PUB 854.1

HQ0842

April 23, 1997 Our File #: 3/104-24;-26

Squamish Watershed Committee

Re: Squamish River Watershed Restoration Program

We are pleased to provide you with the final report for the Squamish River Watershed Restoration Program. This year's studies focused on seven drainages within the Squamish River watershed. Of the seven creeks prioritized in Year 1, four creeks (Ashlu River, Upper Squamish River, High Falls Creek and Shovelnose Creek) had separate ongoing Forest Renewal BC funding, and as such were not assessed as a part of Year 2.

Therefore, this year's works focused on three of the remaining seven drainages prioritized in Year 1 and four drainages in the Mamquam and Cheakamus River systems, as identified by the Department of Fisheries and Oceans. These creeks included: Cloudburst Creek, Evans Creek and Pillchuck Creek which flow directly into the Squamish River; Brohm River, Cheekye River and Chance Creek which flow into the Cheekamus River; and Crawford Creek which flows into the Mamquam River.

Four main areas of study were applied to the drainages: a channel assessment procedure (CAP); a fish habitat assessment procedure (FHAP); a riparian assessment procedure (RAP); and a water quality assessment procedure (WAP). Together, these assessments provide a basis for future restoration activities which will be implemented concurrently throughout the watershed.

Additions to this final report include a review of the vegetation requirements of wildlife in the Squamish area and a listing of licencee activities in the drainages slated for restoration activities. Unfortunately, the GIS maps showing reach breaks, barriers and sample locations were not available at time of printing. The draft maps have been included instead. The digital maps will be forwarded at a later time.

We have enjoyed working with the Squamish Watershed Committee on this project and look forward to your comments.

Yours truly,

Craig Goodings, M.Sc.
Project Manager, Squamish Watershed Restoration Project

EXECUTIVE SUMMARY

Forest Renewal British Columbia

Forest Renewal B.C. (FRBC) was created in 1994 to help ensure that British Columbian forests and lands continue to provide long-term benefits to communities who rely on them. FRBC directs funding under three land based programs: 1) Enhanced Forestry; 2) Watershed Restoration; and 3) Resources Inventory.

Watershed Restoration Program

The Squamish and Lillooet Watersheds Restoration Project falls under the guidelines of the Watershed Restoration Program (WRP). It is designed to accelerate the recovery of watersheds that have been adversely affected by past timber harvesting practices. The goals of the Watershed Restoration Program are to:

1. Provide community-based employment, training, and stewardship opportunities throughout the province.
2. Restore, protect, and maintain fisheries, aquatic, and forest resources adversely affected by forest harvesting practices, that, without intervention, would require decades to recover naturally

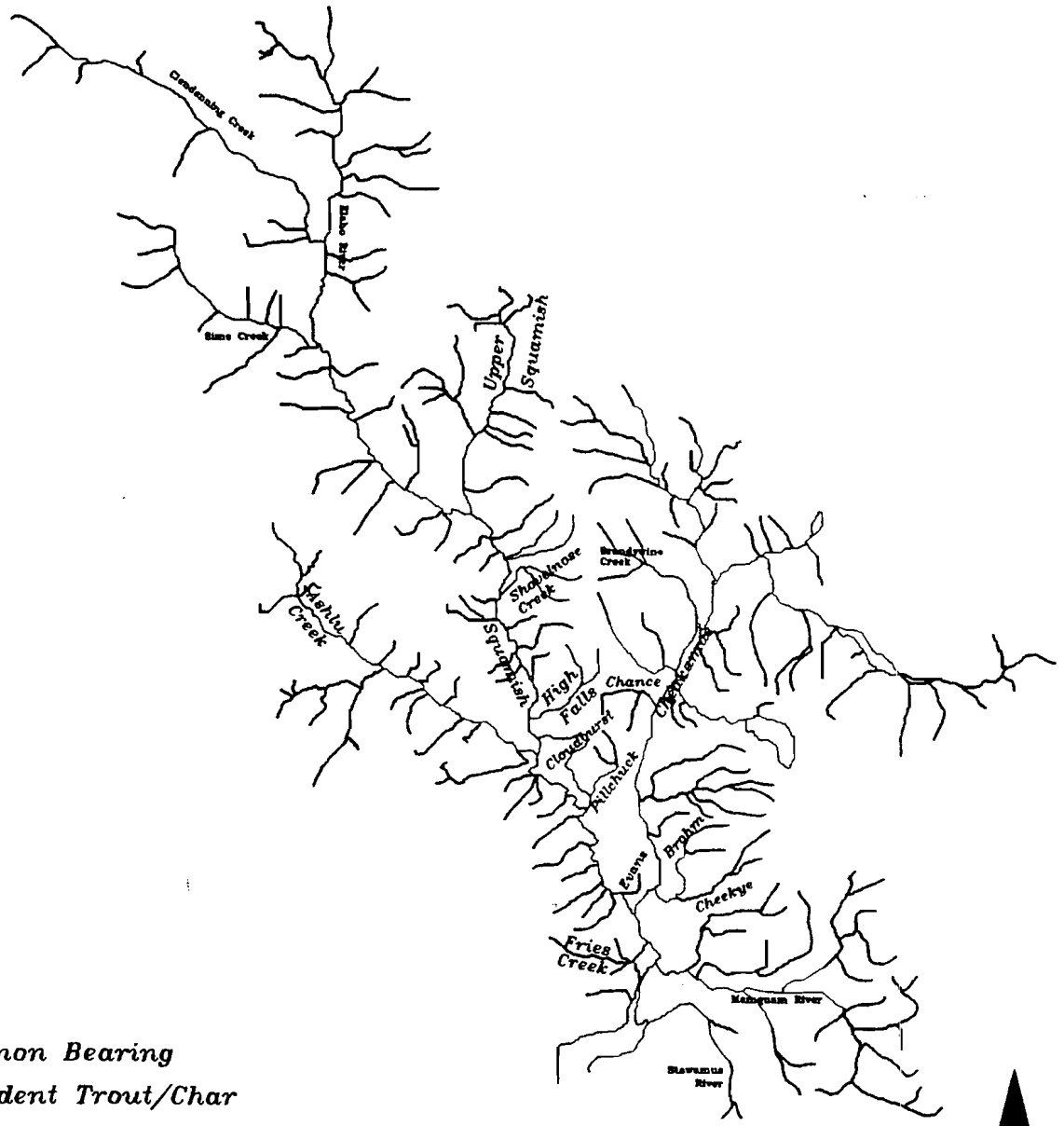
These goals are reflected throughout the Squamish and Lillooet Watershed Restoration Project. Some of our project highlights include:

- Training and hiring of over 40 community members (Figure ES-1)
- Working with the Squamish and Lillooet Watershed Committees
- Prioritization of all creeks within each watershed (Figure ES-2 and ES-3)
- Detailed assessments of twenty creeks, including the development of twenty-year plans for restoration activities
- A restoration pilot project

The following summary of the Squamish and Lillooet Watershed Restoration Project provides a description of community involvement, an overview of Year 1 and Year 2 programs and prescriptions for restoration opportunities in fulfilling the goals of WRP.

Squamish River Watershed

Fish Habitat Classification



Salmon Bearing

Resident Trout/Char

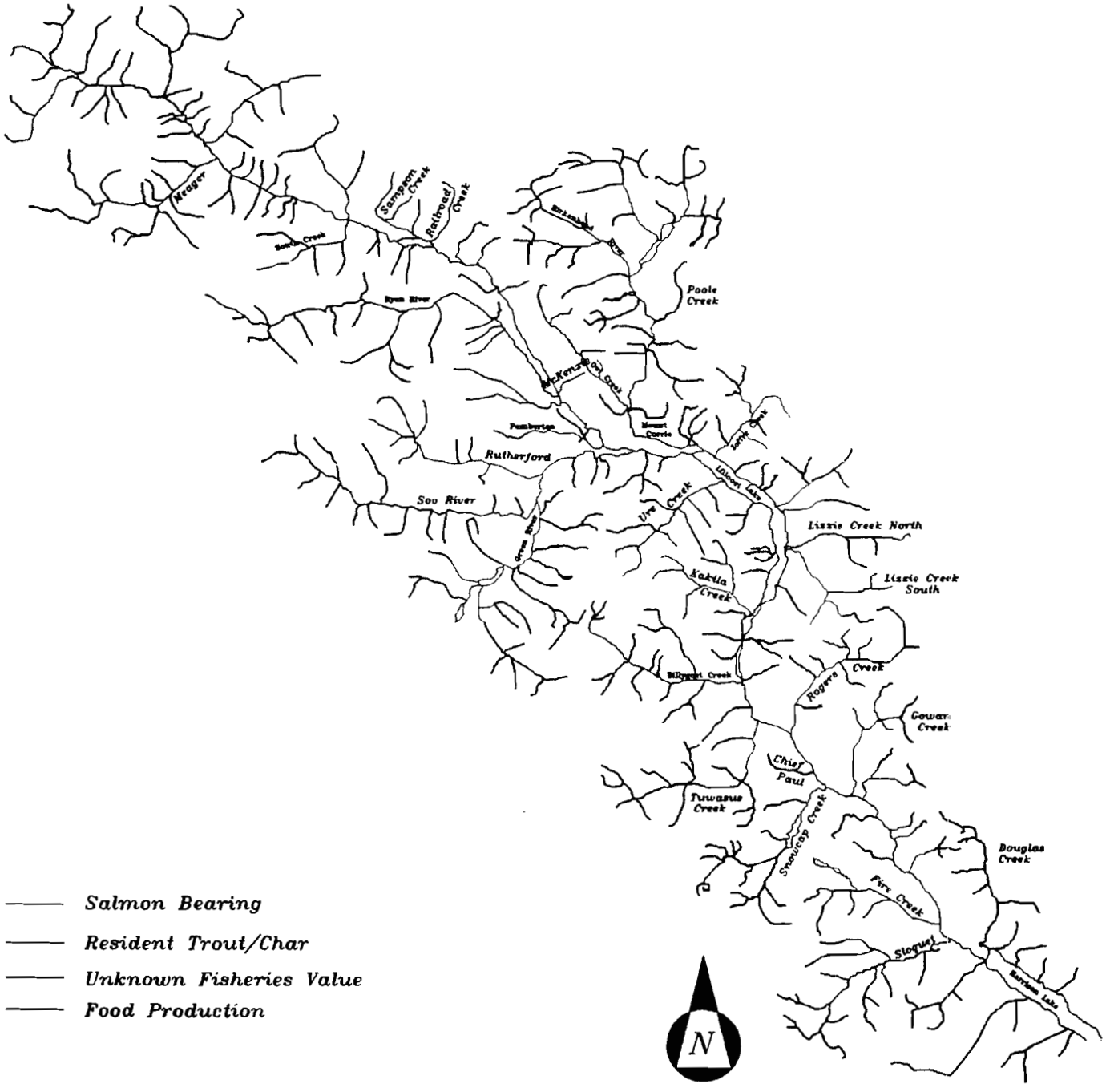
Unknown Fisheries Value

Food Production

Figure ES-2

Lillooet River Watershed

Fish Habitat Classification



Salmon Bearing

Resident Trout/Char

Unknown Fisheries Value

Food Production

Figure ES-3

PROJECT TEAM STRUCTURE AND COMMUNITY INVOLVEMENT

SQUAMISH AND LILLOOET WATERSHED COMMITTEES

An important component of the project was the interaction and direction from the community watershed committees in Squamish and Lillooet. These committees are made up of representatives from forestry, First Nations, and the general public. Such committees are necessary to ensure that the funds allotted through Forest Renewal British Columbia (FRBC) projects provide maximum benefit to the communities in the watershed.

Squamish/Cheakamus Watershed:

Squamish Nation
Forest industry
District of Squamish, Resort Municipality of Whistler, Squamish-Lillooet
B.C. Hydro
General public
B.C. Ministry of Forests
B.C. Ministry of Environment, Lands and Parks
Steelhead Society of B.C.

Lillooet/Green Watershed:

Mt. Currie Band
In-SCHUCK-ch Tribal Council
Department of Fisheries and Oceans (DFO)
Environment Canada
Forest industry
Squamish-Lillooet Regional District
B.C. Ministry of Forests
B.C. Ministry of Environment, Lands and Parks (MELP)
PSWA

PROJECT TEAM STRUCTURE

The study was made possible by the concerted efforts of many individuals. Figure ES-4 presents the organizational structure of the project team. Project direction was provided by the respective watershed committees.

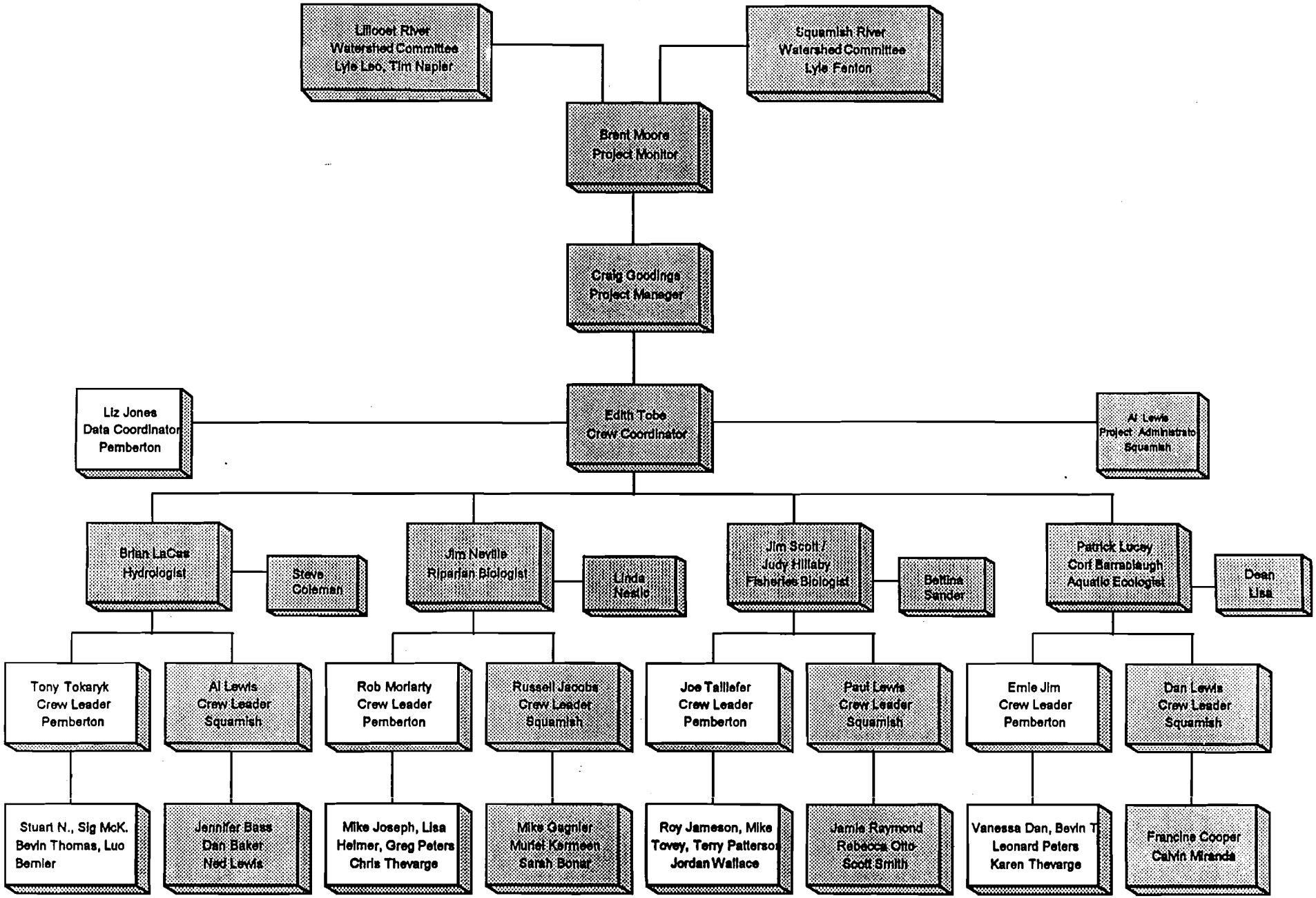


Figure 4. Project Organizational Chart

TRAINING AND SKILLS DEVELOPMENT

An integral component to the Squamish and Lillooet Restoration Project was the training program through which displaced forest workers, First Nations members, and members of the local communities were given an opportunity to learn new skills development and participate in the project.

Forty individuals were hired from the local communities (25 from the Pemberton Area to perform work within the Lillooet River Watershed, and 15 from the Squamish Area to perform work within the Squamish River Watershed), and represented displaced forest workers, First Nations, and residents of the local communities. The individuals hired for the programme were selected on the basis of their past knowledge in related type of field work, their ability to work within a team structure, and an ability to perform assessments with limited supervision. Photographs demonstrating training activities are provided in Figures ES-5 to ES-10.

Introductory Training

A ten day training period conducted in the Pemberton area was given to all employees. Training consisted of an introduction to the nature of the work to be undertaken followed by detailed in-field training in each of the four assessments: Channel Assessment, Riparian Assessment, Fish Habitat Assessment, and Water Quality Assessment. Training was conducted by specialists in each of the four assessment areas.

First Aid Training

First Aid training was provided as part of the training programme to 36 of the candidates who were not certified with the minimal appropriate first aid certification as per Workers' Compensation Board requirements (Occupational First Aid and Transportation Endorsement).

Electroshocking Training

For the crews hired to perform Fish Habitat Assessments and Water Quality Assessments, a separate college certified course was provided. Electro-fishing is conducted by standing in the water while wearing a backpack power unit. This method of sampling is utilized because it provides a safe and expedient method of assessing for fish presence/absence. When properly operated, the electro-fisher temporarily stuns the fish allowing it to be captured and identified. After a short recovery period the fish are returned to the creek, unharmed. The electrofishing training involved a two day course in which the trainees were taught the use, operation, and safety of electrofishing in a Ministry-approved course.

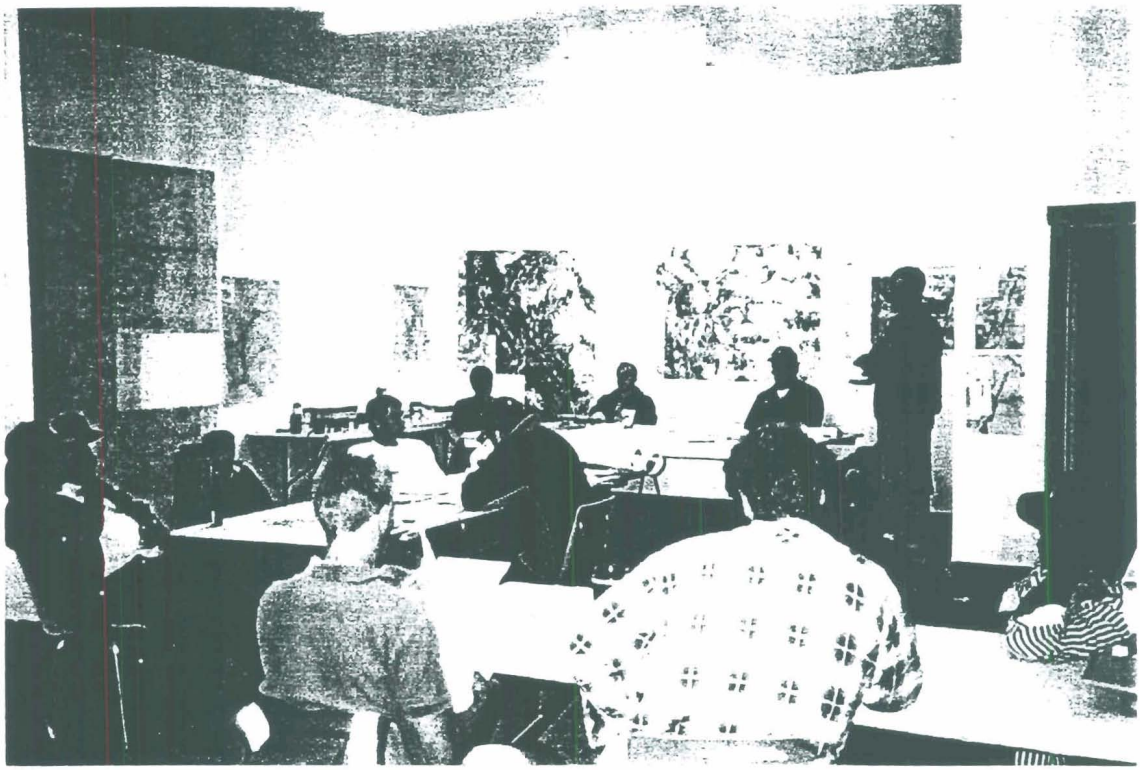


Figure ES-5. Introductory Classroom Training.

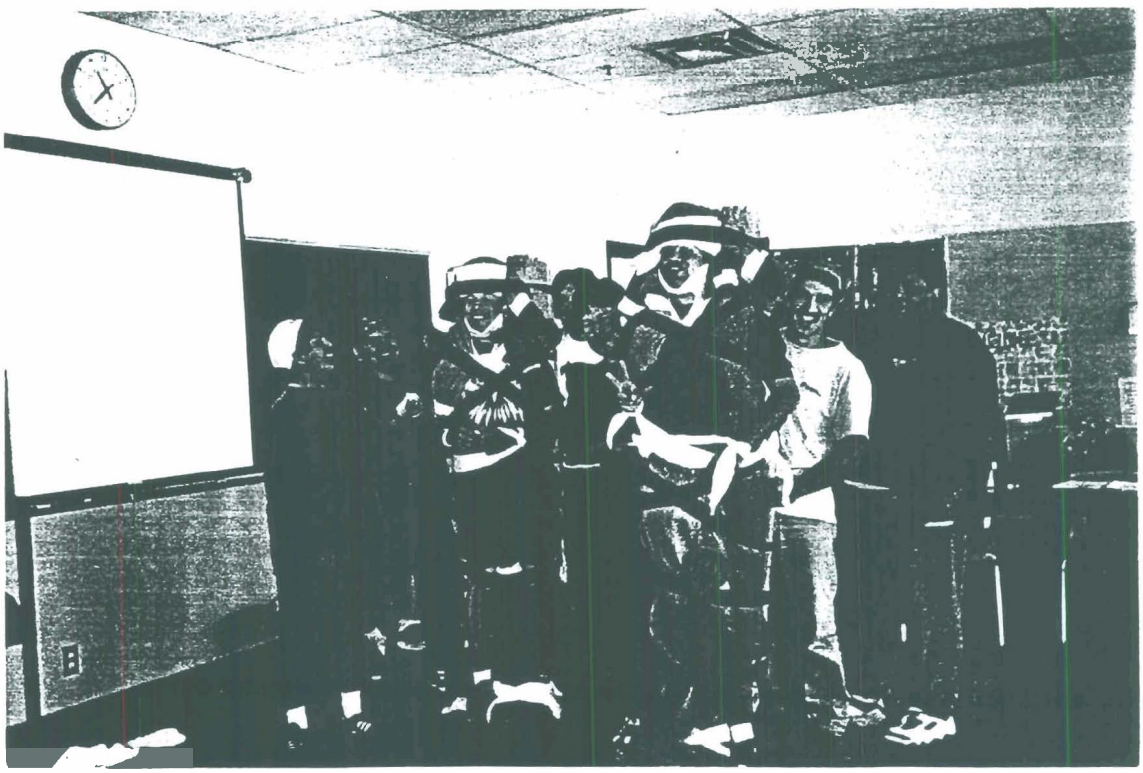


Figure ES-6. First Aid and Transportation Endorsement Training.



Figure ES-7. Field training in channel assessment procedures.

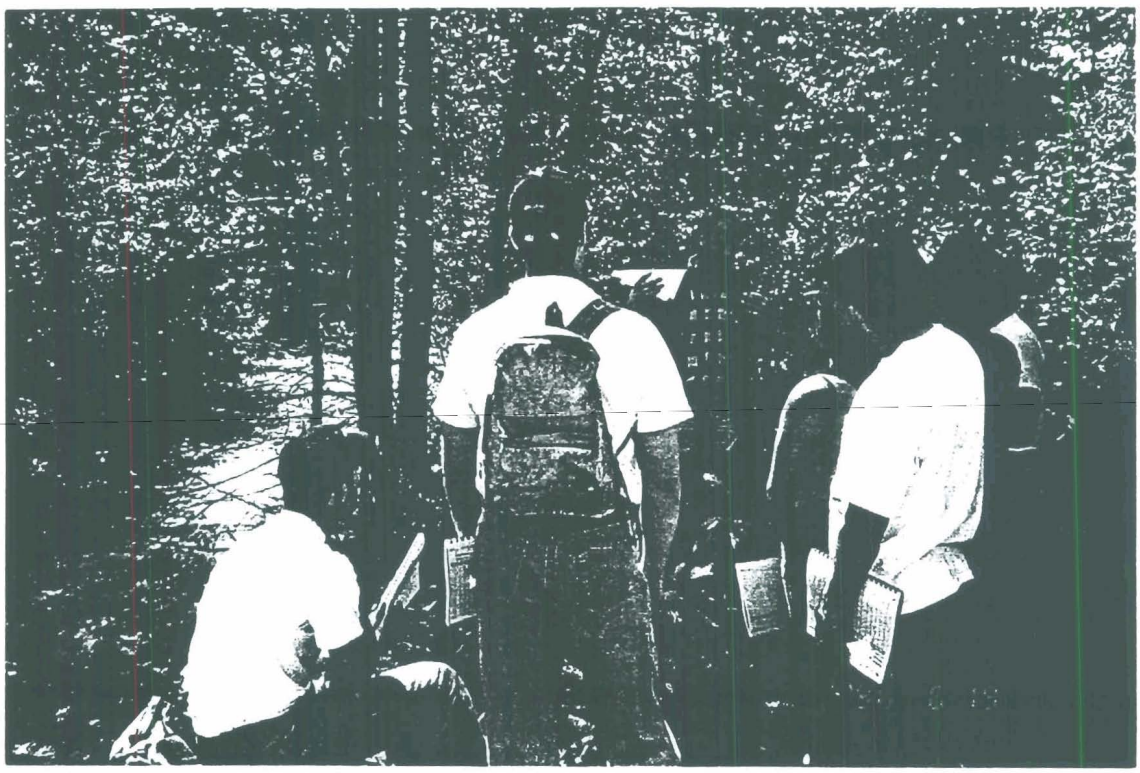


Figure ES-8. Field training in fish habitat assessment techniques.



Figure ES-9. Field training in riparian assessment procedures.



Figure ES-10. Field training in water quality assessment techniques.

The following sections provide an overview of the conditional assessment (Year 1) and the detailed assessments (Year 2) conducted in the Squamish and Lillooet watersheds. The conditional assessment conducted in 1995 formed the basis for Year 2 work.

PROJECT IMPLEMENTATION - CONDITIONAL ASSESSMENT

The conditional assessment of approximately 240 creeks within the two watersheds had two main objectives:

- To train community members in Level One Watershed Assessments
- To assess all creeks draining into the Squamish and Lillooet watersheds and prioritize those drainages that had the most potential for sustainable restoration.

This study differed from other watershed assessments in that a major watershed was assessed rather than a sub-watershed drained by a creek system. The study was based on the following premises:

- an ecosystem approach must be adopted
- watershed ecosystem interactions should be assessed before "restoration" is initiated
- projects can not cease at the physical alteration or "restoration" stage
- projects only designed to increase production of selected species are not effective over the long term
- assessments must be watershed-specific

Characteristics examined included: geology, geomorphology, hydrology, cumulative logging impacts, vegetation, water quality and fishery values (past and present). Effort was directed on identifying creeks with anadromous salmon values. Prioritization was based on a fisheries assessment, water quality, hydrological assessment, and the degree of riparian damage due to logging and road construction. Creeks with salmon and trout fisheries and significant logging impacts were given highest priority, whereas creeks that had recovered from past logging were given the lowest priority.

As a result of the conditional assessment, seven drainages in the Squamish watershed and thirteen drainages in the Lillooet watershed were prioritized as prime candidates for restoration activities and Year 2 assessments.

In the Squamish watershed, these creeks included Cloudburst Creek, Evans Creek and Pillchuck Creek which flow directly into the Squamish River; Brohm River, Cheekye River

and Chance Creek which flow into the Cheakamus River; and Crawford Creek which flows into the Mamquam River.

In the Lillooet watershed, these creeks included Fire Creek, Gowan Creek, Kakila Creek, McKenzie Creek, North Lizzie Creek, South Lizzie Creek, Rogers Creek, Rutherford Creek, Sampson/Railroad Creek, Snowcap Creek, the Soo River and Tuwasus Creek. All of these drainages flow directly into the Lillooet River, except for the Soo River which enters Rutherford Creek before entering the Lillooet River.

DETAILED ASSESSMENTS AND PRESCRIPTIONS FOR RESTORATION

The next step in the watershed restoration process was to undertake a detailed assessment of the shortlisted creeks, with the goal of determining restoration activities and maximizing community benefit. Once creeks within each watershed were prioritized, the project team was able to focus on detailed assessments within the select creeks.

The project objectives for Year Two were to:

- Conduct detailed assessments of selected creeks in each watershed.
- Increase the number of community members trained and employed on the project.

Four main areas of study were applied to the drainages: a *channel assessment procedure* (CAP); a *fish habitat assessment procedure* (FHAP); a *riparian assessment procedure* (RAP); and a *water quality assessment procedure* (WAP). Together, these assessments provide a basis for future restoration activities which will be implemented concurrently throughout the watershed.

Representative photographs of each of these assessments are provided in Figures ES-11 to ES-14. The purpose of these assessments was to identify limiting factors to the aquatic ecosystem and develop detailed procedures to address these limiting factors. In keeping with the mandate of FRBC, these assessments were not carried out by specialists, rather, specialists were used to train crews from the community in the collection of the scientific data necessary for the assessments. After training the crew, the specialist role became one of quality assessment/quality control (QA/QC) to ensure that the data collection methods and data collected and recorded were accurate. This information was used with input from specialists and community members to complete the assessment procedures and develop prescriptions. In this way, the community was intimately involved in the process rather than just the recipients of a completed report.

A total of 40 workers from the Squamish/Lillooet community (divided into separate crews) were trained in methods of data collection and general assessment guidelines to facilitate the development of assessments and prescriptions. The field crews carried out data collection for fish habitat, channel, riparian, and water quality assessments.

Once the detailed assessments were completed in each of the creeks, prescriptions for restoration activities were developed for each component. The prescriptions will be implemented concurrently throughout the watershed based on twenty-year plans. Many of the restoration activities prescribed will be implemented by the community.

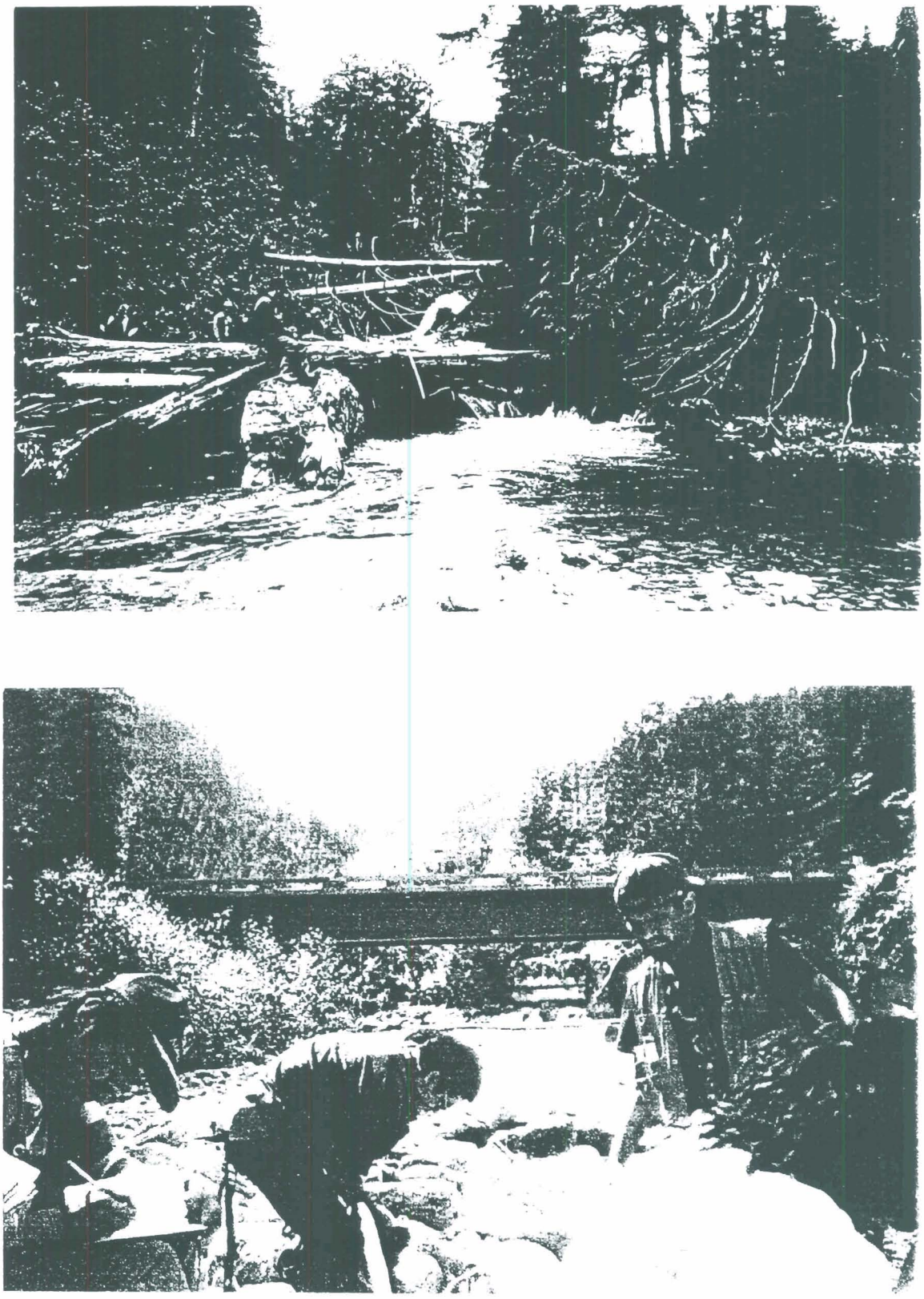


Figure ES-11. Channel Assessment Procedure

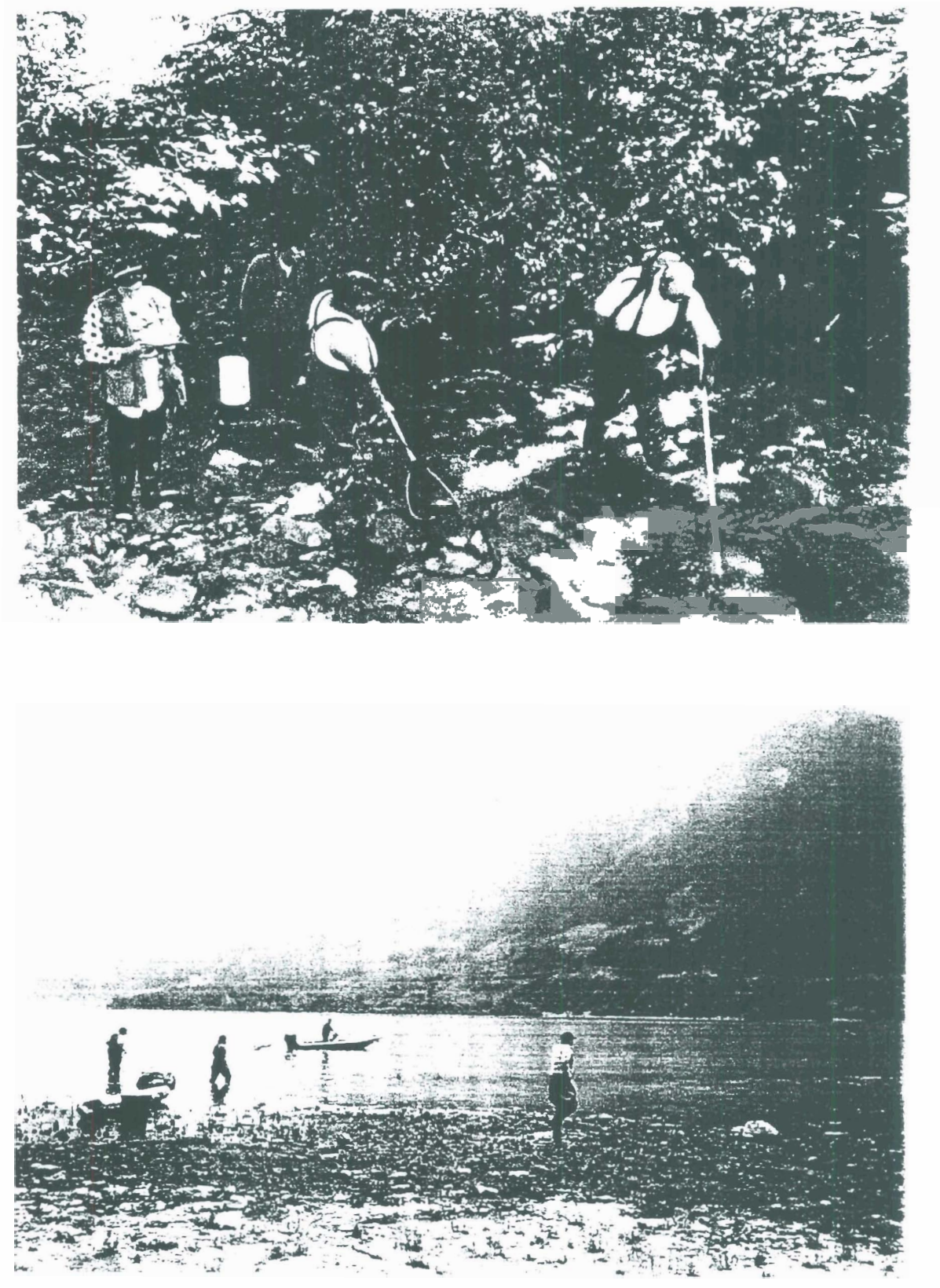


Figure ES-12. Fish Habitat Assessment Procedure

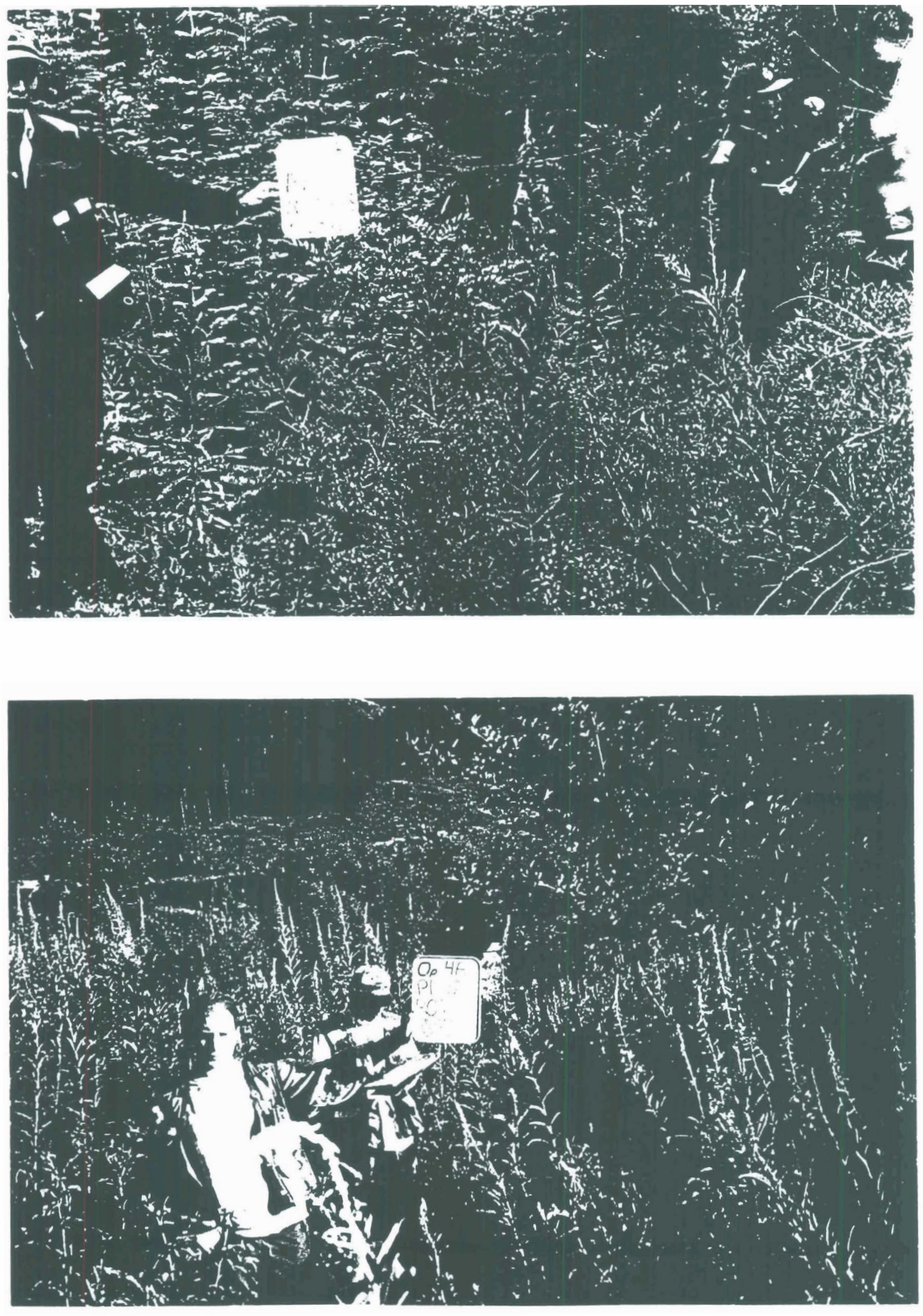


Figure ES-13. Riparian Assessment Procedure



Figure ES-14. Water Quality Assessment Procedure

Table ES-1. Sample Riparian Prescription Table

YEAR	SPRING	SUMMER	FALL	WINTER
1996 (yr 0)	complete Level 1 assessment	conduct Level 2 assessment	develop draft prescriptions; commence live-stake plantings; possible pilot conifer planting	finalize prescriptions; possible continuation of slash removal from RMAs
1997 (yr 1)	additional live-stake plantings; stock selection; supply tree seeds to grower for fall and next spring stock; plant shrubs and berry bushes; removal of fireweed	evaluate success of live stakings; continued periodic removal of fireweed	additional live-stake plantings; obtain tree seedlings from grower; plant tree seedlings	re-visit prescriptions if modifications warranted
1998 (yr 2)	removal of fireweed; continue conifer planting	evaluate success of all planting; if necessary, plan additional planting; removal of fireweed	additional planting as necessary	
1999 (yr 3)	additional planting as necessary; removal of fireweed	removal of fireweed; evaluate success of all planting; if necessary, plan additional planting	additional planting as necessary	
2000 (yr 4)	inspection			
2001 (yr 5)	inspection	evaluate success of all planting; prescribe additional planting if necessary	begin implementation of year 5 prescriptions	
2002 (yr 6)	continued implementation of year 5 prescriptions			
2003 (yr 7)	inspection			
2004 (yr 8)	inspection			
2005 (yr 9)	inspection			
2006 (yr 10)		evaluate success of all planting; prescribe additional planting if necessary	begin implementation of year 10 prescriptions	
2007 (yr 11)	continued implementation of year 10 prescriptions			
2008 (yr 12) to 2016 (yr 20)	inspections on an as-needed basis, e.g., following large flood events; possible site-specific, small scale prescriptions or repairs as necessary; after 20 years, the sites should be self-sustaining and self-perpetuating			



Figure ES-15. Chance Creek Pilot Project - unrestored site.



Figure ES-16. Pilot Project - Crews preparing whips for planting.



Figure ES-17. Pilot Project - Active restoration work by field crews.



Figure ES-18. Pilot Project - Riparian enhancement at Chance Creek.

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1.0 INTRODUCTION

1.1 Forest Renewal British Columbia

Forest Renewal B.C. (FRBC) was created in 1994 to help ensure that British Columbian forests and lands continue to provide long-term benefits to communities who rely on them. FRBC directs funding under three land based programs:

1. Enhanced Forestry
2. Watershed Restoration
3. Resource Inventory

The overall objectives of these programs are to:

- Renew the lands and keep the forests healthy.
- Invest in the forest lands which generate much of our wealth.
- Ensure sustainable use and enjoyment of our forests.
- Ensure the continued availability of good forest jobs.
- Ensure the long-term stability of communities that rely on the forests.

The level one conditional watershed assessment presented in this report was funded under the Watershed Restoration Program (WRP). The main objective of the WRP is to accelerate the recovery of watersheds that have been adversely affected by timber harvesting practices. The stated goals for this program are to:

- Restore, protect and maintain fisheries, aquatic, and forest resources adversely affected by forest harvesting practices that, without intervention, would require decades to recover naturally.
- Bring areas harvested under previous (pre-Forest Practices Code) standards up to Forest Practices Code standards.

- Provide community-based employment, training, and stewardship opportunities throughout the province.

1.2 Guiding Principles of the Squamish Watershed Restoration Program

The Squamish River WRP was initiated by the B.C. Ministry of Environment, Lands and Parks (MELP) Integrated Management Committee to identify, prioritize and undertake required restoration within the Squamish River watershed. The Committee is supported internally by B.C. MELP Fisheries, Wildlife, Habitat Protection and Environmental Protection Programs (Lower Mainland region).

To achieve the objectives of the Forest Renewal Plan, B.C. MELP adopted an approach that bases watershed restoration projects under their jurisdiction on the following premises:

- An ecosystem approach must be adopted.
- Watershed ecosystem interactions should be assessed before "restoration" is initiated.
- Projects can not cease at the physical alteration or "restoration" stage.
- Projects only designed to increase production of selected species are not effective over the long term.
- Assessments must be watershed-specific.

1.2.1 Ecosystem Approach

Support for an ecosystem approach has been widespread in recent years and has been an integral component of many environmental management programs. At a 1991 Lowland Streams Restoration Workshop in Sweden, there was an almost unanimous call for adoption of a holistic ecosystem approach to stream restoration (Osborne et al., 1993). In 1994 Doppelt noted that the most fundamental problem facing salmonid populations region-wide is the consistent degradation of aquatic systems from human activity. Fisheries professionals have been urged to demand scientifically sound implementation in order to grasp what may be the last opportunity to develop sustainable land and water management policies and practices.

"A change with tremendous promise has occurred with the recent adoption of the new Aquatic Conservation Strategy, an ecosystem-based watershed protection and restoration program on federal lands in the Pacific Northwest". (Doppelt, 1994)

The other premises adopted by B.C. MELP in implementation of watershed restoration programs are discussed below and fall within the framework of an ecosystem approach.

1.2.2 Watershed Interactions

Experts in the field have supported watershed ecosystem assessment as an initial step prior to physical restoration. Swanson (1994) lists lessons learned from watershed restoration on Chesapeake Bay in the coastal U.S., and suggests that the process begin with comprehensive, multidisciplinary studies to form a solid, scientific foundation for decision-making. Lichatowich et al. (1995) outlined an ecosystem approach to diagnose and treat depleted Pacific Salmon populations in Pacific Northwest watersheds. The four historic approaches to the restoration of Pacific Salmon (i.e., hatcheries, physical habitat structures, minimum stream flows, reduced harvest rates) have often failed because they were generally conducted independently of any ecological context at the watershed level (Lichatowich et al., 1995). Habitat complexity and the specific self-organizing capacity of a salmon population are cited as important structural ecosystem elements that need to be addressed in watershed-level restoration.

Lichatowich et al. (1995) recommend a stepwise process to watershed restoration. Existing management objectives should first be identified and linked to sustainable restoration. Factors that may be limiting production can then be identified, so that the most effective and economical means to restore natural production can be identified. The three most important elements to the life history-habitat relationship of the species are identified as:

- Geography - the distribution and quality of salmon habitats in a watershed.
- Time - the seasonal pattern of use and connectivity of those habitats.
- Biology - the biological function such as spawning, migration, feeding and escaping predators that takes place in those habitats.

These factors are then considered in environmentally distinct stream reaches, after which production bottlenecks, in which life histories are altered or eliminated, can be described. Only then do recommended treatments (or restoration activities) begin.

1.2.3 Beyond Physical Restoration

The need for a holistic ecosystem approach is not simply based on textbook theory. There are numerous examples of physical restoration efforts that result in only short-lived benefits if not combined with chemical and biological watershed restoration. Lawson (1993) notes that short-term stream habitat restoration projects can quickly increase smolt production, with measurable results in two years or less. However, such projects by themselves are short-lived after being destroyed by floods, bed movement and siltation; as well, they often don't address restoration of the hydrological regime and stream debris sources. Crispin et al. (1993) supports this point, stating that:

> "Although favourable conditions can be achieved by manual installation of structures in some stream reaches, a better method to improve stream conditions is through long-term retention and establishment of riparian vegetation".

In the Oregon-Washington State areas, where WRP-type initiatives have already been undertaken and initially assessed, habitat improvement has not always produced the desired results. Some habitat improvement projects appeared to fail by either (1) not creating the desired change in habitat, or (2) not creating the desired change in fish populations from habitat changes (Nickelson et al., 1992). In 1992, Frisell and Nawa noted that the highest failure rate of restoration or "enhancement" activities such as artificial structures (e.g., log weirs) occurred in watersheds severely damaged by roads, logging and landslides. Respective mean structural failure and damage rates of 48 to 67% were reported for southwest Oregon streams. Borchardt (1993) also pointed out failures in the short-term physical restoration approach, noting that current stream restoration practices are rarely based on sufficient knowledge of the physical habitat requirements of the biota. He showed that drift loss of benthic macroinvertebrates was significantly affected by both shear stress and abundance of refugial space, issues not specifically addressed in current physical restoration practices.

While the Squamish River WRP is expected to be followed-up with restorative measures, the focus of B.C. MELP has been to approach the physical restoration in an ecologically meaningful manner, to maximize the potential for sustainability. The intent of this WRP has been to approach activities from an overall ecosystem perspective preceded by a conditional assessment in an effort to address the types of failures prevalent if only physical restoration is pursued.

1.2.4 Beyond Management for Selected Species

When the Squamish WRP was undertaken it was understood that some current activities are addressing well-documented issues that are presently, or may soon be, impacting on the forestry and/or fishery resources in the watersheds. The expertise of both the forester and fisheries biologist in identifying these issues is certainly recognized. B.C. MELP's direction in initiating the Squamish WRP was to build on these efforts so that restoration of terrain and stream conditions was approached from an ecosystem perspective.

A widely held concept is that any system is more than the sum of its parts, and can therefore not be completely understood or managed without consideration of the dynamics at both the system-level (i.e., holistic) and the "parts-level" (i.e., reductionist). Scientists have expressed concern that restoration based solely on the direct needs of selected species, whether they are harvestable trees or economically important fish, is inappropriate. Martin (1995) questions the fisheries management approach of managing a stream system for "desirable" flora and fauna only. He notes that such approaches can damage the natural ecosystem as much as water quality and quantity impacts. In 1971, Odum wrote:

> "The removal of large volumes of timber without the return of the contained minerals to soil (as would normally occur during the decay of logs) undoubtedly also contributes to the impoverishment of uplands in situations where the pool of nutrients was already limited. One can readily visualize how the destruction of such biological cycling mechanisms could result in the impoverishment of the whole ecosystem for many years to come, since it would require time for the re-establishment of a circulating pool of minerals. In such a case, devising means of returning limited materials (and keeping them *in situ*) would be far more effective than the stocking of fish or planting of tree seedlings".

Lichatowich et al. (1995) stressed that:

> "Sustainability of rehabilitation is not merely a function of numbers but a reestablishment of important ecological relationships...Sustainable restoration cannot be achieved through programs that focus entirely on numbers of fish".

1.3 Design of the Squamish Watershed Restoration Program

The Watershed Restoration Program for the Squamish River were originally designed to differ from other restoration projects by focussing on the premises and guiding principles discussed above; specifically:

- The application is for a major watershed drained by a river rather than a sub-watershed drained by a creek system.

- A major conditional assessment stage is being conducted for the watershed in its entirety before any related restoration work is prioritized and initiated.

- The project is being tied into overall Watershed Management Plan framework, which will utilize alternate funding sources to consider other land use activities, including waste management practices.

- The restoration proposed for the identified impacts will be designed and assessed from an overall ecosystem perspective.

The objective of the WRP was to collect ecosystem-level and community-level information on the Squamish watershed and use this information to prioritize streams that require restoration.

An important element in the design of the Squamish WRP was the involvement of multiple stakeholders as the project progressed. Training programs were incorporated as part of the WRP activities, directly involving the Squamish Nation and Mt. Currie Band and providing a direct benefit to these communities. Active stakeholders in the WRP included:

Squamish/Cheakamus Watershed:

Squamish Nation
Forest industry
District of Squamish, Resort Municipality of Whistler, Squamish-Lillooet Regional District
B.C. Hydro
General public
B.C. Ministry of Forests
B.C. Ministry of Environment, Lands and Parks
Steelhead Society of B.C.

1.2.5 Watershed-specific Assessment

Scientists have also cautioned against using a general approach to watershed restoration, rather than gathering and implementing system (i.e., watershed) specific knowledge. (Statzner and Sperling, 1993). Lichatowich et al. (1994) noted that ecosystem condition is a product of the geologic history of the particular watershed, and must be considered in restoration even though a return to pristine conditions is impractical. They stress that each system is different, and to restore the productive capacity of a watershed requires an understanding of the history of the stream habitat to which native salmon populations have adapted.

1.2.6 Summary

Ensuring the above issues are addressed in watershed restoration programs increases the chances that restoration benefits will not be short-lived. Restoration projects in the Squamish River watershed must be connected to longer term projects such as riparian zone and slope replanting, and both short- and long-term projects must be undertaken in a manner that will produce a watershed ecosystem that will be sustainable. The importance of restoring the valuable fishing and logging resources of each watershed is undeniable. However, the ecological validity of directing restoration programs to simply address the direct needs of economically important species is questionable. Clearly these species are integrated with and dependant on the entire sub-watershed ecosystem, and their restoration to sustainable levels must consider this integration. In the absence of such consideration, previous experience has shown that extensive efforts to restore renewable resource habitats fail in the long term despite positive indications of success in the first few years. Artificially supporting monocultures at levels in excess of those that can be naturally sustained by the environment is indefensible. We must determine what levels of managed forestry or fisheries use each sub-watershed can naturally sustain without negatively impacting on other ecosystems compartments that would, over time, indirectly impact on the managed species. The Squamish WRP is intended to follow this approach before restoration activities are prioritized and initiated.

1.4 First Year: Program Objectives

The Level One conditional assessment had two objectives:

1. To train First Nation technicians in Level One Watershed Assessment.

2. To assess all creeks draining into the Squamish watershed and prioritize those drainages that had the most potential for sustainable restoration.

Characteristics that were examined included: geology, geomorphology, hydrology, cumulative logging impacts, vegetation, water quality and fishery values (past and present). Given time constraints (i.e., short field season) effort was directed on identifying those creeks with maximum salmon value. Of the creeks reviewed by the field crews, seven creeks in the Squamish watershed were given priority for restoration programs.

1.5 Report Content

This report presents the background, methods and results of the 1995/1996 conditional watershed assessment carried out for the Squamish Watershed. It is divided into six sections:

- Section 1.0 - provides a discussion on assessment procedures.
- Section 2.0 - provides an overview of the Squamish watershed.
- Section 3.0 - details methods and factors that should be considered when assessing a drainage.
- Section 4.0 - outlines the training programs offered to First Nations technicians.
- Section 5.0 - presents a discussion of the short-listed drainages.
- Section 6.0 - outlines future studies required.

It is hoped that this report will be used as a reference document to supply scientific support for future restoration projects and assist in forming partnerships, and identify the employment and training programs opportunities through FRBC funding.

1.6 Second Year: Program Objectives

The program objectives for Year Two were to:

- Increase the number of community members trained and employed on the project.
- Conduct detailed assessments of selected creeks in the Squamish Watershed.

Areas of study on the creeks included Fish Habitat Assessment Procedure (FHAP), Channel Assessment Procedure (CAP), Water Quality Assessment Procedure (WAP) and Riparian Asessment Procedure (RAP). The results of these assessments will be used to develop detailed prescriptions to address the limiting factors indicated. In addition, 40 members (six were trained in Year One) of the Squamish/Lillooet community were trained and employed to collect the necessary data.

1.7 Report Content - Year Two Additions

Year Two report additions include the methods and results of the 1996/97 detailed creek assessment carried out for the Squamish Watershed. It is divided into six sections (new additions are printed on recycled green paper):

- Section 1.0 - lists new program objectives and report content.
- Section 2.0 - no additions.
- Section 3.0 - details methods that were used in drainage assessment.
- Section 4.0 - outlines the training programs offered to the community.
- Section 5.0 - presents the results of the detailed creek assessments.
- Section 6.0 - presents a brief overview of activities for Year 3.

It is hoped that this report will be used as a reference document to supply scientific support for future restoration projects and assist in forming partnerships, and identify the employment and training program opportunities through FRBC funding.

2.0 WATERSHED OVERVIEW

The characteristics of a watershed are derived from a complex interaction of geology, geomorphology, climate, human activities, topography, slope vegetation, hydrology, and water quality. These factors combine to determine the specific characteristics of a watershed and define its potential human, wildlife and fishery uses.

The following sections discuss in broad terms the geology, fisheries, hydrology, water quality and riparian vegetation of the Squamish watershed. This section is intended to introduce the limiting factors in the watershed and introduce those concepts and ideas which guided the prioritization process.

2.1 Geology Overview

The present makeup of the rock and sediment substrate of the Howe Sound region includes granitic and metamorphic bedrock, remains of volcanoes formed in the past two million years, sediments related to glaciation that ended 10,000 years ago, and modern sediments that postdate glacier retreat and continue to accumulate today (Figure 1). Of the three main rock types, granites are the most stable, metamorphic rocks are moderately stable and volcanic rocks the least stable.

2.1.1 Granitic Rocks

Granitic rocks form about 80% of the southwestern Coast Mountains with the bulk of the remainder being metamorphosed volcanic and sedimentary rocks (Turner et al., 1991). Northwest-trending, northeast-dipping shear zones that extend tens of kilometres along strike and range in width up to 2 km cut granitic and metamorphic rocks. These shear zones displace the northeast side upwards relative to the southwest. Such shear zones extend from Ashlu Creek to the Stawamus River-Indian River valley, and occur in the Britannia and Garibaldi areas. The Ashlu Creek shear zone is dated between 140 and 100 million years (Turner et al., 1991).

Fission track studies suggest that about 2 km of uplift has occurred in the last 10 million years to form the present Coast Ranges (Turner et al., 1991). It is likely that major stream valleys that cut the Coast Mountains predated this uplift, and that the uplift caused streams to deeply incise their valleys (Turner et al., 1991).

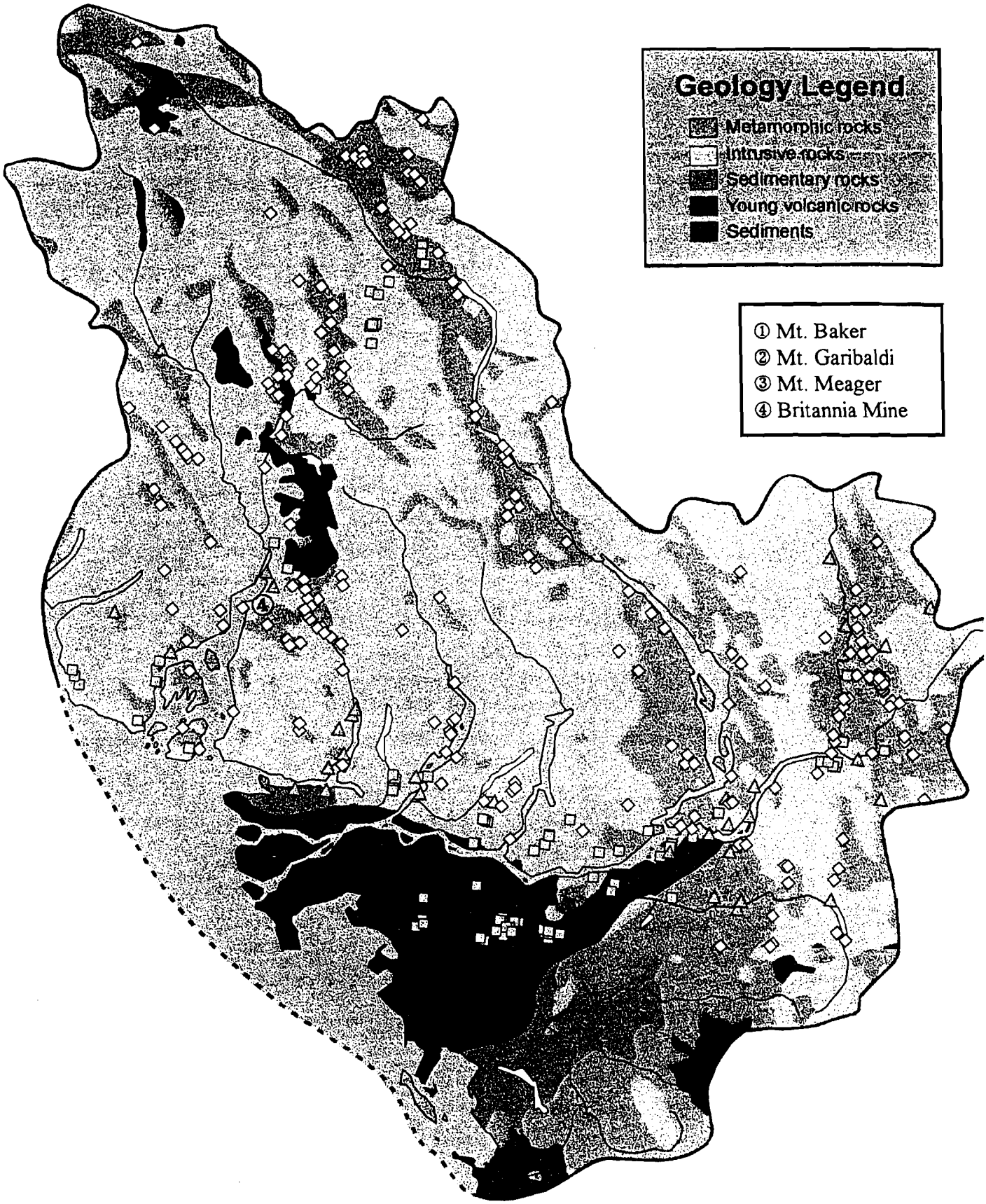


Figure 1. Simplified geologic map of the Squamish/Lillooet watersheds showing the distribution of different rock types. ◆ - copper and gold; □ - sand and gravel pits; ▲ - industrial minerals.

Granitic rocks are composed of interlocking large grains of durable minerals such as quartz, feldspar and hornblende that result in a cohesive fabric. As a result intrusive rocks are resistant to weathering and slopes on these rocks tend to be steep and topography rugged. Spectacular glacier-carved intrusive rocks such as the Chieftain at Squamish have survived the last 10,000 years with little modification. Joints (fractures) tend to be widely spaced in intrusive rocks and consequently mechanical breakdown tends to produce extremely coarse rubble on colluvial slopes. The span of post-glacial time is too short to have allowed significant chemical weathering. However, the least stable minerals such as olivine, pyroxene and calcic feldspar are susceptible to chemical attack and crystals of quartz, potash and sodic feldspar can be released to form a sandy or gritty residue.

2.1.2 Metamorphic Rocks

Metamorphosed volcanic and sedimentary rocks occur in northwest-trending belts. Metavolcanic rocks are often less resistant to mechanical weathering than intrusive rocks due to finer grain size, greater abundance of platy minerals causing cleavage in the rock, and higher density of joints. These rocks tend to be green in colour, fine-grained and include volcanic rocks of intermediate silica content (andesite and dacite). Metavolcanic rocks are composed of Ca-, Mg- and Ge-bearing aluminosilicate minerals (plagioclase, orthoclase, biotite, hornblende, chlorite, epidote), quartz and calcite with variable amounts of trace Cu, Zn, Pb and Ag. The Britannia Cu-Zn-Pb mine occurs within the Gambier Group volcanic rocks. Numerous small Cu deposits also occur within volcanic rocks on Bowen Island. Where faulted or altered to clay-rich compositions, metavolcanic rocks can be very unstable.

2.1.3 Garibaldi Volcanic Belt

The Garibaldi Volcanic Belt (GVB) is the northward extension of the Cascade volcanoes. This chain of strato-volcanoes extends northward from northern California to British Columbia (Figure 1). In Canada, the major volcanic edifices which make up the chain are mounts Garibaldi, Cayley and Meager (Figure 1). Composition of the magmas erupted in this region range from basalt to rhyolite. The arc appears to be segmented (Turner et al., 1991); the central portion is the most active, and the northern end least active (Turner et al., 1991).

Mount Garibaldi, one of the three major strato-volcanoes that make up the GVB, is the closest major explosive vent to Howe Sound. The edifice was built in several explosive (Pelean) phases during the waning stages of the last ice age (Levings et al., 1992). These explosions built blocky, unconsolidated

material up around the vent area and out onto the surrounding sheet of thick glacial ice. As the ice receded, the cone collapsed leaving the steep (600 m) front seen today. The faint layers that can be seen in this steep face are the layers of ash and blocks, some blocks of which are up to 6 m in diameter. This material readily forms landslides in addition to contributing enormous amounts of sediment debris flows originating on the volcano's slopes. This debris built up Cheekeye Fan and continues to contribute to debris flows and rock failures.

The GVB poses a considerable threat in the form of large rock failures and catastrophic debris flows. The volcanoes are extremely rugged regions of high relief underlain by unstable, poorly consolidated and/or strongly jointed volcanic rocks. These conditions have already led to a number of failures and debris flows. Comparable debris flows generated in volcanic areas have much greater run out distances than those generated in nonvolcanic areas, in part because of a greater percentage of fine material in "volcanic" debris flows.

2.2 Fisheries Overview

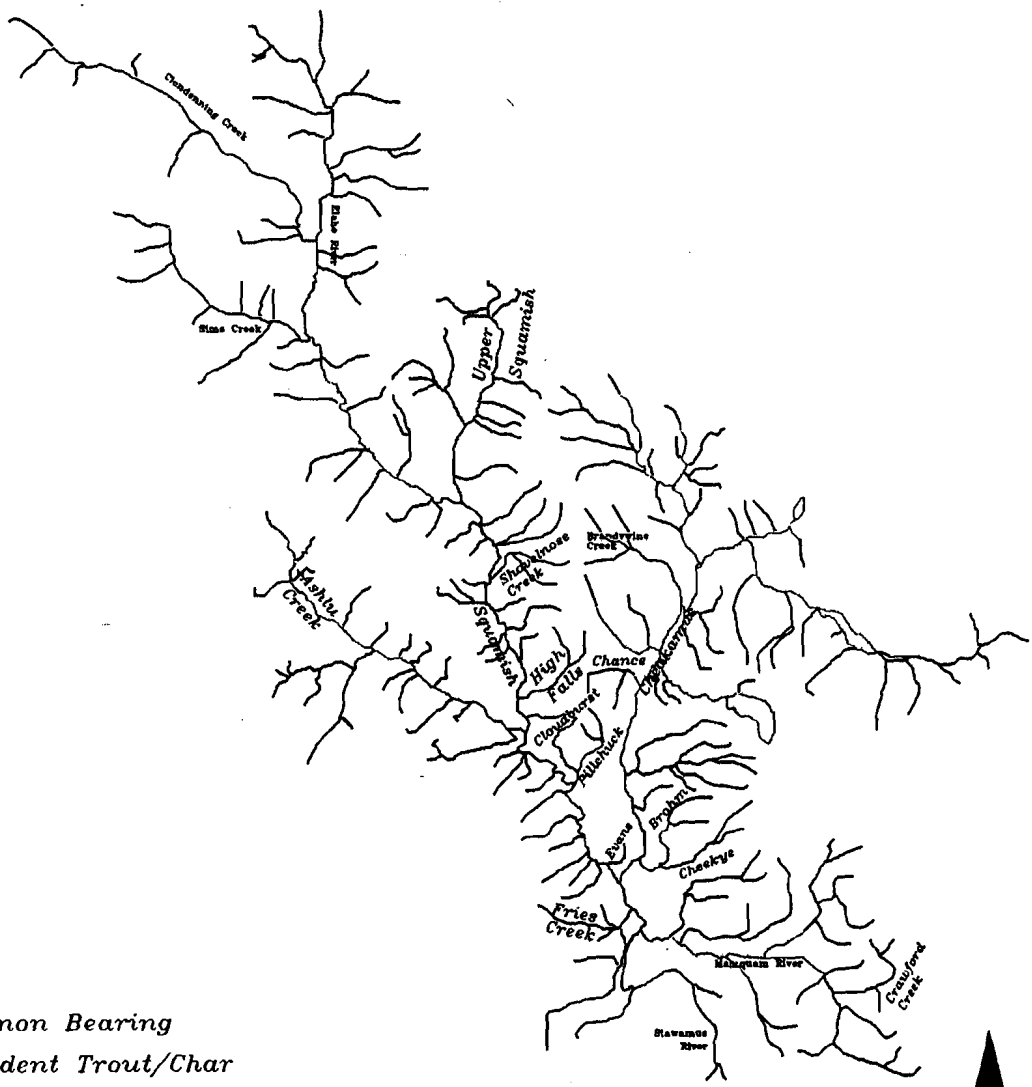
The Squamish and Lillooet drainages in the DFO Squamish Sub District (28B) supports significant escapements of Pacific Salmon (*Oncorhynchus* spp.), anadromous (sea run) and resident trout (*O.* Spp.), anadromous and resident char (*Salvelinus* spp.) and kokanee (land-locked sockeye salmon; *O. nerka*). There are also numerous other non-salmonid species inhabiting these systems. Like many other British Columbian rivers, these systems have suffered declines in salmonid escapements over past decades. Commercial, recreational and subsistence overharvest, habitat degradation and water-use demands may be causative factors.

In watershed, anadromous fish species utilize the lower gradient sections of the drainages that have access from the ocean. The amount of habitat that can be accessed by these species is limited by natural or manmade barriers which prevent upstream migration. Examples of fish migration barriers include waterfalls, steep gradients, high water velocity areas and dams. The extent of anadromous fish migration in the watershed is shown in Figure 2.

In many watercourses, resident (non-anadromous) fish utilize stream sections upstream of barriers. These fish live their entire life cycles within their natal streams. In many situations, resident fish will migrate seasonally within their natal streams to take advantage of various types of habitat at different times of the year.

Squamish River Watershed

Fish Habitat Classification



Salmon Bearing

Resident Trout/Char

Unknown Fisheries Value

Food Production

Figure 2

2.2.1 Squamish River

The Squamish River is fed by four major tributaries, (Mamquam, Cheakamus, Ashlu and Elaho Rivers) and numerous smaller watercourses. Natural barriers occur in the upstream reaches in all four of the major tributaries as well as in the Upper Squamish River. In the Cheakamus River, there is also a dam at the outlet of Daisy Lake. Significant fisheries resources occur in the Cheakamus drainage upstream of Daisy Lake dam, while fewer fish are found above the barriers in the other watercourses. The Ashlu River, although containing historic fisheries values, was barren until 1980, when B.C. MELP attempted headwater stocking of steelhead fry. Some of these fish have residualized, creating a small population of headwater rainbow trout. The Squamish River steelhead stock is managed as a wild fishery (i.e., no hatchery augmentation).

2.3 Hydrological Overview

2.3.1 Squamish Watershed

The Squamish River system includes numerous mountain tributaries, many glacier fed, comprising a total watershed area of 3,600 km^2. The Squamish River extends from its headwaters on the Pemberton Icefields at 2,260 m elevation to Howe Sound (Sea Level).

The peak flow hydrograph for the Squamish River is rain and rain-on-snow dominant. Therefore, peak flows are expected to occur when a severe storm front aligns itself over the entire basin. Early loose snowpack on the mountains would absorb some rainfall, but under the right conditions rapid melting of snow would augment peak flow. Severe summer storms (August 1991) can occur but the peak flows are expected to be lower than a rain-on-snow event.

Based on the Water of Survey of Canada Hydrometric Station 08GA022 (Squamish River Near Brackendale, upstream watershed area of 2,330 km^2), the mean annual flood flow for the Squamish River is 1,200 cm/s. The 20, 50, 100 and 200 year mean annual maximum daily flow is 2,300 cm/s, 3,000 cm/s, 3,500 cm/s and 4,000 cm/s, respectively.

2.3.2 Climate

A climate analysis consists of analysis of temperature and total precipitation (rainfall and snowfall) within a region. The climate analysis for the Squamish River system is based on data sets available from the Squamish STP Climate Station (No. 1047670), located at the 6 m elevation at Latitude 49° 44'N, Longitude 123° 09'W).

