculture	***Low***	Concentrated in spawning reaches	7
- extent	Low	8% of watershed developed	7
- riparian condition/stream length impacted	Low	Localized impacts in spawning areas.	7
- water withdrawal	High	Some tributaries fully recorded	7
- water quality	Low	No problems noted	7
Urbanization	***Low***		7
- population level	Low		7
- extent	Low	Concentrated in spawning reaches	7
- riparian condition/stream length impacted	High	Bank stabilization throughout lower reaches (Car bodies, rip-rap, etc.)	7
- water withdrawal	Low	Lower reaches, some tributaries	7
- water quality	Low		7
Placer Mining	***High***		7
- extent	High	Concentrated in lower reaches and in tributaries near Hixon.	7,11
- water quality	Low	Sedimentation, primarily contributed by Hixon Creek	7, 11
- riparian condition/stream length impacted	Low		7
Other Mining	***Low***		7
- extent	Low	4 showings	7
- water quality	Low	Sedimentation	7

Watershed:	*Naver Creek*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Industrial Development	***Low***		7
- extent	Low	Dunkley's sawmill on Meadowbank Creek	7, 6
- water quality	High	Sedimentation from forest roads and wood leachate from sawmill at Strathnaver	7, 6
- stream/riparian impacts	Low	Sawmill encroaches on tributary	7
Linear Development	***High***	Gas pipeline, highway, railway, and transmission line right-of-ways, forest roads	7
- extent	High	Throughout watershed	7
- stream/riparian impacts	Low	Localized in Hixon Area	7
Hydro Development	***Low***		7
- extent	Low	None	7
- stream/riparian impacts	Low		7
Other Development	***Low***		7
- extent	Low	None	7
- stream/riparian impacts	Low		7

CUMULATIVE DEVELOPMENT ACTIVITY:

Cumulative Development	***High***	Forestry, agriculture, placer mining, channelization	7

* See report section 6.0 References Cited

Watershed:	*Naver Creek*

BIOPHYSICAL CONDITIONS:

Type	Level of Concern	Comments	Ref.*
Soils	***Low***	Localized lacustrine deposits; basin; fluvial	7,11
- types		Glaciolacustrine/glaciofluvial, plateau: morainal & glaciofluvial & some lacustrine	7,11
Terrain	***Low***		7,11
- type		Gently rolling, undissected uplands with glacial drift over bedrock	7, 11
Resistance to Change	***High***	Low elevation basin with few lakes	7
Hydrology	***High***	Low late summer flows in streams. Recent (1990) flood event	7,11
Channel Stability	***High***		7
- type		Lower reaches unstable, channel aggradation occurring, riprap, recent (1990) flooding. Upper reaches generally stable, some bank erosion, valley wall instability and down cutting in plateau.	7
Significant Environmental Variables	***High***	High summer temperatures coincide with low flows	7

SENSITIVE WATERSHED FEATURES:

Type	Present	Comments	Ref.*
Sensitive Physical Features	✓	Past hydraulic mining - Hixon Creek	7
Sensitive Biological Features	✓	Spawning concentrated in lower reaches adjacent to urban areas	7
Unique Features			

* See report section 6.0 References Cited

Watershed:	*Naver Creek*

SPECIAL CONSIDERATIONS:

Type	Present	Comments	Ref.*
Stock Management	✓		
Enhancement Activity/Opportunity		not assessed	7
Restoration Activity	✓	Hixon residents seeking enhancement/restoration activities	7
Native Fishery	✓	Occurs in Fraser River	7
Recreational Fishery	✓	Ocean sport fishery	
Commercial Fishery	✓	Ocean fishery	

RECENT WATERSHED PLANNING/PROJECT INITIATIVES:

Type	Comments	Ref.*
WAP	DFO has requested a formalized Watershed Assessment Procedure be conducted by MoF	7, 11
AOI (PAS)	Designated Area Of Interest in Protected Areas Strategy as of June 1995. (Government Creek, a tributary of Hixon Creek)	7

* See report section 6.0 References Cited

SUMMARY OF HABITAT CONCERNS (no. of high ratings):

Salmon Present	Development Concerns	Biophysical Concerns	Sensitive Watershed Features	Special Considerations
✓	✓(4)	✓(4)	✓(2)	✓(5)

Watershed:	*Naver Creek*

SPECIFIC OBJECTIVES AND STRATEGIES:

Specific Objectives	Specific Strategies
• Maintain natural watershed hydrologic characteristics and stream flow regime.	• Apply FPC riparian guidelines to agricultural and range use of crown land.
• Maintain the natural stream temperature regime.	• Apply riparian guidelines for new placer mines that are consistent with FPC standards.
• Maintain the structural and functional integrity of riparian areas.	• Apply the Watershed Assessment Procedures (WAP) to assess past and potential for future impacts of lands use activities.
• Maintain slope stability.	
• Maintain or improve water quality.	• Apply the Land Development Guidelines to residential and industrial developments.
• Protect stream channels and floodplains from influences of development activities.	• Conduct detailed stream channel stability assessment.
• Ensure the protection of headwater, ephemeral and intermittent channels; recognizing their influence on watershed stability, hydrology and water quality.	• Conduct a stream channel assessment to identify potential barriers to fish migration and remove or facilitate access where appropriate.
• Ensure protection of critical aquatic habitats including: floodplain, off-channel sites, non-natal tributaries and other areas of biological significance.	• Conduct and maintain fisheries, habitat (critical) and enhancement inventories.
• Ensure that the intensity of development activities does not negatively impact the natural watershed ecological processes through site specific or cumulative development.	• Design high elevation forest cutblocks to optimize snow accumulation and retention similar to unharvested or undisturbed areas.
	• Develop Access Management Plans (AMP) for review and direction.
• Ensure the inventory, assessment and implementation of stream restoration and enhancement programs.	• Develop a riparian management plan (RMP) to protect and restore stream habitat in cooperation with agricultural and ranching communities.
• Ensure adequate stream flows are present to maintain fisheries productive capacity.	• Develop a Water Management Plan (WMP) that includes a determination of water demand, fisheries/ minimum low flow of water storage opportunities and potential impacts of water extraction.
• Improve inventories of aquatic resources.	
• Improve fish passage in the watershed.	• Distribute timber harvesting opportunities throughout the available range in elevation to maintain natural hydrologic conditions.
	• Ensure that rate of development (forestry, urban, agriculture, etc.) is balanced against hydrologic recovery to maintain cumulative ECA at or below 25% (total watershed drainage area).

Watershed:	*Naver Creek*

SPECIFIC OBJECTIVES AND STRATEGIES (continued):

Specific Objectives	Specific Strategies
	• Maintain designated "NO STAKING PLACER RESERVES" for placer mining where identified. • Implement a water drainage management plan for sensitive soils, stream crossings or other areas specified in development plans. • Initiate a watershed restoration assessment and inventory for development of a Watershed Restoration Plan. • Implement watershed restoration plan recommendations from assessment and inventory reports. • Initiate restoration, revegetation and stabilization measures on linear developments. • Identify and request complete reclamation of past, present and new placer mining development sites. • Provide Streamside Management Plans (SMP) for harvesting areas identified in the annual forest development plan update. • Restrict or control development within or along tributary confluences, alluvial fans, floodplains or areas of slope instability (e.g. valley walls). • Retain riparian reserves along specified S4-S6 (FPC riparian class) stream channel reaches in high sensitivity areas or channels identified as having stream temperature concerns. • Review and document potential habitat improvement, habitat development and habitat restoration opportunities. • Review resource development plans for compatibility with sensitive habitats in terms of hydrology, water quality, channel stability and riparian condition.

APPENDIX 3. Watershed Profile for the Chilako River Watershed Planning Unit

Streams located within the Chilako River Watershed Planning Unit include:

GENERAL WATERSHED INFORMATION:

Watershed:	***Chilako River***	**SISS Code:**	08-0500
Physiographic Area(s):	Fraser/Nechako Plateau		
Drainage Area (ha):	357,800	**Biogeoclimatic Zone(s):**	Sub-Boreal Spruce
HMA:	Nechako		

WATERSHED HYDROLOGY:

Stream Flows:	Mean Annual	Mean Flood	Mean 7-day low flow			
			Winter		Summer	
(m^3/s)	12.30	80.2	4.91	Dec/Jan	5.35	Aug
Comments:	Reference for above data is the stream mouth. See Reference # 8, p. 12, Table 7 and Appendix B.					

SALMON ESCAPEMENT:

Species	**Historical Max. (yr)**	**1981-92 Ave.**	**1981-92 Max.**	**1969-80 Ave.**	**Population trend**	**Rebuilding potential**
Chinook	425 (NA)	171	425	143	Static	Medium

DEVELOPMENT ACTIVITY:

Type	**Level of Concern**	**Comments**	**Ref.***
Forestry	***High***		7
- percent logging	High	nearly 20 % on average, some tributaries more heavily logged	10
- ECA status	High	Rate-of cut review requested by DFO in 1993	7
- riparian condition/stream length impacted	Low	Some impacts (including loss of vegetation) from forestry	7, 10

Watershed:	*Chilako River*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Agriculture	***High***		7
- extent	High	Extensive from around Punchaw to mouth	7
- riparian condition/stream length impacted	High	Extensive riparian impacts from agriculture (e.g. range cattle damage) in lower reaches.	7, 10
- water withdrawal	High	Review of water licences required	7
- water quality	Low	Review of agriculture use required	7
Urbanization	***Low***		7
- population level	Low		7
- extent	Low	Rural agricultural community	7
- riparian condition/stream length impacted	Low		7
- water withdrawal	Low		7
- water quality	Low		7
Placer Mining	***Low***		7
- extent	Low		7
-water quality	Low		7
- riparian condition/stream length impacted	Low	None	7
Other Mining	***Low***		7
- extent	Low	None	7
- water quality	Low		7

Watershed:	*Chilako River*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Industrial Development	***Low***		7
- extent	Low	None	7
- water quality	Low		7
- stream/riparian impacts	Low		7
Linear Development	***High***		7
- extent	High	Extensive logging roads, CNR and highway rights-of-way and crossings	7
- stream/riparian impacts	Low	Localized to crossing areas	7
Hydro Development	***Low***		7
- extent	Low	None	7
- stream/riparian impacts	Low		7
Other Development	***Low***		7
- extent	Low	None	7
- stream/riparian impacts	Low		7

CUMULATIVE DEVELOPMENT ACTIVITY:

Cumulative Development	***High***	Logging, agriculture, and to a lesser degree linear development	7

* See report section 6.0 References Cited

Watershed:	*Chilako River*

BIOPHYSICAL CONDITIONS:

Type	Level of Concern	Comments	Ref.*
Soils	***Low***		7
- types		Fraser till, typically clayey, is the most abundant soil type	7, 10
Terrain	***Low***		7
- type		Low relief and expanses of flat or gently rolling terrain, low hills separated by broad, flat valleys	7, 10
Resistance to Change	***High***	Low gradient, susceptible to sedimentation, especially in lower reaches due to erosion of lacustrine deposits, low flows	7
Hydrology	***Low***	Large watershed, low water yield, low gradient, beaver dams	7
Channel Stability	***High***	Tortuous meanders, particularly in lower reaches; low gradient	7
- type			
Significant Environmental Variables	***High***	Water temperature and sedimentation concerns	7

SENSITIVE WATERSHED FEATURES:

Type	Present	Comments	Ref.*
Sensitive Physical Features	✓	Lower reaches lacustrine deposits	7
Sensitive Biological Features	✓	Mainstem chinook spawning and rearing and tributary rearing	7, 10
Unique Features			

* See report section 6.0 References Cited

Watershed:	*Chilako River*

SPECIAL CONSIDERATIONS:

Type	Present	Comments	Ref.*
Stock Management	✓		
Enhancement Activity/Opportunity	✓	SEP project at Hutda Lake	7
Restoration Activity			
Native Fishery	✓	Occurs in Fraser and Nechako Rivers	7
Recreational Fishery	✓	Ocean sport fishery	
Commercial Fishery	✓	Ocean fishery	

RECENT WATERSHED PLANNING/PROJECT INITIATIVES:

Type	Comments	Ref.*
WAP review	Watershed Assessment Procedure required by DFO	7, 10
Agriculture review	Reconnaissance level study under way by Prince George DFO	7

* See report section 6.0 References Cited

SUMMARY OF HABITAT CONCERNS (no. of high ratings):

Salmon Present	Development Concerns	Biophysical Concerns	Sensitive Watershed Features	Special Considerations
✓	✓(4)	✓(3)	✓(2)	✓(5)

Watershed:	*Chilako River*

SPECIFIC OBJECTIVES AND STRATEGIES:

Specific Objectives	Specific Strategies
• Maintain natural watershed hydrologic characteristics and stream flow regime. • Maintain the natural stream temperature regime. • Maintain the structural and functional integrity of riparian areas. • Maintain slope stability. • Maintain or improve water quality. • Protect stream channels and floodplains from influences of development activities. • Ensure the protection of headwater, ephemeral and intermittent channels; recognizing their influence on watershed stability, hydrology and water quality. • Ensure protection of critical aquatic habitats including: floodplain, off-channel sites, non-natal tributaries and other areas of biological significance. • Ensure that the intensity of development activities does not negatively impact the natural watershed ecological processes through site specific or cumulative development. • Ensure the inventory, assessment and implementation of stream restoration and enhancement programs. • Improve inventories of aquatic resources. • Support existing fisheries enhancement programs and activities. • Improve fish passage in the watershed.	• Apply FPC riparian guidelines to agricultural and range use of crown land. • Apply riparian guidelines for new placer mines that are consistent with FPC standards. • Apply the Watershed Assessment Procedures (WAP) to assess past and potential for future impacts of lands use activities. • Apply the Land Development Guidelines to residential and industrial developments. • Conduct a stream channel assessment to identify potential barriers to fish migration and remove or facilitate access where appropriate. • Conduct and maintain fisheries, habitat(critical) and enhancement inventories. • Conduct detailed gully assessments for specified sensitive channels identified in development plans. • Conduct minimum flow study. • Develop a Water Management Plan (WMP) that includes a determination of water demand, fisheries/ minimum low flow of water storage opportunities and potential impacts of water extraction. • Develop a detailed riparian management plan (RMP) for the Chilako mainstem identifying areas requiring site specific prescriptions. • Develop a riparian management plan to protect and restore tributary stream habitat in cooperation with agricultural and ranching communities. • Ensure that rate of development (forestry, urban, agriculture, etc.) is balanced against hydrologic recovery to maintain cumulative ECA at or below 25% (total watershed drainage area). • Maintain designated "NO STAKING PLACER RESERVES" for placer mining where identified.

Watershed:	*Chilako River*

SPECIFIC OBJECTIVES AND STRATEGIES (continued):

Specific Objectives	Specific Strategies
	• Implement a water drainage management plan for sensitive soils, stream crossings or other areas specified in development plans. • Initiate a watershed restoration assessment and inventory for development of a Watershed Restoration Plan. • Implement watershed restoration plan recommendations from assessment and inventory reports. • Initiate restoration, revegetation and stabilization measures on linear developments. • Provide Streamside Management Plans (SMP) for harvesting areas identified in the annual forest development plan update. • Restrict or control development within or along tributary confluences, alluvial fans, floodplains or areas of slope instability (e.g. valley walls). • Retain riparian reserves along specified S4-S6 (FPC riparian class) stream channel reaches in high sensitivity areas or channels identified as having stream temperature concerns. • Review and document potential habitat improvement, habitat development and habitat restoration opportunities. • Review resource development plans for compatibility with sensitive habitats in terms of hydrology, water quality, channel stability and riparian condition.

