

639.977
B934
2001
c.1

Healthy Watersheds, Healthy Communities:
Bulkley-Morice Salmonid Preservation Group
Draft Strategic Plan – Phase 1

Prepared by:

Greg Tamblyn

Bulkley-Morice Watershed Stewardship Coordinator

&

Brenda Donas, Fisheries and Oceans Community Advisor, Smithers

July 2001.

Property of the
Bulkley-Morice
Watershed Library

639.977/B934

2001

1

“If you don’t know where you are going, any road will take you there.”
Lewis Carroll, Alice in Wonderland.

ACKNOWLEDGEMENTS

This plan is the result of the hard work of individuals who care about the health of the Bulkley River watershed and made efforts to attend meetings over four months to discuss the key fisheries related issues in the Bulkley River watershed and how they should be addressed. A diverse range of people participated in the planning process: landowners, consultants, First Nations, community group members, and provincial and federal government staff. Thanks to Jana Makar of the *Interior News* and Adam Patrick of CFBC (BVLN) Radio for their keen interest in the planning process and for “getting the word out” to residents of the Hazeltons, Smithers, Houston and Burns Lake. Thanks also to Johanna Pfalz of the Ministry of Sustainable Resource Management for preparing the map in this report.

Fisheries Renewal BC provided the funding for this project as part of its Long Term Planning and Capacity Building Program.

DATE DUE		

639.977/B934 2001
 Healthy Watersheds, Healthy Communities: Bulkley-
 Greg Tamblyn / Brenda Donas

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	I
TABLE OF CONTENTS	II
PREFACE	1
1.0 INTRODUCTION	1
1.1 THE BULKLEY WATERSHED – GENERAL OVERVIEW	1
1.1.1 <i>Physiography</i>	1
1.1.2 <i>Fish</i>	1
1.1.3 <i>Settlements</i>	3
1.1.4 <i>Industry and development</i>	3
1.1.5 <i>Water Use</i>	3
1.2 WHAT IS THE BULKLEY-MORICE SALMONID PRESERVATION GROUP?	4
1.3 WHY DEVELOP A STRATEGIC PLAN?	4
1.4 THE PLANNING PROCESS	5
1.5 LESSONS LEARNED	5
1.6 FUTURE PLANNING STEPS	6
2.0 STRATEGIC DIRECTION FOR THE BMSPG	6
3.0 WATERSHED ISSUES.....	8
ISSUE 1: LOSS OF FISH HABITAT IN STREAMS AND RIVERS.....	8
ISSUE 2: LOSS OF ACCESS TO HISTORICAL SPAWNING AND REARING AREAS.....	10
ISSUE 3: DECLINING SALMONID STOCKS	12
ISSUE 4: WATER QUANTITY.....	14
ISSUE 5: WATER QUALITY	15
ISSUE 6: LACK OF ADEQUATE RIPARIAN ZONES	17
ISSUE 7: LAND EROSION	19
ISSUE 8: CONTINUED OPERATION OF COMMUNITY-BASED FISH HATCHERIES.....	20
4.0 REFERENCES	22
APPENDIX A. PARTICIPANTS.....	23
APPENDIX B: BMSPG AND RELATED PROJECTS 1998 TO MARCH 2001	24
1. UPPER BULKLEY RIVER WATERSHED.....	24
2. BULKLEY RIVER AND TRIBUTARIES.....	28
3. MORICE RIVER AND TRIBUTARIES	36
APPENDIX C: BMSPG PROJECTS LISTED BY WATERSHED ISSUE.	37

PREFACE

This plan represents phase one of a larger planning process and will evolve in response to priority setting and monitoring.

1.0 INTRODUCTION

1.1 The Bulkley Watershed – General Overview

This overview provides a brief description of basic features of the Bulkley River watershed. It is by no means detailed or exhaustive. For more background information on communities, land and resource use, and the physical and biological landscape, see Demarchi (1996), Horn and Tamblyn (2000), Meidinger and Pojar (1991), MOF (1996), Remington (1996), Runka (1974), and Synergy Management Group (1999).

The Bulkley River watershed (460-000000), located in mid-northwestern British Columbia, is a significant tributary to the Skeena River (Figure 1). The Bulkley River and its primary tributary, the Morice River, drain a 12,155 km² (MELP 2001) transitional area from dry, cool, interior ecosystems in the east to generally wetter, milder coastal ecosystems in the west and north.

1.1.1 Physiography

Diverse geography characterizes the Bulkley watershed. The watershed spans four physiographic regions. The eastern headwaters arise from the rolling hills of the Nechako Plateau, the northwestern-most extension of the interior plateau. This plateau yields to the Kitimat Ranges of the Coast Mountains in the southwestern headwaters of the Morice River. The northern portion of the watershed is comprised of the two remaining physiographic regions: the Skeena Mountains on the east side of the Bulkley River downstream of the community of Telkwa, and the Hazelton Mountains (Bulkley Ranges), on the west side of the Bulkley River downstream of Telkwa, including the Telkwa River watershed.

1.1.2 Fish

The Bulkley watershed supports populations of economically, recreationally and culturally important fish species including: coho salmon (*Oncorhynchus kisutch*), chinook salmon (*O. tshawytsca*), pink salmon (*O. gorbuscha*), sockeye salmon and kokanee (*O. nerka*), steelhead and rainbow trout (*O. mykiss*), cutthroat trout (*O. clarki*), Dolly Varden char (*Salvelinus malma*), bull trout (*S. confluentus*), lake trout (*S. namaycush*), burbot (*Lota lota*), lake whitefish (*Coregonus clupeaformis*) and mountain whitefish (*Prosopium williamsoni*) (MELP 2000). The watershed also sustains many other fish species including sculpins, minnows (e.g. dace, shiners, lake chub, squawfish), suckers, and lamprey.

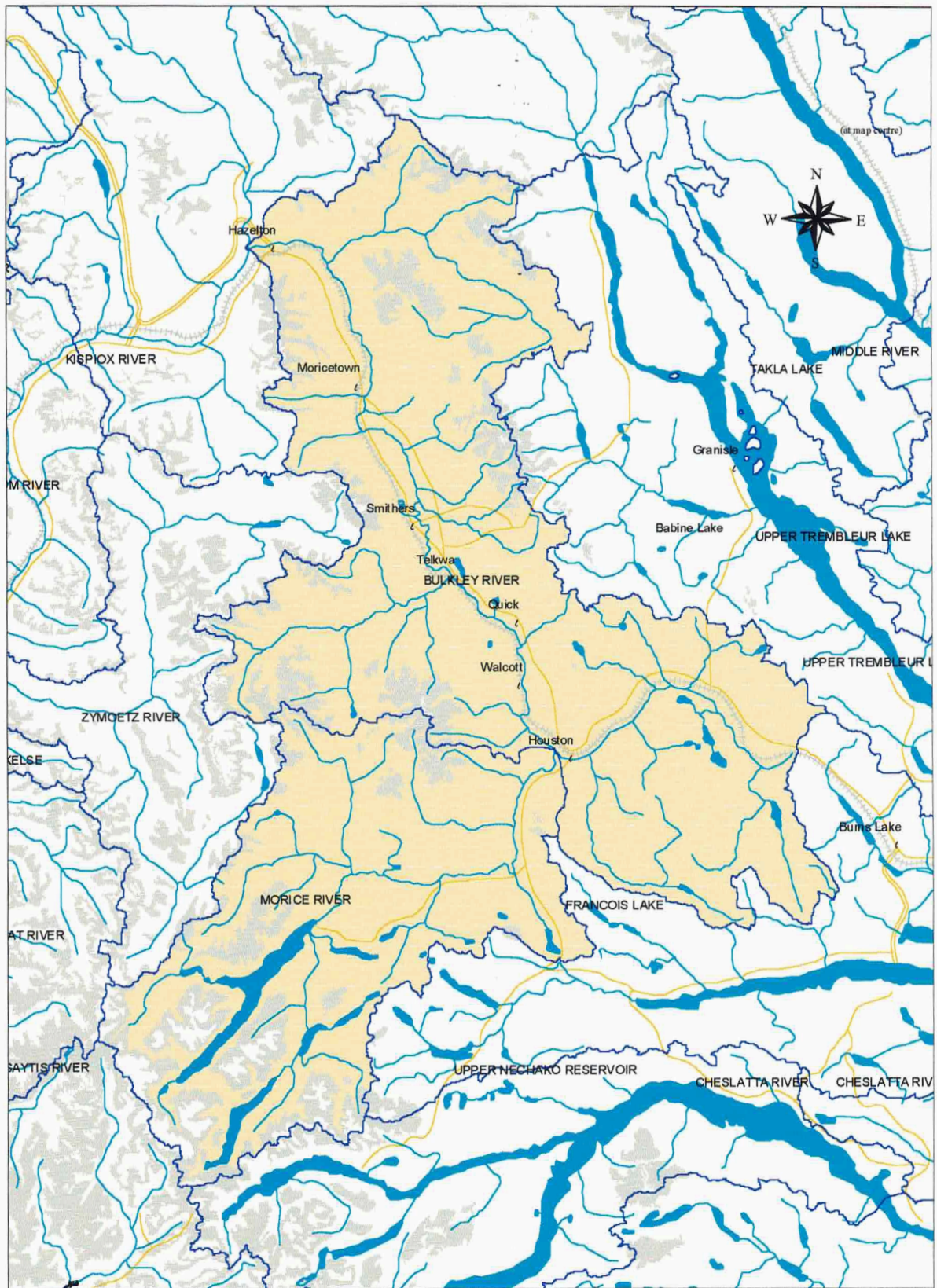


Figure 1: Map of the Bulkley Watershed (in yellow).

1.1.3 Settlements

Prior to the settlement of British Columbia by Europeans, First Nations lived throughout the plan area. Most of the Bulkley watershed is within the traditional territory of the Wet'suwet'en Hereditary Chiefs. Gitksan traditional territory overlaps with the lower end of the watershed near Hazelton. The traditional territory of the Wet'suwet'en First Nation (based in Burns Lake) coincides with that of the Wet'suwet'en Hereditary Chiefs in the extreme east of the Bulkley watershed and in the areas of Owen Lake (Morice watershed) and Nadina River (Nechako watershed). The Lake Babine Nation claims the Babine Lake watershed to the east of the Bulkley as their territory.