The monthly temperature variation for the Squamish STP Climate Station for the period of record from 1993-1995 is illustrated in Figure 3. This figure includes the Extreme Maximum Temperature, Extreme Minimum Temperature and the Average Daily Temperature curves.

The total precipitation variation for the Squamish STP Station for the period of record from 1981-1993 is illustrated in Figure 4. On average over the year, the total precipitation is about 2,217 mm.

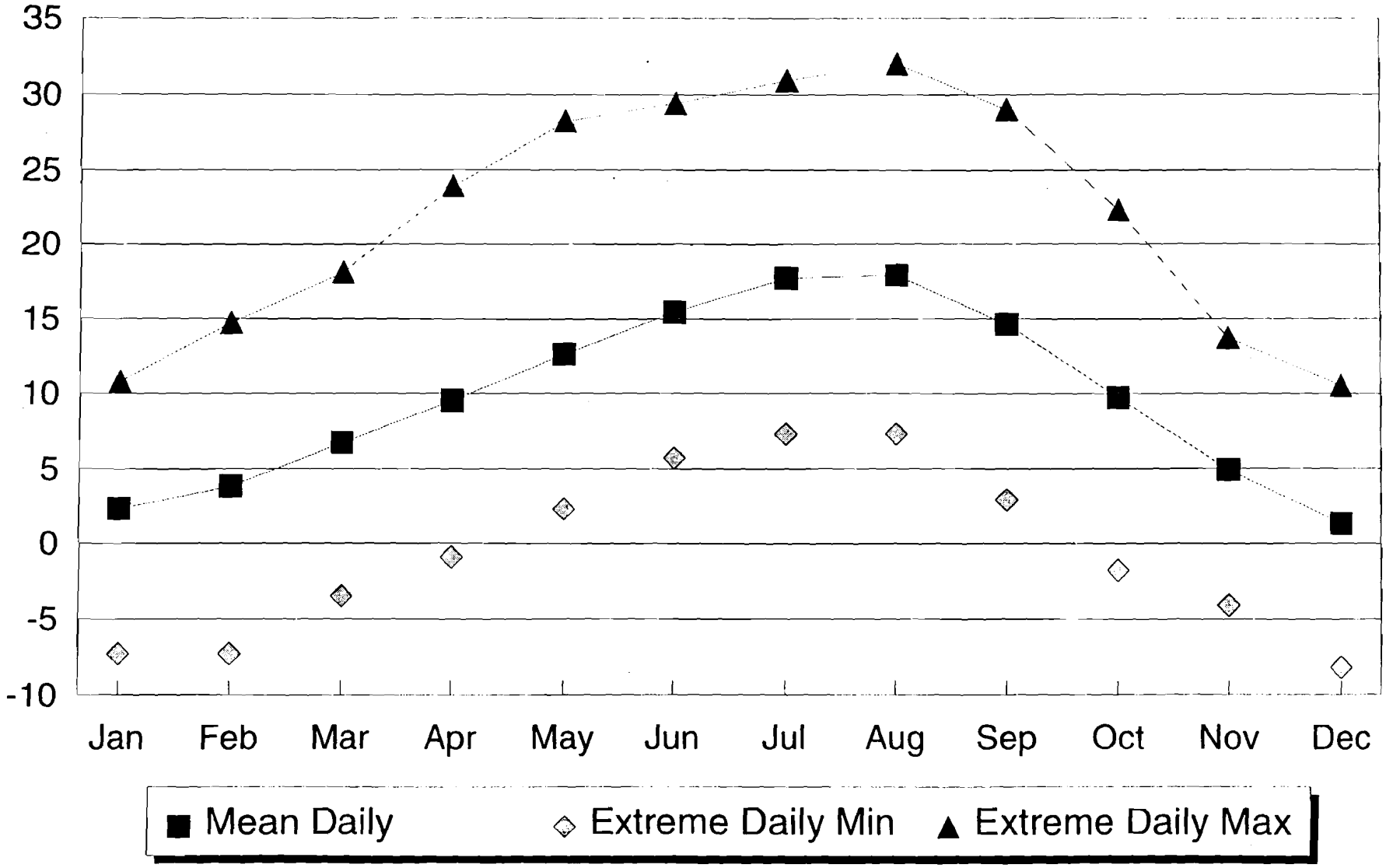


Figure 3. Temperature record for the Squamish STP Climate Station (1993-1995).

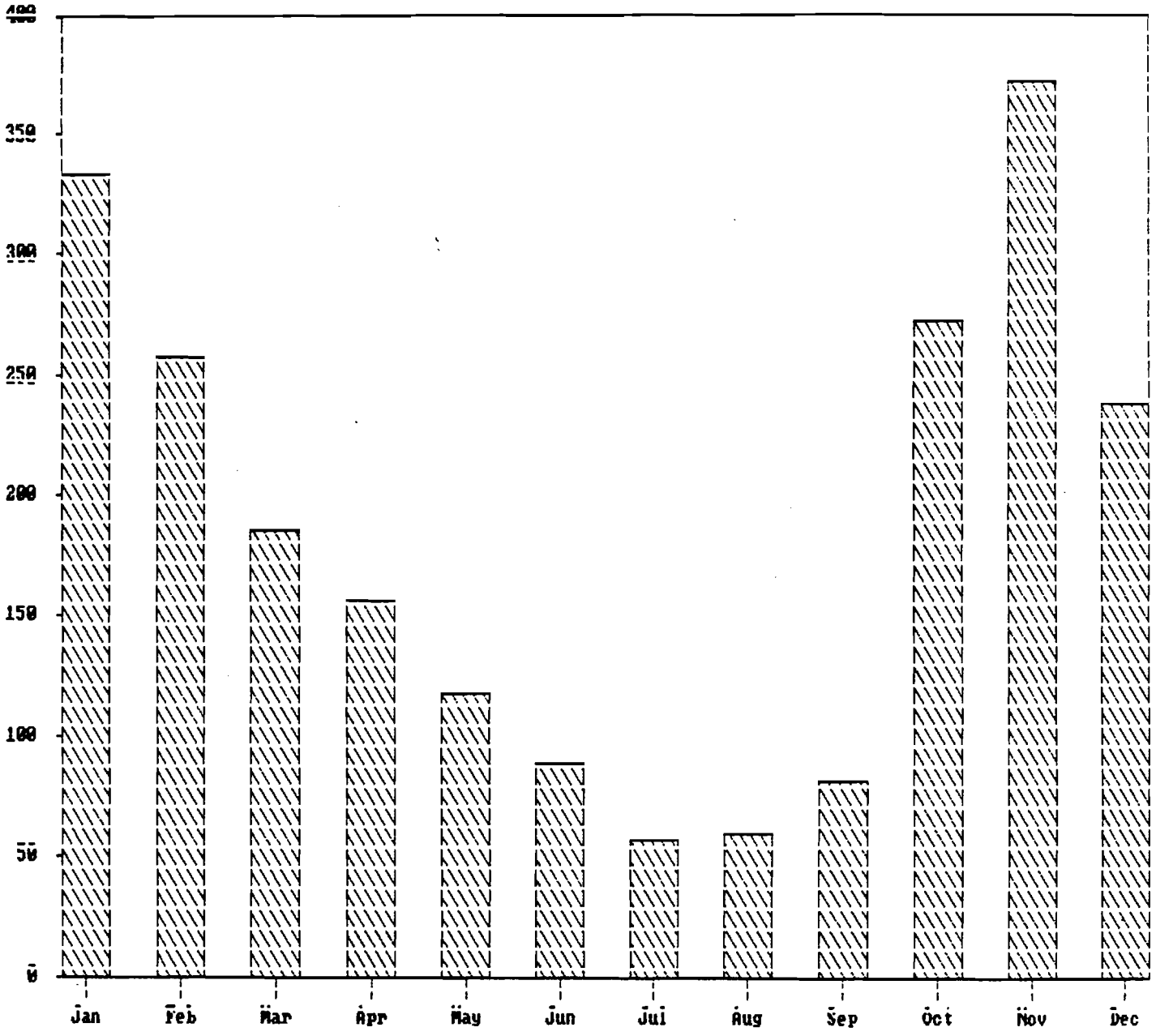


Figure 4. Total precipitation variation for the Squamish STP Climate Station (1981-1993).

2.4 Riparian Overview

Riparian or streamside vegetation is an integral part of the ecology of a stream, serving a number of interconnected functions. Riparian zones may be defined functionally as an area of direct interaction between terrestrial and aquatic environments. These functions include soil formation, streambank retention and stability, prevention of erosion and siltation, microclimate modification, contribution to in-stream nutrient levels and biogeochemical cycling, and wildlife habitat.

A major characteristic of riparian areas is their high potential productivity. Streamside vegetation is a major source of energy and nutrients for instream communities. Green and Kauffman (1989) cite estimates that 90% of the organic matter supporting headwater stream communities is of terrestrial origin. In these small streams of forested ecosystems, up to 99% of the energy input may be from outside (allochthonous) sources, while a scant 1% is derived from instream (autochthonous) sources. A second characteristic of riparian areas is that they are severely disturbed by floods, which have a strong effect on the topography of the valley floor and, as a consequence, on the structure and dynamics of the plant communities. Because of disturbances by flood events, the topography of a valley floor is typically irregular, and this may result in soil moisture that is extremely varied over short distances. This produces a dense mosaic of habitats, resulting in a segregation of species at local scales. These two factors, productivity and disturbance, interact to control patterns of species richness.

The condition of the riparian zone is a reflection of many complex biogeochemical processes with linkages to both aquatic and terrestrial communities. Biogeochemical processes greatly influence water quality, the aquatic ecosystem, and the pattern and productivity of the riparian vegetation.

The streams which feed the Squamish watershed, and the valleys which contain them, are highly dynamic systems. Natural disturbances keep portions of the riparian vegetation along many of these streams in a constant state of successional flux. In some locations, geological instability produces massive rock slides. Annual extremes of hydrologic energy produce debris flows, stream course alterations, and heavy flooding. Climatic extremes produce heavy snow burden, flash floods, and drought.

The Squamish watershed has been extensively logged during the past century, creating another level of disturbance superimposed on the natural processes. Each of the many streams feeding these watersheds exhibits a unique pattern of disturbance. Some older cutblocks have regrown into healthy, mature second-growth forests. Reforestation of other cutblocks has failed, leaving eroded scars on the landscape. Some riparian areas have been nearly denuded of soil and plant life. Others have developed into richly complex ecosystems.

Human activities such as logging act to uncouple riparian and stream ecosystem interactions. This has important implications as riparian zones are physical, biological, and chemical links between terrestrial and aquatic environments. The attributes of the riparian zone and its vegetation are therefore very important to the process of evaluating the potential success and effectiveness of restoration projects.

2.5 Water Quality Overview

The term water quality is used to describe the chemical, physical, radiological, biological and ecological characteristics of the aquatic environment in relation to some specific use of the water (i.e., protection of in-stream fisheries or drinking water). Thus, a water quality parameter is a measurable characteristic of the aquatic environment, while a water quality objective is a numerical statement established to support and protect the designated uses of water at a specified site or for a specified purpose.

While there are literally hundreds of water quality parameters which can be measured, they are often grouped into common categories: (i) physical and chemical constituents; (ii) flow; (iii) sediment; (iv) channel characteristics; (v) riparian; (vi) aquatic organisms; and (vii) ecological or trophic linkages. The term water quality is thus often taken to mean the complex interactions of all these categories which ultimately provide some estimate of the health of the aquatic environment. The nature of water quality as it pertains to fish can be considered in terms of four basic considerations: (1) provision of nutrition or food (both quantitative and qualitative); (2) respiration (adequate supply of oxygen); (3) provision of characteristics conducive to growth and health (i.e., absence of pollution or toxins); and (4) provision of habitat for reproduction. Alterations of any of these basic water quality characteristics can exert varying degrees of stress to fish, either directly (absence of oxygen or smothering of spawning beds) or indirectly (turbidity which prevents algal growth, which reduces invertebrate abundance, which reduces available food for juvenile fry).

Physical and chemical parameters have long been measured as surrogate estimates of biological health and until recently have played a primary role in monitoring and evaluating water quality (Lucey et al., 1987). The water quality parameters measured in the Squamish River system during this study include those that have been commonly measured in forest streams and that are sensitive to forest management activities and which are likely to affect the use of forest stream waters by fish and on those organisms that are trophically important to fish, especially salmonids. These include water temperature, turbidity, colour, light, light attenuation, pH, specific conductance, dissolved oxygen (DO), and nutrient parameters including Nitrogen and Phosphorus compounds.

3.0 METHODS

3.1 Prioritization of Drainages

Prioritization of the creeks in the Squamish Watershed with the most potential for sustainable restoration was a key objective of this first year, Level One conditional assessment. Prioritization followed a three-phase program:

1. Literature review and interviews.

2. Field visits by the field crews.

3. Review of all collected data and helicopter reconnaissance by the specialist team.

The objectives of phase 1 and 2 were to produce a short-list of drainages that had been impacted by past logging activities and had historical or present fishery values. The specialists then prioritized the short-list based on a fisheries assessment, water quality, hydrological assessment, and the degree of riparian damage due to logging and road construction.

The following sections discuss the factors that each specialist considered in reviewing and prioritizing the short-listed creeks. Creeks with salmon and trout fisheries and significant logging impacts were given highest priority whereas creeks that had recovered from past logging were given the lowest priority.

3.2 Fisheries Assessment

The fisheries assessment focussed on four main questions, as posed in the WRP Fish Habitat Assessment manual (MELP and MOF, 1994).

1. What fish species are present in the watershed, where are they and in what numbers (by life stage)?

2. What is the amount, type, actual and potential use of the habitat within the watershed (by species and life stage)?

3. What degraded habitats do you find, where and what quantity (by species and life stage)?

4. What, where and in what quantity are the habitats that limit salmonid production?"

To answer these questions the fisheries resource assessment consisted of two components which took place simultaneously. Available background information was collected to compile data relevant to WRP objectives and to identify information gaps. Field work was then conducted to supplement the existing data base and to examine sites with reported enhancement potential.

3.2.1 Fisheries Information Collected

A field data sheet was designed based on Appendix 2 of MELP and MOF (1994). During the site visits, the field crews identified the following habitat features (from MELP and MOF, 1994):

- Adult holding pools
- Spawning gravel quantity and quality
- Pool area and frequency
- Cover in pools and riffles
- Large woody debris (LWD), defined as debris with a diameter of 10 cm or greater and a length of 2m or greater
- Dominant substrate composition
- Off-channel habitat

For fish to survive, they need a specific set of habitat conditions. If any of these conditions is present in less than optimal levels, the potential for the watercourse to support fish populations is reduced. If particular habitat features are absent or beyond tolerance levels, a watercourse may not be able to support fish.

3.2.2 Field Program

As this project was initiated in late summer, in order to reduce weather constraints and to make full use of the field crews, field work had to commence before all the background information could be collected and analyzed. Interviews were conducted with agency personnel and other knowledgeable stakeholders to identify locations of potential fish habitat enhancement opportunities with no supporting biological data. This enabled the field crew to collect useful information while avoiding potential duplication of efforts. Initial efforts were concentrated on watercourses known or suspected to support anadromous salmonids and where there were no habitat enhancement projects already underway. Level One habitat surveys were conducted to address the "Questions for the Initial Evaluation at Salmonid Habitats" in MELP and MOF (1994).

Because of the approach that was taken to prioritize streams (i.e., anadromous fish presence), it should be emphasized that this does not mean the streams above anadromous barriers have less need for restoration or are less important. In fact, some headwater streams may contain stocks of genetically unique fish such as bull trout (*Salvelinus confluentus*) or coastal cutthroat trout (*O. clarki*). As rehabilitation of multispecies sections of candidate streams are completed and restoration of these watersheds continues, there should be more assessment of habitat enhancement opportunities for resident fish stocks.

3.3 Water Quality Assessment

The intent of the first year of conditional assessment was to obtain data on selected water quality parameters in order to determine each stream's ability to support a healthy periphyton and invertebrate community, which should then support a healthy salmonid population if the physical attributes were acceptable (i.e., channel hydraulics and stability, flow frequencies, channel geometry and patterns, flow conditions and hydraulic habitats). A conceptual diagram outlining the crucial variables affecting elements of riverine ecosystems is presented in Figure 5. The following sections detail the parameters measured and provide a summary of the biological relevance of each parameter.

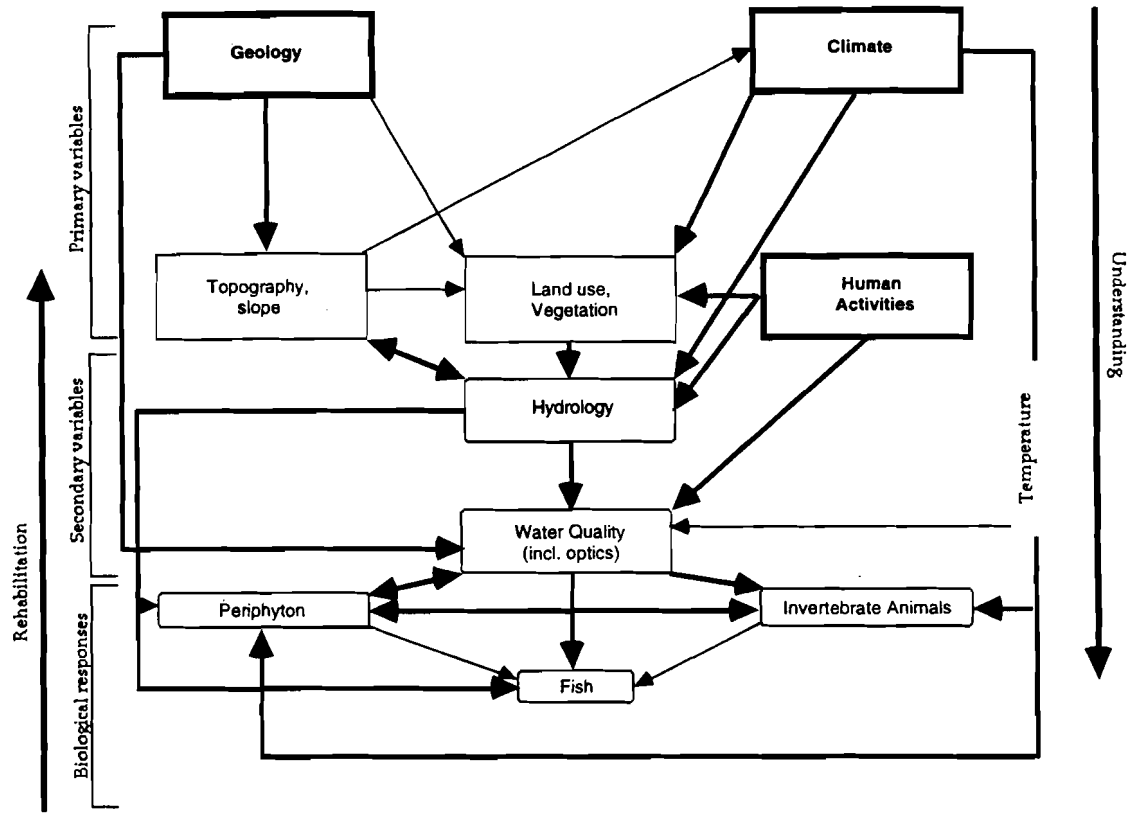


Figure 5. Conceptual diagram depicting crucial variables affecting elements of riverine ecosystems which influence fisheries production.

3.3.1 Physical Water Quality Parameters

Temperature

Water temperature is important in mediating the rate of chemical reactions and is especially important in biological processes. Altering the vegetation in upland areas and in the riparian zone will change the thermal inertia of the water mass, and the rate at which it changes. The regulation of the physical, chemical and biological (i.e., metabolic) dynamics of the stream are, to a variable extent, governed by temperature. Since inputs and outputs of heat are largely surface mediated, the inertial mass of the water can be important in determining the rates and magnitudes of changes throughout the year.

Several biological and ecological issues are temperature dependent. For example, temperature can affect the timing of germination of algal spores and resting stages of algae and invertebrates.

Algal growth and invertebrate life cycles and reproductive capacity are attuned to temperature. Any change in the temperature regimen could affect the periphyton community dynamics. Thus, to preserve present water quality, the option that best maintains the present water temperatures would be preferred. Temperature can also affect chemical parameters: increased temperature can result in increased release of phosphorus from sediments.

Cyanophyte (blue-green algae) blooms can appear in the warmer water months, thus higher water temperatures could increase their prevalence and the potential for toxic species not presently encountered or which occur uncommonly. Also, enhanced concentrations of cyanophyte toxins are known to be positively correlated with increased water temperatures.

Turbidity

The term turbidity is used to describe a number of different processes with respect to water quality. One definition is that turbidity is a measure of the cloudiness of the water (vertical extinction of light). Turbidity is primarily a function of biogenic (algal) and abiogenic suspensoids. The latter include suspended inorganic matter such as clay, silt, carbonate particles, etc. This material results in light being scattered and absorbed, which would otherwise have been transmitted; turbidity is thus an optical property of water. In many of the streams within the Squamish River a major source of abiogenic suspensoids is glacial sediment; this material is extremely fine and does not settle out even in quiescent water. It is typically responsible for the "green" colour of many glacier-fed mountain streams, rivers and lakes.

Measures of turbidity using extinction coefficients are typically measured in the field using a Secchi disk (20 cm black and white disk lowered into the water column); in lakes and reservoirs there is a marked seasonal variation in the depth to which the disk can be observed, under standardized conditions. The highest Secchi values are usually revealed in the fall and winter, and often in the mid-summer (after the spring/summer phytoplankton bloom has been grazed down). Vertical extinction is also referred to as water clarity or transparency. A second measure of turbidity uses the quantity of light (intensity) scattered by the sample under investigation with respect to that of a sample containing a Standard Reference material/ suspension (Wetzel and Likens, 1991). Spectrophotometers or turbidimeters are most frequently used to conduct such measurements. This technique is most frequently used to measure turbidity or clarity of stream or river water. Recently, Davies-Colley (1988) introduced the black-disk method for measurements of visual water clarity. This disk can be viewed horizontally, permitting observations in relatively shallow water. The horizontal sighting distance (yBD) is a measure of the hydrological range and yields an estimate of the beam attenuation coefficient c, one of the fundamental optical properties of water. It is possible that a comparison of turbidity and visual clarity may permit interpretation of historical datasets on turbidity of river and stream waters.

In addition to the aesthetic appeal and public perception of clear water for recreational purposes, clarity can strongly influence the vision of aquatic animals, and, thus, predation efficiency. It can also influence thermal regimens, and light availability for plant photosynthesis. Thus, water colour and clarity (i.e., turbidity) are functions of their optical properties, which in turn are features of their composition (Davies-Colley and Close, 1990).

Davies-Colley and Close (1990) note that water clarity has two main aspects. First, there is visual clarity, or the maximum distance at which aquatic animals and people can see submerged objects. Visual clarity is determined by the attenuation of image-forming light, which is identical to the attenuation of a collimated light beam comprising parallel rays. Second, there is the attenuation into water of sunlight that provides energy for aquatic plants and illuminates submerged objects. The illumination and photosynthetically available radiation in a water body are determined by the attenuation of uncollimated (or diffuse) sunlight. Thus, turbidity is a measure of particulate suspensoids, including silt, clay, organic matter, plankton and other microscopic biota. Particulates are maintained in suspension by turbulence, including velocity and Brownian motion. Turbidity is typically measured as a function of optical interference of suspensoids to the transmission of light through a water sample. Particulates may originate from natural soil erosion and subsequent runoff, algal blooms, etc., with turbidity typically highest during winter and spring runoff periods (McNeely et al., 1979).

With respect to the provision of public drinking water, turbidity is a major concern for water disinfection and treatment facilities. If the particulate matter occurs in significant quantities it must be removed from the water prior to the water's distribution for public consumption or industrial use.

Turbidity is important in potable water supplies since it is both aesthetically undesirable in northern cultures and because turbidity has been shown to reduce the efficacy of disinfection procedures. Microorganisms can reside in small crevices and cracks amongst even the smallest particulates and thus the disinfectant, such as chlorine, cannot always saturate such microhabitats. As well, turbid waters are considered less desirable for recreational uses than clear waters. Drinking waters should not have turbidities which exceed 1 NTU (Nephelometric Turbidity Units), which is an absolute standard. The U.S. EPA recommends that for the protection of fish and other aquatic wildlife the depth of the photosynthetic compensation point should not be reduced by more than 10% from the seasonally established norm. Unfortunately, this standard is difficult to maintain since seasonally norms are seldom known with any degree of certainty.

Turbidity can be used as a reasonably reliable estimate or surrogate for suspended sediment concentrations (typically accounting for approximately 80% of the variation in suspended sediment loads). As well, turbidity is regarded by many as the most sensitive measure of land use effects on the water and habitat quality of streams. The small changes in sediment entering a stream can result in large alterations in turbidity. The primary cautions in using turbidity as a surrogate measure of upland disturbance-water quality relationships is that turbidity-suspended sediment relationships must be determined for each stream, often for each reach. Secondly, the variability in turbidity events and their causes is such that setting simple, absolute standards are difficult and almost unenforceable. The wide range of natural events which create short term erosional events can not always be linked to logging or other man-made intrusions into forests.

Colour (PtCo)

Colour is a function of scattering of different wavelengths, which are affected by dissolved organic matter and, to a lesser extent, particulates. As particle size increases, light scattering is less selective. To a large extent, the colour of water reflects the composition of dissolved organics and inorganic substances. For example, as concentrations of organic matter, especially humic substances, increase, there is a shift from clear to a yellow or red colour. Algae can impart a colour to surface waters, however such coloured water typically requires the massive development of algal populations (Wetzel, 1983). Typical values (PtCo) range from 0 in very clear lake or oligotrophic, coastal B.C. reservoir water (eg., Sooke Reservoir) to 300 in heavily stained bog water.

Light

Light is important in controlling aquatic metabolism (photosynthesis), together with absorption of solar energy (together with its dissipation as heat; see above), which in turn affects many of the water's physical and chemical properties. The extent to which light can penetrate the water is an important regulator of nutrient release from sediment/water interfaces. Recent studies have shown that algae growing on the sediment surfaces can accelerate phosphorus release under darkness, when surface oxygen concentrations become anoxic (deoxygenated). Thus, it is essential for stream waters to be well mixed and tumbled to ensure adequate oxygenation. The importance of this process is thus directly related to the depth to which light can reach deeper benthic areas, enabling photosynthesis to occur.

Light-mediated water quality issues include: penetration into the water column, illumination of the bottom (both of which affect plant growth), and absorption and conversion to heat. In woodland streams it is best to have small openings or variegated openings which produce a mottled lighting of the stream benthos. This will provide adequate sunlight for the production of periphyton communities, without significantly increasing the temperature of the stream. Finally, light is directly linked to temperatures in all three spheres. Temperature increases have been shown to be due almost entirely to shortwave radiation, which can be significantly enhanced by forest canopy removal. Stream temperatures, once elevated, are not easily reduced through reradiation, convection, advection or conduction. Therefore temperatures are usually additive and thus a mosaic of forested/unshaded reaches along a stream course is not an effective approach for minimizing stream temperatures. Thus, pre-logging stream temperatures may not be regained until the riparian canopy has been revegetated. Streams in deforested areas will likely exhibit decreased nighttime winter minima, however, the range will be less in coastal forests subject to the thermal dampening effects of the marine environment. Interior forests less subject to oceanic influence will likely evidence wider variation in winter nighttime minima; the Lillooet River tributaries should thus be more susceptible to this than those of the Squamish. This could be determined by the use of continuous light and temperature monitoring devices.

Light attenuation

Light attenuation is a measure of the absorption (attenuation) of radiation by the water and the substances within it. Quantification of light intensity provides information on the amount of light available to plants (including algae) for photosynthesis. Light quality can also exert an influence on periphyton communities since different light spectral quality can alter algal species. Light intensity data aids in interpretation of temperature data by enabling the characterization of a particular stream reach as shaded or open.

pH

The pH, or concentration of hydrogen ions, is a measure of the acidity of the water. This parameter in practice is less a measure of the absolute concentration of hydrogen ions, but the chemical activity of those ions. Hydrogen ion activity (i.e., pH) is inversely proportional to temperature on a nonlinear basis. Two other terms often mistaken for acidic and basic are alkalinity and acidic factors which refer not to pH but rather to the capacity of a liquid to neutralize acids and bases, respectively. Natural waters are generally slightly acidic (5.7 pH), since they contain dissolved CO_2. It is important that pH be measured in the field because alterations in the quantity of atmospheric based CO_2 can significantly alter the pH during transport and storage in the analytical laboratory. It is desirable that pH be measured in the stream whenever possible, or in a sample obtained from the stream and this sample measured immediately upon being obtained. During this study all pH measurements were made using in-stream analysis. Realistic accuracy of readings under optimal conditions cannot exceed 0.1 pH unit; given the field conditions and recent training of the field sampling team it is recommended that pH accuracy be limited to 0.5 pH, as noted by MacDonald et al. (1991).

The toxicity of ammonia is determined in part by pH, since the toxic, un-ionized form (NH_3) is converted into the non-toxic ionized (NH_4^+) form at low pH. The effect of pH on salmonids is generally not toxic between 5 to 9; however, at values less than 6.5 there have been reported instances of progressive reductions in egg production and hatching success. As well, at pH less than 6.5 emergence of certain aquatic insects also declines (MacDonald et al., 1991). These and other findings have led to a recommended pH range of 6.5 to 9.0 as being acceptable for the protection and preservation of aquatic life.

Forest activities which could affect pH have received very little systematic and long-term study. The few studies which have been conducted in the Pacific Northwest indicate that pH is relatively stable with respect to forest disturbance originating from logging activities. The majority of the anionic load, which results in the pH of the water, originates in atmospheric carbon dioxide; typically the buffering capacity of the forest soils minimizes land disturbances which could alter pH. Indirect forest land uses can affect pH; for example, the presence of large quantities of bark and other organic debris in streams can enhance organic acid concentrations, which increases biochemical oxygen demand, thereby increasing CO_2 inputs due to respiration. Removal of riparian canopies can increase light intensities, which increase periphytic productivity and this can lead to wider diurnal variations in pH. Increased nutrient loading, with no light limitations, could also lead to similar pH rate changes. Erosion can exert a small change in pH from increased dissolved solids, but these changes would be less than those of specific conductance. Mining activities are known to exert a considerable influence on pH through the leaching of acidic dissolved

solids and other ions into streams. It is recommended that all known mining activity in the watersheds be identified and pH values in streams receiving water from lands affected by the mining activity be monitored to determine whether water quality is being influenced by mining related land disturbance.

Specific Conductance

Specific conductance, also termed conductivity, is a parameter which provides an estimate of the ion, or total dissolved solids, content of the water. The movement of ions typically increases as water flows through progressively deeper soil or sediment horizons; surface runoff generally has lower ionic constituents. Stable, undisturbed soils, with a high degree of biodiversity, usually exhibit a tightly bound recycling of nutrients (soluble organic and inorganic molecules) and possess complex bonding and chelating (chemical binding) compounds, which minimize ionic migration. Temperature can exert an influence on specific conductance values. Conductivity is not always directly proportional to the concentration of dissolved ions.

The ratio of monovalent to divalent (M:D) cations has been shown to have an important effect on phytoplankton population dynamics. Alterations in dissolved organic matter can regulate or alter M:D ratios, which also have been shown to exert a major influence on phytoplankton community dynamics. The latter are known to influence taste and odour, an important consideration in waters being used for community consumption. Ion concentration also impacts on corrosion within the distribution system.

The ionic composition, or more correctly referred to as the salinity, of fresh waters consists of the alkalis or alkaline earth compounds (Wetzel, 1983). These consist primarily of the bicarbonates, carbonates, sulphates and chlorides; these dominate the total ionic salinity. Issues regarding these chemicals have been covered under the topic of conductivity. The ionized forms of nitrogen, phosphorus, and iron, together with a host of other minor elements (including trace minerals), while of minor significance with respect to total salinity, are extremely important biologically. The chemical composition of the water in an open, coastal reservoir such as Sooke, the primary water supply of the Capital Regional District, is dominated by the composition of its influent waters (originating in the drainage basin) and deposition from the atmosphere. The resuspension of nutrients from the sediments (benthos) can increase in significance relative to that of lakes, depending upon the extent to which sediments are repeatedly exposed during drawdown periods. The timing of exposure can also have an affect on the nutrient mobilization from exposed sediments into the water column. Finally, the biological community has a profound effect on the chemical mix within the water column through catabolic and metabolic processes. In northern regions, these processes are more important during the summer period and least operative during the winter, primarily as a function of temperature and light intensity.

Conductivity has little effect on restricting water uses in the Pacific Northwest; problems typically arise for drinking water or irrigation when low quality water is withdrawn downstream from reaches subject to pollution originating from agriculture (i.e., non-point source discharges containing high dissolved solids concentrations). Aquatic biota are relatively insensitive to conductivity.

Dissolved oxygen

The measurement of dissolved oxygen (DO) provides information about both the biological and biochemical activity within the creek. Oxygen may be provided to the water as a by-product of photosynthesis from aquatic plants or enter from the atmosphere. It is essential to the metabolism of all aquatic aerobic organisms. The quantity of oxygen which can be dissolved in the water is directly dependent on temperature and pressure; increasing temperatures result in lower dissolved oxygen values.

The balance of aquatic vegetation is critical, since too little vegetation will not provide enough oxygen to the water and too much will deplete the supply as it eventually degrades. The oxygen content of a stream can be modified by the addition of small waterfalls and weirs in order to entrap atmospheric oxygen, and by the removal of excess aquatic vegetation. Lowering the water temperature by shading the creek will increase the capacity of the water to hold oxygen.

Aquatic plants are both a source and consumer of oxygen. Plants, such as algae, respire at night and deplete the creek's oxygen. Also, the decomposition process requires oxygen. Any decomposing material within the creek, be it plant or animal material, will reduce the oxygen content while releasing nutrients into the water. Extremely low flows may also result in reduced oxygen concentrations.

A minimum intergravel oxygen content of 8 mg/L is considered adequate to sustain salmonid embryo and larval stages; this corresponds to an instream value of 11 mg/L. The sustainment of the majority of aquatic life requires a minimum instream value of 6 mg/L (Table 1). This value is particularly important with reference to young salmonids which have a very limited ability to withstand low oxygen concentrations. It is essential to note that this is not an averaged value - the oxygen content of the water must remain above 6 mg/L 24 hours a day since most organisms cannot "stockpile" oxygen when it is in excess and use it later when the supply runs low. Typically most forest streams have cool temperatures (see above), rapid reaeration rates, and relatively low oxygen demands. Generally forest streams have, or are close to, 100% oxygen saturation. Examples of stream waters which may have low saturation, and absolute oxygen concentrations, include streams with large organic debris loads (which increase B.O.D.), extremely slow flows with minimal reaeration rates, high temperatures in which there is excessive periphyton productivity (i.e., high photosynthesis and respiration) with attendant wide fluctuations in

	Dissolved oxygen (mg/L)	
	Instream	Intergravel
I. Salmonid waters		
A. Embryo and larval stages		
no production impairment	11	8
slight production impairment	9	6
moderate production impairment	8	5
severe production impairment	7	4
limit to avoid acute mortality	6	3
B. Other life stages		
no production impairment	8	
slight production impairment	6	
moderate production impairment	5	
severe production impairment	4	
limit to avoid acute mortality	3	
II. Non-salmonid waters		
A. Early life stages		
no production impairment	6.5	
slight production impairment	5.5	
moderate production impairment	5	
severe production impairment	4.5	
limit to avoid acute mortality	4	
B. Other life stages		
no production impairment	6	
slight production impairment	5	
moderate production impairment	4	
severe production impairment	3.5	
limit to avoid acute mortality	3	
III. Invertebrates		
no production impairment	8	
some production impairment	5	
limit to avoid acute mortality	4	

Table 1. Biological consequences of reducing the dissolved oxygen (DO) concentrations on salmonids, non-salmonids, and aquatic invertebrates.

diurnal dissolved oxygen concentrations, and ponded reaches, usually formed by beavers or road construction. Road construction which creates ponds upstream, as a result of culverts creating constricted stream flow, may also reduce oxygen concentration.

Intergravel dissolved oxygen values can often be low if these benthic regions become clogged with fines. This reduces the exchange between oxygen-rich surface waters and the oxygen-deprived intergravel alluvial materials. Groundwater intrusions into the benthic alluvial gravels are usually low in dissolved oxygen, which can affect egg deposited in redds. While there are relatively few causal studies linking forest management activities and intergravel DO, nevertheless the correlations and inferred cause-and-effect linkages have resulted in recommendations for using intergravel DO values as surrogate measures for sediment loading criteria. The need for adequate intergravel DO's is for the provision of concentrations necessary to maintain metabolic requirements in deposited eggs and for macroinvertebrates.

In streams possessing salmonid fish populations which are spawning and in which fry are rearing, U.S. EPA criteria recommend that 1-day minimum and a 7-day mean DO concentration should be 8.0 and 9.5 mg/L, respectively. These criteria reflect an assumption that intergravel DO values are approximately 3 mg/L less than those of surface waters. Intergravel DO values would thus be 5.0 and 6.5 mg/L, respectively. These criteria are less stringent for adult salmonids.

3.3.2 Nutrient Parameters

A major factor in algal and bacteriologic productivity is the availability of nutrients (especially phosphorus and nitrogen). Current information indicates that most of the coastal streams and rivers in B.C. surveyed are oligotrophic (very low in available nutrients) and are typically phosphorus limited. There is indirect evidence that some streams are, at times, nitrogen limited; this has not, however, been confirmed. In particular, data collected to-date from preliminary studies in the Cheakamus River (and other aquatic habitats, including the stream trough facilities located at Daisy Dam and Humpback Reservoir, Victoria, B.C.) indicate phosphorus is the most important nutrient likely to accelerate periphyton development (Lucey et al., 1993). While considerable literature has been devoted to the chemistry of sediment-water interfaces (especially as it relates to aerobic/anaerobic conditions), the rate of phosphorus release is highly variable and the spiralling within streams is significantly correlated with source/sink dynamics and flow/velocity regimens (Mulholland 1991; Mulholland et al., 1992).

It should be noted that within the past five to ten years considerable research has been conducted which indicates that it is the biologically-available phosphorus which is important in determining how water

bodies respond to nutrient enrichment. Research at the University of Victoria has shown that algae respond to extremely low concentrations of nutrients, often at concentrations not routinely detectable in chemical analysis. Similarly, recent work at McGill University and by the B.C. MELP has shown that caution must be exercised in interpreting chemical data at the very low concentrations observed in such water bodies such as the Squamish River and its tributaries.

The majority of organic carbon in water is either dissolved organic carbon (DOC) or dead particulate organic carbon (POC). The separation of these two forms is based upon an arbitrary (and practical) fractionation of 0.5 μm; the smallest colloidal component is thus included in the DOC fraction. A portion of the POC consists of live, functioning cells (bacterioplankton), which although only a minor part of the total, nevertheless represents a significant portion "of the reversible flux between dissolved and particulate phases of detrital carbon" (Wetzel 1983).

Water quality issues related to nutrients arise primarily out of the organisms that grow because of them. In the simplest terms, increased nutrients result in increased biomass. Also, the relative proportions of the different nutrients can affect the biological community structure. The stream/river management option which, with respect to nutrient factors, produces adequate periphyton biomass while producing the healthiest macroinvertebrate community structure is the preferable one. The concept of preserving a healthy aquatic community structure is complex and of central concern throughout this discussion. It should be noted that, in general, only biomass production and productivity are typically measured, that is, only quantitative measures of the community are studied. While the literature concerning the qualitative aspects of periphyton (i.e., the proximate composition or chemical profile; the biochemical nutritional profile or the food/nutritive value) is limited, this aspect of the community is crucial to fish health.

Nitrogen compounds

Nitrogen compounds serve as essential components of bacterial production as well as photosynthesis in terrestrial and aquatic plants. In high concentrations however, they can be toxic to both humans and aquatic life. These thresholds have been calculated by many different agencies and are summarized by Nordin and Pommen (1986). Nitrogen consists of two components, dissolved and particulate. The primary forms of nitrogen include ammonium (NH_4^+), nitrate (NO_3^-), and nitrite (NO_2^-). In undisturbed forest ecosystems nitrate is usually converted into organic nitrogen by microbiological activity. Losses from such forests are typically in the form of nitrate, although such losses are typically small. In unpolluted waters, such as forest streams, nitrate is again the dominant form. Riparian zones have recently been

shown to be very important areas of localized nitrogen transformation, given their anaerobic and aerobic conditions, and are also sites of denitrification.

Ammonia (NH_3) and Ammonium (NH_4^+): Ammonia and ammonium are the most reduced forms of nitrogen found in freshwater and are the product of bacterial decomposition of organic matter. At high pH ammonia is favoured while acidic conditions produce ammonium. The combined forms are referred to as total ammonia. Ammonia (NH_3) is toxic to certain invertebrates and fish at concentrations as low as 0.08 mg/L; chronic effects can occur at values <0.002 mg/L. The acceptable limit of un-ionized ammonia for freshwater aquatic life as defined by various agencies, ranges from 0.007 mg/L at 0°C and pH 6.5 to 0.035 mg/L at pH > 8 and temperature > 15°C (Nordin and Pommen, 1986). In coastal B.C. creeks, summer temperatures typically range from 11 to 24°C and pH ranges from 6.5- 8. Using these criteria, the total ammonia concentration should not exceed 25.2 mg/L at low temperatures and low pH or at the opposite extreme, should not exceed 5.60 mg/L at high temperature and high pH. Maximum concentration of un-ionized ammonia (mg/L-N) should not exceed 0.016 at pH 6 and 11°C or 0.214 at pH 8 and 20°C.

Nitrate and Nitrite (NO_3; NO_2): Nitrate and nitrite result from the oxidation of ammonia, ammonium and nitrogen oxides. Nitrite is the intermediate form and is quickly converted to nitrate by bacteria. Nitrate is not easily adsorbed by soils and as a result, is highly mobile in groundwater. Acceptable limits for the protection of aquatic life vary, but are generally very high (50 to 100 mg/L). Desirable nitrate concentrations may, however, be much lower since nutrient limitation will limit undesirable algal growth. Upper limits for the concentration of nitrite are dependent upon chloride concentration. Chloride in B.C. creeks typically range between 0-3.6 mg/L; accordingly maximum nitrite concentrations should not exceed 0.12 mg/L NO_2-N. Nitrogen can be toxic to human infants at concentrations exceeding 10.0 mg/L NO_3-N; salmonids do not exhibit this sensitivity to nitrate. Nitrite-nitrogen concentrations as low as 0.5 mg/L have been shown to be toxic to rainbow trout. The majority of the non-toxic effects associated with nitrogen loading are linked to increased primary production (bacterial and algal) and subsequent secondary production (macro- invertebrates and fish). The majority of studies to date have linked increased primary production in systems which have had their phosphorus enhanced. The majority of these studies have relied on water chemistry to measure nutrient concentrations and then correlate these with plant growth; that is that coastal stream primary production is limited by P and not by N or light. Recent research has shown that stream nutrients can undergo rapid changes which cannot be reliably measured by conventional chemistry. Thus streams can be nitrogen limited under certain circumstances. Since the concern with nitrogen loading is biological production, the nitrogen concentrations must be considered together with other nutrients, especially phosphorus. Thus, it is the ratio of these nutrients which is as important as their absolute concentrations.

Increased biological production can be beneficial to fish if the production is not so great as to have adverse effects on DO values. In general, nitrogen losses into streams originating from forest related activities do not result in the eutrophication of streams unless there are corresponding increases in phosphorus and there is adequate in-stream light; the latter would occur as a result of canopy removal. Monitoring of nitrogen can provide a data base which can be used to measure long term changes in nutrient loading.

Phosphorus Compounds

Phosphorus occurs in numerous organic and inorganic forms, being present as a dissolved or particulate species. This nutrient, in many waters, especially coastal B.C. waters, is an important factor limiting aquatic plant growth. The combined compound of this element is normally in a dynamic state of flux due to processes of decomposition and synthesis between organically bound forms and oxidized inorganic forms (McNeely et al., 1979). Phosphorus may enter a watercourse through a variety of processes including leaching or weathering of igneous rock, decomposition of organic matter, domestic or agricultural wastes (including detergents and industrial effluents). Phosphorus is not commonly toxic to humans, or other animals or fish (other than the elemental form of phosphorus, rarely encountered).

Ortho-phosphorus: Also known as soluble reactive phosphorus, ortho-P is that fraction of the total phosphorus which is available for plant growth. Excess quantities of phosphorus, together with nitrogen (particularly nitrate) can result in excess algal growth in streams. Maximum desirable concentrations include 0.10 mg/L for flowing waters, 0.05 mg/L for water flowing into lakes and reservoirs and 0.025 mg/L for lakes and reservoirs (U.S.EPA, 1976). The latter criteria have been shown to be unacceptably high for the maintenance of healthy aquatic habitat on southern Vancouver Island and many coastal B.C. lakes and streams.

3.3.3 Field Program

3.3.3.1 Nutrient Dosing Artificial Substrata

The algal component of stream and lake periphyton has been shown to be limited, in its production, most commonly by either phosphorus or nitrogen (Fairchild et al., 1985). Numerous bioassays have been conducted to measure algal response to added nutrient under a variety of conditions. Thus, limitations in periphyton biomass accrual, and alterations in the food value of the periphyton, could have serious potential implications for higher order consumers, which could ultimately limit fish populations. Fairchild et al. (1985) in a study using nutrient-diffusing substrata, showed that the overall community response

to nutrient addition may be dependent upon the growth of only a few indicator, or keystone, species which would have trophic level consequences. These workers used artificial substrata clay flower pots containing nutrient supplements, which leached into the surrounding water for many weeks to determine the limiting nutrient and to determine which periphyton algal species would respond to nutrient enrichment. The attached periphyton on the clay surface could then be sampled to determine biomass responses to various nutrient supplements. This technique was employed in tributaries of the Squamish and Lillooet Rivers to determine overall algal growth and as an in-situ bioassay of nutrient limitation; this would also permit an evaluation of Tilman's (1982) model predicting growth response to essential resources. Finally, it was hoped that these data would supplement similar work elsewhere in these watersheds testing the concept that in such coastal, oligotrophic waters nutrient supplement could trophically enhance fishery production.

The procedures for using nutrient-dosing, clay flower pots are described in detail in Fairchild and Lowe (1984) and Fairchild et al., (1985). Clay flower pots, with an outer diameter of 9.0 cm, 8.0 cm in height, and with an internal volume of approximately 250 cm^3, were each sealed with a plastic petri plate, through which a central hole had been drilled, and then sealed with a small, tightly fitting cork. The petri plate was then sealed into place with silicone and the pots where then inverted such that the narrow base was upper-most. The pots were then filled through the small aperture with a 2% agar solution, in de-ionized water. The agar poured into phosphate (P) pots contained 0.1 M KH_2PO_4, while the nitrate (N) pots contained 0.1 M $NaNO_3$, while control pots contained no nutrient supplements. The agar/nutrient solution was then allowed to cool and gel. Nutrients have been shown to be released from the pots for many weeks (Fairchild and Lowe (1984). When the agar solution had gelled, a wooden dowel was passed through the hole in the bottom of the flower pot and was then secured to a wooden board (untreated Douglas Fir), to which cross-wings where attached.

The pots where placed on the wooden board such that on each board there were four pots: N, P, N+P, and control. Triplicate boards were placed in the streams, at selected locations, each board approximately ten meters apart. The boards were placed in reaches which were typical of the habitat thought to be desirable from a fisheries perspective. Large boulders were placed on the wings of the boards to hold them in place against the current. Locations were selected in which stream velocities were between 1.0 and 1.5 meters per second, where possible. In a few streams velocities were lower than 1.0 meters per second.

3.3.3.2 Analytical Procedures

All water quality samples were obtained using the techniques described in the Ambient Fresh Water and Effluent Sampling Manual and the Biological Sampling Manual, produced by the MELP Resources Inventory Committee (1994), or the Methods of Aquatic Data Collection in British Columbia (Clark and Shera 1985). Sample quality was assured using the procedures described in Appendix A. Analysis of all samples, unless otherwise specified, were conducted by the MELP's contract laboratory (Zenon Ltd.). Specific details of each analytical technique can be obtained from either the laboratory or through the Ministry. In-field measurements were made using equipment calibrated to specified standards as noted above.

In addition to the data collected from the creeks sampled during the fall of 1995, within the scope of the program described here, some additional data from creeks in these two watersheds were obtained from B.C. MELP for comparative purposes. These data were plotted with the former data.

The water quality samples and in-field measurements were conducted by two field crews from the Squamish Nation and from the Mount Currie Band (Lillooet watershed). Team members were trained on the basis of the Sampler Training Program, outlined in a subsequent section. At periodic intervals, the trainers re-tested the samplers and participated in the field sampling to ensure adequate sampling protocols were being adhered to. This also permitted frequent inspection of the sampling equipment and its maintenance.

The data obtained from the analysis of samples taken from creeks in both the Lillooet and Squamish Rivers, and their tributaries, were entered into a spreadsheet. The data for each parameter, for all creeks, were plotted as a function of concentration. The plots contained too many creeks for each creek to be identified, so the first plot consists only of a series of concentrations. This is then followed by a series of plots, in exactly the same order as the first plot, with each creek named. This approach permits the general trend to be ascertained and specific creek values to be compared.

3.4 Hydrological Assessment

The hydrological assessment considered five main issues, including:

- Impacts by forest-related activities
- Water rights and community watershed status

- Year round flow potential
- Debris-laden flood risk potential
- Hydraulic structures

3.4.1 Impacts by Forest-Related Activities

Forest-related activities such as timber harvesting and road construction can impact the quality and quantity of water in a stream. Removal of significant quantities of mature timber from a watershed can increase the peak flows in a stream. Road building including road, bridge and culvert construction can alter the natural drainage pattern of the overland flow and if left unchecked could increase the sediment loading downstream.

3.4.2 Water Rights and Community Watershed Status

Water rights in B.C. are date precedent based with the ownership of the water vested in the Crown. Existing water rights must be maintained by law and any future diversions must be applied for. Licensed diversion of water from one watershed to another will impact flows in both watersheds. Community watershed status is of particular importance and carries with it strict guidelines for activities within the potable watershed.

3.4.3 Year Round Flow Potential

The existence of headwater lakes and glacial headwaters affects the year round flow potential. This is particularly important in logged watersheds where ground disturbances have created a dry creek scenario during summer months. Increasing the storage capacity of headwater lakes via small dams could be used to augment summer flows.

3.4.4 Debris-Laden Flood Risk Potential

A debris-laden flood occurs on steep mountain creeks whereby a bulk of rock, sediment and organic debris dams the creek and suddenly gives way creating a surge of water and debris. Debris-laden floods can cause erosion and scour and could have a devastating impact on bridges, culverts, pipeline crossings, roads and channel remediation works downstream.

3.4.5 Hydraulic Structures

The existence of hydraulic structures including bridges, culverts, flumes, diversion channels and dams can impact the watershed. Undersized structures could fail causing floods or debris-laden floods downstream.

3.5 Riparian Assessment

During the process of evaluating and prioritising individual watercourses in the watersheds, several questions were posed concerning the parameters of the riparian zone:

- Does well-established riparian vegetation exist along all or part of the stream?
- What plant species or strata are represented?
- Will the existing soil type support re-establishment of vegetation?
- Are soil conditions amenable to re-vegetation?
- Is the channel morphology appropriate for re-vegetation?
- Are the reaches restricted or unrestricted?
- Is the geomorphic structure stable and of low-energy?
- Are upslope areas stable and vegetationally productive?

- Is the riparian zone itself stable and productive?

The rationale for each of these questions is presented below:

3.5.1 Presence of Riparian Vegetation

The presence of riparian vegetation is a good indicator of the potential for riparian enhancement. The pre-existence of well-established riparian vegetation along some reaches of a subject watercourse will help ensure the long-term viability of newly planted areas by providing stability and a source of vegetational diversity. The riparian setting influences channel configurations through its effect on bank stability, and through the provision of woody debris into the stream channel, affecting local hydraulic conditions and sediment deposition. Overhanging vegetation, its root systems, and in-channel debris may provide cover for salmonids.

Bank stability is enhanced by dense root systems, and distinctions can be made among riparian vegetation according to root mass density. Deciduous trees have deeper root systems than coniferous trees. Herbaceous plants and shrubs, particularly those characteristic of pioneer stages, develop large, dense root systems very quickly. These often act to constrict channel width by preventing erosion; this forms the basis of suggestions for improvement of trout habitat by replacing streamside trees with shrubs. However, during extremely high water discharges, long-term bank stability and location may be better served by tree root systems than by shrubs.

Woody debris also influences channel configuration and biological properties of streams. In-channel debris acts to form pools and to control sediment and organic matter storage. Its importance to salmonids lies primarily in pool formation and backwater areas for rearing, and in the provision of cover from high flow or from predators. Distinctions to make among riparian vegetation with respect to these functions include the amount and size of debris that is available for input to the channel, and the decomposition time of the wood in the channel. Coniferous trees are able to supply larger amounts of wood than most deciduous trees and, in general, have slower decomposition rates.

3.5.2 Plant species or strata

Food availability, temperature, and physical aspects of the channel are three of the major determinants of fish productivity. These determinants are strongly affected by the nature of and functional roles played

by riparian vegetation, even though salmonid distribution patterns and productivity cannot be tied in a direct fashion to the composition of the streamside vegetation (Wilzbach 1989).

In contrast to most stream invertebrates, salmonids and freshwater fishes in general are much more plastic in their responses to environmental conditions. Salmonids are able to become established in streams that are surrounded by a broad array of vegetation types. The composition of the surrounding vegetation does not of itself limit the ability of a salmonid population to inhabit a stream or river system. Further, there are no apparent relationships between composition of streamside vegetation and other salmonid population parameters such as age structure and productivity (Wilzbach 1989).

Growth rates and productivity of salmonids are influenced to a large degree by temperature. Assuming prey are available for consumption, higher growth is obtained at higher temperatures up to the optimal growth temperature; above this temperature, growth will again decline.

Because of the direct effect on stream temperature, the most important distinction to make among types of riparian vegetation is whether the vegetation provides an open or a closed canopy. In headwater streams this distinction will separate grasses and herbaceous vegetation from some deciduous and coniferous trees, depending upon stream width. In very small streams, even grasses may effectively shade the channel, especially if sideslopes are steep and banks undercut.

In summertime canopy closure may reduce incoming solar radiation by 85 percent (Brown 1983). In mountainous streams the increase in maximum summer temperatures does not usually approach the tolerance limits for resident salmonids, often a very significant problem in low gradient, low elevation sites. Even in mountainous streams, however, increases in the temperature regime may shift fish community composition to favour species other than salmonids (Karr and Schlosser 1978). Overhanging riparian vegetation moderates the thermal regime of aquatic communities by providing cooler instream temperatures. Removal of riparian vegetation can result in increases of water temperatures and decreases in levels of dissolved oxygen and carbon dioxide. Warm water is conducive to algal and bacterial growth including bacterial species pathogenic to fish. Less oxygen available for aerobic life processes will reduce populations of heterotrophs, increasing the amount of nutrients exported from the watershed.

Canopy closure may also prevent heat loss in the winter that can occur by evaporation, convection, and long-wave radiation.

The open or closed nature of the canopy also has an important effect on the availability of food to fish, for at least two reasons. First, light intensity appears to directly affect foraging efficiency. Second, the

degree of canopy opening plays a major role in determining the food resource base for the invertebrate prey community and its consequent composition. The resource base of small woodland streams is heterotrophic, (i.e., dependent upon organic matter provided by the surrounding terrestrial system). In these streams, shredders which feed on coarse particulate organic matter derived from the riparian zone often comprise a dominant component of the invertebrate community. In larger stream or river systems and in small streams lacking a canopy, the in-stream algal production increases and scrapers which feed on algae may largely replace the shredder component.

A distinction between scrapers and shredders is an important one because shredders rarely comprise a significant part of salmonid diets. As a general rule, salmonids feed upon invertebrates as they drift in the water column. Shredders are not often found in the drift, except at times of emergence or in very early life stages, at a size below which salmonids typically detect prey items.

In relation to its effect on food availability, the other important distinction to make among different types of riparian vegetation is the turnover time of its litter inputs to the stream. These can be roughly broken down into fast or slow (Karr and Schlosser 1978). The fast litter category includes many herbaceous plants, shrubs characteristic of recovery stages from a disturbance (such as dogwoods, viburnums, and salmonberry), as well as some types of deciduous trees such as black cherry and alder. The slow litter category includes grasses and sedges, shrubs such as the rhododendrons, conifers, and some deciduous trees such as maples. If litter is derived predominantly from 'fast' plants, there will be a rapid turnover of course particulate organic matter relative to the time of input and a rapid generation of fine particulates, including a significant portion derived from shredder faeces. If litter comes from 'slow' plants, there will be a delayed turnover and generation of fine and course particulates. Quickly decomposing litter supports a fall-winter population of shredders and collectors feeding on detritus from fallen leaves, and favours spring scraper populations. Slowly decomposing litter supports delayed spring-summer populations of shredders and collectors, to the detriment of scrapers, the main prey of salmonids.

Therefore, the combination of turnover time of the litter and the open or closed nature of the canopy may predict the availability and productivity of the food base for salmonids. In general, the expectation is that food availability in streams increases from a completely closed canopy to an open canopy, and also from predominantly slow litter to predominantly fast litter composition.

Differences in food availability are therefore the most likely explanation for the inverse relationship that has often been observed between salmonid production and successional age of the streamside vegetation. Streams with an open canopy and fast litter are characteristic of early stages in a successional sequence.

The succession will lead over time to a closed canopy with faster litter if mature vegetation is deciduous, or to a closed canopy with slower litter where the mature vegetation is evergreen.

These factors have important implications for riparian vegetation management. Generally, riparian areas that have undergone disturbances such as logging or landslides are in early successional stages, which favour fish populations. Fish populations are favoured by natural processes or management practices which slow natural succession by maintaining a high degree of diversity in streambank vegetation.

3.5.3 Soil Conditions

The existence of soil on a particular site is a primary limiting factor determining the viability of riparian restoration. If a site has been subject to severe disturbance such as rock slides or severe erosion, compelling reasons would be necessary to justify the importing of large amounts of topsoil. Such sites might be subject to repeated disturbance episodes because of inherent geomorphological or hydrological instability.

The composition and condition of existing vegetation along a given stream reach is an indicator of whether the existing soil type will support newly-planted riparian vegetation. For example, if only early pioneer species are present, it may be inferred that the soil is deficient in organic matter and nutrients, and may also be very shallow, overlying bedrock outcrops.

3.5.4 Channel Morphology

Riparian restoration is only physically possible if people and machinery can gain access to a site, and if slopes are not so excessive as to limit the ability of plants to become established. Therefore, streams flowing through U-shaped valleys are more amenable to restoration than those within deeply-cut V-shaped valleys or canyon.

3.5.5 Reach Constraints

Reaches are in part delineated by the nature and degree of local constraint imposed by the valley wall at the channel margin. Reaches are constrained by geomorphic structures such as bedrock intrusions, landslides, earthflows, and alluvial fans. Streams within constrained reaches tend to be relatively straight, single-channels with little lateral heterogeneity. In contrast, unconstrained reach types are characterised by complex, often braided channels with extensive floodplains. Studies such as that of Moore and

Gregory (1988) show that valley floor structure can affect stream ecosystems by influencing channel morphology and by regulating energy input and processing.

In their study of the pattern of habitat utilization by resident cutthroat and rainbow trout in a Cascade Mountains stream in Oregon, Moore and Gregory (1988) found that, after emergence, juveniles established territories in lateral habitats exclusively and remained there for at least six weeks. The abundance of juvenile cutthroat trout was greater in unconstrained and semi-constrained reaches than in constrained reaches. Older fish were found to prefer unconstrained reaches, but it was also found that habitat complexity in constrained reaches provided favourable habitats. This complexity might be provided by large boulders which create channel roughness that entrains large woody debris and modifies stream structure with deep pools and backwater areas to create a variety of habitat types within the reach.

Because unconstrained reaches of a creek have a more open canopy, more light energy is available, and primary production is greater than in the constrained reaches. As described above, greater light intensity and increased production in the unconstrained reaches may, in addition to habitat effects, contribute to the greater abundance of fish in these reaches. Previous research cited by Moore and Gregory (1988) has demonstrated that cutthroat trout population density and biomass are greater in recently logged (open clear-cut) stream sites than in streams with mature coniferous stands. The abundance of macroinvertebrates and the availability of drifting prey may be greater in reaches with open riparian canopies because of the effect of increased light on primary production, detritus quality and prey capture efficiency. Moore and Gregory (1988) also found that intraspecific competition between fish of differing age classes varied inversely to stream complexity, so that juveniles were not alienated from habitats containing adult fish if the structure was complex.

3.5.6 Geomorphic Structure

Riparian restoration works are more sustainable on site on, and surrounded by, stable and low-energy geomorphological formations. The potential for major disturbances such as rock slides, avalanches, and mass movement must be assessed before any restoration is undertaken.

3.5.7 Upslope areas

Stable and vegetationally productive upslope areas will help ensure the success and sustainability of riparian restoration by providing soil stability, water-holding capacity, and a source of species recruitment.

3.5.8 Riparian Zone Stability and Productivity

The existence of a riparian area in a condition that suggests it is stable and productive indicates that the riparian zone is intact or has recovered well from past disturbances. Such areas would be of low priority for enhancement, unless a high return can be expected for a modest input of augmentation measures.

3.6 Coastal Watershed Assessment Procedure (ongoing)

A Level One Coastal Watershed Assessment Procedure (CWAP) is used to estimate the cumulative impacts of logging on a specific watershed. It was developed through the detailed analysis of 20 watersheds with varying degrees of logging impacts. The procedure is essentially a map exercise which focuses on areas where logging activities have taken place, causing possible watershed instability.

Areas of particular concern to watershed stability include:

1. Unstable terrain.

2. Slopes between the 300 m to 800 m contour interval (important during rain-on-snow events).

3. Logging roads or cuts adjacent to creeks.

Through a map analysis, measurements are made of clearcut areas, length of streams logged to edge, and length of roads. From these measurements a risk factor is assigned to the following fifteen impact indicators:

1. Peak flow index (based on elevation-weighted equivalent clearcut area determination).

2. Road density (used for assessing peak flow changes).

3. Road density (used for assessing surface erosion).

4. Density of roads on erodible soils.

5. Density of roads less than 100 m from a stream.

6. Density of stream crossings.

7. Portion of stream logged.

8. Portion of fish stream logged.

9. Portion of mainstem logged.

10. Density of landslides in the watershed.

11. Number of large landslides in the watershed.

12. Density of roads on potentially unstable terrain.

13. Percentage of logged, potentially unstable terrain.

14. Density of streams logged on slopes >60%.

15. Density of stream crossings on slopes >60%.

The procedure is useful for identifying those creeks that have risk factors indicating cumulative logging impacts. Complete CWAP analysis is still underway for the Squamish Watershed. Partial results are presented in this report.

3.7 Year Two Assessments

As a follow-up to Year One's conditional assessments, detailed assessments were undertaken on thirteen creeks in the Squamish River watershed. These assessments included a fish habitat assessment procedure (FHAP), a channel assessment procedure (CAP), a riparian assessment procedure (RAP) and a water quality assessment procedure (WAP). The purpose of these assessments was to identify limiting factors to the aquatic ecosystem and develop detailed procedures for addressing these limiting factors. In keeping with the mandate of FRBC, these assessments were not carried out by specialists; rather, specialists were used to train crews from the community of Squamish in the collection of the data necessary for the assessments. After training the crew, the specialist role became one of quality assurance/quality control (QA/QC) to ensure that the data collection methods and data collected and recorded were accurate. Once the data were collected, this information was used, with input from specialists and community members, to complete the assessment procedures and develop prescriptions. In this way, the community was intimately involved in the process rather than just the recipients of a completed report.

The following sections outline the various assessment procedures undertaken, the QA/QC program developed by the specialists and the type of prescriptions that followed from these assessments. Chapter 4 outlines the training program developed by the specialists.

3.8 Fish Habitat Assessment Procedures (FHAP)

Fisheries assessments on the candidate drainages generally followed procedures outlined in "Fish Habitat Assessment Procedures" (Johnston and Slaney, 1996). The flow chart on page 12 (Figure 1) of Johnston and Slaney (1996) was used as a guide to provide direction for appropriate assessment activities.

Survey Design

Helicopter overflights were taken in 1995 and reaches were identified on the candidate streams where suspected forestry related activities had impacted fish habitat, and reasonable physical conditions existed that would allow restoration prescriptions to be implemented (i.e., reasonable stream gradient, non-confined channel walls, proximal road access). Stratified systematic subsampling was used to collect data from the target streams. The crews were instructed to intensively sample habitat from a section of the reach. The distance sampled depended on how difficult it was to access and the relative homogeneity of habitat in the reach. The starting point for a sampling segment was randomly chosen. For example, the crew would be instructed prior to going into the field to start 150 m upstream of the logging bridge and collect data for a 50 m section.

Generally, the current species distribution and abundance of fishes in the candidate drainages was unknown, particularly in upper watershed areas. Therefore, a fisheries inventory was undertaken where required.

At the time the program was initiated, many of the watercourses were still in partial spring freshet. Therefore, if fish were not captured this was not viewed as definitive evidence that fish were absent. More sampling to confirm fish presence was scheduled for later in the summer when flows were lower.

In addition, because of the multi-disciplinary ecosystem approach of this study, a considerable amount of information was collected by the channel, riparian and water quality assessment crews. To compliment this intensity of investigation, the fisheries crew generally collected level 1 habitat survey data (i.e., a

more intensive level than required by Figure 1 in the Fish Habitat Assessment Procedures). This also made sense from a logistical perspective since many of the reaches investigated were difficult to access and habitat data could be collected relatively easily while the fish distribution assessment was being completed. In essence, elements of a level 1 habitat survey were combined with a Forest Practices Code fish-stream identification survey to determine fish species composition, distributions and habitat conditions.

Field Sampling and Data Collection

The primary inventory method was electroshocking although seines and minnow traps were also used. Electroshocking to determine fish presence/absence was done with a new Smith-Root Model 12-B backpack electroshocker . The electroshocking crew would generally move quietly upstream shocking prime habitats such as under large woody debris (LWD) and undercut banks. The distance and number of seconds sampled were recorded to document effort. A 7 x 1.5 m stop net of 6.4 mm mesh was sometimes installed downstream of the work area to catch drifting fish if water clarity was poor. Captured fish were identified for their species and enumerated by total count. Lengths, weights, and scale samples were collected when possible from salmonids. Representative specimens of fish captured from the Squamish River watershed were preserved in 10% formalin.

Linear distances along watercourses were measured using hip chains while bankfull widths and smaller measurements were done with a 30 m measuring tape. Clinometers were used to measure stream gradients and pocket thermometers were used to measure water temperature. The crews were also equipped with an array of safety equipment including whistles and bear spray.

Habitat data was recorded directly on data sheets photocopied from Form 4 in Appendix F of Johnston and Slaney (1996). In addition, the crew was required to provide a detailed sketch of the habitat assessed as well as upstream and downstream photographs. Photographs were also taken of any unique features such as obstructions, side channels, etc. Fish capture data was recorded in field note books.

3.8.1 Quality Assurance/Quality Control (QA/QC)

Data management, quality control checks and quality assurance assessments generally followed the procedures provided by the water quality specialist team at the beginning of the project and those outlined by Geoghegan (1996).

To ensure quality control in the field, workers were regularly accompanied by a member of the fisheries specialist team, particularly at the initiation of the project. The fisheries specialist would observe the crew without comment, then afterwards, reviewed observations with them to reinforce proper sampling and measurement techniques.

The crews were provided with easy to use data sheets and a laminated "information sheet" displaying all the codes for various parameters to reduce the chance of erroneous entries. Crews were also required to provide a detailed sketch of the habitat being described on the data sheets. Upstream and downstream photographs were taken of any habitat described. All unique features such as obstructions, side channels, and so forth were also photographed. Representative samples of fish were preserved in 10% formalin so that species identification could be verified.

To ensure accurate data collection, workers examined completed data sheets to verify and validate all records (i.e., for illegible entries, erroneous codes, incomplete entries, etc.) prior to going into the field for more sampling. This was usually done the morning following sampling. Crews were required to show

the location where they had worked each day on 1:20,000 trim maps so any confusion with regard to location could be identified and clarified immediately. Data sheets were photocopied and one copy was stored in a separate location in case of fire. Once verified by the crew chief, the data sheets were given to a data entry clerk who again examined and verified them prior to entering them into computer files. The clerk would clarify all concerns regarding the data with the crew chief prior to creating computer files. A member of the fisheries specialist team then verified the computer files against the data sheets to identify and correct any data transfer errors.

To assess quality assurance, the two fisheries specialists replicated assessments done by the field crews to evaluate performance of the crews, identify inconsistencies in data collection, and gain an appreciation for the amount of natural variability inherent in some of the parameters (i.e. flow character). The specialists completed assessments in a number of the reaches where field crew assessments had been completed and compared their results to those of the field crew.

A certain amount of discrepancy in data collected by the field crew and the supervisors can be expected due to natural variability. For example, the field crew conducted most of their assessment during high water flows in July and August. Water flows tended to decrease towards the end of August and the beginning of September. The QA/QC checks in selected creeks were conducted by the supervisors in September when water flows were relatively lower. As a result, a natural difference in habitat type is expected between the two assessments. During higher water flows, very little pool habitat was observed in certain creeks, but pool frequency increased during lower water flows. Consequently, the amount of rearing habitat identified in any specific creek will depend on different water levels, and thus, also seasonally. Due to natural variability, the FHAP assessments should be conducted during different seasons to obtain a full understanding of existing and potential fish habitat in each creek.

The amount of "functional" LWD recorded by the field crew may be a misrepresentation of the amount of functional LWD that is actually present in the creek, due to the definition of "functional LWD" presented in Technical Circular No. 8 (Johnston and Slaney, 1996). Johnston and Slaney (1996) define functional LWD as "only the portion of the LWD pieces lying within the bankfull channel are *functional LWD* that influence channel geomorphology by causing scour or impoundment". By this definition, LWD lying parallel to the shoreline is considered as non-functional. Furthermore, Johnston and Slaney (1996) recommend not counting LWD on vegetated bar tops above the bankfull channel. Consequently, the field crew counted functional LWD according to the above definitions, thereby misrepresenting the actual amount in the river. Not all LWD lying parallel to the shore can be considered as non-functional, as it can play a role in pool formation further downstream in future. Furthermore, LWD resting on a bar below the average high water level is probably beginning to collect soil and seeds, thereby stabilizing the bar and also the creek in that area. Alternatively, this LWD may be swept further downstream during high flows where it may become "more" functional as direct fish habitat. Only LWD lying out of the floodplain should be considered as "non-functional". Consequently, before adequate data regarding the amount of "functional" LWD can be collected, its definition needs to be revised and standardized.

3.9 Channel Assessment Procedures (CAP)

Reach Break Determination

The procedures of the channel assessment included an initial airphoto and map review of the watershed and channel in order to determine the reach breaks and reach lengths. Reach breaks were based on the following:

- Changes in stream channel form (e.g. from a straight channel to a sinuous channel or a single thread to a multiple branched channel)
- Changes in sediment supply (e.g. large point sources of sediment such as an actively eroding landslide scar or deposit)
- A tributary confluence (greater than or equal to a 2nd order stream identified on airphotos)
- Changes in channel gradient greater than or equal to 2 percent
- Changes in stream bed or stream bank materials (e.g. cohesive to non-cohesive banks)
- Changes in stream channel confinement (e.g. from a wide floodplain to a confined canyon)
- Changes in land use including a forest clear-cut
- Changes in channel constriction including bridges and major culverts

All reach breaks noted are on 1:20,000 scale trim maps.

Field Assessment and Establishment of Reach Break Identification

The field work began at the mouth of the candidate creek by establishing a permanent metal plate (usually on a mature tree trunk) noting the CAP Crew, Stream Name, Date, Bottom of Reach 1, Reach Length and Longitude and Latitude of the mouth of the creek. The tree trunk was then flagged with blue striped ribbon to signify a reach break boundary. The crew would progressively move upstream establishing reach breaks based on the aforementioned criteria up to the headwaters or until an impassable barrier precluded their progress. Where possible, ribbons on access roads where also installed to effectively direct other specialist crews to the reach break locations on the creek.

Once all of the reach breaks were established in the field the 1:20,000 scale map was revised to reflect the in field conditions and the exact locations of the reach breaks.

Creek Cross Sections and Channel Morphological Parameters

Once reach breaks were determined, the CAP crew would carry out five stream cross sections within each reach break. At each roughly evenly spaced cross section the bankfull width, bankfull depth, channel slope, largest fluvial stone, gravel bar width, valley-flat width, left and right bank slope, large woody debris presence, and upstream logging presence were recorded. Key photographs were also recorded of each cross section noting the time stamp on the photograph or photographing a sign board indicating section number, reach, date and stream name.