APPENDIX 4. Watershed Profile for the Salmon River Watershed Planning Unit

Streams located within the Salmon River Watershed Planning Unit include:

GENERAL WATERSHED INFORMATION:

Watershed:	***Salmon River***	**SISS Code:**	08-5800
Physiographic Area(s):	Nechako Basin & Plateau/ Fraser Basin		
Drainage Area (ha):	443,700	**Biogeoclimatic Zone(s):**	Sub-Boreal Spruce/ Engelmann Spruce - Subalpine Fir
HMA:	Upper Fraser		

WATERSHED HYDROLOGY:

Stream Flows:	Mean Annual	Mean Flood	Mean 7-day low flow			
			Winter		Summer	
(m^3/s)	24.3	176.0	7.80	Jan	3.10	Sep
Comments:	Reference for above data is the stream mouth. See Reference # 12, p. 12, Table 7 and Appendix B.					

SALMON ESCAPEMENT:

Species	**Historical Max. (yr)**	**1981-92 Ave.**	**1981-92 Max.**	**1969-80 Ave.**	**Population trend**	**Rebuilding potential**
Chinook	1,200 (1988)	443	1,200	396	Static	Medium

DEVELOPMENT ACTIVITY:

Type	**Level of Concern**	**Comments**	**Ref.***
Forestry	***High***		7
-percent logging		17 % on average	12
- ECA status	High	Extensive past logging; Watershed Assessment Procedure (WAP) completed for Prince George portion only.	1, 7
- riparian condition/stream length impacted	Low		3

Watershed:	*Salmon River*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Agriculture	***Low***		7
- extent	Low	Localized on lower tributaries	7
- riparian condition/stream length impacted	Low		7
- water withdrawal	Low	Review of water licences required	7
- water quality	Low		7
Urbanization	***Low***	Residential	7
- population level	Low		7
- extent	Low	Localized on lower reaches	7
- riparian condition/stream length impacted	Low		7
- water withdrawal	Low		7
- water quality	Low		7
Placer Mining	***Low***		7
- extent	Low	Not designated for placer mining	7
-water quality	Low		7
- riparian condition/stream length impacted	Low		7
Other Mining	***Low***		7
- extent	Low	None	7
- water quality	Low		7

Watershed:	*Salmon River*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Industrial Development	***Low***		7
- extent	Low	Localized gravel withdrawal from lower reach	7
- water quality	Low		7
-stream/riparian impacts	Low		7
Linear Development	***High***		7
- extent	High	Highway and BC Rail rights-of-way and stream crossings; pipeline; hydro, extensive logging roads	7, 4
- stream/riparian impacts	Low		7
Hydro Development	***Low***		7
- extent	Low	None	7
- stream/riparian impacts	Low		7
Other Development	***Low***	Localized recreational concern	7
-extent	Low		7
-stream/riparian impacts	Low		7

CUMULATIVE DEVELOPMENT ACTIVITY:

Cumulative Development	***Low***		7

* See report section 6.0 References Cited

Watershed:	*Salmon River*

BIOPHYSICAL CONDITIONS:

Type	Level of Concern	Comments	Ref.*
Soils	***Low***		1
- types		Coarse glacio-fluvial sediments	1, 12
Terrain	***Low***		1
- type		Low relief, gently rolling terrain	1, 12
Resistance to Change	***Low***	Relatively low gradient and basin lakes alleviate flood events	1
Hydrology	***High***	Underground flow noted in some years; summer low flow concern noted	1, 12
Channel Stability	***Low***		1
- type		Low gradient, moderately meandering channel	1
Significant Environmental Variables	***High***	Temperature concern in late summer	3

SENSITIVE WATERSHED FEATURES:

Type	Present	Comments	Ref.*
Sensitive Physical Features	✓	Low flows in upper portion of basin concurrent with temperature concerns	7
Sensitive Biological Features	✓	Tributaries utilized by chinook rearing	7
Unique Features			

* See report section 6.0 References Cited

Watershed:	*Salmon River*

SPECIAL CONSIDERATIONS:

Type	Present	Comments	Ref.*
Stock Management	✓		
Enhancement Activity/Opportunity	✓	Chinook hatchery at Prince George used for outplanting back to Salmon River. Lower River fish counting fence.	4
Restoration Activity			
Native Fishery	✓	In Fraser River	7
Recreational Fishery	✓	Ocean sport fishery	
Commercial Fishery	✓	Ocean fishery	

RECENT WATERSHED PLANNING/PROJECT INITIATIVES:

Type	Comments	Ref.*
WAP review	Watershed Assessment Procedure (WAP) completed for Prince George portion	1,7

* See report section 6.0 References Cited

SUMMARY OF HABITAT CONCERNS (no. of high ratings):

Salmon Present	Development Concerns	Biophysical Concerns	Sensitive Watershed Features	Special Considerations
✓	✓(2)	✓(2)	✓(2)	✓(5)

Watershed:	*Salmon River*

SPECIFIC OBJECTIVES AND STRATEGIES:

Specific Objectives	Specific Strategies
• Maintain natural watershed hydrologic characteristics and stream flow regime. • Maintain the natural stream temperature regime. • Maintain the structural and functional integrity of riparian areas. • Protect stream channels and floodplains from influences of development activities. • Ensure the protection of headwater, ephemeral and intermittent channels; recognizing their influence on watershed stability, hydrology and water quality. • Ensure protection of critical aquatic habitats including: floodplain, off-channel sites, non-natal tributaries and other areas of biological significance. • Ensure that the intensity of development activities does not negatively impact the natural watershed ecological processes through site specific or cumulative development. • Ensure the inventory, assessment and implementation of stream restoration and enhancement programs. • Ensure adequate stream flows are present to maintain fisheries productive capacity. • Improve inventories of aquatic resources.	• Apply FPC riparian guidelines to agricultural and range use of crown land. • Apply the Watershed Assessment Procedures (WAP) to assess past and potential for future impacts of lands use activities. • Apply the Land Development Guidelines to residential and industrial developments. • Develop a Water Management Plan (WMP) that includes a determination of water demand, fisheries/ minimum low flow of water storage opportunities and potential impacts of water extraction. • Develop a detailed riparian management plan (RMP) for the Salmon River watershed identifying agricultural areas requiring site specific prescriptions. • Develop a riparian management plan to protect and restore stream habitat in cooperation with agricultural and ranching communities. • Implement a water drainage management plan for sensitive soils, stream crossings or other areas specified in development plans. • Initiate a watershed restoration assessment and inventory for development of a Watershed Restoration Plan. • Implement watershed restoration plan recommendations from assessment and inventory reports. • Restrict or control development within or along tributary confluences, alluvial fans, floodplains or areas of slope instability (e.g. valley walls). • Retain riparian reserves along specified S4-S6 (FPC riparian class) stream channel reaches in high sensitivity areas or channels identified as having stream temperature concerns. • Review resource development plans for compatibility with sensitive habitats in terms of hydrology, water quality, channel stability and riparian condition.

APPENDIX 5. Watershed Profile for the Willow River Watershed Planning Unit

Streams located within the Willow River Watershed Planning Unit include:

GENERAL WATERSHED INFORMATION:

Watershed:	***Willow River***	**SISS Code:**	00-5900
Physiographic Area(s):	Nechako Plain/Fraser Basin & Plateau/Quesnel Highlands		
Drainage Area (ha):	287,500	**Biogeoclimatic Zone(s):**	Sub-Boreal Spruce/ Engelmann Spruce - Subalpine Fir
HMA:	Upper Fraser		

WATERSHED HYDROLOGY:

Stream Flows:	Mean Annual	Mean Flood	Mean 7-day low flow			
			Winter		Summer	
(m^3/s)	36.5	257	7.37	Dec/Jan/ Feb	9.83	Aug
Comments:	Reference for above data is the stream mouth. See Reference # 12, p. 12, Table 7 and Appendix B.					

SALMON ESCAPEMENT:

Species	**Historical Max. (yr)**	**1981-92 Ave.**	**1981-92 Max.**	**1969-80 Ave.**	**Population trend**	**Rebuilding potential**
Chinook	2,100 (NA)	1,107	2,100	370	Increasing	Medium

NB. Above numbers include escapement to Wansa Creek (a tributary).

DEVELOPMENT ACTIVITY:

Type	**Level of Concern**	**Comments**	**Ref.***
Forestry	***High***		7
-percent logging	High	approximately 45%	12
- ECA status	High	Extensive harvesting	7
- riparian condition/stream length impacted	High	Tributaries impacted	7, 3

Watershed:	*Willow River*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Agriculture	***Low***		7
- extent	Low	Concentrated below Highway 16	7
- riparian condition/stream length impacted	High	Riparian removal in lower reaches	7
- water withdrawal	Low		7
- water quality	Low	Not assessed	7
Urbanization	***Low***		7
- population level	Low		7
- extent	Low	Willow River/Giscome/Wells	7
- riparian condition/stream length impacted	High	Impacts in Barkerville/ Wells area and see agriculture	7
- water withdrawal	Low		7
- water quality	Low		7
Placer Mining	***High***	In upper basin	7
- extent	High	Extensive in upper reaches	7
- water quality	High	Extensive sedimentation	7
- riparian condition/stream length impacted	High	Extensive, especially in upper basin tributaries	7
Other Mining	***Low***		7
- extent	Low	Mosquito Creek mine, historic mining in Wells area.	7
- water quality	Low	Monitoring reclamation at Mosquito Creek	7

Watershed:	*Willow River*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Industrial Development	***Low***		7
- extent	Low	None	7
- water quality	Low		7
- stream/riparian impacts	Low		7
Linear Development	***High***	Forest roads, Highway 16 & 26 and CNR right-of-way	7
- extent	High	Extensive throughout watershed	7
- stream/riparian impacts	Low	Localized, e.g. Willow River Bridge @ Pitoney Creek confluence	7
Hydro Development	***Low***		7
- extent	Low	None	7
- stream/riparian impacts	Low		7
Other Development	Low		7
- extent	Low	None	7
- stream/riparian impacts	Low		7

CUMULATIVE DEVELOPMENT ACTIVITY:

Cumulative Development	***High***	Forestry, agriculture, placer mining, linear development	7

* See report section 6.0 References Cited

Watershed:	*Willow River*

BIOPHYSICAL CONDITIONS:

Type	Level of Concern	Comments	Ref.*
Soils	***High***		7
- types		Clay textured glaciolacustrine sediments north of Hwy 16, loamy glacial till and colluvium to the south	14
Terrain	***High***		7
- type		Rolling to steep and rugged (i.e. Cariboo Mountains)	7, 14
Resistance to Change	***Low***	Susceptible to sedimentation	7, 12
Hydrology	***High***	Extensive harvesting may affect hydrograph	7
Channel Stability	***High***		7
- type		Laterally unstable especially below canyon at Hwy 16	7
Significant Environmental Variables	***Low***	Sedimentation concerns	7

SENSITIVE WATERSHED FEATURES:

Type	Present	Comments	Ref.*
Sensitive Physical Features			
Sensitive Biological Features	✓	Tributary rearing	7
Unique Features	✓	Canyon below Hwy 16 hinders upstream migration at higher than average, and possibly extreme low, flows.	7, 12

* See report section 6.0 References Cited

Watershed:	*Willow River*

SPECIAL CONSIDERATIONS:

Type	Present	Comments	Ref.*
Stock Management	✓		
Enhancement Activity/Opportunity	✓	passage improvement	7
Restoration Activity	✓	assessment required regarding bank/channel stability and migration	7
Native Fishery	✓	Occurs in Fraser River	7
Recreational Fishery	✓	Ocean sport fishery	
Commercial Fishery	✓	Ocean fishery	

RECENT WATERSHED PLANNING/PROJECT INITIATIVES:

Type	Comments	Ref.*
WAP review	Watershed Assessment Procedures review underway	7
WRP review	Watershed Restoration Program underway	7

* See report section 6.0 References Cited

SUMMARY OF HABITAT CONCERNS (no. of high ratings):

Salmon Present	Development Concerns	Biophysical Concerns	Sensitive Watershed Features	Special Considerations
✓	✓(4)	✓(4)	✓(2)	✓(6)

Watershed:	*Willow River*

SPECIFIC OBJECTIVES AND STRATEGIES:

Specific Objectives	Specific Strategies
• Maintain natural watershed hydrologic characteristics and stream flow regime. • Maintain the natural stream temperature regime. • Maintain the structural and functional integrity of riparian areas. • Maintain slope stability. • Maintain or improve water quality. • Protect stream channels and floodplains from influences of development activities. • Ensure the protection of headwater, ephemeral and intermittent channels; recognizing their influence on watershed stability, hydrology and water quality. • Ensure protection of critical aquatic habitats including: floodplain, off-channel sites, non-natal tributaries and other areas of biological significance. • Ensure that the intensity of development activities does not negatively impact the natural watershed ecological processes through site specific or cumulative development. • Ensure the inventory, assessment and implementation of stream restoration and enhancement programs. • Improve inventories of aquatic resources. • Improve fish passage in the watershed.	• Apply FPC riparian guidelines to agricultural and range use of crown land. • Apply riparian guidelines for new placer mines that are consistent with FPC standards. • Apply the Watershed Assessment Procedures (WAP) to assess past and potential for future impacts of lands use activities. • Apply the Land Development Guidelines to residential and industrial developments. • Conduct detailed stream channel stability assessment. • Conduct a stream channel assessment to identify potential barriers to fish migration and remove or facilitate access where appropriate. • Conduct and maintain fisheries, habitat (critical) and enhancement inventories. • Conduct detailed gully assessments for specified sensitive channels identified in development plans. • Design high elevation forest cutblocks to optimize snow accumulation and retention similar to unharvested or undisturbed areas. • Develop Access Management Plans (AMP) for review and direction. • Develop a detailed riparian management plan (RMP) for the Willow River watershed identifying agricultural areas requiring site specific prescriptions . • Develop a riparian management plan to protect and restore stream habitat in cooperation with agriculture and ranching communities. • Distribute timber harvesting opportunities throughout the available range in elevation to maintain natural hydrologic conditions. • Document, map and assess watershed terrain and soils conditions and their hazard risk.

Watershed:	*Willow River*

SPECIFIC OBJECTIVES AND STRATEGIES (continued):

Specific Objectives	Specific Strategies
	• Ensure that rate of development (forestry, urban, agriculture, etc.) is balanced against hydrologic recovery to maintain cumulative ECA at or below 25% (total watershed drainage area). • Maintain designated "NO STAKING PLACER RESERVES" for placer mining where identified. • Implement a water drainage management plan for sensitive soils, stream crossings or other areas specified in development plans. • Initiate a watershed restoration assessment and inventory for development of a Watershed Restoration Plan. • Implement watershed restoration plan recommendations from assessment and inventory reports. • Initiate restoration, revegetation and stabilization measures on linear developments. • Identify and request complete reclamation of past, present and new placer mining development sites. • Provide and maintain a water quality assessment and monitoring plan (WQP) for Willow River. • Provide Streamside Management Plans (SMP) for harvesting areas identified in the annual forest development plan update. • Restrict or control development within or along tributary confluences, alluvial fans, floodplains or areas of slope instability (e.g. valley walls). • Retain riparian reserves along specified S4-S6 (FPC riparian class) stream channel reaches in high sensitivity areas or channels identified as having stream temperature concerns. • Review and document potential habitat improvement, habitat development and habitat restoration opportunities.

Watershed:	*Willow River*

SPECIFIC OBJECTIVES AND STRATEGIES (continued):

Specific Objectives	Specific Strategies
	• Review resource development plans for compatibility with sensitive habitats in terms of hydrology, water quality, channel stability and riparian condition.