Current human settlement is concentrated in the Bulkley Valley. Furthest east, along the upper Bulkley River, are the unincorporated areas of Topley and Perow, and the District of Houston. The rural community of Quick, the Village of Telkwa, the Town of Smithers and the Village of Moricetown are located in the middle and lower portions of the watershed. Finally, the Hazeltons are clustered around the mouth of the Bulkley River. Ranches and homesteads are found throughout the valley.

1.1.4 Industry and development

Forestry, agriculture, mining and tourism are the dominant industries within the planning area.

- Forestry is the overwhelming land use over the landscape. Sawmills are located in Houston, Smithers, and the Hazelton area, and also to the east of the watershed in Decker Lake and Burns Lake. Several, generally smaller, value-added manufacturing facilities are found in several communities in the watershed.
- The Bulkley Valley has the highest agricultural potential in the northwest quarter of British Columbia (Remington 1996). Forage, beef and dairy production dominate the low-lying valley bottoms. Access to crown rangeland is vital to the success of the ranching industry.
- Mining has historically been important throughout the watershed. Much of the area has high to very high metallic mineralization. Equity Silver Mine, closed in 1992 (Remington 1996), was the largest mine to have operated in the planning area. Huckleberry Mine, located 86 kilometres southwest of Houston is south of the Bulkley watershed. A coal mine is proposed near Telkwa.
- Tourism activity tends to be seasonal, and is concentrated between May and October (Horn & Tamblyn 2000). Tourists are attracted by the outdoor opportunities available in the watershed. For destination tourists, hunting and fishing are the two largest draws. However, a large part of the tourism trade is highway traffic passing along Highway 16, the main road corridor through the watershed. In the winter, skiing and snowmobiling also attract visitors.

Linear developments in the planning area include roads, rail lines, power lines and natural gas lines.

1.1.5 Water Use

Surface water use within the plan area is primarily agricultural (irrigation, stock watering), municipal (e.g. Moricetown, the Village of Telkwa, and the District of New Hazelton) and domestic (household water supplies). Houston's water supply is sourced in shallow wells next to the Bulkley River and is influenced by water levels in the river. Smithers obtains its water from wells in aquifers not associated with the Bulkley River.

1.2 What is the Bulkley-Morice Salmonid Preservation Group?

The Bulkley-Morice Salmonid Preservation Group (BMSPG) is the delivery partner for Fisheries Renewal BC (FsRBC) funding in the Bulkley watershed¹. It is an umbrella group consisting of representatives from First Nations and non-profit community organizations concerned about fish stocks and the health of the watershed. The group is administered by Community Futures Development Corporation of Nadina (CFDC Nadina), a community economic development organization based in Houston, BC.

Funding decisions are made in a comparative (scoring and ranking) fashion among a suite of proposals that are submitted at predetermined dates throughout the year. Proposals must fall within an eligible project category, and must meet submission criteria laid out in the Terms of Reference/Operating Procedures for the BMSPG. Prior to scoring and ranking by the BMSPG, proposals are reviewed by a Technical Review Committee consisting of two consultants and six representatives from government agencies. The administrative structure of the partner group allows significant economy of effort and resources for the proponents, and the consensus-based decision-making process builds trust and allows dialogue among diverse participants.

The BMSPG, formed in 1998, is currently examining its role in the community, with the intention of expanding beyond a funding allocating body. This plan outlines strategies to allow the BMSPG to work more closely with government agencies and to become more proactive in resource decision-making.

1.3 Why Develop a Strategic Plan?

Over the past three years, funds allocated by the BMSPG have financed approximately 50 local stewardship, education, restoration, assessment and enhancement projects (see Appendix B). Eligible project categories based on the group's missions and goals are outlined in its Terms of Reference / Operating Procedures (Anon 1999). The motivation for many of these projects has been perceived need by local community groups and First Nations. Looking toward the future, the group realized that its efforts could be more effectively focused with a plan that set specific goals and objectives for identified watershed issues and outlined priorities for action. Thus, on behalf of the BMSPG, CFDC Nadina secured funding from FsRBC's Long Term Planning and Capacity Building Program to start a strategic planning process.

Objectives of the planning process:

1. Define a desired end-state for the partner group's efforts.
2. Assess the potential and limitations of the partner group in influencing the renewal of salmonid stocks, the Bulkley-Morice watershed, and communities therein.
3. Determine key watershed issues within the Bulkley-Morice watershed
4. Determine goals, objectives and strategies to address each key issue.
5. Set priorities to guide future funding allocation within the watershed.
6. Develop indicators to track effectiveness in reaching a desired end-state.

¹ The BMSPG's area also covers part of the Babine Lake watershed.

The BMSPG Strategic Plan, as outlined in this document, addresses the first four objectives. Objectives five and six are part of a broader planning effort for the Bulkley watershed.

1.4 The Planning Process

The bulk of the plan was developed over a four-month period between October 2000 and February 2001. Seven half-day public planning sessions, attracting 25 participants, were held in Smithers. An initial meeting was also held in Houston to identify watershed issues in that area. Participants included consultants, government staff, general members of the public and representatives from community groups interested in watershed health issues (Appendix A).

The key steps in the process were:

- 1) inviting public and government representatives;
- 2) developing a vision;
- 3) identifying key watershed issues;
- 4) prioritizing issues (not accomplished in allotted time frame);
- 5) drafting goals, objectives and strategies for each issue; and
- 6) writing the planning document.

This plan is a component of a larger planning process in which priority watersheds will be determined and an implementation and monitoring strategy will be developed. See section 1.6 for more details.

1.5 Lessons Learned

The benefits of the BMSPG strategic planning process extend beyond setting goals, objectives and strategies relating to fish and watershed health. The process resulted in a(n):

- discussion of important watershed issues;
- renewed sense of the interrelated nature of upland land use, in-stream processes, water quality, fish and fish habitat;
- greater understanding and clarification of the role of the BMSPG by government staff, the public and members of the BMSPG;
- increased dialogue among government regulators and community groups concerned with current management of fisheries and aquatic resources;
- greater understanding of the reasons for planning by BMSPG members;
- understanding of the importance of a strategic plan when applying to various agencies/programs for funding and in expending funds where they are needed most;
- discussion on how to improve the function of the BMSPG; desire exists to revise the groups Terms of Reference and Operating Procedures;
- more informed and directed discussion during proposal review; and
- recognition that the current plan is only one component of a larger planning process.

Lessons learned during this planning process are common to most planning processes:

- a well-designed planning process is integral to a successful plan;
- a public planning process must be open and inclusive; such a process takes considerable time and effort; attempts to fast track the process may lead to an incomplete plan, or one that cannot be implemented;

- government regulators need to be involved with the process;
- large watersheds should be subdivided in order to set priorities.

1.6 Future planning steps

The initial phase of the BMSPG strategic plan sets a foundation from which to address the key issues of the Bulkley watershed. However, several steps are required to realize the full benefits of the plan:

- developing a watershed profile summarizing the state of resources and the environment in the watershed;
- prioritizing sub-watersheds for protection, restoration or enhancement;
- prioritizing issues within each sub-watershed;
- developing an implementation plan;
- monitoring objectives and goals based on indicators; and
- reviewing the plan on a consistent basis.

CFDC Nadina plans to progress through these steps via a Watershed-based Fish Sustainability Planning (WFSP) process for the Bulkley-Morice watershed. Watershed-based Fish Sustainability Planning is a new approach to proactive management of fish stocks and fish habitat in British Columbia. "Its overall goal is to ensure effective long-term conservation of fish and fish habitat...." (Fraser 2001).

Adopting a WFSP framework has several advantages:

- 1) It is adaptable to local conditions, and at the same time, the associated guidebook will promote consistency in watershed plans across the province. In fact the existing BMSPG strategic plan outlined in this document can be integrated into the new process.
- 2) It requires the development of a watershed profile that outlines the current state of resources and the environment in the watershed.
- 3) It is sanctioned by both the provincial and federal governments, opening opportunities for government support during the planning and implementation phases of the project.

2.0 STRATEGIC DIRECTION FOR THE BMSPG

This strategic plan is a framework to be used by a wide range of organizations to promote fish sustainability through protection, restoration and enhancement of the aquatic ecosystem. The vision "Healthy Watersheds, Healthy Communities" sets the stage to move beyond fish and fish habitat as distinct entities to consider entire ecosystems. Healthy wild fish populations and fish habitat are dependent on sufficient quantities of clean water and functioning riparian and upland ecosystems. Indeed, the connected nature of watershed issues results in some goals of the plan sharing objectives and strategies.

Education and awareness are the foundations of healthy watersheds. Most people do not understand, or do not think often enough about the link between their actions and declines in fish populations. Through education and experience, awareness levels will rise, leading to actions that respect the health of rivers, at least with a portion of the population:

Education + awareness → attitude change → behaviour change = stewardship.

Strategies in this plan suggest increasing general knowledge about the watershed through researching, assessing and monitoring. In turn, this knowledge can be used to direct resource management decisions and promote protection and conservation of resources. The plan also recognizes the need to work with the public and industry to increase awareness of the values of clean water and fish habitat. The BMSPG has had a history of supporting projects that increase the knowledge of the watershed including salmon stock assessments, fish habitat and stream channel assessments, fish overwintering habitat studies, water quality assessments, and the development of an index of biological integrity using stream insects. Reports resulting from these studies (See Appendix B and C) and other relevant projects are housed in the Bulkley-Morice watershed library, located at the CFDC of Nadina office in Houston, BC.

The BMSPG understands that protection of habitat and existing wild fish stocks is a priority over rehabilitation, restoration or enhancement. Hence, the plan includes a number of goals, objectives and strategies associated with changing attitudes and resource use practices. In the long-run, resource protection is more successful in ensuring a healthy watershed and less expensive both financially and socially than trying to rehabilitate wild systems following damage. This plan also recognizes that artificial stock enhancement should supplement, but not replace, protection and rehabilitation activities.

The BMSPG strategic plan proposes to extend the mandate of the BMSPG beyond allocating FsRBC funding. Strategies within the plan require the group to play a more interactive and cooperative role with government agencies, First Nations, corporations and landowners in an attempt to improve communication and become more active in resource decision-making and policy formulation. For example, the group may encourage the formation of a multi-interest round table to create fishing plans by watershed or house territory.