Bankfull Width

Bankfull width indicates the average annual storm defining the banks within a particular reach. The standard criteria for establishing the bankfull width included:

- A change in vegetation from bare ground with no trees to vegetated ground with trees; from no moss to moss covered ground, or from bare ground to grass covered ground.

- A topographic break from vertical bank to a flat floodplain.
- A topographic break from a steep bank to a relatively gentle slope.
- The highest elevation below which fine woody debris (needles, leaves or seeds) does not occur.
- A change in texture of deposited sediment from clay to sand; form sand to pebbles; or, from boulders to pebbles.

Channel Depth

The next parameter measured was channel depth. This was carried out by using a hip chain thread extended out horizontally from the bankfull width boundary and a tape measure extended vertically to the thalweg (invert of channel).

Channel Slope

The average channel slope was measured using two clinometers held by two different observers of roughly the same height (same eye level) each standing at the water's edge, facing each other, (one upstream and one downstream of the section in question. Both observers recorded their observations and compared results. Any significant differences required a repeat of the exercise.

Largest Fluvial Stone

The average size of the largest stone moved by flowing water was measured. These stones had evidence of movement by flowing water during the past decade. Once identified, the b-axis (intermediate length) diameter of the largest stone was identified. Care was taken not include post-glacial lag stones or colluvium.

Gravel Bar Width

The gravel bar width was measured perpendicular to the flow in the stream from water level to water level for mid-stream gravel bars and from water level to the base of the stream bank for lateral gravel bars.

Valley-Flat Width

The valley-flat width was measured from the left bank (looking downstream) to the nearest break in slope (high ground) demarcating the floodplain boundary. This was repeated for the right bank. The total length was added to determine the valley-flat width for the section. In the case of a canyon, by definition, the valley-flat width is zero. For wide floodplains greater than 100 metres the valley-flat width was noted as greater than 100 metres.

Left and Right Bank Slope

The left and right bank slope was determined using a clinometer.

Large Woody Debris Presence

Significant amounts of large woody debris were also identified. Large woody debris could be in the form of logs lying parallel to the flow or found in a logjam.

Upstream Logging Presence

If upstream logging was present and no, or very sparse, buffer strips were evident then upstream logging presence was noted.

Recording of Raw Data

The aforementioned channel morphological data was recorded at each cross section including the distance upstream from the reach break boundary. Averages of these channel morphological parameters were taken within each reach.

Power Index

The power index is a relative measure of the hydraulic power of a particular reach. The power index is derived from the formula:

$$PI = W_b ds$$

PI = power index
W_b = bankfull width
d = average channel depth
s = average channel gradient

Channel Morphological Indexes

Relative channel size and type of morphology was based on the relative roughness (which is the ratio of the largest fluvial stone and bankfull depth) and the relative width (which is the largest fluvial stone and bankfull width). Using the product of the relative roughness and the relative width of a particular cross section along with the average slope, the particular channel morphology index was determined. In addition, the importance of whether large woody debris was present and functioning was also considered.

The different channel types included:

- Riffle-Pool gravel with functioning LWD
- Riffle-Pool cobble with functioning LWD
- Cascade-Pool cobble with minor functioning LWD
- Cascade-Pool boulder with LWD absent
- Step-Pool boulder with LWD present but minimal function
- Step-Pool boulder, LWD absent

- Step-Pool boulder, boulder-block, with LWD absent

3.9.1 Quality Assurance-Quality Control

The QA/QC method applied to the channel assessment procedure had many facets. Firstly, through a rigorous training program (Chapter 4) of local field personnel the importance of checking and double checking measured parameters was required. Secondly, a trained hydrological technician accompanied the CAP team in the field to ensure measurements were done correctly. Thirdly, periodic visits by a professional hydrological engineer were carried out in the candidate watersheds to review the measurements taken and to assess the validity of the assessment prescriptions. Finally, up to 20 percent of the reaches were re-measured and results compared to determine the validity of the original measurements.

3.10 Water Quality Assessment Procedures (WAP)

The year two water quality objective was to continue assessing the degree to which physical and chemical parameters were affecting the trophic status, habitat quality and salmonid fishery potential of each stream. In particular, stream trophic status was measured to determine whether primary production or secondary consumers were limited by factors which could adversely affect the natural level of fish production. The water quality monitoring program was designed to provide an "overall expression of the structure and function of the biological community taking into account natural physiographic, geographic and climatic factors as well as physical and chemical conditions resulting from landscape activities" (Premazzi and Chiaudani 1992). The monitoring program data will be used in year three to determine the ecological quality of each stream. High ecological quality would result in water quality and habitat which would not be significantly influenced by human activities – one in which, in the absence of other limiting factors, there would be a potential for preserving the salmonid fishery.

Year two water quality and aquatic habitat objectives were to provide detailed water chemistry profiles for each reach including: dissolved oxygen, temperature, specific conductance, periphyton biomass estimates, macro-invertebrate community structure, and nutrient concentrations (phosphorus and nitrogen). The WRP water quality monitoring program was designed to be conducted in collaboration with the year one, Operational Inventory (O.I.) (FRBC)Water Quality monitoring program. The latter program, unfortunately, did not begin until late in the summer; the O.I. program could only provide a single estimate of water quality during the late summer low-flow period. Thus, the WRP and O.I. programs sought to provide site specific details of the ecological quality found in each reach and how this attribute could affect fishery production. In order to protect in-stream fishery values, Premazzi and Chiaudani (1992) have recommended that the ecological quality of surface waters should have the following mandatory characteristics:

1. Dissolved oxygen concentrations should be adequate to provide for the normal respiration of aquatic biota.

2. Concentrations of toxic or other harmful substances in the water, sediments and organisms should be below concentrations known to exert a deleterious effect on aquatic life or prevent the normal uses of the stream.

3. There should be no evidence of elevated levels of disease in animal life, including fish, macroinvertebrates and plant populations due to human influences.

4. The status of the benthic/ periphyton/ macroinvertebrate communities should be representative of the undisturbed state and key species/taxa, normally associated with the natural condition in the streams, should be present.

5. The status of the periphyton community should be such that there is no evidence of excessive growth due to elevated nutrient levels of human origin.

6. Fish populations should be sustainable and key species/taxa normally associated with the natural condition of the ecosystem should be present. There should be no hindrance (either water quality or physical) to the passage of migratory fish caused by human activities.

7. The surface water environment should permit a higher vertebrate community representative of the undisturbed state of the stream.

8. The structure and quality of the stream benthos should not be significantly disturbed by human activities (either in the stream or in the riparian or upland zones).

9. The status of the riparian zone should not be altered to such an extent that the buffering capacity and the trophic energy inputs from this zone are substantially changed from the natural condition.

3.10.1 Parameters Measured for the First Time in Year 2

Invertebrate Sample Collection and Analysis

Invertebrates were sampled at each reach of each stream once during the summer. Ideally, repeated samplings should take place throughout the year; however, neither the time nor budget permitted intensive sampling this year. One Surber sample (250 µm mesh nets) was taken over a 100-200 m long reach, with velocities between 0.5 and 1.5 m/s, and depths of 0.3 and 0.6 m. Samples were normally taken by the same person each day. Samples were examined in the field and pieces of large debris were removed after careful inspection and collection of invertebrates or egg masses from the debris. The sample was poured into a 250 mL glass squat jar, labelled and stored on ice in the dark until it was preserved at the office. Upon return to the office, samples were preserved in formalin (10%).

Water quality measurements (temperature, dissolved oxygen, specific conductance) and periphyton samples were obtained from the reach at the time of invertebrate sampling. Water chemistry samples were taken later in the season during a concurrent Operational Inventory Project.

Invertebrate samples were returned to the laboratory where they were carefully sorted under a dissecting microscope. Both invertebrates and debris from the first six samples were sent to Fraser Environmental Services for examination. Fraser examined the jars of debris to ensure that all invertebrates had been removed. Since it was shown that the debris was free of invertebrates, the debris from future samples was not sent to the lab. Fraser identified and enumerated invertebrates to species where possible. All other organisms were identified to the most easily achievable taxonomic level. A reference collection of invertebrates was created by Fraser and currently resides with Aqua-Tex. This collection will permit comparison of new specimens with old specimens and will allow for re-identification of organisms should the classification change. It will also permit comparison of identification between investigators. All identifications done by Fraser were confirmed with another outside laboratory.

Taxa were classified into taxonomic/feeding classes based on Quinn and Hickey (1990) and Merritt and Cummins (1996). The percentage of the total number of invertebrates represented by each taxonomic group in the sample was plotted for ease of comparison. These data should be considered qualitative only.

3.10.2 QA/QC Overview

Rationale:

In order to write prescriptions for stream restoration, it is necessary to gather accurate baseline data. These data are meaningful only if it is known how they were collected, by whom, when, how samples were handled and preserved before analysis, how they were analyzed, and how data were documented and verified. Errors in any of these steps can result in meaningless data or in misinterpretation. Quality Assurance/ Quality Control (QA/QC) measures are implemented to ensure comparability of all data between sampling dates, years, different individuals and to provide a basis for comparison of different waterways. The QA/QC measures implemented in this study are modelled after those recommended by the Quality Assurance Work Group under the Canada-British Columbia Monitoring Agreement. These measures are intended *"to ensure that all environmental data...are to a significant degree accurate, precise, complete, representative and comparable"* (Clark, 1992). This program will evolve to include innovative techniques and procedures as they arise.

The water quality QA/QC program included the use and revision of the following procedures:

1. Sample/data collection:

Teams implemented self-checks of data collection techniques. For example, on each creek, teams divided themselves into smaller groups and each assessed a single stream reach and then switched places and repeat the other team's reach without communicating with the other group. They then compared notes to ensure that the data were the same and noted in their field books where discrepancies arose. These record sheets were filed together and made available to the specialist for examination.

Specialists and assistants periodically accompanied the team into the field to observe (without comment) the team's performance. The object of this exercise was to assess how well the team worked without the assistance of the specialist; therefore, the specialist did not answer questions while the team was working. Following the assessment, the specialist discussed, with the whole team, their strengths and constructively assessed their weaknesses. At this stage every attempt was made to resolve any outstanding issues regarding the team's function and answer all questions.

Specialists repeated the analysis of random stream reaches and compared their findings to those of the team. The data were comparable, although some expected differences, due to temporal variation, were noted.

2. Field measurement methods including instrument calibration and maintenance:

All field equipment including thermometers, oxygen meters, conductivity meters etc. were subject to routine calibration and maintenance. Calibration of all meters to **known standards** before and after

every use was routine and spaces on the field sheet in which to enter these data were provided so that it could not accidentally be separated from the field measurements to which it applied.

3. Laboratory analysis:

All samples submitted for laboratory analysis were subjected to thorough QA/QC procedures.

Water:

Sample controls, replicate samples, spiked samples, field and lab blanks were incorporated into water chemistry sampling.

Algae:

Since algae are rarely identified in the field, samples were preserved pending submission to a qualified laboratory for identification. Identifications will be confirmed by two (if possible) different phycologists not associated with the project. Representative specimens will be archived and maintained for future reference.

Invertebrates:

Representative specimens of all insects were field preserved. Following identification they were properly labelled with their common/Latin name, date collected and taxonomist's name by Fraser Environmental Services. These labels are annotated with technique used (e.g. Hess/Surber) exact location, the name of the person who collected the sample, the reference source used and distinguishing characteristics. The specimens will be compared against an entomological collection (UBC/UVic/RBCM/PFC) and/or submitted to a entomologist not associated with the project for confirmation of the id. Confirmation of the id has already occurred once as a routine part of Fraser Environmental's own QA program. The specimens have been archived and will be maintained for future reference by Aqua-Tex.

4. Record keeping:

All procedures were documented and noted with each data set. All data sheets were photocopied at the end of each day and stored off site in case of fire and/or other circumstances of loss or damage. Difficulties could arise in ensuring that field notes were copied each day. Specialists photocopied the field books each time they visited the crews. In the future, all notes must be copied each day.

5. Photographs:

Photographs provide essential information which may otherwise have been missed in field records. All sites were photographed by each team, noting landmarks and providing a person, ruler etc. for scale. In most cases, a white board with time, date, stream, reach and features of interest was held so that it appeared in one corner of the photo for positive identification. All photos were documented on the photo record sheet. No more than one stream was documented on a single roll of film. The film was submitted together with the record sheet at the end of each day. The film must be processed immediately. Most photographs were immediately labelled (including ALL copies) with all the applicable information from the photo record sheet. A backlog of photos was labelled at the end of the season. While possible, due to the field record sheet, labelling at the end of the season is undesirable since information may be lost. The

negatives were placed in archival sleeves, labelled, and stored in a location separate from the photographs. All photographs were placed in archival quality photo albums.

6. Documentation of changes in techniques used.

Any aberrations in the data collection technique were noted with the data set (right on the data sheet) and also in a separate log/field notes kept by the team leader. These notes were photocopied and kept on file.

7. Regular review of data:

Data sheets were periodically reviewed by the specialists to ensure that they continued to be correctly filled out and that the data collected appeared to be reasonable given the stream/conditions. Data were be entered into a database and (where appropriate) plotted. The specialists reviewed this final data product at the end of the season. Formal procedures for regular review of the data as it is collected and entered must be implemented in the future in order to catch possible errors early in the season. No problems were found to have arisen from late review of the data this year.

8. Review and/or implementation of innovative procedures:

As part of routine work, specialists were in communication with research colleagues conducting similar studies. In particular, two trips to a field station on the Ste. Marguerite River in Quebec were made to compare procedures with procedures used by Dr. Asit Mazumder's research team and to ensure that all the procedures and research areas for this project were current. Many interesting ideas have arisen out of these meetings which may be pursued in later years of this project. Ensuring that the data collected by the WRP field teams meets the standard of Dr. Mazumder's post-graduate research team and will provide scientific rigour and new insights into the dynamics of local streams.

3.11 Riparian Assessment Procedures

As part of the year 1 reconnaissance conducted by this project team in fall 1995, the Vegetation Ecologist posed a series of questions that should be asked when assessing the level of impacts on riparian areas in watersheds. These questions follow:

- Does well-established riparian vegetation exist along all or part of the stream?
- What plant species or strata are represented?
- Will the existing soil type support re-establishment of vegetation?
- Are soil conditions amenable to re-vegetation?
- Is the channel morphology appropriate for re-vegetation?
- Are the reaches restricted or unrestricted?
- Is the geomorphic structure stable and of low-energy?
- Are upslope areas stable and vegetationally productive?
- Is the riparian zone itself stable and productive?

Overall, these questions point very clearly to the need for a multi-disciplinary team approach to riparian assessment, that runs in tandem with fisheries, hydrogeological, and water quality assessments.

Though the land-water interface is of key importance to the health of stream ecosystems, the condition of riparian areas had long been overlooked as a subject of assessment. It therefore became necessary for BC Environment to hire consultants to develop a new methodology for conducting riparian assessments, and for evaluating the relative levels of various types of negative impacts caused directly and indirectly by logging activities. MELP staff, consultants, industry personnel, and others were first provided with an August 1995 Review Draft, prepared by Oikos Ecological Services Ltd. of Smithers, entitled, Condition Assessment Procedures and Rehabilitation Prescriptions for Riparian Management Areas in British Columbia (Oikos 1995). A work-in-progress, this draft was replaced in June 1996 with Draft # 3, Riparian Assessment and Prescription Procedures, Watershed Restoration Program, prepared by both Oikos Ecological Services Ltd. and T. Johnson and Associates (Oikos and Johnson 1996). Soon thereafter, a revised Draft # 3A was issued, correcting an error in the described method of assessing large woody debris inputs.

The Riparian Management Area (RMA) is an arbitrary designation under the Forest Practices Code given to a strip of land running parallel to each side of a stream. Its width is determined by the stream class developed first for fish habitat assessments. The RMAs of fish-bearing streams and community watersheds wider than 1.5 m (stream classes S1 to S3) consist of both a Reserve Zone, running adjacent to the stream, and a Management Zone, running outside the Reserve Zone. Those of smaller fish-bearing streams or community watersheds (S4) and non-fish-bearing/non-community watersheds (S5, S6)have only a Management Zone. No logging is permitted within a Reserve Zone, while limited logging is permitted within the Management Zone. Depending on terrain, forestry practices may call for a "Machine-Free Zone" at the interface of the Management Zone and the Reserve Zone. It is to this RMA that the riparian assessment procedures apply.

The initial portion of the riparian assessment is the Watershed Level Assessment, in which cutblocks with riparian edges (openings) are located, described, categorized, and prioritized. This roughly corresponds to what is commonly referred to as a Level 1 Assessment. The helicopter survey and other year one (1995) work conducted by this team were part of the Level 1 analysis.

The second portion of the riparian assessment is the Site Assessment, which constitutes the Level 2 analyses. The following were the objectives of the site level assessment:

- Characterize stream segments where there has been significant loss or impairment of one or more riparian functions.
- Describe the ecological parameters of each opening.
- Quantify the degree to which riparian function is impaired.
- Develop a rehabilitation plan which prioritizes rehabilitation at landscape and watershed levels.
- Develop a prescription which provides management objectives and prioritizes stream segments for rehabilitation within a watershed.
- In some cases, to provide preferred and alternative rehabilitation approaches in the prescription for each opening.

It should be noted that in some locations in some creeks it would have been premature to develop prescriptions without additional investigations. This particularly applies to:

- Areas along creeks having impaired riparian function due to causes other than logging.
- Areas where an opportunity exists for riparian vegetation modification or bioengineering in conjunction with future in-stream fish habitat or channel restoration or enhancement.

Essentially, the new riparian assessment procedures allow for the quantifying (in a relative sense) of the level of environmental impact on riparian areas caused by logging. The ratings of low, medium, high, or very high assigned to each of five impact criteria are intended to provide a guide to environmental managers as to what parameters to manage in a given cutblock or opening, and to prioritize efforts within a watershed. These five criteria, and the way their values are derived, closely mirror the nine questions listed at the beginning of this section.

The five impact criteria are:

- Stream shading.
- Input of large woody debris (LWD).
- Input of small organic debris (SOD).
- Surface sediment filtering.
- Subsoil nutrient filtering.

Each criterion is discussed briefly in the following paragraphs.

Stream Shading

Shading by riparian vegetation affects the temperature regime of a stream, and the amount of solar energy available for photosynthesis. The importance of shading is inversely proportional to the width of a stream, with other factors being height and percent cover of vegetation, degree of topographic shading, the biogeoclimatic zone of the subject area, and the aspect (sun direction) on the relevant portion of the stream.

Input of Large Woody Debris

The presence of LWD, made up of large fallen branches and tree trunks, is highly influential to stream morphology and fish habitat heterogeneity. The assessment procedures divide the riparian tree cover according to its ability to provide "present potential LWD" and "future potential LWD". Present LWD is defined as the density of living and dead stems of 22.0 cm or greater DBH (diameter at breast height), while future LWD is divided into living stems of four different size classes. Other relevant factors are the sizes of trees in relation to their distance from the stream, and the width of the stream (stream class).

Input of Small Organic Debris

The provision of SOD to a stream, in the form of fallen leaves and other organic detritus, is an important nutrient source for streams. The amount of available SOD available varies directly as the height of

vegetation, and inversely as its distance from the stream. Other relevant factors are the stream class and the vegetation percent cover in the source area.

In addition, because deciduous vegetation generally provides better quality SOD than coniferous vegetation, the "change class" is also inferred from the species composition. This is a judgement of whether deciduous and coniferous species are increasing or decreasing in absolute terms, and also in proportion to one-another.

Surface Sediment Filtering

Surface sediment filtering is the ability of riparian vegetation to trap sediments being transported by surface water toward the stream. Such sediments could be detrimental to the stream substrate and increase the turbidity level of the water. Assessment of filtering capacity is based on species composition, percent cover, and either terrain stability class or slope class. In addition, observations are made as to whether or not specific upslope sediment sources are present.

Subsoil Nutrient Filtering

This portion of the assessment should be called subsoil chemical filtering, since it includes the ability of the roots of riparian vegetation to take up soil contaminants resulting from silviculture activities, such as pesticides, herbicides, slashburn residues, as well as fertilizers and landfill leachate. Factors influencing this component of the assessment include RMA vegetation development stage and percent cover, terrain slope class, and the presence of potential chemical sources.

Environmental Management Objectives and Principles

The overall purpose of the riparian zone assessments conducted on the sub-watersheds was to develop rehabilitation prescriptions for the restoration of riparian function. These riparian zone rehabilitation prescriptions were based on a series of environmental management and design objectives. These objectives were to:

- Foster the establishment of a mosaic of vegetation in the riparian management area.
- Stabilize creekbeds and control erosion.
- Increase the potential for large woody debris and small organic debris inputs to the creek.
- Increase the surface sediment and subsurface contaminant filtering capacities of the riparian zone vegetation.
- Increase the stream shading potential.
- Improve in-stream productivity.
- Provide high-quality wildlife habitat.

These management objectives were further predicated on several overall principles that devolved during the course of the projects. Riparian restoration measures were chosen on the bases that:

Prescriptions developed for this project take into account all four assessment procedures in order to ensure as many limiting factors as possible are accounted for. This method will ensuring that the prescriptions developed are cost-effective and sustainable. Prescriptions developed will be implemented over a five year period with subsequent follow-up in a 5-20 year period. An example of the types of prescriptions recommended under the Riparian Assessment Procedure is provided in Table

The long-term ecosystem approach will hopefully avoid the pitfalls of other restoration initiatives, particularly in the western states where restoration efforts concentrated on instream works over a short period of time (one to two years) and suffered failure and/or damage to the engineered instream restoration works up to 60% (Frissel and Nawa; 1992)[1]. One of the main reasons for such a high rate of failure was attributed to the fact that these restoration initiatives failed to address restoration of the terrestrial processes first; such as bank erosion, land slides and road failures.

In order to avoid such high failure rates, restoration efforts will concentrate on stabilizing the terrestrial process in the early years by, for example, revegetation of stream banks. The long term plan will also allow for prescriptions to be modified as restoration proceeds to adopt to changing conditions. In other words, such an approach will allow the restoration effort "to work with nature" rather that to impose "our" view of what the creek should look like.

PILOT PROJECT

In addition to this year's detailed assessments, a pilot riparian revegetation project was initiated on an upper reach on Chance Creek in the Squamish watershed, and on North Lizzie Creek in the Lillooet watershed. The purpose of this project was to train the crews in riparian replanting to prepare for next year's restoration activities, to experiment with late fall planting as a means to increase the potential period of employment, and to determine survival rate of the species planted by whip propagation. In addition, the pilot project provide an opportunity to interact with licensees in the watershed in order to determine how prescriptions will be accommodated in their silviculture and stand management plans.

Figure 4-1 to 4-4 demonstrate the pilot project procedure, from site selection to resulting restoration.

[1] Frissel, C.A. and R.K. Nawa. 1992. Incidence and causes of physical failure of artificial habitat structures in streams of Western Oregon and Washington. North American Journal of Fisheries Management. 12:182-197.

1. They would stimulate the development of natural succession processes in the riparian management area.

2. They would be built on extant vegetation and locally-found plant species.

3. Their implementation would require minimal machinery.

4. They would be cost effective.

5. The restorative works would become self-sustaining and -perpetuating following a short period of monitoring and evaluation.

What sets these prescriptions apart from standard reforestation prescriptions is that the ultimate goal is not to grow merchantable tree plantations in the riparian management area. Rather, they are aimed at restoring the vital ecosystem function of the land-water interface, for the integrated benefit of the biota of the watershed.

Ecological Classification of the Study Area

The **Biogeoclimatic Zone** classification of British Columbia ecosystems is described by Meidinger and Pojar (1991). Pertinent elevation ranges of those sub-watersheds within the Lillooet watershed which constitute the study area lie in the Coastal Western Hemlock Biogeoclimatic Zone (CWH) and the Mountain Hemlock Biogeoclimatic Zone (MH). In this region, two variants of the CWH are found: at elevations below approximately 650 m, the Southern Dry Submaritime variant (CWHds1) and, at elevations between approximately 650 m and 900 m, the Southern Moist Submaritime variant (CWHms1). The Leeward Moist Maritime variant of the Mountain Hemlock Zone (MHmm2) begins above the CWHms1, and extends to approximately 1800 m in the study area. The division between these zones is at slightly higher elevations on leeward slopes, and slightly lower elevations on windward slopes.

Green and Klinka (1994) provide a comprehensive guide to identifying and interpreting vegetation types within the Vancouver Forest Region. Of particular pertinence to the development of appropriate prescriptions are the **Site Series** classifications Green and Klinka describe. Site Series is a further subdivision of Biogeoclimatic subzone variants, based on edaphic characteristics of local microsites. The Site Series edaphic grids presented in Tables 1.1, 1.2 and 1.3 are adapted from those of Green and Klinka (1994) for the CWHds1, the CWHms1, and the MHmm2 variants, respectively. On these grids, characteristic or indicator tree and forb species found within the numbered Site Series are provided, based on **soil nutrient regime** on the horizontal axis and **soil moisture regime** on the vertical axis.

Vegetation Species Identified in the Study Area

As part of the riparian vegetation impact assessment process, the crews conducted plot vegetation surveys in order to determine the species structure and character of each sub-watershed and general habitat characteristics. This was not, nor was it intended to be, an exhaustive biological inventory. As such, detailed species-level identification of fungi, grasses, sedges, rushes, and mosses and other lower plants was not undertaken.

Tree, shrub, and herb species identified during the field surveys are listed in Table 3. For each species, pertinent ecological notations are provided. Nomenclature is from Pojar and MacKinnon (1994).

3.11.1 Summary of the Riparian Impact Assessment Procedures

The Year 2 assessments conducted by the Riparian Assessment Procedure Field Team, and led by the Specialist and his assistant, were largely based on the new procedures manual. Initial training and field work was based on the early version (Oikos 1995); when Draft 3 (Oikos and Johnson 1996) became available in mid-July, some field procedures, notably that for assessing large woody debris, were modified accordingly.

Because of the provisional nature of the draft procedures, this document has several shortcomings. One of these is the lack of a full set of data collection forms for use by field teams. The forms used in this study were developed by the Specialist. They are provided in the Appendix.

Another shortcoming of the draught procedures is the lack of a clear, stepwise methodology for conducting the different components of the assessment. The Specialist provided the assessment team with a summary version of the assessment procedures, with minor modifications for practicability. This summary describes the methodology used, and is reproduced in the Appendix. Laminated copies of several reference tables were provide for field use. These are also appended.

The following plant identification field guide was provided to each member of the Riparian Assessment Procedure team:

Pojar, J. and A. MacKinnon (eds.). 1994. Plants of Coastal British Columbia. Vancouver; BC Ministry of Forests and Lone Pine Publishing. 527 pp.

The team was also provided with a copy of:

Green, R.N., and K. Klinka. 1994. A field guide to site identification and interpretation for the Vancouver Forest Region. Victoria; Research Branch, BC Ministry of Forests. 285 pp.

Watershed Level Assessment of Riparian Vegetation

1. Delineate the boundaries of all harvested areas along streams

All harvested areas which directly affected the RMA were outlined on photocopies of recent air photos. Newer cutblocks were also added, based on field observations and forest cover maps. In this study, the term "opening", which was used by Oikos (1995) is used to refer to logged riparian edges of cutblocks.

2. Colour-code stream riparian classes

Oikos and Johnson (1996) call for the colour-coding of riparian edges of openings according to the target RMA width for a given stream class. This procedure was not done, because a) most creeks studied were considered to have the same classification throughout the portions studied, and b) existing stream classification data were sporadic, and a fish habitat survey was being done in parallel to the riparian analyses.

3. Mark and Label Stream Reach Breaks

Following completion of the channel assessment by the Stream Hydrology Team, the reach breaks they defined were mapped along with the cutblock openings.

4. Identify and Number Stream Riparian Segments

Riparian edges of cutblocks (openings) were, in some cases, divided into subsections because of breaks in their continuity. Such breaks consisted of significant leave-strip sections or topographic features. Openings were not subdivided by structural stage, as suggested by Oikos and Johnson (1996) because most were what they refer to as complex units, having mosaics of two or more site series or structural stages or both. In addition, part of the Level 2 (site level) analysis consisted of identifying the structural stages and site series present. This level of detail was not reliably discernible on 1:20,000 air photos.

5. Develop a preliminary classification of riparian vegetation classes

Riparian vegetation class (RVC) labels were developed for each opening, based on data collected from vegetation plot surveys. Oikos and Johnson (1996) suggest this be done provisionally based on air photos and forest cover map data, but this would be of limited accuracy.

6. Conduct a ground and/or helicopter reconnaissance

For each watercourse studied, the crew first conducted an initial reconnaissance. This consisted of examination of air photos for location of the creek and major tributaries, areas impacted on by forestry-related activities, road access, and bridge crossings. The crew then took a driving tour of the creek, making initial observations for Data Sheet 1, the overall creek database. At each opening, field notes were taken describing the riparian vegetation, to aid in air photo interpretation.

7. Finalize the classification of RVCs, assign riparian segments, and develop a data base

Data Sheet 1, "Summary of Stream Segment Assessments", was used to record the overall database for each stream; this database was fine-tuned and confirmed by the Specialist, based on data from later field observations.

Table 3-1 below outlines the information provided in Data Sheet 1, and how these data were derived.

It should be noted that Table 3 of Oikos and Johnson (1996, p. 17), used to determine Canopy Cover Class, has the classes numbered opposite to those in the Fish Habitat Assessment Procedures (Johnston and Slaney 1996, p. 52) used in the Habitat Survey Data Form (p. 92).

8. Assess and prioritize stream segments for field visitation

The openings along each creek were prioritized, based on observations made from the air photo analysis and from the initial reconnaissance. This rating was based on level of disturbance, with understocked openings having impaired riparian function being assigned the highest priority. Older cutblocks with successfully regenerating forest were assigned the lowest priority, and, in most cases, were not visited.

Site Assessments - Evaluating Loss or Impairment of Riparian Function

The detailed methodology, in the form of the assessment procedure summary provided to the crew, is appended. Included are copies of all summary tables and data collection forms used.

Table 3-1. Derivation of Data Sheet 1.

COLUMN TITLE	DERIVATION OF COLUMN CONTENT
Reach Number	determine the reach number corresponding to each subject opening from data provided by the stream hydrology crew
Opening Number	identify openings within reaches
Stream Segment Number	identify (by alphanumeric code) segments within openings which will be assessed separately
Stream Segment Length (m)	measure the approximate length of each stream segment (in metres) using a "run-mate" map wheel or scale rule; then confirm in the field with a hip chain
FPCBC Stream Class	determine from table "Stream Classification/Target RMA Width"
Stream Classification/ Target RMA Width	determine from table "Stream Classification/Target RMA Width"
Riparian Vegetation Class (same as RMA class)	determine from table "RMA Classes and Subzones"
Biogeoclimatic Zone/Subzone	determine from Land Management Handbook (Green and Klinka 1994)
Site Series	determine from tables in Land Management Handbook (Green and Klinka 1994)
Structural Stage	from Table 1 (p. 14) in manual
Years Since Harvest	from forest cover maps or signage at the location
RVC Label	see example Table 2 (p. 16) in manual
Canopy Cover Class	from Table 3 (p. 17) in manual
Other Observations	e.g., evidence of mass wasting, erosion potential, blowdown, pollution sources, burn areas, etc.

The field methodology used by the Riparian Assessment Procedure crew was a hybrid of those described in Draft 1 (Oikos 1995) and Draft 3 (Oikos and Johnson 1996) of the Riparian Assessment and Prescription Procedures manual. This occurred because Draft 3 was unavailable until field work was well along. Operationally, the only major change made thereafter to the field methodology was to the procedure for assessing input of large woody debris. Draft 3 called for the division of "future potential LWD" into four classes, whereas Draft 1 did not. The data collection forms and methodology were altered to reflect this change.

For the assessment of LWD, and for the overall vegetation inventory and site characterization, the sampling method was to use 10 m X 10 m square plots, as described in Draft 1 (Oikos, 1995). Each plot therefore measured 1/100th of a hectare; ten taken together totalled 1/10th of a hectare. This standardized method was deemed by the Specialist to be more practical operationally and more statistically sound than the subjective variable-diameter circular plots suggested in Draft 3. In addition, because the quantitative data are converted to broad "low", "medium", "high", and "very high" ratings, there is little to be gained by using sampling methods beyond the capability of generally-trained field crews.

Assessment of the other criteria, i.e., stream shading, input of SOD, surficial sediment filtering capacity, and subsoil nutrient filtering capacity, were based on overall observations of the opening and its surroundings, as described in Draft 1. It would have been misleading to have based these assessments solely on data from the sample plots (as per Draft 3), though these data were taken into consideration.

3.11.2 Quality Assurance/Quality Control

QA/QC review of data was conducted on approximately 15% of all RAP plots in the Squamish Watershed. Consecutive plots were resurveyed in randomly selected openings to ensure that both the plot assessments, and overall opening assessments could be verified. On average, five plots were surveyed per opening. Creeks were chosen based on accessibility and volume of work done on the creek. Comparisons were made on three parts of the survey: the Overall Assessment (Data sheet 3), Large Woody Debris, and Plot Vegetation Identification. The first and last assessment are fairly subjective, relying on estimates of height, slope, percent cover and other variables. Therefore, some variation between surveys is expected. There should be less variation in the Large Woody Debris assessments, as these are based on calculations of quantitative tree counts in the plot areas. Species identification should also show little variation, as survey teams in both watersheds based identifications on the same field guide (Pojar and McKinnon 1994).

Four creeks were selected for re-survey in the Squamish watershed: Chance and Crawford. QA/QC surveys were conducted between August 27 and September 5 to 11, 1996. The QA/QC results are given below in the section for each creek.

In addition to direct verification of survey results, there are other components to the QA/QC program that increase confidence in the findings of this study. These are as follows.

- Members of the crew had previous technical training or work experience that familiarized them with plant species identification and survey methods.
- A modern field guide (Pojar and MacKinnon 1994) was provided to each crew member so that nomenclature would be standardized.
- 100% of the data were checked and corrected, as necessary, by the Vegetation Ecologist and his assistant.
- Either the Vegetation Ecologist or his assistant was present to work with the crew during approximately one-third of the surveys.
- The training program allowed for questions and problems to be addressed by the Vegetation Ecologist and his assistant.

3.12 Prescriptions

The prescriptions presented in this report will be implemented over a five-year period with subsequent follow-up in a 5-20 year period. It is to be hoped that through such a long-term approach the pitfalls of other restoration initiatives will be avoided. For example, in the western states restoration efforts concentrated on instream works over a short period of time (one to two years) and suffered failure and/or damage to the engineered instream restoration works up to 60% of the time (Frissel and Nawa, 1992). One of the main reasons for such a high rate of failure was attributed to the fact that these restoration initiatives failed to first address restoration of the terrestrial processes such as bank erosion, land slides, and road failures.

In order to avoid such high failure rates, restoration efforts will concentrate on stabilizing the terrestrial process in the early years by, for example, revegetation of stream banks. The long-term plan will also allow for prescriptions to be modified as restoration proceeds to adapt to changing conditions. Such an approach will allow the restoration effort "to work with nature" rather than imposing "our" view of what the creek should look like.

3.12.1 FHAP Prescriptions

Based on data collected during the level 1 fish habitat assessment conducted in selected creeks in the Squamish watershed, suggestions for restoration and rehabilitation prescriptions of fish habitat will be provided. Prescriptions options could include, but may not necessarily be limited to one or more of the following:

- Restoring fish access and spawning sites
- Streambank rehabilitation
- Off-channel habitat rehabilitation
- Restoration of LWD
- Accelerating the recovery of log jam habitat
- Boulder clusters to restore rearing habitat
- Deflectors and weirs to rehabilitate mainstem rearing habitat
- Reconstructing channeled habitat
- Inorganic nutrient additions to restore productivity
- Minimum flow augmentation

These suggestions will form the basis of future work in the area and will determine the necessity of conducting level 2 field surveys to address specific uncertainties in the design of the fish habitat rehabilitation/restoration program. Suggested prescriptions for fish habitat will be consistent with prescriptions based on the CAP, WAP and RAP assessments conducted in the same creeks, and with objectives of the integrated watershed restoration plan and with regional management plans.

3.12.2 CAP Prescriptions

Once the channel type was determined, prescriptions for each reach were prepared. The prescriptions were based on the channel type and whether the channel was stable, aggraded or degraded. An aggraded channel exhibits a higher than normal amount of sediment expected within the reach whereas the degraded channel exhibits a higher than normal amount of erosion and scour within the reach.

Aggraded Channel Prescriptions

Generally if the reach is aggraded then gravel scalping of gravel bars is recommended along with the placement of LWD to promote pool development. Building and enhancing off-channel habitats along with promoting two main threads cutting off multiple channel branches is typically recommended for riffle-pool morphologies. Re-vegetating banks to enhance over-bank sediment trapping is also recommended if appropriate. For cascade-pool and step-pool morphologies stone lines are typically recommended to be re-built to enhance flushing of fine textured sediment.

Degraded Channel Prescriptions

Generally if the reach is degraded then, interrupting long runs, re-connecting or building off-channel habitats, increasing riffle variability are typically recommended for riffle-pool morphologies along with the placement of LWD to increase sediment storage along channel margins. Pool development is promoted to achieve larger pool sizes with diversity in shape and depth by the strategic placement of LWD. Re-vegetating banks to enhance over-bank sediment trapping is also recommended, if appropriate. For cascade-pool and step-pool morphologies stone lines are typically recommended to be re-built to increase sediment textural variability.

3.12.3 WAP Prescriptions

General prescriptions for creeks and tributaries are described below, together with supplemental data-gathering recommendations for year three. Note that since there exists a continuous, uni-directional flow of water through each reach, only rarely will it be possible to develop reach-specific prescriptions. At present, insufficient data exist to link riparian structure, water quality and aquatic habitat and food availability (quantity and quality) with optimum fish densities; it is recognized that fish density and fish condition (health) must be co-determined.

1. Maximize stream surface area through increased small stones and cobble.

    - Cobble should be anchored between larger rock on the stream bed.
    - Enhance relative streambed roughness (height of streambed sediments relative to water depth).

4.0 TRAINING PROGRAMS

The training programs conducted during the first year of the conditional assessment were designed to expose the First Nations technicians to the methods used by the specialist team in making a Level One assessment of streams. The program involved class and field work. During the field component, the technicians were shown how field data was collected and assisted the resource biologist and specialists in collecting the required data for drainage prioritization.

4.1 Fisheries

The fisheries biology training session was conducted September 6 through 13, 1995. Training included one half-day classroom information presentation and two days of multi-discipline field exercises. The instructor also accompanied the crew on the first two days of the field program to help reinforce the information and procedures taught during the training session.

Classroom

Information and methods presented were largely derived from MELP and MOF (1994) and Koning (1994). The classroom presentation included exposure to the following topics:

- Introduction, including background of the instructor and definition of "what is fish biology?"

- Fisheries resources in the Squamish and Lillooet watersheds and habitat requirements of various life stages of different species (spawning, rearing juveniles and resident adults, overwintering shelter and rearing, migration by juveniles and adults, adult holding areas and periphery habitats); stream flow, stream substrate, stream structure (large woody debris) and riparian cover, water temperature, water quality (dissolved oxygen, water clarity and suspended sediment), and fish food production.

- Regulatory agencies and the Fisheries Act.

- Logging related fish habitat impacts, stream classification, fisheries sensitive zones and common impacts of forest harvesting (compaction, puddling, soil displacement; riparian vegetation removal; surface erosion/mass wasting); including review of sediment impacts on fish and fish habitat.

- Fish habitat assessment procedures, including Level One Assessment, Level One Habitat Survey; brief exposure to Level Two Assessments and Level Two Habitat Survey; discussion of fish habitat evaluation; data sheets were explained and field collection/measurement techniques were demonstrated.

Field Training

The field training program focussed on reiterating fish biology and habitat requirements while looking at real examples, and practical application of the Level One Habitat Assessment methods.

4.2 Hydrology and Terrain Analysis

A one day workshop was carried out on October 16, 1995 at the Resort Municipality of Whistler. The workshop consisted of in-class introduction of terrain and hydrological analysis, and a field visit to Fitzsimmons Creek and Whistler Creek.

Workshop

The workshop included a general overview of the Level One Coastal Watershed Assessment Procedure demonstrating the use of forest cover maps and terrain maps and an overview of the Channel Assessment Procedure (CAP).

Channel morphology changes as a result of forest-practices throughout a channel reach (similar discharge, morphology and gradient) and sediment surplus or deficit was described. Incorporation of the CAP results in the CWAP and prescriptions were reviewed.

Field Training

The field assessment portion of the workshop included two site visits to Fitzsimmons Creek: one near the mouth and one 4 km upstream in the canyon. In addition, one site visit was carried out on Whistler Creek just upstream of the skier bridge. The field trip concentrated on identifying reaches and reach geomorphologic parameters.

During the field assessment the crew was shown how to take specific measurements of geomorphologic parameters such as channel slope, channel width and D:d ratio. The following 7 channel types were also discussed:

Block Step
Boulder-Step Pool
LWD-Boulder Step Pool
Boulder Cascade Pool
LWD-Cobble-Step Pool
Riffle Pool
Riffle Bar Pool

4.3 Water Quality

Introduction

The program was based upon the philosophy that the result of any test procedure can be no better than the sample on which it is performed.

The cardinal objective of the program was to provide students with the essential skills to assess and collect a representative portion of the stream or river water that represents the actual water body's composition. Prior to sampling an aquatic ecosystem it is essential that some estimate of the system's health be determined. The sampling program can then be tailored to provide further measurements of selected parameters to fine tune the diagnosis. Understanding basic functions of aquatic ecosystems, and their structures, is thus a pre-requisite to studies of ecosystem health. Since the emphasis of this program was on acquiring practical skills, the majority of the program was conducted in the field, with minimal lecture material.

The following sections describe basic concepts of aquatic ecology and sampling and monitoring techniques that were covered during the training session. The majority of topics covered during field exercises including the following:

- Basic Aquatic Ecology Principles
- Monitoring Rationale and Techniques

- Generalized Sampling Techniques
- Dissolved Oxygen Meter Standardization and Calibration
- pH Meter Standardization and Calibration
- Secchi Disk Transparency Sampling Techniques
- Periphyton and Phytoplankton Net Tows Sampling Techniques
- Invertebrate Sampling Techniques
- Surber Sampler Sampling Techniques
- MELP Lake and Stream Bottom Sediment Sampling Manual
- MELP Biological Sampling Manual
- MELP Ambient Fresh Water and Effluent Sampling Manual

Key concepts addressed through this training program included:

- Water as a substance: limnology as a discipline.
- Aquatic Ecosystems: structure and productivity.
- Nesting of hydraulic habitats in a stream.
- The four basic elements: physical, chemical, biological, temporal.
- Nutrient cycles.
- Community structure: periphyton *vs*. phytoplankton.

- Littoral communities: larger plants.
- Food webs and linkage interactions.
- Bottom-up and top-down processes.
- Even *vs*. odd numbered systems.

The field and lecture training program consisted of a workshop designed on the basis of six major activities:

- Formulating the specific objectives of the water quality sampling program.
- Collecting representative samples.
- Proper sample handling, preservation and shipping.
- Maintenance of chain-of-custody and sample identification procedures.
- Maintenance of QA/QC program.
- Proper analysis of samples both *in-situ* and in the laboratory.

The training program was designed to provide an introduction to the basic skills required to accurately collect water samples from the water systems. The samples would then either be analyzed in-house by the sampler or packaged and forwarded to the contract laboratory for analysis. Additionally, certain data had to be collected in the field, since some environmental parameters cannot be accurately measured in the laboratory (i.e., dissolved oxygen).

The program consisted of such components as: discussions on aquatic ecosystem structures, identification of basic periphyton community types, sampling design and philosophy, analytical equipment maintenance, pre-sampling preparation, in-field sampling procedures, sample preparation, in-house analytical procedures, sample transportation, and data records and storage.

Classroom

The in-house procedures included:

- Health and safety (legal framework and responsibilities).
- Basic laboratory techniques
  - glass and plastic ware
  - basic lab practices.
- Measures and units (SI units).
- Scientific approach (observations, methods, sampling).
- Record keeping
  - practical notes and records
  - communicating data.
- Obtaining specimens (collecting, fixing, preserving).
- Quality Assurance and Quality Control
  - introduction to control concepts
  - sample custody
  - data recording
  - accuracy *vs*. precision.
- Sample container preparation.

Field Training

The in-field procedures included:

- Health and safety (legal framework and responsibilities).
- Collecting, preserving and handling samples.

- Drawings and diagrams and photographs.

- Quality Assurance and Quality Control
  - introduction to control concepts
  - sample custody
  - analytical standards and calibration, and performance checks
  - data recording.

- Sample preparation for shipping.

- Sample transportation.

- Identification of sampling errors.

- Basic concepts of how aquatic ecosystems function and are structured and how this can affect fisheries populations.

This training approach emphasized practical skills acquisition supported by a sound understanding of the scientific principles on which the sampling is based and how these are used to develop an understanding of the health of a specific aquatic habitat. Knowledge and understanding eliminates or minimizes errors and enhances the quality and accuracy of the data.

4.4 Riparian Zones

The forest and riparian ecosystem portions of the technician training course consisted of classroom instruction on ecological concepts, and the application of those concepts in the field. The objective of the program was to train First Nations technicians in the aims and methods of riparian vegetation ecology, so that they can function as a field investigations team under the supervision of the resource biologist. By the end of this training program, the technicians were intended to have an understanding of:

1. Basic principles of riparian zone vegetation ecology.

2. Plant species identification.

3. Ecological importance of key species.

4. Methodology for a qualitative riparian vegetation assessment.

5. Reporting procedures.

Course Outline:

1. Definition of a forest:
   - an ecosystem dominated by trees
   - a landscape that has the soil, climate, and set of organisms that make up what we think of as a "forest"
   - a type of landscape in which the redevelopment of a plant, animal, and microbial community dominated by trees will occur naturally, or with management assistance, following removal of trees by natural or human-caused disturbance.

2. Concepts of disturbance and serial change.

3. Definitions of ecosystem and environment
   - ecosystem means an ecological system, that is, it is the total assemblage of living organisms together with their non-living environment in a particular area
   - ecology is the study of the relationships between living organisms and their total environment
   - living organisms are the "biotic" components of the environment, while the physical characteristics such as climate and topography are the "abiotic" components of the environment.

4. Ecology versus environmentalism
   - ecology is a branch of the science of biology
   - environmentalism is the establishment of a value system concerning the condition of the ecosystems that make up the environment
   - it is the combination of ecology and society's value judgments about the environment that provides the basis for developing successful conservation policies and strategies.

5. Major characteristics of ecosystems
   - Structure
   - Function
   - Complexity
   - Biotic diversity

- Interdependency or interaction of components
- Tendency to change over time.

6. Nutrient cycling
   - The geochemical cycle
   - The biogeochemical cycle.

7. Ecological succession
   - why do ecosystems change?
   - concept of "ecological succession" and seral stages
   - change caused by plants themselves (e.g., microclimate, soil formation)
   - definition of "pioneer species" and processes of ecological succession
   - change caused by animals or disease (e.g., disease, defoliation, grazing)
   - succession related to fire, wind or other abiotic factors
   - primary and secondary succession
   - climax forests.

8. Characteristics of the Coastal Western Hemlock Biogeoclimatic Zone.

9. Key representative vegetation species
   - how to recognize them
   - their ecological importance
   - what they indicate about their site.

10. Methodology
    - vegetation plots
    - linear recording.

Each student was provided with the following course materials:

Pojar, J. and A. MacKinnon. 1994. Plants of Coastal British Columbia, including Washington, Oregon and Alaska. Vancouver; BC Forest Service and Lone Pine Publishing. [field guide]

Pojar, J, K. Klinka, and D.A. Demarchi. 1991. Chapter 6: Coastal Western Hemlock Zone. In: D. Meidenger and J. Pojar (eds.). Ecosystems of British Columbia. Victoria; BC Ministry of Forests. pp. 95-111. [photocopies made by permission of the publisher]

Illustrations [reproduced by permission of the publisher] from:

Kimmins, J.P. 1992. Balancing act, environmental issues in forestry. Vancouver; UBC Press

Figure 4.2 The three major types of nutrient cycles

Figure 4.3 Relationship between environment type and degree of ecosystem disturbance

Figure 4.4 Three successional stages in a forest following the removal of the previous forest by logging or natural disturbances

The vegetation ecologist designed two forms which were used for data collection during the field component of the training program. The first is used for quantitative analysis of vegetation species and site characteristics within a plot. The second is for qualitative recording of vegetation community type and species in a linear fashion by chain length along a streambed. The students were also suppield with a list of common and scientific names of the more abundant plant species found in the Coastal Western Hemlock Biogeoclimatic Zone. Each species was assigned a two-letter code, based on the scientific binomial, to help the technicians standardise their data entry.

4.5 Training Program

One of the mandates of Forest Renewal BC's Watershed Restoration Program was to retrain displaced forest workers and First Nations persons in skills that would provide them with employment. An integral component of the Year 2 Conditional Assessment WRP was to provide this training.

Forty individuals were hired from the local communities (25 from the Pemberton area to perform work within the Lillooet River Watershed, and 15 from the Squamish area to perform work within the Squamish River Watershed) representing displaced forest workers, First Nations, and residents of the local communities. The individuals hired for the program were selected on the basis of their past knowledge in related types of field work, their ability to work within a team structure, and their ability to perform assessments with limited supervision.

To advertise the position, a fax or letter was issued throughout the Squamish Forest District corridor to as many forest industry-related locations as possible (refer to Appendix D). A follow-up phone call was also made to inform the companies of the employment opportunity and to try to solicit candidates for the Watershed Restoration Program. The position was also advertised internally through the office of the Squamish Nation and throughout the Lillooet River Watershed (down to Harrison Lake) through the Mount Currie Band Forest Office. The intention was to inform the forest sector and First Nations populations initially, and then to advertise the position to the community if there was a shortage in applicants.

An initial 45 individuals were short-listed from which the 40 crew members were selected. A ten-day training period was given to all the candidate employees during which time a short-list was made. The training took place in Pemberton and consisted of an introduction to the nature of the work to be undertaken, followed by detailed in-field training of each candidate in the procedures for gathering information for the four assessments: Channel Assessment, Riparian Assessment, Fish Habitat Assessment, and Water Quality Assessment. The training was conducted by the four specialists in each discipline. Details of the training for each assessment are outlined below. An initial two-day introductory session was provided in the field to the entire group, after which the group was broken up into four sub-groups which became specialized in one of the four assessments. An effort was made to try to match each individual with an assessment of his or her choice or to match their knowledge and abilities.

At the end of the ten-day period 40 individuals were selected and hired for the season. Four Crew Leaders from each of the two watersheds were chosen to lead each of the four assessment groups. The Crew Leaders were selected based on their past experience working in a supervisory capacity, as well as from their performance during the training period. Ongoing evaluation was conducted throughout the field season, assessing the job performance, attitude, and skills development of each of the crew members.

First aid training was provided as part of the training program to 36 of the candidates who did not have appropriate first aid certification. Occupational First Aid and Transportation Endorsement was required by Worker's Compensation Board as a minimum training level. Two one-day training courses were provided locally to the short-listed candidates. The purpose of Occupational First Aid was to provide workers with prompt, easily accessible and appropriate first aid treatment methods and to keep records of each treatment[1]. Transportation Endorsement gave the Occupational First Aid certificate-holder training

[1] Occupational First Aid Regulations, Workers' Compensation Board, printed 3/94, page

to transfer an injured worker to a spine board or a basket stretcher to allow the injured worker to be moved[2].

For the 11 crew members hired to perform the Fish Habitat Assessment and Water Quality Assessment (in which fish-gut analysis was to be performed), a separate college-certified course was provided in the use and operation of electroshocking equipment. The course was Ministry of Environment approved. Electroshocking is the use of electricity for the capture and control of fish[3]. Electroshocking is conducted by standing in the water while wearing a backpack power unit. This method of sampling is used because it provides a safe and expedient method of determining fish presence. When properly operated, the electroshocker temporarily stuns the fish, allowing it to be observed and its species recorded. Once recorded, the fish is unharmed, and is returned to the watercourse. The electroshocking training involved a two-day course, in which the trainees were taught the use, operation, and safety of electroshocking.

The overall Watershed Restoration Program consisted of the initial training period, then the field work, and concluded with a restoration pilot project. The final pilot project involved retaining six individuals from each of the two communities (for a total of twelve people). A pilot project was performed in each of the two watersheds and involved the planting of alder, willow, and cottonwood whips within a 1 hectare riparian area. The whips were collected in the local vicinity of the pilot area within the watershed and planted shortly thereafter.

The training also involved a restoration project in the Lillooet River Watershed on side channels adjacent to South Creek. Hugh Naylor oversaw this component of the project and involved one of the crew members to assist him with the instream work.

4.6 Fish Habitat Assessment Procedure (FHAP)

The 1996 training program included a classroom presentation for all participants that introduced them to the fisheries specialist team and gave brief exposure to fisheries biology, the objectives of the program and the types of information that would be collected. Information and methods presented were largely derived from Johnston and Slaney (1996) and Anonymous 1996. The classroom presentation included brief exposure to the following topics:

- Introduction including background of the instructor and definition of "what is fish biology?"
- Overview of fisheries resources in the Squamish River and Lillooet River watersheds and habitat requirements of various life stages of different species (spawning, rearing juveniles and resident adults, overwintering shelter and rearing, migration by juveniles and adults, adult holding areas and periphery habitats); stream flow, stream substrate, stream structure (large woody debris) and riparian cover, water temperature, water quality (dissolved oxygen, water clarity and suspended sediment), and fish food production.

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2 *ibid.* page 47.

3 Electroschocking Student Workbook, Ministry of Environment, August 1989, page 6.

- Logging related fish habitat impacts, fisheries sensitive zones and common impacts of forest harvesting (compaction, puddling, soil displacement, riparian vegetation removal, surface erosion/mass wasting); including a review of sediment impacts on fish and fish habitat.

- An overview of the fish habitat assessment procedures that were to be used was presented.

Following the introductory session, all participants were given exposure to the primary data collection procedures in the field at North Lizzie Creek. At this point, the participants were required to choose which discipline they wanted to work in during the assessment program.

4.6.1 Detailed Fisheries Training Program

Ten of the participants were selected to form the two fisheries crews, one crew for each of the Squamish River and Lillooet River watersheds. The primary elements of the training program were field application of the overview and level 1 assessment procedures, a formal electroshocking certification course and a tour of the demonstration restoration projects in the Squamish River watershed. All participants in the fisheries group were provided with a copy of Fish Habitat Assessment Procedures (Johnston and Slaney, 1996) and Fish Habitat Rehabilitation Procedures (Anonymous, 1996) and encouraged to read them and, in particular, learn the fish habitat assessment procedure.

All of the field training took place in the Lillooet River watershed in the South Lizzie, Sampson and Rutherford Creek drainages. The first detailed training for fisheries assessments was a field exposure to fish and fish habitat conducted in the South Lizzie Creek drainage and involved the whole group working together. The instructor used an electroshocker to capture fish from various habitat types and stimulated discussion on:

- Why fish at some life stages were captured in some habitats and not in others.

- Habitat characteristics and how to document them according to the prescribed procedures.

- How habitat characteristics in different reaches may vary and why.

- How fish utilization of habitat varies temporally throughout the year and why.

- Limiting factors and restoration techniques used to improve habitat limitations.

At Sampson Creek the crew was divided into two groups and required to conduct assessments according to the level 1 field assessment procedure on different reaches of the stream. The crews then switched and worked in the reach the other crew had been working in, replicating the assessment. When completed, results were compared to identify discrepancies between the data sets and to clarify procedures regarding the measurement of various parameters.

Training at Rutherford Creek watershed involved practical application of the field assessment procedure. In addition to electroshocking to determine fish presence and documentation of habitat characteristics and habitat limitations, participants were exposed to fish sampling techniques including the use of anaesthetic, measuring fish lengths and weights and collecting scale samples.

The group then received a formal electroshocking course conducted by an instructor from Malaspina College.

The detailed training program then culminated with a tour of the Squamish River watershed demonstration restoration projects. The objective of the tour was to give participants an exposure to the type and scope of restoration/rehabilitation techniques that can be applied under WRP.

In summary, participants with no formal educational background in fisheries science and little or no previous fisheries work experience were inundated with scientific and technical information over a very short period of time. The entire project was essentially a training program. The participants really began to learn as the basic information that was presented at the initiation of the project was practically applied while conducting assessments in the respective watersheds. As would be expected, the competency of the crews increased as the summer progressed.

4.7 Channel Assessment Procedure (CAP)

A total of 40 local people, from the Squamish and Pemberton areas, were selected through an interview process to be candidates for field training. Brian LaCas, P.Eng., professional hydrological engineer of LaCas Consultants Inc. was the instructor for the Channel Assessment Procedure. The training began with classroom instruction on the background of general hydrological and geomorphological principles as well as a description of the flood and drought scenarios within the Squamish River and Lillooet River Watersheds. A field session followed at South Lizzie Creek, where all trainees where taken to a variety of sites along the river to demonstrate the channel processes of aggradation and degradation. A second field session followed at Sampson and Railroad Creeks where field training and recording measurements were demonstrated by a professional hydrological engineer.

The trainees then went through rigorous training on how to effectively and safely take the measurements described in Section 3.8. Recording and checking data entries were demonstrated and emphasized. How to locate reach breaks on the map and how to take and record photographs were demonstrated along with the use of the information sign board (used in the photographs).

A trained hydrological technician worked with the groups to assist in measurements and prescription writing. A professional hydrological engineer periodically accompanied both the CAP Squamish and CAP Pemberton crews in the field to provide them with some on-going training and to investigate problem areas of the creek in question.

4.8 Water Quality Assessment Procedure (WAP)

Training of the water quality team took place over an intensive ten day period which was then followed by supplemental training throughout the summer. The ten day intensive training covered the basics of water quality sampling: calibration and standardization of meters and equipment, proper water sampling technique, benthic invertebrate sampling technique, periphyton sampling technique, data recording protocols, and chain of command. It also covered the philosophy of the restoration program that this group is conducting as well as basic ecological concepts, both aquatic and terrestrial. Details of the topics covered can be found in Chapter 4- Training. The following list contains the topics covered during the ten day training period:

Introduction to aquatic ecology

Role of aquatic ecology component in relation to other specialties

Stream community structure

- Food webs: primary vs. secondary productivity/production
- Control of primary production through grazing vs. nutrient limitation (top-down vs. bottom-up controls)
- Role of aquatic ecology in watershed assessment
- Key areas of stream assessment
- Three needs of all algal communities: CO_2, nutrients, light and implication for fish bearing streams

In-field site description including:

- Riparian vegetation, canopy closure
- Site location by major and minor landmarks
- stream benthos characterization
- Algal community characterization
- Rationale for extensive site description

Use of basic field equipment

- Dissolved oxygen meter operation & standardization/calibration
- Conductivity meter operation & standardization/calibration
- How to interpret results

Quality Assurance/Quality Control measures:

- Introduction to control concepts
- Accuracy vs. precision
- Identification of correct order in which to take samples/measurements
- Collecting, preserving & handling samples: general principles
- Correct water sampling techniques
- Proper data recording techniques
- Sample preparation for shipping
- Sample transportation

- Dissolved oxygen meter standardization/calibration
- Conductivity meter standardization/calibration
- Specific conductance- how to interpret results
- Labelling of sample bottles
- Photographic records
- Health & safety (legal framework & responsibilities)
- Approved analytical standards and calibration and performance checks
- Identification of sampling errors
- Data interpretation

Integration of aquatic ecology with fisheries biology/ terrestrial ecology

Nesting of hydraulic habitats within a stream

- Role of velocity in structuring stream ecology

Periphyton sampling

- Sample site selection
- Periphyton sampling techniques
- Algal preservation techniques
- Rationale: artificial vs. natural substrates

Major groups of algae

- Lab session: examination of algal samples under the microscope

Benthos sampling

- Sample site selection
- Invertebrate sampling techniques:
    * Use of Hess sampler
    * Use of Surber sampler
    * Benthos preservation techniques

4.9 Riparian Assessment Procedure (RAP)

Formal crew training began with introductory seminars, conducted jointly by the members of the specialist team, to acquaint members of all crews with the overall scope, objectives, and rationale for the project. The

seminar on riparian ecology and management included a primer on ecology and forest ecosystems, and a discussion of riparian rehabilitation and restoration.

The primer on ecology and forest ecosystems included the following topics:

- Definition of a forest as a type of landscape in which the redevelopment of a plant, animal, and microbial community dominated by trees will occur naturally, or with management assistance, following removal of trees by natural or human-caused disturbance.

- Definition of an "ecosystem" as the total assemblage of living organisms together with their non-living environment in a particular area.

- Definition of "ecology", which comes from the Greek word "oikos", meaning "dwelling place", and the Latin word "logia", meaning "study", as the study of the relationships between living organisms and their total environment or their "house".

- Distinguishing between "Ecology" as a branch of the science of biology, and, as such, being descriptive, and non value-laden, and "environmentalism", which is the establishment of a value system concerning the condition of the ecosystems that make up the environment, both of which provide the basis for developing successful conservation policies and strategies.

- The major characteristics of ecosystems, including vertical and horizontal structure, ecosystem function, ecosystem complexity, biodiversity, interaction of ecosystem components, the tendency to change over time, nutrient cycling, ecological succession, and biogeoclimatic zone classification.

The discussion of riparian zone rehabilitation and restoration included the following topics:

- Distinguishing between the terms "rehabilitation", "restoration" and "enhancement"

- An overview of riparian function in soil formation, streambank retention and stability, prevention of erosion, filtering of surficial sediments and prevention of siltation, subsoil filtering, microclimate modification, contribution to in-stream nutrient levels, contribution to biogeochemical cycling, provision of large woody debris, and wildlife habitat

- Definition of riparian zones as zones of direct interaction between terrestrial and aquatic environments, and those portions of the floodplain submerged annually

- Riparian zone evaluation criteria

- A description and synopsis of the new riparian assessment procedures

Following selection of crew members, formal crew training consisted of classroom and field session.

Classroom training included air photo interpretation and measurement, map analysis, and methods used for deriving the information to be included on data collection sheets.

Field training consisted of run-throughs of full assessments, to ensure that the methodology was well-understood. The crews conducting the Squamish and Lillooet Watershed Assessments were trained together, so that teams were able to repeat and compare one another's assessments. This allowed points of difficulty to be recognized and addressed.

In addition to the formal training, ongoing training, results monitoring, and spot-checking of the crew continued throughout the course of the project.

5.0 RESULTS

5.1 Introduction

As discussed in the Methods section, a short-list of candidate drainages was prepared by the Resource Biologist and field technicians. These creeks are listed below. Based on this list, the specialist teams reviewed the collected data and air photos, and conducted a helicopter survey. For each creek short-listed, data summary sheets were compiled in order to assess the logging impacts and prioritize the drainages.

SQUAMISH SHORT-LISTED CREEKS

Pillchuck Creek	Upper Squamish River
Ashlu River	Cloudburst Creek
Chance Creek	High Falls Creek
Shovelnose Creek	Fries Creek

5.2 Water Quality Overview

Temperature

The range of temperatures observed during the sampling period ranged from a high of 15°C to a low of 2°C. This data is similar to that obtained from the Ministry of Environment, Lands and Parks (Table 2) during 1994 when a range of 15 to 8°C was obtained during the period July through September, within tributaries in the Squamsih River watershed. Although no summer or late winter temperatures were measured, it is expected that summer values would be higher than those recorded during this preliminary survey. The values measured in late autumn in this survey would likely reflect the lowest temperatures expected in the streams.

Station	Water Chemistry Geometric Means					
	pH rel. units	Sp. Cond. µS/cm	Turb. NTU	Temp. °C	O-P µg/L	No_2/No_3 µg/L
Green River						
030097	7.4	49	6.3	12	1.2	24
D/S	7.1	27	17	12	1.8	39
Soo R.	7.0	20	48	8.0	1.4	27
Rutherford R.	7.1	26	16	8.3	1.6	36
Fitzsimmons Ck.	7.4	62	13	7.8	1.9	51
Lillooet R.						
U/S	7.2	51	54	11	4.1	43
D/S of Reserve	7.2	39	51	9.6	2.2	21
D/S of Lake	7.2	42	12	13	1.7	47
Pemberton Ck.	6.8	18	12	12	3.0	NA
Ryan R.	6.9	25	22	10	–	NA
Birkenhead R.	7.1	54	2.2	15	3.5	NA
Cheakamus R.						
0300116	7.2	32	1.9	12	1.1	NA
0301595	7.3	35	1.8	13	1.3	NA
D/S Dam	7.3	41	0.4	12	1.7	NA

Table 2. Data sumary for water quality parameters measured weekly at eight established stations (July 27/28 - Aug.31/Sept.1 1994).

The optimal temperature range for most salmonid species is 12 - 14°C (MacDonald et al., 1991). These authors note that "...lethal levels for adult salmonids will vary according to factors such as the acclimation temperature and duration of the temperature increase, but they generally are in the range of 20 - 25°C." Spawning adults, juveniles and eggs are known to be even more sensitive than adults to increased temperatures, with optima being typically less than 13°C. Little research has been conducted on the health of salmonids, at any of their freshwater life cycle stages, with respect to prolonged exposure to sub-lethal temperatures. As well, there is relatively little information on the sub-lethal effects of altered thermal regimens resulting from forest harvest changes to ground water and in-stream temperatures. Behavioral responses to temperature are also poorly understood. One aspect which has received some attention is the behavioral thermoregulation of salmonids whereby they move into gravel or other protected areas, at temperatures below 5°C, to minimize body temperature fluctuations during wide variations in stream temperatures. Such changes can also have effects on more than one life cycle stage and have been shown to persist during all stages of the fishes life cycle (MacDonald et al., 1991).

Finally, assessment of temperature should include measurements of diurnal fluctuations and the sensitivity of daily peak stream temperatures to short-term fluctuations in air temperature. It is recommended that continuous recording apparatus be used to eliminate the difficulty and cost of sampling such habitats manually. Turbulent, shaded streams will require minimal monitoring, whereas pools and backwaters require supplemental monitoring to determine whether there are cool-water intrusions or thermal stratification. Continuous temperature monitoring should be conducted in both reference streams, known to contain fish populations close to their maximum carrying capacity, as well as in a number of streams located in harvested areas which appear to be candidates for restoration.

Turbidity

Turbidity values in Squamish were measured in three creeks (High Falls, Mile 28 Squamish, Brohm Creek) and values were all below 2 NTU's (Figure 6). The majority of values were less than 0.5 NTU. Values measured in 1994 (Table 2) evidenced values which ranged from 0.4 to 54. The Cheakamus River had levels less than 2.0 NTU, as did the Birkenhead. The Green River, and a number of its tributaries all draining a glacier, had values which ranged from 13 to 48 NTU. It was evident from the numerous field studies that aquatic environments which receive much or all of their surface flows from glacial melt have high turbidities and are often coloured. The particulates in these systems are so small that they typically do not sediment even during the slowest flows or when the water remains static for prolonged periods.

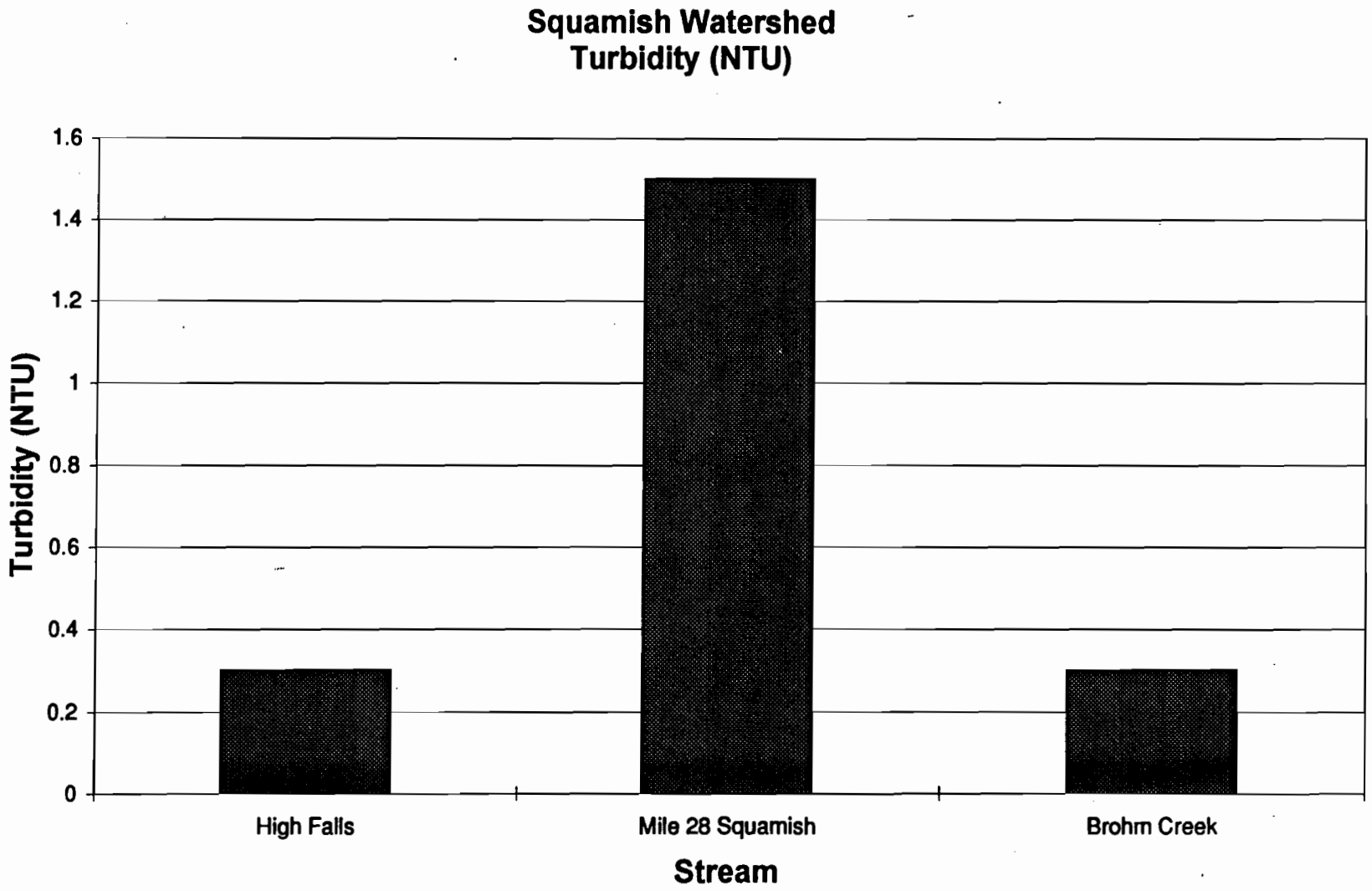


Figure 6. Turbidity values measured in the Squamish River watershed.

Turbidities above 25-70 NTU have been shown to impair the ability of salmonids to capture food or prey items. Growth reduction and gill tissue impairment has been observed at turbidities of 25 NTU after as little as 5-10 days exposure. Above 50 NTU's some species of salmonids are displaced (MacDonald et al., 1991). Although little is known concerning the relationship between turbidity and temperature in streams, in lakes and reservoirs and deep sections of rivers high turbidities could enhance stratification. Stratification could adversely affect mixing and thus create deeper zones in which oxygen concentrations could be significantly reduced. Their is an empirical relationship between suspended sediment loads and turbidity which is related to soil characteristics. Some research has shown that suspended sediment concentrations appear to be more sensitive to disturbance than turbidity. There did not appear to be any evidence given the few samples measured during this study that harvesting had any effect on increasing turbidity. It is recommended that turbidity be measured during the second phase of the study in both reference and treatment streams. Consideration should be given to selecting the treatment stream most likely to have the highest turbidities for continuous monitoring to both temperature and turbidity. Caution should be taken in interpreting turbidity and the establishment of guidelines since there exist significant sources of error in its measurement and variability among sites and across time.

Colour

The waters observed during this study did not appear to be significantly coloured based upon visual examination. No samples were measured for colour, however, streams selected for restoration should have their colour measured during both low flow periods and during peak flows during summer freshet.

Light

No light monitoring was conducted during this part of the study; it is recommended that continuous monitoring devices be used to measure light in selected reaches of the reference streams and post-harvested streams selected for restoration.

pH

Squamish watershed tributaries exhibited pH values very close to being neutral, ranging from 6.2 to 7.5 (Figure 7), which are well within recommended standards. pH values obtained during the 1994 sampling program yielded values consistently above 7. This likely reflects the authors observation that laboratory values are higher than those measured in the field.

The pH of streams selected for restoration should be monitored for pH, especially during periods of greatest periphyton production. pH assessment at these periods should be measured during both the late afternoon and in the middle of the night to determine what effects algal photosynthesis and respiration are having on stream pH. Instrument calibration tests should be conducted to verify that the extremely low ionic concentrations of the streams (see section on specific conductance below) are not affecting the pH values. Both pH standards and pH probes should be tested for false high readings and in-field tests measuring the pH of de-ionized, air saturated water, together with that of stream water similarly treated, should be conducted to cross-calibrate standard solutions. The difficulty in obtaining accurate and reliable pH readings should not be underestimated.