APPENDIX 6. Watershed Profile for the McGregor River Watershed Planning Unit

Streams located within the McGregor River Watershed Planning Unit include:

GENERAL WATERSHED INFORMATION:

Watershed:	***McGregor River***	**SISS Code:**	00-6200
Physiographic Area(s):	McGregor Plateau/Nechako Plain/Hart & Park Ranges		
Drainage Area (ha):	276,900	**Biogeoclimatic Zone(s):**	Sub-Boreal Spruce/ Engelmann Spruce-Subalpine Fir/ Alpine Tundra
HMA:	Upper Fraser		

NB. The **Drainage Area** figure does not include the Herrick, Captain, Otter and Seebach Creek drainage areas.

WATERSHED HYDROLOGY:

Stream Flows:	Mean Annual	Mean Flood	Mean 7-day low flow			
			Winter		Summer	
(m^3/s)	209	1127	35.7	Mar	95.0	NA
Comments:	Reference for above data is the stream mouth and hence includes input from Herrick, Captain, Otter and Seebach tributaries. See Ref. #12, p. 12, Table 7 and Appendix B.					

SALMON ESCAPEMENT:

Species	**Historical Max. (yr)**	**1981-92 Ave.**	**1981-92 Max.**	**1969-80 Ave.**	**Population trend**	**Rebuilding potential**
Chinook	0	0	0	0	NA	NA

NB. The McGregor mainstem is a migration route and provides rearing habitat.

DEVELOPMENT ACTIVITY:

Type	**Level of Concern**	**Comments**	**Ref.***
Forestry	***High***		7
-percent logging		approximately 7 %	12
- ECA status	Low		12
- riparian condition/stream length impacted	High	Extensive floodplain harvesting	3, 7

Watershed:	*McGregor River*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Agriculture	***Low***		7
- extent	Low	None	7
- riparian condition/stream length impacted	Low		7
- water withdrawal	Low		7
- water quality	Low		7
Urbanization	***Low***		7
- population level	Low		7
- extent	Low	Logging camps	7
- riparian condition/stream length impacted	Low		7
- water withdrawal	Low		7
- water quality	Low		7
Placer Mining	***Low***		7
- extent	Low	None	7
- water quality	Low		7
- riparian condition/stream length impacted	Low		7
Other Mining	***Low***		7
- extent	Low	Proposed quartz mine at Bastille Creek.	7
- water quality	Low		7

Watershed:	*McGregor River*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Industrial Development	***Low***		7
- extent	Low	None, some old, abandoned sawmills	7
- water quality	Low		7
- stream/riparian impacts	Low		7
Linear Development	***Low***		7
- extent	Low	Logging roads and bridges throughout	7
- stream/riparian impacts	Low	Localized	7
Hydro Development	***Low***	Hydro reserve. McGregor Diversion proposal	7
- extent	Low	None	7
- stream/riparian impacts	Low		7
Other Development	***Low***		7
- extent	Low	None	7
- stream/riparian impacts	Low		7

CUMULATIVE DEVELOPMENT ACTIVITY:

Cumulative Development	***High***	Forestry; extensive floodplain and low elevation harvesting	7

* See report section 6.0 References Cited

Watershed:	*McGregor River*

BIOPHYSICAL CONDITIONS:

Type	Level of Concern	Comments	Ref.*
Soils	***High***	Unstable soils, high eroding stream banks	12
- types		Large deposits of lacustrine and fluvial soils throughout mid and lower elevations	7, 12
Terrain	***High***		7
- type		Originates in alpine area, mid reaches steep and wet	7, 12
Resistance to Change	***Low***	Large glacial, dynamic river	7
Hydrology	***Low***	Large river - low winter flows	7, 12
Channel Stability	***High***		7
- type		extensive island/off channel habitat laterally unstable throughout	12
Significant Environmental Variables	***High***	Suspended sediments; glacial flour and till and eroding banks	7, 12

SENSITIVE WATERSHED FEATURES:

Type	Present	Comments	Ref.*
Sensitive Physical Features	✓	Soils	7
Sensitive Biological Features	✓	Extensive off channel rearing in lower 57 km and tributaries; Canyon/waterfall 57 km upstream of mouth is impassable to salmon.	7, 12
Unique Features			

* See report section 6.0 References Cited

Watershed:	*McGregor River*

SPECIAL CONSIDERATIONS:

Type	Present	Comments	Ref.*
Stock Management	✓		
Enhancement Activity/Opportunity		Was enhanced from Quesnel hatchery in previous years	7
Restoration Activity			
Native Fishery	✓	Occurs in Fraser River	7
Recreational Fishery	✓	Ocean sport fishery	
Commercial Fishery	✓	Ocean fishery	

RECENT WATERSHED PLANNING/PROJECT INITIATIVES:

Type	Comments	Ref.*
	None	

* See report section 6.0 References Cited

SUMMARY OF HABITAT CONCERNS (no. of high ratings):

Salmon Present	Development Concerns	Biophysical Concerns	Sensitive Watershed Features	Special Considerations
✓	✓(2)	✓(4)	✓(2)	✓(4)

Watershed:	*McGregor River*

SPECIFIC OBJECTIVES AND STRATEGIES:

Specific Objectives	Specific Strategies
• Maintain natural watershed hydrologic characteristics and stream flow regime. • Maintain the structural and functional integrity of riparian areas. • Maintain slope stability. • Maintain or improve water quality. • Protect stream channels and floodplains from influences of development activities. • Ensure the protection of headwater, ephemeral and intermittent channels; recognizing their influence on watershed stability, hydrology and water quality. • Ensure protection of critical aquatic habitats including: floodplain, off-channel sites, non-natal tributaries and other areas of biological significance. • Ensure that the intensity of development activities does not negatively impact the natural watershed ecological processes through site specific or cumulative development. • Ensure the inventory, assessment and implementation of stream restoration and enhancement programs. • Ensure adequate stream flows are present to maintain fisheries productive capacity. • Improve inventories of aquatic resources.	• Apply the Watershed Assessment Procedures (WAP) to assess past and potential for future impacts of lands use activities. • Conduct detailed stream channel stability assessment. • Conduct and maintain fisheries, habitat (critical) and enhancement inventories. • Conduct detailed gully assessments for specified sensitive channels identified in development plans. • Design high elevation forest cutblocks to optimize snow accumulation and retention similar to unharvested or undisturbed areas. • Develop Access Management Plans (AMP) for review and direction. • Develop a detailed riparian management plan (RMP) for the McGregor watershed identifying areas requiring site specific prescriptions (urban/agriculture). • Distribute timber harvesting opportunities throughout the available range in elevation to maintain natural hydrologic conditions. • Document, map and assess watershed terrain and soils conditions and their hazard risk. • Ensure that rate of development (forestry, urban, agriculture, etc.) is balanced against hydrologic recovery to maintain cumulative ECA at or below 25% (total watershed drainage area). • Maintain designated "NO STAKING PLACER RESERVES" for placer mining where identified. • Implement a water drainage management plan for sensitive soils, stream crossings or other areas specified in development plans. • Initiate a watershed restoration assessment and inventory for development of a Watershed Restoration Plan.

Watershed:	*McGregor River*

SPECIFIC OBJECTIVES AND STRATEGIES (continued):

Specific Objectives	Specific Strategies
	• Implement watershed restoration plan recommendations from assessment and inventory reports. • Provide Streamside Management Plans (SMP) for harvesting areas identified in the annual forest development plan update. • Restrict or control development within or along tributary confluences, alluvial fans, floodplains or areas of slope instability (e.g. valley walls). • Retain riparian reserves along specified S4-S6 (FPC riparian class) stream channel reaches in high sensitivity areas or channels identified as having stream temperature concerns. • Review and document potential habitat improvement, habitat development and habitat restoration opportunities. • Review resource development plans for compatibility with sensitive habitats in terms of hydrology, water quality, channel stability and riparian condition.

APPENDIX 7. Watershed Profiles for the Seebach/Otter/Captain Watershed Planning Unit

Streams located within the Seebach/Otter/Captain Watershed Planning Unit include:

GENERAL WATERSHED INFORMATION:

Watershed:	***Seebach Creek***	**SISS Code:**	00-6200-020
Physiographic Area(s):	Nechako Plain/McGregor Plateau		
Drainage Area (ha):	42,100	**Biogeoclimatic Zone(s):**	Sub-Boreal Spruce
HMA:	Upper Fraser		

WATERSHED HYDROLOGY:

Stream Flows:	Mean Annual	Mean Flood	Mean 7-day low flow			
			Winter		Summer	
(m^3/s)	6.46	60.6	1.22	NA	1.12	NA
Comments:	Reference for above data is the stream mouth. See Reference #12, p. 12, Table 7 and Appendix B.					

SALMON ESCAPEMENT:

Species	Historical Max. (yr)	1981-92 Ave.	1981-92 Max.	1969-80 Ave.	Population trend	Rebuilding potential
Sockeye	230 (NA)	29	230	NA	Static	Medium
Chinook	2,500 (1986 & 1987)	973	2,500	625	Increasing	Medium

DEVELOPMENT ACTIVITY:

Type	Level of Concern	Comments	Ref.*
Forestry	***Low***		12
-percent logging	Low	Proposed logging would increase logged area to 11%, currently 2%	12
- ECA status	Low		7
- riparian condition/stream length impacted	Low	Localized impacts in lower reaches	3, 7

Watershed:	*Seebach Creek*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Agriculture	***Low***		7
- extent	Low	None	7
- riparian condition/stream length impacted	Low		7
- water withdrawal	Low		7
- water quality	Low		7
Urbanization	***Low***		7
- population level	Low		7
- extent	Low	None	7
- riparian condition/stream length impacted	Low		7
- water withdrawal	Low		7
- water quality	Low		7
Placer Mining	***Low***		7
- extent	Low	None	7
- water quality	Low		7
- riparian condition/stream length impacted	Low		7
Other Mining	***Low***		7
- extent	Low	None	7
- water quality	Low		7

Watershed:	*Seebach Creek*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Industrial Development	***Low***		7
- extent	Low	None	7
- water quality	Low		7
- stream/riparian impacts	Low		7
Linear Development	***Low***		7
- extent	Low	Logging roads and bridge crossings	7
- stream/riparian impacts	Low	Sediment input and localized impacts at stream crossings	7
Hydro Development	***Low***		7
- extent	Low	None	7
- stream/riparian impacts	Low		7
Other Development	***Low***		7
- extent	Low	None	7
- stream/riparian impacts	Low		7

CUMULATIVE DEVELOPMENT ACTIVITY:

Cumulative Development	***Low***		7

* See report section 6.0 References Cited

Watershed:	*Seebach Creek*

BIOPHYSICAL CONDITIONS:

Type	Level of Concern	Comments	Ref.*
Soils	***Low***		7
- types		Coarse, glaciofluvial deposits, some lacustrine	7, 12
Terrain	***Low***		7
- type		Low relief	7, 12
Resistance to Change	***High***	Small stream, low summer flows/high peak flows	7, 12
Hydrology	***High***	Peak flows average 10 times mean flow and 50+ times summer low flow (see Watershed Hydrology table).	12
Channel Stability	***Low***		7
- type		Upper reaches steep and confined, lower reaches in broad valley, alluvial fans, some areas laterally unstable and bank erosion in lower reaches	7
Significant Environmental Variables	***Low***		7

SENSITIVE WATERSHED FEATURES:

Type	Present	Comments	Ref.*
Sensitive Physical Features			
Sensitive Biological Features	✓	Tributary chinook rearing	7
Unique Features			

* See report section 6.0 References Cited

Watershed:	*Seebach Creek*

SPECIAL CONSIDERATIONS:

Type	Present	Comments	Ref.*
Stock Management	✓		
Enhancement Activity/Opportunity		was enhanced in 1980's using Quesnel hatchery stock	7
Restoration Activity			
Native Fishery	✓	Occurs in Fraser River	7
Recreational Fishery	✓	Ocean sport fishery	
Commercial Fishery	✓	Ocean fishery	

RECENT WATERSHED PLANNING/PROJECT INITIATIVES:

Type	Comments	Ref.*
	None	

* See report section 6.0 References Cited

SUMMARY OF HABITAT CONCERNS (no. of high ratings):

Salmon Present	Development Concerns	Biophysical Concerns	Sensitive Watershed Features	Special Considerations
✓		✓(2)	✓	✓(4)

Watershed:	*Seebach Creek*

SPECIFIC OBJECTIVES AND STRATEGIES:

Specific Objectives	Specific Strategies
• Maintain natural watershed hydrologic characteristics and stream flow regime. • Maintain the natural stream temperature regime. • Maintain the structural and functional integrity of riparian areas. • Maintain slope stability. • Maintain or improve water quality. • Protect stream channels and floodplains from influences of development activities. • Ensure the protection of headwater, ephemeral and intermittent channels; recognizing their influence on watershed stability, hydrology and water quality. • Ensure protection of critical aquatic habitats including: floodplain, off-channel sites, non-natal tributaries and other areas of biological significance. • Ensure that the intensity of development activities does not negatively impact the natural watershed ecological processes through site specific or cumulative development. • Ensure adequate stream flows are present to maintain fisheries productive capacity. • Improve inventories of aquatic resources. • Improve fish passage in the watershed.	• Conduct a stream channel assessment to identify potential barriers to fish migration and remove or facilitate access where appropriate. • Conduct and maintain fisheries, habitat (critical) and enhancement inventories. • Conduct detailed gully assessments for specified sensitive channels identified in development plans. • Design high elevation forest cutblocks to optimize snow accumulation and retention similar to unharvested or undisturbed areas. • Develop Access Management Plans (AMP) for review and direction. • Develop a detailed riparian management plan (RMP) for the Seebach Creek watershed identifying areas requiring site specific prescriptions. • Distribute timber harvesting opportunities throughout the available range in elevation to maintain natural hydrologic conditions. • Document, map and assess watershed terrain and soils conditions and their hazard risk. • Ensure that rate of development (forestry, urban, agriculture, etc.) is balanced against hydrologic recovery to maintain cumulative ECA at or below 25% (total watershed drainage area). • Maintain designated "NO STAKING PLACER RESERVES" for placer mining where identified. • Implement a water drainage management plan for sensitive soils, stream crossings or other areas specified in development plans. • Initiate a watershed restoration assessment and inventory for development of a Watershed Restoration Plan. • Implement watershed restoration plan recommendations from assessment and inventory reports.

Watershed:	*Seebach Creek*

SPECIFIC OBJECTIVES AND STRATEGIES (continued):

Specific Objectives	Specific Strategies
	• Provide Streamside Management Plans (SMP) for harvesting areas identified in the annual forest development plan update. • Restrict or control development within or along tributary confluences, alluvial fans, floodplains or areas of slope instability (e.g. valley walls). • Retain riparian reserves along specified S4-S6 (FPC riparian class) stream channel reaches in high sensitivity areas or channels identified as having stream temperature concerns. • Review and document potential habitat improvement, habitat development and habitat restoration opportunities. • Review resource development plans for compatibility with sensitive habitats in terms of hydrology, water quality, channel stability and riparian condition.

GENERAL WATERSHED INFORMATION:

Watershed:	***Otter Creek***	**SISS Code:**	00-6200-060
Physiographic Area(s):	McGregor Plateau		
Drainage Area (ha):	16,700	**Biogeoclimatic Zone(s):**	Sub-Boreal Spruce/ Engelmann Spruce - Subalpine Fir
HMA:	Upper Fraser		

WATERSHED HYDROLOGY:

Stream Flows:	Mean Annual	Mean Flood	Mean 7-day low flow			
			Winter		Summer	
(m^3/s)	6.98	37.9	0.45	NA	1.58	NA
Comments:	Reference for above data is the stream mouth. See Reference # 12, p. 12, Table 7 and Appendix B.					