3.0 WATERSHED ISSUES

This section of the plan lists goals, objectives and strategies associated with each of the eight watershed issues identified during the planning process. Goals are generally worded statements that describe a desired end state for the watershed. Objectives indicate what is to be done to accomplish each goal. Strategies are actions required to achieve objectives. Together, these goals, objectives and strategies form the heart of the plan and will help provide direction to the BMSPG to work toward “Healthy Watersheds, Healthy Communities.”

Issue 1: Loss of Fish Habitat in Streams and Rivers

Development and settlement within the Bulkley watershed has impacted large areas of fish habitat. As a result, species compositions have shifted in some areas and numbers of salmonids the watershed can sustain have diminished. Indeed, loss of habitat is widely considered to be one of the contributing factors to poor salmon returns in some regions of the Bulkley watershed.

Fish habitat is simply those areas of a water system that fish need to live – to spawn, to feed, to rear and to over-winter. The river channel, the stream bottom, the riparian zone and water itself are components of that habitat. For fish to survive and flourish, water quality parameters must be within specific ranges. In rivers and streams, water must be flowing and of sufficient depth to ensure that water is oxygenated, metabolic bi-products are removed, and fish have access to spawning and rearing grounds. All fish require slightly different habitat features. Salmonids (salmon, trout, char and whitefish) generally require cool, clean, and well-oxygenated water. Salmonids also need habitat features including pools, riffles and glides; cover from cutbanks, woody debris or overhanging vegetation; and gravel and cobble on the stream bottom.

A vegetative strip along the stream banks, called a riparian zone, is another vital component of fish habitat. It provides temperature regulation, streambank stabilization, runoff filtration, woody debris recruitment, food for stream insects and food for fish. A healthy riparian area also acts as sponge, helping to reduce the severity of high energy, high water events at times of snow melt or heavy precipitation. Vegetation also provides a natural biological filter that helps remove excess nutrients and other inputs that may be harmful to fish and fish habitat.

Loss of one or more of these fish habitat components impacts the productivity of fish stocks.

Goal 1-1: Prevent additional loss of habitat used or potentially used by fish.

Objectives:	Strategies:
<i>Maintain or protect in-stream habitat features required by salmonids.</i>	<ul style="list-style-type: none"> • Create a baseline inventory of habitat features in priority sub-watersheds and monitor over time. • Stabilize river and stream banks where fish habitat may benefit, emphasizing techniques that benefit fish and do not negatively impact downstream users. • Protect or rehabilitate the riparian zone – see Goals 6-1 & 6-2. • Encourage best management practices for land use adjacent to streams including linear corridor (i.e. rail lines, roads, power lines and gas lines) agricultural and forest practices. • Encourage stewardship groups to monitor activities in the watershed and to help determine the effects of these activities.
<i>Maintain or improve the function of riparian zones along all streams in the Bulkley Watershed.</i>	<ul style="list-style-type: none"> • On private land - educate landowners and developers about the value of riparian corridors and the connection between land use practices. Distribute and promote the Land Development Guidelines. • Work with the local agricultural community to develop creative methods to discourage cattle movement in and along streams and to adopt environmental best management practices. • Promote best management practices with contractors, corporations and government agencies responsible for linear corridors. • Raise awareness that a riparian zone is a corridor that includes streamside vegetation AND the stream itself. • Replant degraded riparian zones with vegetation natural to that streamside ecosystem. Use some of these sites as demonstration sites for educational purposes. • Promote and assist in developing and implementing riparian silvicultural programs in forest development planning.

Goal 1-2: Increase fish habitat in streams and rivers within the Bulkley watershed.

Objectives:	Strategies:
<i>Maintain or improve the function of riparian zones along all streams in the Bulkley Watershed.</i>	<ul style="list-style-type: none"> • Rehabilitate / restore riparian vegetation using active or passive methods where appropriate. • See strategies under Goal 1-1 “Prevent additional loss of habitat used or potentially used by fish.”
<i>Maintain or increase water flows to allow sufficient water quantities for fish throughout the year.</i>	<ul style="list-style-type: none"> • Work with the Water Management Branch to determine which streams have recognized flow concerns and work to ensure flows are sufficient to sustain or increase fish populations. • Monitor water withdrawals and assess effects of withdrawal on water flows and ultimately, on fish. • Encourage the appropriate government agency (Water Management Branch of the Ministry of Sustainable Resource Management) to amend the water use approval process.
<i>Increase spawning habitat where it is limiting to species of concern.</i>	<ul style="list-style-type: none"> • Place structures in the river that will naturally create spawning habitat (e.g. large woody debris and riffle structures). • In systems with limited natural gravel recruitment, consider placing spawning substrate into creek if natural hydrological processes can keep the gravel clean and if the substrate will remain stable within the system.
<i>Increase the complexity of overwintering and rearing habitat where it is limiting to species of concern.</i>	<ul style="list-style-type: none"> • Install simple in-stream structures, including riffles. (cabling and epoxy methods are decreasing in popularity because they work against the natural patterns of the river and have a short life span). • Develop off-channel habitat for coho salmon juveniles where conditions are appropriate.

Issue 2: Loss of access to historical spawning and rearing areas

Land use and development in the Bulkley watershed has restricted access to streams or sections of streams salmonids have historically used for spawning and rearing. Culvert installation without consideration for fish passage and rail line construction blocking access to channels and oxbows are the most significant and obvious restrictions to fish migration. Beaver dams and changes in water flows also limit fish access to spawning and rearing grounds.

- Culverts:
 - Perched or hanging culverts create a height barrier to upstream fish migration.
 - Insufficiently sized culverts or culverts installed at too steep a slope cause water to flow at speeds fish cannot navigate, thus creating velocity barriers.
- Rail line construction: During construction of what is now the CN Rail line, many of the oxbows of the upper Bulkley River were cut-off from the main river channel. As a result, many kilometers of rearing habitat was rendered inaccessible to fish.
- Beaver Dams: Although once almost extinct, beaver populations have recovered since the days of the fur trade. Although beavers are found throughout the Bulkley watershed, forest

harvesting and land clearing along stream banks often promote the growth of shrubs and deciduous trees, the preferred foods of the beaver. With a stable food supply, beaver populations grow and more dams are built to provide suitable habitat. Beaver dams, although generally temporary or partial barriers, can restrict both adult and juvenile fish migration. On the other hand, beaver dams create good rearing and overwintering habitat for fish.

- Forestry and land clearing for agriculture may alter the sponge-like ability of the land to hold and slowly release water and may change water flow patterns. The result may be low water levels during fish migration, restricting fish access to spawning grounds or rearing habitat.

Goal 2-1: Improve fish access to historical spawning and rearing areas.

Objectives:	Strategies:
<i>Restore access to previously available habitat for historically occurring species.</i>	<ul style="list-style-type: none"> • Work with Fisheries and Oceans Canada and provincial resource ministries to identify and map stream crossings that impair fish passage, and to set priorities to restore fish access. This includes crossings on private land. • Gather information on alternative strategies and options for overcoming barriers to improve local knowledge base. • Encourage, and aid where possible, corporations and government agencies responsible for installing culverts to construct stream crossings to allow fish passage. • Implement beaver or beaver dam management strategies on Buck Creek, Bulkley River, Owen Creek, Kathlyn Creek and or other identified systems where beaver dams block access to spawning grounds. • Use adaptive management and monitor projects to continue to learn about what access management methods work and what do not.
<i>Improve knowledge of potential carrying capacity of the systems being considered for access works.</i>	<ul style="list-style-type: none"> • Identify the quality and quantity of the habitat upstream of an artificial barrier prior to carrying out access work.
<i>Prevent future works that could limit fish access.</i>	<ul style="list-style-type: none"> • Form partnerships among local groups, government agencies at all levels, forest companies and corporations responsible for linear corridors to reduce the number of stream crossings that block fish passage. • Increase education and awareness around activities that are not targeted in the referral process (i.e. fencing, private landowner activities)

Issue 3: Declining Salmonid Stocks

Many of the salmon stock populations within the Bulkley watershed have decreased significantly from historical levels. While the reasons for these declines vary by location, decreased numbers of fish can be attributed to a combination of the following factors:

- over-fishing;
- mixed-stock fisheries;
- loss and degradation of fresh water habitat;
- alterations to natural hydrological processes, which may affect water quality and /or water quantity; and
- ocean mortality due to shifts in climate regimes and water temperatures and
- marine pollution, development in estuaries and other human impacts on marine environments;

Over-fishing is a difficult issue to address with respect to coho and sockeye as these stocks are part of a mixed-stock fishery with the abundant Babine sockeye stock. In addition, Bulkley/Morice coho are subjected to high exploitation in Alaskan fisheries. For example, in 1997, the exploitation by the Alaskan fishery on Toboggan Creek coho, the Upper Skeena coho indicator stock, was 69.7% (Holtby and Finnegan 1997).

Degradation of fresh water habitat is the result of poor environmental practices in forestry, agriculture, mining, urban and rural residential development and the construction of transportation and utility corridors.

The fact that some salmonid stocks are declining is the underlying reason for the existence of the Bulkley Morice Salmonid Preservation Group. We cannot reverse past decisions; however, we can encourage future management decisions to protect wild fish populations and the ecosystems on which they rely.

Goal 3-1: Increase the survival success and overall numbers of fish in stocks that are identified as conservation concerns.

This goal assumes that fish stocks of concern have been identified by provincial and federal government agencies. Some possible stocks to consider are:

- Sockeye: Nanika River, Maxan River.
- Coho: upper Bulkley River, Owen Creek, Canyon Creek, McBride Creek, Deep Creek.

Objectives:	Strategies:
<i>Increase the functional integrity of habitat that is limiting to fish survival.</i>	<ul style="list-style-type: none"> • Rehabilitate habitat in sub-watersheds determined as priorities – see Goals 1-1 and 1-2. • Create new habitat / refuge areas.
<i>Maintain minimal target numbers of salmonids in key watersheds to avoid population collapse until stocks have recovered on their own.</i>	<ul style="list-style-type: none"> • Assist stocks of concern through hatcheries or other fish culture techniques without exceeding the carrying capacity of the system or displacing existing species. • Work with Fisheries and Oceans Canada to provide justifications to increase escapement numbers. • Conduct work that augments DFO’s stock assessment studies in priority watersheds. • Improve knowledge of potential carrying capacity for fish in the Bulkley watershed. • Determine whether habitat is being utilized to its fullest potential. • Educate the public and fishers living along the Skeena River or involved with the ocean fishery along the coast about the issues facing the habitat in the Bulkley Valley in order to increase awareness of difficulties faced by salmon in their spawning and rearing habitats. We could write columns and articles in newspapers.
<i>Minimize by-catch of weak anadromous fish stocks.</i>	<ul style="list-style-type: none"> • Work with government agencies to encourage terminal fisheries for all user groups in key locations in the lower Skeena River and Bulkley River. • Encourage use of selective fishing gear in the commercial and First Nations’ fisheries.