Specific Conductance

Specific conductance values measured in the Squamish watershed tributaries ranged from a low of 18 to a high of 60 μmhos/cm. the majority of readings were between 30 and 50 μmhos/cm (Figure 8). As with other reported studies in coastal streams these values indicate that the streams contain very few dissolved solids or other ions. The potable range for the U.S. and Canada is 30 to 1500 μmhos/cm. In the Carnation Creek study on Vancouver Island, streams whose upland forests had been intensively logged and then burned exhibited values which ranged from 50-120 μmhos/cm during moderate and low flows; values of 20-40 μmhos/cm were recorded during high flow events. This study and others have demonstrated that forest activities related to harvesting typically have little effect on specific conductance.

Conductivity should be monitored in streams selected for restoration to determine whether there are significant intrusions of groundwater into stream channels. Conductivity should also be monitored in streams which have had mining activities within their catchments. A map of conductivity should be compared with pH and bedrock geology to determine correlations. This data may be useful to determine the potential for periphyton production given nutrient sources related to parent bedrock materials; basaltic intrusions are known to release more nutrients than granitic ones. Nutrient (N and P) concentrations are present at such low levels that they exert minimal influence on conductivity values. Thus conductivity can not be considered an inexpensive surrogate measure of the more costly nutrient profiles.

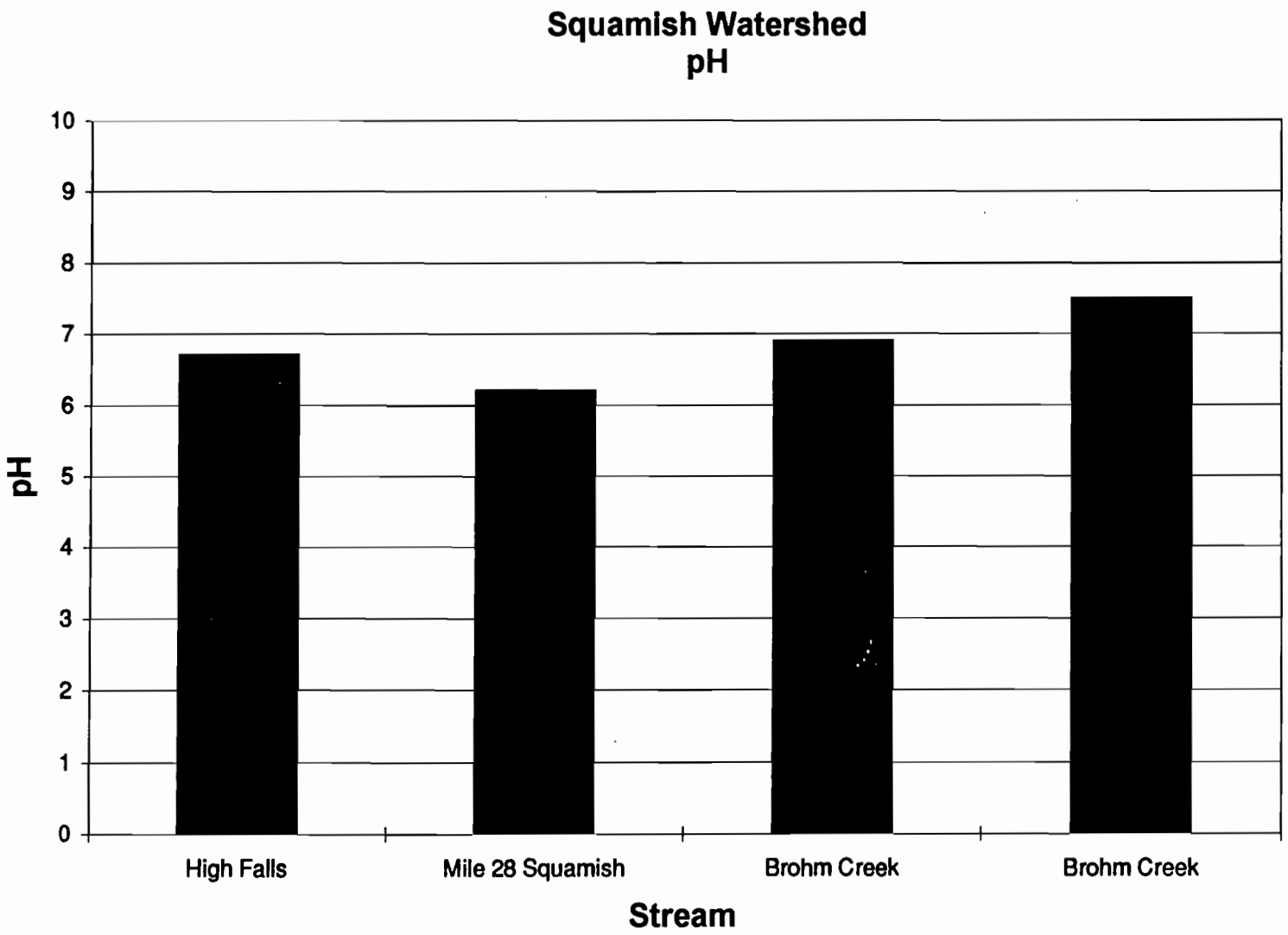


Figure 7. Plot of pH (relative units) for the Squamish watershed streams.

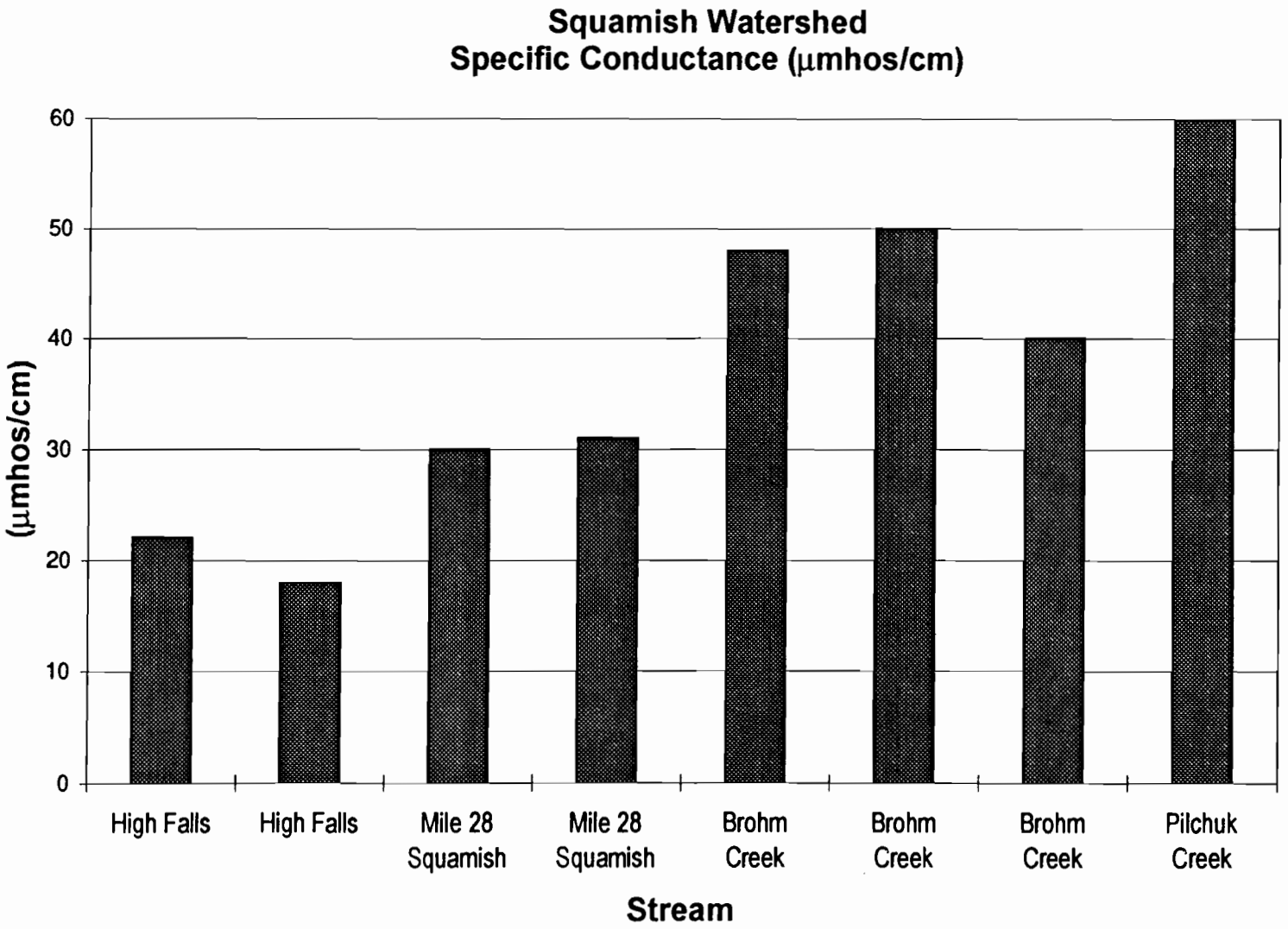


Figure 8. Plot of specific conductance (μmhos/cm) for the Squamish watershed streams.

Dissolved Oxygen

Dissolved oxygen concentrations in the Squamish River tributaries ranged between 7.5 and 12.2 mg/L (Figure 9). The lowest value (7.5 mg/L) was recorded in the Mile 28 stream which had a low slope gradient and exhibited a slow flow at the time of the recording. This creek also exhibited a benthos which was covered in fine sediment and likely had very low intergravel DO values. The other creeks all had much higher slope gradients, which resulted in the high absolute DO values; they also exhibited high saturation values.

Future monitoring should attempt to correlate surface/ water column DO concentrations with those of the intergravel alluvial materials. Establishing this ratio for each watershed will enable criteria to be established which will provide adequate protection of benthic invertebrates and deposited eggs. In general, provision of adequate DO does not appear to a problem in the Lillooet watersheds given their higher slope gradients.

Water Nutrients

Ammonia

All values for ammonia were less than detectable limits (<0.005 mg/L). While these values would appear to indicate that the stream waters did not contain significant concentrations of ammonia, the inaccuracy in determining this parameter from field samples indicates that caution should be urged in its interpretation. Therefore it is recommended that future measurements of this parameter be made in the field and that field samples of both de-ionized and stream water be spiked with ammonia to determine the range of detection and recoverability.

Nitrite + Nitrate

In the Squamish River watersheds the combined nitrite-nitrate ranged from a low of 0.01 mg/L to a high of 0.037 mg/L (Figure 10). These values are typical of the very low nitrogen loads carried by most coastal streams, even those which have been subject to varying degrees of logging. Nitrite values were very low in all three streams; the values in Mile 28 creek were somewhat elevated, likely due to the enhanced sediment load observed on the creek bottom (Figure 11). The decomposition processes associated with this material would have resulted in elevated nitrite levels. Nitrite is thus contributing minimally to the nitrogen loading, indicating that there is little organic loading occurring within the upland areas of these watersheds.

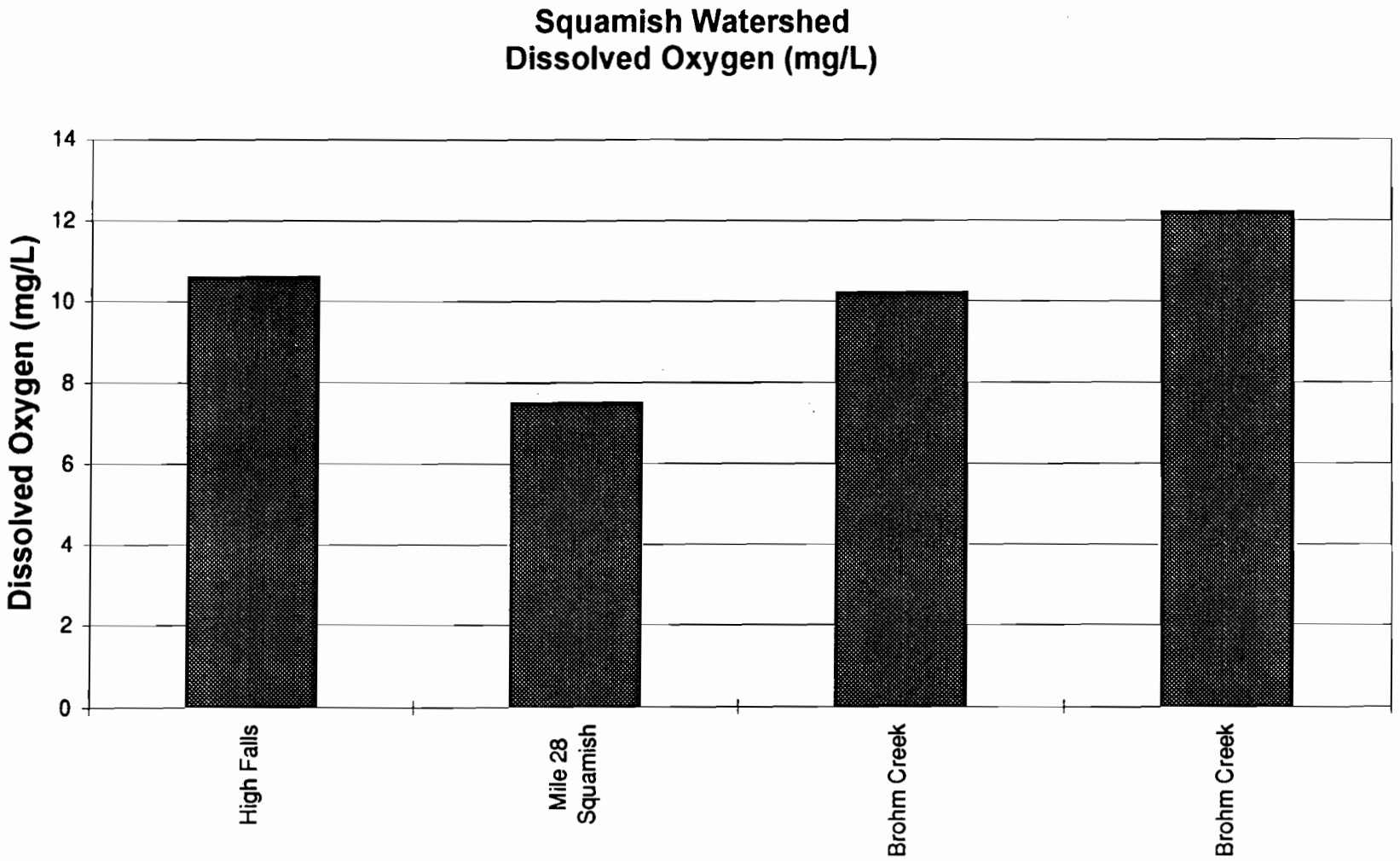


Figure 9. Dissolved oxygen (mg/L) concentrations measured in the Lillooet watershed streams.

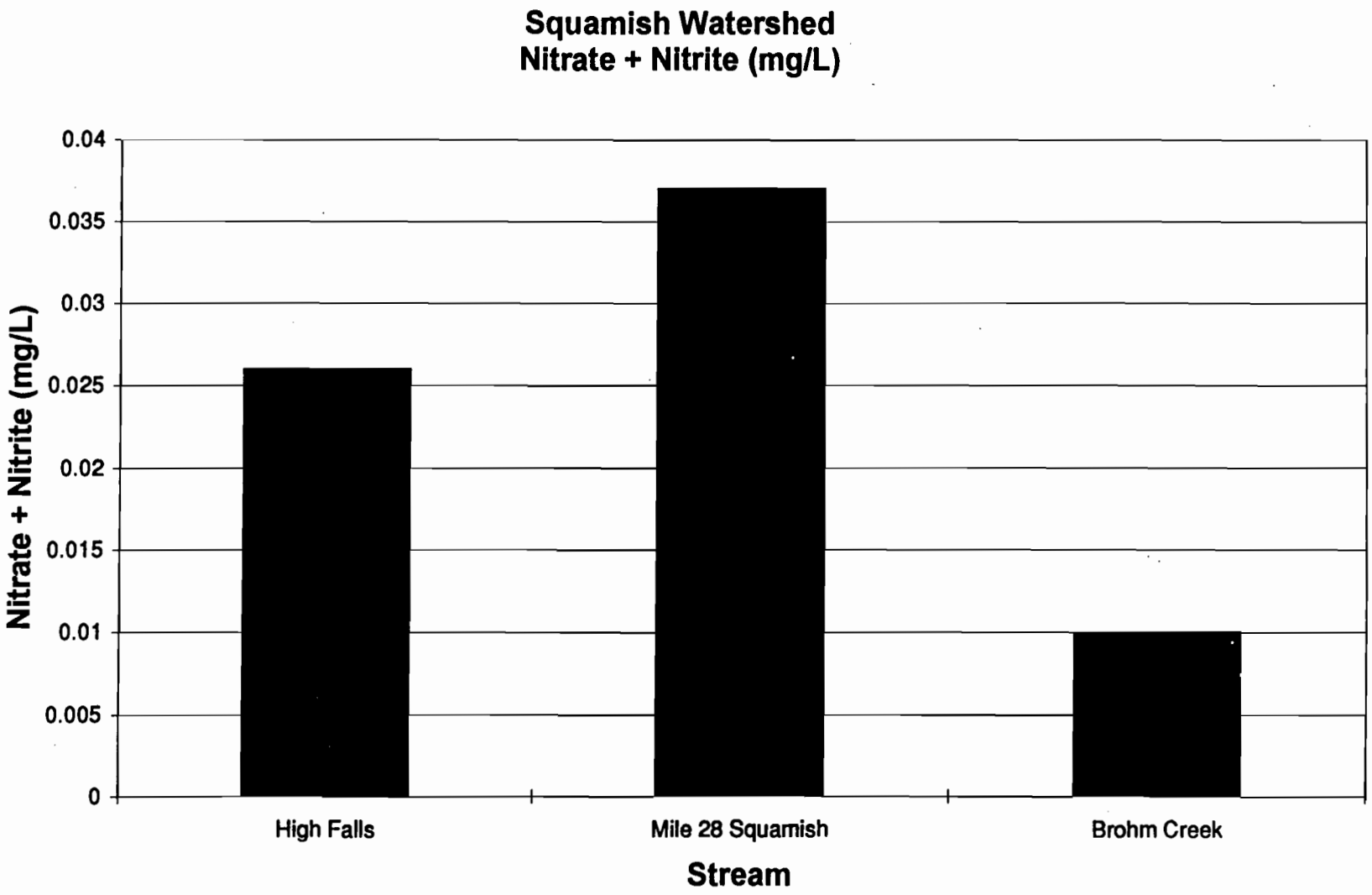


Figure 10. Nitrate + Nitrite (mg/L) concentrations for the Lillooet watershed streams.

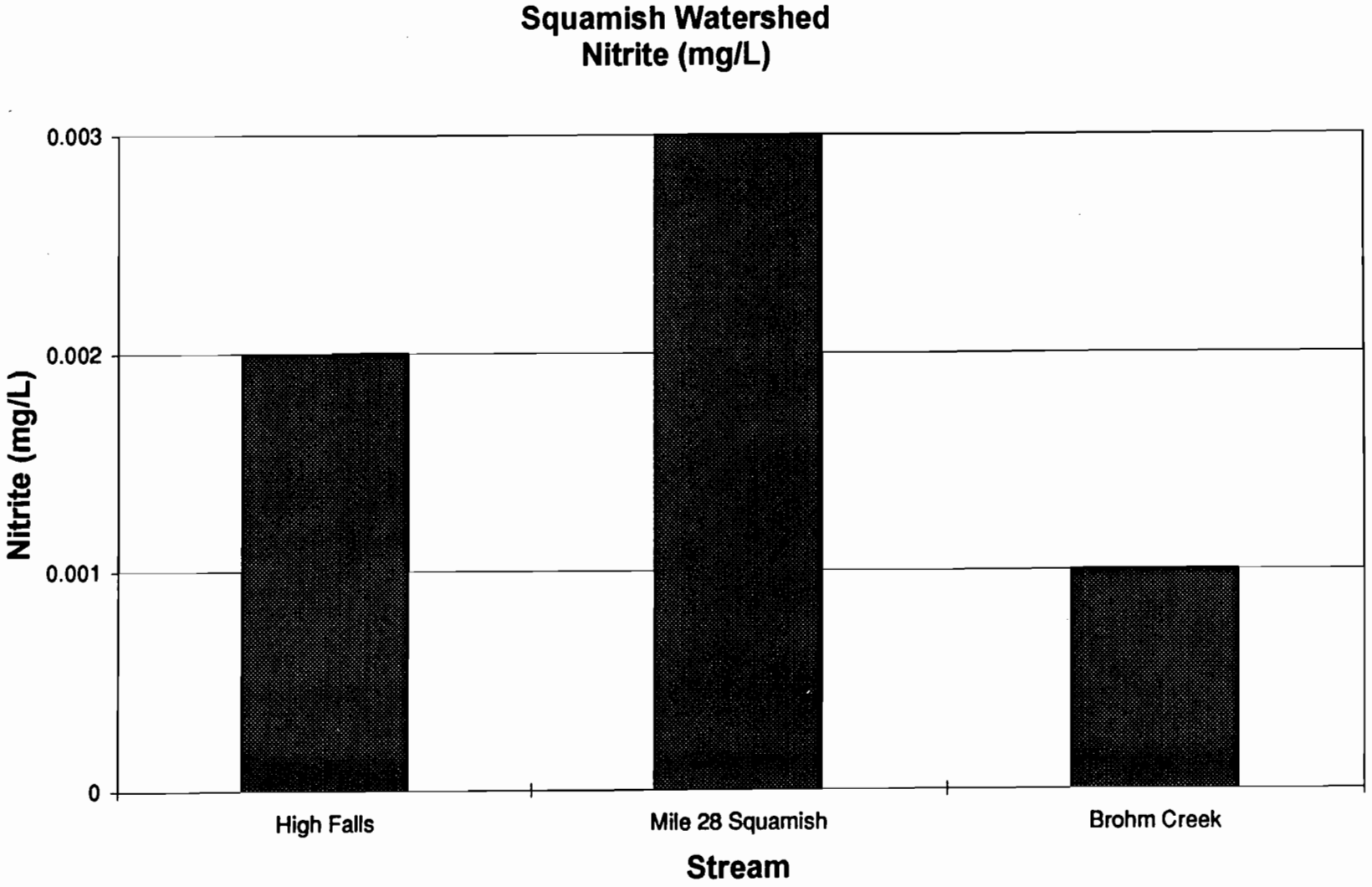


Figure 11. Nitrite (mg/L) concentrations for the Squamish watershed streams.

Ortho Phosphorus

Phosphorus loading in the Squamish streams showed a sixfold variation ranging from a low of 0.002 to 0.013 mg/L (Figure 12). The value of 0.002 mg/L for High Falls creek was indicative of the parent bedrock (granite) and the forested upland areas of this small watershed. The phosphorus value is, in fact, at the limit of detection and caution should be used in assigning any accuracy to this value. Mile 28 creek exhibited a value 3 times higher than that for High Falls, again as with the nitrogen loading, evidence of the enhanced organic loading visible within the creek. Brohm creek water originates in a small, meso-trophic lake, which has a high degree of shoreline development, typical of nutrient rich, shallow lakes. Thus, the elevated phosphorus was predictable given the short distance between the lake and the downstream sample location. Although this value is at the upper end of the range for coastal watershed streams, it is still significantly lower than values observed in deforested watersheds. Examination of the creek revealed a well developed periphyton community and numerous small fry, suggesting that the slightly enhanced nutrients were beneficial from a primary production consideration. Detailed study of the creeks periphyton community should be conducted during the restoration program to confirm whether this is increasing fish production. A comparison of the specific conductance values and those of phosphorus indicates that the trends are the same for all three Squamish streams. The same was not true for nitrogen.

Periphyton Development

The growth of periphyton in Pacific northwest streams and rivers is highly variable, reflecting the wide range of physical, chemical and biological parameters which can affect growth rates and the accrual of biomass. A number of studies have reported differences in periphyton production in streams flowing through both forested and harvested landscapes.

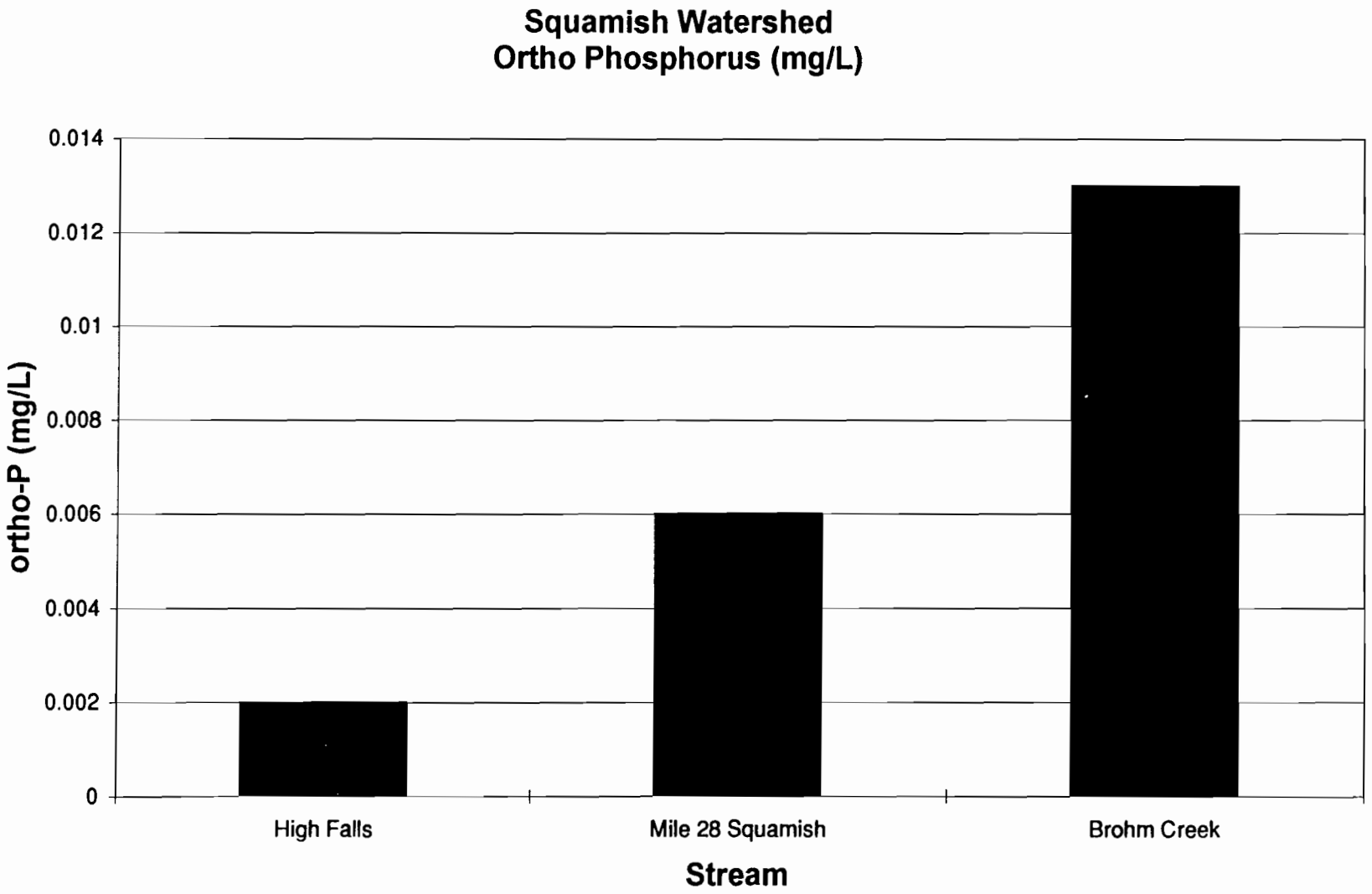


Figure 12. Ortho-phosphorus (mg/L) concentrations for the Squamish watershed streams.

Squamish River Watershed

Pillchuck Creek



5.3 Pillchuck Creek

Data Summary Sheet

✓	Yes	x	No	?	Unknown

HISTORY

✓	Was watershed logged prior to 1988?
x	Is watershed within a municipal boundary?
?	Have FRBC funds been spent on watershed?
?	Are FRBC applications pending for work on watershed?

FISHERIES INFORMATION

?	Have forest activities impacted fisheries resources?
✓	Does the watercourse have existing fisheries values?
✓	Does the watercourse have historical fisheries values?
✓	Is the watercourse accessible to salmon?
✓	Is the watercourse habitat suitable for salmon?
?	Are there enhancement opportunities for salmon?
✓	Is the watercourse habitat suitable for trout and char?
?	Are there enhancement opportunities for trout and char?

WATER QUALITY

?	Does the watercourse have an adequate water quality?
	If not, can it be rehabilitated?
?	Does the watercourse have an adequate food supply?
	If not, can it be restored?
x	Was periphyton community surveyed?
x	Was invertebrate community surveyed?
x	Was water chemistry surveyed?

x	Was sediment or intergravel habitat surveyed?
x	Have there been scientific surveys in the stream?
x	Have nutrient dosing pots been placed in the stream?

HYDROLOGICAL FACTORS

✓	Are there forest-related activity impacts?
✓	Are there existing Water Rights (domestic, power, community watershed)?
✓	Is there year-round flow potential?
✓	Are there any existing hydraulic structures (dams, wiers, bridges, etc.)?
✓	Is there a debris-flow potential?

RIPARIAN ZONE

x	Have forestry activities had negative impact on riparian vegetation?
✓	Is there existing well-established riparian vegetation?
✓	Are soil conditions amenable to re-vegetation?
✓	Is the channel morphology appropriate for re-vegetation?
✓	Are unrestricted reaches present?
✓	Would re-vegetation be expected to benefit fish/wildlife habitat?

TERRESTRIAL PROCESS

✓	Have slopes >60% been logged?
✓	Are roads built on slopes >60%?
✓	Is bedrock-geology of basin stable?
?	Has basin experienced landslides?
?	Have landslides entered mainstream?

H	High	M	Medium	L	Low	U	Unknown

CREEK RATING

L	Impacts by logging
M	Fish resources
L	Rehabilitation potential

5.3.1 Factors of Concern

Fisheries

No practical enhancement opportunities apparent.

Hydrological

Pillchuck Creek is a steep mountain creek with a watershed area of approximately 15 km^2, is tributary to the Squamish River at 26 km upstream of the mouth of the Squamish River on Howe Sound. The watershed has a east aspect rising from an elevation about 310 m at it's mouth to 1,870 m at it's headwaters (Cloudburst Mountain) over it's 10 km channel length. For the first 1.5 km the creek is relatively flat. The Pillchuck Creek watershed was been logged in the lower part of the watershed. There has been some regrowth however present clearcuts may increase sediment loading and peak flows in the creek.

Fifteen crossings including two bridge has been identified and should be inspected by a Professional Engineer (Hydrological) to find out if the bridge or culvert can pass the 100 year peak flows and to make recommendations for any improvements including removal.

There are about three lakes including Lewis Lake within the watershed which may provide an opportunity to construct low dams to facilitate the augmentation of summer flows. The fact that Pillchuck Creek does have existing water rights (C109836, C041340) for domestic and power purpose may complicate future instream work.

The overall steep slope (average 16%) could sustain debris-laden floods under the right conditions. Prior to proceeding with instream works, a limited gulley and channel assessment should be carried out in the field.

Water Quality

This creek has had some water quality parameters monitored. The specific conductance would indicate it has a moderate nutrient loading which could be used by the periphyton community. It is, however, frequently turbid and appears to have a significant sediment load which minimizes the periphyton

community's development and likely has poor intergravel habitat. No data exists on the periphyton on invertebrate species of this creek.

Riparian Zone

Pillchuck Creek flows through a steep canyon until it emerges onto the Squamish River floodplain for the final 1.6 km to its mouth on the Squamish River. The riparian area is quite diverse, with beaver dams and natural logfalls creating side-channels, pools, and backwater areas. The mixed forest vegetation consists of bigleaf maple, cottonwood, red alder, willow, sitka spruce, and western red cedar, with a dense and varied understorey.

No recent forestry impacts were noted from examination of air photos. Field investigations will be necessary to determine whether riparian enhancement is desirable.

Logging History

A record of logging activities summarized from the Ministry of Forests Integrated Silviculture Information System Ecology Report is presented as follows:

Year	Total Area Logged (ha)	Year	Total Area Logged (ha)
1975	3	1966	62
1974	48	1965	71
1973	11	1963	6
1972	117	1962	84
1971	30	1960	5
1967	25		

Watershed Assessment Report Sheet

	(1)	(2)
Watershed Name?	Pillchuck Creek	
Map units are in: (1=km. and sq.km.; 2=m. and ha.)	1	
Total watershed area (TA)	14.62	sq.km.
Peak Flow		
Area below 300 m.	2.26	sq.km.
Area between 300 and 800 m.	8.45	sq.km.
Area above 800 m.	3.91	sq.km.
Road length between 300 and 800 m. (not used)	6	km.
Surface Erosion		
Total road length	20.4	km.
Length of road on erodable soils?	5.8	km.
Roads within 100 m. of a stream?	7	km.
Number of active stream crossings?	17	
Riparian Buffer		
Total stream length?	16	km.
Length of stream logged?	7.1	km.
Length of mainstem?	8.2	km.
Landslides		
Length of road on unstable terrain?	5.8	km.
Headwaters		
Length of headwater streams logged?	3.4	km.
Number of crossings on headwater streams?	5	

FOR REACH BREAKS SEE MAPS 92G084 (in back pocket).

5.3.2 FHAP Overview

Pillchuck Creek is a tributary to the Squamish River. The first 2.0 km of Pillchuck Creek run through farm land and a residential area and, consequently, had been impacted by urbanization (e.g., water removal, fertilizer). The creek is an important spawning system as well as a domestic and commercial water source. As of March 1996, there were two existing water licences on Pillchuck Creek (BCMELP, 1996, file data). One licence was for the removal of water to obtain commercial power. The other allowed removal of water for domestic and industrial (stock watering) purposes. Both licences allowed removal during the whole year.

Pillchuck Creek is also an important spawning system for trout and salmon (BCMELP, 1992, file data). Fish species which have been observed in the creek historically include: coho and chum salmon, steelhead, cutthroat, brook, and rainbow trout, and Dolly Varden (BCMELP, 1992, file data; SISS, 1988). Coho migrate upstream into Pillchuck Creek in October and spawn in the lower reaches downstream of the falls to the bridge and in all accessible tributaries including Cloudburst Creek from October to January (SISS, 1988). Chum spawn in the creek from October to December (SISS, 1988).

A FHAP assessment was conducted from July 9 to August 13, 1996, in Pillchuck Creek from its confluence with the Squamish River to Pillchuck Lake located approximately 5.6 km upstream. This area was divided into ten reaches (Map 92G084, 92G094). The dominant habitat type in Reaches 1 and 2 was identified as glide, which changed to cascade in Reaches 3, 4, 5 and 6. The gradient in Reaches 5 and 6 changed from 11 to >45%. Dominant habitat type upstream of the barrier, which included Reaches 7-10, altered between glide and riffle. The dominant substrate in all reaches was a mix between sand, gravel and cobble. Boulders were observed in Reaches 4-6 and 8-10. Very low water flows were observed in Reaches 1 and 2. Overhanging vegetation (OV) and small woody debris (SWD) supplied most of the cover in Reaches 1-3 and 8-10. OV and boulders (B) provided most of the cover in Reaches 4-7. Numerous side channels were noted throughout the length of Pillchuck Creek. Most of them are accessible to fish only at high water flows; few were accessible at most flows. An impassable barrier (i.e., waterfall >2 m, chute) was observed in Reaches 5-6. Other potential barriers to fish include: beaver dams, bridges, jog jams and chutes. Disturbance indicators included: aggradation of boulders in Reach 4 downstream of the waterfall, braiding of the channel, and log jams. The primary factors limiting fish habitat in Pillchuck Creek are a lack of water flow and a lack of habitat complexity in the lower section, and instability of the upper watershed.

5.3.3 FHAP Assessment

Habitat Types

Habitat types identified in Pillchuck Creek from July 9 to August 13, 1996, is summarized in Appendix E. Predominant habitat in Reaches 1-2, and 7-10 consisted of riffle and glide. Average gradient in the riffle and glide habitat ranged from 1.1 to 4.0%. Cascade was the dominant habitat in Reaches 3-7. Gradient in Reaches 4-6 ranged from 11 to >45%. No pool habitat was identified by the field crew during the assessment.

Off-channel Habitat

Side channels were observed in Reaches 1, 2, 3, 6, 7 and 8. The side channel identified in Reach 1 was not accessible to fish under any water flows. Of the four side channels observed in Reaches 2 and 3, two were accessible to fish during high flows only, whereas the other two were accessible at most flows. All five plus the three side channels noted in Reaches 6 and 7, respectively, were accessible at high flows only. The side channel identified in Reach 8 was also only accessible to fish during high flows. Other off-channel habitat noted was a groundwater source in Reach 6 and a tributary in Reach 8. This tributary likely flowed into Pillchuck Lake.

Large Woody Debris (LWD)

Appendix E provides LWD loading data for reaches with LWD. LWD per bankfull width ranged from 0.8 to >14.2, indicating either poor or good quality rearing habitat, based on the diagnostic table (Table 5) provided in Johnston and Slaney (1996). The majority of functional LWD observed in Pillchuck Creek was classified as providing good quality rearing habitat.

Based on data collected during the FHAP assessment, there was sufficient LWD in most reaches in Pillchuck Creek. Reaches 1, 2 and 4 contained relatively less LWD than Reaches 3, 5, and 7-10. LWD observed in the lower reaches was comprised of individual pieces, whereas LWD noted in the upper reaches usually formed part of a log jam. LWD in the form of a log jam could obstruct fish passage or provide functional fish habitat, or both depending on the level and flow rate of water in the creek. In July/August most of the log jams in Pillchuck Creek provided shelter and created pool habitat as water was flowing freely through the jams and fish were observed in resulting pools. However, the quality as represented in Appendix E does not necessarily reflect the quality of habitat that may exist at other times of the year when water flows are different.

Substrate Type

Substrate type observed in each reach surveyed in Pillchuck Creek and associated spawning habitat potential is provided in Appendix E. The dominant substrate type in most reaches surveyed was sand, gravel and cobble, which could provide either little or abundant habitat for spawning. Boulders were observed in Reaches 4-6 and 8-10. Substrate in the lower reaches was covered with silt and algae, indicating sediment deposition due to instability of upper reaches. The best substrate for spawning habitat was observed in Reaches 2, 3 and 8-10.

Fish Distribution

Fish presence/absence was determined by electroshocking in Reaches 1, 7 and 9-10 in Pillchuck Creek on July 29 and August 9, 1996. Fish distribution data is summarized in Table 5.3-1.

No fish were captured in Reach 1 presumably due to the high water levels at the time the survey was conducted. However, it is expected that fish found in the Squamish River would also be found in the lower reaches of Pillchuck Creek. These would include: sockeye, coho, chum, chinook, steelhead, cutthroat, Dolly Varden, and rainbow trout (SISS, 1988).

Fish present in Reach 7, upstream of the anadromous fish barrier, were 11 rainbow trout. Fork lengths and weights of these fish ranged from 80 to 190 mm and 5.6 to 66.3 g, respectively. Fish captured in Reaches 9-10 were cutthroat trout which ranged in fork length from 40 to 162 mm. Although

electroshocking was not conducted in all reaches, juvenile fish were observed in most sections of the creek that were surveyed.

Table 5.3-1. Summary of fish capture data in Pillchuck Creek (1996).

Reach No.	Date of Electroshocking	Electroshocking Effort (seconds @ voltage)	Species Captured	Stream Class
1	July 29, 1996	382 @ 400	None	S2
7	July 29, 1996	464 @ 400	Rainbow trout	S2
9-10	August 9, 1996	216 @ 200	Cutthroat trout	S2

Adult Upstream Migration

The FHAP assessment was conducted in July and August at which time adult anadromous fish were not observed in the system. Historical data reports migration of all salmon to a barrier located 3.0 km upstream of the Pillchuck Creek-Squamish River confluence (SISS, 1988). However, our study found the anadromous fish barrier (waterfall, gradient >45%) in Reach 6 was located approximately 2.2 km upstream of the Pillchuck Creek-Squamish River confluence. Several log jams observed in the lower reaches (i.e., downstream of the barrier) may prevent the upstream migration of anadromous and resident fish under certain water flows. Log jams identified in the upper reaches may prevent the migration of adult resident fish between reaches upstream of the anadromous fish barrier at certain water flows.

Spawning and Incubation Conditions

Potential spawning habitat was observed in most reaches surveyed in Pillchuck Creek except in Reaches 4-6 due to a steep gradient (8 to >45%) and a boulder-dominated substrate. In Reaches 1-3, substrate was dominated by sand with little gravel and cobble, and water flows were low. Consequently, spawning habitat in the lower reaches was limited by a lack of gravel and a possible inability to maintain adequate oxygen levels for incubation. Habitat in reaches upstream of the barrier (Reaches 7-10) were better suited for spawning and incubation due to increased substrate quality and increased water flows.

Summer Rearing Habitat

Summer rearing habitat refers to areas in a creek or river that provide shelter and refuge for fry, juvenile and adult fish. Summer rearing habitat can be found in the form of deep pools, side channels, small woody debris (SWD), large woody debris (LWD), overhanging vegetation within 1 m of the water surface (OV), in-stream vegetation (IV), boulders, and undercut banks (C). Appendix E tables summarize potential cover types observed in Pillchuck Creek during the FHAP assessment. Cover in Reaches 1-3 and 8-10 was dominated by SWD and OV. OV cover was predominant in Reaches 4-7. Undercut banks were observed in Reaches 1, 4, 5, 6 and 9. In general, the quality of cover ranged from poor to good, and was probably not limiting to fish. Boulder cover ranged from 0 to 80%. Rearing habitat provided by boulders was poor in Reaches 1-5, fair in Reach 8, and good in Reach 9.

Despite numerous side channels throughout Pillchuck Creek, their accessibility to fish only at high flows provided little summer rearing habitat.

Winter Rearing Habitat

Winter rearing habitat can most often be found in side channels and deep pools that are not likely to freeze during the winter. Numerous side channels were identified along Pillchuck Creek which could provide suitable winter rearing habitat for fish depending on water levels. Some sections of the creek may be deep enough to provide overwintering habitat. For example, water depths in Reaches 1 and 2 ranged from 1.1 to >2 m and may not freeze during winter, thereby providing fish rearing habitat. However, water in this section of the creek may be more subject to freezing due to the low flow rates and, consequently, any developing ice layers may be thicker than expected in streams with a higher flow rate. Water depths in the upper reaches were lower (0.1 to 0.8 m), but were probably not limiting due to an increased flow rate. Since this assessment was conducted in the summer it is difficult to assess the amount of winter rearing habitat available in Pillchuck Creek. Further investigation should be conducted during the winter months to determine water levels, flow rates and accessibility of off-channel habitat.

Juvenile Migration

Juvenile fish may migrate upstream from the Pillchuck Creek-Squamish River confluence to the barrier in Reach 6. Upstream from the barrier juvenile fish were free to migrate through Reaches 7-10 and into Pillchuck Lake provided log jams did not create a barrier. Juvenile fish may migrate downstream from Pillchuck Lake to the Squamish River provided they survive the falls.

5.3.4 FHAP Prescriptions

Based on the above FHAP assessment, the most limiting factors to fish in Pillchuck Creek were a lack of water flow and habitat complexity in the lower sections, and instability of the upper watershed. A number of rehabilitation/restoration options existed which would address these limitations. Most importantly, the upper watershed needs to be stabilized. This will reduce the aggradation of debris at the bottom of the waterfall and the formation of log jams, both of which have and could further impact fish habitat. Once the watershed has been stabilized, the hydraulic flow of the creek should be increased in the lower section. This can be accomplished by reviewing water licences so that less water is removed from the system, by decreasing channel width, by dredging some of the channel, and/or by extracting groundwater from the source identified in Reach 6. Increasing hydraulic flow of the creek would serve to increase spawning and incubation potential. Once the flow has been increased, spawning habitat can be further enhanced by depositing more gravel into the creek at selected sites and rearing habitat can be enhanced by increasing habitat complexity (e.g., creating more pool habitat and developing side channels).

Future Studies

Once the upper watershed of Pillchuck Creek has been stabilized, potential fish habitat restoration opportunities in the lower, anadromous fish accessible reaches should be reassessed.

5.3.5 FHAP QA/QC

Sections of Reach 3 were assessed in early September by the FHAP supervisors as part of the QA/QC program. Comparative data collected by the field crews and the supervisors is provided in Appendix E. Parameters such as mean bankfull depth, maximum water depth, dominant bed material, spawning gravel,

percent overhead cover, off-channel habitat, and canopy cover were similar between the two assessments. However, variability was observed in identification/measurement of habitat type, percent gradient, mean bankfull width, mean wetted width, pool frequency, and functional LWD. Of these latter parameters, the greatest discrepancies were observed for habitat type/pool frequency, gradient, mean wetted width, and functional LWD.

Habitat type identified during the July/August assessment by the field crew was cascade. Habitat type identified in the September assessment conducted by the supervisors in the same area consisted of pools and cascades. Mean wetted width in July/August was 1.6 to 2.1 times wider than that in measured during the September assessment. These differences are most likely explained by a difference in water levels in the creek between the two assessments. Water levels in July/August were higher than flows in September. As a result, wetted widths would be narrower and the frequency of pool habitat would increase in September.

There is potential for disagreement in the field as to the classification of "functional" LWD, as discussed in detail in Section 3.8.1. This was further emphasized by the fact that the "functional" LWD tally in Reach 3 recorded by the field crew was 82, whereas the tally by the supervisors for the same reach was 31. The identification of LWD needs further scrutinization before it can be used as a measure of providing adequate fish rearing habitat.

The results of the QA/QC program emphasize the need for conducting FHAP assessments in more than one season so that the natural variability in potential fish habitat can be documented and restoration options designed accordingly. The definition of "functional" LWD needs to be revised and standardized so that potential fish habitat is not underestimated.

5.3.6 CAP Overview

Pillchuck Creek has excessive functioning large woody debris within the channel. Access in many reaches is difficult. There is an excessive amount of debris in the creek.

5.3.7 CAP Assessment

Reaches 1 and 2

Riffle-pool
General Bed Material: Silt
Sensitivity Rating: L

Reach 1 extends from the confluence of the Pillchuck with the Squamish River to a bridge crossing located upstream where Cloudburst Creek enters the Pillchuck. There is little or no flow in these reaches, as the slope is very gentle and averages less than 1%. The reach is stable, however it appears that the reach was dredged many years ago to facilitate drainage to adjacent lands. The reach is susceptible to backwater from the Squamish River. A major bridge crosses the Pillchuck at the bottom of reach 1.

Reach 2 extends from the confluence with Cloudburst Creek up towards a small tributary on the left bank. It exhibits the same general characteristics as Reach 1.

No prescriptions are required for Reaches 1 and 2.

Reach 3

Riffle-pool
General Bed Material: Gravel/Cobble
Sensitivity Rating: L

This reach appears to be stable. In the upper portions of the reach, the general bed material is composed primarily of gravel and cobble, whereas in the lower portion of this reach it is composed of fines. An increased slope is found on this reach, resulting in an increased flow. There is a small private log bridge crossing the Pillchuck at the top of this reach.

No prescriptions are required for Reach 3.

Reach 4

Cascade-pool
General Bed Material: Boulder
Sensitivity Rating: L

This reach extends from the small wood bridge at the top of reach 3 through a steep cascade-pool area. The reach appears to be stable.

No prescriptions are required in Reach 4.

Reaches 5-7

Cascade-pool
General Bed Material: Boulder
Sensitivity Rating: H

Reaches 5-7 comprise a steep section of creek. Several discarded old vehicles were found within the creek, which probably fell from the old logging road located above the left bank. These vehicles should be removed as they are a source of contaminants to the creek.

Reaches 8-10

Riffle-pool
General Bed Material: Cobble/Gravel
Sensitivity Rating: M

Reaches 8-10 exhibit an overall milder slope than Reaches 5-7. A general channel morphology of riffle-pool is observed. The creek is generally stable in this section, although there is a moderate potential for debris to enter the creek from the banks. The potential hazard due to upstream disturbance is not clear.

Table 5.3-2 provides field data summary for the creek.

Table 5.3-2 Pillchuck Creek field data summary.

Reach	Bankfull		Slope	Average Rock	Relative	Power	Sensitivity	Channel	Channel
	Width (m)	Depth (m)	(%)	D (m)	Roughness	Index	Rating	Condition	Type
1	15	2	0.5	Fines	-	-	L	Stable	Riffle-pool
2	14.58	1.46	0.83	0.02	0.02	17.76	L	Stable	Riffle-pool
3	-	-	-	-	-	-	-	-	-
4	10.18	2.18	21	1.34	0.61	466.04	L	-	Cascade-pool
5	-	-	-	-	-	-	H	-	Cascade-pool
6	-	-	-	-	-	-	H	-	Cascade-pool
7	-	-	-	-	-	-	H	-	Cascade-pool
8	7.24	1.10	2.8	0.33	0.30	22.30	M	Stable	Riffle-pool
9	5.37	0.70	1	0.27	0.38	3.76	L	Stable	Riffle-pool
10	7.52	0.76	8.6	0.36	0.47	49.15	M	Stable	Riffle-pool

5.3.8 CAP Prescriptions

Creek Prescription (Year 1)

In the fisheries window LWD and vehicles should be removed from the creek.

Creek Prescriptions (Years 2 - 5)

None.

Creek Prescriptions (Years 5 - 20)

None.

5.3.9 CAP Quality Assurance/Quality Control

All data collected in the field and entered into electronic forms was checked for transcription accuracy. QA/QC was conducted on approximately 20% of Pillchuck Creek by field confirmation of values by specialists at specified. All measurements were duplicated at specific cross-sections and compared with field crew results.

5.3.10 WAP Overview

Fishery production in this creek does not appear to be limited by temperature or dissolved oxygen concentrations. The stream has very low specific conductance, which suggests that it is nutrient limited. This stream should be considered a candidate for nutrient enrichment therapy.

Table 5.3-3 Pillchuck Creek summary table.

Reach	Morphology	Assessment	Prescription	Timing	Year	Rating
1	Channeled Clay/Silt Bed Material	This reach is stable, however it appears that the reach was dredged many years ago to facilitate drainage to adjacent lands. This reach is susceptible to backwater from the Squamish River.	No prescription required	N/A	N/A	L
2	Channeled Clay/Silt Bed Material	The confluence with Cloudburst Creek is at the bottom of this reach.	No prescription required	N/A	N/A	L
3	Riffle Pool Gravel/Cobble Bed Material	These reach appears to be stable. There is a small private log bridge crossing the Pillchuck within this reach (Bridge No. 3).	No prescription required	N/A	N/A	L
4	Cascade Pool Boulder Bed Material	This reach is very steep and appears to be stable.	No prescription required	N/A	N/A	L
5 6 7	Cascade Pool Boulder Bed Material	These reaches are very steep. Some old vehicles have been discarded into the creek	Remove vehicles from creek.	Jul 15-Aug 15	1	H

5.3.11 WAP Assessment

Temperature

Stream temperature values were generally between 10 and 11 °C; the outflow water from the lake was measured at 26 °C. Measurements made using the two thermistors were typically within 1 °C; however, in a number of cases the values between the two instruments were significantly different, in one instance being 5 °C apart (reach 1 bottom). Temperatures reflected a trend of increasing downstream. The temperatures were all within a range for which salmonid growth would not be adversely affected. The elevated lake temperatures did not exert any detectable influence on stream values.

Dissolved Oxygen and Specific Conductance

Dissolved oxygen values, in the stream, ranged between 8 and 12 mg/L, well within permissible concentrations. Only the lake DO was low (6 mg/L), again a reflection of its elevated temperature. DO values did not appear to be limiting the respiration of aquatic biota.

As with most of the other creeks in this watershed, the specific conductance values were typically at or below 20 µmhos/cm. At three sites (1 bottom, 3 and lake) the values were 30 µmhos/cm. In all cases the dissolved ionic concentrations were very low, indicating that the system is likely nutrient limited.

Periphyton & Nutrient Dosing Pots

Periphyton samples were not analysed for Pilchuk Creek. Nutrient dosing pots were not deployed in Pilchuk Creek.

Invertebrates

Pilchuck Reach 1 96-Jul-09

Invertebrates from five different groups were found here: Diptera (46%), Oligochaeta (41%), Ephemeroptera (8%), Hirudinea (3%), and Bivalvia (3%). The dominant taxa at this site were juvenile, oligochaete worms, of the Family Tubificidae, representing 41% of the sample (15 specimens). The most abundant group of organisms here were the Diptera: 16 of the 17 specimens were chironomids (5 UID juveniles, 1 *Brillia sp.*, 1 *Chironomus sp.*, 1 *Cardiocladius sp.*, 3 *Cricotopus sp.*, 1 *Micropsectra sp.*, 3 *Paratendipes sp.*, and 1 *Polypedilum (Pentapedilum) sp.*), the last Diptera specimen was 1 black fly larvae, *Simulium sp.*

No stoneflies or caddisflies were collected at this site, and only 3 mayflies were found: 2 *Baetis sp.* (collector-gatherer), and 1 *Paraleptophlebia sp.* (shredder-detritivore). One leech was found here, 1 *Helobdella stagnalis*, as well as 1 bivalve, *Pisidium sp.*

Pilchuck Reach 3 96-Jul-10

Invertebrates from only three different orders were found here: Diptera (50%), Trichoptera (38%), and Ephemeroptera (13%). There was no dominant taxa at this site as no group was represented by more than 1 specimen, indeed, only 8 organisms were collected in total. Of the 4 Diptera specimens collected (all chironomids), there was 1 UID juvenile, 1 *Cricotopus sp.*, 1 *Micropsectra sp.*, and 1 *Thienemanniella sp.*

Of the 3 caddisflies collected, there was 1 UID pupa, 1 *Arctopsyche sp.* (collector-filterer), and 1 *Grensia sp.* (generally shredder-detritivores, but can be collector-gatherers and/or scrapers). No stoneflies were found here, and the only mayfly collected was 1 *Ephemerella (Seratella) tibialis*, a collector-gatherer and/or scraper.

Pilchuck Reach 6 96-Jul-12

Invertebrates from eight different groups were found here: Ephemeroptera (62%), Trichoptera (18%), Plecoptera (6%), Diptera (3%), Hydracarina (3%), Amphipoda (3%), Oligochaeta (3%), and Turbellaria (3%). There was not a dominant taxon at this site as the mayflies shared the highest abundances fairly equally between them. The Ephemeroptera contained 21 specimens: 5 *Baetis sp.*, 6 *Epeorus (Iron) longimanus*, 6 *Ephemerella spinifera*, 3 *E. (Seratella) tibialis* (all of which are collector-gatherers and/or scrapers), and 1 *Paraleptophlebia sp.* (shredder-detritivore).

The second most abundant group, the caddisflies, contained 6 specimens: 3 *Lepidostoma sp.* (shredder-detritivore), 1 *Micrasema sp.* (shredder-herbivore; chewer, and/or collector-gatherer), 1 *Rhyacophila (acropedes or vao)*, and 1 *R. tucula* (both of which are predator-engulfers). Only 2 stoneflies were collected here: 1 *Sweltsa sp.* (predator-engulfer), and 1 *Zapada sp.* (shredder-detritivore and/or herbivore on moss). The remaining 5 groups of organisms were represented by 1 specimen each: Diptera/chironomids (1 *Cricotopus sp.*), Hydracarina (1 *Lebertia sp.*), Amphipoda (1 *Crangonyx pseudogracilis*), Oligochaeta (1 of the Family Enchytraeidae), and Turbellaria (1 *Polycelis sp.*?).

Sedimentation Buckets

Sedimentation buckets were not deployed in Crawford Creek.

5.3.12 WAP Prescriptions

Channel structure: silviculture planting should revegetate lower floodplain surface (estimated recover period is 10-100 years); this will also increase organic cellulose pool of potential woody debris but will require long time periods. *Pool and riffle structures:* should be re-established such that they are consistent with natural channel structure and hydrologic regimens. *Large structural elements (wood and boulders):* placement should be made with respect to creating microhabitat within pool / riffle zones (1-10 year recovery period). Channel modifications must be made in conjunction with road and culvert stabilization. Large woody debris should be enhanced to increase microhabitat for macroinvertebrates and to increase the trapping of adult salmon carcasses (5-25 years); this creek's production appears to be, in part, nutrient limited and increasing adult carcasses would reduce the effect of this limitation. Increasing LWD and boulder size in the lower reaches will i) enhance refugia habitat to reduce predation and ii) increase organic matter storage. *Sediment:* sediment traps should be placed in the lower reaches to encourage deposition where insufficient spawning sediment exists (5-20 years) *Hyporheic zones:* reestablishing bed forms and bed composition will create new and redistribution of subsurface flows; new hydrologic sources will help to restore subsurface flows (5-20 year period of recovery). ***Hydrology:*** discharge rates can be controlled, in the long term (10-50 years) if upslope and riparian vegetation is undertaken. Since sediment and bed-load movement can also increase ablation and disruption of periphyton accrual 1-10 years), every effort must be made to stabilize upper reach bed load. Natural and artificial dams must be removed since they tend to alter natural discharge patterns. *Low flows:* Channel modifications which result in a cessation of rapid hydrologic fluctuations will result in recolonisation of stream banks by riparian trees, shrubs, grasses and forbs and benthic surfaces by aquatic biota and thereby increase trophic complexity (1-10 years). ***Sediment:*** upslope and riparian reforestation will

diminish erosion-based soil inputs; this will reduce short term nutrient enhancement and decrease undesirable smothering of instream habitat (10-50 years). ***Water quality:*** *temperature:* re-establishment of riparian canopy cover will reduce solar inputs and stream temperatures (10-40 years); solar insolation profiles should be conducted under both open and closed canopies (both deciduous and coniferous)(1-10 years). Changes in solar quality and quantity will modify algal community structure and productivity and production (5-25 years). Continuous data logger thermistors should be installed in the creek to define temperature profiles. *Dissolved oxygen:* decreasing temperature, through shade recovery, will increase oxygen concentrations (1-10 years); in-stream weirs and large structural elements will also increase turbulence and therefore air entrainment. *Nutrients:* revegetation of the upslope and riparian areas will reduce nutrient washout and diminish nutrient loading into stream waters; this may result, together with increased canopy cover and shading, in reduced summer and autumn periphyton production. An assessment of winter periphyton production should be conducted. ***Riparian and immediate upslope forest:*** *Trophic and organic food production:* mature and old-growth forest and riparian zone vegetation restores natural inputs from terrestrial ecosystems (40-80 years); introduction of leaf litter is essential for provision of structural substrate on which bacterial and protozoan communities develop; macroinvertebrates derive a significant portion of their nutrition from this microbiotic community (5-10 years). Fish gut studies should be conducted to determine what food resources are being used as the primary nutrition source. The creation of specific microhabitat, which provides for the specific requirements of selected algal and micro and macroinvertebrate populations, must be created when lower reach channel morphologies are altered (1-10 year cycles). *Shading:* re-establishment of riparian canopy will ultimately reintroduce light as a factor limiting primary production, which will eventually return to predisturbance values (5-20 year cycle). *Rooting systems:* growth of woody vegetation on stream banks, and the concomitant root network, will result in enhanced stream bank integrity; grasses and forbs, planted in the adjacent meadows, will reduce soil erosion (20-80 years). The lower reaches were observed to have significant quantities of fine sediment deposits. *Nutrient modification:* successional processes occurring as riparian plant communities develop can, in some situations, enhance nutrient filtering capability; however, subsurface hydrologic flows are complex and may be little influenced by riparian root structures (20-80 year cycles)(see FHAP prescription above). ***Exogenous material:*** the presence of a private residence adjacent to the creek in the lower reaches did not appear to be the source of any such materials; no *Exotic biota:* were observed to have become established.

5.3.13 RAP Overview

The Riparian Assessment Procedure field crew found no recent clearcut areas directly adjacent to Pillchuck Creek during their reconnaissance. Therefore, no assessment of riparian vegetation was conducted.

There may be opportunities for riparian vegetation enhancement or bioengineering work in conjunction with fish habitat enhancement, channel and bank stabilization, or other proposals for this creek. Such investigations will for part of Year 3 activities.

Squamish River Watershed

Ashlu Creek



5.4 Ashlu River

Data Summary Sheet

✓	Yes	x	No	?	Unknown

HISTORY

✓	Was watershed logged prior to 1988?
x	Is watershed within a municipal boundary?
?	Have FRBC funds been spent on watershed?
?	Are FRBC applications pending for work on watershed?

FISHERIES INFORMATION

✓	Have forest activities impacted fisheries resources?
✓	Does the watercourse have existing fisheries values?
✓	Does the watercourse have historical fisheries values?
✓	Is the watercourse accessible to salmon?
✓	Is the watercourse habitat suitable for salmon?
✓	Are there enhancement opportunities for salmon?
✓	Is the watercourse habitat suitable for trout and char?
✓	Are there enhancement opportunities for trout and char?

WATER QUALITY

?	Does the watercourse have an adequate water quality?
	If not, can it be rehabilitated?
?	Does the watercourse have an adequate food supply?
	If not, can it be restored?
x	Was periphyton community surveyed?
x	Was invertebrate community surveyed?
?	Was water chemistry surveyed?
x	Was sediment or intergravel habitat surveyed?

✓	Have there been scientific surveys in the stream?
x	Have nutrient dosing pots been placed in the stream?

HYDROLOGICAL FACTORS

✓	Are there forest-related activity impacts?
✓	Are there existing Water Rights (domestic, power, community watershed)?
✓	Is there year-round flow potential?
✓	Are there any existing hydraulic structures (dams, wiers, bridges, etc.)?
✓	Is there a debris-flow potential?

RIPARIAN ZONE

✓	Have forestry activities had negative impact on riparian vegetation?
✓	Is there existing well-established riparian vegetation?
✓	Are soil conditions amenable to re-vegetation?
✓	Is the channel morphology appropriate for re-vegetation?
✓	Are unrestricted reaches present?
✓	Would re-vegetation be expected to benefit fish/wildlife habitat?

TERRESTRIAL PROCESS

✓	Have slopes >60% been logged?
✓	Are roads built on slopes >60%?
✓	Is bedrock-geology of basin stable?
✓	Has basin experienced landslides?
?	Have landslides entered mainstream?

H	High	M	Medium	L	Low	U	Unknown

CREEK RATING

H	Impacts by logging
H	Fish resources
H	Rehabilitation potential

5.4.1 Factors of Concern

Fisheries

The area below the barrier has high potential for habitat enhancement. Potential projects are being investigated by other groups/agencies. However, there should be more detailed assessment of water quality and existing fisheries values. More assessment is required to establish background data on habitat condition and fish distribution if restoration project proposed. Historical fisheries values are well documented. Requires information on current habitat and fish utilization to facilitate evaluation.

Hydrological

Ashlu Creek is a tributary to the Squamish River at 25 km upstream of mouth of the Squamish River on Howe Sound. The watershed has a southwest aspect rising from an elevation about 60 m at it's mouth to 2,200 m at it's headwaters (on Mt. Jimmy Jimmy) over it's 29 km channel length. The major tributaries of the Ashlu include: Pokosha Creek, Roaring Creek, Coin Creek, Marien Creek, Pyrette Creek, Tatlow Creek and Red Mountain Creek. The Ashlu Creek watershed has been clearcut logged extensively. Some slide activity may increase sediment loading and clear cut areas may increase peak flows in the creek.

Five creek crossings including five bridges have been identified. All crossings should be inspected by a Professional Engineer (Hydrological) to find out if the bridge or culvert can pass the 100 year peak flows and to make recommendations for any improvements including removal.

There are at least ten lakes within the watershed which may provide an opportunity to construct low dams to facilitate the augmentation of summer flows. The fact that Ashlu Creek, Coin Creek and Roaring Creek have existing water rights (Z102852, Z102203, Z103619, C049987, C054865, C061679, C061680, C070023) for power generation could cause complications of future instream work.

The overall steep slope (average 7%) and existence of steep sidewalls with existing slide activity could feed material and sustain debris-laden floods under the right conditions. Prior to proceeding with instream works, a limited gulley and channel assessment should be carried out in the field.

Water Quality

No information pertaining to the periphyton or invertebrate community has been obtained from this creek. Water quality was not monitored, nor was intergravel or sediment studied. Periphyton and invertebrate communities, and sediment and/or intergravel habitat should be monitored. Basic water quality parameters should be monitored. The MOELP has conducted studies on this creek in the past; all water quality data should be obtained; other water quality data has been developed by companies which have sought to have the hydroelectric power generating potential developed and should be obtained.

Riparian Zone

The Ashlu River is a very diverse, energetic, and dynamic system. The river is restricted to a narrow canyon in its lower portion, before entering the Squamish River floodplain. Further upstream, the valley bottom is wider and flows moderately restricted. Going upstream, it is approximately 14.3 km from the mouth of the Ashlu to the entry, from the south, of its major tributary which flows off Mount Jimmy Jimmy.

The Ashlu River valley slopes have been heavily logged. Older clearcuts adjacent to the riverbank extend upstream from a point about 4 km from the river mouth. For much of the extensive area, logging occurred right up to the riverbank, or up to one tree-width from the river.

Generally reforestation of the older cut blocks appears from air photos to have been successful. Further studies will probably identify numerous areas with high potential for riparian enhancement, within an overall management plan.

Squamish River Watershed

Chance Creek



5.5 Chance Creek

Data Summary Sheet

✓	Yes	x	No	?	Unknown

HISTORY

✓	Was watershed logged prior to 1988?
x	Is watershed within a municipal boundary?
x	Have FRBC funds been spent on watershed?
?	Are FRBC applications pending for work on watershed?

FISHERIES INFORMATION

✓	Have forest activities impacted fisheries resources?
✓	Does the watercourse have existing fisheries values?
✓	Does the watercourse have historical fisheries values?
x	Is the watercourse accessible to salmon?
x	Is the watercourse habitat suitable for salmon?
x	Are there enhancement opportunities for salmon?
✓	Is the watercourse habitat suitable for trout and char?
✓	Are there enhancement opportunities for trout and char?

WATER QUALITY

?	Does the watercourse have an adequate water quality?
	If not, can it be rehabilitated?
?	Does the watercourse have an adequate food supply?
	If not, can it be restored?
x	Was periphyton community surveyed?
x	Was invertebrate community surveyed?
x	Was water chemistry surveyed?
x	Was sediment or intergravel habitat surveyed?

x	Have there been scientific surveys in the stream?
x	Have nutrient dosing pots been placed in the stream?

HYDROLOGICAL FACTORS

✓	Are there forest-related activity impacts?
✓	Are there existing Water Rights (domestic, power, community watershed)?
✓	Is there year-round flow potential?
✓	Are there any existing hydraulic structures (dams, wiers, bridges, etc.)?
✓	Is there a debris-flow potential?

RIPARIAN ZONE

✓	Have forestry activities had negative impact on riparian vegetation?
✓	Is there existing well-established riparian vegetation?
✓	Are soil conditions amenable to re-vegetation?
✓	Is the channel morphology appropriate for re-vegetation?
✓	Are unrestricted reaches present?
✓	Would re-vegetation be expected to benefit fish/wildlife habitat?

TERRESTRIAL PROCESS

✓	Have slopes >60% been logged?
✓	Are roads built on slopes >60%?
✓	Is bedrock-geology of basin stable?
?	Has basin experienced landslides?
?	Have landslides entered mainstream?

H	High	M	Medium	L	Low	U	Unknown

CREEK RATING

M,H	Impacts by logging
M	Fish resources
M	Rehabilitation potential

5.5.1 Factors of Concern

Fisheries

Helicopter reconnaissance revealed some potential for riparian habitat improvement in upper watershed. More assessment is required to establish background data on habitat condition and fish distribution if a restoration project proposed. Fish are present upstream and downstream of natural barrier 300 m above confluence with Cheakamus River.

Hydrological

Chance Creek is a steep mountain creek with a watershed area of approximately 16 km^2, is tributary the Cheakamus River about 3 km downstream of the Daisy Lake Dam. The watershed has a east aspect rising from an elevation about 310 m at it's mouth to 1,870 m at it's headwaters (Cloudburst Mountain) over it's 8 km channel length. The Chance Creek watershed has been extensively logged. There has been some regrowth however present clearcuts may increase sediment loading and peak flows in the creek.

Three crossings have been identified and should be inspected by a Professional Engineer (Hydrological) to find out if the bridge or culvert can pass the 100 year peak flows and to make recommendations for any improvements including removal.

There are about eight lakes within the watershed which may provide an opportunity to construct low dams to facilitate the augmentation of summer flows. The fact that Chance Creek has water rights (F005607 and C056052) for domestic and power generation purposes may cause complications of future instream work.

Water Quality

No information pertaining to the periphyton or invertebrate community has been obtained from this creek. Water quality has not been monitored, nor has intergravel or sediment been studied. Periphyton and invertebrate communities, and sediment and/or intergravel habitat should be monitored. Basic water quality parameters should be monitored.

Riparian Zone

Chance Creek flows approximately 3 km down the west flank of Cloudburst Mountain from its source in the alpine area to its confluence with High Falls Creek. The gradient is moderately steep for most of the length of the creek.

The riparian areas along Chance Creek have been heavily disturbed by clearcutting. Clearcuts extend from approximately 0.5 km to 1.4 km upstream from the mouth. Over a large proportion of these clearcuts, a riparian leave-strip only one tree wide has been left untouched. In addition, the creek is crossed in several locations by logging roads which may be subject to erosion.

As logging operations end and these clearcuts are replanted, good opportunities may exist to implement a program to replant riparian herb and shrub vegetation.

Logging History

A record of logging activities summarized from the Ministry of Forests Integrated Silviculture Information System Ecology Report follows:

Year	Total Area Logged (ha)	Year	Total Area Logged (ha)
1985	10	1978	31
1983	56	1976	69
1981	47	1975	100

Watershed Assessment Report Sheet

	(1)	(2)
Watershed Name?	Chance Creek	
Map units are in: (1=km. and sq.km.; 2=m. and ha.)	1	
Total watershed area (TA)	14.88	sq.km.
Peak Flow		
Area below 300 m.	0	sq.km.
Area between 300 and 800 m.	6.1	sq.km.
Area above 800 m.	8.78	sq.km.
Road length between 300 and 800 m. (not used)	12	km.
Surface Erosion		
Total road length	19	km.
Length of road on erodable soils?	0.11	km.
Roads within 100 m. of a stream?	3.9	km.
Number of active stream crossings?	8	
Riparian Buffer		
Total stream length?	22.6	km.
Length of stream logged?	7.9	km.
Length of mainstem?	8.4	km.
Landslides		
Length of road on unstable terrain?	0.11	km.
Area logged on unstable terrain?	92.5	sq.km.
Headwaters		
Length of headwater streams logged?	0	km.
Number of crossings on headwater streams?	0	
Other Watershed Characteristics		
Percent area of crown land?	100	
Percent area of private land?	0	
Are glaciers present?	No	

FOR REACH BREAKS SEE MAPS 92G094, 92G095 (in back pocket).

5.5.2 FHAP Overview

Chance Creek flows into the Cheakamus River about 2 km downstream of Daisy Lake Dam and upstream of an anadromous fish barrier in the Cheakamus River. An FHAP assessment was conducted from July 22 to 26, 1996, in Chance Creek from its confluence with the Cheakamus River to Chance Lake. The study area was divided into 26 reaches. A complete FHAP assessment was conducted from Reaches 1-12, but not from Reaches 13-26 due to steep gradients and a canyon making accessibility difficult.

5.5.3 FHAP Assessment

Habitat Types

A summary of habitat types identified in Chance Creek from July 22 to 26, 1996, is provided in Appendix E. Predominant habitat throughout the creek was cascade. Average gradient in these areas ranged from >10 to >40%. Riffle and glide habitat were observed in Reaches 1, 2, 5, 6 and 12, where average gradient ranged from 1.5 to 4.0%. Reach 7 was dominated by pool habitat. Individual pools were also noted in Reach 5. Pool habitat was noted in Reach 17. There was an aggradation of debris in Reaches 1 and 2 along with channel braiding, unvegetated bars, eroding banks, log jams and LWD parallel to the banks.

Off-channel Habitat

Side channels were observed in Reaches 2, 5, and 12. Three side channels which were accessible to fish at most flows were identified in Reach 2. Side channels observed in Reach 5 and 12 were accessible only at high flows. A tributary in Reach 6 and in Reach 12 ran directly through an opening, and had been impacted by logging activities. Water flow in both tributaries was extremely low and overhead cover was non-existent, thereby providing very little suitable fish habitat under present conditions.