SALMON ESCAPEMENT:

Species	**Historical Max. (yr)**	**1981-92 Ave.**	**1981-92 Max.**	**1969-80 Ave.**	**Population trend**	**Rebuilding Potential**
Chinook	30 (1977)	0	0	NA	Decreasing	NA

DEVELOPMENT ACTIVITY:

Type	**Level of Concern**	**Comments**	**Ref.***
Forestry	***Low***	Proposed logging would increase logged area to 13%	12
-percent logging	Low	currently 4%	12
- ECA status	Low		7
- riparian condition/stream length impacted	Low		3

Watershed:	*Otter Creek*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Agriculture	***Low***		7
- extent	Low	None	7
- riparian condition/stream length impacted	Low		7
- water withdrawal	Low		7
- water quality	Low		7
Urbanization	***Low***		7
- population level	Low		7
- extent	Low	None	7
- riparian condition/stream length impacted	Low		7
- water withdrawal	Low		7
- water quality	Low		7
Placer Mining	***Low***		7
- extent	Low	None	7
- water quality	Low		7
- riparian condition/stream length impacted	Low		7
Other Mining	***Low***		7
- extent	Low	None	7
- water quality	Low		7

Watershed:	*Otter Creek*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Industrial Development	***Low***		7
- extent	Low	None	7
- water quality	Low		7
- stream/riparian impacts	Low		7
Linear Development	***Low***		7
- extent	Low	Logging roads and bridge crossings	7
- stream/riparian impacts	Low	Sediment input and localized impacts at stream crossings	7
Hydro Development	***Low***		7
- extent	Low	None	7
- stream/riparian impacts	Low		7
Other Development	***Low***		7
- extent	Low	None	7
- stream/riparian impacts	Low		7

CUMULATIVE DEVELOPMENT ACTIVITY:

Cumulative Development	***Low***		7

* See report section 6.0 References Cited

Watershed:	*Otter Creek*

BIOPHYSICAL CONDITIONS:

Type	Level of Concern	Comments	Ref.*
Soils	***Low***		7
- types		Coarse, glaciofluvial deposits, some lacustrine	7, 12
Terrain	***High***		7
- type		Steep slopes	7
Resistance to Change	***High***	Small stream, low summer and winter flows/high peak flows	7, 12
Hydrology	***High***	Mean flows average 15 times summer mean low flow.	12
Channel Stability	***Low***		7
- type		Upper reaches steep and confined, lower reaches in broad valley, alluvial fans, laterally unstable and bank erosion in lower reaches	7
Significant Environmental Variables	***Low***		7

SENSITIVE WATERSHED FEATURES:

Type	Present	Comments	Ref.*
Sensitive Physical Features			7
Sensitive Biological Features	✓	Chinook rearing in lower reaches	7
Unique Features			7

* See report section 6.0 References Cited

Watershed:	*Otter Creek*

SPECIAL CONSIDERATIONS:

Type	Present	Comments	Ref.*
Stock Management	✓		
Enhancement Activity/Opportunity	✓	Previously enhanced from Quesnel hatchery	7
Restoration Activity			
Native Fishery	✓	Occurs in Fraser River	
Recreational Fishery	✓	Ocean sport fishery	
Commercial Fishery	✓	Ocean fishery	

RECENT WATERSHED PLANNING/PROJECT INITIATIVES:

Type	Comments	Ref.*
	None	

* See report section 6.0 References Cited

SUMMARY OF HABITAT CONCERNS (no. of high ratings):

Salmon Present	Development Concerns	Biophysical Concerns	Sensitive Watershed Features	Special Considerations
✓		✓(3)	✓	✓(5)

Watershed:	*Otter Creek*

SPECIFIC OBJECTIVES AND STRATEGIES:

Specific Objectives	Specific Strategies
• Maintain natural watershed hydrologic characteristics and stream flow regime. • Maintain the natural stream temperature regime. • Maintain the structural and functional integrity of riparian areas. • Maintain slope stability. • Maintain or improve water quality. • Protect stream channels and floodplains from influences of development activities. • Ensure the protection of headwater, ephemeral and intermittent channels; recognizing their influence on watershed stability, hydrology and water quality. • Ensure protection of critical aquatic habitats including: floodplain, off-channel sites, non-natal tributaries and other areas of biological significance. • Ensure that the intensity of development activities does not negatively impact the natural watershed ecological processes through site specific or cumulative development. • Ensure adequate stream flows are present to maintain fisheries productive capacity. • Improve inventories of aquatic resources. • Improve fish passage in the watershed.	• Conduct a stream channel assessment to identify potential barriers to fish migration and remove or facilitate access where appropriate. • Conduct and maintain fisheries, habitat (critical) and enhancement inventories. • Conduct detailed gully assessments for specified sensitive channels identified in development plans. • Design high elevation forest cutblocks to optimize snow accumulation and retention similar to unharvested or undisturbed areas. • Develop Access Management Plans (AMP) for review and direction. • Develop a detailed riparian management plan (RMP) for the Otter Creek watershed identifying areas requiring site specific prescriptions. • Distribute timber harvesting opportunities throughout the available range in elevation to maintain natural hydrologic conditions. • Document, map and assess watershed terrain and soils conditions and their hazard risk. • Ensure that rate of development (forestry, urban, agriculture, etc.) is balanced against hydrologic recovery to maintain cumulative ECA at or below 25% (total watershed drainage area). • Maintain designated "NO STAKING PLACER RESERVES" for placer mining where identified. • Implement a water drainage management plan for sensitive soils, stream crossings or other areas specified in development plans. • Initiate a watershed restoration assessment and inventory for development of a Watershed Restoration Plan. • Implement watershed restoration plan recommendations from assessment and inventory reports.

Watershed:	*Otter Creek*

SPECIFIC OBJECTIVES AND STRATEGIES (continued):

Specific Objectives	Specific Strategies
	• Provide Streamside Management Plans (SMP) for harvesting areas identified in the annual forest development plan update. • Restrict or control development within or along tributary confluences, alluvial fans, floodplains or areas of slope instability (e.g. valley walls). • Retain riparian reserves along specified S4-S6 (FPC riparian class) stream channel reaches in high sensitivity areas or channels identified as having stream temperature concerns. • Review and document potential habitat improvement, habitat development and habitat restoration opportunities. • Review resource development plans for compatibility with sensitive habitats in terms of hydrology, water quality, channel stability and riparian condition.

GENERAL WATERSHED INFORMATION:

Watershed:	*Captain Creek*	**SISS Code:**	00-6200-070-020
Physiographic Area(s):	Nechako Plain/McGregor Plateau		
Drainage Area (ha):	13,500	**Biogeoclimatic Zone(s):**	Sub-Boreal Spruce/ Engelmann Spruce - Subalpine Fir/ Alpine Tundra
HMA:	Upper Fraser		

WATERSHED HYDROLOGY:

Stream Flows:	Mean Annual	Mean Flood	Mean 7-day low flow			
			Winter		Summer	
(m^3/s)	5.64	30.6	0.36	NA	1.29	NA
Comments:	Reference for above data is the stream mouth. See Reference #12, p. 12, Table 7 and Appendix B.					

SALMON ESCAPEMENT:

Species	**Historical Max. (yr)**	**1981-92 Ave.**	**1981-92 Max.**	**1969-80 Ave.**	**Population trend**	**Rebuilding index**
Chinook	60 (NA)	28	60	45	Decreasing	Medium

DEVELOPMENT ACTIVITY:

Type	**Level of Concern**	**Comments**	**Ref.***
Forestry	***Low***	Proposed logging would increase logged area to 8%	12
-percent logging	Low	currently 5%	12
- ECA status	Low		7
- riparian condition/stream length impacted	Low	Localized impacts in lower reaches	3

Watershed:	*Captain Creek*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Agriculture	***Low***		7
- extent	Low	None	7
- riparian condition/stream length impacted	Low		7
- water withdrawal	Low		7
- water quality	Low		7
Urbanization	***Low***		7
- population level	Low		7
- extent	Low	None	7
- riparian condition/stream length impacted	Low		7
- water withdrawal	Low		7
- water quality	Low		7
Placer Mining	***Low***		7
- extent	Low	None	7
- water quality	Low		7
- riparian condition/stream length impacted	Low		7
Other Mining	***Low***		7
- extent	Low	None	7
- water quality	Low		7

Watershed:	*Captain Creek*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Industrial Development	***Low***		7
- extent	Low	None	7
- water quality	Low		7
- stream/riparian impacts	Low		7
Linear Development	***Low***		7
- extent	Low	Logging roads and bridge crossings	7
- stream/riparian impacts	Low	Sediment input and localized impacts at stream crossings	7
Hydro Development	***Low***		7
- extent	Low	None	7
- stream/riparian impacts	Low		7
Other Development	***Low***		7
- extent	Low	None	7
- stream/riparian impacts	Low		7

CUMULATIVE DEVELOPMENT ACTIVITY:

Cumulative Development	***Low***		7

* See report section 6.0 References Cited

Watershed:	*Captain Creek*

BIOPHYSICAL CONDITIONS:

Type	Level of Concern	Comments	Ref.*
Soils	***Low***		7
- types		Coarse, glaciofluvial deposits, some lacustrine	7, 12
Terrain	***High***	Steep valley side slopes	7
- type			7
Resistance to Change	***High***	Small stream, low summer and winter flows/high peak flows	7, 12
Hydrology	***High***	Low summer flows/high peak flows	12
Channel Stability	***Low***		7
- type		Upper reaches steep and confined, lower reaches in broad valley, alluvial fans, laterally unstable and bank erosion in lower reaches	7
Significant Environmental Variables	***Low***		7

SENSITIVE WATERSHED FEATURES:

Type	Present	Comments	Ref.*
Sensitive Physical Features	✓	Steep valley side slopes	7
Sensitive Biological Features	✓	Tributary chinook rearing	7
Unique Features			7

* See report section 6.0 References Cited

Watershed:	*Captain Creek*

SPECIAL CONSIDERATIONS:

Type	Present	Comments	Ref.*
Stock Management	✓		
Enhancement Activity/Opportunity	✓	Previously enhanced from Quesnel hatchery	7
Restoration Activity			
Native Fishery	✓	Occurs in Fraser River	7
Recreational Fishery	✓	Ocean sport fishery	
Commercial Fishery	✓	Ocean fishery	

RECENT WATERSHED PLANNING/PROJECT INITIATIVES:

Type	Comments	Ref.*
	None	

* See report section 6.0 References Cited

SUMMARY OF HABITAT CONCERNS (no. of high ratings):

Salmon Present	Development Concerns	Biophysical Concerns	Sensitive Watershed Features	Special Considerations
✓		✓(3)	✓(2)	✓(5)

Watershed:	*Captain Creek*

SPECIFIC OBJECTIVES AND STRATEGIES:

Specific Objectives	Specific Strategies
• Maintain natural watershed hydrologic characteristics and stream flow regime. • Maintain the natural stream temperature regime. • Maintain the structural and functional integrity of riparian areas. • Maintain slope stability. • Maintain or improve water quality. • Protect stream channels and floodplains from influences of development activities. • Ensure the protection of headwater, ephemeral and intermittent channels; recognizing their influence on watershed stability, hydrology and water quality. • Ensure protection of critical aquatic habitats including: floodplain, off-channel sites, non-natal tributaries and other areas of biological significance. • Ensure that the intensity of development activities does not negatively impact the natural watershed ecological processes through site specific or cumulative development. • Ensure adequate stream flows are present to maintain fisheries productive capacity. • Improve inventories of aquatic resources. • Improve fish passage in the watershed.	• Conduct a stream channel assessment to identify potential barriers to fish migration and remove or facilitate access where appropriate. • Conduct and maintain fisheries, habitat (critical) and enhancement inventories. • Conduct detailed gully assessments for specified sensitive channels identified in development plans. • Design high elevation forest cutblocks to optimize snow accumulation and retention similar to unharvested or undisturbed areas. • Develop Access Management Plans (AMP) for review and direction. • Develop a detailed riparian management plan (RMP) for the Captain Creek watershed identifying areas requiring site specific prescriptions. • Distribute timber harvesting opportunities throughout the available range in elevation to maintain natural hydrologic conditions. • Document, map and assess watershed terrain and soils conditions and their hazard risk. • Ensure that rate of development (forestry, urban, agriculture, etc.) is balanced against hydrologic recovery to maintain cumulative ECA at or below 25% (total watershed drainage area). • Maintain designated "NO STAKING PLACER RESERVES" for placer mining where identified. • Implement a water drainage management plan for sensitive soils, stream crossings or other areas specified in development plans. • Initiate a watershed restoration assessment and inventory for development of a Watershed Restoration Plan. • Implement watershed restoration plan recommendations from assessment and inventory reports.

Watershed:	*Captain Creek*

SPECIFIC OBJECTIVES AND STRATEGIES (continued):

Specific Objectives	Specific Strategies
	• Provide Streamside Management Plans (SMP) for harvesting areas identified in the annual forest development plan update. • Restrict or control development within or along tributary confluences, alluvial fans, floodplains or areas of slope instability (e.g. valley walls). • Retain riparian reserves along specified S4-S6 (FPC riparian class) stream channel reaches in high sensitivity areas or channels identified as having stream temperature concerns. • Review and document potential habitat improvement, habitat development and habitat restoration opportunities. • Review resource development plans for compatibility with sensitive habitats in terms of hydrology, water quality, channel stability and riparian condition.

APPENDIX 8. Watershed Profile for the Herrick Creek Watershed Planning Unit

Streams located within the Herrick Creek Watershed Planning Unit include:

GENERAL WATERSHED INFORMATION:

Watershed:	*Herrick Creek*	SISS Code:	00-6200-070
Physiographic Area(s):	McGregor Plateau/Hart Ranges		
Drainage Area (ha):	205,800	Biogeoclimatic Zone(s):	Sub-Boreal Spruce/ Engelmann Spruce-Subalpine Fir/Alpine Tundra
HMA:	Upper Fraser		

WATERSHED HYDROLOGY:

Stream Flows:	Mean Annual	Mean Flood	Mean 7-day low flow			
			Winter		Summer	
(m^3/s)	86	466.8	5.93	NA	17.47	NA
Comments:	Reference for above data is the stream mouth. See Reference # 12, p. 12, Table 7 and Appendix B.					

SALMON ESCAPEMENT:

Species	Historical Max. (yr)	1981-92 Ave.	1981-92 Max.	1969-80 Ave.	Population trend	Rebuilding potential
Chinook	4,052 (NA)	1,625	4,052	453	Increasing	Medium

NB. Above data includes escapement to the tributaries James the Bad, Fontoniko, and Spakwaniko creeks.