Comments: DFO is working to conserve coho stocks. Americans take 20-30% of coho harvest. Some of the reports funded by FsRBC may contribute to management decisions if they are scientifically and technically valid.

Goal 3-2: Maintain the natural genetic diversity of fish stocks found in the Bulkley watershed.

Genetic diversity increases a species' ability to survive in the face of disease or rapid environmental change. As numbers of fish within a stock decline, or a species is extirpated (locally extinct), the genetic blueprint for that population may be diminished or lost.

Genetic studies of fish within the Bulkley watershed are still in their infancy. We may have already lost genetically distinct stocks and may lose more before they are identified. Some evidence exists that the Bulkley may contain fewer genetically distinct stocks than formerly believed. For instance, evidence from Fisheries and Oceans studies suggests that upper Bulkley and Morice coho are genetically the same stock.

Objectives:	Strategies:
<i>See objectives for goal 3-1.</i>	<ul style="list-style-type: none"> • See strategies for goal 3-1.
<i>Increase understanding of genetic diversity within fish stocks.</i>	<ul style="list-style-type: none"> • Assist government agencies in clarifying the genetic make-up of fish stocks. • Incorporate the collection of baseline DNA samples into fisheries studies where recommended by Fisheries and Oceans Canada or Ministry of Water, Land and Air Protection.

Issue 4: Water Quantity

Water quantity can be referred to as water flow (discharge) and water level. Sufficient water flows and levels are required to allow upstream migration of spawners over shallow gravel bars and small cascades and waterfalls. Streams with low flows and water levels are also subject to extremes in water temperature, especially when riparian vegetation has been removed. During the warm summer months, low flows may lead to increased stream temperatures, which may stress or kill salmonids, or reduce reproductive success. Conversely, during harsh winter months in interior regions, low water flows and water levels lead to freezing which reduces available habitat.

The annual maximum flow for the Bulkley River normally occurs during May and June. Many of the smaller tributaries to the Bulkley River peak earlier than the mainstem. Although instantaneous peak discharges appear to be increasing in the Bulkley River, annual discharges are declining. Trends also indicate increasing atmospheric temperatures between April and September and a 7 to 10% decrease in precipitation between October and April in areas of the watershed (Brocklehurst 1998). These trends should be considered when water allocation decisions are made.

Goal 4-1: Ensure sufficient water is available to support historical populations of the natural range of fish species in the watershed.

Objectives:	Strategies:
<i>Maintain a natural hydrological flow regime.</i>	<ul style="list-style-type: none"> • Encourage riparian protection and rehabilitation. • Work with the Water Management Branch to determine which streams have recognized flow concerns and work to ensure flows are sufficient to sustain or increase fish populations. • Apply for a water license for conservation purposes. • Provide information to appropriate agencies to help them determine streams that could be deemed “sensitive streams” under Fish Protection Act or Section 14 of the Operational Planning Regulations of the Forest Practices Code. DFO and the Water Management Branch have recommended streams with water quality concerns – upper Bulkley tributaries. The provincial government is piloting the <i>Fish Protection Act</i> on some streams in the south of the province.) • Work with landowners to conserve water in priority watersheds. • Encourage hydrological models to be incorporated into forestry planning initiatives. • Monitor water withdrawals and assess effects of withdrawal on water flows.
<i>Promote adequate summer flows for fish in streams which have a tendency to dry-up.</i>	<ul style="list-style-type: none"> • See strategies for “<i>Maintain a natural hydrological flow regime</i>” • Identify streams (in conjunction with government agencies) which dry-up or have low water quantities which may harm fish populations. • If and where feasible, develop water retention / distribution facilities that store water during times of high flow and release to maintain flow throughout the year. Such a facility must not block fish passage and must also allow channel-maintaining flows. • Assess and monitor water withdrawals in priority watersheds and work with license holders and agencies to conserve water during critical times of the year.

Issue 5: Water Quality

Water quality includes physical, chemical and biological attributes of water. Water temperature, suspended sediment loads, nutrient levels, attached algae (periphyton) and pathogens are among the top water quality concerns in the Bulkley watershed. Water quality is affected by land use activities such as logging, road building, livestock grazing, residential storm water effluent, sewage treatment effluent, and run-off of manure and fertilizer. Elevated water temperature is often the result of the loss of shade when riparian vegetation is cleared. Suspended sediment can result from bank erosion and road run-off. Nutrient loading, increased plant growth and

pathogen transfer can result from wildlife feces, domestic sewage sources and agricultural run-off. Cumulatively, these impacts can damage fish and fish habitat directly through poisoning or smothering of eggs by sediment, or indirectly through modifications of insect communities or declines in dissolved oxygen due to decaying vegetation. The end result is a decline in fish survival.

Goal 5-1: Ensure water quality is optimal for fish production.

Objectives:	Strategies:
<i>Maintain, or in some cases, improve water quality in the Bulkley River and its tributaries to provincial or federal government guidelines for aquatic life.</i>	<ul style="list-style-type: none"> • Assist agencies with the collection of water quality to determine if standards for drinking water and aquatic life are met and to determine trends. • Improve public knowledge of local water quality through education. • Encourage best management practices to maintain good water quality, which benefits both agricultural producers and natural systems. • Monitor water quality using physical, chemical and biological methods. Involve the public in Streamkeepers programs or other water quality monitoring programs (e.g. Index of Biological Integrity – IBI) to increase the number of people monitoring local streams. • Provide material for use in municipal and regional district official community planning processes that outlines how water quality issues may be incorporated into bylaws as well as zoning and other planning classifications (e.g. Regional District of Fraser Fort George or District of North Vancouver). • Promote the use of development setbacks as outlined in the Land Development Guidelines in official community plans and in bylaws adopted by relevant regional districts.
<i>Reduce sources of sedimentation from roads and road building activities.</i>	<ul style="list-style-type: none"> • Identify priority non-paved road crossings and pave crossings to minimize sediment that washes into streams. • Monitor non-paved road crossings to determine if sediments are washing into creeks. • Monitor road maintenance and practices to determine sedimentation levels and work with the Ministry of Forests, Ministry of Transport and Highways, forest companies, the and private landowners to promote best management practices to minimize sedimentation.

In future versions of this plan, objectives may be created for additional specific water quality parameters.

Issue 6: Lack of Adequate Riparian Zones

The riparian zone is the band of trees, shrubs and other plants that grows alongside a stream, lake or wetland. This includes vegetation on upslope areas next to water as well as the vegetation that grows within the bank area. Riparian vegetation plays several vital functions in the stream ecosystem: runoff filtration, water retention (roots act like a sponge), woody debris recruitment, organic matter addition (leaves for aquatic insects), bank and hill slope stabilization (minimizes or prevents erosion along stream banks), and streams shading to keep water temperatures within safe limits for fish.

Land clearing activities used in agriculture, forestry, rural and urban development as well as road, rail and utility crossings can compromise riparian zones. Clearing within the riparian zone will impair riparian function, which both directly and indirectly affects water quality, stream flow rates, fish habitat and natural flood protection.

Goal 6-1: Prevent further loss of riparian habitat.

Objectives:	Strategies:
<i>Retain existing riparian areas.</i>	<ul style="list-style-type: none"> • Educate and raise awareness within the public and key groups of the importance of riparian zones to streams, fish, fish habitat and protection from erosion. • Build relationships with landowners and industry and promote best management practices that minimize impacts to riparian zones. • Assist landowners and industry to find sources of funding to protect riparian habitat.
<i>Maintain, as minimums, riparian and road guidelines from the Forest Practices Code.</i>	<ul style="list-style-type: none"> • Promote and seek improvements to existing riparian and road building and maintenance guidelines and promote use of guidelines on private land.
<i>Talk with 15-20 landowners per year regarding the value of riparian habitat.</i>	<ul style="list-style-type: none"> • Involve landowners in on-the-ground work to rehabilitate riparian zones or stabilize banks. • One-on-one discussions with landowners. • Presentations at agricultural functions.

Goal 6-2: Rehabilitate riparian areas along fish streams that are currently functioning poorly.

Objectives:	Strategies:
<i>Rehabilitate at least 3 km of riparian areas within the Bulkley watershed per year.</i>	<ul style="list-style-type: none">• Identify, assess and prioritize watersheds in which riparian function has been reduced see Goals 1-1 and 1-2.• Evaluate value and funding feasibility of restoration (fish, habitat.)• Identify the appropriate procedures for rehabilitation (develop prescriptions, planting, grazing strategies, fencing, watering).• Use the Forest Practices Code Riparian Management Guidelines as minimum guidelines for riparian zone widths.

Issue 7: Land Erosion

Rivers naturally move and migrate within their floodplains. Land erosion is a natural process associated with river migration. However, erosion is often accelerated beyond natural rates by human development and activity including straightening channels, armouring banks with rock, removing streamside (riparian) vegetation, or changing peak flows through clearing of large areas of land. Sediment from land erosion can have several impacts on the aquatic environment including:

- smothering fish eggs and aquatic insects that juvenile fish depend on for food;
- infilling pools, which diminishes quality of rearing and overwintering habitat for fish;
- decreasing light transmittal through the water, impacting productivity of the system; and
- physically harming fish and other aquatic organisms.

In settled areas, land erosion can have a much more obvious effect – the loss of property, be it the land itself or structures on that land. Landowners are directly impacted by erosion and stream migration. Thus, land erosion as discussed here will take the perspective of effects of land erosion on fish and fish habitat as well as private property owners losing land. Effects of land erosion on fish habitat are also addressed under issue 1: “Loss of Fish Habitat” and Issue 6 “Lack of Adequate Riparian Zones.”

Goal 7-1: Minimize accelerated rates of land erosion.