Large Woody Debris (LWD)

Appendix E provides LWD loading data for reaches with LWD. LWD per bankfull width ranged from 0.3 to 6.0, indicating either poor or good quality rearing habitat, based on the diagnostic table provided in Johnston and Slaney (1996). The quality of LWD in providing rearing habitat was generally poor in Reaches 1-4 and 12, and was classified as good in Reaches 5, 6, and 11.

Based on data collected during the July FHAP assessment, it would appear that sufficient LWD existed in most reaches of Chance Creek. However, these high counts may be misleading as most LWD was found forming part of unstable log jams rather than as individual pieces. LWD in the form of a log jam obstruct fish passage or provide functional fish habitat, or both during different seasons depending on the level and flow rate of water in the creek. Most of Chance Creek appeared unstable upstream of Reach 2 it was difficult to assess whether the log jams could provide fish habitat on a consistent basis. Thus, the quality as represented in Appendix E does not necessarily reflect the quality of habitat that may exist at other times of the year when water flows are different.

Furthermore, the amount of "functional" LWD recorded by the field crew may be a misrepresentation of the amount of functional LWD that was actually present in the creek, due to the definition of "functional" LWD presented in Technical Circular No. 8 (Johnston and Slaney, 1996) as discussed in Section 3.8.1.

Substrate Type

Substrate type observed in each reach surveyed in Chance Creek and associated spawning habitat potential is provided in Appendix E. Dominant substrate type in most reaches surveyed was cobble and boulder. Gravel was observed in Reaches 2, 3, 5, 18 and 26 and provided some suitable habitat for spawning. However, due to the instability of the watershed much of the gravel had been impacted by sediment deposition.

Fish Distribution

Fish presence/absence in Chance Creek was determined by electroshocking in Reach 1 on July 29, 1996, and in Reaches 5-6 on 12-13 August 11, 1996. Fish distribution data is summarized in Table 5.5-1. Rainbow trout were captured in Reach 1. These fish ranged in fork length from 27 to 175 mm, and weighed from 0.2 to 57.5 g. No fish were captured or observed upstream of Reach 2. The presence of resident fish above the impassable barriers seemed unlikely due to a continuous, steep gradient and the lack of suitable rearing and spawning habitat. In addition, it was unlikely that fish proliferate in Chance Lake due to its extremely cold year-round temperatures associated with direct glacier-melt. A glacier ends at the shore of the lake and icebergs were still floating in the lake in July. However, the presence/absence of fish in Chance Lake and Chance Creek upstream of Reach 3 needs to be confirmed through more extensive field investigations.

Historically, fish species distribution in Chance Creek included only resident populations of juvenile rainbow trout and probably Dolly Varden and cutthroat trout (Triton, 1993). The lower reaches had been classified as good rearing habitat for steelhead fry and parr, and probably provided a nursery stream for middle Cheakamus River fish stocks (Triton, 1993). No anadromous fish could access Chance Creek due to an impassable barrier in the Cheakamus River downstream of the Chance Creek-Cheakamus River confluence.

Table 5.5-1 Summary of fish capture data in Chance Creek (1996).

Date	Reach	Effort (seconds @ voltage)	Fish Captured	Stream Class
29-Jul	1	500@ 400	Rainbow trout	S2
11-Aug	5-6	242 @400	none	S5
11-Aug	12-13	242 @ 200	none	S5

Adult Upstream Migration

Anadromous fish did not have access to Chance Creek due to an impassable barrier in the Cheakamus River located downstream of the Chance Creek-Cheakamus River confluence. Consequently, only resident populations of fish would be expected in Chance Creek. Based on the location of an impassable barrier in Reach 3, adult upstream migration is limited to the first 425 m upstream from the mouth of Chance Creek. If fish inhabited the upper reaches, adult migration would be limited to sections of the

creek between high gradient areas (i.e., cascades and waterfalls) and velocity barriers. These areas are limited to sections of Reaches 5, 6, 12, and 17.

Spawning and Incubation Conditions

Potential spawning habitat in Chance Creek existed in Reaches 2, 3, 5, 12 , 18 and 26. However, these areas were susceptible to aggradation and sediment deposition due to instability in the upper watershed. The most potential for spawning habitat existed in Reach 2, where the channel had braided. In-stream cover and substrate type were ideal for spawning.

Summer Rearing Habitat

Appendix E provide a summary of potential cover types observed in Chance Creek during the July 1996 FHAP assessment. Cover in Reaches 1-5 and 12 was dominated by SWD and OV. Undercut banks were observed in Reach 12. In general, the quality of cover ranged from fair to good, and was probably not limiting to fish. Although boulders were observed in many reaches, they generally provided poor quality rearing habitat. Little pool habitat was observed in Chance Creek during the July survey, but pool frequency increased during the September survey when water levels were lower. Thus, the potential for rearing habitat in the form of pools was dependent on seasonal changes in water flows.

Winter Rearing Habitat

Potential winter habitat was difficult to assess with field data collected only during the summer months. Given that the source of water for Chance Creek was glacier based, low flows were expected during the winter due to freezing. Consequently, most side channels would provide little overwintering habitat as they were only accessible during high flows. Further impeding overwintering was the lack of deep pools. Residual depth of pools measured ranged from 0.45 to 0.8 m. Further investigation should be conducted during the winter months to determine water levels, flow rates and accessibility of off-channel habitat.

Juvenile Migration

Juvenile fish may migrate upstream from the Chance Creek-Cheakamus River confluence to the barrier in Reach 3. Upstream from the barrier, migration of juvenile fish may be confined to areas between potential barriers in Reaches 7-11, 13-16, and 19-26. If juvenile fish were present in Chance Lake, they could migrate downstream from the lake.

5.5.4 FHAP Prescriptions

Based on the above FHAP assessment, the most limiting factors to fish in Chance Creek were an unstable upper watershed and a lack of habitat complexity. A number of rehabilitation/restoration options exist which would address these limitations. Most importantly, the upper watershed needs to be stabilized through stabilization of banks, replanting of riparian vegetation, and removal of unstable log jams. This will reduce aggradation of debris at the base of the waterfall, channel braiding, and the formation of log jams, and the subsequent impact on fish habitat. Once the watershed has been stabilized, habitat complexity can be increased by adding more gravel to some areas to increase spawning habitat, and/or addition of LWD to form more pools for rearing habitat, and excavation of side channels. However, before restoration plans are implemented for the upper watershed, the presence/absence of fish above the barrier in Reach 3 needs to be confirmed through further field investigations.

Future Studies

Fish absence in Reaches 5, 6, 12 and 17 should be reconfirmed and fish presence/absence in Chance Lake confirmed. Assessment of overwintering habitat in Reaches 1 and 2 should be undertaken to determine potential habitat limitations at that time of the year. Once the upper watershed of Chance Creek has been stabilized, potential fish habitat restoration opportunities in the lower reaches should be reassessed.

5.5.5 FHAP QA/QC

Sections of Reaches 2 and 7 were assessed in early September by the FHAP supervisors as part of the QA/QC program. Comparative data collected by the field crews and the supervisors is provided in Table 2.5. In Reach 2, dominant bed material, spawning gravel, functional LWD, and overhead cover type differed between the two surveys. Substrate type in the September survey included sand and gravel, and thus, provided little to abundant suitable spawning habitat. No gravel was observed during the July survey and thus, no suitable spawning habitat was identified.

The comparability of parameters measured in Reach 7 was not complete because the assessment was not completed by the field crew due to inaccessibility of sections of this reach because of higher water flows in July than in September. The lower water flows in September would also explain the presence of pools and riffles in this section that were not identified in July.

Estimates of functional LWD in Reaches 2 and 7 were not similar between the field crew and the supervisors. The field crew observed no functional LWD in the reaches, whereas the supervisors counted 8 and 35 pieces in Reach 2 and 7, respectively. This discrepancy can best be explained by the differences in the definition of "functional" LWD between the two crews. Much of the LWD in Chance Creek was found lying parallel to the shore which, according the Johnston and Slaney (1996), should be classified as non-functional. Consequently, the field crew omitted these from the LWD tally. However, not all LWD lying parallel to the shore can be considered as non-functional (see Section 3.8.1 for more detail). Consequently, the supervisors included some of the LWD lying parallel to the shore in their tally and thus, numbers were higher in the September survey.

The results of the QA/QC program emphasize the need for conducting FHAP assessments in more than one season so that the natural variability in potential fish habitat can be documented and restoration options designed accordingly. In addition, the definition of "functional" LWD needs to be revised and standardized so that potential fish habitat is not underestimated.

5.5.6 CAP Overview

Chance Creek has had significant logging on both banks with the watershed. Often, there is little or no riparian fringe. Excessive LWD is functioning within the channel. Increased sediment appear to have caused both aggradation in various reaches within the creek.

5.5.7 CAP Assessment

Reach 1, 2 & 3

Riffle Pool Morphology
Sensitivity Rating: High

There is evidence of aggradation and potential channel avulsion. Extensive gravel bars that are greater than half the bankfull width occupy the channel. There may be opportunities for development of future fisheries enhancement channels.

Table 5.5-2 Chance Creek field data summary.

Reach	Bankfull Width (m)	Depth (m)	Slope (%)	Average Rock D (m)	Relative Roughness	Power Index	Sensitivity Rating	Channel Condition	Channel Type
1	11.2	1	3	1	1	33.6	H	0	Riffle-pool
2	10	2	2	0.4	0.2	40	H	0	Riffle-pool
3	7.3	1	6	0.7	0.7	43.8	H	0	Riffle-pool
4	-	-	-	-	-	-	L	0	Step-pool
5	16.47	1.4	3.67	0.43	0.31	84.53	M	0	Riffle-pool
6	28.26	1.56	2.6	0.82	0.53	114.62	H	0	Riffle-pool
7	7.14	1.4	9.8	1.14	0.81	97.96	M	0	Step-pool
8	8.98	1.14	7	0.78	0.68	71.66	M	0	Cascade-pool
9	10.26	1.16	5.8	0.80	0.69	69.03	H	0	Cascade-pool
10	11.98	0.88	3.6	0.62	0.70	37.95	M	Aggraded	Riffle-pool
11	7.63	1.7	14.33	0.67	0.39	186.00	H	Stable	Riffle-pool
12	7.37	0.87	6.67	0.57	0.65	42.56	H	Stable	Riffle-pool
13	11.7	1.5	7.5	0.60	0.40	131.63	H	Stable	Riffle-pool
14	5.46	1.02	15	0.46	0.45	83.54	H	Stable	Step Pool
15	5.8	0.88	11.2	0.38	0.43	57.16	L	Stable	Step Pool

Reach 4

Step Pool Morphology
Boulder Block Bed Material
Sensitivity Rating: Medium

The canyon has limited large organic debris in the channel. The canyon functions as a sediment transport zone dumping alluvial material within Reach 3.

Reaches 5 & 6

Riffle Pool Morphology
Cobble & Gravel Bed Material
Sensitivity Rating: Medium

The channel within these reaches is severely aggregated exhibiting gravel bars greater than half its bankfull width. Stone lines are disorganized and as a result pooling has been interrupted.

Reaches 7 & 8

Riffle Pool Morphology
Sand & Gravel Bed Material
Sensitivity Rating: Medium

These reaches appear to be stable.

Reaches 9 & 10

Canyon Morphology
Bedrock Material
Sensitivity Rating: Low

There is functioning LWD within the channel.

Reaches 11, 12 &13

Riffle Pool Morphology
Gravel & Cobble Bed Material
Sensitivity Rating: Medium

The channel within these reaches is slightly degraded and lacks large woody debris.

Reach 14

Step Pool Morphology
Boulder Block Bed Material
Sensitivity Rating: Medium

The channel is degrading. Both banks have been logged significantly, often leaving little or no riparian fringe. Significant large organic debris and small organic debris is present in the channel. Stone lines appear to be degraded.

Reach 15

Step Pool Morphology
Boulder Block Bed Material
Sensitivity Rating: Medium

Moss covered boulders occupy the 5m wide channel in this shaded reach. This is upstream of any forestry related activities. This is a control reach and no restoration work is prescribed.

5.5.8 CAP Prescriptions

Creek Prescriptions (Year One)

All instream construction should be subject to a Debris Flow Review and a Bridge/Culvert Sizing Review. Restoration efforts should focus on removal large woody debris and placement rebuilt stone lines rebuilt in Reaches 12 through 14.

Creek Prescriptions (Year Two to Five)

In the following two to five years, Chance Creek should have continued channel morphology reconstruction done. Further stone lines and gravel bar work should take place, enhancing pool development. Channel construction should be carried out from the upper reaches down. A yearly summary report should be written to identify work carried out in specific location as well as progression made during the project.

General Creek Work Involved (Year Five to Twenty)

A general inspection of river stability should be carried out every two years for the proceeding five years. At this time, any instream work necessary should be identified and carried out immediately. A summary report should be written up detailing the progress and any deficiencies within the creek at the end of each inspection. After year ten an inspection should be carried out every five years. Again, if instream work is necessary it should be identified and carried out immediately. A final summary report should be composed as well as a final photo catalog.

5.5.9 CAP Quality Assurance/Quality Control

Quality Assurance/Quality Control for Chance Creek was done with two major goals: 1) to ensure that the data collected was reliable; and 2) to ensure that the data collected was entered accurately into the computer system for analysis. To achieve the first goal, field data was recollected by CAP trainers on three reaches within the channel. Three reaches were chosen to attain a 20% level of QA/QC. This data was then compared to the data collected by the field crews. In general, field data collection was considered adequate. All data collected and entered into the computer system was verified by inspection. Any discrepancies were fixed to the original electronic data files. As Chance Creek was to be used as a pilot project for watershed restoration works within the Squamish River watershed, the creek was visited by a professional hydrological engineer after the field data collection was complete.

The Channel Assessment Procedure Training took place on North Lizzie Creek. Measurements taken by field crews were under the direction and supervision of a hydrological field technician, thereby validating data collected. All data collected in the field and entered into electronic forms was checked for transcription accuracy.

Table 5.5-3 Chance Creek summary table.

Reach	Morphology	Assessment	Prescription	Timing	Year	Rating
1 2 3	Riffle Pool Cobble Bed Material	There is a high degree of aggradation in the first 3 reaches of Chance Creek. This is evidenced by extensive gravel bars exceeding half the bankfull width. In addition there are several dry channels with channel splitting evident. Large woody debris is limited in these lower reaches.	Construct and enhance off-channel habitats. All crossings should be inspected by a professional hydrological engineer.	July 15 - Aug. 15	2	H
4	Step Pool Boulder Bed Material	Canyon has limited large organic debris. The canyon functions as a sediment transport zone dumping alluvial material into reach 3 downstream.	Limited stream clearing of any wedged large debris within the canyon.	July 15 - Aug. 15	3	L
5	Riffle Pool Cobble Bed Material	The channel is severely aggraded with gravel bars widths greater than half the bankfull width.	Gravel bars should be scalped and pool development should be promoted by constructing stone lines.	July 15 - Aug. 15	2	M
6	Riffle Pool Cobble Bed Material	Reach 6 consists of a typical stretch of creek with a riffle-pool morphology. The creek is aggraded along the reach, with several areas having build-up of large woody debris	Gravel bars should be scalped and pool development should be promoted by constructing stone lines.	July 15 - Aug. 15	2	H

Reach	Morphology	Assessment	Prescription	Timing	Year	Rating
7 8	Riffle Pool Cobble Bed Material	Stable channel.	No prescriptions.	N/A	N/A	L
9	Canyon	Significant large woody debris in the channel.	Remove and reposition LWD and gravel build up where applicable.	July 15 - Aug. 15	2	M
10 11 12	Riffle Pool Cobble Bed Material	Reaches 10-12 consist of a section of creek with a riffle-pool morphology. There is a lack of large woody debris in the channel.	Strategic placement of large woody debris in the channel is needed.	July 15 - Aug. 15	1	H
14	Step Pool Boulder Bed Material	The channel in reach 14 is degraded with stone lines exhibiting degradation. Logging is evident on both banks.	The stone lines should be rebuilt with boulders and some large organic debris. The excessive small organic debris should be removed from the channel and placed above the high water mark of the channel.	July 15- Aug 15	1	H
15	Step Pool Boulder Bed Material	The riparian vegetation is intact, stone lines are moss covered and very stable.	No prescriptions required.	N/A	N/A	L

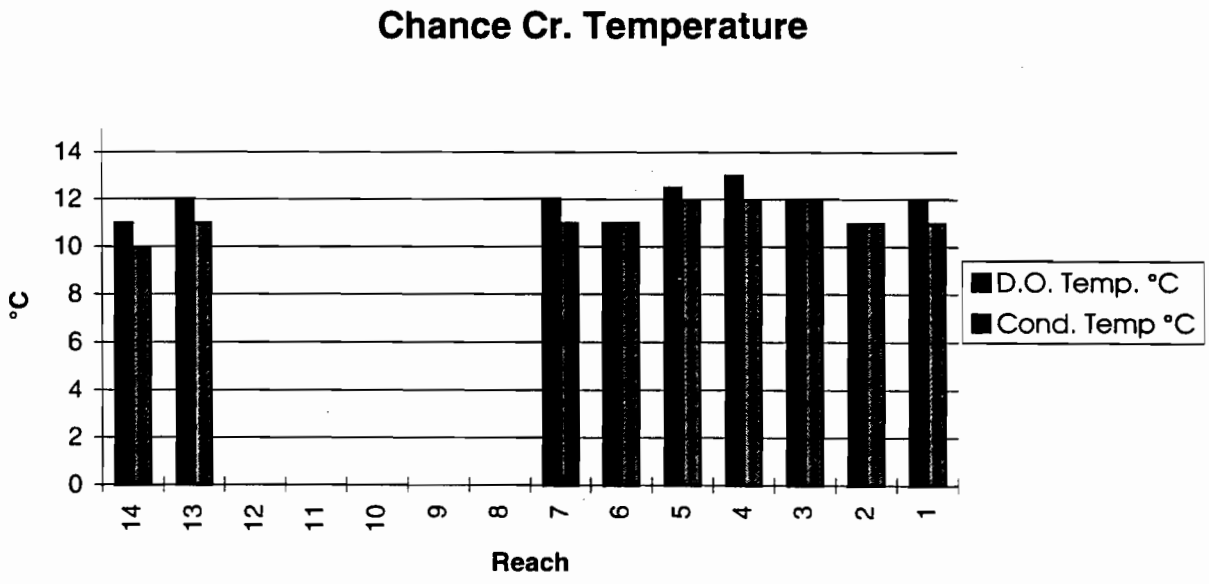
5.5.10 WAP Overview

Stream temperatures did not appear to be a limiting factor in this creek, being less than the maximum acceptable of 15 °C. The temperature range indicates that the growth rates of juvenile salmon would not be adversely affected; in fact the temperatures were in the optimal range for salmonid growth. Dissolved oxygen values, during the sampling period did not appear to be limiting aquatic biota respiration. The extremely low specific conductance values (<30 µmhos/cm) indicate that this creek is likely nutrient limited, with minimal periphyton production. The limited nutrient loading likely also limits macroinvertebrate community. The stream should be reassessed in year three to determine if the nutrient regimen is constantly depressed, which would make this stream a potential candidate for nutrient enrichment. The periphyton community should be monitored using nutrient-dosing pots to measure both normal biomass accrual and which nutrient is in limited supply. Given the very low specific conductance it will not be possible to reliably determine, from water chemistry values, which nutrient is limiting.

5.5.11 WAP Assessment

Temperature

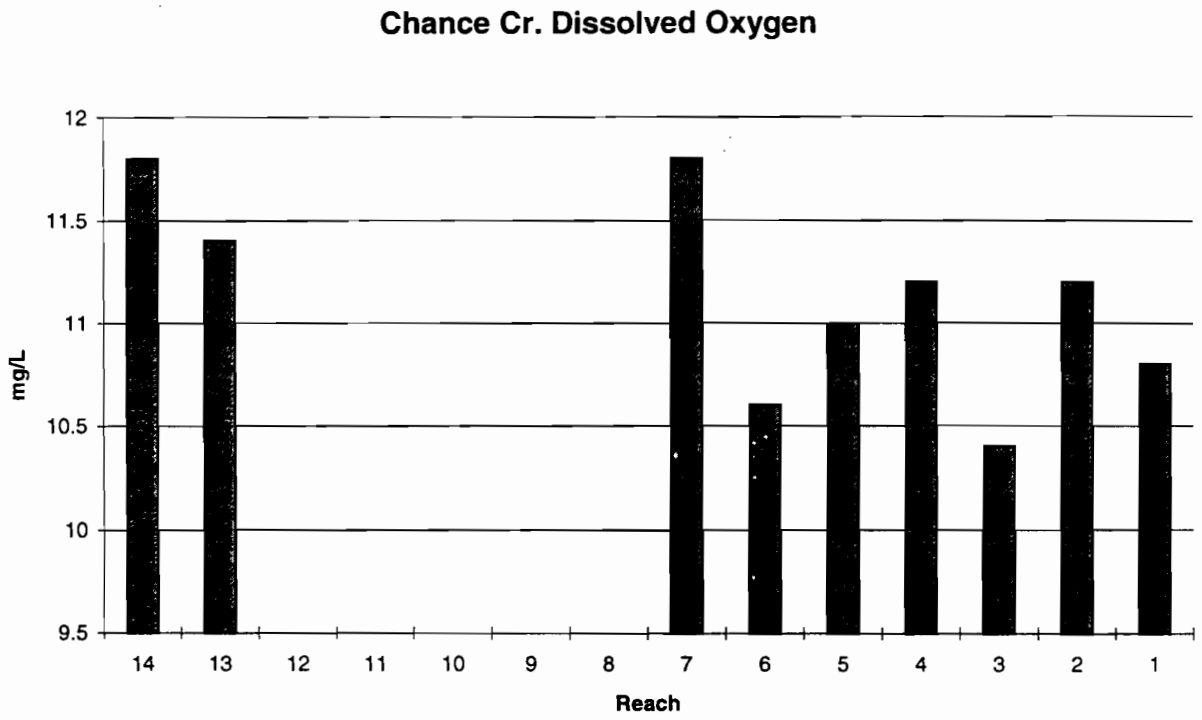
Stream temperatures were similar throughout the creek during the study period, ranging between 10 and 13 °C. Stream temperatures were slightly lower in the two upper reaches (13 and 14). The temperatures measured by the two different instruments were generally within 1 °C of each other. The similar temperatures throughout the creek indicate that there would not be any sudden temperature change stresses with which migrating fish would have to contend.



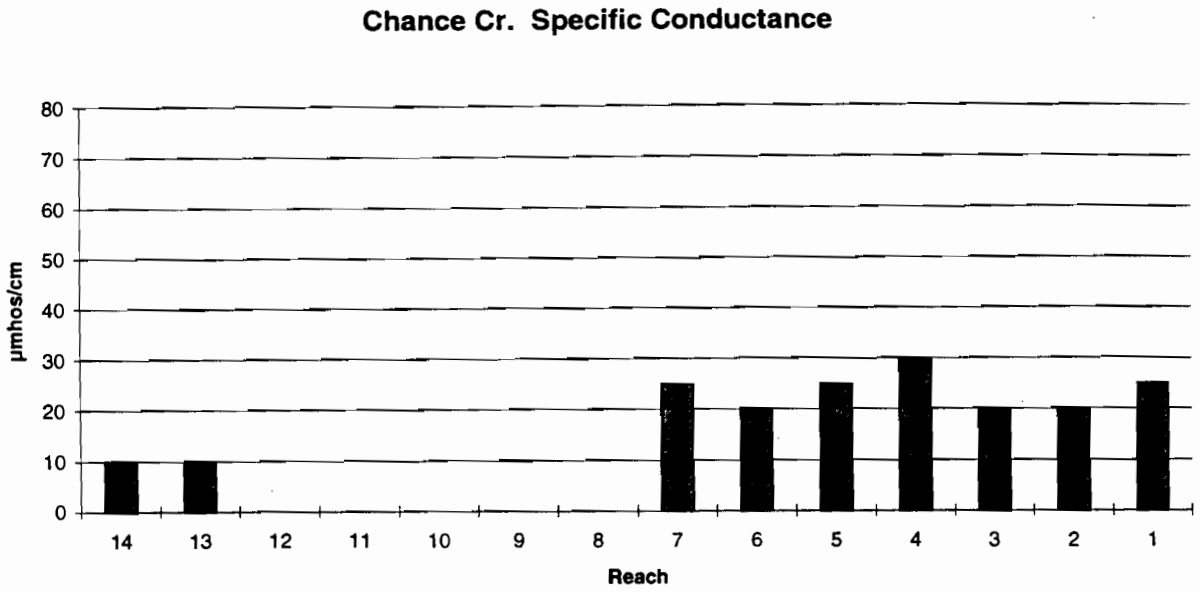
Dissolved Oxygen and Specific Conductance

The absolute dissolved oxygen concentrations fluctuated minimally throughout the creek. The upper reaches (13 and 14) exhibited high DO levels (11.0 to 11.7 mg/L); in the mid-reach (7) the values remained high (11.7 mg/L), whereas in the next lower reach the value had decreased to 10.5 mg/L.

Values in the reaches below 7 ranged between 10.4 to 11.4 mg/L. These values indicate that the dissolved oxygen concentrations did not represent a threat to aquatic biota, to any significant degree, in any of the reaches. Dissolved oxygen values appeared to inversely reflect temperatures, as predicted. Percent saturation values also were relatively high.



Specific conductance values in the creek ranged between 10 and 30 µmhos/cm, generally being lowest in the upper reaches and increasing downstream. Below reach 7 the values were double (+20 µmhos/cm) those of 13 and 14 (10 µmhos/cm). The highest reaches have values as low as any in the literature, being some of the lowest we have ever measured. The low values reflect the low nutrient loss from the parent bedrock and soils. This indicates that the upper reaches are nutrient limited. The enhanced values in the lower reaches, although significantly higher than those in the highest reaches, are still very low compared with values of coastal streams.



Periphyton & Nutrient Dosing Pots

The algal cover, as estimated by the field crews, varied widely in all reaches. The extent to which periphyton community development effected benthos cover ranged from a low of 20% in reaches 1,3 and 14, to a high of +80% in reaches 2,6 and 13.

In September, the natural substrate, (epilithic) main channel periphyton in the main channel was dominated by a canopy of *Zygnema* (14%) and l.b.g.b.'s (80%) and an understory of *Achnanthes* (6%). The logged site revealed a community also characterised by Cyanobacteria (small l.b.g.b.'s, 64%; large l.b.g.b.'s, 6%), no filamentous Chlorophytes and a diatom structure dominated by *Achnanthes* (5%), *Ceratoneis arcus* (1%), *Diatoma hiemale* (3%), *Fragilaria/Synedra* (3%) and *Gomphonema* (18%).

Invertebrates

Chance Creek Main Channel **96-Sept-19**

Invertebrates from four different orders were found here: Ephemeroptera (59%), Diptera (31%), Trichoptera (9%), and Plecoptera (1%). The dominant taxa at this site were ephemerellid mayflies, *Ephemerella doddsi*, representing 23% of the sample. These mayflies inhabit lotic, erosional and depositional waters, are characterised as **clingers** (some **swimmers**) and belong to the trophic guilds of **collector-gatherers** and **scrapers**. The remaining Ephemeroptera specimens were: 3 *Ameletus sp.* (Family Siphlonuridae), 15 *Baetis sp.* (Family Baetidae), 8 *Cinygmula sp.*, 15 *Rhithrogena sp.* (both belonging to the Family Heptageniidae), and 2 *Ephemerella sp.*

The second most abundant group, the flies, contained 37 specimens: 5 "noseeums", Family Ceratopogonidae, *Palpomyia sp.*, 6 crane flies, Family Tipulidae, *Hexatoma sp.*, and 26 chironomids of which there were 6 UID juveniles, 1 *Cardiocladius sp.*, 3 *Corynoneura sp.*, 1 *Cricotopus sp.*, 1 *Eukiefferiella sp.*, 5 *Micropsectra sp.*, 1 *Synorthocladius sp.*, 5 *Tanytarsus sp.*, 1 *Thienemanniella sp.*, and 2 *Thienemannimyia sp.* The Order Trichoptera was represented by: 2 *Agraylea sp.*, 5 *Ecclisomyia sp.* which inhabit lotic-erosional zones (cold alpine streams), are characterised as **clingers** and belong to the

trophic guilds of **collector-gatherers** and **scrapers**, 1 *Grensia sp.*(?) which inhabits lentic-littoral zones (tundra lakes) and is characterised as a **sprawler** (?), 2 UID juvenile limnephilids and 1 *Rhyacophila coloradensis*. Only 1 stonefly was collected at this site, *Visoka (cataractae)*, Family Nemouridae, belonging to the trophic guilds of **shredder**s-facultative **detritivore**s and **collector-gatherers**.

Chance Creek Main Channel (1 of 2) **96-Dec-19**

Invertebrates from five different groups were found here: Oligochaeta (44%), Ephemeroptera (23%), Diptera (18%), Plecoptera (14%), and Trichoptera (1%). The dominant taxa at this site were naidid oligochaete worms, 42 Family. Naididae and 1 *Nais spp.* representing 44% of the sample. The second most abundant group, the mayflies, contained 22 specimens: 9 *Baetis sp.*, 11 *Cinygmula sp.*, 1 *Ephemerella sp.*, and 1 *Rhithrogena sp.*, all of which belong to the trophic guilds of **collector-gatherers** and/or **scrapers**.

All of the Diptera specimens collected were chironomids: 5 UID juveniles, 1 *Brillia sp.*, 5 *Cricotopus sp.*, 5 *Eukiefferiella sp.*, and 1 *Synorthocladius sp.* Members of the Family Chironomidae inhabit essentially all types of aquatic habitats, including marine, springs and tree holes, are characterised as **burrowers** (most are **tube builders**), and belong to the trophic guilds of **collector-gatherers** and **filterer**s or **predators** (engulfers and piercers). Of the 14 stoneflies collected at this site, 7 were *Capnia sp.* (**sprawler-clinger**; **shredder-detritivore**), and 7 were *Sweltsa sp.* (**clinger**; **predator-engulfer**). Only 1 caddisfly was found here, *Rhyacophila coloradensis*, a **predator-engulfer**.

Chance Main Channel (2 of 2) **96-Dec-19**

Invertebrates from only three different Orders were found here: Diptera (55%), Ephemeroptera (27%), and Plecoptera (18%). Also, the sample consisted of only 11 specimens in total, of which there were: 6 UID juvenile chironomids (the dominant taxa at this site), 3 heptagenid mayflies, *Cinygmula sp.*, **clingers**, belonging to the trophic guilds of **scrapers** (diatoms) and/or **collector-gatherers** (detritus, diatoms), and 2 stoneflies; 1 *Capnia sp.* (**sprawler-clinger**; **shredder-detritivore**), and 1 *Taenionema sp.* (**sprawler-clinger**; **scraper**).

Chance Creek @ Rail Bridge **96-Jul-22**

Invertebrates from five different groups were found here: Ephemeroptera (44%), Diptera (43%), Trichoptera (8%), Hydracarina (3%), and Coleoptera (2%). The dominant taxa at this site were chironomids, *Cricotopus sp.*, representing 21% of the sample (26 specimens). These midges inhabit lentic-vascular hydrophytes (and algal mats, sediments, detritus), lotic-erosional and depositional zones (some instar 1 planktonic), are characterised as **clingers** (**tube builders**), **burrowers** (**miners** and **tube builders**), and belong to the trophic guilds of **shredder-herbivores** (**miners** and **chewers**) and/or **collector-gatherers** (detritus and algae). Of the remaining 28 Diptera, 26 were also chironomids: 19 UID juveniles, 3 *Cardiocladius sp.*, 2 *Eukiefferiella sp.*, and 2 *Polypedilum (Pentapedilum) sp.* The last 2 Diptera specimens were empidid flies, Chelifera sp.

The mayflies contained 55 specimens: 16 *Baetis sp.*, 1 *Cinygmula sp.*, 16 *Epeorus (Iron) albertae*, 5 *E. I. deceptivus*, 1 *Ephemerella coloradensis*, 13 *E. (Seratella) tibialis*, 2 *Ephemerella sp.*, and 1 *Rhithrogena sp.* (all of which are **collector-gatherers** and/or **scrapers**). Ten caddisflies were collected at this site: 1 UID pupa, 1 UID juvenile hydroptilid, 1 *Hydroptila sp.* (piercer-**herbivore**, **scraper**), 2 *Rhyacophila (acropedes or vao)*, 2 *R. angelita*, 2 *R. coloradensis*, and 1 *R. tucula* (all of which are **predator-engulfers**). Also found at this site were: 2 riffle beetles; 1 adult, 1 larva, both *Lara sp.* (Fam. Elmidae), and 4 water mites; 1 UID juvenile, 2 *Lebertia sp.*, and 1 *Sperchon sp.*

Chance Creek Reach 1 96-Jul-22

Invertebrates from seven different groups were found here: Ephemeroptera (67%), Diptera (25%), Trichoptera (3%), Hydracarina (3%), Plecoptera (1%), Coleoptera (1%), and Oligochaeta (1%). The dominant taxa at this site were heptagenid mayflies, *Epeorus (Iron) albertae*, representing 30% of the sample (24 specimens). These mayflies inhabit lotic-erosional zones, are characterised as **clingers**, and belong to the trophic guilds of **collector-gatherers** (detritus, diatoms) and/or **scrapers**. The remaining Ephemeroptera were: 14 *Baetis sp.*, 2 *Cinygmula sp.*, 5 *Epeorus (Iron) deceptivus*, 1 *Ephemerella coloradensis*, 2 *E. doddsi*, 3 *E. (Seratella) tibialis*, 1 *Ephemerella sp.*, and 2 *Rhithrogena sp.* (all of which are **collector-gatherers** and/or **scrapers**).

The second most abundant group, the true flies, contained 20 specimens, all of which were chironomids: 5 UID juveniles, 1 *Cardiocladius sp.*, 1 *Corynoneura sp.*, 3 *Cricotopus sp.*, 1 *Eukiefferiella sp.*, 1 *Micropsectra sp.*, 5 *Polypedilum (Pentapedilum) sp.* (**climber-clinger**, **shredder-herbivore**, **collector-gatherer** and/or **filterer**?, **predator-engulfer**), 1 *Thienemanniella sp.*, 1 *Thienemannimyia sp.*, and 1 *Zavrellimyia sp.* Two caddisflies were collected at this site: 1 *Rhyacophila angelita*, and 1 *R. coloradensis*, both of which are **predator-engulfers**. The only stonefly found here was 1 *Visoka (cataractae)*, a **shredder-detritivore**. Also collected at this site were: 1 larval, riffle beetle, *Narpus sp.* (Fam. Elmidae), 2 water mites; 1 *Lebertia sp.*, and 1 *Oribatei*, and 1 oligochaete worm, Family Lumbriculidae.

Chance Creek Reach 2 96-Jul-22

In contrast to the upper reach of the creek which was chironomid dominated, Reach 2 was dominated by mayfly nymphs (Order Ephemeroptera). Amongst the mayflies present, 40 were from the family Heptageniidae, 16 were Ephemerellidae, 14 were Ameletidae (formerly in Siphlonuridae) and 10 were Baetidae. The Ameletidae were not found in the upper reach. *Ameletus* are **scrapers** and **collector-gatherers** which feed on detritus and diatoms. They are **swimmers** and **clingers** and, like the other three mayfly families in Reach 2, are typical of riffle zones.

The true flies (Order Diptera) accounted for 14% of the invertebrates and included one blackfly specimen and 16 Chironomids. Four larval *Phaenopsectra sp.* (Sub-Family Chironomini) were found; as well as 6 larval Orthocladiinae and 6 larval Diamesinae. Some of the Orthocladinae and the Diamesinae are **sprawlers** who have specialised abilities to remain on the surface of floating leaves or on the surface of fines sediments without clogging their gills. The *Phaenopsectra* species are **tube builders** which are usually found in lakes. They are **scrapers** and **collector-gatherers**.

The stoneflies (Order Plecoptera) were the next most abundant group and included 9 specimens form the Family Chloroperlidae and 4 from the Family Perlidae. Both the Perlidae family and some Chloroperlidae species are **predators** (engulfers) who attack and eat other animals including other insects. One specimen of the *Sweltsa* Genus was found- these insects are known to feed on both Chironomids and Blackflies. This may account for the lower numbers of Dipterans found in Reach 2 as compared to Reach 14.

Ten Caddisflies were found (Order Trichoptera): 7 *Rhyacophila spp.* (Family Rhyacophilidae) and 3 *Clostoeca sp.* (Family Limnephilidae). *Rhyacophila* are predatory while *Clostoeca* species are **shredders-detritivores**. *Clostoeca* species are typically found in lotic waters in depositional zones or around groundwater seeps. Their cases are made up of large leaf pieces with flanges and are somewhat flattened. One water mite (Hydracarina) was identified.

The presence of lotic species in this reach as well as the large proportion of **predators** suggests that the waters move more slowly than in Reach 14. The insects here appear to be relying on the detritus which may settle out of the water column as the waters slow down.

Chance Creek Reach 13 96-Jul-25

Invertebrates from five different groups were found here: Ephemeroptera (80%), Diptera (13%), Trichoptera (4%), Plecoptera (3%), and Hydracarina (1%). The dominant taxa at this site were baetid mayflies, *Baetis sp.*, representing 31% of the sample (36 specimens). These mayflies inhabit lotic, erosional and depositional zones, are characterised as **swimmers** , **climbers** and/or **clingers**, and belong to the trophic guilds of **collector-gatherers** (detritus, diatoms) and/or **scrapers**. The remaining Ephemeroptera were: 3 *Ameletus sp.*, 6 *Cinygmula sp.*, 14 *Epeorus (Iron) albertae*, 22 *E. (I.) deceptivus*, 1 *Ephemerella doddsi*, 1 *E. (Seratella) tibialis* (all of which are **collector-gatherers** and/or **scrapers**), and 9 *Paraleptophlebia sp.* (**collector-gatherer** of coarse material, facultative **shredder-detritivore**).

The second most abundant group, the true flies, contained 15 specimens, all of which were chironomids: 1 UID juvenile, 1 UID adult, 5 *Cricotopus sp.*, 4 *Micropsectra sp.*, 1 *Thienemanniella sp.*, 1 *Thienemannimyia sp.*, and 2 *Zavrellimyia sp.* Five caddisflies were collected here: 1 *Lepidostoma sp.* (**shredder**-detritivore), 3 *Rhyacophila (acropedes or vao)*, and 1 *R. coloradensis* (both of which are **predator-engulfers**). All of the stoneflies found here (3) were *Zapada (haysi)*, a **shredder-detritivore**, **herbivore** on moss. Also collected at this site was 1 water mite, *Sperchon sp.*, Hydracarina.

Chance Creek Reach 14 96-Jul-25

Reach 14 was the uppermost reach of Chance Creek for which water quality data were collected. This site was dominated in late July by larval chironomids (Order Diptera, Family Chironomidae) from the Sub-families Orthocladiinae and Tanytarsini followed by the Diamesinae. The Orthoclidiinae are generally burrowers though the dominant genus, *Cricotopus* contains species which build tubes and anchor themselves to firm substrates. They live in both riffle and pool areas and some have a planktonic first instar. They are shredder-detritivores and collector-gatherers.

Mayfly nymphs from the Families Heptageniidae and Baetidae as well as a few Ephemerellid and Leptophlebiid nymphs accounted for 35% of the invertebrates enumerated. The Heptagenid mayflies are clingers who can withstand strong current and are usually found in riffle areas. They are scrapers and collector-gatherers who feed on periphyton as well as fine organic matter. The Baetid mayflies are swimmers and clingers and are typically found in riffle areas as well as in small pools and along stream margins. They are primarily collector-gatherers which feed upon decomposing fine particulate organic matter. The Ephemerellid species are found in riffles and are generally considered to be collector-gatherers as well. One of Leptophlebiid mayflies found in this reach *Drunella doddsi*, is a predatory species which will attack and eat other animals.

Caddisflies made up eight percent of the inverts found and included 19 *Rhyacophila spp.*, 8 from the family Limnephilidae and 1 Hydropsychid caddisfly. The Limnephilidae are generally shredder-detritivores or collector-gathers and sometimes scrapers. *Rhyacophila* species are clingers and, like *Drunella* , are predatory. The Hydropsychid species spin fine nets which they use to filter detritus from the water. Only eight stoneflies (Order Plecoptera), all nymphs, were present. The dominant stonefly genus, *Zapada*, has a 1-2 year life cycle. It lives in riffle areas and is a shredder-detritivore-herbivore which feeds on leaf litter and moss. Leeches (Class Hirudinea, Phylum Annelida) accounted for 2% of the invertebrates.

These invertebrate data suggest that this reach is dominated by typical riffle species. Most of the invertebrates rely upon detritus for food and there are few shredders in this area to break down leaf litter upon which the others can feed. The secondary mode of feeding appears to be scraping which indicates that the insects are reliant on algal biomass.

Sedimentation Buckets

Total suspended solids in Chance creek were 7 mg/L in the main on September 16, 1997. This agrees with the sediment bucket data which suggests that most transported sediments are comparatively large (> 2.8 mm) and thus would settle out easily.

5.5.12 WAP Prescriptions

Channel structure: Large woody debris should be enhanced to increase microhabitat for macroinvertebrates and to increase the trapping of adult salmon carcasses (5-25 years). Increasing LWD and boulder size will i) enhance refugia habitat to reduce predation and energy expended combating high flows, ii) increase organic matter storage, and, iii) reduce downstream nutrient movement. *Sediment:* hydraulic flushing of excessive sediment deposits is largely ineffective; sediment traps should be placed in reaches to encourage deposition where insufficient spawning sediment exists (5-20 years) ***Hydrology:*** discharge rates can be controlled, in the long term (10-50 years) if upslope and riparian vegetation is undertaken to reestablish interception and evapotranspiration rates. Natural and artificial dams must be removed since they tend to alter natural discharge patterns. *Low flows:* Channel modifications which result in a cessation of rapid hydrologic fluctuations will result in recolonisation of stream banks by riparian trees, shrubs, grasses and forbs and benthic surfaces by aquatic biota and thereby increase trophic complexity (1-10 years). ***Sediment:*** upslope and riparian reforestation will diminish erosion-based soil inputs; this will reduce short term nutrient enhancement and decrease undesirable smothering of instream habitat (10-50 years). ***Water quality:*** *solar insolation:* profiles should be conducted under both open and closed canopies (both deciduous and coniferous). Changes in solar quality and quantity will modify algal community structure and productivity and production (5-25 years). Continuous data logger thermistors should be installed in the creek to define temperature profiles. *Nutrients:* revegetation of the upslope and riparian areas will reduce nutrient loading; this may result, together with increased canopy cover and shading, in reduced summer and autumn periphyton production. Wherever possible periphyton samples should be analyzed, if adequate funding is available. An assessment of winter periphyton production should be conducted, although this watershed is extremely difficult to access in winter due to its large snow pack. ***Riparian and immediate upslope forest:*** Small tributaries and ephemeral streams, which provide lateral shelter, rearing habitat and act as a feedstock production area, must be protected and revegetated where necessary; care should be taken to ensure that they are maintained with respect to protection of trophic in-stream attributes. A survey of ephemeral streams should be made; damaged stream habitat should be restored. *Production of large wood:* the long term perspective should be the production of mature and old-growth forest structure for the production of new wood. Upstream production and subsequent downstream transport, through stream washout and landslides, delivers large structural elements to the lower reaches, although this is on a long term (100-300 year) horizon. *Trophic and organic food production:* mature and old-growth forest and riparian zone vegetation restores natural inputs from terrestrial ecosystems (40-80 years); introduction of leaf litter is essential for provision of structural substrate on which bacterial and protozoan communities develop; macroinvertebrates derive a significant portion of their nutrition from this microbiotic community (5-10 years). This system appeared to have a healthy macroinvertebrate community. Fish gut studies should be conducted to determine what food resources are being used as the primary nutrition source. The creation of specific microhabitat, which provides for the specific requirements of selected algal and micro and macroinvertebrate populations, must be created when channel morphologies are altered (1-10 year

cycles). The only potential for the introduction of **exogenous material,** into the creek, would be through the derailment of railcars on the B.C. Rail line, at the creek's mouth. Since anthropogenic chemicals vary tremendously in persistence, and in toxicity, in the environment, no general recovery times can be provided in the absence of species-specific knowledge of the chemicals. Although *exotic biota,* once established, are typically very difficult to eliminate from indigenous community assemblages, no such species were observed and therefore no generalized recovery time frame can be developed.

5.5.13 RAP Overview

The Riparian Assessment Procedure (RAP) field team investigated four openings along Chance Creek. These were: opening 1 on reaches 3 to 5, opening 2 on reach 13, opening 3 on reach 13, and opening 4 on reach 14. In addition, an opening was investigated along the large tributary entering from the left at the reach 13 demarcation.

It is recommended that riparian rehabilitation be undertaken in Openings 2, 3, and 4 on the mainstem of Chance Creek, and on the tributary opening. This represents an enlargement of the area in Openings 2 and 3 earlier targeted for the enhancement Pilot Project. These portions of Chance creek are:

- Logged right to the banks.
- Unstable because little vegetation remains to attenuate water flows and prevent erosion and debris torrents.
- Easily accessible along the main logging road.

5.5.14 RAP Assessment

The riparian zone along the subject openings has been extensively clearcut to the creek banks on both the left and right sides. The main logging road is located to the left of the creek.

Very few trees remain in the riparian zone along this portion of Chance Creek. At an early successional stage, the riparian area is densely vegetated with herbs and low shrubs, particularly pioneer fireweed.

Several significant tributaries enter Chance Creek within this highly disturbed area, increasing the potential for erosion-related problems.

Regenerating trees in the subject openings include western hemlock, western redcedar, amabilis fir, grand fir, and red alder. The main species in the shrub layers were Sitka mountain ash, red-osier dogwood, Scouler's willow, false azalea, oval-leaved blueberry black huckleberry, bunchberry, salmonberry, thimbleberry, five-leaved bramble, stink currant, and common juniper. Characteristic herb species were fireweed, small-flowered willow herb, Queen's cup, one-sided wintergreen, foamflower, star-flowered false solomon's-seal, rosy twisted stalk, clasping twisted stalk, Indian hellebore, skunk cabbage, arrow-leaved groundsel, pearly everlasting, rattlesnake-plantain, Siberian miner's-lettuce, goat's beard, enchanter's-nightshade, pacific bleeding heart, leatherleaf saxifrage, deer fern, lady fern and oak fern. This species assemblage is characteristic of the site series CWHms1/04, 05, 06, and 11. The soils are of poor to rich nutrient levels, and slightly dry to wet, depending on the microsite.

Management Objectives

The riparian vegetation impact assessment scores for openings investigated on Chance Creek are shown in Table 5.5-4. Management priority should be assigned as follows:

- Foster the establishment of a mosaic of vegetation in the riparian management area.
- Increase the potential for large woody debris and small organic debris inputs to the creek.
- Increase the stream shading potential.
- Attenuate surface water runoff.
- Provide high-quality wildlife habitat.

Table 5.5-4 Chance Creek - Riparian Impact Assessment Scores

Reach Number	Opening Number	Stream Shading	Large Woody Debris	Small Organic Debris	Surficial Sediment Filtering	Subsoil Filtering Capacity
4	1R	medium	high	medium	low	low
5	1A	high	low	low	low	low
6	1B	very high	low	low	low	low
14	2R	high	very high	medium	low	low
14	2L	high	high	medium	low	low
14	3R	high	high	medium	low	medium
14	3L	high	very high	medium	low	medium
15	4R	high	high	medium	low	low
15	4L	high	high	medium	low	low
	trib R	medium	high	low	low	low
	trib L	medium	very high	low	low	low

5.5.15 RAP Prescriptions

It is recommended that a combination of treatments be applied to the subject openings:

- A "nurse tree shelterwood", consisting of black cottonwood, bitter cherry, red alder, and western redcedar along the creek margin, and along lower portions of tributaries, as appropriate

- Clustered planting of grand fir in wet depressional microsites, and of western hemlock on elevated microsites further back from the creek channel

- Enhancement of existing riparian shrub growth by hand slashing of competing fireweed; additional augmentation of berry-bushes, Sitka mountain-ash and red alder.

Table 5.5-5 outlines the recommended treatments.

Table 5.5-5 Chance Creek - recommended rehabilitation treatments and their locations

Treatment	**Site Series**	**Location**	**Recommended Species**	**Stocking Densities (stems/ha)**
Nurse Tree Shelterwood	CWHms1/04, 06	creekside strip	western redcedar	500 - 900
Clustered Planting	CWHms1/05	raised microsites with high amounts of humus and decaying wood	western hemlock	500 - 900
	CWHms1/11	very wet depressional areas	grand fir	500 - 900
Shrub Enhancement	throughout	throughout	removal of fireweed; possible planting of Sitka mountain-ash, red alder, berry bushes	clustered

Table 5.5-6 Chance Creek - twenty year schedule of activities.

YEAR	SPRING	SUMMER	FALL	WINTER
1996 (yr 0)	complete Level 1 assessment	conduct Level 2 assessment	develop draft prescriptions; commence live-stake plantings for pilot project	finalize prescriptions
1997 (yr 1)	continued live-stake plantings at pilot site and elsewhere; stock selection; supply tree seeds to grower for fall and next spring stock; plant shrubs and berry bushes	evaluate success of live stakings; periodic removal of fireweed	additional live-stake plantings; obtain tree seedlings from grower; plant tree seedlings	re-visit prescriptions if modifications warranted
1998 (yr 2)	removal of fireweed; continue conifer planting	evaluate success of all planting; if necessary, plan additional planting; removal of fireweed	additional planting as necessary	
1999 (yr 3)	additional planting as necessary; removal of fireweed	removal of fireweed; evaluate success of all planting; if necessary, plan additional planting	additional planting as necessary	
2000 (yr 4)	inspection			
2001 (yr 5)	inspection	evaluate success of all planting; prescribe additional planting if necessary	begin implementation of year 5 prescriptions	
2002 (yr 6)	continued implementation of year 5 prescriptions			
2003 (yr 7)	inspection			
2004 (yr 8)	inspection			
2005 (yr 9)	inspection			
2006 (yr 10)		evaluate success of all planting; prescribe additional planting if necessary	begin implementation of year 10 prescriptions	
2007 (yr 11)	continued implementation of year 10 prescriptions			
2008 (yr 12) to 2016 (yr 20)	inspections on an as-needed basis, e.g., following large flood events; possible site-specific, small scale prescriptions or repairs as necessary; after 20 years, the sites should be self-sustaining and self-perpetuating			

5.5.16 RAP Quality Assurance/ Quality Control

Five plots (numbers 1 to 3 in Opening 2L; numbers 1 and 2 in Opening 3L) were re-assessed for quality assurance. Overall opening assessment (Data sheet 3) was completed only for Opening 2L where all plots were re-assessed.

Overall Assessment

Overall impact scores varied in three impact categories, large woody debris, surface sediment filtering and subsurface filtering capacity. Overall stream shading impact was calculated to be medium in both surveys. Overall LWD impact was classified as high in the original assessment and medium in the QA/QC review, due to different LWD counts in the plots. Details on the LWD assessment are described below. Small organic debris impacts were identical between assessments, with overall impact scored as medium. Surficial sediment filtering was given a low overall impact in the original survey, and a medium in the QA/QC survey, with the difference in the potential upstream sediment sources category. Subsurface filtering capacity was low for the original survey and medium for the QA/QC survey, due to a difference in subsoil chemical filtering capacity class.

Squamish River Watershed

Upper Squamish River



5.6 Upper Squamish River

Data Summary Sheet

✓	Yes	x	No	?	Unknown

HISTORY

✓	Was watershed logged prior to 1988?
x	Is watershed within a municipal boundary?
✓	Have FRBC funds been spent on watershed?
?	Are FRBC applications pending for work on watershed?

FISHERIES INFORMATION

?	Have forest activities impacted fisheries resources?
✓	Does the watercourse have existing fisheries values?
✓	Does the watercourse have historical fisheries values?
?	Is the watercourse accessible to salmon?
?	Is the watercourse habitat suitable for salmon?
?	Are there enhancement opportunities for salmon?
✓	Is the watercourse habitat suitable for trout and char?
?	Are there enhancement opportunities for trout and char?

WATER QUALITY

?	Does the watercourse have an adequate water quality?
	If not, can it be rehabilitated?
?	Does the watercourse have an adequate food supply?
	If not, can it be restored?
x	Was periphyton community surveyed?
x	Was invertebrate community surveyed?
x	Was water chemistry surveyed?
x	Was sediment or intergravel habitat surveyed?

x	Have there been scientific surveys in the stream?
x	Have nutrient dosing pots been placed in the stream?

HYDROLOGICAL FACTORS

✓	Are there forest-related activity impacts?
x	Are there existing Water Rights (domestic, power, community watershed)?
✓	Is there year-round flow potential?
✓	Are there any existing hydraulic structures (dams, wiers, bridges, etc.)?
✓	Is there a debris-flow potential?

RIPARIAN ZONE

✓	Have forestry activities had negative impact on riparian vegetation?
✓	Is there existing well-established riparian vegetation?
?	Are soil conditions amenable to re-vegetation?
✓	Is the channel morphology appropriate for re-vegetation?
x	Are unrestricted reaches present?
?	Would re-vegetation be expected to benefit fish/wildlife habitat?

TERRESTRIAL PROCESS

✓	Have slopes >60% been logged?
✓	Are roads built on slopes >60%?
x	Is bedrock-geology of basin stable?
✓	Has basin experienced landslides?
?	Have landslides entered mainstream?

H	High	M	Medium	L	Low	U	Unknown

CREEK RATING

M,H	Impacts by logging
U	Fish resources
U	Rehabilitation potential

5.6.1 Factors of Concern

Fisheries

Little is known about fish resources in the Upper Squamish.

Hydrological

The Upper Squamish River is a braided river above the confluence with Ashlu Creek (22 km upstream of the mouth of the Squamish River on Howe Sound). The Upper Squamish watershed has north aspect rising from an elevation about 60 m at it's mouth to 2,260 m at it's headwaters (Pemberton Icefields). The Upper Squamish River has several major tributaries including: High Falls Creek, Shovelnose Creek, Turbid Creek, Elaho River and Dipper Creek.

The Upper Squamish River watershed was been extensively. There has been some regrowth however present clearcuts may increase sediment loading and peak flows in the creek. The main channel has a significant amount of large organic debris and sediment.

At least four bridges have been identified and should be inspected by a Professional Engineer (Hydrological) to find out if the bridge or culvert can pass the 100 year peak flows and to make recommendations for any improvements including removal. The fact that the Upper Squamish River does not have any water rights and is not a designated community watershed reduces the complications of future instream work.

Water Quality

This creek did not receive any detailed monitoring for periphyton, invertebrate, water quality or sediment parameters. It is recommended that the periphyton, invertebrate and benthic habitat be monitored.

Riparian Zone

Much of the Upper Squamish River flows through a restrictive canyon, the walls of which have been heavily logged. In many locations, a leave strip only one tree in width remains beside the river. Erosion problems are evident, and this has resulted in considerable siltation of the river, quite visible from air

photos taken during low-flow conditions. The worst slide problem is on the east bank, between 3 and 3.75 km north of the confluence with the Ashlu River.

Clearcuts which may require stabilization are found on the left (west) side of the river, between 6.1 and 10.4 km upstream from the Ashlu, and on both sides between 10.4 and 13.5 km north of the Ashlu. Opportunities for riparian zone enhancement will probably be identified along these portions of the river as well.

Squamish River Watershed

Cloudburst Creek



5.7 Cloudburst Creek

Data Summary Sheet

✓	Yes	x	No	?	Unknown

HISTORY

✓	Was watershed logged prior to 1988?
x	Is watershed within a municipal boundary?
x	Have FRBC funds been spent on watershed?
?	Are FRBC applications pending for work on watershed?

FISHERIES INFORMATION

?	Have forest activities impacted fisheries resources?
?	Does the watercourse have existing fisheries values?
✓	Does the watercourse have historical fisheries values?
✓	Is the watercourse accessible to salmon?
?	Is the watercourse habitat suitable for salmon?
?	Are there enhancement opportunities for salmon?
✓	Is the watercourse habitat suitable for trout and char?
?	Are there enhancement opportunities for trout and char?

WATER QUALITY

?	Does the watercourse have an adequate water quality?
	If not, can it be rehabilitated?
?	Does the watercourse have an adequate food supply?
	If not, can it be restored?
x	Was periphyton community surveyed?
x	Was invertebrate community surveyed?
x	Was water chemistry surveyed?
x	Was sediment or intergravel habitat surveyed?

?	Have there been scientific surveys in the stream?
x	Have nutrient dosing pots been placed in the stream?

HYDROLOGICAL FACTORS

✓	Are there forest-related activity impacts?
✓	Are there existing Water Rights (domestic, power, community watershed)?
✓	Is there year-round flow potential?
✓	Are there any existing hydraulic structures (dams, wiers, bridges, etc.)?
✓	Is there a debris-flow potential?

RIPARIAN ZONE

x	Have forestry activities had negative impact on riparian vegetation?
✓	Is there existing well-established riparian vegetation?
✓	Are soil conditions amenable to re-vegetation?
✓	Is the channel morphology appropriate for re-vegetation?
✓	Are unrestricted reaches present?
✓	Would re-vegetation be expected to benefit fish/wildlife habitat?

TERRESTRIAL PROCESS

✓	Have slopes >60% been logged?
✓	Are roads built on slopes >60%?
✓	Is bedrock-geology of basin stable?
?	Has basin experienced landslides?
?	Have landslides entered mainstream?

H	High	M	Medium	L	Low	U	Unknown

CREEK RATING

M	Impacts by logging
L	Fish resources
L	Rehabilitation potential

5.7.1 Factors of Concern

Fisheries

Limited water supply (ephemeral in headwaters). Stream has been impacted by residential development. May be enhancement/mitigation opportunities related to urban impacts.

Hydrological

Cloudburst Creek is a steep mountain creek with a watershed area of approximately 9 km^2, is tributary to Pillchuck Creek which in turn is tributary to the Squamish River at 26 km upstream of the mouth of the Squamish River on Howe Sound. The watershed has a east aspect to southeast aspect rising from an elevation about 310 m at it's mouth to 1,870 m at it's headwaters (Cloudburst Mountain) over it's 8.5 km channel length. For the first 3 km the creek is relatively flat. The Cloudburst Creek watershed was been logged in the lower part of the watershed. There has been some regrowth however present clearcuts may increase sediment loading and peak flows in the creek.

One crossing including one bridge (at the confluence with Pillchuck Creek) has been identified and should be inspected by a Professional Engineer (Hydrological) to find out if the bridge or culvert can pass the 100 year peak flows and to make recommendations for any improvements including removal. There is only one intermittent lake located on Cloudburst Mountain.

The fact that Cloudburst Creek has existing water rights (C102363, Z110242, C048527, C048528 and Z110243) for domestic, power generation and irrigation purposes, may complicate future instream work. The overall steep slope (average 22%) could sustain debris-laden floods under the right conditions. Prior to proceeding with instream works, a channel assessment should be carried out in the field.

Water Quality

This creek was not surveyed for its periphyton or invertebrate communities. No water quality data was obtained for this creek. It is though that some data has been obtained for this creek as part of the MOELP survey of Cheakamus River.

Riparian Zone

Cloudburst Creek flows approximately 3.7 km from its source, a glacial lake on the southwest flank of Cloudburst Mountain, to its confluence with Pillchuck Creek. The first 1.2 km of flow is within a narrow gorge with a steep gradient down the side of Cloudburst Mountain. The final 2.5 km of the creekbed is very gently sloping, as the creek flows along the base of the mountain to Pillchuck Creek. No recent effects of forestry activities were found from air photos. Some opportunities for riparian zone vegetation enhancement may exist on the lower, flatter portion of the creekbed.

Watershed Assessment Report Sheet

	(1)	(2)
Watershed Name?	Cloudburst Creek	
Map units are in: (1=km. and sq.km.; 2=m. and ha.)	1	
Total watershed area (TA)	11.73	sq.km.
Peak Flow		
Area below 300 m.	4.71	sq.km.
Area between 300 and 800 m.	3	sq.km.
Area above 800 m.	3.18	sq.km.
Road length between 300 and 800 m. (not used)	9.4	km.
Surface Erosion		
Total road length	11.2	km.
Length of road on erodable soils?	0.6	km.
Roads within 100 m. of a stream?	1.6	km.
Number of active stream crossings?	3	
Riparian Buffer		
Total stream length?	11.2	km.
Length of stream logged?	0	km.
Length of mainstem?	7.8	km.
Landslides		
Length of road on unstable terrain?	0.6	km.
Area logged on unstable terrain?	8	sq.km.
Headwaters		
Length of headwater streams logged?	0	km.
Number of crossings on headwater streams?	0	

FOR REACH BREAKS SEE MAPS 92G084 (in back pocket).

5.7.2 FHAP Overview

Cloudburst Creek is a tributary to Pilchuck Creek which ultimately drains into the Squamish River. The first 5.3 km of Cloudburst Creek runs through a residential area and, consequently, the creek is and has been subject to urban impacts such as water removal, re-channelization and inputs from landowners (e.g., fertilizer). As of March 1996, there were five active water licences on Cloudburst Creek (BCMELP, 1996, file data). Three water licences were for domestic purposes which allowed water removal from January 1 to December 31. One of these licences also allowed water removal for irrigation. A fourth licence allowed water removal from April 1 to September 30 for irrigation purposes, and the fifth licence allowed water removal for the purposes of generating commercial power. Fish species historically observed in the creek include: juvenile and adult coho salmon and cutthroat trout (BCMELP, 1978, file data; SISS, 1988).

A FHAP assessment was conducted from August 21 to 22, 1996, in Cloudburst Creek from its confluence with Pilchuck Creek to a cascade located approximately 5.3 km upstream. This area was divided into thirteen reaches. The dominant habitat type was glide from Reaches 1-12, which changed to cascade in Reach 12 and continued in Reach 13. The gradient in Reach 13 changed from 6 to >15% and represented an impassable barrier to fish in the form of a waterfall. The dominant substrate in all reaches was sand, except in Reach 13 where the dominant substrate was cobble and boulders. Water flow throughout the reaches surveyed was mainly stagnant, and appeared to be of poor quality (i.e., iron deposits), particularly in Reaches 2, 3 and 4. The main water source for the creek seemed to come from a tributary located in Reach 11, rather than from the mainstem at this point. The tributary contained gravel substrate suitable for spawning, adequate cover from overhanging vegetation and LWD, and had a good flow.

Overhanging vegetation SWD supplied most of the cover in Reaches 1-12. Side channels were noted in Reaches 3, 5 and 6, and were accessible to fish at high flows only. Tributaries were observed in Reaches 3, 4, and 11, but were dry during the August assessment. Potential barriers to fish consisted of beaver dams which spanned the wetted width of the creek in Reaches 2, 5, and 6. The height of these beaver dams ranged from 1 to 2 m and may be impassable to fish at low flows. Disturbance indicators included braiding of the channel and aggradation of debris in Reaches 12 and 13, and extensive areas of unvegetated bars in Reach 13. The primary factors limiting fish habitat in Cloudburst Creek were a lack of water flow and a lack of habitat complexity.

5.7.3 FHAP Assessment

Habitat Types

A summary of habitat types identified from August 21 to 22, 1996, is provided in Appendix E. Habitat consisted predominantly of glide and cascade. Average gradient ranged from 0.5 to >15%. No pool habitat was identified by the field crew during the August assessment.

Off-channel Habitat

Side channels were observed in Reaches 3, 5 and 6, and were accessible to fish at high water flows only. Tributaries which may be considered as potential off-channel habitat were noted in Reach 3 at 1.2 km, in Reach 4 at 2.0 km, and in Reach 11 at 4.4 km. Locations of tributaries were reported upstream of the Cloudburst Creek-Pilchuck River confluence. These tributaries were dry.

Large Woody Debris (LWD)

Appendix E provides LWD loading data for reaches with LWD. LWD per bankfull width ranged from 0.16 to 4.34, indicating poor to good quality rearing habitat based on the diagnostic table provided in Johnston and Slaney (1996). However, the potential rearing habitat in the majority of reaches surveyed in Cloudburst Creek are classified as poor, Good quality LWD was observed only in Reach 7. Consequently, based on these diagnostics, the amount of functional LWD provided little rearing habitat for anadromous and resident fish.

Substrate Type

Substrate type observed in each reach surveyed in Cloudburst Creek and associated spawning habitat potential is provided in Appendix E. Dominant substrate type in most of the reaches surveyed was sand, providing little habitat for spawning. Patches of gravel were observed in Reaches 4-12. Due to the low gradient and low flow rates in this section of the creek, it seemed unlikely that these gravel patches were the result of natural hydrological movements. Rather, gravel had been placed into these sections of the creek in an attempt to increase fish habitat. Potential spawning habitat in these sections of gravel ranged from low to high suitability.

Fish Distribution

Fish presence/absence was determined by electroshocking in Reaches 6 and 10 in Cloudburst Creek on September 9, 1996. Fish distribution data is summarized in Table 5.7-1. Fish captured included coho salmon, cutthroat trout, rainbow trout, and an unidentified species thought to be stickleback. Coho captured in Reach 6 ranged in fork length from 50 to 70 mm, and stickleback ranged from 50 to 55 mm. Only one cutthroat trout was captured in this reach whose fork length measured 120 mm. Coho captured in Reach 10 measured 45 to 55 mm, rainbow measured 50 to 140 mm, and stickleback measured 25 to 30 mm. Although electroshocking was not conducted in all reaches, juvenile fish were observed in most reaches assessed.

Historically, fish species observed in Cloudburst Creek had included juvenile and adult coho salmon and cutthroat trout (BCMELP, 1978, file data; SISS, 1988). However, it is possible that other species of fish also frequent waters of Cloudburst Creek. Fish species observed in Pilchuck Creek include: coho, chum, steelhead, cutthroat, Dolly Varden, brook trout and rainbow trout (SISS, 1988). Consequently, it would be expected that these same species would also be observed in Cloudburst Creek in different seasons as Cloudburst Creek is tributary to Pilchuck Creek and there was nothing to prevent immigration. This needs to be confirmed by additional fish capture and identification studies in Cloudburst creek at different seasons.

Table 5.7-1 Summary of fish capture data in Cloudburst Creek (1996).

Reach No.	Date of Electroshocking	Electroshocking Effort (seconds @ voltage)	Species Captured	Stream Class
6	September 9, 1996	398 @ 200	Coho, Cutthroat, Stickleback	S2
10	September 9, 1996	202 @ 400	Steelhead, Coho, Stickleback	S2

Adult Upstream Migration

The FHAP assessment was conducted in August and September at which time adult fish were not observed in the system.. However, historical data reports the migration of adult coho salmon to a distance of 4.5 km upstream of the Cloudburst Creek-Pilchuck River confluence (SISS, 1988). Our study agrees with SISS (1988). Several beaver dams were observed in Cloudburst Creek which may act as a barrier to the upstream migration of adult fish at low water flows. Beaver dams were observed in Reaches 2, 5 and 6, spanned the width of the creek, and ranged in height from 1 to 2 m.

Spawning and Incubation Conditions

Potential spawning habitat was observed in Reaches 4-12, and varied from little suitable spawning habitat to abundant. Potential spawning habitat in these sections of gravel ranged from low to high suitability. Based largely on the hydrology of Cloudburst Creek in these reaches, the gravel was assumed to be of anthropogenic origin, placed there in an attempt to increase spawning habitat. However, the functionality of these gravel patches was questionable as most of it was compacted with sediment. No spawning habitat was observed in Reaches 1-3 due to the sandy substrate and in Reach 13 due to substrate dominated by cobble and boulders.

Summer Rearing Habitat

Appendix E tables provide a summary of potential cover types observed in Cloudburst Creek during the August 1996 FHAP assessment. Cover in Reaches 1-12 was dominated by SWD and OV. IV cover was observed in Reaches 3-5, 7 and 11. Undercut banks were observed in Reach 5, and boulder cover was observed in Reach 13. In general, overhead cover for rearing habitat was good in Reaches 1-10, but poor in Reaches 11-13. Boulder cover was poor in all reaches, and therefore provided little summer rearing habitat.

Winter Rearing Habitat

Several side channels and tributaries were identified along Cloudburst Creek which could provide suitable winter rearing habitat for fish depending on water levels. In addition, some sections of the creek may be deep enough to provide overwintering habitat. However, the water in this creek may be more subject to freezing due to the low flow rates and, consequently, any developing ice layers may be thicker than expected in streams with a higher flow rate. Since this assessment was conducted in the summer, it was difficult to assess the amount of winter rearing habitat available in Cloudburst Creek. Further

investigation should be conducted during the winter months to determine water levels, flow rates and accessibility of off-channel habitat.

Juvenile Migration

An impassable barrier to the upstream migration of juvenile fish, in the form of a waterfall/cascade with gradient >15%, was identified in Reach 13. Potential barriers in the lower reaches included several beaver dams and were dependent on water levels. Consequently, juvenile fish were expected to migrate freely throughout the first 5.0 km of Cloudburst Creek under most conditions.

5.7.4 FHAP Prescriptions

Based on the above FHAP assessment, the most limiting factors to fish in Cloudburst Creek were unstable upstream reaches, the low flow rates and a lack of habitat complexity. A number of rehabilitation/restoration options existed which would address these limitations. The hydraulic flow of the creek must be increased in the lower section of the creek. This can be accomplished by reviewing water licences so that less water is removed from the system, by decreasing channel width, and/or by dredging some of the channel. Increasing hydraulic flow of the creek would serve to increase spawning potential. Once the flow has been increased, spawning habitat can be further enhanced by depositing more gravel into the creek at selected sites. Once the flow has been increased, habitat complexity can be increased by adding more LWD for the purpose of creating more pool habitat and by developing side channels. Fish passage can be improved by altering some of the beaver dams. Before fish habitat can be restored in the lower reaches of the creek, the upper sections need to be stabilized.

Future Studies

Assessment of overwintering habitat in Cloudburst Creek should be undertaken to determine potential habitat limitations at that time of the year. Once the upper watershed of Cloudburst Creek has been stabilized, potential fish habitat restoration opportunities in the lower reaches should be reassessed.

5.7.5 FHAP QA/QC

Sections of Reaches 2, 8 and 9 were assessed in early September by the FHAP supervisors as part of the QA/QC program. Comparative data collected by the field crews and the supervisors is provided in Appendix E. Parameters such as percent gradient, mean bankfull depth and width, dominant bed material, spawning gravel, percent overhead cover, and canopy cover were similar between the two assessments. Variability was observed in identification/measurement of habitat type, maximum water depth, mean wetted width, pool frequency, functional LWD and off-channel habitat. Of these latter parameters, the greatest discrepancies were observed for habitat type, pool frequency and functional LWD.

Habitat type identified during the August assessment by the field crew was glide. In contrast, the habitat type identified in the September assessment conducted by the supervisors consisted of pools. This difference is most likely explained by a change in flow rates.

The results of the QA/QC program emphasized the need for conducting FHAP assessments in more than one season so that the natural variability in potential fish habitat can be documented and restoration options designed accordingly. In addition, the definition of pool habitat needs to be clarified and the definition of "functional" LWD needs to be revised and standardized so that potential fish habitat is not underestimated.

5.7.6 CAP Overview

Limiting factors in Cloudburst Creek include the unstable upstream reaches, and nearby road run-off. Several patches of oil were found within the creek. There is also LWD functioning within the channel.

5.7.7 CAP Assessment

Summary results for field data collection on Cloudburst Creek are presented in Table 5.7-2.

Table 5.7-2 Cloudburst Creek field data summary table.

Reach	Bankfull		Slope	Average Rock	Relative	Power	Sensitivity	Channel	Channel
	Width (m)	Depth (m)	(%)	D (m)	Roughness	Index	Rating	Condition	Type
1	7.8	1.43	1	0.03	0.02	11	L	Stable	Riffle-pool
2	10.64	0.66	0.8	0.02	0.03	6	L	Stable	Riffle-pool
3	17.92	0.84	1.1	0	0	17	L	Stable	Riffle-Pool
4	14.76	0.96	0.2	0.04	0.04	3	M	Stable	Riffle-Pool
5	12.36	0.88	0	0.06	0.07	0	L	Stable	Riffle-Pool
6	16.4	1.1	0	0	0	0	L	Stable	Riffle-pool
7	26.88	1.04	0.7	0.06	0.05	20	L	Stable	Riffle-pool
8	11.22	0.84	0.3	0.18	0.21	3	L	Stable	Riffle-pool
9	9.6	0.77	0	0.23	0.30	0	M	Stable	Riffle-pool
10	4.27	0.77	0.5	0.2	0.26	2	M	Stable	Riffle-pool
11	23.9	1.28	0.5	0.12	0.09	15	M	Stable	Riffle-pool
12*	-	-	-	-	-	-	-	-	-
13	15.32	2.08	13.6	1.06	0.51	433	H	Aggraded	Step-pool

* Creek flows underground within Reach 12.

Reaches 1 - 11

Glide Morphology
Sand and Gravel Bed Material
Sensitivity Rating: Medium

Reaches 1-11 represent the portion of the creek flowing at the base of Cloudburst Mountain toward the confluence with Pilchuck Creek. The creek meanders roughly parallel with a major roadway. The majority of the reach breaks indicated are based on the presence of bridges crossing Cloudburst Creek. These bridges are for residential use, and would provide good access for stream restoration works.