DEVELOPMENT ACTIVITY:

Type	Level of Concern	Comments	Ref.*
Forestry	***Low***		7
-percent logging	Low	approximately 1%	12
- ECA status	Low	Rate of proposed development is high over next 10 years.	7
- riparian condition/stream length impacted	Low		7, 12, 3

Watershed:	*Herrick Creek*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Agriculture	***Low***		7
- extent	Low		7
- riparian condition/stream length impacted	Low		7
- water withdrawal	Low		7
- water quality	Low		7
Urbanization	***Low***	one logging camp	7
- population level	Low		7
- extent	Low		7
- riparian condition/stream length impacted	Low		7
- water withdrawal	Low		7
- water quality	Low		7
Placer Mining	***Low***		7
- extent	Low	None	7
- water quality	Low		7
- riparian condition/stream length impacted	Low		7
Other Mining	***Low***		7
- extent	Low	None	7
- water quality	Low		7

Watershed:	*Herrick Creek*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Industrial Development	***Low***		7
- extent	Low	None	7
- water quality	Low		7
- stream/riparian impacts	Low		7
Linear Development	***Low***		7
- extent	Low	Forestry roads and bridge crossings planned throughout watershed, presently in lower valley	7
- stream/riparian impacts	Low	Some off channel rearing areas impacted	7
Hydro Development	***Low***	B.C. Hydro reserve for proposed McGregor River Diversion	5
- extent	Low	None	7
- stream/riparian impacts	Low		7
Other Development	***Low***		7
- extent	Low	None	7
- stream/riparian impacts	Low		7

CUMULATIVE DEVELOPMENT ACTIVITY:

Cumulative Development	***Low***		7

* See report section 6.0 References Cited

Watershed:	*Herrick Creek*

BIOPHYSICAL CONDITIONS:

Type	Level of Concern	Comments	Ref.*
Soils	***High***	Unstable soils, high eroding stream banks	7
- types		Large deposits of lacustrine and fluvial soils at lower elevations	7, 12, 5
Terrain	***High***		7
- type		Rugged terrain, deeply incised stream. Originates in alpine area, mid reaches steep and wet.	7, 12
Resistance to Change	***Low***	Large, glaciated dynamic stream	7
Hydrology	***Low***	Flashy, low flows in summer and winter noted	7, 12
Channel Stability	***High***	Unstable valley walls, laterally unstable	7
- type			
Significant Environmental Variables	***High***	High background suspended sediments due to glaciers, lacustrine soil, bank instability, and flashy hydrograph	7, 12, 5

SENSITIVE WATERSHED FEATURES:

Type	Present	Comments	Ref.*
Sensitive Physical Features	✓	Lacustrine deposits	7
Sensitive Biological Features	✓	Spawning below Herrick Falls, off channel rearing in lower valley	7, 12
Unique Features			

* See report section 6.0 References Cited

Watershed:	*Herrick Creek*

SPECIAL CONSIDERATIONS:

Type	Present	Comments	Ref.*
Stock Management	✓		
Enhancement Activity/Opportunity	✓	Enhanced from the Quesnel hatchery in the 1980's	7
Restoration Activity			
Native Fishery	✓	Occurs in Fraser River	7
Recreational Fishery	✓	Ocean sport fishery	
Commercial Fishery	✓	Ocean fishery	

RECENT WATERSHED PLANNING/PROJECT INITIATIVES:

Type	Comments	Ref.*
LRUP completed	Consensus Report for the Herrick Creek Local Resource Use Plan. Completed January 1995, not yet (October 1995) implemented	5,7

* See report section 6.0 References Cited

SUMMARY OF HABITAT CONCERNS (no. of high ratings):

Salmon Present	Development Concerns	Biophysical Concerns	Sensitive Watershed Features	Special Considerations
✓		✓(4)	✓(2)	✓(5)

Watershed:	*Herrick Creek*

SPECIFIC OBJECTIVES AND STRATEGIES: (NB. Refer to completed LRUP)

Specific Objectives	Specific Strategies
• Maintain natural watershed hydrologic characteristics and stream flow regime. • Maintain the natural stream temperature regime. • Maintain the structural and functional integrity of riparian areas. • Maintain slope stability. • Maintain or improve water quality. • Protect stream channels and floodplains from influences of development activities. • Ensure the protection of headwater, ephemeral and intermittent channels; recognizing their influence on watershed stability, hydrology and water quality. • Ensure protection of critical aquatic habitats including: floodplain, off-channel sites, non-natal tributaries and other areas of biological significance. • Ensure that the intensity of development activities does not negatively impact the natural watershed ecological processes through site specific or cumulative development. • Ensure the inventory, assessment and implementation of stream restoration and enhancement programs. • Improve inventories of aquatic resources.	• Apply the Watershed Assessment Procedures (WAP) to assess past and potential for future impacts of lands use activities. • Conduct detailed stream channel stability assessment. • Conduct and maintain fisheries, habitat (critical) and enhancement inventories. • Conduct detailed gully assessments for specified sensitive channels identified in development plans. • Design high elevation forest cutblocks to optimize snow accumulation and retention similar to unharvested or undisturbed areas. • Develop Access Management Plans (AMP) for review and direction. • Develop a detailed riparian management plan (RMP) for the Herrick Creek watershed identifying areas requiring site specific prescriptions. • Distribute timber harvesting opportunities throughout the available range in elevation to maintain natural hydrologic conditions. • Document, map and assess watershed terrain and soils conditions and their hazard risk. • Ensure that rate of forest harvesting is balanced against hydrologic recovery to maintain cumulative ECA at or below 25% (total watershed drainage area). • Maintain designated "NO STAKING PLACER RESERVES" for placer mining where identified. • Implement a water drainage management plan for sensitive soils, stream crossings or other areas specified in development plans. • Implement watershed restoration plan recommendations from assessment and inventory reports. • Provide and maintain a water quality assessment and monitoring plan (WQP) for Herrick Creek.

Watershed:	*Herrick Creek*

SPECIFIC OBJECTIVES AND STRATEGIES (continued):

Specific Objectives	Specific Strategies
	• Provide Streamside Management Plans (SMP) for harvesting areas identified in the annual forest development plan update. • Restrict or control development within or along tributary confluences, alluvial fans, floodplains or areas of slope instability (e.g. valley walls). • Retain riparian reserves along specified S4-S6 (FPC riparian class) stream channel reaches in high sensitivity areas or channels identified as having stream temperature concerns. • Review and document potential habitat improvement, habitat development and habitat restoration opportunities. • Review resource development plans for compatibility with sensitive habitats in terms of hydrology, water quality, channel stability and riparian condition.

APPENDIX 9. Watershed Profiles for the Bowron/Kenneth Watershed Planning Unit

Streams located within the Bowron/Kenneth Watershed Planning Unit include:

GENERAL WATERSHED INFORMATION:

Watershed:	***Bowron River***	**SISS Code:**	00-6300
Physiographic Area(s):	Nechako Plain/Fraser Basin & Plateau/Quesnel Highlands/ Cariboo Mountains		
Drainage Area (ha):	360,000	**Biogeoclimatic Zone(s):**	Sub-Boreal Spruce/ Interior Cedar-Hemlock/ Engelmann Spruce - Subalpine Fir
HMA:	Upper Fraser		

WATERSHED HYDROLOGY:

Stream Flows:	Mean Annual	Mean Flood	Mean 7-day low flow			
			Winter		Summer	
(m^3/s)	63.4	351	15.6	Dec/Feb /Mar	21.70	Aug/Sep
Comments:	Reference for above data is the stream mouth. See Reference # 12, p. 12, Table 7 and Appendix B.					

SALMON ESCAPEMENT:

Species	**Historical Max. (yr)**	**1981-92 Ave.**	**1981-92 Max.**	**1969-80 Ave.**	**Population trend**	**Rebuilding potential**
Sockeye	35,024 (1979)	5,937	12,804	9,741	Decreasing	High
Chinook	12,265 (1987)	6,224	12,265	1,392	Increasing	Medium

NB. The above data includes chinook escapement to the Haggen, Indianpoint and Antler creek tributaries and sockeye escapement to Indianpoint Creek. (Sockeye escapement to the other tributaries has not been documented).

DEVELOPMENT ACTIVITY:

Type	**Level of Concern**	**Comments**	**Ref.***
Forestry	***High***		7
-percent logging	High	approximately 39 % of the basin logged to date, some due to spruce bark beetle kill	7, 12
- ECA status	High	Watershed Assessment Procedure (WAP) under way	7
- riparian condition/stream length impacted	High	Extensive harvesting to streamside, especially in mid to upper reaches	3, 2

Watershed:	*Bowron River*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Agriculture	***Low***		7
- extent	Low	None	7
- riparian condition/stream length impacted	Low		7
- water withdrawal	Low		7
- water quality	Low		7
Urbanization	***Low***		7
- population level	Low	Some recreational dwellings and Provincial Park at Purden Lake	7
- extent	Low	None	7
- riparian condition/stream length impacted	Low		7
- water withdrawal	Low		7
- water quality	Low		7
Placer Mining	***Low***		7
- extent	Low	Concentrated on Antler Creek	7
- water quality	Low		7
- riparian condition/stream length impacted	Low		7
Other Mining	***Low***		7
- extent	Low	Exploration for coal and other minerals	7
- water quality	Low		7

Watershed:	*Bowron River*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Industrial Development	***Low***		7
- extent	Low	None	7
- water quality	Low		7
- stream/riparian impacts	Low		7
Linear Development	***High***	Logging roads and stream crossings, CNR and highway rights-of-way and crossings	7
- extent	High	Extensive throughout	7
- stream/riparian impacts	High	Extensive throughout	7
Hydro Development	***Low***		7
- extent	Low	None	7
- stream/riparian impacts	Low		7
Other Development	***Low***		7
- extent	Low	None	7
- stream/riparian impacts	Low		7

CUMULATIVE DEVELOPMENT ACTIVITY:

Cumulative Development	High	Logging related	7

* See report section 6.0 References Cited

Watershed:	*Bowron River*

BIOPHYSICAL CONDITIONS:

Type	Level of Concern	Comments	Ref.*
Soils	***High***		7
- types		Glaciofluvial and lacustrine sediments, till and colluvial soil	7, 12, 2
Terrain	***High***		7
- type		Primarily moderate slope with some areas steep and rugged	7, 12
Resistance to Change	***High***	Extensive sedimentation observed in the 1980's	7
Hydrology	***High***	Lake headed but glacial fed, snowmelt generated peak flow	7
Channel Stability	***High***	Tributaries on the eastern side of the upper basin (especially Haggen Creek) and mainstem below Hwy 16 are unstable.	7, 12, 2
- type			
Significant Environmental Variables	***High***	Water temperature and sedimentation concerns	7

SENSITIVE WATERSHED FEATURES:

Type	Present	Comments	Ref.*
Sensitive Physical Features	✓	Lacustrine deposits	7
Sensitive Biological Features	✓	Significant flood plain rearing habitat areas as well as tributary rearing	7
Unique Features	✓	Major spruce beetle salvage contributed to extent of logging. Largest chinook producer north of Quesnel River. Bowron Lake Provincial Park on headwaters.	7

* See report section 6.0 References Cited

Watershed:	*Bowron River*

SPECIAL CONSIDERATIONS:

Type	Present	Comments	Ref.*
Stock Management	✓		
Enhancement Activity/Opportunity	✓	Past outplanting of chinook from Quesnel hatchery	7
Restoration Activity	✓	Watershed restoration program	7
Native Fishery	✓	Occurs in Fraser River	
Recreational Fishery	✓	Locally significant sport fishery, ocean sport fishery	7
Commercial Fishery	✓	Ocean fishery	

RECENT WATERSHED PLANNING/PROJECT INITIATIVES:

Type	Comments	Ref.*
WRP	Watershed Restoration Program underway	7
WAP	Watershed Assessment Procedure under way	7

* See report section 6.0 References Cited

SUMMARY OF HABITAT CONCERNS (no. of high ratings):

Salmon Present	Development Concerns	Biophysical Concerns	Sensitive Watershed Features	Special Considerations
✓	✓(3)	✓(6)	✓(3)	✓(6)

Watershed:	*Bowron River*

SPECIFIC OBJECTIVES AND STRATEGIES:

Specific Objectives	Specific Strategies
• Maintain natural watershed hydrologic characteristics and stream flow regime. • Maintain the natural stream temperature regime. • Maintain the structural and functional integrity of riparian areas. • Maintain slope stability. • Maintain or improve water quality. • Protect stream channels and floodplains from influences of development activities. • Ensure the protection of headwater, ephemeral and intermittent channels; recognizing their influence on watershed stability, hydrology and water quality. • Ensure protection of critical aquatic habitats including: floodplain, off-channel sites, non-natal tributaries and other areas of biological significance. • Ensure that the intensity of development activities does not negatively impact the natural watershed ecological processes through site specific or cumulative development. • Ensure the inventory, assessment and implementation of stream restoration and enhancement programs. • Ensure adequate stream flows are present to maintain fisheries productive capacity. • Improve inventories of aquatic resources. • Ensure compatibility of lake foreshore developments with salmon utilization.	• Apply riparian guidelines for new placer mines that are consistent with FPC standards. • Apply the Watershed Assessment Procedures (WAP) to assess past and potential for future impacts of lands use activities. • Conduct detailed stream channel stability assessment. • Conduct and maintain fisheries, habitat (critical) and enhancement inventories. • Conduct detailed gully assessments for specified sensitive channels identified in development plans. • Design high elevation forest cutblocks to optimize snow accumulation and retention similar to unharvested or undisturbed areas. • Develop Access Management Plans (AMP) for review and direction. • Develop a detailed riparian management plan (RMP) for the Bowron River watershed identifying areas requiring site specific prescriptions. • Distribute timber harvesting opportunities throughout the available range in elevation to maintain natural hydrologic conditions. • Document, map and assess watershed terrain and soils conditions and their hazard risk. • Ensure that rate of development (forestry, urban, agriculture, etc.) is balanced against hydrologic recovery to maintain cumulative ECA at or below 25% (total watershed drainage area). • Maintain designated "NO STAKING PLACER RESERVES" for placer mining where identified.

Watershed:	*Bowron River*

SPECIFIC OBJECTIVES AND STRATEGIES (continued):

Specific Objectives	Specific Strategies
	• Implement a water drainage management plan for sensitive soils, stream crossings or other areas specified in development plans. • Initiate a watershed restoration assessment and inventory for development of a Watershed Restoration Plan. • Implement watershed restoration plan recommendations from assessment and inventory reports. • Initiate restoration, revegetation and stabilization measures on linear developments. • Identify and request complete reclamation of past, present and new placer mining development sites. • Provide Streamside Management Plans (SMP) for harvesting areas identified in the annual forest development plan update. • Restrict or control development within or along tributary confluences, alluvial fans, floodplains or areas of slope instability (e.g. valley walls). • Retain riparian reserves along specified S4-S6 (FPC riparian class) stream channel reaches in high sensitivity areas or channels identified as having stream temperature concerns. • Review and document potential habitat improvement, habitat development and habitat restoration opportunities. • Review resource development plans for compatibility with sensitive habitats in terms of hydrology, water quality, channel stability and riparian condition.

GENERAL WATERSHED INFORMATION:

Watershed:	***Kenneth Creek***	**SISS Code:**	00-6425
Physiographic Area(s):	Nechako Plain/Fraser Basin & Plateau/Quesnel Highlands		
Drainage Area (ha):	21,600	**Biogeoclimatic Zone(s):**	Sub-Boreal Spruce/ Interior Cedar-Hemlock/ Engelmann Spruce - Subalpine Fir
HMA:	Upper Fraser		

WATERSHED HYDROLOGY:

Stream Flows:	Mean Annual	Mean Flood	Mean 7-day low flow			
			Winter		Summer	
(m^3/s)	3.31	31.1	0.63	NA	0.58	NA
Comments:	Reference for above data is the stream mouth. See Reference # 12, p. 12, Table 7 and Appendix B.					