Objectives:	Strategies:
<i>Maintain, as minimums, riparian and road guidelines from the Forest Practices Code.</i>	<ul style="list-style-type: none"> • Promote and seek improvements to existing riparian and road building and maintenance guidelines and promote use of guidelines on private land.
<i>Maintain the natural hydrologic cycle to avoid changes in peak run-offs.</i>	<ul style="list-style-type: none"> • Become involved with the Innovative Forest Practices Agreement in the Morice and Lakes forest districts to ensure hydrological issues are addressed. • Promote the use of hydrological models and the conducting of watershed assessments. • Encourage protection of riparian vegetation and promote riparian planting on private land. • Encourage storm water retention facilities in urban areas.
<i>Stabilize a minimum of 1km of stream bank per year within the watershed.</i>	<ul style="list-style-type: none"> • Identify and prioritize areas of stream bank erosion. • Encourage the use of stabilization methods that maximize fish habitat and minimize downstream impacts.
<i>Protect riparian zones along all streams, lakes and wetlands.</i>	<ul style="list-style-type: none"> • Promote the use of development setbacks as outlined in the Land Development Guidelines in official community plans and in bylaws adopted by relevant regional districts. • See Goal 6.1 and 6.2.
<i>Minimize erosion of road-side banks and ditches.</i>	<ul style="list-style-type: none"> • Promote best management practices for roadside ditching and stabilization of road banks.

Issue 8: Continued Operation of Community-Based Fish Hatcheries

The fish hatcheries in the Bulkley/Morice watershed are small community hatcheries producing several thousand fry and smolts annually. This plan refers only to those small community based hatcheries. Within the Bulkley Watershed two small community-based hatcheries are operating: the Toboggan Creek and the Chicago Creek hatcheries. The objective of these hatcheries is not to supplement existing fisheries, but rather to collect information on coho and chinook stocks through a variety of stock assessment programs and to retain the genetics of those stocks that are at risk of extirpation. Those hatcheries are also a delivery mechanism for public education and participation initiatives regarding the salmon resource. This plan supports the continued operation of small community-based hatcheries for purposes of education, scientific monitoring and enhancement of stocks at risk under the following conditions:

- Hatcheries are used along with a suite of other tools to improve the health of fish stocks
- Hatcheries are not a replacement for protection of habitat.

Discussions regarding hatcheries can be controversial. The general concerns and possible benefits are outlined below:

Possible Concerns:

- potential loss of genetic diversity. Up to date protocols need to be followed to minimize genetic problems or over supplies of fish;
- dependency on hatcheries to supply fish and becoming complacent with respect to protecting or rehabilitating habitat;
- released fish may displace wild salmon or resident fish from habitat;
- poor economic returns;
- high mortality of hatchery fish when released (this does not appear to be a problem in the Bulkley River watershed);
- collected data does not get analyzed; and
- brood stock capture could threaten wild spawning success.

Many of these concerns can be minimized with proper planning and management.

Potential Benefits:

- hatchery tagging and enumeration programs provide a better understanding of survival rates, spawning locations, fish movement and exploitation rates. Information on ocean distribution and international exploitation rates is used in Pacific Salmon Treaty negotiations;
- small hatcheries can provide (albeit limited) terminal fishery opportunities;
- survival of stocks at risk through targeted enhancement;
- education - school/public;
- central place to develop community expertise with respect to fish and habitat.

Goal 8-1: Encourage small-scale community based fish culture projects.

Objectives:	Strategies:
<i>Secure funding for small-scale community hatcheries while they are still beneficial from a scientific, educational or enhancement perspective.</i>	<ul style="list-style-type: none"> • Explore funding possibilities and partner with available funding sources. • Work with Fisheries and Oceans Canada (DFO) to keep community hatcheries operating. .
<i>Maximize the scientific information gathered from hatchery released fish.</i>	<ul style="list-style-type: none"> • Promote the collection of long-term data sets to identify trends in salmon numbers / stock status and fresh water and ocean survival rates. • Ensure that scientific studies are asking appropriate, clearly stated questions or hypotheses. Assess success of releases and returns. • Mark every fish to ensure differentiation between wild and hatchery fish for future eggs taken. • Coordinate studies with Alaskan agencies.
<i>Enhance weak or endangered stocks to ensure that stocks are not lost.</i>	<ul style="list-style-type: none"> • Analyze current enhancement strategy (e.g. smolt vs. fry release) and determine options for different stocks, streams and species (attend DFO planning meetings organized by Brenda Donas each March). • Use up-to-date hatchery protocols.
<i>Maximize opportunities to educate and raise awareness of fish and fish habitat.</i>	<ul style="list-style-type: none"> • Advertise hatchery times in paper and with highway signs. • Organize visits from school groups. • Have hatchery tours included in local tourism brochures and tourism offices. • Support the “Salmonids in the Classroom” program. • Build interpretative trails and operate field trips to educate people around components of fish habitat and the value of riparian vegetation.

4.0 REFERENCES

- Anon. 1999. *Bulkley Morice Salmonid Preservation Group Terms of Reference and Operating Procedures*. Version 1.2. Community Futures Development Corporation of Nadina, Houston, BC.
- Brocklehurst, S.J. 1998. *Historical Data Review on the Upper Bulkley Watershed*.
- Demarchi, D. 1996. *An Introduction to the Ecoregions of British Columbia*. Wildlife Branch, Ministry of Environment, Lands and Parks. Victoria, B.C.
- Fraser, J. 2001. Watershed-based fish sustainability planning: Conserving B.C. fish populations and their habitat: a guidebook for participants. B.C. Ministry of Environment, Lands and Parks, and Fisheries and Oceans Canada.
- Holtby, L.B. and Finnegan, B. 1997. *A biological assessment of the coho salmon of the Skeena River, British Columbia, and recommendations for fisheries in 1998*.
- Horn, H. and G. Tamblyn. 2000. *Morice Planning Area Background Report: An overview of natural, cultural, and socio-economic features, land uses and resource management*. Prepared for the Prince Rupert Interagency Management Committee, Smithers, BC.
- Meidinger D.J. and Pojar, J. 1991. *Ecosystems of British Columbia*. Ministry of Forests. Crown Publications. Victoria, B.C.
- Ministry of Environment, Lands and Parks. 2001. Watershed Atlas.
- _____. 2000. Fisheries Information Summary System website:
<http://www.bcfisheries.gov.bc.ca/fishinv/fiss.html>
- Ministry of Forests. 1996. *Morice TSA Timber Supply Analysis*.
- Remington, D. 1996. *Review and Assessment of Water Quality in the Skeena River Watershed, British Columbia, 1995*.
- Runka, G.G. 1974. Soil Resources of the Smithers-Hazelton Area. British Columbia Department of Agriculture, Kelowna, BC. Reprinted by ELUC Secretariat.
- Synergy Management Group. 1999. *Morice Forest Sector Strategic Plan: Opportunity Study and Action Plan*.

APPENDIX A. PARTICIPANTS

Participation ranged from attending 1 meeting to attending the majority of the 8 meetings held.

Facilitator – Greg Tamblyn, Watershed Stewardship Coordinator, CFDC Nadina (Nadina Community Futures).

Name	Organization	BMSPG Member
Mary Lou Burleigh	Bulkley Valley Steelhead Society	X
Jessy Chaplin	McElhanney	
John Davidson	Landowner	
Brenda Donas	Fisheries and Oceans Canada	BMSPG Technical Review Committee Member
Angus Glass	Nadina Community Futures	
Greig Houlden	Chicago Creek Community Environment Enhancement Society	Alternate
Tim Lemke	Chicago Creek Community Environment Enhancement Society	X
Gladys Lemke	Chicago Creek Community Environment Enhancement Society	X
Walter Joseph	Wet'suwet'en Fisheries	X
Jack Love	AMEC Consulting	
Al McCracken	Upper Bulkley River Round Table	X
Patty Menning	Fisheries and Oceans Canada	
Pat Moss	Northwest Institute for Bioregional Research	X
Janice Nooski	Wet'suwet'en First Nations	X
Mike O'Neill	BC Wildlife Federation / Toboggan Creek Enhancement Society	X
Jason Paquette	McElhanney	
Tom Pendray	Fisheries and Oceans Canada	BMSPG Technical Review Committee Member
Ev Person	Toboggan Creek Enhancement Society	X
Stephanie Powell	Nadina Community Futures	
Sharon Robertson	BC Fly Fishers Federation	X
Regina Saimoto	SKR Consultants Ltd.	
Ron Saimoto	SKR Consultants Ltd.	
Stefan Schug	Wet'suwet'en Fisheries	X
Ian Sharpe	Ministry of Environment, Lands and Parks	BMSPG Technical Review Committee Member
Gord Wadley	BV Steelhead Society/ Nortec Consulting	Alternate

APPENDIX B: BMSPG AND RELATED PROJECTS 1998 TO MARCH 2001

This section was contributed by Brenda Donas, Community Advisor, Fisheries and Oceans Canada, Smithers.

1. Upper Bulkley River Watershed

A Upper Bulkley River Fry Salvage

Purpose: This project was in response to the decline in coho stocks in the UBR watershed i.e. especially the low 1997 brood year escapement through the UBR Coho Assessment Fence. The objective was to determine areas where fry were becoming stranded and then salvage stranded fry and return them to an area of adequate flow in the tributary/river. It was thought that by salvaging fry, wild fry survival could be augmented.

Report:

- Eady, W. and S. Billard. 1998. *Fry Salvage*.

B Upper Bulkley River Water Quality Monitoring 1998 - 2000

Purpose: A similar water quality study had been conducted on Toboggan Creek from 1996 to 1998. Both Toboggan Creek and the Upper Bulkley River are heavily impacted by agriculture but also have forestry, mining and transportation corridor impacts. The objective was to identify areas of heavy nutrient input and determine the effects on water quality for fish. Both areas are nursery areas for rearing salmonids and support spawning populations of coho, a conservation concern in the upper Skeena watershed. Water quality in the Upper Bulkley watershed was suspected to be one of the limiting factors to salmonid survival and so may be contributing to the decline of salmon stocks in that watershed.

Results from the report were used as an educational tool for local landowners, ranchers, hobby farmers, Ministry of Transportation and Highways, CN Rail and the Upper Skeena Agriculture Focus Group. Results from the report led to education of water quality impactors by DFO Conservation and Protection Officers. The net result is to be a shift from poor land use practices to better compliance with Best Management Practices and more fish friendly use of the land in the Upper Bulkley watershed.

Report:

- Remington, D. 2000. *Nutrients and Algae in the Upper Bulkley River Watershed 1997-2000*.