These reaches have a fairly consistent slope of less than 1%. The general bed material is dominated by a layer of fine silt, with rare instances of gravel material. These conditions have resulted in a very slow-moving channel along a flat area, creating swamp-like conditions in several places. Beaver dams are present throughout the link, composed mostly of small woody debris. Large woody debris is found dispersed throughout the channel.

Sensitivity in these reaches is mainly concerned with the potential for an upstream disturbance to cause downstream effects. Another factor of concern includes the nearby road runoff. Several patches of oil were found within the creek.

Restoration potential is very high in these reaches. In particular, side channels could be built in various sections to promote spawning areas in cooperation with fisheries habitat recommendations. The creek itself needs cleaning to remove garbage. All reaches have good access.

Reaches 12 & 13

Boulder, Cobble and Gravel Bed Material
Sensitivity Rating: Medium

Reaches 12 and 13 were found to be highly sensitive, and could present major problems for downstream restoration works. Evidence of major reoccurring debris flows exiting from the canyon was found in these reaches. Trees were found to be bruised by debris flow, and the forest floor was covered in mounds of large rock and logs. If a log jam were to occur somewhere within the canyon and be blown out by a high water event, downstream reaches would be severely affected. In addition, there is a house locatedat the base of the mountain directly in line with a debris flow. Brian LaCas, P. Eng., warned the property ownver of possible dangers.

Upper Reaches

The upper reaches were not assessed due to access problems, and has only been assessed by aerial photographs. If future logging were to occur in the upper watershed, it may increase the likelihood of a debris event in Cloudburst Creek.

5.7.8 CAP Prescriptions

Creek Prescriptions (Year One)

All instream construction should be subject to a Debris Flow Review and a Bridge/Culvert Sizing Review. Restoration potential is very high in lower reaches. In particular, side channels should be constructed in Reaches 1 and 2 to promote spawning areas in cooperation with fisheries habitat recommendations. The creek channel needs cleaning to remove foreign debris.

Creek Prescriptions (Year Two to Five)

In the following two to five years, Cloudburst Creek should have continued channel morphology reconstruction done. Previous channel construction should be inspected for stability. Channel construction should be carried out from the top down. The lower reaches should be reconstructed at this time if deemed necessary.

General Creek Work Involved (Year Five to Twenty)

A general inspection of river stability should be carried out every two years for the proceeding five years. At this time, any instream work necessary should be identified and carried out immediately. A summary report should be written up detailing the progress and any deficiencies within the creek at the end of each inspection. After year ten an inspection should be carried out every five years. Again, if instream work is necessary it should be identified and carried out immediately.

5.7.9 CAP Quality Assurance/Quality Control

All data collected in the field and entered into electronic forms was checked for transcription accuracy. QA/QC was conducted on approximately 20% of Cloudburst Creek by field confirmation of values by specialists at specified reaches. All measurements were duplicated at specific cross-sections and compared with field crew results.

5.7.10 WAP Overview

Elevated temperatures in the mid reaches were approaching the maximum acceptable values, beyond which salmonids would be at risk from overheating. As well, the dissolved oxygen values in a number of reaches was at, or below, the permissible level for salmonids. Increasing the flows to the stream would likely decrease the temperatures and increase oxygen concentrations.

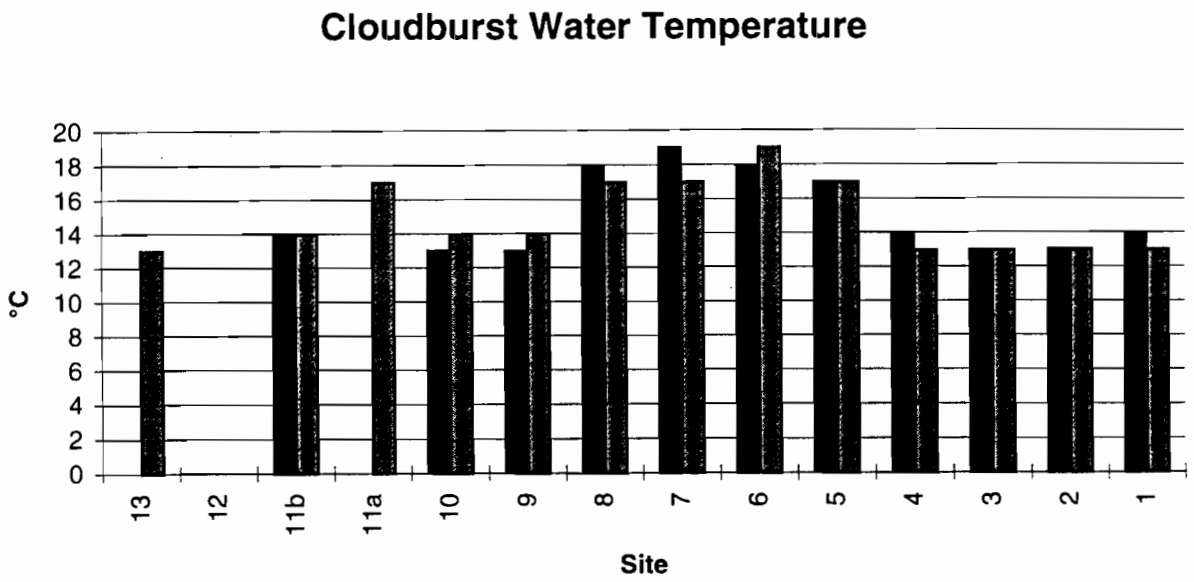
5.7.11 WAP Assessment

Temperature

Temperatures were above 13 °C in all reaches, ranging from 13 ° C, in the upper reaches to 19 °C in reaches 5 through 8. The higher temperatures in the mid reaches are approaching those at which juvenile salmonids become stressed to the point that, if they remain at these temperatures for prolonged periods, their health may be adversely affected. The higher temperatures reflected the open canopy in the mid reaches, which may also be subjecting the fish to enhanced UV-B irradiation. This creek also had numerous quiescent pools and backwaters in which there was no visible flows. Such areas are typically higher in temperature and may also be subject to enhanced evaporation rates. If the water lost to evaporation is not replaced at the same rate the pools can become substantially reduced in size (or may dry up completely) increasing the environmental stress to any fish trapped in the pool.

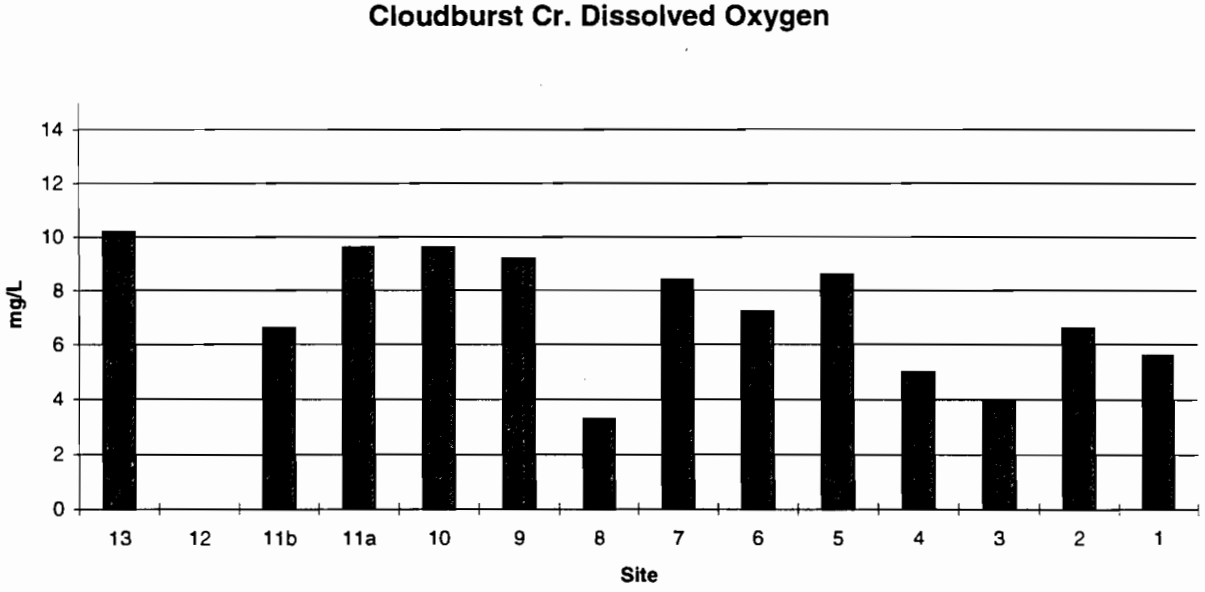
Table 5.7-3 Cloudburst Creek summary table.

Reach	Morphology	Assessment	Prescription	Timing	Year	Rating
1 2 3 4 5 6 7 8 9 10 11	Glide Sand & Gravel Bed Material	These reaches represent the lower portion of the creek flowing alongside the base of Cloudburst Mountain toward the confluence with Pilchuck Creek. Most of the reach breaks indicated are based on the bridge crossings on Cloudburst Creek. These bridges are for residential use, and provide good access for stream restoration works. These reaches have a mild slope of less than 1%. The general bed material is dominated by a layer of fine silt, with rare instances of gravel material. These conditions have resulted in a very slow-moving flow creating swamp-like conditions. Beaver dams are present.	Limited cleaning of the channel including removal of excessive LWD and foreign debris. Construction of side channels on Reaches 1 and 2.	July 15 - Aug. 15	1	M
12 13	Cascade Pool Boulder & Cobble Bed Material	Reaches 12 and 13 show evidence of major re-occurring debris flows exiting from the canyon. Trees were found to be bruised by debris flow, and the forest floor downstream of the canyon is buried in boulders and logs.	A Professional Geotechnical Engineer should assess the likely return period for a debris flow and potential debris flow production volume. There is a real concern for not only future restoration works downstream but for the people in the homes at the base of the slope.		1	H

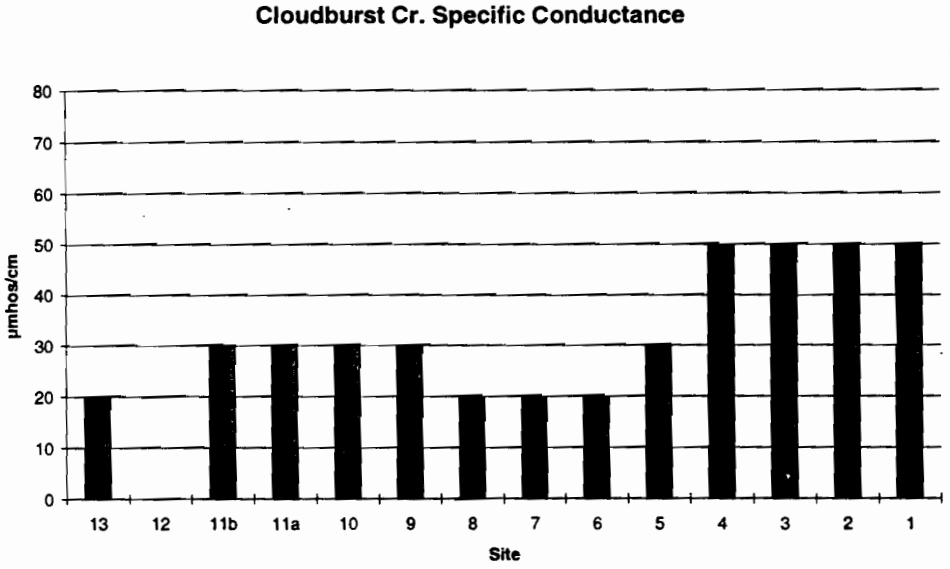


Dissolved Oxygen and Specific Conductance

Dissolved oxygen values fluctuated significantly in the creek, ranging from a low of 5 mg/L to a maximum of 10 mg/L; DO values mirrored those of temperature. Reaches 1 – 4, and 8 were all at or below the minimum acceptable dissolved oxygen concentrations, for the maintenance of salmonid health. The low values reflected both elevated temperatures and reduced, or non-existent, stream flows. The high biomass observed in a number of pools would have elevated their BOD, thereby reducing the oxygen concentrations.



Specific conductance values were lowest in the upper reaches (20 to 30 µmhos/cm), being highest in the four lower reaches (50 µmhos/cm). The values may have been at artifact of the absence of stream discharge from the lake. The visual observation of the lake was that it appeared to have moderate growth, indicating that outflow discharges would likely have elevated nutrients. The year three assessments should include some measure of lake nutrient profiles. Should the lake water also be nutrient poor, this creek should be considered a candidate for nutrient enrichment. Specific conductance values in this creek were generally slightly higher than in Chance but similar to those of Brohm.



Periphyton & Nutrient Dosing Pots

Periphyton samples were not analysed for Cloudburst Creek. Nutrient dosing pots were not deployed in Cloudburst Creek.

Invertebrates

Cloudburst Reach 5

This site was dominated by dipterans (73%) with few mayflies (8%) and even fewer stoneflies (4%). The diversity of organisms was much lower than that at all other sites in the stream.

Cloudburst Reach 6 96-Aug-14

Invertebrates from twelve different groups were found here: Diptera (34%), Ephemeroptera (29%), Oligochaeta (19%), Hydracarina (12%), Plecoptera (3%), Trichoptera (1%), Amphipoda (1%), Coleoptera (<1%), Bivalvia (<1%), Collembola (<1%), Homoptera (<1%), and terrestrial Oligochaeta (<1%). The dominant taxa at this site were leptophlebid mayflies, *Paraleptophlebia sp.*, representing 27% of the sample. These mayflies inhabit lotic-erosional zones (sediments and detritus), are characterized as swimmers, clingers, sprawlers, and belong to the trophic guilds of collector-gatherers (coarse detritus, diatoms) and/or facultative shredder-detritivores. The remaining Ephemeroptera were: 2 *Baetis sp.*, 2 *Epeorus (Iron) deceptivus*, 1 *Ephemerella doddsi*, and 1 *Rhithrogena sp.* (all of which are collector-gatherers and/or scrapers).

The most abundant group, the true flies, contained 95 specimens: 50 were chironomids (22 UID juveniles, 1 UID pupa, 5 *Cardiocladius sp.*, 4 *Cricotopus sp.*, 3 *Eukiefferiella sp.*, 3 *Heleniella sp.*, 3 *Micropsectra sp.*, 1 *Psectrocladius sp.*, 1 *Synorthocladius sp.*, and 7 *Thienemannimyia sp.*), 39 were black flies, characterized as clingers, and belonging to the trophic guild of collector-filters (1 UID Fam. Simulidae adult, 33 *Simulium sp.* larvae, and 5 *Simulium sp.* pupae), and 6 were crane fly larvae (*Dicranota sp.*, Fam. Tipulidae).

The third most abundant group, the oligochaetes, contained 53 specimens, of which 51 were UID juveniles of the Family Tubificidae, 1 was *Nais sp.*, and 1 was *Chaetogaster sp.* (both of the Family Naididae). The fourth most abundant group, the water mites (Hydaracarina), contained 34 specimens, of which 27 were *Lebertia sp.*, 4 were *Sperchon sp.*, and 3 were UID juveniles. Eight stoneflies were collected at this site: 2 *Capnia sp.* (shredder-detritivore), 3 *Zapada (haysi)*, and 3 *Zapada sp.* (both of which are shredder-detritivores and/or herbivores on moss).

The remaining 7 groups of organisms were represented by less than 2 specimens each: Trichoptera (2 *Psychoglypha sp.*, a collector-gatherer and/or shredder-detritivore), Amphipoda (2 *Crangonyx pseudogracilis*), Coleoptera (1 UID adult), Bivalvia (1 *Pisidium sp.*), Collembola (1 terrestrial, *Isotomurus sp.*), Homoptera (1 terrestrial, Fam. Aphididae), and terrestrial Oligochaeta (1 Fam. Lumbricidae).

Cloudburst Reach 10 96-Aug-19

Invertebrates from thirteen different groups were found here: Diptera (75%), Plecoptera (16%), Oligochaeta (5%), Ephemeroptera (3%), Hydracarina (<1%), Trichoptera (<1%), Bivalvia (<1%), Nematoda (<1%), Coleoptera (<1%), Copepoda (<1%), Gastropoda (<1%), Homoptera (<1%), and Hymenoptera (<1%). The dominant taxa at this site were black fly larvae, *Simulium sp.*, representing 54% of the sample (934 specimens). These black fly larvae inhabit lotic and lentic erosional zones, are characterized as clingers, and belong to the trophic guild of collector-filterers. The remaining Diptera were: 1 'noseeum', *Palpomyia sp.* (Fam. Ceratopogonidae), 343 chironomids (212 UID juveniles, 3 UID pupae, 1 UID adult, 14 *Brillia sp.*, 5 *Cardiocladius sp.*, 39 *Cricotopus sp.*, 25 *Eukiefferiella sp.*, 43 *Micropsectra sp.*, and 1 *Synorthocladius sp.*), 18 black fly pupae, *Simulium sp.*, and 6 crane fly larvae (2 *Dicranota sp.*, and 4 *Hexatoma sp.*).

The second most abundant group, the stoneflies, contained 274 specimens: 205 *Zapada sp.*, 43 *Zapada (haysi)* (both of which are shredder-detritivores and/or herbivores on moss), 5 *Sweltsa sp.*, 2 *Doroneuria sp.* (both of which are predator-engulfers), and 19 *Capnia sp.* (shredder-detritivore). The third most abundant group were oligochaete worms (87 specimens), of which 85 were UID juveniles of the Family Tubificidae, 1 was *Chaetogaster sp.*, and 1 was of the Family Lumbriculidae. The fourth most abundant group, the mayflies, contained 56 specimens: 15 *Baetis sp.*, 1 *Cinygma sp.*, 1 *Cinygmula sp.*, 1 *Epeorus (Iron) deceptivus*, 2 *Ephemerella (Seratella) tibialis*, 3 *Rhithrogena sp.* (all of which are collector-gatherers and/or scrapers), and 33 *Paraleptophlebia sp.* (collector-gatherer and/or facultative shredder-detritivore).

The water mites, Hydracarina, were represented by 7 specimens: 4 UID juveniles, 2 *Lebertia sp.*, and 1 *Sperchon sp.* Four caddisflies were collected at this site: 2 UID pupae, 1 *Glossosoma sp.* (scraper), and 1 *Onocosmoecus sp.* (shredder). Also, 4 bivalves were found here, all *Pisidium sp.*, and 3 nematodes. Finally, the remaining 5 groups of organisms were represented by 1 specimen each: Coleoptera (1 larval, *Cylloepus sp.*, a clinger, belonging to the guilds of collectors and/or scrapers), Copepoda (1 *Harpacticoida*), Gastropoda (1 *Gyraulus parvus*), Homoptera (1 terrestrial, Family Aphididae), and Hymenoptera (1 UID terrestrial adult).

Invertebrates from seven different groups were found here: Ephemeroptera (60%), Diptera (15%), Plecoptera (12%), Trichoptera (12%), Hydracarina (1%), Coleoptera (<1%), and Oligochaeta (<1%). The dominant taxa at this site were ephemerellid mayflies, *Ephemerella doddsi*, representing 34% of the sample (197 specimens). These mayflies inhabit lotic-erosional and depositional zones, are characterized as clingers (some swimmers), and belong to the trophic guilds of collector-gatherers and/or scrapers. The remaining Ephemeroptera were: 64 *Baetis sp.*, 3 *Cinygmula sp.*, 3 *Epeorus (Iron) albertae*, 2 *E. (I.) deceptivus*, 1 *Ephemerella spinifera*, 61 *Ephemerella sp.*, 3 *Rhithrogena sp.* (all of which are collector-gatherers and/or scrapers), and 11 *Paraleptophlebia sp.* (collector-gatherers and/or facultative shredder-detritivores).

The second most abundant group, the true flies, contained 88 specimens: 80 were chironomids (20 UID juveniles, 8 UID pupae, 3 UID adults, 2 *Brillia sp.*, 2 *Cardiocladius sp.*, 2 *Corynoneura sp.*, 10 *Cricotopus sp.*, 20 *Eukiefferiella sp.* (a sprawler, belonging to the guilds of collector-gatherers, scrapers and/or predator-engulfers), 8 *Micropsectra sp.*, 1 *Synorthocladius sp.*, and 4 *Thienemanniella sp.*), there was 1 'noseeum', *Palpomyia sp.*, Fam. Ceratopogonidae, 4 empidid flies (1 UID pupa, 1 *Chelifera sp.*, and 2 *Weidemannia sp.*), 1 fly of the Family Pelecorhynchidae, *Glutops sp.*?, and 2 crane fly larvae, *Dicranota sp.*, Family Tipulidae.

The stoneflies were represented by 68 specimens: 5 UID juveniles, 7 Leuctridae juveniles (shredder-detritivores), 2 *Megarcys sp.* (predator-engulfer), 1 *Pteronarcys princeps* (shredder-detritivore), 12 *Sweltsa sp.*(predator-engulfer), 2 *Visoka (cataractae)*, and 39 *Zapada (haysi)*, both of which are shredder-detritivores. The caddisflies were well represented at this site (67 specimens): 8 *Arctopsyche sp.*(collector-filterer), 1 *Grensia sp.* (limnephilid, generally shredder-detritivores, some collector-gatherers and/or scrapers) , 44 UID limnephilid juveniles, 3 *Rhyacophila (acropedes or vao)*, 9 *R. coloradensis*, and 2 *R. vepulsa* (all of which are predator-engulfers).

The remaining 3 groups of organisms were represented by less than 5 specimens each: Hydracarina (1 UID juvenile, 2 *Sperchon sp.*, 1 *Torrenticola sp.*, and 1 *Wandesia sp.*), Copepoda (3 *Harpacticoida*), and Oligochaeta (2 specimens of the Family Lumbriculidae).

Sedimentation Buckets

Sedimentation buckets were not deployed in Cloudburst Creek.

5.7.12 WAP Prescriptions

Channel structure: floodplain modifications to the main channel should be undertaken and silviculture planting in the upper reaches should revegetate upslope and riparian zones (estimated recover period is 1-10 years); this will also increase organic cellulose pool of potential woody debris but will require long time periods (centuries). *Pool and riffle structures:* should be re-established, in the lower reaches, such that they are consistent with natural channel structure and hydrologic regimens. *Large structural elements (wood and boulders):* placement should be made with respect to creating microhabitat within pool / riffle zones (1-10 year recovery period). Channel modifications must be made in conjunction with road and culvert stabilization. Large woody debris should be enhanced to increase microhabitat for macroinvertebrates and to increase the trapping of adult salmon carcasses (5-25 years). Increasing LWD and boulder size will i) enhance refugia habitat to reduce predation and energy expended combating high flows, ii) increase organic matter storage, and, iii) reduce downstream nutrient movement. *Sediment:* sediment traps should be placed in reaches to encourage deposition where insufficient spawning sediment

exists (5-20 years) *Hyporheic zones:* reestablishing bed forms and bed composition will create new and redistribution of subsurface flows; new hydrologic sources will help to restore subsurface flows (5-20 year period of recovery).

Hydrology: discharge rates can be controlled, in the long term (10-50 years) if upslope and riparian vegetation is undertaken to reestablish evapotranspiration rates. Since sediment and bed-load movement can also increase ablation and disruption of periphyton accrual (1-10 years), every effort must be made to stabilize bed load. Natural (beaver and log jam) and artificial dams must be removed since they tend to alter natural discharge patterns and limit migratory passage. *Low flows:* replacement of conifers with deciduous vegetation will reduce evapotranspiration rates and change the nature and rate of terrestrial organic inputs (25-50 year cycle). Channel modifications which result in a cessation of rapid hydrologic fluctuations will result in recolonisation of stream banks by riparian trees, shrubs, grasses and forbs and benthic surfaces by aquatic biota and thereby increase trophic complexity (1-10 years).

Sediment: upslope and riparian reforestation will diminish erosion-based soil inputs; this will reduce short term nutrient enhancement and decrease undesirable smothering of instream habitat (10-50 years). It is crucial that remaining roads and culverts be maintained to standards which minimize or eliminate local, steep slope, water movements which would otherwise induce enhanced sediment deposition into creeks and streams (20-200 year cycles).

Water quality: temperature: Solar insolation profiles should be conducted under both open and closed canopies (both deciduous and coniferous) (1-10 years); changes in solar quality and quantity will modify algal community structure and productivity and production (5-25 years). Continuous data logger thermistors should be installed in the creek to define temperature profiles. *Nutrients:* revegetation of the upslope and riparian areas will reduce nutrient washout and diminish nutrient loading into surface waters; this may result, together with increased canopy cover and shading, in reduced summer and autumn periphyton production. An assessment of winter periphyton production should be conducted.

Riparian and immediate upslope forest: Small tributaries and ephemeral streams, which provide lateral shelter, rearing habitat and act as a feedstock production area, must be protected and revegetated where necessary; care should be taken to ensure that stream crossings are designed, installed and maintained with respect to protection of trophic in-stream attributes. A survey of ephemeral streams should be made; damaged stream habitat should be restored. *Production of large wood:* the long term perspective should be the production of mature and old-growth forest structure for the production of new wood. Upstream production and subsequent downstream transport, through stream washout and landslides, delivers large structural elements to local reaches (100-300 year horizon). *Trophic and organic food production:* mature and old-growth forest and riparian zone vegetation restores natural inputs from terrestrial ecosystems (40-80 years); introduction of leaf litter is essential for provision of structural substrate on which bacterial and protozoan communities develop; macroinvertebrates derive a significant portion of their nutrition from this microbiotic community (5-10 years). Fish gut studies should be conducted to determine what food resources are being used as the primary nutrition source. The creation of specific microhabitat, which provides for the specific requirements of selected algal and micro and macroinvertebrate populations, must be created when channel morphologies are altered (1-10 year cycles). *Shading:* re-establishment of riparian canopy will ultimately reintroduce light as a factor limiting primary production, which will eventually return to predisturbance values (5-20 year cycle). No exogenous materials were observed to be present, nor were any exotic biota discovered.

5.7.13 RAP Overview

The Riparian Assessment Procedure field crew found no recent clearcut areas directly adjacent to Cloudburst Creek during their reconnaissance. Therefore, no assessment of riparian vegetation was conducted.

There may be opportunities for riparian vegetation enhancement or bioengineering work in conjunction with fish habitat enhancement, channel and bank stabilization, or other proposals for this creek. This will be investigated as part of Year 3 activities.

Squamish River Watershed

High Falls Creek



5.8 High Falls Creek

Data Summary Sheet

✓	Yes	x	No	?	Unknown

HISTORY

✓	Was watershed logged prior to 1988?
x	Is watershed within a municipal boundary?
✓	Have FRBC funds been spent on watershed?
✓	Are FRBC applications pending for work on watershed?

FISHERIES INFORMATION

✓	Have forest activities impacted fisheries resources?
✓	Does the watercourse have existing fisheries values?
✓	Does the watercourse have historical fisheries values?
✓	Is the watercourse accessible to salmon?
✓	Is the watercourse habitat suitable for salmon?
✓	Are there enhancement opportunities for salmon?
✓	Is the watercourse habitat suitable for trout and char?
✓	Are there enhancement opportunities for trout and char?

WATER QUALITY

x	Does the watercourse have an adequate water quality?
?	If not, can it be rehabilitated?
x	Does the watercourse have an adequate food supply?
?	If not, can it be restored?
x	Was periphyton community surveyed?
x	Was invertebrate community surveyed?
x	Was water chemistry surveyed?
x	Was sediment or intergravel habitat surveyed?

x	Have there been scientific surveys in the stream?
x	Have nutrient dosing pots been placed in the stream?

HYDROLOGICAL FACTORS

✓	Are there forest-related activity impacts?
✓	Are there existing Water Rights (domestic, power, community watershed)?
✓	Is there year-round flow potential?
✓	Are there any existing hydraulic structures (dams, wiers, bridges, etc.)?
✓	Is there a debris-flow potential?

RIPARIAN ZONE

✓	Have forestry activities had negative impact on riparian vegetation?
x	Is there existing well-established riparian vegetation?
?	Are soil conditions amenable to re-vegetation?
✓	Is the channel morphology appropriate for re-vegetation?
✓	Are unrestricted reaches present?
✓	Would re-vegetation be expected to benefit fish/wildlife habitat?

TERRESTRIAL PROCESS

✓	Have slopes >60% been logged?
✓	Are roads built on slopes >60%?
✓	Is bedrock-geology of basin stable?
?	Has basin experienced landslides?
?	Have landslides entered mainstream?

H	High	M	Medium	L	Low	U	Unknown

CREEK RATING

H	Impacts by logging
M,L	Fish resources
L	Rehabilitation potential

5.8.1 Factors of Concern

Fisheries

Opportunities for physical structures to be installed may be low due to unpredictable flood levels of Squamish River in flood plain where enhancement works are proposed. Low nutrient levels may limit opportunity for fish production.

Hydrological

High Falls Creek is a steep mountain creek with a watershed area of approximately 15 km^2, is tributary to the Squamish River at 31 km upstream of mouth of the Squamish River on Howe Sound. The watershed has a southwest aspect rising from an elevation about 60 m at it's mouth to 1,980 m at it's headwaters (Tricount Peak) over it's 12 km channel length. The High Falls Creek watershed was been logged in the lower part of the watershed. There has been some regrowth however present clearcuts may increase sediment loading and peak flows in the creek. One crossing has been identified and should be inspected by a Professional Engineer (Hydrological) to find out if the bridge or culvert can pass the 100 year peak flows and to make recommendations for any improvements.

There are about five lakes within the watershed which may provide an opportunity to construct low dams to facilitate the augmentation of summer flows. The fact that High Falls Creek and ZZ Creek have existing water rights (Z104545) for a total of two power generation plants may complicate future instream work. The overall steep slope (average 16%) and existence of steep sidewalls (some clearcut) could sustain debris-laden floods under the right conditions. Prior to proceeding with instream works, a limited gulley and channel assessment should be carried out in the field.

Water Quality

High Falls Creek was visited by the survey team and used as one of the training creeks. The specific conductance and N and P concentrations indicate this creek has very little nutrient loading. The riparian zone extended right over the creek and there was some canopy loss into the creek which would provide some additional nutrient loading. The periphyton community did not develop until late in the autumn indicating there was little food, within the creek, available for invertebrates and thus for fish. It may be possible to supplement nutrient loading in this creek to enhance periphyton community production. the lack of knowledge about the periphyton community composition, its biomass or the invertebrate

community structure should be addressed; this should be conducted before and after additional nutrients are added.

Riparian Zone

The lower reach (0 to 0.8 km) of High Falls Creek flows through the Squamish River floodplain, encountering side channels of the Squamish during periods of high flow. This area supports a rich Western hemlock-Western red cedar-red alder forest with a dense understorey shrub growth. Between 0.8 km and 1.4 km, High Falls Creek cascades down a steep canyon with heavily-forested slopes. Further upstream the creek remains restricted within a canyon, though the gradient is less severe. Heavy clearcutting is evident in two locations. Between 2.5 and 5.5 km upstream of the mouth, logging on both flanks of the creek has left a very narrow tree corridor, one to two trees in width, for most of its length. Older clearcutting from 6.5 to 7.75 km extended right up to the creek banks. Re-planted trees have become well-established in this area. Both of these logged areas show evidence of limited landslide occurrence, some of which may be attributable to logging activities, and some of which is probably natural. The lower, more recently clearcut area may warrant some enhancement of riparian vegetation. However, because of the steep canyon through which High Falls Creek flows, such opportunities are limited.

Squamish River Watershed

Shovelnose Creek



5.9 Shovelnose Creek

Data Summary Sheet

✓	Yes	x	No	?	Unknown

HISTORY

✓	Was watershed logged prior to 1988?
x	Is watershed within a municipal boundary?
✓	Have FRBC funds been spent on watershed?
✓	Are FRBC applications pending for work on watershed?

FISHERIES INFORMATION

✓	Have forest activities impacted fisheries resources?
✓	Does the watercourse have existing fisheries values?
✓	Does the watercourse have historical fisheries values?
✓	Is the watercourse accessible to salmon?
✓	Is the watercourse habitat suitable for salmon?
✓	Are there enhancement opportunities for salmon?
✓	Is the watercourse habitat suitable for trout and char?
✓	Are there enhancement opportunities for trout and char?

WATER QUALITY

✓	Does the watercourse have an adequate water quality?
?	If not, can it be rehabilitated?
?	Does the watercourse have an adequate food supply?
✓	If not, can it be restored?
✓	Was periphyton community surveyed?
✓	Was invertebrate community surveyed?
✓	Was water chemistry surveyed?
?	Was sediment or intergravel habitat surveyed?

✓	Have there been scientific surveys in the stream?
x	Have nutrient dosing pots been placed in the stream?

HYDROLOGICAL FACTORS

✓	Are there forest-related activity impacts?
x	Are there existing Water Rights (domestic, power, community watershed)?
✓	Is there year-round flow potential?
✓	Are there any existing hydraulic structures (dams, wiers, bridges, etc.)?
✓	Is there a debris-flow potential?

RIPARIAN ZONE

✓	Have forestry activities had negative impact on riparian vegetation?
✓	Is there existing well-established riparian vegetation?
?	Are soil conditions amenable to re-vegetation?
✓	Is the channel morphology appropriate for re-vegetation?
✓	Are unrestricted reaches present?
✓	Would re-vegetation be expected to benefit fish/wildlife habitat?

TERRESTRIAL PROCESS

✓	Have slopes >60% been logged?
✓	Are roads built on slopes >60%?
✓	Is bedrock-geology of basin stable?
?	Has basin experienced landslides?
?	Have landslides entered mainstream?

H	High	M	Medium	L	Low	U	Unknown

CREEK RATING

H	Impacts by logging
H,M	Fish resources
M	Rehabilitation potential

5.9.1 Factors of Concern

Fisheries

Enhancement projects in progress. Will require post treatment monitoring and assessment. Historical fisheries values well documented. Currently undergoing enhancement by Squamish River Habitat Task Force.

Hydrological

Shovelnose Creek is a steep mountain creek with a watershed area of approximately 22 km^2, is tributary to the Squamish River at 47 km upstream of mouth of the Squamish River on Howe Sound. The watershed has a south to southwestern aspect rising from an elevation about 260 m at it's mouth to 2,290 m at it's headwaters (Mount Caley) over it's 13 km channel length. The Shovelnose Creek watershed was been logged in the lower part of the watershed. There has been some regrowth however present clearcuts may increase sediment loading and peak flows in the creek.

One crossing has been identified near the mouth of Shovelnose Creek and should be inspected by a Professional Engineer (Hydrological) to find out if the bridge or culvert can pass the 100 year peak flows and to make recommendations for any improvements.

There are about five lakes within the watershed which may provide an opportunity to construct low dams to facilitate the augmentation of summer flows. The fact that Shovelnose Creek does not have any water rights and is not a designated community watershed reduces the complications of future instream work. The overall steep slope (average 17%) and existence of steep sidewalls (some clearcut) could sustain debris-laden floods under the right conditions. Prior to proceeding with instream works, a limited gulley and channel assessment should be carried out in the field.

Water Quality

This creek has been subjected to extensive monitoring by both the MOELP and Fisheries Branch (UBC). There is at present a nutrient supplement program being conducted in this creek by Mr. Ken Ashely (UBC). It is not known if the periphyton and invertebrate communities have been surveyed; however, monitoring has been conducted by MOELP for water quality, fish egg bioassay and sediment particle/bed-load movement (1993).

Riparian Zone

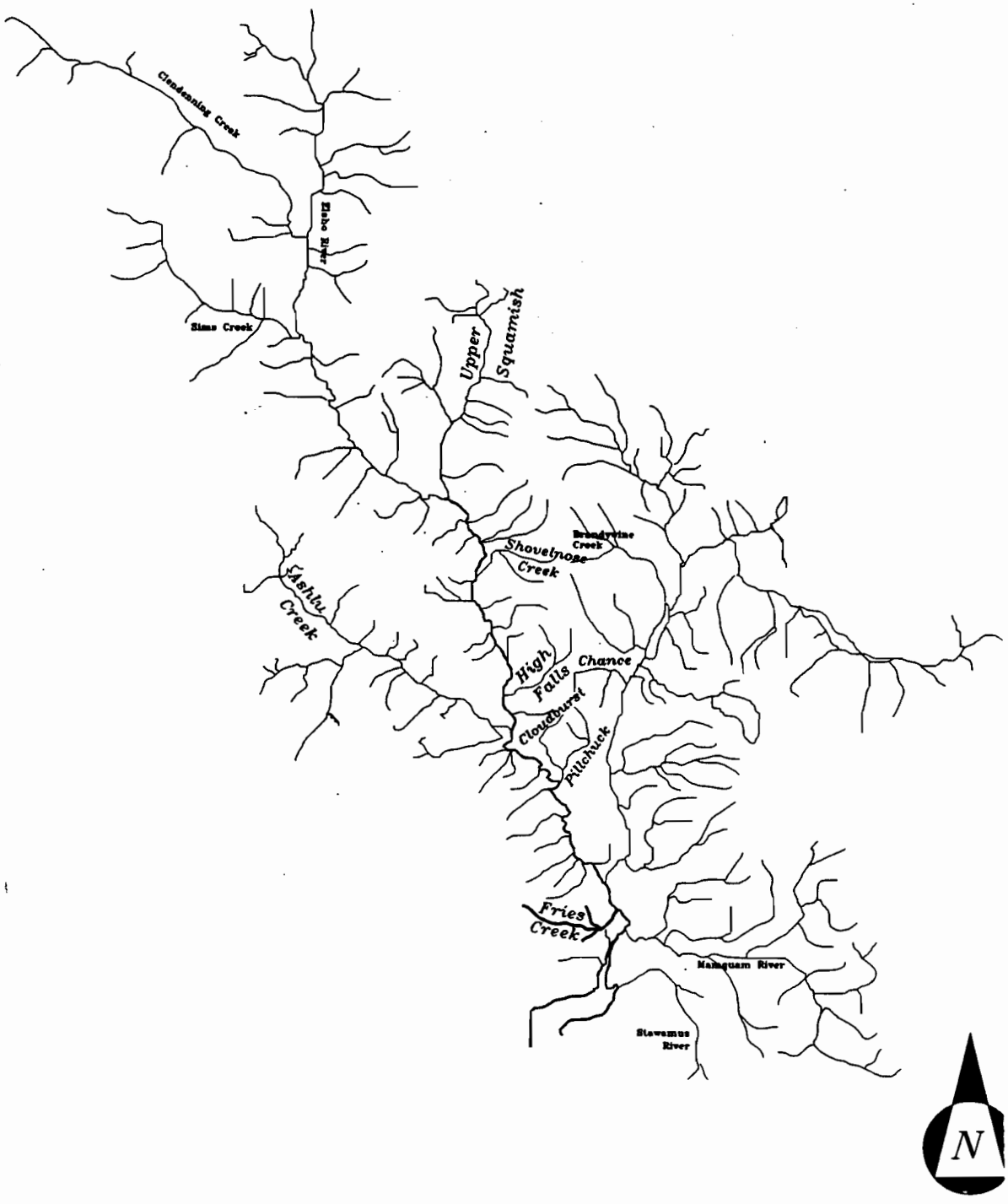
Shovelnose Creek is part of a system of creeks, consisting also of Mud Creek and Turbid Creek. All have their confluences with the Squamish River near the same location. The final 1.2 km Shovelnose Creek flows within the Squamish River floodplain, while from 1.2 km upstream to 6 km the creek flows through a moderately steep canyon. Within the canyon, the riparian vegetation is generally well-established, with trees extending up to the creek banks, and there is no overt evidence of landslide activity.

Heavy logging has occurred upslope from the creeks in this system, on the lower flanks of the mountain, between Mud Creek and Turbid Creek, and between Turbid Creek and Shovelnose Creek. An opportunity may exist for vegetative stabilisation of these cut-blocks, which appear to be subject to significant erosion.

There may also be an opportunity to augment the riparian habitat in the floodplain area just upstream from the mouth of the creek. At this location the riparian forest is quite open, the trees consisting mainly of Western hemlock, Western red cedar, willow, bigleaf maple, red alder. There is a dense and diverse understorey shrub and herb layer. The addition of large woody debris to the creekbed would enhance the creation of pools and backwaters areas.

Squamish River Watershed

Fries Creek



5.10 Fries Creek

Data Summary Sheet

✓	Yes	x	No	?	Unknown

HISTORY

✓	Was watershed logged prior to 1988?
?	Is watershed within a municipal boundary?
x	Have FRBC funds been spent on watershed?
x	Are FRBC applications pending for work on watershed?

FISHERIES INFORMATION

x	Have forest activities impacted fisheries resources?
?	Does the watercourse have existing fisheries values?
?	Does the watercourse have historical fisheries values?
?	Is the watercourse accessible to salmon?
?	Is the watercourse habitat suitable for salmon?
?	Are there enhancement opportunities for salmon?
?	Is the watercourse habitat suitable for trout and char?
?	Are there enhancement opportunities for trout and char?

WATER QUALITY

?	Does the watercourse have an adequate water quality?
	If not, can it be rehabilitated?
?	Does the watercourse have an adequate food supply?
	If not, can it be restored?
x	Was periphyton community surveyed?
x	Was invertebrate community surveyed?
x	Was water chemistry surveyed?
x	Was sediment or intergravel habitat surveyed?

x	Have there been scientific surveys in the stream?
x	Have nutrient dosing pots been placed in the stream?

HYDROLOGICAL FACTORS

✓	Are there forest-related activity impacts?
x	Are there existing Water Rights (domestic, power, community watershed)?
✓	Is there year-round flow potential?
x	Are there any existing hydraulic structures (dams, wiers, bridges, etc.)?
✓	Is there a debris-flow potential?

RIPARIAN ZONE

x	Have forestry activities had negative impact on riparian vegetation?
✓	Is there existing well-established riparian vegetation?
?	Are soil conditions amenable to re-vegetation?
✓	Is the channel morphology appropriate for re-vegetation?
✓	Are unrestricted reaches present?
?	Would re-vegetation be expected to benefit fish/wildlife habitat?

TERRESTRIAL PROCESS

?	Have slopes >60% been logged?
✓	Are roads built on slopes >60%?
✓	Is bedrock-geology of basin stable?
✓	Has basin experienced landslides?
✓	Have landslides entered mainstream?

H	High	M	Medium	L	Low	U	Unknown

CREEK RATING

L	Impacts by logging
U	Fish resources
U	Rehabilitation potential

5.10.1 Factors of Concern

Hydrological

Fries Creek is a steep mountain creek with a watershed area of approximately 22 km^2, is tributary to the Squamish River at 10 km upstream of mouth of the Squamish River on Howe Sound. The watershed has a east aspect rising from an elevation of less than 30 m at it's mouth to 1,980 m at it's headwaters (Mount Pelops, Iota Mountain) over it's 10 km channel length.

The Fries Creek watershed was been logged in the lower part of the watershed. A BC Hydro ROW also crosses the creek at about 1.5 km about it's mouth. There has been some regrowth however logging may increase sediment loading and peak flows in the creek.

There are about three lakes within the watershed which may provide an opportunity to construct low dams to facilitate the augmentation of summer flows. The fact that Fries Creek does not have any water rights and is not a designated community watershed reduces the complications of future instream work.

The overall steep slope (average 20%) and existence of steep sidewalls (some clearcut) could sustain debris-laden floods under the right conditions. Prior to proceeding with instream works, a limited gulley and channel assessment should be carried out in the field.

Water Quality

No information pertaining to the periphyton or invertebrate community has been obtained from this creek. Water quality has not been monitored, nor has intergravel or sediment been studied. Periphyton and invertebrate communities, and sediment and/or intergravel habitat should be monitored. Basic water quality parameters should be monitored.

Riparian Zone

The lower 4 km of Fries Creek flows down a mountainside within a narrow, restricted channel with a steep gradient. No recent logging is evident along these lower reaches. Further upstream, the valley widens, and many cutblocks harvested approximately 30 years ago support well-developed second-growth forest. Because of the inherent instability, and also because logging roads appear from the air photos to have been decommissioned, it is unlikely that any efforts to enhance riparian vegetation are advisable.

Squamish River Watershed

Evans Creek



FOR REACH BREAKS SEE MAPS 92G075, 92G085 (in back pocket).

5.11 Evans Creek

5.11.1 FHAP Overview

Evans Creek drains into the Squamish River. A FHAP assessment was conducted from August 21 to 22, 1996. The study area covered approximately 5.8 km upstream of the Evans Creek-Squamish River confluence to Levett Lake. The creek was divided into 22 reaches: Reaches 1-10 and 12-22 covered the creek and Reach 11 covered Evans Lake. The FHAP assessment was conducted along the creek, whereas minimal observations regarding fish habitat were conducted in Evans Lake.

There was little historical information available on Evans Creek. However, the area had been heavily logged in the past and as recently as two years ago (Lewis, P., pers. comm.). Evans Lake had historically been stocked with rainbow trout which had since been discontinued (Gellner, R., pers. comm.). No information was found in the BCMELP data files and no information had been recorded on the Stream Information Summary System (SISS).

In general, Evans Creek was comprised of variable habitat consisting of cascades, riffles and glides. Much of the creek downstream of Evans Lake was flowing subterranean. Only small isolated pools of water were observed. Gradient ranged from 0 to >45%. Impassable barriers to fish were observed in Reaches 5-7, and a potential barrier to fish was observed in Reaches 13-17 and was largely dependent on water flows. Spawning habitat varied from low to high suitability for both anadromous and resident fish, depending on substrate type (i.e., gravel, cobble, boulder) present. In general, the LWD provided either poor or good rearing habitat for fish. The greatest evidence of disturbance to the creek was observed in the lower reaches and included channel braiding, eroding banks, log jams, and skid roads crossing the creek. The major limiting factor to fish in Evans Creek was the lack of a continuous flow of water during the summer season.

5.11.2 FHAP Assessment

Habitat Types

A summary of habitat types identified in Evans Creek from August 21 to 22, 1996 is provided in Appendix E. Habitat type was difficult to assess during the assessment as much of the creek was flowing subterranean. Of the habitat that was identifiable, the majority was comprised of cascades, especially through Reaches 5-7 and Reaches 12-18. Isolated pools between dry sections were observed throughout the creek and could provide fish habitat under continuous flow conditions. Pool habitat was identified in the cascade running through Reaches 12, 13, and 19. However, the maximum depth of these pools was 0.25 cm at the time the assessment was conducted, and therefore, were too shallow to fall within the definition of a "pool" according to Johnston and Slaney (1996). Reach 21 included a swampy area with a pond providing good fish and wildlife habitat. This requires further assessment.

Off-channel Habitat

Side channels were observed in Reaches 2, 3 and 5, and varied in length from 40 to 91 m. All three side channels were accessible to fish at high flows only and serve as potential rearing habitat depending on the level of water in the creek.

Other off-channel habitat included several tributaries which drain into the mainstem of Evans Creek and Levett Lake. However, most of the tributaries draining into the mainstem were also dry and, therefore, provided little habitat under low flow conditions. Three tributaries drained into Levett Lake and were identified as Tributary 1, 2, and Hut Lake Tributary. Dominant habitat in Tributaries 1 and 2 was cascade with a gradient of 20-22%. Despite their steepness, dominant bed material included gravel, cobble and boulder thereby providing some spawning habitat for resident fish. Cover in these tributaries included SWD and B, and provided between 5 and 80% cover. Dominant habitat type in the third tributary, which drains Hut Lake, was glide. Dominant substrate type was sand, indicating poor spawning habitat for resident fish. Cover in the form of SWD and IV ranged between 80 and 90% providing good cover for rearing. Limitations to fish in all tributaries was the lack of a continuous flow of water.

Large Woody Debris (LWD)

Appendix E provides LWD loading data for reaches with LWD. LWD per bankfull width ranged from 0.15 to >8.61 indicating poor to good quality rearing habitat based on the diagnostic table provided in Johnston and Slaney (1996). The potential rearing habitat in the majority of reaches surveyed in Evans Creek are classified as poor or good. Consequently, based on these diagnostics, the amount of functional LWD in Evans Creek could provide adequate rearing habitat for anadromous and resident fish in some sections.

The amount of "functional" LWD recorded by the field crew may be a misrepresentation of the amount of functional LWD that is actually present in the river due to the definition of "functional" LWD presented in Technical Circular No. 8 (Johnston and Slaney, 1996) as discussed in Section 3.8.1.

Substrate Type

Substrate type observed in each reach surveyed in Evans Creek and associated potential spawning habitat is provided in Appendix E. Potential spawning areas for anadromous and resident fish, depending on substrate type present, existed in various sections of Reaches 1-5, and for resident fish in Reaches 8, 12, 13 and 15-19. Substrate in these reaches consisted mostly of gravel, cobble and boulder, and consequently, provided either no suitable, little suitable, or highly suitable spawning habitat.

Fish Distribution

Fish presence/absence was determined by electroshocking in selected reaches in Evans Creek on September 10, 1996. Fish distribution data is summarized in Table 5.11-1. Fish captured included rainbow trout and cutthroat trout both upstream and downstream of the impassable barrier in Reaches 5-7. Crayfish were also captured, but only in Reach 4. Rainbow trout captured in Reach 4 ranged in fork length from 120 to 220 mm. Cutthroat trout captured were smaller; fork length ranged from 50 to 60 mm. Rainbow trout captured in Reach 10 ranged in fork length from 115 to 196 mm, and cutthroat trout ranged from 37 to 60 mm. All fish were captured from isolated pools.

Although electroshocking was not conducted in all reaches, juvenile fish were observed in most isolated pools of water. Fish were also observed upstream and downstream of the swamp/pond area located in Reach 20, and in Levett Lake, but were not identified as they were not captured.

Table 5.11-1 Summary of fish capture data in Evans Creek (1996).

Reach No.	Date of Electroshocking	Electroshocking Effort (seconds @ voltage)	Species Captured	Stream Class
4	September 10/96	421 @ 300	Rainbow, Cutthroat, Crayfish	S2
10	September 10/96	236 @ 400	Rainbow, Cutthroat	S2

Adult Upstream Migration

The most restrictive factor to adult upstream migration was the lack of water in the lower reaches and the lack of continuous water flow throughout most of the creek. During higher water flows, the presence of impassable barriers in Reaches 5-7 would prevent the upstream migration of anadromous fish. Possible barriers in these reaches included waterfalls greater than 2 m in height and/or log jams. A second potential barrier was observed in Reaches 12-18. Fish observed in isolated pools in various sections of these upper reaches may indicate the migration of resident fish from upstream reaches or from Levett Lake to downstream sections of Evans Creek.

Spawning and Incubation Conditions

Potential spawning habitat based on substrate type present for each reach is provided in Appendix E. Potential spawning habitat was observed in Reaches 1-4, 8, 12, 13 and 15-19, and varied from little suitable habitat to abundant. Fish had limited or no access to these areas of discontinuous water flows during summer and early fall thus preventing migration of fish between different sections of the creek. Temperature and flow rate would have to be assessed during times of continuous water flow to determine the adequacy of these areas for spawning.

Summer Rearing Habitat

Appendix E tables summarize potential cover types observed in Evans Creek during the August 1996 FHAP assessment. Cover in all reaches surveyed was dominated by SWD and OV. IV, C and B cover was observed in some reaches. In general, overhead cover for rearing habitat was classified as good in most reaches. Boulder cover was poor in most reaches and provided little rearing habitat.

Due to the low water flows at the time the survey was conducted, it was difficult to determine the frequency of pools, accessibility of side channel, and functionality of overhead cover as potential rearing habitat for fish. Of the pools that were measured, water depths were very shallow and provided little refuge. These shallow depths also raised a concern for the effects of reduced dissolved oxygen levels and the effects of water evaporation on fish. There was the potential for good rearing habitat in Evans Creek, but the functionality remains questionable due to limited water flows.

Winter Rearing Habitat

Several side channels were identified along Evans Creek which could provide suitable winter rearing habitat for fish. However, their accessibility during the winter remains unknown and dependent on water flows. During higher flows, pool habitat identified may also provide better winter rearing habitat due to increased water depth and accessibility of other sections of the creek to fish. It is assumed that the heavier rains in the winter months provide enough water for continuous flow in Evans Creek. This requires further investigation before potential winter rearing habitat in Evans Creek can be adequately assessed.

Juvenile Migration

The greatest effect on juvenile migration in Evans Creek was the lack of continuous water flow during the summer season. Fry and juvenile rainbow and cutthroat trout had been observed upstream and downstream of the impassable barrier in Reaches 5-7, but their migration within the upper and lower sections was limited due to the creek's lack of continual flow. The impassable barrier in Reaches 5-7 would prevent the upstream migration of juvenile fish similar to adult fish. Juvenile fish observed upstream from the barrier probably migrated from Levett Lake or other upstream sections of the creek.

Juvenile migration may also be affected in the lower reaches of Evans Creek due to disturbance. Reaches 1 and 2 are subject to flooding and intrusion from the Squamish River during high water flows, thereby causing fish to be washed out (i.e., seeking refuge in upper reaches, side channels or tributaries). If water levels in areas upstream of the flood zone are dry then little rearing habitat is available, thereby preventing their migration into Evans Creek altogether. Past disturbance in the lower reaches by heavy machinery which passed through the creek may also affect juvenile migration due to habitat disturbance.

It is interesting that juvenile coho salmon were not captured in the lower reaches, as they would be expected in this area at the time of year the assessment was conducted. Future studies should focus on more intensive fish capturing effort and the identification of possible barriers to coho in the lower reaches (e.g., culverts).

5.11.3 FHAP Prescriptions

Based on the above FHAP assessment, the most limiting factor to fish in Evans Creek was the lack of a continuous flow of water from its headwaters to its mouth. This results in many fish being stranded in isolated pools, and exposed to the consequences of evaporation, low dissolved oxygen levels and predation for much of the summer. These stress factors may lead to fish mortality during summer months. Consequently, fish rehabilitation/restoration options include better water management plans and a fish salvage program.

Better water management plans would begin with gaining a better understanding of what the main source of water is to Evans Creek and subsequent cause of periods of discontinuous flow. The water management plan should ensure that the flow of water is maintained at a level to ensure a constant and steady flow from Levett Lake to the Evans Creek-Squamish River confluence to ensure adequate fish passage. All water licences removing water from Evans Creek should be reviewed to establish limits where appropriate.

In the event that discontinuous flows are due to natural influences which cannot easily be adjusted, a fish salvage program could be implemented. The objective of a fish salvage program would be to gather all fish stranded in isolated pools. The fish would be transferred to a summer rearing facility (i.e., Tenderfoot Hatchery), and returned to the creek in the fall when the water level has risen to an acceptable level. Before this can become effective, a better understanding of seasonal changes in water flows in Evans Creek must be assessed. For example, a better understanding of when flows are continuous and when they become discontinuous is necessary, so that fish can be salvaged at the appropriate times of the year.

Regardless of the fish restoration options described above, water flows and fish habitat in the lower reaches can be enhanced by excavation of the main channel in the lower reaches with habitat complexing.

Future Studies

A seasonal assessment of flows and habitat conditions downstream of Evans Lake .should be undertaken to determine if low flows are a limiting factor during winter.

5.11.4 FHAP QA/QC

QA was not conducted in Evans Creek. However, the supervisors were present during the assessment conducted by the field crew for Reaches 17-22 at which time field notes, comments and numbers recorded by the field crew were reviewed by the supervisors (QC).

5.11.5 CAP Overview

Evans Creek has a significant amount of remnant logging equipment within the channel. There is also evidence of aggradation in the form of gravel bars in the creek as well as excessive LWD. Bridge and culvert sites should be inspected by a professional hydrological engineer.

Evans Creek has a total of 22 reaches extending from mouth to headwaters. The creek is ephemeral, and as such only flows (surface) intermittently during wetter periods of the year. Reach 11 consists of Evans Lake. Significant secondary growth has occurred on the Evans Creek watershed. The watershed does not have any active logging.

5.11.6 CAP Assessment

Table 5.11-2 provides summary information for all reaches within Evans Creek. Overall, Evans Creek was found to be moderately sensitive to logging impacts, and has a stable channel condition.

Table 5.11-2 Evans Creek field data summary.

Reach	Bankfull		Slope	Average Rock	Relative Roughness	Power Index	Sensitivity Rating	Channel Condition	Channel Type
	Width (m)	Depth (m)	(%)	D (m)					
1	15.3	2.40	1	0.07	0.03	37	L	Stable	Riffle-pool
2	9.58	1.40	0.7	0.22	0.16	9	L	Stable	Riffle-pool
3	8.9	0.80	1	0.13	0.16	7	L	Stable	Riffle-pool
4	6.18	0.90	1	0.25	0.28	6	L	Stable	Riffle-pool
5	11.1	1.26	12	0.54	0.43	168	M	Stable	Cascade-pool
6	8.4	1.80	26.33	0.67	0.37	398	M	Stable	Cascade-pool
7	3.83	1.37	26	0.43	0.32	136	M	Stable	Cascade-pool
8	6.15	0.95	0.5	0.30	0.32	3	L	Stable	Swamp
9	4.6	0.87	7.33	0.43	0.50	29	M	Stable	Cascade-pool
10	10.83	0.73	3	0.33	0.45	24	M	Stable	Riffle-pool
11	-	-	-	-	-	-	-	-	Lake
12	4.5	0.68	7.5	0.30	0.44	23	M	Stable	Cascade-pool
13	5.85	0.53	15	0.43	0.81	46	M	Stable	Cascade-pool
14	9.23	0.63	14	0.30	0.47	82	M	Stable	Cascade-pool

Reach	Bankfull		Slope	Average Rock	Relative Roughness	Power Index	Sensitivity Rating	Channel Condition	Channel Type
	Width (m)	Depth (m)	(%)	D (m)					
15	6.47	0.73	15.33	0.37	0.50	73	M	Stable	Cascade-pool
16	7.07	0.57	13.67	0.30	0.53	55	M	Stable	Cascade-pool
17	4.85	0.68	8.75	0.28	0.41	29	L	Stable	Riffle-pool
18	6.93	0.87	2.67	0.27	0.31	16	L	Stable	Riffle-pool
19	3.5	0.85	1.5	0.33	0.38	5	L	Stable	Riffle-pool
20	8.5	1.30	0	0.00	0.00	0	L	Stable	Pond
21	3.4	1.20	0	0.00	0.00	0	L	Stable	Pond
22	8.33	1.07	2.33	0.30	0.28	21	L	Stable	Riffle-pool

Reaches 1-4

Riffle-pool Morphology
Silt/Cobble Bed Material
Sensitivity Rating: Low

Reaches 1-4 have gentle slope averaging less than 1%. The creek is stable over these reaches, and has an overall sensitivity rating of low. There is a large valley-flat and the surrounding slopes are gentle. The average valley width indicator is also low, as alluvial deposits are found to be insignificant or nonexistent. The rating for upstream disturbance has been classified as medium, as upstream disturbances are not clearly identifiable. The creek runs adjacent to a gravel pit in reach 3, where evidence of logging activity can be seen in the form of rusty cables in the creek. The entry of gravel into the creek from this source should be restricted, and the creek should be cleaned of old logging equipment. A double culvert crosses the creek under a paved road at reach break 2. At the top of reach 4, a gravel road crosses through the creek. Both crossings should be inspected by a professional hydrological engineer.

Reaches 5-7

Cascade-pool Morphology
Cobble/Boulder Bed Material
Sensitivity Rating: Medium

Reaches 5-7 displays an increase in slope, and consists of a series of waterfalls. The creek is stable within these reaches, and has a general bed material of cobble mixed with boulder. The channel has an overall sensitivity rating of medium. The potential for upstream disturbance is unclear, and has been rated as medium.

Reach 8

Swamp

Reach 8 consists of a swamp/marsh area through which the creek meanders. Reach break 8 is a gravel road which crosses the creek via a culvert. The culvert should be inspected by a professional hydrological engineer.

Reaches 9 and 10

Cascade-pool; Riffle-pool Morphology
Cobble/Boulder Bed Material
Sensitivity Rating: Medium

Reaches 9 and 10 consist of a stable portion of creek with a slope ranging from 3% to approximately 7%. The reach has an overall sensitivity level of medium. Large woody debris can be found in this reach, including a foot bridge which is causing a log jam at reach break 10. Random gravel deposits are found within reach 10, but were not significant.

Reach 11

Reach 11 consists of Evans Lake.

Reaches 12-16

Cascade-pool Morphology
Cobble/Boulder Bed Material
Sensitivity Rating: Medium

Reaches 12-16 consists of a continuous stable section of cascade-pool, divided into reaches by the presence of ephemeral tributaries and gravel road crossings. The general bed material is primarily cobble, with occasional lag boulder present. Evidence of logging activities can be seen in this section of the channel, as old cables were found in the trees and along the banks. Several old wooden bridges were found throughout this section. Large woody debris was found in some sections of the creek. Fish were seen in pools in reach 12.

Restoration efforts on this section of creek should focus on the assessment of the wooden bridges in the creek and their ability to pass high flows. Efforts should be made to clean up remnants of logging activities (cables, tires, etc.).

Reaches 17-19

Riffle-pool Morphology
Cobble/Boulder Bed Material
Sensitivity Rating: Low

Reaches 17-19 exhibits a riffle-pool morphology with a general bed material mix primarily of cobble and lag boulders. This section of creek has a low sensitivity to logging impacts, and is stable.

Restoration efforts in reaches 17-19 should focus on removal of large woody debris jams, hydraulic assessment of wooden bridges crossing the creek at reach breaks, and cleaning of logging debris such as oil barrels and cables.

Reaches 20-22

Pond/Riffle-pool Morphology
Silt/Cobble Bed Material
Sensitivity Rating: Low

Reaches 20-22 contain the upper portions of Evans Creek, including the headwaters. This section of creek has been given an overall sensitivity rating of low, as no impacts were found due to logging or sedimentation. The creek is stable.

5.11.7 CAP Prescriptions

Creek Prescriptions (Year One) See Summary Table

Restoration efforts on Evans Creek in year 1 should be concentrated on work within Reaches 12 - 16, 8 - 10 and 1 - 2. Instream and offstream ponds should be constructed in Reaches 1 and 2 along with the placement of LWD. Stream clearing should be carried out as well as hydraulic assessments of bridge/culvert crossings on Evans Creek.

Table 5.11-3 Evans Creek summary table.

Reach	Morphology	Assessment	Prescription	Timing	Year	Rating
1 2 3 4	Riffle Pool Silt & Cobble Bed Material	Reaches 1-4 have gentle slope averaging less than 1%. The creek flows adjacent to a gravel pit in reach 3, where evidence of logging activity can be seen in the form of rusty cables in the creek. At reach break 2 a twin culvert directs the flow under a paved road. At the top of reach 4, a gravel road fords the creek.	Within Reaches 1 and 2, instream and offstream ponds should be developed. Placement of LWD to improve habitat. All crossings including the twin culvert, and ford should be inspected by a professional hydrological engineer. The sediment source potential of the existing gravel pit should be investigated further with mitigation measures to be recommended by a professional hydrological engineer. All discarded logging cables and other foreign debris should be removed from the creek channel.	July 15 - Aug. 15	1	M
5 6 7	Cascade Pool Cobble & Boulder Bed Material	Reaches 5-7 consists of a series of waterfalls. The creek is stable within these reaches.	No prescription required.		NA	M
8 9 10	Swamp	Reach 8 consists of a swamp/marsh area through which the creek meanders. Reach break 8 is a gravel road which crosses the creek via a culvert.	Removal of log jam at foot bridge.	Inspection in 1997.	NA	M
11	Evans Lake	No assessment.	No prescription required.		NA	L
12 13 14 15 16	Cascade Pool Cobble & Boulder Bed Material	Reaches 12-16 are stable with the cobble bed material, with the occasional lag boulder present. Past logging activities are evident, as old cables were found in the trees and along the banks. Several old wooden bridges were found throughout this reach. Large woody debris was found in some areas of the creek.	Removal of excessive LWD and logging equipment debris. Bridge and culvert sites should be inspected by a professional hydrological engineer.	July 15 - Aug. 15	1	M

Reach	Morphology	Assessment	Prescription	Timing	Year	Rating
17 18 19	Riffle Pool Cobble & Boulder Bed Material	These reaches are stable.	No prescriptions required.	NA	NA	L
20 21 22	Pond/Riffle Pool Silt & Cobble Bed Material	Reaches 20-22 form the headwaters of Evans Creek. No impacts were found due to logging or sedimentation. The creek is stable within these reaches.	No prescriptions required	NA	NA	L

Creek Prescriptions (Year Two to Five)

In the following two to five years Evans Creek should have continued channel morphology reconstruction done. Stone lines should be rebuilt and gravel bars should be scalped. Channel cleaning should continue. Channel construction should be carried out from the upper reaches down. A yearly summary report should be written to identify work carried out in specific location as well as progression made during the project.

General Creek Work Involved (Year Five to Twenty)

A general inspection of river stability should be carried out every two years for the proceeding five years. At this time, any instream work necessary should be identified and carried out immediately. A summary report should be written up detailing the progress and any deficiencies within the creek at the end of each inspection. After year ten an inspection should be carried out every five years. Again, if instream work is necessary it should be identified and carried out immediately. A final summary report should be composed as well as a final photo catalog.

5.11.8 CAP Quality Assurance/Quality Control

All data collected in the field and entered into electronic forms was checked for transcription accuracy. QA/QC was conducted by a hydrological specialist as part of a site visit while crews were collecting field data.

5.11.9 WAP Overview

The temperatures of this creek should not be permitted to increase, as they are at the point of being borderline limiting. At these higher temperatures the dissolved oxygen values are approaching the lowest acceptable threshold, below which juvenile salmonids become stressed. Consideration should be given to enhancing riparian canopy cover and increasing stream turbulence to increase DO values.

Temperature

Stream temperatures were elevated, ranging from a low of 11 °C (reach 9 trib), to a median of 14 °C (reaches 6 and 12 through 19), to a high of 20 °C in reach 11. The stream generally had higher temperatures than those measured elsewhere. Measurements made by both thermistors were within 1 °C of each other. Temperatures were highest in the upper and lower reaches, being lower in the mid reaches. Temperatures in the lower reaches were approaching undesirable levels. In the mid reaches the values would be acceptable for growth of fish. These values reflect the more open canopy of this stream, with increased insulation being responsible for the higher temperatures.

Dissolved Oxygen and Specific Conductance

The DO values were considerably lower than those concentrations measured in other creeks, which also had lower median temperatures. A few reaches (18 and 21) had values below the minimum acceptable threshold (6 mg/L). Values in the other reaches were generally between 6 and 8 mg/L, reflecting the relatively high water temperatures. Increased canopy cover should reduce stream temperatures; increased stream turbulence, combined with lower temperatures, would increase dissolved oxygen values.

Specific conductance values were typically higher than those of other streams, being generally above 40 µmhos/cm. Reach 14 was less than 10 µmhos/cm and reaches 9 trib, 12b and 13, 15, 16, 19 trib and 20 all had values equal to, or exceeding, 60 µmhos/cm. These values suggest that the creek has a moderate degree of dissolved ions, including nutrients. The values were among the highest recorded for any of the creeks in this watershed.

Periphyton & Nutrient Dosing Pots

Periphyton samples were not analysed for Evans Creek. Nutrient dosing pots were not deployed in Evans Creek.

Invertebrates

Evans Creek (reach not specified) 96-Aug-21

Invertebrates from four different groups were found here: Plecoptera (43%), Ephemeroptera (29%), Diptera (14%), and Hemiptera (14%). There was not a particularly dominant taxa at this site, in fact, only 7 specimens were collected in total: 3 stoneflies (1 *Zapada sp.*, a shredder-detritivore and 2 UID perlid nymphs, generally predator-engulfers), 2 mayflies, both *Paraleptophlebia sp.* (collector-gatherers of coarse detritus, diatoms and/or facultative shredder-detritivore), 1 UID chironomid of the Sub-family Orthocladiinae, and 1 water strider, Family Gerridae, Order Hemiptera.

Evans Creek Reach 9 96-Aug-21

Invertebrates from four different groups were found here: Plecoptera (43%), Ephemeroptera (29%), Diptera (14%), and Hemiptera (14%). There was no dominant taxon at this site as no group was represented by more than 3 specimens. Indeed, only 7 organisms were collected in total. The stoneflies contained 3 specimens: 2 UID larvae, and 1 *Zapada sp.*, a shredder-detritivore and/or herbivore on moss. Two mayflies were collected here, both of which were *Paraleptophlebia sp.*, a collector-gatherer of coarse materials and/or facultative shredder-detritivore. One UID juvenile chironomid was found here, representing the Diptera, and 1 water strider, Family Gerridae, Order Hemiptera.

Sedimentation Buckets

Sedimentation buckets were not deployed in Evans Creek.

5.11.10 WAP Prescriptions

Channel structure: *Pool and riffle structures:* should be re-established such that they are consistent with natural channel structure and hydrologic regimens, if modifications are made to the channel near the mouth. *Large structural elements (wood and boulders):* placement should be made with respect to creating microhabitat within pool / riffle zones (1-10 year recovery period). Channel modifications must be made in conjunction with road and culvert stabilization; a number of road crossings of the creek were observed. The trapping of adult salmon carcasses should be enhanced in the lower reaches. *Hyporheic zones:* little is known about the hydraulic flows in this creek. **Hydrology:** *Low flows:* the high temperatures could be reduced with increased flows and supplemental riparian planting (5-25 year cycle). Natural and artificial dams must be removed since they tend to alter natural discharge patterns. ***Sediment:*** unnatural mass failures of upslope and riparian areas, together with landslides, must be reduced largely through reductions in unnecessary road networks and upgrading of existing roads; it is

crucial that remaining roads and culverts be maintained to standards which minimize or eliminate local, steep slope, water movements which will otherwise induce enhanced sediment deposition (20-200 year cycles). ***Water quality:*** *temperature:* re-establishment of riparian canopy cover will reduce solar inputs and stream temperatures (10-40 years); solar insolation profiles should be conducted under both open and closed canopies (both deciduous and coniferous). Continuous data logger thermistors should be installed in the creek to define temperature profiles. *Dissolved oxygen:* decreasing temperature, through shade recovery, will increase oxygen concentrations (1-10 years). *Nutrients:* An assessment of winter periphyton production should be conducted. Although the survey of periphyton and macroinvertebrates was cursory, visual observation of numerous isolated pools and stream sections revealed substantial biota. If this stream is to receive channel and hydraulic changes, additional effort should be spent studying the systems productivity. *Ephemeral streams:* Small tributaries and ephemeral streams, which provide lateral shelter, rearing habitat and act as a feedstock production area, must be protected and revegetated where necessary; care should be taken to ensure that stream crossings are maintained with respect to protection of trophic in-stream attributes. A survey of ephemeral streams should be made; damaged stream habitat should be restored. *Production of large wood:* the long term perspective should be the production of mature and old-growth forest structure for the production of new wood; introduction of leaf litter is essential for provision of structural substrate on which bacterial and protozoan communities develop; macroinvertebrates derive a significant portion of their nutrition from this microbiotic community (5-10 years). Fish gut studies should be conducted to determine what food resources are being used as the primary nutrition source, in the lower reaches. The creation of specific microhabitat, which provides for the specific requirements of selected algal and micro and macroinvertebrate populations, must be created when channel morphologies are altered (1-10 year cycles)(see channel and fishery prescriptions above). ***Exogenous material:*** *logging material:* logging equipment and other industrial debris should be removed, since its presence serves to reduce respect for the aquatic habitat and biota which inhabit it. *Exotic biota:* no exotics were observed.