SALMON ESCAPEMENT:

Species	Historical Max. (yr)	1981-92 Ave.	1981-92 Max.	1969-80 Ave.	Population trend	Rebuilding potential
Chinook	100 (1986 & 1988)	52	100	NA	NA	Medium

DEVELOPMENT ACTIVITY:

Type	Level of Concern	Comments	Ref.*
Forestry	***High***		7
-percent logging	High	Approximately 74 % of the basin logged to date, some due to beetle kill	12
- ECA status	High		7
- riparian condition/stream length impacted	High	Extensive harvesting to streamside	3, 12

Watershed:	*Kenneth Creek*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Agriculture	***Low***		7
- extent	Low	None	7
- riparian condition/stream length impacted	Low		7
- water withdrawal	Low		7
- water quality	Low		7
Urbanization	***Low***		7
- population level	Low		7
- extent	Low	None	7
- riparian condition/stream length impacted	Low		7
- water withdrawal	Low		7
- water quality	Low		7
Placer Mining	***Low***		7
- extent	Low	None	7
- water quality	Low		7
- riparian condition/stream length impacted	Low		7
Other Mining	***Low***		7
- extent	Low	None	7
- water quality	Low		7

Watershed:	*Kenneth Creek*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Industrial Development	***Low***		7
- extent	Low	None	7
- water quality	Low		7
- stream/riparian impacts	Low		7
Linear Development	***High***	Primarily logging roads and Highway 16 crossing as well as stream crossings	7
- extent	High	Extensive throughout	7
- stream/riparian impacts	High	Extensive throughout	7
Hydro Development	***Low***		7
- extent	Low	None	7
- stream/riparian impacts	Low		7
Other Development	***Low***		7
- extent	Low	None	7
- stream/riparian impacts	Low		7

CUMULATIVE DEVELOPMENT ACTIVITY:

Cumulative Development	***High***	Logging, riparian harvesting and roads, stream crossings	7

* See report section 6.0 References Cited

Watershed:	*Kenneth Creek*

BIOPHYSICAL CONDITIONS:

Type	Level of Concern	Comments	Ref.*
Soils	***High***		7
- types		Glaciofluvial and lacustrine sediments, till and colluvial soil	7, 12
Terrain	***High***		7
- type		Moderate to steep and rugged	7, 12
Resistance to Change	***High***		7
Hydrology	***High***	Summer low flows may limit fish access and habitat, peak flows	12
Channel Stability	***High***	Extensive meandering and channel widening, particularly in lower reaches	7
- type			
Significant Environmental Variables	***Low***	post harvesting streamside sedimentation	7

SENSITIVE WATERSHED FEATURES:

Type	Present	Comments	Ref.*
Sensitive Physical Features	✓	summer low flow may limit fish access and habitat	12
Sensitive Biological Features			
Unique Features			

* See report section 6.0 References Cited

Watershed:	*Kenneth Creek*

SPECIAL CONSIDERATIONS:

Type	Present	Comments	Ref.*
Stock Management	✓		
Enhancement Activity/Opportunity			
Restoration Activity	✓	Rehabilitation work including beaver dam removal was done as part of employment/corrections project	12
Native Fishery	✓	Occurs in Fraser River	7
Recreational Fishery	✓	Ocean sport fishery	
Commercial Fishery	✓	Ocean fishery	

RECENT WATERSHED PLANNING/PROJECT INITIATIVES:

Type	Comments	Ref.*
	None	

* See report section 6.0 References Cited

SUMMARY OF HABITAT CONCERNS (no. of high ratings):

Salmon Present	Development Concerns	Biophysical Concerns	Sensitive Watershed Features	Special Considerations
✓	✓(3)	✓(5)	✓	✓(5)

Watershed:	*Kenneth Creek*

SPECIFIC OBJECTIVES AND STRATEGIES:

Specific Objectives	Specific Strategies
• Maintain natural watershed hydrologic characteristics and stream flow regime. • Maintain the natural stream temperature regime. • Maintain the structural and functional integrity of riparian areas. • Maintain slope stability. • Maintain or improve water quality. • Protect stream channels and floodplains from influences of development activities. • Ensure the protection of headwater, ephemeral and intermittent channels; recognizing their influence on watershed stability, hydrology and water quality. • Ensure protection of critical aquatic habitats including: floodplain, off-channel sites, non-natal tributaries and other areas of biological significance. • Ensure that the intensity of development activities does not negatively impact the natural watershed ecological processes through site specific or cumulative development. • Ensure the inventory, assessment and implementation of stream restoration and enhancement programs. • Ensure adequate stream flows are present to maintain fisheries productive capacity. • Improve inventories of aquatic resources. • Improve fish passage in the watershed.	• Apply riparian guidelines for new placer mines that are consistent with FPC standards. • Apply the Watershed Assessment Procedures (WAP) to assess past and potential for future impacts of lands use activities. • Conduct detailed stream channel stability assessment. • Conduct and maintain fisheries, habitat (critical) and enhancement inventories. • Conduct detailed gully assessments for specified sensitive channels identified in development plans. • Conduct minimum flow study. • Design high elevation forest cutblocks to optimize snow accumulation and retention similar to unharvested or undisturbed areas. • Develop Access Management Plans (AMP) for review and direction. • Develop a detailed riparian management plan (RMP) for the Kenneth Creek watershed identifying areas requiring site specific prescriptions. • Distribute timber harvesting opportunities throughout the available range in elevation to maintain natural hydrologic conditions. • Document, map and assess watershed terrain and soils conditions and their hazard risk. • Ensure that rate of development (forestry, urban, agriculture, etc.) is balanced against hydrologic recovery to maintain cumulative ECA at or below 25% (total watershed drainage area). • Maintain designated "NO STAKING PLACER RESERVES" for placer mining where identified. • Implement a water drainage management plan for sensitive soils, stream crossings or other areas specified in development plans.

Watershed:	*Kenneth Creek*

SPECIFIC OBJECTIVES AND STRATEGIES (continued):

Specific Objectives	Specific Strategies
	• Initiate a watershed restoration assessment and inventory for development of a Watershed Restoration Plan. • Implement watershed restoration plan recommendations from assessment and inventory reports. • Initiate restoration, revegetation and stabilization measures on linear developments. • Identify and request complete reclamation of past, present and new placer mining development sites. • Provide Streamside Management Plans (SMP) for harvesting areas identified in the annual forest development plan update. • Restrict or control development within or along tributary confluences, alluvial fans, floodplains or areas of slope instability (e.g. valley walls). • Retain riparian reserves along specified S4-S6 (FPC riparian class) stream channel reaches in high sensitivity areas or channels identified as having stream temperature concerns. • Review and document potential habitat improvement, habitat development and habitat restoration opportunities. • Review resource development plans for compatibility with sensitive habitats in terms of hydrology, water quality, channel stability and riparian condition.

APPENDIX 10. Watershed Profile for the Hungary Creek Watershed Planning Unit

Streams located within the Hungary Creek Watershed Planning Unit include:

GENERAL WATERSHED INFORMATION:

Watershed:	*Hungary Creek*	SISS Code:	00-6500
Physiographic Area(s):	Rocky Mountain Trench/Cariboo Mountains		
Drainage Area (ha):	9,600	Biogeoclimatic Zone(s):	Sub-Boreal Spruce/ Interior Cedar-Hemlock/ Engelmann Spruce-Subalpine Fir
HMA:	Upper Fraser		

WATERSHED HYDROLOGY:

Stream Flows:	Mean Annual	Mean Flood	Mean 7-day low flow			
			Winter		Summer	
(m^3/s)	4.01	21.8	0.25	NA	0.93	NA
Comments:	Reference for above data is the stream mouth. See Reference # 12, p. 12, Table 7 and Appendix B.					

SALMON ESCAPEMENT:

Species	Historical Max. (yr)	1981-92 Ave.	1981-92 Max.	1969-80 Ave.	Population trend	Rebuilding potential
Chinook	NA (NA)	NA	NA	NA	NA	NA

NB. Chinook are known to be present however escapement numbers are not available.

DEVELOPMENT ACTIVITY:

Type	Level of Concern	Comments	Ref.*
Forestry	*High*		7
-percent logging	High	37 % of total basin	12
- ECA status	High		7
- riparian condition/stream length impacted	Low		7

Watershed:	*Hungary Creek*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Agriculture	***Low***		7
- extent	Low	None	7
- riparian condition/stream length impacted	Low		7
- water withdrawal	Low		7
- water quality	Low		7
Urbanization	***Low***		7
- population level	Low		7
- extent	Low		7
- riparian condition/stream length impacted	Low		7
- water withdrawal	Low		7
- water quality	Low		7
Placer Mining	***Low***		7
- extent	Low	None	7
- water quality	Low		7
- riparian condition/stream length impacted	Low		7
Other Mining	***Low***		7
- extent	Low	None	7
- water quality	Low		7

Watershed:	*Hungary Creek*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Industrial Development	***Low***		7
- extent	Low	None	7
- water quality	Low		7
- stream/riparian impacts	Low		7
Linear Development	***Low***		7
- extent	Low	Highway 16 right-of-way, logging roads and stream crossings	7
- stream/riparian impacts	Low	Highway 16 culvert may be impassible	12
Hydro Development	***Low***		7
- extent	Low	None	7
- stream/riparian impacts	Low		7
Other Development	***Low***		7
- extent	Low	None	7
- stream/riparian impacts	Low		7

CUMULATIVE DEVELOPMENT ACTIVITY:

Cumulative Development	***Low***		7

* See report section 6.0 References Cited

Watershed:	*Hungary Creek*

BIOPHYSICAL CONDITIONS:

Type	Level of Concern	Comments	Ref.*
Soils	***High***		7
- types		Localized lacustrine deposits, glacial till, alluvium	7
Terrain	***High***		7
- type		Upper portion of watershed in rugged Cariboo Mountains, lower basin in gentle terrain	7
Resistance to Change	***High***	High glacial sediment delivery exacerbated by flashy hydrograph	7
Hydrology	***High***	Flashy, summer and especially winter low flow	7, 12
Channel Stability	***High***	Evidence of flooding, braided, bank instability	7
- type			
Significant Environmental Variables	***High***	High sediment level, low summer and winter flow	7, 12

SENSITIVE WATERSHED FEATURES:

Type	Present	Comments	Ref.*
Sensitive Physical Features	✓	Lacustrine deposits, high suspended sediment, extensive beaver activity	7
Sensitive Biological Features			
Unique Features			

* See report section 6.0 References Cited

Watershed:	*Hungary Creek*

SPECIAL CONSIDERATIONS:

Type	Present	Comments	Ref.*
Stock Management	✓		
Enhancement Activity/Opportunity			
Restoration Activity	✓	Hwy 16 culvert may prevent upstream migration to best spawning habitat. Re-engineer crossing.	12, 7
Native Fishery	✓	Occurs in Fraser River	7
Recreational Fishery	✓	Ocean sport fishery	
Commercial Fishery	✓	Ocean fishery	

RECENT WATERSHED PLANNING/PROJECT INITIATIVES:

Type	Comments	Ref.*
	None	

* See report section 6.0 References Cited

SUMMARY OF HABITAT CONCERNS (no. of high ratings):

Salmon Present	Development Concerns	Biophysical Concerns	Sensitive Watershed Features	Special Considerations
✓	✓	✓(6)	✓	✓(5)

Watershed:	*Hungary Creek*

SPECIFIC OBJECTIVES AND STRATEGIES:

Specific Objectives	Specific Strategies
• Maintain natural watershed hydrologic characteristics and stream flow regime. • Maintain the natural stream temperature regime. • Maintain the structural and functional integrity of riparian areas. • Maintain slope stability. • Maintain or improve water quality. • Protect stream channels and floodplains from influences of development activities. • Ensure the protection of headwater, ephemeral and intermittent channels; recognizing their influence on watershed stability, hydrology and water quality. • Ensure protection of critical aquatic habitats including: floodplain, off-channel sites, non-natal tributaries and other areas of biological significance. • Ensure that the intensity of development activities does not negatively impact the natural watershed ecological processes through site specific or cumulative development. • Ensure the inventory, assessment and implementation of stream restoration and enhancement programs. • Improve inventories of aquatic resources. • Improve fish passage in the watershed.	• Apply the Watershed Assessment Procedures (WAP) to assess past and potential for future impacts of lands use activities. • Conduct detailed stream channel stability assessment. • Conduct a stream channel assessment to identify potential barriers to fish migration and remove or facilitate access where appropriate. • Conduct and maintain fisheries, habitat (critical) and enhancement inventories. • Conduct detailed gully assessments for specified sensitive channels identified in development plans. • Design high elevation forest cutblocks to optimize snow accumulation and retention similar to unharvested or undisturbed areas. • Develop Access Management Plans (AMP) for review and direction. • Develop a detailed riparian management plan (RMP) for the Hungary Creek watershed identifying areas requiring site specific prescriptions. • Distribute timber harvesting opportunities throughout the available range in elevation to maintain natural hydrologic conditions. • Document, map and assess watershed terrain and soils conditions and their hazard risk. • Ensure that rate of development (i.e forestry) is balanced against hydrologic recovery to maintain cumulative ECA at or below 25% (total watershed drainage area). • Maintain designated "NO STAKING PLACER RESERVES" for placer mining where identified. • Implement a water drainage management plan for sensitive soils, stream crossings or other areas specified in development plans.

Watershed:	*Hungary Creek*

SPECIFIC OBJECTIVES AND STRATEGIES (continued):

Specific Objectives	Specific Strategies
	• Initiate a watershed restoration assessment and inventory for development of a Watershed Restoration Plan. • Implement watershed restoration plan recommendations from assessment and inventory reports. • Provide Streamside Management Plans (SMP) for harvesting areas identified in the annual forest development plan update. • Restrict or control development within or along tributary confluences, alluvial fans, floodplains or areas of slope instability (e.g. valley walls). • Retain riparian reserves along specified S4-S6 (FPC riparian class) stream channel reaches in high sensitivity areas or channels identified as having stream temperature concerns. • Review and document potential habitat improvement, habitat development and habitat restoration opportunities. • Review resource development plans for compatibility with sensitive habitats in terms of hydrology, water quality, channel stability and riparian condition.

APPENDIX 11. Watershed Profile for the Slim Creek Watershed Planning Unit

Streams located within the Slim Creek Watershed Planning Unit include:

GENERAL WATERSHED INFORMATION:

Watershed:	***Slim Creek***	**SISS Code:**	00-6600
Physiographic Area(s):	Rocky Mountain Trench/Cariboo Mountains/Fraser Plateau		
Drainage Area (ha):	85,600	**Biogeoclimatic Zone(s):**	Sub-Boreal Spruce/ Engelmann Spruce - Subalpine Fir
HMA:	Upper Fraser		

WATERSHED HYDROLOGY:

Stream Flows:	Mean Annual	Mean Flood	Mean 7-day low flow			
			Winter		Summer	
(m^3/s)	35.8	194.1	2.4	NA	7.54	NA
Comments:	Reference for above data is the stream mouth. See Reference # 12, p. 12, Table 7 and Appendix B.					