Related Reports ((Funded by Fisheries and Oceans Canada)

- Brocklehurst, S.J. 1998. *Historical Data Review on the Upper Bulkley Watershed*
- Remington, D and B. Donas. 1999. *Water quality in the Toboggan Creek watershed 1996-1998: are land use activities affecting water quality and salmonid health?*

- Remington, D. 1998. *Water quality and accumulation of periphyton (attached algae) in the Bulkley River and tributaries, 1997: relationship with land use activities in rural watersheds.*

C. Upper Bulkley River Overwintering Study 1998-2001

Purpose: To determine if overwintering habitat is a limiting factor to salmonid production in the watershed. The project will also quantify what constitutes quality overwintering habitat especially for coho salmon juveniles and will assist with identifying potential restoration opportunities to improve overwintering habitat. This project is in response to rapidly declining coho stocks in the Upper Bulkley watershed.

Results from this project were used in conjunction with the Buck Creek Fry Release Program – DFO Strategic Stock Enhancement program. The Buck Creek Fry Release program involved releasing up to 80,000 coded wire tagged coho fry into the upper reaches of Buck Creek at the two to four gram stage. Hatchery juveniles that are released as fry are subject to natural selection pressures and may therefore be better suited to their environments – this could increase survival to the adult stage.

The overwintering study included index sites just downstream of the fry release location. During the first winter, some coded wire tagged coho were captured downstream of the release area. This caused concern that perhaps a portion of these released fry were actually emigrating from Buck Creek to rear elsewhere prior to the onset of winter. The Buck Creek Juvenile Trapping Program (Spring 2000 – Strategic Stock Enhancement Program) showed that less than 50% of the coded wire tagged fry migrated downstream past the trapping site. There were two possible reasons for only 50% of the fish migrating downstream: 1) There is a 50% or greater overwinter mortality rate on juvenile coho or 2) a portion of the coded wire tagged coho fry emigrated from Buck Creek prior to the onset of winter.

To determine if coho were emigrating from Buck Creek, the Strategic Stock Enhancement Program funded the **Buck Creek Emigration Study: Fall 2000**. A six foot diameter rotary screw trap and Gee minnow traps at index locations were used to determine if coded wire tagged fry were in fact migrating downstream prior to the onset of winter. The study results show that no fry emigration occurred prior to the onset of winter. The **2000/2001 Upper Bulkley River Overwintering Study** also showed that there were no coded wire tagged coho captured at index locations from just downstream of the fry release location to 0.5 kms upstream of the Buck Creek/Upper Bulkley River confluence.

The overwintering study showed that coho prefer habitat that consists of at least 50% pool habitat, small woody debris (root wads) and stream bottom that consists of at least 50% cobble that is minimally embedded.

Habitat consisting of at least 50% pool, dense root wads and 50% of bottom covered with cobble, was created in the Buck Creek Release Pond (DFO Strategic Stock Enhancement Program funded the Buck Cr. Release Pond construction). This habitat was created to test the use of such habitat by coho as compared to other species utilizing the Release Pond for

overwintering habitat. At the onset of winter, monitoring showed that coho were spatially separated from chinook and rainbow juveniles and were using the pool/root wad/cobble habitat exclusively. This result sets direction as to type of overwintering habitat to construct within the Upper Bulkley watershed for coho.

Reports:

- Donas, B. and R. Saimoto. 1999. *Upper Bulkley River Overwintering Study 1998-2000 Interim Report.*
- Donas, B. and R. Saimoto. 2000. *Upper Bulkley River and Toboggan Creek Overwintering Study 1999-2000.*
- Donas, B. and R. Saimoto. 2001. *Upper Bulkley River and Toboggan Creek Overwintering Study 2000-2001.*
- Tamblyn, G. 2000. *Buck Creek Juvenile Salmonid Emigration Program – Autumn 2000.* Funded by DFO Strategic Stock Enhancement Program and Fisheries Renewal B.C.

Related Reports:

- Saimoto, R. and M. O. Jessop. 1997. *Assessment of overwintering habitat and distribution of Coho Salmon (Oncorhynchus kisutch) in the Mid-Bulkley Watershed (Houston to Bulkley Lake), January to March 1997* (funded by DFO Skeena Green Plan)
- SKR Consultants. 2000. *Buck Creek Juvenile Salmon Trapping Program – Project Number F1528-0-1702.* Funded by DFO Strategic Stock Enhancement Program

D. Water Flow and Water Level Monitoring Program (1999 – 2001)

Purpose: To re-install some of the Upper Bulkley watershed staff gauges that had been discontinued by Water Survey Canada. Water flows and levels could then be monitored and compared to flow trends that had been identified in the Historical Water Data Review on the Upper Bulkley Watershed. New water flow and level information would assist in clarifying water allocation issues in the watershed.

Staff gauges were surveyed in at the Water Survey Canada locations on Maxan Creek and Richfield Creek and a new location was designated for the Buck Creek staff gauge. Water levels were monitored a minimum of twice per month and gauges were calibrated four times annually.

The staff gauge on Buck Creek is monitored daily throughout the Buck Creek Juvenile Salmonid Trapping Program. Monitoring showed that there are two peaks of downstream smolt migration that correspond to the peak in water level as measured at the staff gauge. It was also determined that water temperature had an impact on smolt migration timing.

Staff gauge data was also used to justify obtaining a water license for the water inflow pipe to the Buck Creek Release pond. Staff gauge readings showed that there was sufficient water available to operate the Release Pond without harming fish habitat in the Buck Creek mainstem.

Reports:

- AGRA Earth and Environmental. 2000. *Reinstallation of Historic Water Survey of Canada Staff Gauges, Upper Bulkley River British Columbia.*
- McElhanney Consultants Ltd. Report for the 2000/2001 staff gauge operations is in progress

E. Substrate Assessment.

Purpose: To determine if sedimentation from eroding banks and loss of land due to erosion along the Upper Bulkley River was causing sediment compaction within the riverbed gravels. Sediment compaction could result in lowered dissolved oxygen levels and reduced inter-gravel flows to incubating salmonid eggs. McNeil and freeze core sampling was conducted on the streambed material at three redd locations on the Upper Bulkley River. Interstitial dissolved oxygen was measured within the gravels at the same three areas.

Results showed that the Upper Bulkley system contains natural fines i.e. sand type particles that fill interstitial spaces in the gravel. There did appear to be some compaction as some of the samples showed dissolved oxygen levels below safe standards for incubating salmonid eggs.

Report:

- AGRA Earth and Environmental. 1999. *Substrate Composition, Mensuration including McNeil Coring, Freeze Coring and Interstitial Dissolved Oxygen Measurement of Three Spawning Redds on the Upper Bulkley River and Maxan Creek in October and November 1998.*

F: Riparian Restoration

Purpose: To begin rehabilitation of the riparian areas impacted by agriculture on Maxan and Richfield Creeks. Rehabilitation of the riparian area would lead to stabilization of streambanks, restoration of stream canopy, improvement of water retention and natural bio-filtration of runoff water prior to its entrance into the stream.

Training on riparian planting techniques was accomplished and a riparian area of 520 linear metres by about 30 metres wide was planted with willow, cottonwood, Dogwood and white spruce.

Report:

- Burton, C. 2000. *Riparian Restoration Plantings in the Upper Bulkley Watershed: Completion Report.*

G: Index of Biological Integrity: A Tool for Monitoring and Assessing Stream Health

Purpose: To develop a cumulative effects monitoring and assessment tool using aquatic benthic invertebrate surveys at 25 index locations in the Upper Bulkley River watershed. To teach community members how to use this method and how to interpret results.

Several community members, consultants and government representatives were educated with respect to this method. Identifying index sites and collecting information are activities that are doable however, there is a bottleneck in getting sample results due to so few professional taxonomists available to conduct sample analysis. This is a tool that can be used in place of or along with other indicators of stream health such as presence of salmonid and trout species (i.e. densities, species composition, numbers of returning spawners etc...)

Report:

- Rysavy, S. 2000. *Calibration of a Multimetric Benthic Invertebrate Index of Biological Integrity for the Upper Bulkley River Watershed.*

2. Bulkley River and Tributaries

A. Fish Enumeration:

Mission Creek Coho Fence 1998-2000 Purpose: a) To enumerate adult coho entering into Mission Creek, a tributary of the Bulkley River, b) to release a portion of the captured and enumerated coho upstream of the impassable Highway 16 culvert and c) to release a portion of the captured and enumerated coho upstream of the coho fence. A portion of the coho adults were removed to be used as coho broodstock for the Chicago Creek hatchery program.

Mission Creek is impacted by urban development, municipal domestic water withdrawal, forestry in the headwaters, Highway 16 (impassable culvert), CN Rail, a chipper mill and a sewage outflow. Due to the impassable culvert and other land use impacts, the coho stock had declined to a remnant level. Monitoring of the stream, coho enhancement and stream restoration activities have been initiated to rebuild the coho stock in Mission Creek.

From 1998 to 2000 coho returns to the Mission Creek fence ranged from 19(2000) coho to 162 coho (1999). The maximum number of coho released to spawn upstream of the Highway 16 culvert was 42 females and 45 males. Usually about 12 females and 15 males are retained for use as hatchery broodstock. Between 20,000 and 30,000 coho eggs are taken at the Chicago Creek hatchery each year.

All coho captured at the fence are sampled for sex and presence of a right maxillary clip. (All hatchery coho that are released are marked with a right maxillary clip).

Resistivity Meter Feasibility Study on Toboggan Creek. Purpose: To assess the feasibility of installing and using a resistivity meter to count coho and steelhead escapements

to Toboggan Creek. The meter counts fish under all water conditions using electrodes to detect changes in electrical resistance as a fish passes through the unit. Currently a fish fence is operated on the creek. However, the fence restricts fish movement, cannot be operated during high flows, and is located upstream of some spawning areas.

Reports:

- Donas, B. 1998. *Mission Creek Adult Coho Enumeration and Adult Transport Program*.
- Donas, B. and the Chicago Creek Community Environmental Enhancement Society. 1999. *Mission Creek Coho Fence Report 1999*
- Donas, B. and the Chicago Creek Community Environmental Enhancement Society 2000. *Mission Creek Coho Fence: Final Report November 2000*.
- Kinston & Associates Ltd and Don McCubbing Instream Fisheries Consultants. 2001. *Resistivity Meter Feasibility Study, Toboggan Creek Stream Rehabilitation Project, 2000/2001*.

B. Chicago Creek Coho Hatchery 1998-2000

Purpose: To renovate the hatchery and construct an incubation building in order to increase survival on enhanced coho.