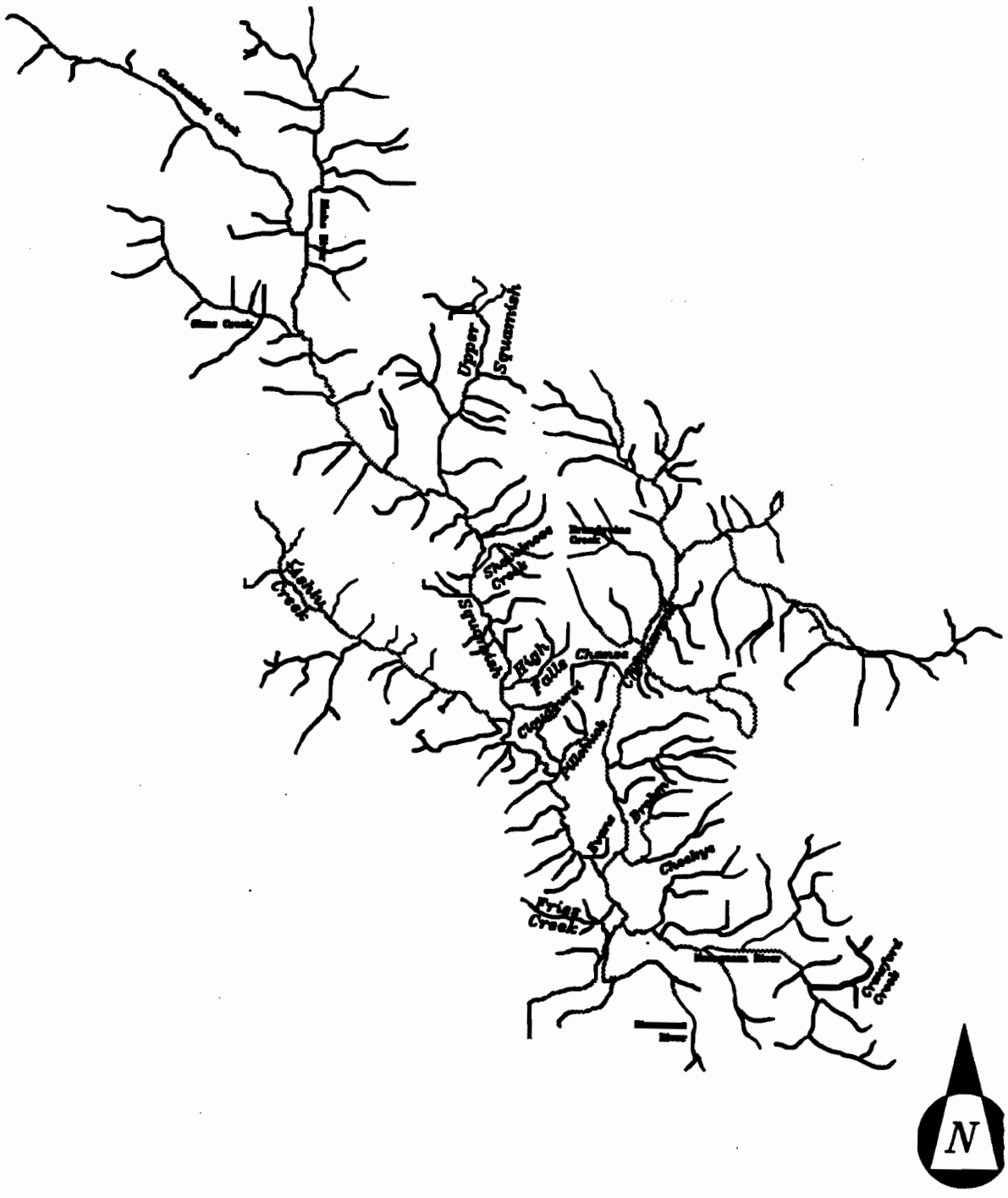
5.11.11 RAP Overview

The Riparian Assessment Procedure field crew found no recent clearcut areas directly adjacent to Evans Creek during their reconnaissance. Therefore, no assessment of riparian vegetation was conducted.

There may be opportunities for riparian vegetation enhancement or bioengineering work in conjunction with fish habitat enhancement, channel and bank stabilization, or other proposals for this creek. Options will be investigated in as part of Year 3 activities.

Squamish River Watershed

Crawford Creek



FOR REACH BREAKS SEE MAPS 92G066, 92G076 (in back pocket).

5.12 Crawford Creek

5.12.1 FHAP Overview

Crawford Creek is a tributary to the Mamquam River, which ultimately drains into the Cheakamus River. The FHAP assessment in Crawford Creek was conducted from September 16 to 18, 1996. The study area was divided into 25 reaches which covered approximately 5.0 km upstream of the Crawford Creek-Mamquam River confluence.

Habitat type altered predominantly between cascade and riffle throughout the length of the creek surveyed. Some glide habitat was identified in the upper reaches. Dominant substrate type from Reaches 1-20 were cobble and boulder which changed to cobble and gravel from Reaches 20-25. Rearing habitat in the form of overhead cover or in-stream cover was provided mainly by B, OV or LWD. Fish captured in Reaches 1 and 15 during the assessment were identified as cutthroat trout. An impassable barrier to anadromous fish was noted in the canyon spanning Reaches 3-5. Disturbance indicators included multiple channel braiding and eroding banks. The primary factors limiting fish habitat in Crawford Creek are instability of the watershed, associated log jams and aggradation of debris.

5.12.2 FHAP Assessment

Habitat Types

A summary of habitat types identified in Crawford Creek from September 16 to 18, 1996, is provided in Appendix E. The dominant habitat type in Reaches 1, 5, 6 and 9 was cascade. Riffle habitat dominated in Reaches 7, 11-14, and 16-26. Pool and glide habitat was noted in only a few reaches. Average gradient could not be calculated for all reaches because habitat type and gradient recorded by field crews did not always coincide.

Off-channel Habitat

Side channels were abundant throughout the length of the creek, but were frequently not accessible to fish. Two side channels observed in Reach 21 were accessible to fish at high flows only, whereas the two side channels identified in Reach 24 were accessible to fish at most flows. In addition, a groundwater source was observed in Reach 17 which could provide potential off-channel habitat.

Large Woody Debris (LWD)

Appendix E summarizes LWD loading data for reaches with LWD. LWD per bankfull width ranged from 0.06 to 6.66, indicating poor to good quality rearing habitat, based on the diagnostic table (Table 5) provided in Johnston and Slaney (1996). The majority of functional LWD observed in the creek provided poor or fair quality rearing habitat. Good quality habitat was mostly observed in Reaches 7-10, and 23-25.

Based on data collected during the September FHAP assessment, it would seem that sufficient LWD existed in Reaches 7-10 and 23-25 of Crawford Creek. However, these high counts may be misleading as

most LWD in these reaches was found forming part of unstable log jams rather than as individual functional pieces. LWD in the form of a log jam could act obstruct fish passage or as provide functional fish habitat, or both during different seasons depending on the level and flow rate of water in the creek. Most of Crawford Creek appeared very unstable and it was difficult to assess whether the log jams could provide fish habitat on a consistent basis.

Substrate Type

The dominant and subdominant substrate type in all reaches surveyed in Crawford Creek in September 1996 was cobble and boulder, with some gravel in the upper reaches.

Fish Distribution

Fish presence/absence was determined by electroshocking in Reach 1 in Crawford Creek on September 16, 1996. Fish distribution data is provided in Table 5.12-1. The only fish species captured was cutthroat trout. These trout ranged in fork length from 60 to 165 mm.

Table 5.12-1 Summary of fish capture data in Crawford Creek (1996).

Reach No.	Date of Electroshocking	Electroshocking Effort (seconds @ voltage)	Species Captured	Stream Class
1	September 16/96	645 @ 400	Cutthroat	S2

Adult Upstream Migration

An impassable barrier existed in the canyon in Reach 5 which may act as a velocity barrier to resident fish. The presence of this potential barrier was not confirmed due to inaccessibility of this reach to the field crew, but its potential presence was based on the steep gradient and banks in this section of the creek. Due to past logging activities and to the present instability of the watershed, other potential barriers to the upstream migration of fish would include old and/or newly formed log jams, and aggradation of debris.

Spawning and Incubation Conditions

Substrate type in Crawford Creek consisted mainly of cobble and boulders, with some gravel and little sand, thereby providing either no, little or abundant suitable habitat for spawning and incubation throughout the creek. However, existing spawning and incubation habitat was subject to extreme instability due to eroding banks, log jams, and aggradation in most of the creek.

Summer Rearing Habitat

Appendix E summarizes potential cover types observed in Crawford Creek during the September 1996 FHAP assessment. Cover throughout the creek consisted mainly of B, OV and LWD, but provided poor quality rearing habitat (i.e., cover ranged from 1 to 5%). Pool habitat provided approximately 60% cover in Reach 1, but was not significant in other reaches at the time of this assessment. Side channels were

numerous but provided little rearing habitat due to their inaccessibility to fish. Consequently, little summer rearing habitat was observed in Crawford Creek in September.

Winter Rearing Habitat

Most side channels identified in Crawford Creek were not accessible to fish: only two were accessible at high flows and two were accessible at most flows. Consequently, accessibility of these latter side channels should be further investigated during winter. Some pool habitat was observed during the September survey, but their functionality during winter months was unknown.

Juvenile Migration

Migration of juvenile fish in Crawford Creek would be similar to that of adult fish. Potential velocity barriers formed by the canyon in Reach 5 may prevent the further upstream migration of juvenile fish. If an impassable barrier exists in the canyon then upstream migration would be limited to approximately 1.6 km upstream of the Crawford Creek-Mamquam River confluence. Juvenile fish upstream from Reach 5 may migrate downstream to the lower reaches provided they survive the potential velocity barriers in the canyon.

5.12.3 FHAP Prescriptions

Based on the above FHAP assessment, the most limiting factor to fish in Crawford Creek is the instability of the upper watershed. Frequently eroding banks, and aggradation, primarily in the lower reaches, results in the destruction of fish habitat. A number of rehabilitation/restoration options exist which would address these limitations. However, the upper watershed must be stabilized before restoration options can be implemented. Stabilization of the upper watershed can be achieved by removal of excessive log jams and gravel aggradation, by reconstruction of stream channels and by revegetation of banks. The objectives of these efforts will result in reduced aggradation of debris, reduced channel braiding, and ultimately, reduced impact on fish habitat. Once the watershed has been stabilized and reassessed, habitat complexity can be increased by adding gravel to increase spawning habitat, and/or addition of LWD to form more pools, and excavation of side channels to increase rearing habitat.

Future Studies

Assessment of overwintering habitat in Crawford Creek should be undertaken to determine potential habitat limitations at that time of the year. Once the upper watershed of Crawford Creek has been stabilized, potential fish habitat restoration opportunities in the lower reaches should be reassessed.

5.12.4 FHAP QA/QC

QA/QC was not conducted by the supervisors in the Crawford Creek. Most of the habitat in Crawford Creek, including habitat type, substrate type, cover type, disturbance indicators, and riparian vegetation, did not vary throughout the length of the creek. Consequently, due to this limited variability and due to time and cost constraints, the supervisors did not conducted a full FHAP assessment in any of the reaches in this creek.

5.12.5 CAP Overview

Crawford Creek exhibits aggradation evidenced by large gravel bars. Debris volumes may be a result of clearcuts on adjacent hillslopes. Channel widening and bank erosion are also evident. There is a significant amount of LWD as well as remnants of logging equipment wasn't found within the creek.

Crawford Creek flows from its headwaters westward into the Mamquam River, which in turn joins with the Squamish River further downstream. Logging activities have taken place along most reaches.

Crawford Creek was broken down into 28 reaches, which were established based on tributaries, bridges, and major changes in channel morphology.

Table 5.12-2 Crawford Creek field data summary table.

Reach	Bankfull		Slope	Average Rock	Relative Roughness	Power Index	Sensitivity Rating	Channel Condition	Channel Type
	Width (m)	Depth (m)	(%)	D (m)					
1	15.3	0.76	5.6	0.56	0.74	65	M	Stable	Cascade-pool
2	21.67	1.87	10.33	0.83	0.45	418	M	Stable	Cascade-pool
3	18.38	1.16	8	0.52	0.45	171	M	Stable	Riffle-pool
4	14.84	0.64	3	0.46	0.72	29	M	Stable	Riffle-pool
5	-	-	-	-	-	-	-	-	Canyon
6	13.63	0.53	4.33	0.50	0.94	32	M	Stable	Cascade-pool
7	-	-	-	-	-	-	-	-	-
8	17.48	0.98	3.2	0.76	0.78	55	M	Aggraded	Riffle-pool
9	12.77	1.70	13.17	0.50	0.29	286	M	Aggraded	Cascade-pool
10	21.77	1.43	2.67	0.77	0.53	83	M	Aggraded	Riffle-pool
11	17.92	1.16	3.7	0.64	0.55	77	M	Aggraded	Riffle-pool
12	20.17	1.23	1.33	0.33	0.27	33	M	Aggraded	Riffle-pool
13	18.57	1.30	2	0.50	0.38	48	M	Aggraded	Riffle-pool
14	19.4	1.50	1.83	0.60	0.40	53	M	Aggraded	Riffle-pool
15	21.14	1.22	1.6	0.50	0.41	41	M	Stable	Riffle-pool
16	14.57	1.53	2.67	0.63	0.41	60	M	Stable	Riffle-pool

Reach	Bankfull		Slope	Average Rock	Relative Roughness	Power Index	Sensitivity Rating	Channel Condition	Channel Type
	Width (m)	Depth (m)	(%)	D (m)					
17	17.5	1.40	7	0.68	0.48	172	M	Stable	Riffle-pool
18	12.46	1.30	9.8	0.62	0.48	159	M	Stable	Cascade-pool
19	11.9	1.28	5.4	0.52	0.41	82	M	Stable	Riffle-pool
20	11.23	1.03	2	0.33	0.32	23	M	Stable	Riffle-pool
21	14.08	1.00	3.6	0.42	0.42	51	M	Stable	Riffle-pool
22	16.3	1.22	3	0.52	0.43	60	M	Stable	Riffle-pool
23	12.05	1.30	2.5	0.45	0.35	39	M	Stable	Riffle-pool
24	13.73	0.80	2	0.43	0.53	22	M	Stable	Riffle-pool
25	14.9	0.60	7.67	0.73	1.22	69	M	Aggraded	Cascade-pool
26	19.53	2.60	10.67	0.47	0.18	542	M	Stable	Riffle-pool
27	-	-	-	-	-	-	-	-	-
28	12.08	1.14	14.5	0.50	0.44	200	M	Stable	Cascade-pool

5.12.6 Assessment and Prescriptions

Reach 1

Cascade-pool Morphology
Boulder Bed Material
Sensitivity Rating: Medium

Reach 1 stretches from the confluence with the Mamquam River to a gravel road crossing the stream via a log bridge. The road running alongside the creek is a sedimentation source and is resulting in gravel buildup in the creek. The reach break was established at a log bridge, which should be inspected by a professional hydrological engineer. A side channel was found to rejoin the main channel within this reach, which may have additional fisheries value. Erosion has occurred on the right bank, causing trees to fall into the streambed. Cables from past logging were found littered in the creek. Overall, the reach was given a sensitivity rating of medium, although the impact due to upstream disturbance was rated high. The high rating was given as logging is or has occurred in many of the reaches. A rating of medium was given for the hillslope-valley-flat connection, as the creek banks are greater than 20% in some points and may be sources of material.

Prescription efforts for Reach 1 should focus on stabilizing the channel.

Reach 2

Cascade-pool Morphology
Boulder Bed Material
Sensitivity Rating: Medium

Reach 2 has the same general characteristics of reach 1, except it has a much steeper slope. There is some evidence of aggradation. Gravel bars average one-third of the creek bankfull width. Large woody debris is present within the creek, causing log jams on both sides of the creek channel. In several places LWD jams cover half of the total width of the creek. Erosion is occurring on the right bank causing alder trees to fall into the creek channel. Overall, the reach was given a sensitivity rating of medium, although the impact due to upstream disturbance was rated high. The high rating was given as logging is or has occurred in many of the reaches, and was noted at all cross-sections within this reach.

Restoration efforts in reach 2 should focus on cleaning up large woody debris jams. The right bank needs stabilization in places where erosion is occurring. Cables and other logging equipment should be removed from the creek.

Reaches 3 and 4

Riffle-pool Morphology
Cobble Bed Material
Sensitivity Rating: Medium

Reach 3 consists of a stretch of creek approximately 800 m long. The general bed material is cobble, with slight aggradation occurring in the lower portions of the reach. The average gravel bar width is about one quarter of the channel bankfull width. The channel is fairly well restricted, and as such has been given a low sensitivity rating for average valley width. Logging has occurred on the right bank, with regeneration growth fairly well established. Reach 4 exhibits the same general characteristics, although it has a milder slope.

Stone lines within this reach should be re-established to pre-logging.

Reach 5

Reach 5 was classified as a canyon, and was determined to unassessable by field crews.

Reach 6

Cascade-pool Morphology
Boulder Bed Material
Sensitivity Rating: Medium

Reach 6 was found to be a stable reach, with insignificant aggradation or erosion. As with all areas of Crawford Creek, the reach is highly sensitive to upstream logging disturbances.

Reach 8

Riffle-pool Morphology
Cobble Bed Material
Sensitivity Rating: Medium

Reach 8 consists of a typical stretch of creek with a riffle-pool morphology. The reach is approximately 400 m long. It has at least three minor tributaries and several runoff points. There is a large valley-flat, low average bank slope, and logging all along the creek. These factors can combine to cause the creek to

meander into a channel. The creek is aggraded along the reach, with several areas having build-up of large woody debris.

Gravel bars should be scalped and stone lines should be re-established.

Reach 9

Cascade-pool Morphology
Cobble/Bedrock Bed Material
Sensitivity Rating: Medium

Reach 9 contains a major log jam which crosses the entire creek width. Alluvial material of cobble to gravel size is beginning to buildup in the log jam. An ephemeral creek on the left bank is located about halfway up the reach.

The top of Reach 9 is defined by a waterfall. The overall sensitivity rating in Reach 9 is medium, although the sensitivity to upstream disturbance is high as evidenced by the log jam.

The log jam in Reach 9 needs to be investigated by a professional hydrological engineer.

Reaches 10-14

Riffle-pool Morphology
Cobble Bed Material
Sensitivity Rating: Medium

Reaches 10-14 consist of a section of creek with a riffle-pool morphology. There is evidence of aggradation in the form of gravel bars and alluvial deposits generally comprising about one-quarter of the creek width. Several tributaries enter the creek in this section. Only some were used as reach breaks to simplify the assessment. The buffer zone from logging ends in reach 10, where logging has removed the riparian fringe. Reach 13 contains a connected slide of clay/gravel material (entering the creek). Log jams are present in many portions of the creek. These jams are comprised not only of logging debris, but from trees along the banks whose base has been eroded away, resulting in the tree falling into the channel.

Restoration efforts in this portion of the creek should focus on stabilization of the banks in places where erosion is occurring, and on the removal of large woody debris. Gravel bars in the creek need to be scalped and stone lines re-established.

Reaches 15-17

Riffle-pool Morphology
Cobble/Boulder Bed Material
Sensitivity Rating: Medium

Reaches 15-17 display a characteristic stable riffle-pool morphology. Several tributaries enter the creek from the left bank. There is slight aggradation at several points, although in general the section of creek is stable.

No restoration efforts are prescribed for reaches 15-17.

Reach 18

Cascade-pool Morphology
Boulder/Cobble Bed Material
Sensitivity Rating: Medium

Reach 18 has an average slope of approximately 10%, resulting in a cascade-pool morphology. The reach is stable, although minor gravel bars are beginning to form. Several ephemeral tributaries are found within the reach on the left bank. The medium overall sensitivity rating of the reach is due to the high upstream disturbance sensitivity rating. Fish were spotted in this reach.

Prescription efforts in this reach should focus on ensuring that stone lines are intact.

Reaches 19-24

Riffle-pool Morphology
Cobble/Boulder Bed Material
Sensitivity Rating: Medium

Reaches 19-24 exhibit a riffle-pool morphology with a general bed material comprised mostly of cobble and lag boulders. About a dozen ephemeral streams enter the creek from the left bank. A dry side channel was also found. Significant gravel bars are present within this section of creek. Logging has occurred along most portions of the creek.

Restoration efforts in reaches 19-24 should focus on maintaining stone lines. Several log jams were found in Reaches 23 and 24 which should be investigated by a professional hydrological engineer.

Reach 25

Cascade-pool Morphology
Cobble Bed Material
Sensitivity Rating: Medium

Reach 25 is aggraded, exhibiting gravel bars which comprise almost the entire bankfull width. A side channel was found which may have been the former main channel. The channel runs underground (sinking stream) for a section of the reach. Large woody debris is found throughout the reach. The top of the reach is defined by a bridge which should be fully assessed by a professional hydrological engineer.

Restoration efforts in this reach should focus on channel stabilization.

Reach 26

Riffle-pool Morphology
Cobble/Boulder Bed Material
Sensitivity Rating: Medium

Reach 26 extends from the bridge at the top of reach 25 to a tributary on the left bank. Overall, it is stable.

Reach 28

Cascade-pool Morphology
Boulder Bed Material
Sensitivity Rating: Medium

Reach 28 is a stable cascade-pool reach with a general bed material composed mostly of lag boulders. Gravel bars are beginning to form in the channel. The top of the reach is defined by a waterfall approximately 60 m high.

Restoration efforts in this reach should focus on bank stabilization, removal of large woody debris, and the clean-up of logging debris.

5.12.7 CAP Prescriptions

Creek Prescriptions (Year One)

No prescriptions for year one.

Creek Prescriptions (Year Two to Five)

In the following two to five years, Crawford Creek should have channel morphology reconstruction done. Previous channel construction should be inspected for stability. Channel construction should be carried out from the top down. The lower reaches should be reconstructed at this time if deemed necessary.

General Creek Work Involved (Year Five to Twenty)

A general inspection of river stability should be carried out every two years for the proceeding five years. At this time, any instream work necessary should be identified and carried out immediately. A summary report should be written up detailing the progress and any deficiencies within the creek at the end of each inspection. After year ten an inspection should be carried out every five years. Again, if instream work is necessary it should be identified and carried out immediately. A final summary report should be composed as well as a final photo catalog.

5.12.8 CAP Quality Assurance/Quality Control

All data collected in the field and entered into electronic forms was checked for transcription accuracy. QA/QC was conducted by a hydrological specialist as part of a site visit while crews were collecting field data.

5.12.9 WAP Overview

In year three the specific conductance should be remeasured and, if the very high values in certain reaches are re-observed, the sources should be determined. These very high values (60 to 140 µmhos/cm) could reflect point sources of pollution or enhanced nutrient loading.

Table 5.12-3 Crawford Creek summary table (draft).

Reach	Morphology	Assessment	Prescription	Timing	Year	Rating
1 2	Cascade Pool Boulder Bed Material	Reach 1 stretches from the confluence with the Mamquam River to a gravel road crossing the stream via a log bridge. The road running alongside the creek is a sediment source to the creek. A side channel was observed within this reach. Erosion has occurred on the right bank, causing trees to fall into the creek. Cables from past logging were found littered in the creek channel.	Erosion control measures at the direction of a professional hydrological engineer is prescribed. In addition, LWD, cables and other foreign materials should be removed from within the creek corridor. The enhancement of a small side channel is recommended. The aforementioned log bridge should be inspected by a professional hydrological engineer.	July 15 - Aug. 15	2	M
3 4	Riffle Pool Cobble Bed Material	Aggradation is evident in the lower portions of reach 3. The average gravel bar width is about one quarter of the channel bankfull width.	Stone lines should be re-established to pre-logging form.		2	M
5	Canyon	Not accessible.	No prescriptions required.		NA	
6 7	Cascade Pool Boulder Bed Material	Reach 6 is stable.	No prescriptions required.		NA	M
8	Riffle Pool Cobble Bed Material	Reach 8 exhibits riffle-pool morphology. The reach is approximately 400 m long There is a large valley-flat, low average bank slope, and logging all along the creek, therefore there is a potential for channel avulsion. The creek is aggraded along the reach, with several areas having significant LWD.	Scalp gravel bars and remove excessive LWD.	July 15 - Aug. 15	2	M
9	Cascade Pool Cobble & Bedrock Bed Material	Reach 9 contains a major log jam extending across the channel. It was observed that cobbles and gravels are beginning to buildup behind the logjam. In addition, an ephemeral creek was observed on the left bank approximately halfway up the reach.	Remove excessive LWD and gravel build up where applicable.	July 15 - Aug. 15	2	M

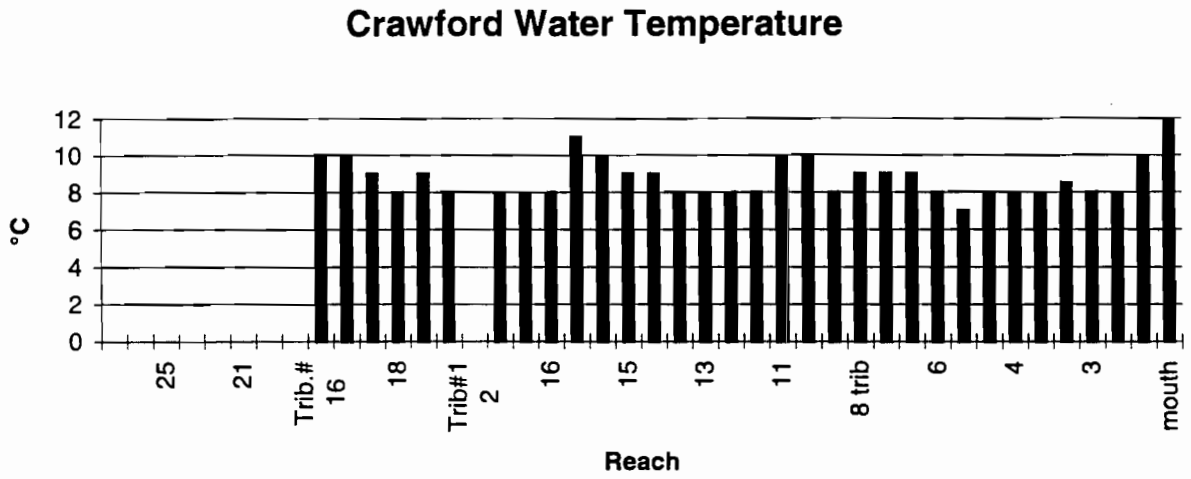
Reach	Morphology	Assessment	Prescription	Timing	Year	Rating
10 11 12 13 14	Riffle Pool Cobble Bed Material	Reaches 10-14 exhibit riffle-pool morphology. There is evidence of aggradation in the form of gravel bars and alluvial deposits. The riparian buffer zone ends in reach 10 removal of the riparian canopy. Reach 13 contains a connected slide of clay/gravel material entering the creek. Log jams are present in many areas of the creek. These jams are comprised not only of logging debris, but from riparian vegetation that has fallen into the creek due to bank erosion.	Scalp gravel bars and revegetate banks. Bank erosion protection works should be installed where applicable at the direction of a professional hydrological engineer. LWD should also be removed.	July 15 - Aug. 15	2	M
15 16 17	Riffle Pool Cobble & Boulder Bed Material	Reaches 15-17 exhibit a stable riffle-pool morphology.	No prescriptions required.		NA	M
18	Cascade Pool Boulder & Cobble Bed Material	Reach 18 is steep cascade and stable. Several ephemeral tributaries are found within the reach adjoining the main channel from the left bank.	Ensure that stone lines are intact.	Assess-ment in 2 years.	2	M
19 20 21 22 23 24	Riffle Pool Cobble & Boulder Bed Material	Reaches 19-24 exhibit a riffle-pool morphology with a general bed material comprised mostly of cobble and lag boulders. About a dozen ephemeral tributaries enter the creek from the left bank. A dry side channel was also found. Significant gravel bars are present within this section of creek. Logging has occurred along most banks of the creek.	Scalp excessive gravel material. Create one main channel thread. Remove excessive LWD.	July 15 - Aug. 15	2	M

Reach	Morphology	Assessment	Prescription	Timing	Year	Rating
25	Cascade Pool Cobble Bed Material	Reach 25 is very aggraded with gravel bars almost extending across the entire bankfull width. A side channel was found which may have been a former main channel. The water in the channel was observed to sink into the bed for a short section of the reach. Large woody debris is found throughout the reach. The top of the reach is defined by a bridge crossing.	Scalp excessive gravel. Create one main channel thread. Remove excessive LWD. A professional hydrological engineer should inspect the existing bridge.	July 15 - Aug. 15	2	M
26	Riffle Pool Cobble & Boulder Bed Material	Reach 26 extends from the bridge at the top of reach 25 to a tributary on the left bank. Overall, it is stable. The bank slope in many areas is greater than 20 percent.	Remove excessive gravel bar material. Assess in 2 years.	July 15 - Aug. 15	3	M
27 28	Cascade Pool Boulder Bed Material	Reach 28 is a stable cascade-pool reach with a general bed material with mostly large boulders. Gravel bars are beginning to form in the channel. The top of the reach is defined by a waterfall approximately 60 m in height.	Assess in 2 Years. No prescription required at this time.		3	M

5.12.10 WAP Assessment

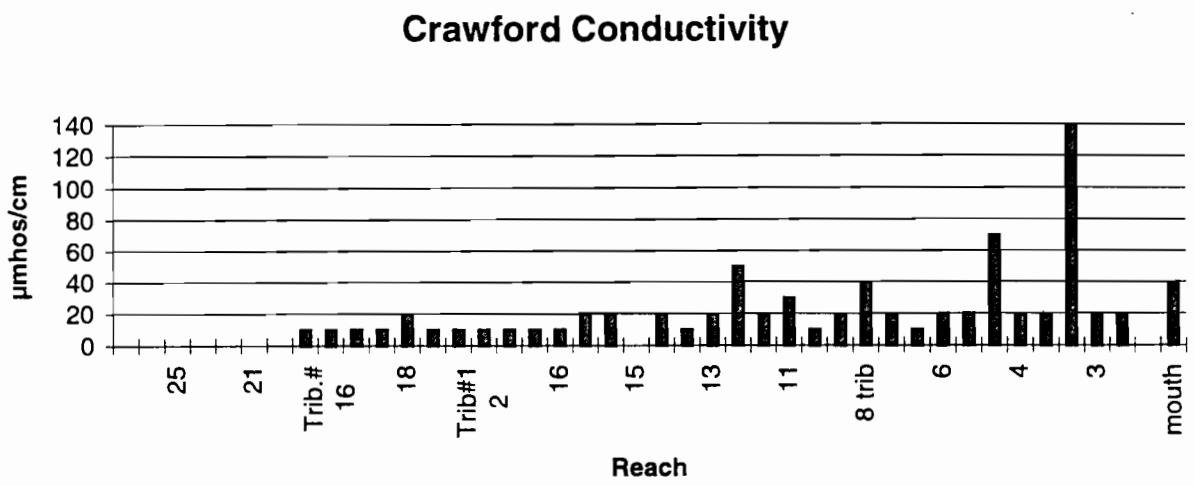
Temperature

Temperatures in this stream were consistently low, being typically between 8 and 10 °C. Only a few reaches evidenced higher values, with the highest value (12 °C) observed at the mouth. The temperature range of this creek would appear to indicate that, while being slightly lower than other creeks in this watershed, growth should be significantly affected by low temperatures.



Dissolved Oxygen and Specific Conductance

No dissolved oxygen data was available for this stream. Specific conductance values were typically very low in the upper reaches, being approximately 10 µmhos/cm. Values ranged significantly in the lower reaches, with most values approximately 20 µmhos/cm; however, a few sites exhibited significantly elevated values. Reaches mouth, 8 and 12 had values between 40 and 50 µmhos/cm. Reach 5 had a value of 70, while that of reach 3/trib was 140 µmhos/cm. This creek exhibited the greatest variability in specific conductance of any streams in this watershed.



Periphyton & Nutrient Dosing Pots

Periphyton samples were not analysed for Crawford Creek. Nutrient dosing pots were not deployed in Crawford Creek.

Invertebrates

Crawford Reach 1 96-Sept-04

Invertebrates from five different groups were found here: Ephemeroptera (88%), Diptera (9%), Trichoptera (2%), Hydracarina (1%), and Turbellaria (1%). The dominant taxa at this site were baetid mayflies, *Baetis sp.*, representing 32% of the sample (34 specimens). These mayflies inhabit lotic, erosional and depositional zones, are characterized as swimmers, climbers and/or clingers, and belong to the trophic guilds of collector-gatherers (detritus, diatoms) and/or scrapers. The remaining Ephemeroptera were: 7 *Cinygmula sp.*, 2 *Epeorus (Iron) albertae*, 15 *E. (I.) deceptivus*, 3 *Ephemerella coloradensis*, 8 *E. doddsi*, 1 *E. spinifera*, 1 *Ephemerella sp.*, and 22 *Rhithrogena sp.* (all of which are collector-gatherers and/or scrapers).

The second most abundant group, the true flies, contained 9 specimens, all of which were chironomids: 2 UID juveniles, 2 *Cricotopus sp.*, 4 *Eukiefferiella sp.*, and 1 *Micropsectra sp.* Only 2 caddisflies were collected here, both of which were *Rhyacophila coloradensis*, a predator-engulfer. No stoneflies were found here, but 1 water mite, *Sperchon sp.* (Hydracarina), and 1 Turbellaria (*Polycelis sp.*?) were collected.

Crawford Reach 2 96-Sept-04

Invertebrates from seven different groups were found here: Ephemeroptera (88%), Diptera (6%), Trichoptera (3%), Hydracarina (1%), Oligochaeta (1%), Turbellaria (1%), and Nematoda (1%). The dominant taxa at this site were heptagenid mayflies, *Rhithrogena sp.*, representing 24% of the sample (32 specimens). These mayflies inhabit lotic-erosional zones, are characterized as clingers, and belong to the trophic guilds of collector-gatherers (detritus, diatoms) and/or scrapers. The remaining Ephemeroptera were: 30 *Baetis sp.*, 23 *Cinygmula sp.*, 2 *Epeorus (Iron) albertae*, 16 *E. (I.) deceptivus*, 4 *Ephemerella coloradensis*, and 11 *E. doddsi* (all of which are collector-gatherers and/or scrapers).

The second most abundant group, the Diptera, or true flies, contained 8 specimens: 5 were chironomids (2 *Cricotopus sp.*, 2 *Eukiefferiella sp.*, and 1 *Micropsectra sp.*), 2 were empidid flies (1 *Chelifera sp.*, and 1 *Weidemannia sp.*), and 1 was a black fly pupa (*Prosimulium sp.*). Four caddisflies were collected here, of which 3 were *Rhyacophila coloradensis*, and 1 was *Rhyacophila (acropedes or vao)*, both of which are predator-engulfers. No stoneflies were found here, but 1 water mite, *Brachypoda sp.*, 1 oligochaete worm, Family Lumbriculidae, 1 Turbellaria (*Polycelis sp.*?), and 1 nematode were collected at this site.

Crawford Reach 3 96-Sept-05

Invertebrates from only four different groups were found here: Ephemeroptera (86%), Trichoptera (7%), Diptera (4%), and Turbellaria (4%). The dominant taxa at this site were heptagenid mayflies, *Rhithrogena sp.*, representing 36% of the sample (10 specimens). These mayflies inhabit lotic-erosional zones, are characterized as clingers, and belong to the trophic guilds of collector-gatherers (detritus, diatoms) and/or scrapers. The remaining Ephemeroptera were: 7 *Baetis sp.*, 3 *Cinygmula sp.*, 2 *Epeorus (Iron) deceptivus*, 1 *Ephemerella coloradensis*, and 1 *E. doddsi* (all of which are collector-gatherers and/or scrapers).

The second most abundant group, the caddisflies, contained 2 specimens: both *Rhyacophila (acropedes or vao)*, which are predator-engulfers. No stoneflies were collected, but 1 chironomid, *Micropsectra sp.*, and 1 Turbellaria (*Polycelis sp.*?) were found here.

Crawford Reach 10 96-Sept-09

Invertebrates from only four different groups were found here: Diptera (46%), Plecoptera (31%), Ephemeroptera (15%), and Trichoptera (8%). There was no dominant taxa at this site as only 13 specimens were collected in total. Six true flies were found, all of which were chironomids: 2 UID pupa, 3 *Cricotopus sp.*, and 1 *Eukiefferiella sp.* Four stoneflies were collected: 2 *Zapada (haysi)*, a shredder-detritivore, and 2 *Kogotus sp.*, a predator-engulfer. Only 2 mayflies were found here, 1 *Baetis sp.*, and 1 *Rhithrogena sp.*, both of which are collector-gatherers and/or scrapers. Finally, 1 caddisfly was collected, 1 *Rhyacophila coloradensis*, a predator-engulfer.

Crawford Reach 11 96-Sept-10

Invertebrates from only four different orders were found here: Ephemeroptera (86%), Diptera (6%), Plecoptera (4%), and Trichoptera (4%). The dominant taxa at this site were baetid mayflies, *Baetis sp.*, representing 34% of the sample (34 specimens). These mayflies inhabit lotic, erosional and depositional zones, are characterized as swimmers, climbers and/or clingers, and belong to the trophic guilds of collector-gatherers (detritus, diatoms) and/or scrapers. The remaining Ephemeroptera were: 2 *Ameletus sp.*, 12 *Cinygmula sp.*, 2 *Epeorus (Iron) albertae*, 4 *E. (I.) deceptivus*, 3 *Ephemerella coloradensis*, 25 *E. doddsi*, 1 *E. (Seratella) tibialis*, and 4 *Rhithrogena sp.* (all of which are collector-gatherers and/or scrapers).

The second most abundant group, the true flies, contained 6 specimens, of which 5 were chironomids: 1 UID pupa, 1 UID adult, 1 *Brillia sp.*, 1 *Micropsectra sp.*, and 1 *Rheotanytarsus sp.* The remaining Diptera was 1 crane fly larvae, *Hexatoma sp.* (Fam. Tipulidae). Four stoneflies were collected here, of which 3 were *Capnia sp.*, and 1 was *Zapada (haysi)*, both of which are shredder-detritivores. Finally, 4 caddisflies were found here, of which 3 were predator-engulfers (1 *Rhyacophila (acropedes or vao)*, 1 *R. coloradensis*, and 1 *R. vepulsa*), and 1 was a scraper, collector-gatherer, *Oligophleboides sp.*

Crawford Reach 12 96-Sept-10

Invertebrates from only four different orders were found here: Ephemeroptera (92%), Diptera (3%), Trichoptera (3%), and Plecoptera (2%). The dominant taxa at this site were Ephemerellid mayflies, *Ephemerella doddsi*, representing 27% of the sample (17 specimens). These mayflies inhabit lotic-erosional and depositional zones, are characterized as clingers (some swimmers), and belong to the trophic guilds of collector-gatherers and/or scrapers. The remaining Ephemeroptera were: 12 *Baetis sp.*, 11 *Cinygmula sp.*, 2 *Epeorus (Iron) albertae*, 6 *E. (I.) deceptivus*, 2 *Ephemerella coloradensis*, 1 *Ephemerella sp.*, and 6 *Rhithrogena sp.* (all of which are collector-gatherers and/or scrapers).

Only 5 other specimens were collected at this site: 2 true flies (1 chironomid, *Eukiefferiella sp.*, and 1 empidid fly, *Chelifera sp.*), 2 caddisflies (1 *Oligophleboides sp.*, and 1 *Rhyacophila coloradensis*), and 1 stonefly (1 *Zapada (haysi)*).

Crawford Reach 20 96-Sept-12

Invertebrates from only four different orders were found here: Ephemeroptera (94%), Plecoptera (4%), Trichoptera (1%), and Diptera (1%). The dominant taxa at this site were ephemerellid mayflies, *Ephemerella doddsi*, representing 31% of the sample (29 specimens). These mayflies inhabit lotic-erosional and depositional zones, are characterized as clingers (some swimmers), and belong to the trophic guilds of collector-gatherers and/or scrapers. The remaining Ephemeroptera were: 1 *Ameletus sp.*, 23 *Baetis sp.*, 3 *Cinygmula sp.*, 5 *Epeorus (Iron) albertae*, 11 *E. (I.) deceptivus*, 3 *Ephemerella coloradensis*, and 13 *Rhithrogena sp.* (all of which are collector-gatherers and/or scrapers).

Only 6 other specimens were collected from this site: 4 stoneflies (3 *Skwala (paralella)*, predator-engulfers and 1 *Zapada (haysi)*), 1 caddisfly (1 *Rhyacophila (acropedes or vao)*), and 1 Diptera/chironomid (1 *Eukiefferiella sp.*).

Crawford Reach 21 96-Sept-12

Invertebrates from only three different orders were found here: Ephemeroptera (95%), Trichoptera (4%), and Diptera (1%). The dominant taxa at this site were ephemerellid mayflies, *Ephemerella doddsi*, representing 46% of the sample (108 specimens). These mayflies inhabit lotic-erosional and depositional zones, are characterized as clingers (some swimmers), and belong to the trophic guilds of collector-gatherers and/or scrapers. The remaining Ephemeroptera were: 33 *Baetis sp.*, 11 *Cinygmula sp.*, 5 *Epeorus (Iron) albertae*, 14 *E. (I.) deceptivus*, 4 *Ephemerella coloradensis*, and 50 *Rhithrogena sp.* (all of which are collector-gatherers and/or scrapers).

The second most abundant group, the caddisflies, contained 9 specimens: 2 *Glossosoma sp.*(clinger, scraper), 2 *Rhyacophila (acropedes or vao)*, 3 *R. coloradensis*, and 2 *R. vepulsa* (all of which are predator-engulfers). No stoneflies were collected here, and only 2 true fly specimens, both chironomids, *Cricotopus sp.*

Crawford Reach 22 96-Sept-12

Invertebrates from only four different orders were found here: Ephemeroptera (94%), Trichoptera (3%), Diptera (2%), and Plecoptera (1%). The dominant taxa at this site were ephemerellid mayflies, *Ephemerella doddsi*, representing 37% of the sample (84 specimens). These mayflies inhabit lotic-erosional and depositional zones, are characterized as clingers (some swimmers), and belong to the trophic guilds of collector-gatherers and/or scrapers. The remaining Ephemeroptera were: 51 *Baetis sp.*, 4

Cinygmula sp., 8 *Epeorus (Iron) albertae*, 19 *E. (I.) deceptivus*, 3 *Ephemerella coloradensis*, and 48 *Rhithrogena sp.* (all of which are collector-gatherers and/or scrapers).

Only 13 other specimens were collected at this site: 6 caddisflies (1 *Arctopsyche sp.*, a collector-filterer, 1 *Glossosoma sp.*, a scraper, and 4 *Rhyacophila coloradensis*, all predator-engulfers), 4 Diptera/chironomids (2 UID juveniles, and 2 *Cricotopus sp.*), and 3 stoneflies (2 *Zapada (haysi)*, and 1 *Zapada sp.*, both of which are shredder-detritivores and herbivores on moss).

Sedimentation Buckets

Sedimentation buckets were not deployed in Crawford Creek.

5.12.11 WAP Prescriptions

Channel structure: silviculture planting should revegetate upper upslope reaches and riparian zones (estimated recover period is 10-100 years); this will also increase organic cellulose pool of potential woody debris but will require long time periods (centuries). *Pool and riffle structures:* should be re-established such that they are consistent with natural channel structure and hydrologic regimens. *Large structural elements (wood and boulders):* placement should be made with respect to creating microhabitat within pool / riffle zones (1-10 year recovery period). Channel modifications must be made in conjunction with road and culvert stabilization. Large woody debris should be enhanced to increase microhabitat for macroinvertebrates and to increase the trapping of adult salmon carcasses (5-25 years). Increasing LWD and boulder size will i) enhance refugia habitat to reduce predation and energy expended combating high flows, ii) increase organic matter storage, and, iii) reduce downstream nutrient movement. *Sediment:* hydraulic flushing of excessive sediment deposits is largely ineffective; sediment traps should be placed in reaches to encourage deposition where insufficient spawning sediment exists (5-20 years) ***Hydrology:*** discharge rates can be controlled, in the long term (10-50 years) if upslope and riparian vegetation is undertaken to reestablish interception and evapotranspiration rates; erosion presently results in substrata instability and decreased production. Since sediment and bed-load movement can also increase ablation and disruption of periphyton accrual 1-10 years), every effort must be made to stabilize bed load. Natural and artificial dams must be removed since they tend to alter natural discharge patterns. *Low flows:* replacement of conifers with deciduous vegetation will reduce evapotranspiration rates and change the nature and rate of terrestrial organic inputs (25-50 year cycle). Channel modifications which result in a cessation of rapid hydrologic fluctuations will result in recolonisation of stream banks by riparian trees, shrubs, grasses and forbs and benthic surfaces by aquatic biota and thereby increase trophic complexity (1-10 years).

Sediment: upslope and riparian reforestation will diminish erosion-based soil inputs; this will reduce short term nutrient enhancement and decrease undesirable smothering of instream habitat (10-50 years). Unnatural mass failures of upslope and riparian areas, together with landslides, must be reduced largely through reductions in unnecessary road networks and upgrading of existing roads; it is crucial that remaining roads and culverts be maintained to standards which minimize or eliminate local, steep slope, water movements which would otherwise induce enhanced sediment deposition into creeks and streams (20-200 year cycles).

Water quality: temperature: re-establishment of riparian canopy cover will maintain existing solar inputs and stream temperatures (10-40 years); solar insolation profiles should be conducted under both open and closed canopies (both deciduous and coniferous)(1-10 years). Changes in solar quality and quantity will modify algal community structure and productivity and production (5-25 years). Continuous data logger

thermistors should be installed in the creek to define temperature profiles. *Nutrients:* revegetation of the upslope and riparian areas will reduce nutrient washout and diminish nutrient loading into surface waters; this may result, together with increased canopy cover and shading, in reduced summer and autumn periphyton production. An assessment of winter periphyton production should be conducted.

Riparian and immediate upslope forest: Small tributaries and ephemeral streams, which provide lateral shelter, rearing habitat and act as a feedstock production area, especially in those reaches below reach 5, must be protected and revegetated where necessary; care should be taken to ensure that stream crossings are designed, installed and maintained with respect to protection of trophic in-stream attributes. A survey of ephemeral streams should be made; damaged stream habitat should be restored. *Production of large wood:* the long term perspective should be the production of mature and old-growth forest structure for the production of new wood. Upstream production and subsequent downstream transport, through stream washout and landslides, is presently delivering large structural elements to the lower reaches (100-300 year horizon). *Trophic and organic food production:* mature and old-growth forest and riparian zone vegetation restores natural inputs from terrestrial ecosystems (40-80 years); introduction of leaf litter is essential for provision of structural substrate on which bacterial and protozoan communities develop; macroinvertebrates derive a significant portion of their nutrition from this microbiotic community (5-10 years). Fish gut studies should be conducted to determine what food resources are being used as the primary nutrition source. Creating specific microhabitat, in those reaches below reach 5, which provides for the specific requirements of selected algal and micro and macroinvertebrate populations, must be created when channel morphologies are altered (1-10 year cycles). *Shading:* re-establishment of riparian canopy will ultimately reintroduce light as a factor limiting primary production, which will eventually return to predisturbance values (5-20 year cycle). *Rooting systems:* growth of woody vegetation on stream banks, and the concomitant root network, results in enhanced stream bank integrity (20-80 years). *Nutrient modification:* successional processes occurring as riparian plant communities develop can, in some situations, enhance nutrient filtering capability; however, subsurface hydrologic flows are complex and may be little influenced by riparian root structures (20-80 year cycles).

Exogenous material: *chemicals:* anthropogenic chemicals vary tremendously in persistence, and in toxicity, in the environment; no general recovery times can be provided in the absence of species-specific knowledge of the chemicals. No such conditions appear to exist in this watershed. *Exotic biota:* once established, exotic species are typically very difficult to eliminate from indigenous community assemblages; each species exerts a different influence on the regional community. No generalized recovery time frame can be used. As in the other watersheds, no exotic biota were observed in the samples analyzed to present.

5.12.12 RAP Overview

The Riparian Assessment Procedure (RAP) field team investigated eight openings on Crawford Creek and its major tributary.

It is recommended that riparian enhancement be conducted on each of these openings.

5.12.13 RAP Assessment

Opening 1

Opening 1 is located on reach 3, adjacent to a ravine, within which Crawford Creek flows over a series of cascades, separated by pools. The topography is steeply sloping, parallel to the creek. A narrow leave

strip, consisting of veteran mountain hemlock, western redcedar, and amabilis fir, remained along the edge of the ravine. Regenerating trees within the survey plots were mountain hemlock and amabilis fir. The sparse shrub and herb layers consisted of bog blueberry, black huckleberry, five-leaved bramble, bunchberry, Queen's cup, common juniper, lady fern, and deer fern. The substrate was predominantly very mossy, organic soil. This species composition indicates that this site is transitional between the Mountain Hemlock and Coastal Western Hemlock Biogeoclimatic Zones. Because of the presence of western redcedar, more characteristic of the CWH (Green and Klinka 1994), the site series in this opening best represent CWHms1/01, 04, 05. Depending on the microsite, the soil nutrient regime ranges from poor to rich, and the soil moisture regime from slightly dry to very moist.

Opening 2

Opening 2 is located on reach 4, adjacent to a waterfall. Scattered veteran mountain hemlock and amabilis fir stood adjacent to the creek. Regenerating seral tree species consisted of amabilis fir, western hemlock, mountain hemlock, yellow cedar, and western redcedar. The shrub species identified in this opening were Sitka mountain ash, Sitka alder, bog blueberry, oval-leaved blueberry, Pacific willow, false azalea, common juniper, salmonberry, highbush cranberry, five-leaved bramble, stink currant, bunchberry, and twinflower. The herb layer was quite species-rich; characteristic species were Queen's cup, rosy twistedstalk, fireweed, pearly everlasting, Indian hellebore, skunk-cabbage, sweet-scented bedstraw, foamflower, oak fern, lady fern, and deer fern. Like Opening 1, Opening 2 is transitional between the MHmm2 and the CWHms1 zones. With reference to Green and Klinka (1994), the plant species found in this opening are most characteristic of CWHms1/01, 03, 04, 05, 06, 07, and 09.

Opening 3 (left bank)

The left side of Opening 3 was generally well-vegetated, with good stands of regenerating trees and shrubs. The opening was logged to the creekbank along some of its length. Main canopy trees and regenerating sersal tree species consisted of amabilis fir, mountain hemlock, western hemlock, and yellow cedar. The composition of the shrub and herb layers closely resembled those of Opening 2; therefore, the site series present in Opening 3 (left) were also CWHms1/01, 03, 04, 05, 06, 07, and 09.

Opening 3 (right bank)

The right side of Opening 3 was less well-treed than the left side, but shrub and herb growth was dense. The dominant or main-canopy trees were amabilis fir and yellow cedar, while seral tree species consisted of amabilis fir, yellow cedar, western redcedar, and western hemlock. The shrub and herb composition was also close to that observed in Opening 2, but for the notable absence of skunk cabbage. This indicates a slightly drier regime, characteristic of CWHms1/01, 03, 04, 05, 06, and 07.

Opening 4

Most of Opening 4 was logged to the creekbank, though a few veteran amabilis fir and western hemlock remain. Regenerating trees are fairly sparse, the species consisting of western hemlock, amabilis fir, and yellow cedar. Species identified in the shrub layer consisted of Sitka alder, Sitka mountain ash, stink currant, salmonberry, bog blueberry, red elderberry, five-leaved bramble, bunchberry, and false azalea. Characteristic herb species were fireweed, grasses, oak fern, lady fern, clasping twistedstalk, rosy twistedstalk, Devil's club, Indian hellebore, common horsetail, and Queen's cup. These species are representative of the site series MHmm2/ 01, 03, 04, 04, 06, and 07, indicating slightly dry to very moist soil with a poor to rich nutrient regime, depending on the microsite.

Opening 5

The soil in Opening 5 was very moist, and consisted mainly of organic matter. Dense growth of mosses, liverworts, and willow was noted. Vegetation species composition was generally similar to that of Opening 4. Regenerating tree species were western hemlock, amabilis fir, and yellow cedar, while shrub species identified were Sitka alder, Sitka willow, Sitka mountain-ash, salmonberry, five-leaved bramble, black gooseberry, bunchberry, false azalea, bog blueberry, black huckleberry. The herb layer was representative of moist sites, and contained fireweed, Alaska rein-orchid, skunk cabbage, common horsetail, spiny wood fern, oak fern, lady fern, stream violet, pearly everlasting, wall lettuce, foamflower, rosy twistedstalk, clasping twistedstalk, Indian hellebore, Devil's club, Queen's cup, pink monkey-flower, and miner's-lettuce. Site series present were therefore MHmm2/ 03, 05, 07, and 09, indicating fresh to wet soil rich in nutrients.

Opening 6

Opening 6 was logged to the creek edge for most of its length, except for some remnant veteran yellow cedar, mountain hemlock, and amabilis fir. Main canopy trees in the sample plots consisted of red alder and western hemlock, while regenerating seral species were western hemlock, mountain hemlock, amabilis fir, yellow cedar, and possibly a spruce. The shrub species recorded here consisted of Sitka alder, highbush cranberry, bog blueberry, five-leaved bramble, salmonberry, thimbleberry, false azalea, bunchberry, and Devil's club. Characteristic herb species were common horsetail, oak fern, lady fern, deer fern, skunk cabbage, foamflower, pearly everlasting, Queen's cup, Indian hellebore, clasping twisted-stalk, and rosy twistedstalk. These species are representative of the site series MHmm2/ 01, 03, 04, 05, 06, 07, and 09, indicating slightly dry to wet soil with a poor to rich nutrient regime, depending on the microsite.

Opening 7

Opening 7 is located adjacent to a substantial ephemeral flood channel, just downstream from a bridge. The narrow leavestrip of veteran trees appears to have been bolstered with riprap, and the main creek channeled to its present location. Veteran and main canopy tree species were amabilis fir, western hemlock, and red alder. Regenerating trees in the sample plots were western hemlock, mountain hemlock, yellow cedar, and amabilis fir. Shrubs in the sample plots were Sitka alder, salmonberry, red elderberry, bog blueberry, Pacific willow, Scouler's willow, black gooseberry, stink currant, five-leaved bramble, Devil's club, and false azalea. Characteristic herb species were oak fern, lady fern, clasping twistedstalk, rosy twistedstalk, foamflower, Indian hellebore, fireweed, pearly everlasting, sweet-scented bedstraw, and arctic lupine. This opening had a slightly drier regime than Opening 6, characteristic of the site series MHmm2/ 01, 03, 04, 05, 06, and 07.

Opening 8 (tributary)

Opening 8 was located alongside a waterfall on a tributary of Crawford Creek. A narrow leave-strip, consisting of veteran mountain hemlock, amabilis fir, and yellow cedar, was present along the shoreline. Conifer regeneration also consisted of these three species. Behind the leave-strip, this opening was notable as being sparsely vegetated, with large areas of bare organic soil. Shrub species identified were Sitka mountain-ash, common juniper, false azalea, bog blueberry, black huckleberry, salal, salmonberry, five-leaved bramble, bunchberry, Devil's club, and twinflower. Few herb species were present; those identified in plot surveys were fireweed, deer fern, lady fern, foamflower, clasping twistedstalk, rosy twistedstalk, Queen's cup, false Solomon's-seal, stream violet, and trailing yellow violet. This species

assemblage indicates the presence of the site series MHmm1/ 04, 05 and 07, that is, moist to very moist, medium to rich soils.

Management Objectives

The riparian vegetation impact assessment scores for openings surveyed on Crawford Creek are shown in Table 5.12-4. Management priority should be assigned as follows:

- Increased shrub stocking in all openings
- Increased conifer stocking, particularly in openings 3, 4, 5, 6, and 7
- Application of bioengineering techniques for erosion control in opening 7

Table 5.12-4 · Crawford Creek riparian impact assessment scores.

Reach Number	Opening Number	Stream Shading	Large Woody Debris	Small Organic Debris	Surficial Sediment Filtering	Subsoil Filtering Capacity
3	1	high	low	low	low	medium
4	2	high	low	medium	low	medium
	3R	high	medium	low	low	low
	3L	high	high	low	medium	medium
	4	high	high	low	low	low
	5	medium	high	medium	low	low
	6	high	medium	medium	medium	low
	7	medium	medium	medium	low	medium
	8 TRIB	high	low	high	low	medium

5.12.14 RAP Prescriptions

It is recommended that a combination of treatments be applied:

- Increased stocking of mountain hemlock and subalpine fir in Openings 3, 4, 5, 6, and 7
- Planting of Sitka alder whips and assorted berry bushes adjacent to the shore in all openings

[Bioengineering techniques to be used for erosion control and channel stabilization along Opening 7 should be determined following discussions with the team's hydrological engineer and geologist.]

Table 5.12-5 outlines the recommended treatments.

Table 5.12-5 Crawford Creek - recommended rehabilitation treatments and their locations

Treatment	Site Series	Location	Recommended Species	Stocking Densities (stems/ha)
increased conifer stocking	MHmm2/01, 03, 04, 05, 06 and 07.	Openings 3 to 7 throughout RMA	mountain hemlock subalpine fir	500 - 900
increased shrub stocking	MHmm2/ 06 and 07.	all openings adjacent to creek	Sitka alder, assorted berry bush species	clustered
bioengineering technique to be developed	N/A	Opening 7; downstream from bridge	TBA	TBA

Table 5.12-6 Crawford Creek - twenty year schedule of activities.

YEAR	SPRING	SUMMER	FALL	WINTER
1996 (yr 0)	complete Level 1 assessment	conduct Level 2 assessment	develop draft prescriptions	finalize prescriptions
1997 (yr 1)	commence live-stake plantings; stock selection; supply tree seeds to grower for fall and next spring stock; plant shrubs and berry bushes; removal of unwanted slash from RMAs	evaluate success of live stakings; investigate applicability of bioengineering technique in Opening 7	additional live-stake plantings; obtain tree seedlings from grower; plant tree seedlings; possible initiation of bioengineering project	re-visit prescriptions if modifications warranted
1998 (yr 2)	continue conifer planting; possible continuation of bioengineering project	evaluate success of all planting; if necessary, plan additional planting; removal of fireweed	additional planting as necessary	
1999 (yr 3)	additional planting as necessary; removal of fireweed	removal of fireweed; evaluate success of all planting; if necessary, plan additional planting	additional planting as necessary	
2000 (yr 4)	inspection			

YEAR	SPRING	SUMMER	FALL	WINTER
2001 (yr 5)	inspection	evaluate success of all planting; prescribe additional planting if necessary	begin implementation of year 5 prescriptions	
2002 (yr 6)	continued implementation of year 5 prescriptions			
2003 (yr 7)	inspection			
2004 (yr 8)	inspection			
2005 (yr 9)	inspection			
2006 (yr 10)		evaluate success of all planting; prescribe additional planting if necessary	begin implementation of year 10 prescriptions	
2007 (yr 11)	continued implementation of year 10 prescriptions			
2008 (yr 12) to 2016 (yr 20)	inspections on an as-needed basis, e.g., following large flood events; possible site-specific, small scale prescriptions or repairs as necessary; after 20 years, the sites should be self-sustaining and self-perpetuating			

5.12.15 RAP Quality Assurance/Quality Control

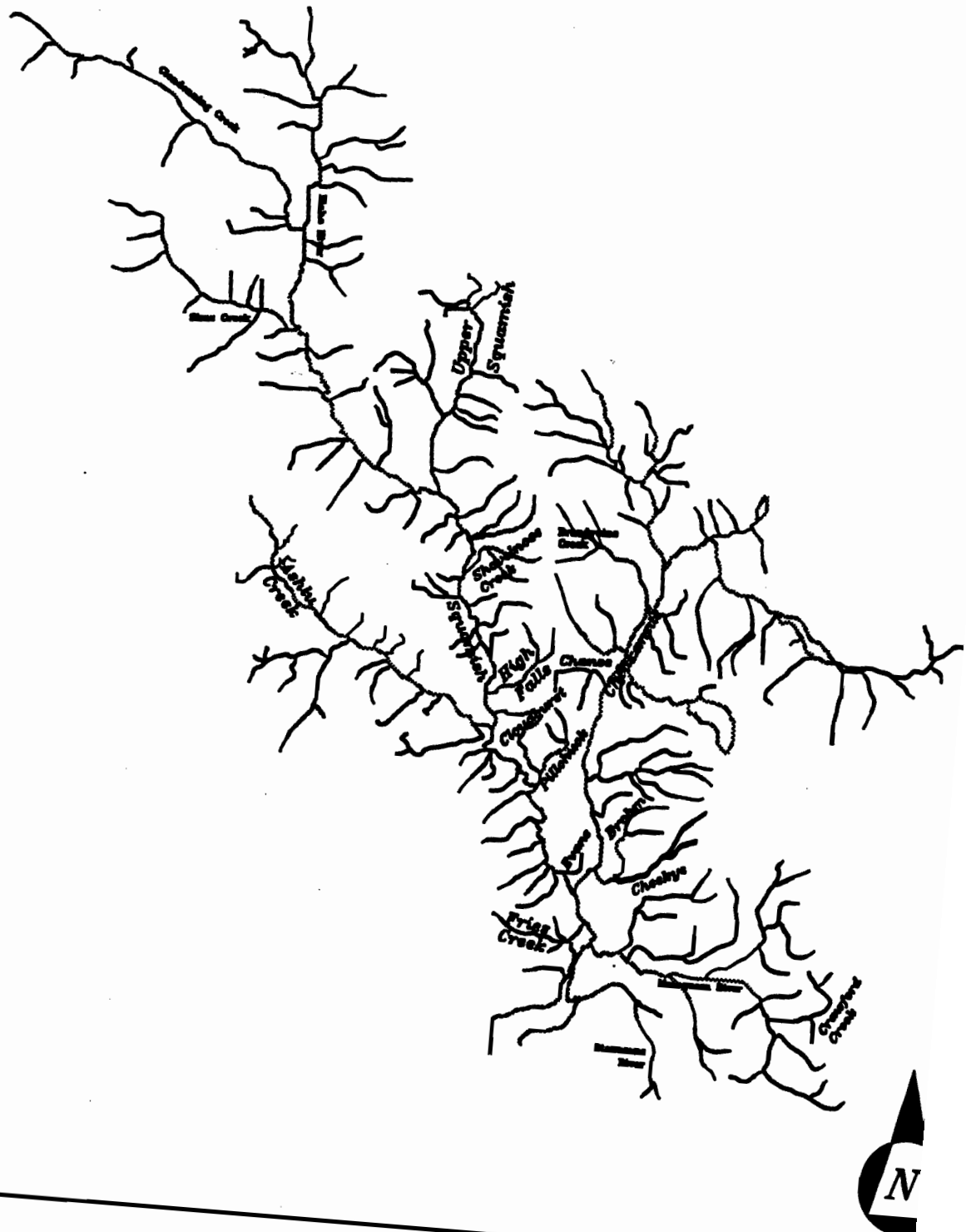
Five plots (numbers 1 to 3 in Opening 4L; numbers 5 and 6 in Opening 7A) were re-assessed for quality assurance. Overall opening assessment (Data sheet 3) was completed only for Opening 4L where all plots were re-assessed.

Overall assessment

An overall assessment was not conducted for this creek.

Squamish River Watershed

Cheekye River



FOR REACH BREAKS SEE MAPS 92G075, 92G085 (in back pocket).

5.13 Cheekye Creek

5.13.1 FHAP Overview

Cheekye River is a tributary to the Cheakamus River and receives Brohm River flows. In general, the banks of the Cheekye River were steep with a high capacity for carrying bedload and debris causing degradation in the upper reaches, aggradation in the lower reaches, and sediment deposition in the Cheakamus River (Triton, 1993). Debris flows in the Cheekye River have been triggered by heavy rainfalls, and there has been a long history of instability in the watershed. The channel in the lower Cheekye River changed frequently due to the large floodplain and the bed at the Cheekye River-Cheakamus River confluence has been elevated creating potential barriers to adult fish at low flows (Triton, 1993). Anadromous fish had access to the first 6 km of the Cheekye River where a barrier made the upper 9 km inaccessible (Triton, 1993).

Historical data indicated that the Cheekye River had a high concentration of dissolved material which can be readily visible in the water column at certain times of the year (Triton, 1993). High alkalinity and total phosphorus concentrations had also been recorded in the Cheekye River (Triton, 1993)). The source of total phosphorus in the river may be related to erosion of volcanic sediments.

The FHAP assessment in the Cheekye River was conducted on September 19, 1996. The study area was divided into 15 reaches which covered approximately 3.8 km upstream of the Cheekye River-Cheakamus River confluence. The only habitat type identified in the river during the time of the survey was cascade. No pool habitat was observed in any of the reaches surveyed. The river had been channelized for much of its length and provided little spawning or rearing habitat in the form of overhead cover or in-stream cover. Fish captured in Reaches 1 and 2 during the survey were identified as steelhead trout. No impassable barriers to fish were noted in the 11 reaches surveyed. Disturbance indicators included multiple channel braiding due to flooding. The primary factors limiting fish habitat in Cheekye River were instability of the watershed and a lack of habitat complexity.

5.13.2 FHAP Assessment

Habitat Types

A summary of habitat types identified in Cheekye River on September 19, 1996, is provided in Appendix E. The dominant habitat type in all reaches surveyed was cascade. Average gradient ranged from 4.9 to 10.1%. No pool, riffle or glide habitat was identified.

Off-channel Habitat

Side channels were identified in Reaches 8, 9, 10 and 11. The side channel in Reach 8 was accessible to fish at high flows only. Two side channels were observed in Reach 9: one was accessible at high flows only and the other was not accessible at all. The side channels in Reaches 10 and 11 were both inaccessible to fish at most water levels.

Brohm River entered Cheekye River at the upstream end of Reach 6, and would provide spawning and rearing habitat. Fish habitat in Brohm River is discussed in more detail in Section 5.14.1.

Large Woody Debris (LWD)

Appendix E provides LWD loading data for reaches with LWD. LWD per bankfull width ranged from 0.11 to <0.8, indicating poor quality rearing habitat, based on the diagnostic table (Table 5) provided in Johnston and Slaney (1996). Most of the LWD had been blown out by high flows in the Cheekye River and, therefore, had been stranded on the floodplain or gravel bars. LWD stranded on the floodplain or resting on a bar below the average high water level was probably beginning to collect soil and seeds, thereby stabilizing the bar and also the river in that area. This LWD may be swept further downstream during high flows where it may become "more" functional as direct fish habitat. However, due to the instability of the river any movement of LWD which results in fish habitat is probably very unstable and will not stay in that position for long enough to benefit fish migrating through the river. In general, there was insufficient fish habitat provided by LWD in the Cheekye River.

Substrate Type

The dominant and subdominant substrate type in all reaches surveyed in the Cheekye River in September 1996 was cobble and boulder, respectively.

Fish Distribution

Fish presence/absence was determined by electroshocking in Reaches 1 and 2 in Cheekye River on September 12, 1996. Fish distribution data are provided in Appendix E. The only fish species captured were rainbow trout. These trout ranged in fork length from 48 to 130 mm. Fry were observed in Reach 9, but were not captured.

Historically, presence of chinook, chum, coho, pink and sockeye salmon, steelhead trout, and Dolly Varden char have been documented in the Cheakamus River (Triton, 1993). Due to the instability of the Cheekye River and to a lack of habitat complexity, the Cheekye River is mainly used for migration from the Cheakamus River to Brohm River for spawning and rearing.

Table 5.13-1 Summary of boulder cover in riffle/cascade habitats in Cheekye River.

Reach No.	No. of Habitat Units Sampled (Riffle or cascades < 8% gradient)	Range of Boulder Cover (%)	Quality of Cover[1]
1	1	1	poor
2	1	0.5-1	poor
3	1	1-3	poor
4	1	1-3	poor
5	1	2-3	poor

Reach No.	No. of Habitat Units Sampled (Riffle or cascades < 8% gradient)	Range of Boulder Cover (%)	Quality of Cover[1]
6	1	1-2	poor
7	1	1	poor
8	1	1-2.5	poor
9	1	1-2.5	poor
10	1	1-1.5	poor
11	1	1	poor

1 Quality of boulder cover for rearing habitat is based on diagnostics described in Table 5 in Johnston and Slaney (1996).

Adult Upstream Migration

No impassable barriers (e.g., waterfalls >2 m, velocity barriers) were observed in the 11 reaches surveyed in the Cheekye River as part of the FHAP assessment. Consequently, fish are able to migrate a distance of at least 3.8 km upstream from the Cheekye River-Cheakamus River confluence. Due to the lack of rearing and spawning habitat, the main function of the Cheekye River is to provide a migratory route for sockeye, pink, and coho salmon, steelhead, cutthroat and rainbow trout to the Brohm River system.

Spawning and Incubation Conditions

Substrate type in the Cheekye River consisted of cobble and boulders, and provided little suitable habitat for spawning and incubation. Furthermore, the lower reaches of the river had a wide floodplain, were relatively unstable due to bedload and debris torrents, and frequently changed channels. Consequently, any suitable habitat for spawning and incubation would be subject to extreme instability.

Summer Rearing Habitat

Appendix E tables summarize potential cover types observed in the Cheekye River during the September 1996 FHAP assessment. The only cover type identified in all reaches surveyed was B, which provided poor quality rearing habitat. No pool habitat was observed in the reaches surveyed. Side channels identified were either inaccessible to fish or accessible only at high flows. Consequently, little summer rearing habitat was observed in the Cheekye River.

Winter Rearing Habitat

Side channels identified in the Cheekye River were either not accessible to fish or accessible only at high flows. No pool habitat was observed in the reaches surveyed in September when water levels were relatively low.

Juvenile Migration

Migration of juvenile fish in the Cheekye River would be similar to that of adult fish. No impassable barriers (e.g., waterfalls >2 m, velocity barriers) were observed in the 11 reaches surveyed in the Cheekye River as part of the FHAP assessment. Consequently, fish are able to migrate a distance of at least 3.8 km upstream from the Cheekye River-Cheakamus River confluence. The Cheekye River would also serve as a major migratory route for juvenile fish to the Brohm River system.

5.13.3 FHAP Prescriptions

Based on the above FHAP assessment, the most limiting factors to fish in the Cheekye River were instability of the upper watershed and the lack of habitat complexity. The upper watershed must be stabilized before restoration options can be implemented in the lower reaches.

Future Studies

Once the upper watershed of Cheekye River has been stabilized, potential fish habitat restoration opportunities in the lower reaches should be reassessed.

5.13.4 FHAP QA/QC

QA/QC was not conducted by the supervisors in the Cheekye River. Most of the habitat in the Cheekye River, including: habitat type, substrate type, functional LWD tally, cover type, disturbance indicators, and riparian vegetation, did not vary throughout the length of the river. Consequently, due to the limited variability, the supervisors did not conduct a full FHAP assessment in any of the reaches but conducted a site reconnaissance in Reach 5 to verify observations made by the field crew.

5.13.5 CAP Overview

Cheekye River has a high degree of debris production volume exhibited by the formulation of large gravel bars. Increased bedload has created channel widening and significant bank erosion in some areas. There is an excessive active alluvial fan. The Cheekye is a very large system. This is a limiting factor in that instream reconstruction would be difficult.

A total of 15 reaches were established on the Cheekye River system. Reaches 1 begins where the Cheekye drains into the Squamish. Reach break 5 occurs at the Highway 99 crossing. Reaches 6 through 15 extend from the highway to the headwaters.

5.13.6 CAP Assessment

Reaches 1-5

Riffle-pool Morphology
Cobble/Boulder/Gravel Bed Material
Sensitivity Rating: Medium

Reaches 1-5 extend from the confluence with the Squamish River to the Highway 99 bridge crossing. Reach breaks were established based on bridges and changes in channel slope. The bankfull width enlarges from reach 5 down to reach 1, and approximately doubles in width. Extreme aggradation and erosion was evidenced in all 5 reaches. The aggradation has resulted in the development of large gravel bars in many sections. The large amount of alluvial deposits, combined with the large valley-flat, result in a high potential for the channel to avulse. The overall channel sensitivity of this section of the river was determined to be medium, although the direct effects of logging are unclear.

Reaches 6-9

Riffle-pool Morphology
Cobble Bed Material
Sensitivity Rating: Medium

The average bankfull width is not as wide as Reaches 1-5 and there is an increase in average channel slope to approximately 7%. Although large alluvial deposits are present in this section, the risk of the channel avulsing was not determined to be high as the bank slopes were greater than 20%, and thus able to contain the channel. Patches of erosion were seen along this stretch of the channel.

Reaches 10-14

Riffle-pool Morphology
Cobble Bed Material
Sensitivity Rating: Medium

Reaches 10-14 exhibited the same general characteristics as Reaches 6-9, although the channel was less restricted by bank slope. The overall sensitivity rating was medium, although direct effects due to logging activity are unclear.

Reach 15

Riffle-pool Morphology
Boulder Bed Material
Sensitivity Rating: Medium

The uppermost reach of the Cheekye River was the only reach determined to be stable.

5.13.7 CAP Prescriptions

Creek Prescriptions (Year One)

No prescriptions in year one.

Table 5.13-2 Cheekye River summary table (draft).

Reach	Morphology	Assessment	Prescription	Timing	Year	Rating
1 2 3 4 5	Riffle Pool Gravel, Cobble & Boulder Bed Material	The bankfull width doubles from reach 5 down to reach 1. Extreme aggradation and erosion was evident in all 5 reaches. Large gravel bars were found in may areas.	No prescriptions.	NA	NA	M
6 7 8 9	Riffle Pool Cobble Bed Material	Reaches 6-9 exhibit a riffle pool morphology aggradation to a lesser degree than in reaches.	No prescriptions.	NA	NA	M
10 11 12 13 14	Riffle Pool Cobble Bed Material	Reaches 10-14 exhibited the same general characteristics as Reaches 6-9.	No prescriptions.	NA	NA	M
15	Riffle Pool Boulder Bed Material	The uppermost reach of the Cheekye River was the only reach determined to be stable confined by steep bank slopes over 100%.	No Prescriptions required.	NA	NA	M

Creek Prescriptions (Year Two to Five)

A general inspection of river stability should be carried out every two years for the proceeding five years.