SALMON ESCAPEMENT:

Species	**Historical Max. (yr)**	**1981-92 Ave.**	**1981-92 Max.**	**1969-80 Ave.**	**Population trend**	**Rebuilding potential**
Chinook	5,500 (NA)	3,084	5,500	1,131	Increasing	Medium

DEVELOPMENT ACTIVITY:

Type	**Level of Concern**	**Comments**	**Ref.***
Forestry	***High***	Extensive past harvesting along upper mainstem and tributaries particularly Everett Creek.	7
-percent logging	High	19% on average, 23% in Everett Creek	12
- ECA status	High		7
- riparian condition/stream length impacted	High	Impacts on upper mainstem	7, 12

Watershed:	*Slim Creek*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Agriculture	***Low***		7
- extent	Low	None	7
- riparian condition/stream length impacted	Low		7
- water withdrawal	Low		7
- water quality	Low		7
Urbanization	***Low***		7
- population level	Low	None	7
- extent	Low		7
- riparian condition/stream length impacted	Low		7
- water withdrawal	Low		7
- water quality	Low		7
Placer Mining	***Low***		7
- extent	Low	None	7
- water quality	Low		7
- riparian condition/stream length impacted	Low		7
Other Mining	***Low***		7
- extent	Low	None	7
- water quality	Low		7

Watershed:	*Slim Creek*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Industrial Development	***Low***		7
- extent	Low	None	7
- water quality	Low		7
- stream/riparian impacts	Low		7
Linear Development	***High***		7
- extent	High	Logging roads, CNR and highway right of way and numerous stream crossings	7
- stream/riparian impacts	High	Localized, sedimentation from logging road cutbanks and loss of riparian vegetation	7, 12
Hydro Development	***Low***		7
- extent	Low	None	7
- stream/riparian impacts	Low		7
Other Development	***Low***		7
- extent	Low	None	7
- stream/riparian impacts	Low		7

CUMULATIVE DEVELOPMENT ACTIVITY:

Cumulative Development	***Low***		7

* See report section 6.0 References Cited

Watershed:	*Slim Creek*

BIOPHYSICAL CONDITIONS:

Type	Level of Concern	Comments	Ref.*
Soils	***High***		7
- types		Sandy, terraced glaciofluvial deposits	15
Terrain	***High***		7
- type		Upper valley in the rugged Cariboo Mountains; lower basin in gentle terrain	7, 12
Resistance to Change	***Low***	Lake headed stable mainstem	7
Hydrology	***Low***	Low summer and winter flows, lake headed	7, 12
Channel Stability	***Low***	Upper basin steep and confined, lower reaches stable below lake	7
- type			
Significant Environmental Variables	***High***	High mainstem summer water temperatures	12

SENSITIVE WATERSHED FEATURES:

Type	Present	Comments	Ref.*
Sensitive Physical Features	✓	Channel upstream of spawning grounds filled with sediment from logging activities. Summer water temperature.	12
Sensitive Biological Features	✓	Chinook rearing in tributaries and small lakes during summer.	7
Unique Features			

* See report section 6.0 References Cited

Watershed:	*Slim Creek*

SPECIAL CONSIDERATIONS:

Type	Present	Comments	Ref.*
Stock Management	✓		
Enhancement Activity/Opportunity			
Restoration Activity			
Native Fishery	✓	Occurs in Fraser River	7
Recreational Fishery	✓	Ocean sport fishery	
Commercial Fishery	✓	Ocean fishery	

RECENT WATERSHED PLANNING/PROJECT INITIATIVES:

Type	Comments	Ref.*
Research	One of the few upper Fraser River watersheds evaluated for Fisheries-Land Use interactions. 1972-1978, revisited in 1990's. DFO Science Branch. Continued monitoring of juvenile chinook habitat use.	7

* See report section 6.0 References Cited

SUMMARY OF HABITAT CONCERNS (no. of high ratings):

Salmon Present	Development Concerns	Biophysical Concerns	Sensitive Watershed Features	Special Considerations
✓	✓(2)	✓(3)	✓(2)	✓(4)

Watershed:	*Slim Creek*

SPECIFIC OBJECTIVES AND STRATEGIES:

Specific Objectives	Specific Strategies
• Maintain natural watershed hydrologic characteristics and stream flow regime. • Maintain the natural stream temperature regime. • Maintain the structural and functional integrity of riparian areas. • Maintain slope stability. • Maintain or improve water quality. • Protect stream channels and floodplains from influences of development activities. • Ensure the protection of headwater, ephemeral and intermittent channels; recognizing their influence on watershed stability, hydrology and water quality. • Ensure protection of critical aquatic habitats including: floodplain, off-channel sites, non-natal tributaries and other areas of biological significance. • Ensure that the intensity of development activities does not negatively impact the natural watershed ecological processes through site specific or cumulative development. • Ensure the inventory, assessment and implementation of stream restoration and enhancement programs. • Ensure adequate stream flows are present to maintain fisheries productive capacity. • Improve inventories of aquatic resources. • Ensure compatibility of lake foreshore developments with salmon utilization. • Improve fish passage in the watershed.	• Apply the Watershed Assessment Procedures (WAP) to assess past and potential for future impacts of lands use activities. • Conduct detailed stream channel stability assessment. • Conduct a stream channel assessment to identify potential barriers to fish migration and remove or facilitate access where appropriate. • Conduct and maintain fisheries, habitat (critical) and enhancement inventories. • Conduct detailed gully assessments for specified sensitive channels identified in development plans. • Conduct foreshore inventory and classification of Slim and Tumuch Lakes for delineation of fisheries sensitive zones (FSZ) prior to development. • Design high elevation forest cutblocks to optimize snow accumulation and retention similar to unharvested or undisturbed areas. • Develop Access Management Plans (AMP) for review and direction. • Develop a detailed riparian management plan (RMP) for the Slim Creek watershed identifying areas requiring site specific prescriptions. • Distribute timber harvesting opportunities throughout the available range in elevation to maintain natural hydrologic conditions. • Document, map and assess watershed terrain and soils conditions and their hazard risk. • Ensure that rate of development (forestry, urban, agriculture, etc.) is balanced against hydrologic recovery to maintain cumulative ECA at or below 25% (total watershed drainage area). • Maintain designated "NO STAKING PLACER RESERVES" for placer mining where identified.

Watershed:	*Slim Creek*

SPECIFIC OBJECTIVES AND STRATEGIES (continued):

Specific Objectives	Specific Strategies
	• Implement a water drainage management plan for sensitive soils, stream crossings or other areas specified in development plans. • Initiate a watershed restoration assessment and inventory for development of a Watershed Restoration Plan. • Implement watershed restoration plan recommendations from assessment and inventory reports. • Provide Streamside Management Plans (SMP) for harvesting areas identified in the annual forest development plan update. • Restrict or control development within or along tributary confluences, alluvial fans, floodplains or areas of slope instability (e.g. valley walls). • Retain riparian reserves along specified S4-S6 (FPC riparian class) stream channel reaches in high sensitivity areas or channels identified as having stream temperature concerns. • Review and document potential habitat improvement, habitat development and habitat restoration opportunities. • Review resource development plans for compatibility with sensitive habitats in terms of hydrology, water quality, channel stability and riparian condition.

APPENDIX 12. Watershed Profiles for the Dome/Ptarmigan Watershed Planning Unit

Streams located within the Dome/Ptarmigan Watershed Planning Unit include:

GENERAL WATERSHED INFORMATION:

Watershed:	***Dome Creek***	**SISS Code:**	00-6660
Physiographic Area(s):	Rocky Mountain Trench/Cariboo Mountains		
Drainage Area (ha):	27,300	**Biogeoclimatic Zone(s):**	Sub-Boreal Spruce/ Interior Cedar-Hemlock/ Engelmann Spruce-Subalpine Fir/ Alpine Tundra
HMA:	Upper Fraser		

WATERSHED HYDROLOGY:

Stream Flows:	Mean Annual	Mean Flood	Mean 7-day low flow			
			Winter		Summer	
(m^3/s)	11.4	61.9	0.74	NA	2.52	NA
Comments:	Reference for above data is the stream mouth. See Reference # 12, p. 12, Table 7 and Appendix B.					

SALMON ESCAPEMENT:

Species	**Historical Max. (yr)**	**1981-92 Ave.**	**1981-92 Max.**	**1969-80 Ave.**	**Population trend**	**Rebuilding potential**
Chinook	523 (1991)	269	523	NA	Static	Medium

DEVELOPMENT ACTIVITY:

Type	**Level of Concern**	**Comments**	**Ref.***
Forestry	***Low***		7
-percent logging	Low	11% on average	12
- ECA status	Low		7
- riparian condition/stream length impacted	Low	Extensive riparian harvest concentrated in upper reaches	7

Watershed:	*Dome Creek*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Agriculture	***Low***		7
- extent	Low	Some on lower reaches	7
- riparian condition/stream length impacted	Low	Localized impacts	7
- water withdrawal	Low		7
- water quality	Low		7
Urbanization	***Low***		7
- population level	Low		7
- extent	Low	Community of Dome Creek on lower reaches	12
- riparian condition/stream length impacted	Low	Some channelization associated with community	12
- water withdrawal	Low		7
- water quality	Low		7
Placer Mining	***Low***		7
- extent	Low	None	7
- water quality	Low		7
- riparian condition/stream length impacted	Low		7
Other Mining	***Low***		7
- extent	Low	None	7
- water quality	Low		7

Watershed:	*Dome Creek*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Industrial Development	***Low***		7
- extent	Low	None	7
- water quality	Low		7
- stream/riparian impacts	Low		7
Linear Development	***High***		7
- extent	Low	Logging roads, CNR and Highway 16 rights-of-way and crossings	7
- stream/riparian impacts	Low	Concentrated at crossings	7
Hydro Development	***Low***		7
- extent	Low	None	7
- stream/riparian impacts	Low		7
Other Development	***Low***		7
- extent	Low	Old log booming dam about 8 km upstream of mouth probable migration barrier at certain flows	7
- stream/riparian impacts	Low		7

CUMULATIVE DEVELOPMENT ACTIVITY:

Cumulative Development	***Low***		7

* See report section 6.0 References Cited

Watershed:	*Dome Creek*

BIOPHYSICAL CONDITIONS:

Type	Level of Concern	Comments	Ref.*
Soils	***High***		7
- types		Localized lacustrine deposits, glacial till, alluvium	7, 12
Terrain	***High***		7
- type		Upper reaches - Cariboo Mountains (rugged), frequent landslides Lower reaches - gentle terrain	7, 12
Resistance to Change	***High***	High glacial sediment delivery, flashy	7
Hydrology	***High***	Large watershed, low water yield (low winter and summer flow)	7, 12
Channel Stability	***High***	Evidence of flooding	7
- type		Bank instability and channelization	7
Significant Environmental Variables	***High***	High sediment levels	7

SENSITIVE WATERSHED FEATURES:

Type	Present	Comments	Ref.*
Sensitive Physical Features	✓	High suspended sediment load	7
Sensitive Biological Features			
Unique Features			

* See report section 6.0 References Cited

Watershed:	*Dome Creek*

SPECIAL CONSIDERATIONS:

Type	Present	Comments	Ref.*
Stock Management	✓		
Enhancement Activity/Opportunity	✓	Dome Creek counting fence, Penny hatchery, side channel rearing facility	7, 12
Restoration Activity	✓	Log weir upstream of Highway 16 should be removed.	7, 12
Native Fishery	✓	Occurs in Fraser River	7
Recreational Fishery	✓	Ocean sport fishery	
Commercial Fishery	✓	Ocean fishery	

RECENT WATERSHED PLANNING/PROJECT INITIATIVES:

Type	Comments	Ref.*
WRP	Some localized restoration projects underway	7

* See report section 6.0 References Cited

SUMMARY OF HABITAT CONCERNS (no. of high ratings):

Salmon Present	Development Concerns	Biophysical Concerns	Sensitive Watershed Features	Special Considerations
✓	✓	✓(6)	✓	✓(6)

Watershed:	*Dome Creek*

SPECIFIC OBJECTIVES AND STRATEGIES:

Specific Objectives	Specific Strategies
• Maintain natural watershed hydrologic characteristics and stream flow regime. • Maintain the natural stream temperature regime. • Maintain the structural and functional integrity of riparian areas. • Maintain slope stability. • Maintain or improve water quality. • Protect stream channels and floodplains from influences of development activities. • Ensure the protection of headwater, ephemeral and intermittent channels; recognizing their influence on watershed stability, hydrology and water quality. • Ensure protection of critical aquatic habitats including: floodplain, off-channel sites, non-natal tributaries and other areas of biological significance. • Ensure that the intensity of development activities does not negatively impact the natural watershed ecological processes through site specific or cumulative development. • Ensure the inventory, assessment and implementation of stream restoration and enhancement programs. • Improve inventories of aquatic resources. • Support existing fisheries enhancement programs and activities. • Improve fish passage in the watershed.	• Apply FPC riparian guidelines to agricultural and range use of crown land. • Apply the Land Development Guidelines to residential and industrial developments. • Conduct detailed stream channel stability assessment. • Conduct a stream channel assessment to identify potential barriers to fish migration and remove or facilitate access where appropriate. • Conduct and maintain fisheries, habitat (critical) and enhancement inventories. • Conduct detailed gully assessments for specified sensitive channels identified in development plans. • Design high elevation forest cutblocks to optimize snow accumulation and retention similar to unharvested or undisturbed areas. • Develop Access Management Plans (AMP) for review and direction. • Develop a detailed riparian management plan (RMP) for the Dome Creek watershed identifying areas requiring site specific prescriptions. • Develop a riparian management plan to protect and restore stream habitat in cooperation with agricultural and ranching communities. • Distribute timber harvesting opportunities throughout the available range in elevation to maintain natural hydrologic conditions. • Document, map and assess watershed terrain and soils conditions and their hazard risk. • Ensure that rate of development (forestry, urban, agriculture, etc.) is balanced against hydrologic recovery to maintain cumulative ECA at or below 25% (total watershed drainage area).

Watershed:	*Dome Creek*

SPECIFIC OBJECTIVES AND STRATEGIES (continued):

Specific Objectives	Specific Strategies
	• Maintain designated "NO STAKING PLACER RESERVES" for placer mining where identified. • Implement a water drainage management plan for sensitive soils, stream crossings or other areas specified in development plans. • Initiate a watershed restoration assessment and inventory for development of a Watershed Restoration Plan. • Implement watershed restoration plan recommendations from assessment and inventory reports. • Initiate restoration, revegetation and stabilization measures on linear developments. • Provide Streamside Management Plans (SMP) for harvesting areas identified in the annual forest development plan update. • Restrict or control development within or along tributary confluences, alluvial fans, floodplains or areas of slope instability (e.g. valley walls). • Retain riparian reserves along specified S4-S6 (FPC riparian class) stream channel reaches in high sensitivity areas or channels identified as having stream temperature concerns. • Review and document potential habitat improvement, habitat development and habitat restoration opportunities. • Review resource development plans for compatibility with sensitive habitats in terms of hydrology, water quality, channel stability and riparian condition.

GENERAL WATERSHED INFORMATION:

Watershed:	*Ptarmigan Creek*	SISS Code:	00-6710
Physiographic Area(s):	Rocky Mountain Trench/Cariboo Mountains		
Drainage Area (ha):	18,300	Biogeoclimatic Zone(s):	Sub-Boreal Spruce/ Interior Cedar-Hemlock/ Engelmann Spruce-Subalpine Fir/ Alpine Tundra
HMA:	Upper Fraser		

WATERSHED HYDROLOGY:

Stream Flows:	Mean Annual	Mean Flood	Mean 7-day low flow			
			Winter		Summer	
(m^3/s)	7.65	41.5	0.49	NA	1.72	NA
Comments:	Reference for above data is the stream mouth. See Reference # 12, p. 12, Table 7 and Appendix B.					