Originally, the incubation system sat in the open covered by a small insulated, plywood box. The water line was prone to freezing which meant that incubation water was at risk of being shut off at crucial times of the year.

The hatchery construction saw completion of a hatchery building that the Chicago Creek Community Environmental Enhancement Society had begun constructing. Also, a concrete block incubation building was constructed in close proximity to the incubation water source.

Since construction of the hatchery and incubation building there have been no water line freeze-ups. Survival to the smolt stage has increased.

Reports:

- Donas, B. and Chicago Cr. Community Environmental Enhancement Society. 1998. *Chicago Creek Hatchery: Incubation Building Construction Report 1998*.
- Houlden, G. 2000. *Chicago Creek Hatchery Operations: Final Report 2000*.

C. Stream Survey / Assessment Projects

Purpose: Mission Creek: A cursory stream survey was conducted based on the Streamkeepers Advanced Stream Survey Module. The stream was broken into three main sections: Waterfalls Creek which flows through New Hazelton, Station Creek which meets Waterfalls Creek downstream of New Hazelton and Mission Creek which originates at the confluence of Waterfalls and Station Creeks. This survey was intended to assist with future habitat restoration projects.

The stream survey was conducted from the confluence of Mission Creek with the Bulkley River. The stream was surveyed into the Station Creek side and also the Waterfalls Creek section was surveyed to the impassable falls. Stream survey data included reach and section lengths, cross-sectional widths and depths, slope, cobble diameter, cobble embeddedness, description of riparian area, canopy cover and any pertinent impacts.

Dahlie Creek: This urban stream flowing through the town of Smithers has been impacted by residential and industrial subdivision development. The Smithers Rotary Club received funding from FsRBC to have a detailed fish habitat and channel assessment conducted in 1999 to determine feasibility of rehabilitating the creek and creating a salmon viewing area (part of the Central Bulkley study described in the following paragraph). The Town of Smithers, also interested in rehabilitating the creek, had water quality data and some additional habitat assessments done.

Central Bulkley Tributaries: A modified overview assessment and a detailed fish habitat assessment (FHAP), a modified riparian assessment (RAP) and a channel assessment (CAP) were conducted on a number of Bulkley River tributaries between Telkwa and Houston in 1999. The purpose was to assess the impact of land use activity on fish and fish habitat and to focus restoration priorities on areas with the greatest opportunities for effective rehabilitation.

Reports:

- Donas, B. and Joe, T. 2000. *Mission Creek Stream Survey Report: 1999*
- Saimoto, R. and Remington, D. 2000. *Dahlie Creek: Salmonid Overwintering and Water Quality Studies: Interim Report.*
- Tamblyn, G. and M. Jessop. 2000. *Detailed Fish Habitat, Riparian and Channel Assessment for Select Central Bulkley River Tributaries.*

D. Toboggan Creek Water Quality Monitoring Report

Purpose: A similar water quality study has been conducted on the Upper Bulkley River 1998-2000. Both Toboggan Creek and the Upper Bulkley River are heavily impacted by agriculture but also have forestry, mining and transportation corridor impacts. The objective was to identify areas of heavy nutrient input and determine the effects on water quality for fish. Both areas are nursery areas for rearing salmonids and support spawning populations of coho, a conservation concern in the upper Skeena watershed. Water quality in the Toboggan Creek watershed was suspected as becoming a limiting factor to salmonid survival.

Nutrient samples were collected over a two and one half year period. During the low elevation snow melt time of the year, there were significant nutrient inputs into Toboggan Creek. Toboggan creek is showing signs of eutrophication i.e. elevated nutrient and bacterial concentrations that contribute to undesirable changes to the stream system.

Report:

- Remington, D. and B. Donas. 1999. *Water quality in the Toboggan Creek watershed 1996-1998: are land use activities affecting water quality and salmonid health?*

Related Reports:

- Remington, D. 1998. *Water quality and accumulation of periphyton (attached algae) in the Bulkley River and tributaries, 1997: relationship with land use activities in rural watersheds.*
- Donas, B. and Remington, D. 2000. *Nutrients and algae in the Upper Bulkley River watershed 1997 – 2000.*

E. Toboggan Creek Juvenile Salmonid Sampling Program 1998

Purpose: This project arose as a result of intimations by the DFO Stock Assessment Division that hatchery coho were surviving at considerably lower rates than wild coho. The DFO Stock Assessment Division operated a downstream smolt migration program using fyke net traps or a rotary screw trap that was placed near the Toboggan Creek assessment fence – which is about 2 kms upstream from the confluence of Toboggan Creek with the Bulkley River. To determine the proportion of salmonid juveniles i.e. coho that were being missed in the downstream, a juvenile trapping program was initiated. It was also hoped that by comparing coho density indices at a variety of index sites it would be possible to determine if fry were emigrating from Toboggan Creek prior to the onset of winter. These fry would therefore not be included in a downstream program as a result of emigrating well before the spring enumeration program. This would indicate an error in the method for calculating wild smolt survival from the downstream trapping program at its location 2 km upstream from the Toboggan Creek/Bulkley River confluence.

Note: In 1999, the Toboggan Creek wild smolt enumeration program was changed. Wild smolts are trapped upstream of the Toboggan Creek hatchery and are coded wire tagged and

adipose clipped. Wild coho smolt survival is calculated based on the information from the recovered coded wire tagged coho.

Report:

- Mitchell, S. 1999. *Juvenile Coho Salmon and Steelhead Assessment of Lower Toboggan Creek, September – November 1998.*

Related Report:

- SKR Consultants. 1999 and 2000. *Toboggan Creek Coho Smolt Enumeration.* Funded by the Strategic Stock Enhancement Program – DFO

F. Steelhead Population Studies

Purpose: To determine the steelhead escapement to Toboggan Creek and to estimate adult steelhead population in the Bulkley/Morice watershed using a mark and recapture program.

The Toboggan Creek Steelhead escapement program involves operating the Toboggan Creek Assessment fence from early April to late June. Steelhead adults are live trapped at the fence, enumerated, sampled for sex, presence of marks (dorsal fin tags and caudal punch), scales and length. Steelhead are also dorsal fin tagged with tags that are discrete from those put on at the Moricetown seine and dipnet fisheries. Downstream migrating kelts are seined just upstream of the Toboggan Creek fence and checked for the presence of a dorsal fin tag. A population estimate is calculated based on the number of tags put on at the fence and the number of tags recovered from downstream migrating kelts.

Data from the Toboggan Creek steelhead program is also used in the Steelhead Population Study.

The Steelhead Population Study involves tagging steelhead at the Moricetown seine and dipnet fisheries with dorsal fin tags. The seine fishery occurs downstream of the dipnet fishery at the Moricetown canyon. A population estimate can be done based on tag recoveries in the Moricetown canyon dipnet fishery. To provide further information on a population estimate, an angling program was conducted in the Bulkley and Morice systems to recover further tags. Another mark/recapture estimate was conducted to estimate steelhead population in the Bulkley and Morice systems.

Reports:

- Mitchell, S. 1999. *Toboggan Creek Steelhead Assessment – 1999.*
- Mitchell, S. 2000. *Toboggan Creek Steelhead Assessment –2000.*
- Mitchell, S. and G. Wadley. 1999. *Bulkley/Morice Steelhead Assessment Project 1998/99.*
- Mitchell, S. 2000. *A Petersen Mark-Recapture Estimate of the Steelhead Population of the Bulkley/Morice River Systems Upstream of Moricetown Canyon.*

- SKR Consultants Ltd. 2000. *2000 Steelhead Tagging Project at Moricetown Canyon: Data Analysis and Recommendations by Wet'suwet'en Fisheries and SKR Consultants Ltd.*
- Mitchell, S. 2001. Bulkley/Morice Steelhead Assessment 2000. *A Petersen Mark-Recapture Estimate of the Steelhead Population of the Bulkley/Morice River Systems Upstream of Moricetown Canyon During Autumn, 2000, Including Synthesis with 1998 and 1999 Results.*

G. Toboggan Creek Creel Survey 1999-2001

Purpose: Using DFO designed Creel Survey procedures, acquire information on recreational fishery exploitation at the Toboggan Creek fishery. The creel survey was expanded to include the Bulkley River.

The species of interest in this creel survey were coho and steelhead. Information on angler origin, gear type used, catch per unit effort, proportion of marked/dorsal fin tagged fish in the catch and number of anglers was collected. The Toboggan Creek fishery (confluence of Toboggan Creek with the Bulkley River) is actually the only fishery that is catch and keep for hatchery coho upstream of Terrace.

Reports:

- Struthers, D. 2000. *1999 Upper Skeena Creel Survey.*
- Mitchell, S. 2001. *2000 Bulkley River Creel Survey: An evaluation of the angling community on the Bulkley River using a complemented access-roving creel survey.*

Related Reports:

- Various authors. Toboggan Creek Creel Survey Reports from 1994 to 1998: Toboggan Creek Steelhead and Salmon Enhancement Society. –.

H. Riparian Projects

Purpose: To assess riparian area within selected areas of the Bulkley watershed, to design prescriptions for riparian restoration and to implement riparian restoration.

These projects involve assessing riparian area by air photo interpretation and on the ground surveys. Once potential riparian restoration areas are identified, prescriptions were devised for selected areas. Riparian planting projects have occurred on Maxan Creek and Richfield Creek in the upper Bulkley River watershed.

Protection of the riparian area is another method for riparian protection and restoration. A fencing program was done at the outlet of Toboggan Lake to discourage beavers from harvesting the riparian area for construction of beaver dams. This project is also related to

creating access for upstream migrating coho and steelhead adults for purposes of spawning. (No report on this project).

Prescriptions have been developed for other areas in the watershed to take advantage of future funding opportunities.

Reports:

- Tambllyn, G. and Jessop, M. 2000. *Detailed Fish Habitat, Riparian and Channel Assessment for Select Central Bulkley River Tributaries.*

Related Reports:

- Mitchell, S. 1997. Riparian and In-stream Assessment of the Bulkley River System. An Examination and Priorization of Impacts on the Tributaries to the Bulkley River Mainstem

I. Public Education and Awareness Projects

Purpose: Through signage projects and other historical data review projects, educate the public about the salmon resource.

The **Chicken Creek Signage Communications Project** involved design and installation of five signs along the Smithers Perimeter Trail. That section of trail that follows Chicken Creek was chosen as the site for sign implementation. The signs take an ecosystem approach and include information not only on the local fisheries resource but also on the riparian area, bird and wildlife as well as other aquatic organisms.

The **Bulkley Morice Watershed Library** has been established at the Houston office of the Community Futures Development Corporation of Nadina. The library contains hard-copy information that includes technical, biological, educational books, pamphlets and reports related to the fisheries resource in the Bulkley/Morice watersheds. Maps and aerial photos are also available at the library. A part-time librarian is on hand to assist library users.

Library holdings are searchable on the internet through the website of Northwest Community College: <http://www.nwcc.bc.ca/sbnr/>. Holdings of government agencies are also available through this website.

The **Status of Salmon Spawning Stocks in the Skeena River** report is an educational document that presents the historical status of Skeena salmon and steelhead stocks. The document has been presented at a variety of public information and consultation meetings throughout Skeena River watershed.

The **Salmonid Habitat Sensitivity Mapping for the Morice Forest District** was conducted to assist with and streamline the referral process by creating a map which indicates sensitive salmonid habitat areas within the Morice Forest District. Digital GIS coverages have been forwarded to the Ministry of Sustainable Resource Management and Fisheries and Oceans Canada.

The **Bulkley Watershed Coho Summary Report** summarizes existing data and information pertinent to Bulkley watershed coho stocks and determines trends (when possible).

The **Working Around Water Fact Sheet** is a pamphlet that educates proponents planning to work in and around a stream about provincial and federal policies and regulations (*Fisheries Act, Water Act*), who to contact regarding the referral process and what types of applications must be approved prior to the work commencing.

Reports:

- Morrell, M. 2000. *Status of Salmon Spawning Stocks in the Skeena River*
- Jessop, M. 2000. *Stream Assessments of Robin Creek, Deep Creek, and Thompson Creek.*
- Jessop, M. 2001. *Salmonid Habitat Sensitivity Mapping: Morice Forest District.*
- Saimoto, R. and R. Saimoto. 2001. *Coho Salmon in the Upper Bulkley River Watershed.*
- Working Around Water Fact Sheet: Fact Sheet #1 (Pamphlet) – available at Provincial and Federal government offices Smithers and surrounding communities and at the Community Future Development Corporation of Nadina offices in Smithers and Houston.

J: Habitat Restoration/Protection/ Feasibility Projects

Purpose: To determine good candidates for habitat protection and restoration. To determine the feasibility of conducting specific habitat restoration and protection projects.

CGV Riparian Restoration: This project involved cattle management and structures to minimize cattle access to Canyon Creek, Glacier Gulch Creek and Vanderven Creek (in the Smithers area).

- Canyon Creek – installation of fencing and watering troughs.
- Glacier Gulch Creek – Construction of hardened approach for cattle crossing on creek. This project involved installation of a geotech webbing into the approach way to the stream crossing. This crossing area is an area of gravel and cobble substrate in the stream. The special webbing, which is filled with gravels, prevents erosion and therefore sediment input at the area of the cattle crossing.
- Vanderven Creek – construction of fencing and bridge for cattle.

The **Toboggan Creek Groundwater Channel Monitoring** project involved monitoring two sites in a remnant stream channel. The purpose of the monitoring was to determine if there was groundwater influence in the area of the remnant stream channel and to determine if water quality parameters were suitable for fish. If water quality parameters are suitable, a small groundwater channel/pool will be excavated such that water flow is returned to the remnant stream channel. This would increase rearing habitat in this area by 400 linear metres. An overwintering pool would be installed at the head of the groundwater channel and this would increase the overwintering habitat available by approximately 150 cubic metres. This would be a pilot project that would be monitored and if successful, expansion would occur in the future.

Reports:

- Donas, B., T. Joe, and R. Grebliunas. 2001. *Toboggan Creek Groundwater Channel Monitoring Project January – March 2001.*

3. Morice River and Tributaries

A: Morice River Overwintering Study 1998-2000:

Purpose: To determine if overwintering habitat is a limiting factor to salmonid survival in the Morice River system. To determine what constitutes quality overwintering habitat for salmonids.

The Morice River overwintering study was designed in a similar manner to the Upper Bulkley River overwintering study. A series of index sites were monitored during the winter months to determine juvenile density indices, fish condition, and trends in water quality and habitat conditions over time.

Results from this study indicated that dissolved oxygen levels at several of the index sites decreased below critical levels for salmonids. Density indices declined over the course of the winter indicating that there may be overwinter mortality, although emigration to other rearing sites is possible. This study also showed that there were more juvenile salmonids captured in side channel sites than at other sites sampled and the juvenile coho and chinook captured in the side channel and tributary index sites were larger in size than those captured in the mainstem index sites.

In the 2000/2001 winter, a visual reconnaissance study was conducted to observe salmonid juvenile behaviour in habitat under winter conditions.

Reports:

- SKR Consultants Ltd. *Overwintering Study of salmonids in the Morice Watershed: Interim Report 1999-2000.*
- Wet'suwet'en Fisheries. 2001. *Over-Wintering Visual Reconnaissance Study 2000/01.*

Related Projects:

- British Columbia Conservation Foundation. 1998. *Morice Detailed Fish Habitat/Riparian / Channel Assessment for Watershed Restoration – Nanika and Lamprey Sub-basins.*

APPENDIX C: BMSPG PROJECTS LISTED BY WATERSHED ISSUE.

The Bulkley-Morice Salmonid Preservation Group has funded and conducted 60 projects between 1998 and 2001. Most of these projects have addressed one or more of the eight watershed issues identified in the BMPSG strategic planning process. Below is a list of the projects associated with objectives for each of the key watershed issues.

ISSUE 1: LOSS OF FISH HABITAT

- Stream Survey Projects – Dahlie Creek; Mission Creek; Mid-Bulkley Stream Assessment; Central Bulkley Stream Assessment.
- Upper Bulkley and Morice Overwintering Studies.
- Riparian and cattle management projects – Fencing and off-channel watering in the Trout Creek watershed; Richfield Creek and Maxan Creek fencing and riparian planting, Glacier Gulch Crossing, Vandervan Creek Crossing and fencing, Canyon Creek off-channel watering.
- Working Around Water Fact Sheet
- Water Flow and Water Level Monitoring
- Bulkley Watershed Water Quality Monitoring Projects: 1996-2000
- Toboggan Creek Groundwater Channel Monitoring Project
- Salmonid Habitat Sensitivity Mapping for the Morice Forest District

ISSUE 2: LOSS OF ACCESS TO HISTORICAL SPAWNING AND REARING AREAS

- Stream Survey Projects – Dahlie Creek; Mission Creek; Mid-Bulkley Stream Assessment; Central Bulkley Stream Assessment.
- Upper Bulkley and Morice Overwintering Studies
- Toboggan Lake Outlet Beaver Fencing Project
- Salmonid Habitat Sensitivity Mapping for the Morice Forest District

ISSUE 3: DECLINING SALMONID STOCKS

- Upper Bulkley and Morice Overwintering Studies
- Toboggan Creek Groundwater Channel Monitoring Project
- Chicago Creek Hatchery Operations
- Upper Bulkley River Fry Salvage Project
- Mission Creek Coho Fence
- Buck Creek Emigration Study
- Toboggan Creek Juvenile Salmonid Sampling Program
- Toboggan Creek Creel Survey
- Spring Steelhead Assessment Fence (Toboggan Creek)
- Toboggan Creek Resistivity Counter (Feasibility Study)
- Upper Skeena Creel Survey
- Steelhead Population Studies
- Riparian and cattle management projects – Fencing and off-channel watering in the Trout Creek watershed; Richfield Creek and Maxan Creek fencing and riparian planting, Glacier Gulch Crossing, Vanderven Creek Crossing and fencing, Canyon Creek off-channel watering.
- Stream Survey Projects – Dahlie Creek; Mission Creek; Mid-Bulkley Stream Assessment; Central Bulkley Stream Assessment.

ISSUE 4: WATER QUANTITY

- Upper Bulkley River and Toboggan Creek Water Quality Studies
- Water Flow and Water Level Monitoring Program

ISSUE 5: WATER QUALITY

- Upper Bulkley River and Toboggan Creek Water Quality Studies
- Water Flow and Water Level Monitoring Program
- Working Around Water Fact Sheets
- Bulkley and Morice Overwintering Studies
- Substrate Composition, McNeil and Freeze Coring and Interstitial Dissolved Oxygen Monitoring
- Index of Biological Integrity: A Tool for Monitoring and Assessing Stream Health
- Riparian and cattle management projects – Fencing and off-channel watering in the Trout Creek watershed; Richfield Creek and Maxan Creek fencing and riparian planting, Glacier Gulch Crossing, Vanderven Creek Crossing and fencing, Canyon Creek off-channel watering.

ISSUE 6: LACK OF ADEQUATE RIPARIAN ZONES

- Stream Survey Projects – Dahlie Creek; Mission Creek; Mid-Bulkley Stream Assessment; Central Bulkley Stream Assessment.
- Riparian and cattle management projects – Fencing and off-channel watering in the Trout Creek watershed; Richfield Creek and Maxan Creek fencing and riparian planting, Glacier Gulch Crossing, Vanderven Creek Crossing and fencing, Canyon Creek off-channel watering.
- Salmonid Habitat Sensitivity Mapping for the Morice Forest District
- Toboggan Lake Outlet Beaver Fencing Project

ISSUE 7: LAND EROSION

- Riparian and cattle management projects – Fencing and off-channel watering in the Trout Creek watershed; Richfield Creek and Maxan Creek fencing and riparian planting, Glacier Gulch Crossing, Vanderven Creek Crossing and fencing, Canyon Creek off-channel watering.
- Working Around Water Fact Sheets
- Salmonid Habitat Sensitivity Mapping for the Morice Forest District
- Stream Survey Projects – Dahlie Creek; Mission Creek; Mid-Bulkley Stream Assessment; Central Bulkley Stream Assessment.

ISSUE 8: CONTINUED OPERATION OF COMMUNITY-BASED HATCHERIES

- Chicago Creek Hatchery Operations
- Mission Creek Coho Fence
- Buck Creek Emigration Study
- Bulkley and Morice Overwintering Studies
- Toboggan Creek Groundwater Channel Monitoring Project
- Chicken Creek Signage Project
- Status of Salmon Spawning Stocks in the Skeena River
- Bulkley Watershed Coho Summary Report
- Toboggan Creek Creel Survey
- Upper Skeena Creel Survey