SALMON ESCAPEMENT:

Species	Historical Max. (yr)	1981-92 Ave.	1981-92 Max.	1969-80 Ave.	Population trend	Rebuilding potential
Chinook	130 (NA)	74	130	NA	Static	Medium

DEVELOPMENT ACTIVITY:

Type	Level of Concern	Comments	Ref.*
Forestry	*Low*		7
-percent logging	Low	14% on average	12
- ECA status	Low	No information available	7
- riparian condition/stream length impacted	Low	No information available	7

Watershed:	*Ptarmigan Creek*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Agriculture	***Low***		7
- extent	Low		7
- riparian condition/stream length impacted	Low		7
- water withdrawal	Low		7
- water quality	Low		7
Urbanization	***Low***		7
- population level	Low		7
- extent	Low		7
- riparian condition/stream length impacted	Low		7
- water withdrawal	Low		7
- water quality	Low		7
Placer Mining	***Low***		7
- extent	Low		7
- water quality	Low		7
- riparian condition/stream length impacted	Low		7
Other Mining	***Low***		7
- extent	Low		7
- water quality	Low		7

Watershed:	*Ptarmigan Creek*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Industrial Development	***Low***		7
- extent	Low	CN rail quarry	7
- water quality	Low		7
- stream/riparian impacts	Low	Creek diverted to prevent flooding of facilities	7
Linear Development	***Low***		7
- extent	Low	Logging roads, CNR and Highway 16 rights-of-way and stream crossings	7
- stream/riparian impacts	Low		7
Hydro Development	***High***	Robson Valley Power Corporation (RVPC)	7
- extent	Low	Run-of-the-river small hydro plant at falls 4.5 km upstream of mouth.	12
- stream/riparian impacts	High	Channel diversion and re-engineering	7
Other Development	***Low***		7
- extent	Low		7
- stream/riparian impacts	Low		7

CUMULATIVE DEVELOPMENT ACTIVITY:

Cumulative Development	***Low***		7

* See report section 6.0 References Cited

Watershed:	*Ptarmigan Creek*

BIOPHYSICAL CONDITIONS:

Type	Level of Concern	Comments	Ref.*
Soils	***High***		7
- types		Localized lacustrine deposits, glacial till, alluvium	7, 12
Terrain	***High***		7
- type		Upper reaches - Cariboo Mountains (rugged) Lower reaches - gentle terrain	7, 12
Resistance to Change	***High***	High sediment delivery during fall and spring rainstorms, flashy	12
Hydrology	***High***	Low winter and summer flow, flashy	12
Channel Stability	***High***	Unstable in lower reaches	7
- type			
Significant Environmental Variables	***High***	High sediment levels in lower reaches	7

SENSITIVE WATERSHED FEATURES:

Type	Present	Comments	Ref.*
Sensitive Physical Features	✓	High suspended sediment load	7
Sensitive Biological Features			
Unique Features			

* See report section 6.0 References Cited

Watershed:	*Ptarmigan Creek*

SPECIAL CONSIDERATIONS:

Type	Present	Comments	Ref.*
Stock Management	✓		
Enhancement Activity/Opportunity	✓	Rearing and spawning channels and tailrace gravel installed downstream of small hydro plant by owners	12
Restoration Activity			
Native Fishery	✓	Occurs in Fraser River	7
Recreational Fishery	✓	Ocean sport fishery	
Commercial Fishery	✓	Ocean fishery	

RECENT WATERSHED PLANNING/PROJECT INITIATIVES:

Type	Comments	Ref.*
	None	

* See report section 6.0 References Cited

SUMMARY OF HABITAT CONCERNS (no. of high ratings):

Salmon Present	Development Concerns	Biophysical Concerns	Sensitive Watershed Features	Special Considerations
✓	✓(1)	✓(6)	✓	✓(5)

Watershed:	*Ptarmigan Creek*

SPECIFIC OBJECTIVES AND STRATEGIES:

Specific Objectives	Specific Strategies
• Maintain natural watershed hydrologic characteristics and stream flow regime. • Maintain the natural stream temperature regime. • Maintain the structural and functional integrity of riparian areas. • Maintain slope stability. • Maintain or improve water quality. • Protect stream channels and floodplains from influences of development activities. • Ensure the protection of headwater, ephemeral and intermittent channels; recognizing their influence on watershed stability, hydrology and water quality. • Ensure protection of critical aquatic habitats including: floodplain, off-channel sites, non-natal tributaries and other areas of biological significance. • Ensure that the intensity of development activities does not negatively impact the natural watershed ecological processes through site specific or cumulative development. • Ensure the inventory, assessment and implementation of stream restoration and enhancement programs. • Improve inventories of aquatic resources. • Support existing fisheries enhancement programs and activities. • Improve fish passage in the watershed.	• Conduct detailed stream channel stability assessment. • Conduct and maintain fisheries, habitat (critical) and enhancement inventories. • Conduct detailed gully assessments for specified sensitive channels identified in development plans. • Design high elevation forest cutblocks to optimize snow accumulation and retention similar to unharvested or undisturbed areas. • Develop Access Management Plans (AMP) for review and direction. • Develop a detailed riparian management plan (RMP) for the Ptarmigan Creek watershed identifying areas requiring site specific prescriptions. • Develop a riparian management plan to protect and restore stream habitat in cooperation with agricultural and ranching communities. • Distribute timber harvesting opportunities throughout the available range in elevation to maintain natural hydrologic conditions. • Document, map and assess watershed terrain and soils conditions and their hazard risk. • Ensure that rate of development (forestry, urban, agriculture, etc.) is balanced against hydrologic recovery to maintain cumulative ECA at or below 25% (total watershed drainage area).

Watershed:	*Ptarmigan Creek*

SPECIFIC OBJECTIVES AND STRATEGIES (continued):

Specific Objectives	Specific Strategies
	• Maintain designated "NO STAKING PLACER RESERVES" for placer mining where identified. • Implement a water drainage management plan for sensitive soils, stream crossings or other areas specified in development plans. • Initiate a watershed restoration assessment and inventory for development of a Watershed Restoration Plan. • Implement watershed restoration plan recommendations from assessment and inventory reports. • Initiate restoration, revegetation and stabilization measures on linear developments. • Provide Streamside Management Plans (SMP) for harvesting areas identified in the annual forest development plan update. • Restrict or control development within or along tributary confluences, alluvial fans, floodplains or areas of slope instability (e.g. valley walls). • Retain riparian reserves along specified S4-S6 (FPC riparian class) stream channel reaches in high sensitivity areas or channels identified as having stream temperature concerns. • Review and document potential habitat improvement, habitat development and habitat restoration opportunities. • Review resource development plans for compatibility with sensitive habitats in terms of hydrology, water quality, channel stability and riparian condition.

APPENDIX 13. Watershed Profile for the Torpy River Watershed Planning Unit

Streams located within the Torpy River Watershed Planning Unit include:

GENERAL WATERSHED INFORMATION:

Watershed:	***Torpy River***	**SISS Code:**	00-6700
Physiographic Area(s):	Rocky Mountain Trench/McGregor Plateau/ Park Ranges		
Drainage Area (ha):	128,500	**Biogeoclimatic Zone(s):**	Sub-Boreal Spruce/ Engelmann Spruce-Subalpine Fir/ Interior Cedar-Hemlock
HMA:	Upper Fraser		

WATERSHED HYDROLOGY:

Stream Flows:	Mean Annual	Mean Flood	Mean 7-day low flow			
			Winter		Summer	
(m^3/s)	53.7	291.4	3.65	NA	11.13	NA
Comments:	Reference for above data is the stream mouth. See Reference # 12, p. 12, Table 7 and Appendix B.					

SALMON ESCAPEMENT:

Species	**Historical Max. (yr)**	**1981-92 Ave.**	**1981-92 Max.**	**1969-80 Ave.**	**Population trend**	**Rebuilding potential**
Chinook	4,000 (NA)	2,136	4,000	672	Increasing	Medium

NB. The above numbers include escapement to the tributaries Walker and West Torpy creeks.

DEVELOPMENT ACTIVITY:

Type	**Level of Concern**	**Comments**	**Ref.***
Forestry	***High***	Extensive harvesting proposed in upper valley, Hemlock looper infestation in lower valley	7
-percent logging	High	9% on average, more than 20% on mainstem, 30% in Upper Torpy River watershed	7, 12
- ECA status	High	Extensive harvesting in lower valley especially along floodplain below Pass Lake	7
- riparian condition/stream length impacted	High	Extensive impacts from forestry	7, 12, 3

Watershed:	*Torpy River*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Agriculture	***Low***		7
- extent	Low	None	7
- riparian condition/stream length impacted	Low		7
- water withdrawal	Low		7
- water quality	Low		7
Urbanization	***Low***		7
- population level	Low		7
- extent	Low	None	7
- riparian condition/stream length impacted	Low		7
- water withdrawal	Low		7
- water quality	Low		7
Placer Mining	***Low***		7
- extent	Low	None	7
- water quality	Low		7
- riparian condition/stream length impacted	Low		7
Other Mining	***Low***		7
- extent	Low	None	7
- water quality	Low		7

Watershed:	*Torpy River*

DEVELOPMENT ACTIVITY (continued):

Type	Level of Concern	Comments	Ref.*
Industrial Development	***Low***		7
- extent	Low	None	7
- water quality	Low		7
- stream/riparian impacts	Low		7
Linear Development	***High***		7
- extent	High	Extensive logging roads and crossings	7
- stream/riparian impacts	High	Localized	7
Hydro Development	***Low***		7
- extent	Low	None	7
- stream/riparian impacts	Low		7
Other Development	***Low***		7
- extent	Low	None	7
- stream/riparian impacts	Low		7

CUMULATIVE DEVELOPMENT ACTIVITY:

Cumulative Development	***High***	Substantial past harvest and more planned; Salvage planned to combat severe hemlock looper infestation.	7

* See report section 6.0 References Cited

Watershed:	*Torpy River*

BIOPHYSICAL CONDITIONS:

Type	Level of Concern	Comments	Ref.*
Soils	***High***	Elevated suspended sediment load, siltation of spawning areas	7, 12
- types		Lacustrine sediments in benches along main valley	12
Terrain	***High***	Slope failure in upper basin, e.g. in 1994	7, 12
- type		Lower mainstem is in a broad floodplain and upper mainstem steep and confined in valley walls	12
Resistance to Change	***High***	Low flows/high sediment input, lacustrine valley bottom	7
Hydrology	***High***	Low flows in summer and winter	7
Channel Stability	***High***		7
- type		Wide floodplain, meanders in lower valley, unstable banks	7
Significant Environmental Variables	***High***	High suspended sediment levels	7

SENSITIVE WATERSHED FEATURES:

Type	Present	Comments	Ref.*
Sensitive Physical Features	✓	Lacustrine deposits	7
Sensitive Biological Features	✓	Chinook rearing in tributaries	7
Unique Features			

* See report section 6.0 References Cited

Watershed:	*Torpy River*

SPECIAL CONSIDERATIONS:

Type	Present	Comments	Ref.*
Stock Management	✓		
Enhancement Activity/Opportunity	✓	Removal of impassible falls above Pass Lake (approx. 63 km upstream of mouth) would provide access to excellent spawning areas in upper reaches	12
Restoration Activity			
Native Fishery	✓	Occurs in Fraser River	7
Recreational Fishery	✓	Ocean sport fishery	
Commercial Fishery	✓	Ocean fishery	

RECENT WATERSHED PLANNING/PROJECT INITIATIVES:

Type	Comments	Ref.*
ROC	Rate of Cut review done	7
TRP	Total Resource Plan underway - Joint report (MoF/CFS) on extent of insect infestation	7
Research	Proposed for upper Fraser watershed synoptic-level joint (MoF, MoELP, DFO, University of Northern British Columbia [UNBC]) fishery/forestry interactions research program. A UNBC initiative.	7

* See report section 6.0 References Cited

SUMMARY OF HABITAT CONCERNS (no. of high ratings):

Salmon Present	Development Concerns	Biophysical Concerns	Sensitive Watershed Features	Special Considerations
✓	✓(3)	✓(6)	✓(2)	✓(5)

Watershed:	*Torpy River*

SPECIFIC OBJECTIVES AND STRATEGIES:

Specific Objectives	Specific Strategies
• Maintain natural watershed hydrologic characteristics and stream flow regime. • Maintain the natural stream temperature regime. • Maintain the structural and functional integrity of riparian areas. • Maintain slope stability. • Maintain or improve water quality. • Protect stream channels and floodplains from influences of development activities. • Ensure the protection of headwater, ephemeral and intermittent channels; recognizing their influence on watershed stability, hydrology and water quality. • Ensure protection of critical aquatic habitats including: floodplain, off-channel sites, non-natal tributaries and other areas of biological significance. • Ensure that the intensity of development activities does not negatively impact the natural watershed ecological processes through site specific or cumulative development. • Ensure the inventory, assessment and implementation of stream restoration and enhancement programs. • Improve inventories of aquatic resources. • Improve fish passage in the watershed.	• Apply the Watershed Assessment Procedures (WAP) to assess past and potential for future impacts of lands use activities(underway). • Conduct detailed stream channel stability assessment. • Conduct a stream channel assessment to identify potential barriers to fish migration and remove or facilitate access where appropriate. • Conduct and maintain fisheries, habitat (critical) and enhancement inventories. • Conduct detailed gully assessments for specified sensitive channels identified in development plans. • Design high elevation forest cutblocks to optimize snow accumulation and retention similar to unharvested or undisturbed areas. • Develop Access Management Plans (AMP) for review and direction. • Develop a detailed riparian management plan (RMP) for the Torpy River watershed identifying areas requiring site specific prescriptions . • Develop a Water Management Plan (WMP) that includes a determination of water demand, fisheries/ minimum low flow of water storage opportunities and potential impacts of water extraction. • Distribute timber harvesting opportunities throughout the available range in elevation to maintain natural hydrologic conditions. • Document, map and assess watershed terrain and soils conditions and their hazard risk. • Ensure that rate of development (forestry, urban, agriculture, etc.) is balanced against hydrologic recovery to maintain cumulative ECA at or below 25% (total watershed drainage area).

Watershed:	*Torpy River*

SPECIFIC OBJECTIVES AND STRATEGIES (continued):

Specific Objectives	Specific Strategies
	• Maintain designated "NO STAKING PLACER RESERVES" for placer mining where identified. • Implement a water drainage management plan for sensitive soils, stream crossings or other areas specified in development plans. • Initiate a watershed restoration assessment and inventory for development of a Watershed Restoration Plan. • Implement watershed restoration plan recommendations from assessment and inventory reports. • Provide Streamside Management Plans (SMP) for harvesting areas identified in the annual forest development plan update. • Restrict or control development within or along tributary confluences, alluvial fans, floodplains or areas of slope instability (e.g. valley walls). • Retain riparian reserves along specified S4-S6 (FPC riparian class) stream channel reaches in high sensitivity areas or channels identified as having stream temperature concerns. • Review and document potential habitat improvement, habitat development and habitat restoration opportunities. • Review resource development plans for compatibility with sensitive habitats in terms of hydrology, water quality, channel stability and riparian condition.

APPENDIX 14. List of Relevant Environmental Guidelines *

1. Environmental Guidelines for Beef Producers in British Columbia. B.C. Ministry of Agriculture, Fisheries and Food, B.C. Association of Cattle Feeders, B.C. Cattlemen's Association, and B.C. Federation of Agriculture. 1992.

2. Why Keep Livestock out of Watercourses? B.C. Ministry of Agriculture, Fisheries and Food. 1990.

3. Placer Mining Regulations and Guidelines for the Protection of Fisheries Resources in British Columbia. Department of Fisheries and Oceans. 1982.

4. Guide to Legislation and Approvals in Placer Mining. Ministry of Energy, Mines and Petroleum Resources. 1986.

5. Guidelines for Mineral Exploration: Environmental, Reclamation and Approval Requirements. Ministry of Energy, Mines and Petroleum Resources. 1992.

6. Environmental Objectives and Procedures for Water Crossings. B.C. Ministry of Environment. 1984.

7. Culvert Guidelines: Recommendations for the Design and Installation of Culverts in British Columbia to Avoid Conflict with Anadromous Fish. Department of Fisheries and Oceans. 1978.

8. Fact Sheets Prepared for B.C. Ministry of Transportation and Highways - Seminars on Highway Maintenance. Ministry of Transportation and Highways. 1989.

9. Guidelines for the Protection of Fish and Fish Habitat During Bridge Maintenance Operations in British Columbia. Department of Fisheries and Oceans. 1991.

10. Guidelines for the use of Explosives in Canadian Fisheries Waters. Department of Fisheries and Oceans. 1994 (Draft).

11. Land Development Guidelines for the Protection of Aquatic Habitat. Department of Fisheries and Oceans and Ministry of Environment, Lands and Parks. 1993.

12. A Handbook for Fish Habitat Protection on Forest Lands in B.C. Department of Fisheries and Oceans. 1981.

13. A Handbook for Forest Roadside Erosion Control in B.C. Ministry of Forests. 1980.

14. Guidelines for the Protection of Fish and Fish Habitat at Small Hydro Developments. Triton Environmental Consultants Ltd. for Department of Fisheries and Oceans. 1991.

15. A Guide for Management of Landslide-Prone Terrain in the Pacific Northwest. Ministry of Forests. 1991.

16. Forest Practices Code of B.C. Act, Regulations, Standards and Guidebooks. Ministry of Forests. 1995.

17. Stream Stewardship. A guide for planners and developers. Department of Fisheries and Oceans and Ministry of Environment, Lands and Parks. 1993.

* Please Note: This is not intended to be an exhaustive list. However, it highlights the principal operational and habitat protection guidelines presently in use.