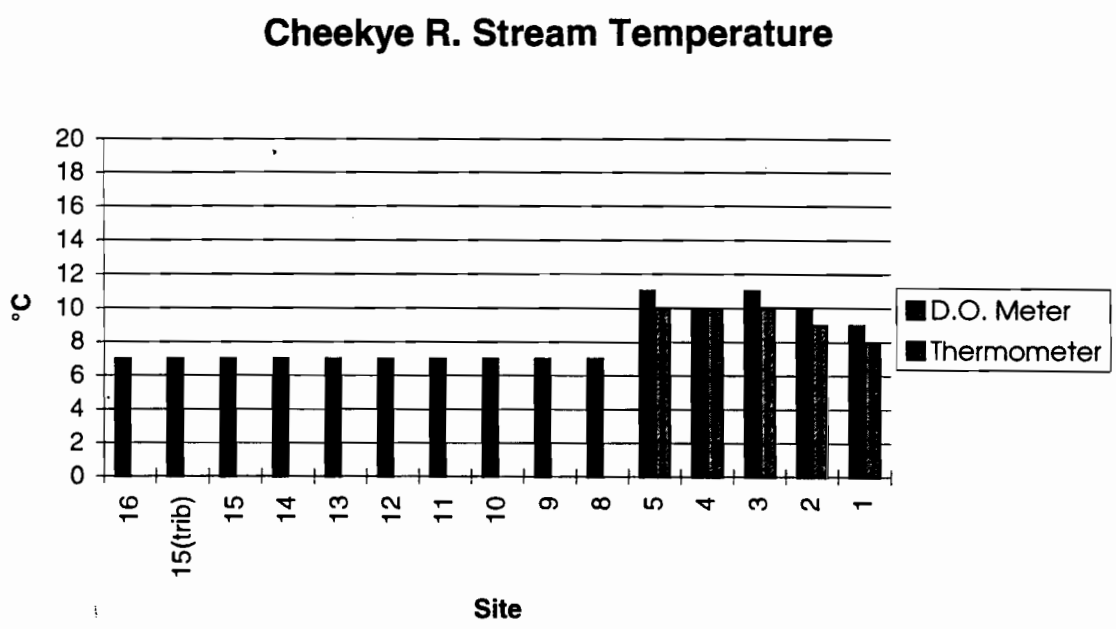
5.13.8 WAP Overview

The relatively little water quality data collected for this creek makes it difficult to assess whether there are limiting factors, affecting either periphyton growth or macroinvertebrates. Considerably more attention should be paid to establishing baseline data for this creek in the third year assessment.

5.13.9 WAP Assessment

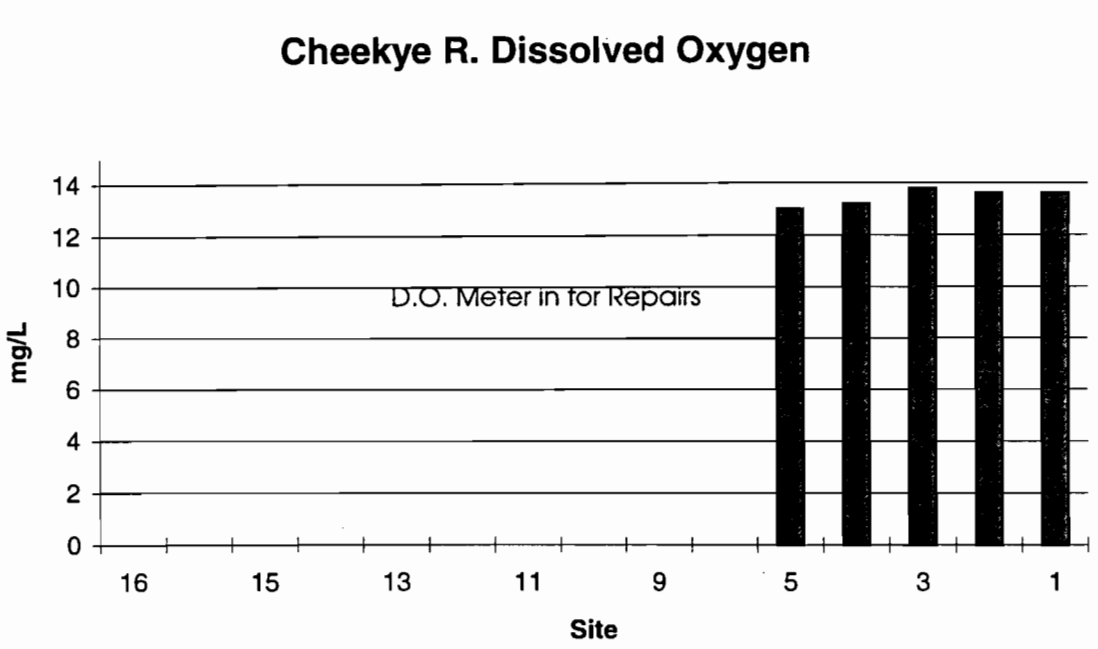
Temperature

Stream temperatures were consistent in reaches 8 through 16 (7 °C) and were moderately higher in the lower reaches, being between 9 and 11 °C. These temperatures were below those typically observed in the other creeks, at this period. In the higher reaches growth rates would be expected to be reduced, compared with those nearer the creek's mouth.



Dissolved Oxygen

The stream was only measured in the lower reaches, in which dissolved oxygen values were all approximately 13 mg/L; at a temperature of 9 to 10 °C, the water was well saturated with oxygen. Given the rather low water temperatures in the upper reaches, the third year water quality assessments should focus on determining whether these waters are super-saturated.



Periphyton & Nutrient Dosing Pots

Periphyton samples were not analysed for the Cheekeye River. Nutrient dosing pots were not deployed in the Cheekeye River.

Invertebrates

Identifications of invertebrates from the Cheekeye River were not made.

Sedimentation Buckets

Sedimentation buckets were not deployed in the Cheekeye River.

5.13.10 WAP Prescriptions

Although little water quality data has been obtained on this system, and no data on trophic structure is available, the following general considerations should form the basis for future data collecting and subsequent restoration prescriptions. Included are the typical time frames required to achieve specific restoration efforts or modifications to either aquatic or terrestrial habitat.

Channel structure: floodplain should be reconnected to the main channel and silviculture planting should revegetate floodplain surface (estimated recover period is 10-100 years); this will also increase organic cellulose pool of potential woody debris but will require long time periods (centuries). *Pool and riffle structures:* should be re-established such that they are consistent with natural channel structure and hydrologic regimens. *Large structural elements (wood and boulders):* placement should be made with respect to creating microhabitat within pool / riffle zones (1-10 year recovery period). Channel modifications must be made in conjunction with road and culvert stabilization. Large woody debris should be enhanced to increase microhabitat for macroinvertebrates and to increase the trapping of adult

salmon carcasses (5-25 years). Increasing LWD and boulder size will i) enhance refugia habitat to reduce predation and energy expended combating high flows, ii) increase organic matter storage, and, iii) reduce downstream nutrient movement. *Sediment:* hydraulic flushing of excessive sediment deposits is largely ineffective; sediment traps should be placed in reaches to encourage deposition where insufficient spawning sediment exists (5-20 years) *Hyporheic zones:* reestablishing bed forms and bed composition will create new and redistribution of subsurface flows; new hydrologic sources will help to restore subsurface flows (5-20 year period of recovery).

Hydrology: discharge rates can be controlled, in the long term (10-50 years) if upslope and riparian vegetation is undertaken to reestablish evapotranspiration rates. Erosion will result in substrata instability and decreased production. Since sediment and bed-load movement can also increase ablation and disruption of periphyton accrual (1-10 years), every effort must be made to stabilize bed load. Natural and artificial dams must be removed since they tend to alter natural discharge patterns. *Low flows:* replacement of conifers with deciduous vegetation will reduce evapotranspiration rates and change the nature and rate of terrestrial organic inputs (25-50 year cycle). Channel modifications which result in a cessation of rapid hydrologic fluctuations will result in recolonisation of stream banks by riparian trees, shrubs, grasses and forbs and benthic surfaces by aquatic biota and thereby increase trophic complexity (1-10 years).

Sediment: upslope and riparian reforestation will diminish erosion-based soil inputs; this will reduce short term nutrient enhancement and decrease undesirable smothering of instream habitat (10-50 years). Unnatural mass failures of upslope and riparian areas, together with landslides, must be reduced largely through reductions in unnecessary road networks and upgrading of existing roads; it is crucial that remaining roads and culverts be maintained to standards which minimize or eliminate local, steep slope, water movements which would otherwise induce enhanced sediment deposition into creeks and streams (20-200 year cycles).

Water quality: *temperature:* re-establishment of riparian canopy cover will reduce solar inputs and stream temperatures (10-40 years); solar insolation profiles should be conducted under both open and closed canopies (both deciduous and coniferous)(1-10 years). Changes in solar quality and quantity will modify algal community structure and productivity and production (5-25 years). Continuous data logger thermistors should be installed in the creek to define temperature profiles. *Dissolved oxygen:* decreasing temperature, through shade recovery, will increase oxygen concentrations (1-10 years). *Nutrients:* revegetation of the upslope and riparian areas will reduce nutrient washout and diminish nutrient loading into surface waters; this may result, together with increased canopy cover and shading, in reduced summer and autumn periphyton production. Wherever possible periphyton samples should be analyzed, if adequate funding is available. An assessment of winter periphyton production should be conducted.

Riparian and immediate upslope forest: Small tributaries and ephemeral streams, which provide lateral shelter, rearing habitat and act as a feedstock production area, must be protected and revegetated where necessary; care should be taken to ensure that stream crossings are designed, installed and maintained with respect to protection of trophic in-stream attributes. A survey of ephemeral streams should be made; damaged stream habitat should be restored. *Production of large wood:* the long term perspective should be the production of mature and old-growth forest structure for the production of new wood. Upstream production and subsequent downstream transport, through stream washout and landslides, delivers large structural elements to local reaches (100-300 year horizon). *Trophic and organic food production:* mature and old-growth forest and riparian zone vegetation restores natural inputs from terrestrial ecosystems (40-80 years); introduction of leaf litter is essential for provision of structural substrate on which bacterial and protozoan communities develop; macroinvertebrates derive a significant portion of their nutrition from this microbiotic community (5-10 years). Fish gut studies should be conducted to determine what food resources are being used as the primary nutrition source. The creation of specific

microhabitat, which provides for the specific requirements of selected algal and micro and macroinvertebrate populations, must be created when channel morphologies are altered (1-10 year cycles). *Shading:* re-establishment of riparian canopy will ultimately reintroduce light as a factor limiting primary production, which will eventually return to predisturbance values (5-20 year cycle). *Rooting systems:* growth of woody vegetation on stream banks, and the concomitant root network, results in enhanced stream bank integrity; grasses and forbs, planted in natural meadows, reduce soil erosion (20-80 years). *Nutrient modification:* successional processes occurring as riparian plant communities develop can, in some situations, enhance nutrient filtering capability; however, subsurface hydrologic flows are complex and may be little influenced by riparian root structures (20-80 year cycles).

Exogenous material: *chemicals:* anthropogenic chemicals vary tremendously in persistence, and in toxicity, in the environment; no general recovery times can be provided in the absence of species-specific knowledge of the chemicals. *Exotic biota:* once established, exotic species are typically very difficult to eliminate from indigenous community assemblages; each species exerts a different influence on the regional community. No generalized recovery time frame can be used.

5.13.11 RAP Overview

The Riparian Assessment Procedure field crew found no recent clearcut areas directly adjacent to the Cheekye River during their reconnaissance. Therefore, no assessment of riparian vegetation was conducted.

There may be opportunities for riparian vegetation enhancement or bioengineering work in conjunction with fish habitat enhancement, channel and bank stabilization, or other proposals for this creek. Related investigations should be included in the Year 3 program.

Squamish River Watershed

Brohm River



FOR REACH BREAKS SEE MAPS 92G084 (in back pocket).

5.14 Brohm Creek

5.14.1 FHAP Overview

The Brohm River system surveyed during this study included: Brohm River, Brohm Creek and Brohm Lake. Brohm River refers to the mainstem channel which drains into the Cheekye River, which flows into the Cheakamus River and ultimately into the Squamish River. The FHAP assessment focused mainly on Brohm River to approximately 3.2 km upstream of the Brohm River-Cheekye River confluence. Brohm Creek runs from the outlet of Brohm Lake, approximately 800 m through a swampy area adjacent to Highway 99, under Highway 99 via culverts, and into Brohm River. A complete FHAP assessment was conducted in Brohm River, whereas minimal observations related to fish habitat were made in Brohm Creek and Brohm Lake.

Brohm Lake had historically been stocked with rainbow trout to support the sport fishery. The lake was stocked six times in 1990 (BCMELP, 1990, file data), and three to four times per year since then (Gellner, R., pers. comm.). This year, 1996, the lake was stocked three times starting in May (Gellner, R., pers. comm.). In addition, rainbow trout were transplanted to the lower reaches of Brohm River in 1985 (SISS, 1988). Brohm River had also been documented as excellent habitat for steelhead (Triton, 1993). Other fish species observed in Brohm River included sockeye, pink, and coho salmon, cutthroat trout, and Dolly Varden (SISS, 1988). Coho migrate into Brohm River in October and spawn during November and December, and steelhead spawn from March to June (SISS, 1988). Accessibility of Brohm Creek to anadromous fish was unlikely due to the present position of the culverts under Highway 99, but had not been confirmed (Triton, 1993).

Historically, the upper Brohm River watershed had experienced major logging, and the North Arm had been logged and burned, and may have impacted fish habitat in the past (SISS, 1988). As a result, fish habitat enhancement efforts had included removal of a log jam, in 1977, located approximately 1.75 km upstream of the Brohm River-Cheekye River confluence to facilitate passage by steelhead (Triton, 1993). In 1979, a barrier created by a large boulder was removed by blasting to facilitate anadromous fish passage (Triton, 1993).

Water removal from Brohm River may also have an impacted fish habitat, although this had not been confirmed. Water was removed from Brohm River through two water licences (BCMELP, 1996, data file). One was a conditional licence that allowed removal of water year-round for domestic purposes. The second licence allowed the removal of water for commercial power from Brooks Creek, a tributary to Brohm River.

The FHAP assessment was conducted in Brohm River from July 31 to August 6, 1996. Brohm River was divided into 12 reaches and all were accessible to anadromous and resident fish at the time the assessment was conducted. The first potential impassable barrier to fish (i.e., high waterfalls, chute) and consequently, also a limit to the upstream migration of anadromous fish was observed in the upper sections of Reach 12. The fish habitat assessment was not conducted upstream of Reach 12 due to inaccessibility of the river to the field crew and due to a gradient >20%. Therefore, the presence/absence of fish in the upper sections of Brohm River has not been determined.

In general, Brohm River was comprised of variable habitat consisting of glide, riffle and cascade habitat types. Little pool habitat was observed at the time the assessment was conducted due to high water flows. Gradient ranged from approximately 1 to >20%. Spawning habitat varied from low to high suitability for

both anadromous and resident fish depending on substrate type (i.e., gravel, cobble, boulder) present. Frequent braiding of the channel and presence of unvegetated bars were observed indicating disturbance to the system. Other disturbance indicators included large woody debris lying parallel to the banks. In general, functional LWD providing rearing habitat was of poor or fair quality. The primary factors limiting fish habitat in Brohm River were a lack of pool habitat and a lack of habitat complexity at high water flows.

Habitat in Brohm Creek varied between glide, riffle and cascade. No spawning habitat was observed at the time the assessment was conducted, however potential rearing habitat was observed and consisted of cover by SWD, OV, and IV.

5.14.2 FHAP Assessment

Habitat Types

A summary of habitat types identified in Brohm River from July 31 to August 6, 1996, is provided in Appendix E. Habitat consisted mainly of riffles and cascades, with some glides in Reaches 5 and 8. Very little pool habitat was observed in July/August due to high water flows in Brohm River. Some isolated pools were observed in cascade habitat in some reaches and may serve as rearing habitat, particularly at low water flows. There were several side channels that were identified along the river which could potentially serve as spawning and/or rearing habitat, but accessibility to fish would be at high flows only. Fish habitat in Brohm River upstream of Brohm Creek had been documented as good for juvenile steelhead based on abundant riparian and in-stream cover and pool and riffle microhabitat (Triton, 1993).

Off-channel Habitat

Side channels were observed in Reaches 1, 2, 3, 6 and 9, and may serve as potential rearing habitat depending on accessibility during varying water flows. More specifically, side channels in Reach 1 were observed at 200 m and at 365 m upstream of the Brohm River-Cheekye River confluence. Both side channels ranged in length from 40-45 m and were accessible to fish only at high water flows. In Reach 2, side channels were noted at the downstream end of the reach (i.e., 0 m) and at 36 m upstream of the reach break. The first one was accessible to fish only at high flows, whereas the latter was accessible at most flows. Side channels in Reaches 3 and 6 were noted at 60 m upstream of the reach break and at the downstream end of the reach, respectively. The side channel in Reach 3 was accessible at most flows, whereas the one in Reach 6 was only accessible at high flows. A side channel, accessible to fish only at high flows, in Reach 9 was located at the 140 m mark from the downstream end of the reach.

Other potential off-channel habitat observed in Brohm River were various sources of groundwater in Reaches 2, 9 and 11.

Large Woody Debris (LWD)

Appendix E summarizes LWD loading data for reaches with LWD. LWD per bankfull width ranged from 0.09 to 36.5, indicating poor to good quality rearing habitat, based on the diagnostic table provided in Johnston and Slaney (1996). However, the potential rearing habitat in the majority of reaches surveyed in Brohm River were classified as poor to fair. Consequently, habitat could be enhanced by addition of more functional LWD.

The amount of "functional" LWD recorded by the field crew may be a misrepresentation of the amount of functional LWD that was actually present in the river, due to the definition of "functional" LWD presented in Technical Circular No. 8 (Johnston and Slaney, 1996) as discussed in Section 3.8.1.

Substrate Type

Substrate type observed in each reach surveyed in Brohm River and associated potential spawning habitat is summarized in Appendix E. Potential spawning areas for anadromous and resident fish, depending on substrate type present, existed in various sections of Reaches 1-10. Substrate in these reaches consisted mostly of gravel, cobble and boulder, and consequently, provided either no suitable, little suitable, or highly suitable spawning habitat. No suitable spawning habitat was observed in Reaches 11 and 12, as substrate was dominated by cobble and boulders, with some sand. No gravel was noted in Reaches 11 and 12.

Fish Distribution

Fish were observed and captured by electroshocking in various sections of Brohm River from Reach 1-12. Fish presence/absence upstream of Reach 12 could not be assessed during the present study due to inaccessibility to the field crew (i.e., steep canyon).

Historically, fish species distribution in Brohm River included sockeye, coho, chum, cutthroat, Dolly Varden, and rainbow trout (SISS, 1988). In addition, Brohm River had been documented as the major producer of juvenile steelhead in the Squamish River system due to the large amount of nutrient input from the wetland/foreshore complex associated with Brohm Lake (SISS, 1988; BCMELP, 1990, file data). Fish presence/absence in the upper sections of Brohm River (i.e., upstream from the barriers) remains unknown. Historical reports indicated that the upper Brohm River did not contain fish due to its steep gradient (BCMELP, 1982, file data), whereas Triton (1993) reported the presence of resident fish in the upper sections of Brohm River. Clearly, further investigation in the upper sections is warranted as it is likely that the channel may have changed since 1982 due to logging activities thereby affecting fish habitat and possible fish presence/absence.

Adult Upstream Migration

Historical information reported that coho salmon migrate in the lower reaches of Brohm River in October (SISS 1988). As the FHAP assessment was conducted in August and September, 1996, adult coho, and other adult salmon were not present.

Impassable barriers to upstream migration of anadromous fish were observed in Reach 12 approximately 3.2 km upstream of the Brohm River-Cheekye River confluence. Possible obstructions to fish passage in Reach 12 included a log jam, high falls (>2 m), and a velocity barrier (chute). Historical records indicated an impassable barrier at 2.1 km upstream of the Brohm River-Cheekye River confluence (BCMELP, 1976, file data). However, fish habitat upstream and downstream of this barrier was reported as excellent for spawning and rearing salmonids (BCMELP, 1976, file data). Historical data presented in the Stream Information Summary System (SISS, 1988) reported an impassable obstruction to all salmon at a distance of 4.8 km upstream of the confluence. Based on these observations, the presence of an upstream barrier(s) to fish in Brohm River seemed certain, but its exact location had changed over the years. This may, in part, be explained by past logging activities on Brohm Ridge which had caused debris accumulation in various downstream sections of the river, as well as heavy sediment deposition in the lower channel, requiring frequent debris removal to ensure fish passage (BCMELP, 1982, file data).

Spawning and Incubation Conditions

Potential spawning habitat was observed in Reaches 1-10, but varied from little suitable spawning habitat to abundant. No suitable spawning habitat was observed in Reaches 11 and 12. Substrate in Reach 11 seemed to be covered by a layer of sediment which was not observed in any of the other reaches that were surveyed. Reach 11 was located downstream of the first bridge located on the logging road and the sediment accumulation was probably due to bank erosion along the first 50 m of Reach 12 due to excavation of the right bank.

Summer Rearing Habitat

Appendix E tables summarize potential cover types observed in Brohm River during the July/August 1996 FHAP assessment. Cover in all reaches surveyed was dominated by SWD, IV and OV. C and B cover was observed in Reach 10, and in Reaches 11 and 12, respectively. In general, cover for rearing habitat ranged from poor quality in some reaches to good in others. B cover was poor in all reaches and provided little rearing habitat.

Riparian vegetation along Brohm River was representative of a young forest, comprised of deciduous and coniferous trees. Riparian vegetation was observed right to the streamside in all reaches surveyed, except for a short section in Reach 8, where part of the riparian zone had been clearcut. The cut trees in this area were not removed causing some to fall into the river and provide shelter for fish. No pool habitat was observed in the river during the summer survey in this assessment.

The availability of summer rearing habitat was largely dependent on water flows. At the time the fish survey was conducted in early August 1996, water flows were medium and therefore pool habitat and potential refuge habitat was limited. Most of the river surveyed was either riffle or cascade. However, in early September more pool habitat was identified due to lower flows. Consequently, although there was the potential for good rearing habitat in the form of pools, their occurrence was limited by changes in water flows, and was dependent on seasonal changes.

Winter Rearing Habitat

Several side channels were identified along Brohm River which could provide suitable winter rearing habitat for fish. However, their accessibility to fish during the winter remains unknown. Because the fish survey was conducted during the summer, the potential for winter freezing of the side channels could not be determined. In addition, since the hydrology of the creeks in the Squamish River area is largely glacially based, seasonally low water levels are expected to occur during mid-winter when the icecaps freeze. Consequently, accessibility of these side channels and off-channel habitat during the winter is unknown.

Although pool habitat was scarce during periods of high flow in August, pool frequency increased as flows became lower in September. Maximum pool depth reached 1.0 m and residual depth reached 0.8 m in Reach 8. Consequently, depth of these pools may be adequate to sustain fish during the winter provided flows remained high enough to prevent freezing. A better understanding of seasonal changes in flow rates and depths, and winter conditions in the creek is required before conclusions can be drawn regarding winter rearing habitat.

Juvenile Migration

Although there was a barrier in Reach 12 that was impassable to upstream migrating fish, it is possible that resident juvenile fish inhabiting the river upstream of the barrier could migrate to the lower reaches of the river (i.e., these fish could move through the barrier with the flow of water). Although fish presence/absence by electroshocking was not determined upstream of Reach 12 during this study, resident fish presence had been documented in the upper sections (Triton, 1993). In addition, juvenile fish from Brohm Lake may migrate down Brohm Creek, through the culvert under Highway 99, and into Brohm River. No other barriers to juvenile migration were observed in the lower reaches (i.e., Reach 1-12) during this assessment.

5.14.3 FHAP Prescriptions

Based on the above FHAP assessment, Brohm River was primarily lacking refuge habitat during high flows and habitat complexity. A number of rehabilitation and restoration options existed that would address these limitations. Rearing habitat could be increased during high flows by developing side channels and/or groundwater sources. Excavation of groundwater sources had been successful in other areas in the Squamish River system (Triton, 1993). Habitat complexity could be increased by increasing the amount of functional LWD in some reaches for the purpose of creating more pool habitat. Fish passage to and from Brohm Lake could be improved by reconstructing the culverts in Brohm Creek which run under Highway 99.

A number of activities could be conducted to protect the current fish habitat in Brohm River:

1. Stabilization of eroding banks, particularly in Reach 12 upstream of the bridge, where there was a large area that had been excavated. This would reduce the amount of sediment being deposited downstream (i.e., Reach 11).

2. Auditing of present land management practices in the Brohm River watershed. Better road construction is required as sections of the road were being washed out by water from tributaries running freely across the road. This was also causing increased sediment to be deposited in Brohm River. Culverts/cross-ditches need to be installed.

3. Brohm Creek runs along highway 99 and is, therefore, susceptible to impacts from highway improvement and expansion projects. Consequently, proper land management practices which minimize the impacts to highly productive habitat for steelhead and coho need to be devised.

Future Studies

Fish presence/absence in Brohm River upstream of Reach 12 should be determined. Assessment of overwintering habitat in Brohm River downstream of the Brohm Creek confluence should be undertaken to determine potential habitat limitations at that time of the year. Specific locations where LWD could be installed to increase complexity should be inventoried and assessed by both a fisheries specialist and the river hydrology specialist.

5.14.4 FHAP QA/QC

Reaches 8 and 12 were assessed in early September by the FHAP supervisors as part of the QA/QC program. Comparative data collected by the field crews and the supervisors is provided in Appendix E.

Parameters such as percent gradient, mean bankfull width, dominant bed material percent cover, and canopy cover were similar between the two assessments. However, variability was observed in identification/ measurement of habitat type and functional LWD.

Habitat type identified during the July/August assessment consisted of glide and cascade. In the September assessment, habitat consisted of an alternate pattern of cascade and pools. This difference was most easily explained by a difference in water levels observed between the two assessments rather than habitat being misidentified by either the field crew or the supervisors. Water flows in July and August were much higher than in September, and thus, more pool habitat was observed during the September assessment. Consequently, the potential for Brohm River to provide rearing and spawning habitat was related to different water flows (i.e., seasonally dependent). There was potential for disagreement in the field as to the classification of functional LWD as discussed in detail in Section 3.8.1.

The results of the QA/QC program emphasized the need for conducting FHAP assessments in more than one season so that the natural variability in potential fish habitat could be documented and restoration options designed accordingly.

5.14.5 CAP Overview

Brohm River has significant aggradation in many reaches. Access is limited in many areas. Excessive LWD is functioning within the channel.

The Brohm River was divided into a total of 33 reaches, stretching from its confluence with the Cheekye River to its headwaters. The river flows roughly parallel with highway 99 for the first 13 reaches. Active logging is taking place on the Brohm River watershed.

5.14.6 CAP Assessment

Table 5.14-1 Brohm Creek data summary table.

Reach	Bankfull		Slope (%)	Average Rock D (m)	Relative Roughness	Power Index	Sensitivity Rating	Channel Condition	Channel Type
	Width (m)	Depth (m)							
1	12.80	1.22	5	0.74	0.61	78	L	Stable	Riffle-pool
2	16.87	0.93	4	0.27	0.29	63	M	Stable	Riffle-pool
3	17.43	1.47	2.33	0.33	0.23	60	M	Aggraded	Riffle-pool
4	15.92	0.78	1.5	0.34	0.44	19	L	Aggraded	Riffle-pool
5	16.34	1.64	2.2	0.48	0.29	59	M	Aggraded	Riffle-pool
6	15.10	1.00	4.5	0.64	0.64	68	M	Stable	Riffle-pool

Reach	Bankfull		Slope (%)	Average Rock D (m)	Relative Roughness	Power Index	Sensitivity Rating	Channel Condition	Channel Type
	Width (m)	Depth (m)							
7	13.20	0.93	2.67	0.67	0.71	33	M	Stable	Riffle-pool
8	12.40	1.07	4	1.30	1.22	53	M	Stable	Riffle-pool
9	11.65	1.35	4.5	0.55	0.41	71	M	Stable	Riffle-pool
10	11.86	1.56	6.8	0.70	0.45	68	M	Stable	Riffle-pool
11	13.87	1.53	8.67	0.87	0.57	33	M	Aggraded	Cascade-pool
12	12.85	2.05	16.5	0.90	0.44	53	M	Stable	Cascade-pool
13*	-	-	-	-	-	-	-	-	-
14	14.03	1.67	12.33	0.77	0.46	126	M	Stable	Cascade-pool
15	10.37	0.83	9.33	0.47	0.56	81	M	Stable	Cascade-pool
16	8.68	1.00	11	0.50	0.50	96	M	Stable	Cascade-pool
17	6.60	0.87	17	0.80	0.92	97	M	Stable	Step-pool
18	7.13	1.13	5	0.70	0.62	40	M	Aggraded	Cascade-pool
19	36.13	0.83	6.67	0.57	0.68	201	M	Stable	Riffle-pool
20	6.63	0.57	19.33	0.40	0.71	73	M	Stable	Step-pool
21	7.77	0.53	8.33	0.47	0.88	35	M	Stable	Cascade-pool
22	5.73	1.03	12.33	0.30	0.29	73	H	Stable	Step-pool
23	7.10	0.90	22.67	0.17	0.19	145	M	Stable	Riffle-pool
24	10.27	0.97	6.67	0.73	0.76	66	M	Aggraded	Cascade-pool
25	7.27	0.63	10.33	0.47	0.74	48	M	Stable	Cascade-pool
26	4.60	0.17	6.67	0.83	5.00	5	M	Stable	Step-pool
27	6.20	0.30	16.67	0.97	3.22	31	M	Stable	Step-pool
28	7.40	0.40	9.67	0.90	2.25	29	M	Stable	Step-pool

Reach	Bankfull		Slope (%)	Average Rock D (m)	Relative Roughness	Power Index	Sensitivity Rating	Channel Condition	Channel Type
	Width (m)	Depth (m)							
29	7.10	0.17	10.5	0.63	3.80	12	L	Stable	Step-pool
30	4.63	0.13	18.5	0.57	4.25	11	M	Stable	Step-pool
31	4.57	0.10	11.33	0.60	6.00	5	M	Stable	Step-pool
32	5.90	0.20	11.67	0.67	3.33	14	M	Stable	Step-pool
33	7.50	1.50	23	0.20	0.13	259	M	Stable	Step-pool

Reach 13 classified as canyon, unsafe assess.

Reach 1

Riffle-pool Morphology
Cobble Bed Material
Sensitivity Rating: Low

Reach 1 has an average bankfull width of about 13 m. It is a stable reach with a channel morphology classification of riffle-pool with a general bed material of cobble.

Reach 2

Riffle-pool Morphology
Cobble Bed Material
Sensitivity Rating: Medium

Reach 1 has an average bankfull width of about 17 m. It is a stable reach with a channel morphology classification of riffle-pool with a general bed material of cobble.

Reaches 3-5

Riffle-pool Morphology
Cobble/Gravel Bed Material
Sensitivity Rating: Medium/Low

In Reaches 3-5 (riffle-pool morphology) in some cases alluvial deposits span the entire creek bankfull width.

Restoration efforts for this section of creek should focus on the scalping of gravel bars and stabilization of the main channel. Stone lines should be re-established concurrently with the gravel bar scalping.

Reaches 6-10

Riffle-pool Morphology
Cobble/Boulder Bed Material
Sensitivity Rating: Medium

Reaches 6-10 has an average bankfull width ranging from about 11 m to approximately 15 m. This section of creek is stable, and is classified as riffle-pool. There is limited aggradation.

Reaches 11-16

Cascade-pool Morphology
Cobble/Boulder Bed Material
Sensitivity Rating: Medium

This section of creek has a cascade-pool morphology and is generally stable. Reach 13 consists of a canyon which was not safe for access by field crews, and as such was not assessed. Overall the reach was given a sensitivity rating of medium. The hillslope valley-flat sensitivity rating was assessed as high in several parts of this section of creek, as there are steep banks which are a source of material entering the creek.

Reach 13 should be re-assessed in the future to ensure that no debris jams are present which may disrupt downstream restoration efforts.

Reach 17

Step-pool Morphology
Cobble/Boulder Bed Material
Sensitivity Rating: Medium

Reach 17 has an average bankfull width of 7 m, and consists of a deep canyon with waterfalls and step-pools. The reach was found to be stable.

Reach 18

Cascade-pool Morphology
Cobble Bed Material
Sensitivity Rating: Medium

Reach 18 has an average bankfull width of 7 m and an average slope of 5%. The channel has been aggraded in several locations. A gravel road runs alongside the creek and crosses over via a wood bridge at reach break 19.

The gravel bars within the channel should be scalped and stone lines re-established. The bridge at reach break 19 should be assessed by a professional hydrological engineer.

Reach 19

Riffle-pool Morphology
Cobble Bed Material
Sensitivity Rating: Medium

Reach 19 has undergone extensive logging which has since regenerated into mature second growth. There is some evidence of aggradation.

The gravel bars should be scalped. The riparian areas should be checked for stabilization of bank material.

Reach 20

Step-pool Morphology
Bedrock/Boulder Bed Material
Sensitivity Rating: Medium

Reach 20 has a step-pool morphology consisting of a series of ravines and pools. The reach is generally stable. No restoration efforts are required.

Reach 21 and 22

Cascade-pool/Step-pool Morphology
Bedrock/Cobble Bed Material
Sensitivity Rating: Medium

Reaches 22 to 21 display a transition from a step-pool morphology to a cascade-pool morphology. Both reaches are stable, with insignificant build-up of gravel deposits present. There is a series of low falls within the reaches.

Reach 23

Riffle-pool Morphology
Bedrock/Cobble Bed Material
Sensitivity Rating: Medium

Reach 23 has been classified as riffle-pool. Its general characteristics are that of a canyon with a general bed material comprised mostly of bedrock. The top of reach 23 at reach break 24 is a waterfall. The reach has been given an overall sensitivity rating of medium.

Reaches 24 and 25

Cascade-pool Morphology
Bedrock/Cobble Bed Material
Sensitivity Rating: Medium

Reaches 24 and 25 exhibit a cascade-pool morphology with several tributaries joining the main channel from the right bank. There is some aggradation in Reach 24,and a large woody debris jam in reach 24 which is diverting the flow. This debris jam should be investigated by a professional hydrological engineer.

Reaches 26-33

Step-pool Morphology
Cobble Bed Material
Sensitivity Rating: Medium/Low

Reaches 26-33 exhibit a characteristic step-pool morphology, including a series of falls and rapids. The creek has a steep slope in this section of creek, ranging from a low of 7% to approximately 23%.

5.14.7 CAP Prescriptions/ Restoration

Creek Prescriptions (Year One)

No prescriptions for year one.

Creek Prescriptions (Year Two to Five)

In the following two to five years, Brohm River should have channel morphology reconstruction done. Work done in the first year should be inspected for stability. Further gravel bar work and stone line work may be planned and implemented if deemed necessary. Channel construction should be carried out from the top down. A yearly summary report should be written to identify work carried out in specific location as well as progression made during the project.

General Creek Work Involved (Year Five to Twenty)

A general inspection of river stability should be carried out every two years for the proceeding five years. At this time, any instream work necessary should be identified and carried out immediately. A summary report should be written up detailing the progress and any deficiencies within the creek at the end of each inspection. After year ten, an inspection should be carried out every five years. Again, if instream work is necessary it should be identified and carried out immediately.

5.14.8 CAP Quality Assurance/Quality Control

All data collected in the field and entered into electronic forms was checked for transcription accuracy. QA/QC was conducted on approximately 20% of the Brohm River by field confirmation of values by specialists at Reaches 3, 4, 5, 11, and 12. All measurements were duplicated at specific cross-sections and compared with field crew results.

5.14.9 WAP Overview

Overview and Limiting Factors

The creek did not have either temperature or dissolved oxygen as limiting factors. The temperature was well within the range for adequate to good growth for juvenile salmonids. The creek has been studied for a number of years and has always had a moderate periphyton community. The nutrient loading is thought to originate from the eutrophic Brohm Lake, which also provides a warm water source (i.e., thermal inertial mass). The stream should be remeasured, using nutrient-dosing pots, to determine the limiting nutrient. These data would also provide a three year data profile of periphyton-nutrient response.

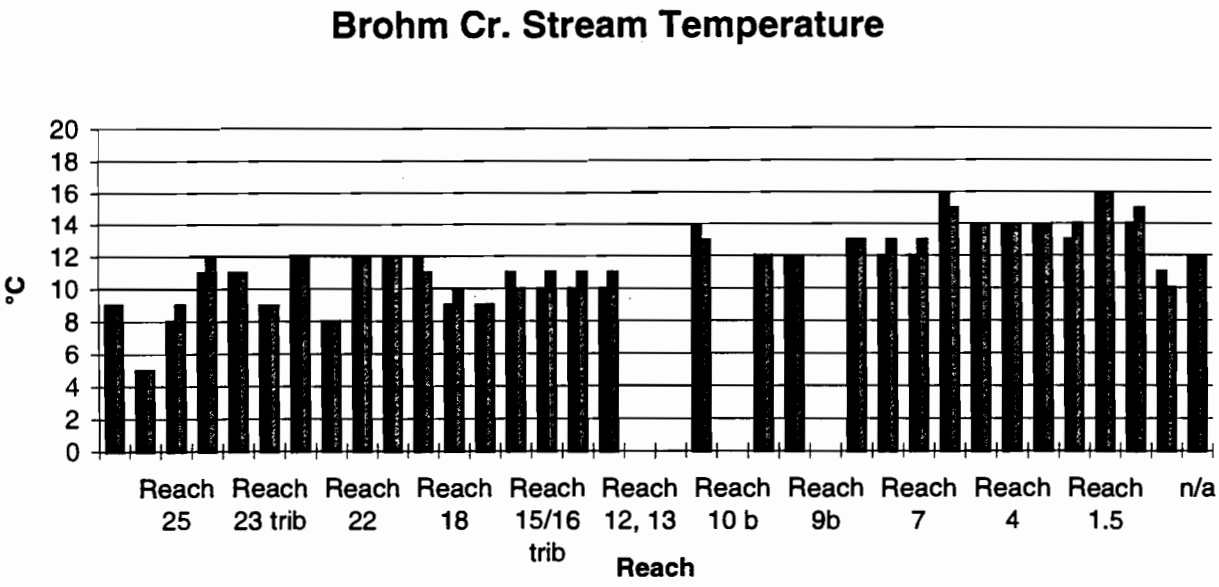
Temperature

Temperatures ranged from a low of 5 °C (reach 25 trib) to a high of 16 °C (reaches 6 and 1.5). Generally, temperatures were above 8 °C; temperatures were lowest in the upper reaches. The cold water entering the main stem from reach 25 trib. appears to have little effect in reducing the streams downstream thermal profile. The two thermistors measured within 1 °C of each other.

Table 5.14-2 Brohm Creek summary table (draft).

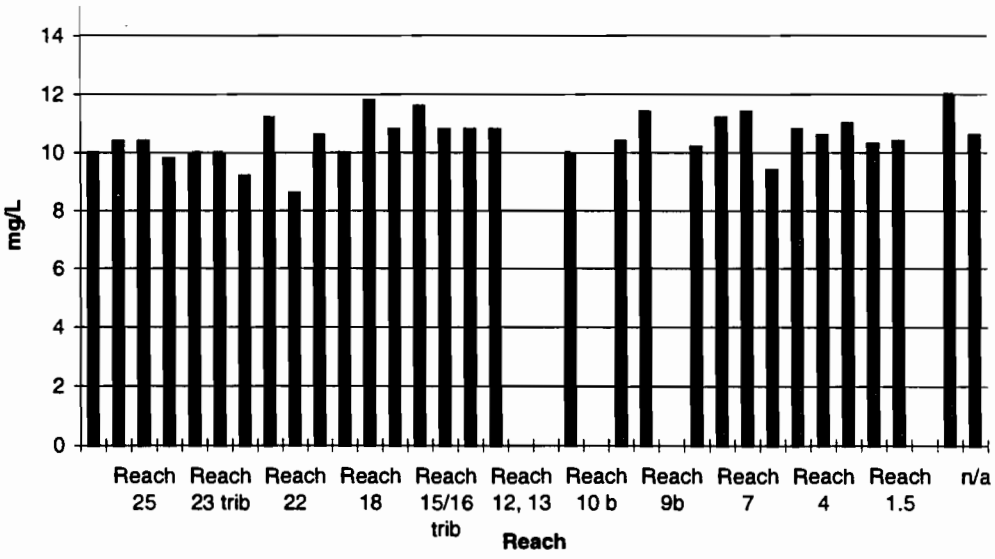
Reach	Morphology	Assessment	Prescription	Timing	Year	Rating
1	Riffle Pool Cobble Bed Material	This reach is stable.	No prescription required	NA	NA	L
2	Riffle Pool Cobble Bed Material	This reach is stable.	No prescription required	NA	NA	M
3 4 5	Riffle Pool Cobble & Gravel Bed Material	These reaches are aggraded. In some instances gravel bars span the entire width of the creek.	Scalp gravel bars.	July 15 - Aug. 15	2	M L
6 7 8 9 10	Riffle Pool Cobble & Boulder Bed Material	These reaches are stable. There are minor gravel deposits accumulating in areas.	Inspect area in 2 years.	Inspection in 2 years.	3	M
11 12 13 14 15 16	Cascade Pool Cobble & Boulder Bed Material	These reaches are stable. Some sections are within a canyon.	No prescription required Should be assessed to ensure that no debris jams are present.	NA	NA	M
17	Step Pool Cobble & Boulder Bed Material	This reach is stable. It consists of a canyon and waterfalls.	No prescription required	NA	NA	M

Reach	Morphology	Assessment	Prescription	Timing	Year	Rating
18 19	Cascade pool & Riffle Pool Cobble Bed Material	There is limited aggradation which may be attributed to increased sediment sources form the adjacent hillslope logging.	Scalp gravel bars.	July 15 - Aug. 15	2	M
20 21 22	Step Pool & Cascade Pool Bedrock & Boulder Bed Material	These reaches are stable.	No prescription required	NA	NA	L
23	Riffle Pool Bedrock & Cobble Bed Material	This reach is a stable canyon.	No prescription required.	NA	NA	M
24 25	Cascade Pool Bedrock & Cobble Bed Material	These reaches are stable.	No prescription required.	NA	NA	M
26 27 28 29 30 31 32 33	Step Pool Cobble & Boulder Bed Material	These reaches are stable.	No prescription required	NA	NA	M



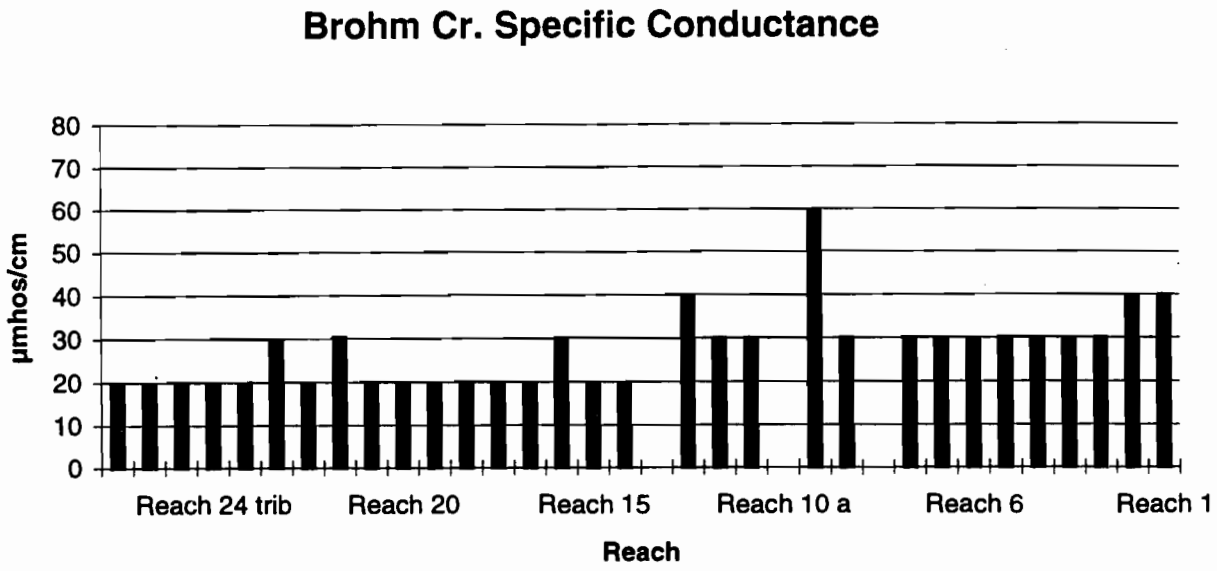
Dissolved Oxygen and Specific Conductance

Dissolved oxygen values throughout the creek ranged from a low of 9 mg/L (reach 22) to a high of 12 mg/L (inlet reach). Typically the concentrations were above 10.0 mg/L, indicating that the creek waters are well oxygenated. Concentrations were inversely related to temperature, as expected.



Specific conductance values were relatively low, being approximately 20 µmhos/cm in the upper reaches (14 through 26) and approximately 30 µmhos/cm in the lower. The highest value recorded was in reach 9 trib., (60 µmhos/cm) which was 2 to 3 times that in the main stem. Visual examination of the stream over the past two summers indicates that there is a healthy periphyton community in those reaches of the creek

receiving adequate solar insulation. The specific conductance values were moderately higher than those measured in Chance Creek.



Periphyton & Nutrient Dosing Pots

Brohm River has had nutrient dosing substrates placed into it at least twice over the last few years (B. Moore, pers. comm., 1996). The present data should be interpreted in the context of these historical data rather than in isolation. Both Chlorophyll *a* and biomass were very low in Brohm River on all pots. The highest chlorophyll (50 µg) and biomass 250 µg/g were seen on the P enriched substrate.

Epilithic periphyton cultured on nutrient dosing flower pots revealed that, in late September, there were few community structural differences between the control, N, or P surfaces. Cyanobacteria, consisting of l.b.g.b.'s averaged 25% of the species abundances, with diatoms comprising the majority of the community. The adnate Achnanthes made up approximately another 25%, while Fragilaria/Synedra was a co-dominate, ranging between 15 and 31%. Cocconeis was a third co-dominant. Eunotia, Gomphonema, Synedra ulna and Cymbella were sub-dominantes. Under N+P enrichment the community was 54% l.b.g.b.'s, with Achnanthes (19%), Fragilaria/Synedra and Cocconeis (11% each) and Eunotia and Cymbella (1% each) forming the understory.

One month later (October 24th), the cultured periphyton communities structure was consistent across all surfaces, regardless of nutrient profile. Lb.g.b.'s formed the Cyanobacterial community, ranging between 17 and 34% (numerical abundance). Achnanthes was the dominant diatom (27-38%), with Cocconeis, Fragilaria/Synedra, Eunotia and Gomphonema comprising the understory community. Although relative abundances varied between nutrient regimens, during the late summer, early autumn period, there did not appear to be significant differences with respect to community architecture. Small Cyanobacterial clusters and adnate diatoms dominated, with erect diatoms forming a sub-canopy above them. During this period of the year the epilithic periphyton was dominated by diatoms, regardless of the nutrient profile. One untested consideration was whether there were proximate (biochemical) composition differences (i.e. fatty acid or other lipids) between communities, resulting from shifts in N:P ratios. The differences would likely be Eukaryotic based and not reflected within the Cyanobacterial community.

The December, main channel periphyton which developed on the cobble substrata, revealed a community structure dominated by Cyanobacteria (l.b.g.b.'s, 80%; *Oscillatoria*, 7%; *Chaemesiphon*, 1%), an unidentified, branched Rhodophyta (9%) and *Achnanthes* (3%).

Invertebrates

Brohm River Main Channel 96-Sept-15

Invertebrates from eight different groups were found here: Ephemeroptera (67%), Diptera (18%), Plecoptera (5%), Trichoptera (3%), Hemiptera (2%), Coleoptera (2%), *Hydracarina* (2%), and Oligochaeta (2%). The dominant taxa at this site were heptagenid mayflies, *Epeorus deceptivus*, representing 30% of the sample (18 specimens). These mayflies inhabit lotic, erosional zones, are characterised as **clingers** and belong to the trophic guilds of **collector-gatherers** and **scrapers**. The remaining Ephemeroptera specimens (of which all are **collector-gatherers** and/or **scrapers**) were: 13 *Baetis sp.*, 7 *Ephemerella doddsi*, 1 *Ephemerella* (*Seratella*) *tibialis*, and 2 *Rhithrogena sp.*

The second most abundant group, the flies, contained 11 specimens of which 10 were chironomids: 1 UID adult, 7 *Cricotopus sp.*, 1 *Eukiefferiella sp.*, and 1 *Thienemannimyia sp.* The remaining Diptera was a 'house fly', Family Muscidae, *Lispe sp.* Only 3 stoneflies were found here: 2 *Zapada sp.* and 1 *Visoka* (*cataractae*), both belonging to the trophic guild of **shredder-detritivore**s. Also, only 2 caddisflies were collected: 1 *Ecclisomyia sp.* (**collector-gatherer**) and 1 juvenile limnephilid unidentifiable beyond the level of Family.

The remaining four groups are all represented by 1 specimen each: 1 *Hydracarina*, *Wandesia sp.*, 1 oligochaete worm, *Turbellaria* (*Polycelis sp.*?), 1 UID Hemiptera nymph, and 1 rove beetle, Order Coleoptera, Family Staphylinidae.

Brohm River Main Channel 96-Dec-18

Invertebrates from five different groups were found here: Ephemeroptera (86%), Oligochaeta (6%), Trichoptera (4%), Plecoptera (3%) and Diptera (1%). The dominant taxa at this site were Baetid mayflies, *Baetis sp.*, representing 43% of the sample (107 specimens). These mayflies inhabit lotic, erosional and depositional zones, as well as lentic, littoral zones (vascular hydrophytes), are characterised as **swimmers** , **climbers** and **clingers**, and belong to the trophic guilds of **collector-gatherers** (detritus, diatoms) and **scrapers**. The remaining specimens of the Order Ephemeroptera were: 21 *Cinygmula sp.*, 38 *Epeorus deceptivus*, 15 *Ephemerella doddsi*, 1 *Ephemerella sp.*, and 33 *Rhithrogena sp.* All of these mayflies also belong to the guilds of **collector-gatherers** and **scrapers**.

The second most abundant group, the oligochaetes, contained only 15 specimens, all of the Family Naididae. Nine caddisflies were collected: 4 *Glossosoma sp.* (**scrapers**), 4 *Hydropsyche sp.* (collectors-**filterers**), and 1 juvenile limnephilid unidentifiable beyond the level of Family. Also, only 8 stoneflies were collected at this site of which 6 were *Sweltsa sp.* (**predator-engulfers**) and 2 were *Capnia sp.* (**shredder-detritivore**s). Finally, only 3 Diptera specimens were collected: of the Family Chironomidae, 1 UID juvenile and 1 *Cricotopus sp.*, and 1 black fly larva, *Simulium sp.* (Family Simulidae).

Brohm River Reach 1 96-Jul-29

Invertebrates from five different groups were found here: Ephemeroptera (46%), Diptera (44%), Plecoptera (4%), Trichoptera (4%), and *Hydracarina* (1%). The dominant taxa at this site were baetid mayflies, *Baetis sp.*, representing 25% of the sample (40 specimens). These mayflies inhabit lotic, erosional and depositional zones, are characterised as **swimmers** , **climbers** and/or **clingers**, and belong

to the trophic guilds of **collector-gatherers** (detritus, diatoms) and/or **scrapers**. The remaining Ephemeroptera were: 12 *Epeorus* (*Iron*) *deceptivus* (**collector-gatherer**, **scraper**), 1 *Ephemerella coloradensis*, 7 *E. doddsi*, 11 *Ephemerella* (*Seratella*) *tibialis*, 1 *Ephemerella sp.*, and 2 *Rhithrogena sp.* (all of which are **clingers**, some **swimmers** , and belong to the guilds of **collector-gatherers**, **scrapers**), and 1 *Paraleptophlebia sp.* (**swimmer** , **clinger**, **sprawler**, belonging to the guilds of **collector-gatherer**: coarse detritus, diatoms, and facultative **shredder-detritivore**).

The second most abundant group, the true flies, contained 72 specimens, of which 68 were chironomids: 7 UID juveniles, 3 UID pupae, 1 *Boreoheptagyia sp.*, 1 *Brillia sp.*, 1 *Cardiocladius sp.*, 2 *Corynoneura sp.*, 6 *Cricotopus sp.*, 6 *Eukiefferiella sp.*, 31 *Micropsectra sp.* (inhabits lentic-littoral (including brackish) and lotic-erosional, is characterised as a **climber**, **sprawler**, and belongs to the guild of **collector-gatherer**), 3 *Polypedilum* (*Pentapedilum*) *sp.*, 6 *Rheotanytarsus sp.*, and 1 *Thienemannimyia sp.* The remaining Diptera was comprised of 1 moth fly, *Maruina sp.* (Fam. Psychodidae), and 3 black fly larvae, *Simulium sp.* (Fam. Simulidae).

All (7) of the caddisflies collected at this site were limnephilids, *Ecclisomyia sp.*, which inhabit lotic-erosional zones (cold alpine streams), are characterised as **clingers** (case a mineral tube, may have long plant pieces), and belong to the trophic guilds of **collector-gatherers** and **scrapers**. There were also 7 stoneflies found here, of which 3 were *Zapada* (*haysi*), 1 *Zapada sp.* (all of which are **sprawler-clingers**, and **shredder-detritivores**), 1 *Doroneuria sp.*, 1 *Kogotus sp.* (both of which are **clingers**, **predator-engulfers**), and 1 *Capnia sp.* (a **shredder-detritivore**). Finally, 1 water mite, *Wandesia sp.* was collected here.

Brohm River Reach 2 96-Jul-30

Invertebrates from six different groups were found here: Ephemeroptera (61%), Diptera (32%), Trichoptera (5%), Plecoptera (1%), Coleoptera (<1%), and Nematoda (<1%). The dominant taxa at this site were baetid mayflies, *Baetis sp.*, representing 30% of the sample (72 specimens). These mayflies inhabit lotic, erosional and depositional zones, are characterised as **swimmers** , **climbers** and/or **clingers**, and belong to the trophic guilds of **collector-gatherers** (detritus, diatoms) and/or **scrapers**. The remaining Ephemeroptera were: 2 *Cinygmula sp.*, 30 *Epeorus* (*Iron*) *deceptivus*, 2 *Ephemerella coloradensis*, 13 *E. doddsi*, 21 *Ephemerella* (*Seratella*) *tibialis*, 2 *Ephemerella sp.*, and 2 *Rhithrogena sp.* (all of which belong to the trophic guilds of **collector-gatherers**, **scrapers**).

The second most abundant group at this site were true flies. Of the 77 specimens collected, 47 were chironomids: 3 UID juveniles, 2 UID pupae, 4 *Brillia sp.*, 3 *Eukiefferiella sp.*, 31 *Micropsectra sp.* (**climber-sprawler**, **collector-gatherer**), 1 *Polypedilum* (*Pentapedilum*) *sp.*, and 3 *Rheotanytarsus sp.* The remaining Diptera were comprised of: 27 black fly larvae, *Simulium sp.* (**clinger**, collector-**filterer**), and 3 crane fly larvae, *Dicranota sp.* (**sprawler**-burrower, **predator-engulfer**).

The Order Trichoptera is fairly well represented at this site: 1 UID pupa, 5 *Ecclisomyia sp.* (**clinger**, **collector-gatherer**, **scraper**), 1 *Lepidostoma sp.* (**climber-sprawler-clinger**, **shredder-detritivore**), 1 *Micrasema sp.* (**clinger-sprawler**, **shredder-herbivore**, **collector-gatherer**), and 4 *Rhyacophila* (*acropedes* or *vao*) (**clinger**, **predator-engulfer**) were found here. Only 2 stoneflies were collected here: 1 *Capnia sp.* (**shredder-detritivore**), and 1 *Sweltsa sp.* (**predator-engulfer**). Also found at this site were: 1 riffle beetle (adult), *Lara sp.* (Fam. Elmidae), which inhabits wood debris, is characterised as a **clinger**, burrower (wood), and belongs to the trophic guild of **shredder-detritivore** (wood), and 1 nematode.

Brohm River Reach 3 96-Jul-30

Invertebrates from seven different groups were found here: Ephemeroptera (54%), Diptera (37%), Plecoptera (5%), Trichoptera (3%), Oligochaeta (<1%), Turbellaria (<1%), and Coleoptera (<1%). The dominant taxa at this site were baetid mayflies, *Baetis sp.*, representing 30% of the sample (98 specimens). These mayflies inhabit lotic, erosional and depositional zones, are characterised as **swimmers** , **climbers** and/or **clingers**, and belong to the trophic guilds of **collector-gatherers** (detritus, diatoms) and/or **scrapers**. The remaining Ephemeroptera were: 1 UID adult, 1 *Cinygmula sp.*, 22 *Epeorus (Iron) deceptivus*, 1 *Ephemerella coloradensis*, 26 *E. doddsi*, 22 *Ephemerella (Seratella) tibialis*, and 4 *Rhithrogena sp.* (all of which are **collector-gatherers** and/or **scrapers**).

The second most abundant group, the true flies, contained 119 specimens, of which 115 were chironomids: 93 *Micropsectra sp.* (**climber-sprawler, collector-gatherer**), 3 UID juveniles, 1 UID pupa, 2 *Brillia sp.*, 3 *Cricotopus sp.*, 6 *Eukiefferiella sp.*, 3 *Polypedilum (Pentapedilum) sp.*, 3 *Rheotanytarsus*, and 1 *Thienemannimyia sp.* The remaining Diptera included 3 black fly larvae, *Simulium sp.*, and 1 crane fly larva, *Dicranota sp.* Seventeen stoneflies were collected at this site: 2 *Megarcys sp.* (**predator-engulfer**), 5 *Pteronarcys princeps* (**shredder-detritivore** and **herbivore** on macroalgae, facultative **predator-engulfer**, facultative **scraper**), 2 *Sweltsa sp.* (**predator-engulfer**), 1 *Zapada (haysi)*, and 7 *Zapada sp.* (both of which are **sprawler-clingers, shredder-detritivores**).

Of the 8 caddisflies found here, there were: 1 UID pupa, 1 *Glossosoma sp.* (**clinger**, turtle shell case, mineral, belonging to the trophic guild of **scraper**), 4 *Rhyacophila (acropedes or vao)*, and 2 *Rhyacophila coloradensis* (both of which are **clingers, predator-engulfers**). Also collected at this site were: 1 larval, riffle beetle, *Lara sp.*, 2 oligochaete worms, Family Lumbriculidae, and 2 Turbellaria (*Polycelis sp.*?).

Brohm Creek Reach 4

Brohm Creek was dominated by mayflies (63%) at the end of July. The second most abundant group were the flies (31%) while the stoneflies accounted for 4% of the total. One leech and one water mite were also found.

The mayflies were from 4 families: Baetidae, Ephemerellidae, Heptageniidae and Family Ameletidae (formerly in Siphlonuridae). All the Baetids were *Baetis bicaudatis* (49)- collector–gatherers who feed on detritus and diatoms. The Ephemerellids were from 3 genera: 24 *Drunella sp.*, 13 *Serratella sp.* and 3 unidentified. The *Drunella* species are scrapers and engulfers while the *Serratella* species are collector–gatherers of detritus. Twelve of the Heptageniids were *Epeorus sp.* while 8 were *Rhithrogena sp.* All of the Ameletidae were *Ameletus sp.* (14). The latter groups are collector–gatherers or scrapers.

Tanytarsus , a collector-filterer and gatherer, was the most abundant chironomid and accounted for 23 of the 44 found. Thirteen *Eukiefferiella*, 4 *Brillia sp.* 2 *Orthocladius sp.*, and 2 *Phaenopsectra sp.* were also present. *Eukiefferiella* is predatory on other chironomid eggs and larvae, *Brillia* burrows into rotted wood and is a shredder-detritivore, *Orthocladius* is a collector-gatherer which may burrow into algal mats and *Phaenopsectra* clings to rocks inside tubes and is a scraper collector-gatherer.

Eight stoneflies were present at this site and represented at least 2 different families: 1 *Sweltsa complex* and 2 unidentified (Family Chloroperlidae), 7 *Zapada sp.* (Family Nemouridae) and 2 other unidentified stoneflies. *Zapada* is a shredder-detritivore-herbivore which feeds on leaf litter and moss.

Fourteen blackfly larvae (*Simulium sp.*) and 3 cranefly larvae (*Dicranota sp.*) enumerated. Blackflies inhabit erosional habitats and are collector-filterers. The craneflies found here are predatory sprawlers and burrowers. There are 55 North American species.

The abundance of scraper species as well as the presence of *Orthocladius*, suggests that algae are the food source for many invertebrates at this site.

Brohm River Reach 5 96-Jul-30

Reach 5 of the Brohm River , sampled as part of the WRP program in July, revealed very little diversity. The community was dominated by mayflies (63%) and true flies (31%) with few stoneflies present (4%). Most species were of the **collector-gatherer** type.

Brohm River Reach 9 96-Aug-01

Invertebrates from six different groups were found here: Ephemeroptera (45%), Plecoptera (20%), Diptera (16%), Trichoptera (15%), Coleoptera (2%), and Oligochaeta (2%). The dominant taxa at this site were baetid mayflies, *Baetis sp.*, representing 14% of the sample (15 specimens). These mayflies inhabit lotic, erosional and depositional zones, are characterised as **swimmers** , **climbers** and/or **clingers**, and belong to the trophic guilds of **collector-gatherers** (detritus, diatoms) and/or **scrapers**. The remaining Ephemeroptera were: 1 *Ameletus sp.* (**swimmer -clinger, scraper** and/or **collector-gatherer**), 8 *Epeorus (Iron) deceptivus*, 4 *Ephemerella coloradensis*, 6 *E. doddsi*, 5 *Ephemerella (Seratella) tibialis*, 9 *Rhithrogena sp.* (all of which are **collector-gatherers** and/or **scrapers**), and 2 *Paraleptophlebia sp.* (swimmer-**clinger-sprawler, collector-gatherer** and/or facultative **shredder-detritivore**).

The second most abundant group, the stoneflies, contained 22 specimens: 3 *Doroneuria sp.*, 1 *Kogotus sp.*, 1 *Megarcys sp.*, 3 *Sweltsa sp.* (all of which are **predator-engulfers**), 7 *Zapada (haysi)*, and 7 *Zapada sp.* (both of which are **shredder-detritivores** and/or **herbivores** on moss). All of the 18 Diptera specimens collected were chironomids: 3 UID juveniles, 3 *Brillia sp.*, 1 *Corynoneura sp.*, 4 *Eukiefferiella sp.*, 6 *Micropsectra*, and 1 *Rheotanytarsus sp.* The Order Trichoptera is well represented at this site: 2 UID juveniles, 7 *Ecclisomyia sp.* (**collector-gatherers, scrapers**), 3 *Lepidostoma sp.* (**shredder-detritivores**), 3 *Rhyacophila (acropedes* or *vao)*, and 2 *Rhyacophila coloradensis* (both of which are **predator-engulfers**) were found here. Also found at this site were: 1 adult, riffle beetle, *Lara sp.* (Fam. Elmidae), a **shredder-detritivore**, 1 adult, diving beetle, *Brachyvatus sp.* (Fam. Dysticidae), a **swimmer -climber**, predator-piercer, and 2 oligochaete worms, Family Lumbriculidae.

Brohm River Reach 10 96-Aug-01

Invertebrates from five different groups were found here: Ephemeroptera (76%), Plecoptera (9%), Trichoptera (8%), Diptera (6%), and Coleoptera (1%). The dominant taxa at this site were heptagenid mayflies, *Epeorus (Iron) albertae*, representing 28% of the sample (34 specimens). These mayflies inhabit lotic-erosional zones, are characterised as **clingers**, and belong to the trophic guilds of **collector-gatherers** and/or **scrapers**. The remaining Ephemeroptera were: 30 *Baetis sp.*, 7 *Cinygmula sp.*, 2 *Epeorus (Iron) deceptivus*, 5 *Ephemerella coloradensis*, 4 *E. doddsi*, 5 *Ephemerella (Seratella) tibialis*, and 6 *Rhithrogena sp.* (all of which are **collector-gatherers** and/or **scrapers**).

The second most abundant group, stoneflies, contained 11 specimens: 2 *Doroneuria sp.*, 1 *Kogotus sp.*, 2 *Sweltsa sp.* (all of which are **predator-engulfers**), and 6 *Zapada (haysi)*, a **shredder-detritivore** and/or **herbivore** on moss. The caddisflies are represented by: 1 *Arctopsyche sp.* (**clinger**-netspinner, fixed retreats, collector-**filterer** of coarse particles), 1 *Ecclisomyia sp.* (**collector-gatherer, scraper**), 3 *Lepidostoma sp.* (**shredder-detritivore**), 1 *Rhyacophila (acropedes or vao)*, and 4 *Rhyacophila coloradensis* (both of which are **predator-engulfers**). All of the Diptera specimens collected were chironomids: 1 UID juvenile, 1 *Brillia sp.*, 2 *Eukiefferiella sp.*, and 3 *Micropsectra sp.* Also found at this site was 1 larval, riffle beetle, *Lara sp.* (Family Elmidae), a **shredder-detritivore**.

Brohm River Reach 11 96-Aug-07

Invertebrates from six different groups were found here: Ephemeroptera (50%), Diptera (26%), Plecoptera (13%), Trichoptera (6%), Turbellaria (4%), and Oligochaeta (1%). The dominant taxa at this site were heptagenid mayflies, *Rhithrogena sp.*, representing 31% of the sample (25 specimens). These mayflies inhabit lotic-erosional zones, are characterised as **clingers**, and belong to the trophic guilds of **collector-gatherers** (detritus, diatoms) and/or **scrapers**. The remaining Ephemeroptera were: 4 *Baetis sp.*, 2 *Cinygmula sp.*, 1 *Epeorus (Iron) albertae*, 2 *E. (I.) deceptivus*, 3 *Ephemerella doddsi*, and 3 *E. (Seratella) tibialis* (all of which are **collector-gatherers** and/or **scrapers**).

The second most abundant group, the true flies, contained 21 specimens, of which 18 were chironomids: 7 UID juveniles, 9 *Brillia sp.* (**shredder-detritivore**, **collector-gatherer**), 1 *Corynoneura sp.*, and 1 *Micropsectra sp.* The remaining Diptera were 3 crane fly larvae, *Dicranota sp.* (Fam. Tipulidae). Of the 10 stoneflies collected, there were: 2 *Doroneuria sp.*, 1 *Kogotus sp.*, 4 *Sweltsa sp.* (all of which are **predator-engulfers**), 1 *Zapada (haysi)*, and 2 *Zapada sp.* (both of which are **shredder-detritivores**, **herbivores** on moss). Five caddisflies were found here: 2 UID juveniles, 1 *Lepidostoma sp.* (**shredder-detritivore**), 1 *Rhyacophila (acropedes or vao)*, and 1 *R. angelita* (both of which are **predator-engulfers**). Also collected at this site were 3 Turbellaria (*Polycelis sp.*?), and 1 oligochaete worm, Family Lumbriculidae.

Brohm River Reach 16 96-Aug-08

Invertebrates from five different groups were found here: Ephemeroptera (74%), Diptera (9%), Plecoptera (6%), Trichoptera (6%), and Turbellaria (4%). The dominant taxa at this site were heptagenid mayflies, *Rhithrogena sp.*, representing 49% of the sample (38 specimens). These mayflies inhabit lotic-erosional zones, are characterised as **clingers**, and belong to the trophic guilds of **collector-gatherers** (detritus, diatoms) and/or **scrapers**. The remaining Ephemeroptera were: 12 *Baetis sp.*, 3 *Cinygmula sp.*, 1 *Epeorus (Iron) albertae*, and 4 *Ephemerella coloradensis* (all of which are **collector-gatherers** and/or **scrapers**).

The second most abundant group, the true flies, contained 7 specimens, of which 6 were chironomids: 1 UID juvenile, 4 *Brillia sp.*, and 1 *Thienemanniella sp.* The remaining Diptera was 1 adult house fly (Fam. Muscidae). Of the 5 stoneflies collected at this site, there were 4 *Sweltsa sp.* and 1 *Doroneuria sp.* (both of which are **predator-engulfers**). Five caddisflies were found here: 3 UID juveniles, 1 *Ecclisomyia sp.* (**collector-gatherer** , **scraper**), and 1 *Rhyacophila coloradensis* (**predator-engulfer**). Also collected here were 3 Turbellaria (*Polycelis sp.*?).

Brohm River Reach 22 96-Aug-13

Invertebrates from six different groups were found here: Ephemeroptera (81%), Diptera (7%), Trichoptera (5%), Plecoptera (4%), Hydracarina (1%), and Turbellaria (1%). The dominant taxa at this site were heptagenid mayflies, *Rhithrogena sp.*, representing 35% of the sample (26 specimens). These mayflies inhabit lotic-erosional zones, are characterised as **clingers**, and belong to the trophic guilds of **collector-gatherers** (detritus, diatoms) and/or **scrapers**. The remaining Ephemeroptera were: 15 *Baetis sp.*, 5 *Cinygmula sp.*, 11 *Epeorus (Iron) albertae*, 2 *Ephemerella coloradensis* and 1 *E. doddsi* (all of which are **collector-gatherers** and/or **scrapers**).

The second most abundant group, the true flies, contained 5 specimens, of which 4 were chironomids: 1 UID juvenile, 2 UID pupae, and 1 *Eukiefferiella sp.* The remaining Diptera was 1 *Glutops sp.*, Family Pelecorhynchidae, which inhabits lotic-depositional zones, is characterised as a **sprawler**-burrower, and belongs to the trophic guild of predator-piercer, **shredder-detritivore**?. Of the 4 caddisflies collected, there were 2 *Rhyacophila coloradensis* (a **predator-engulfer**), 1 UID juvenile and 1 UID pupa. Only 3

stoneflies were found, all of which were *Sweltsa sp.*, a **predator-engulfer**. Also collected at this site were: 1 water mite (Hydracarina), *Wandesia sp.*, and 1 Turbellaria (*Polycelis sp.*?).

Brohm River Reach 23 96-Aug-13

Invertebrates from only three different orders were found here: Ephemeroptera (69%), Diptera (23%), and Plecoptera (8%). There was no dominant taxa at this site as only 13 specimens in total were collected. Of the 9 mayflies collected, there were: 3 *Baetis sp.*, 1 *Cinygmula sp.*, 2 *Epeorus (Iron) deceptivus*, and 3 *Rhithrogena sp.* (all of which are **collector-gatherers** and/or **scrapers**). Only 3 Diptera specimens were found, 2 UID chironomid adults, and 1 adult black fly (Fam. Simulidae). The only stonefly collected was 1 *Visoka (cataractae)*, a **shredder-detritivore**.

Brohm River Reach 24 96-Aug-13

Invertebrates from six different groups were found here: Ephemeroptera (74%), Plecoptera (11%). Diptera (10%), Trichoptera (4%), Homoptera (1%), and Gastropoda (1%). The dominant taxa at this site were heptagenid mayflies, *Cinygmula sp.*, representing 24% of the sample (25 specimens). These mayflies inhabit lotic-erosional zones, are characterised as **clingers**, and belong to the trophic guilds of **scrapers** (diatoms) and/or **collector-gatherers** (detritus, diatoms). The remaining Ephemeroptera were: 8 *Baetis sp.*, 18 *Epeorus (Iron) albertae*, 4 *E. (I.) deceptivus*, 3 *Ephemerella coloradensis*, 1 *E. doddsi*, 17 *Rhithrogena sp.* (all of which are **collector-gatherers**), and 1 *Paraleptophlebia sp.* (**collector-gatherer** of coarse detritus and/or facultative **shredder-detritivore**).

The second most abundant group, the stoneflies, contained 11 specimens: 6 *Sweltsa sp.*(**predator-engulfers**), 4 *Visoka (cataractae)*, and 1 *Zapada (haysi)*, both of which are **shredder-detritivores**. All of the Diptera collected were chironomids: 1 UID juvenile, 5 *Brillia sp.*, 2 *Eukiefferiella sp.*, 1 *Micropsectra*, and 1 *Thienemanniella sp.* Four caddisflies were found here: 1 UID pupa, 1 UID juvenile, 1 *Ecclisomyia sp.* (**collector-gatherer**, **scraper**), and 1 *Rhyacophila (acropedes or vao)*, a **predator-engulfer**. Also collected at this site were: 1 terrestrial homopteran, Family Aphididae, and 1 gastropod, Fam. Pupillidae, *Fossaria sp.*?.

Sedimentation Buckets

Total Suspended Solids were similar at all sites in September and were somewhat higher than the other streams studied. Values were very low (2 mg/L). Most of the suspended particles in Brohm River are large > 150 mm and thus should settle out quickly. Visual examination of the stream bed suggests that it has good spawning gravel and small cobble in most areas.

5.14.10 WAP Prescriptions

Channel structure: *Pool and riffle structures:* should be re-established such that they are consistent with natural channel structure and hydrologic regimens. *Large structural elements (wood and boulders):* placement should be made with respect to creating microhabitat, especially in within pool zones (1-10 year recovery period). Channel modifications must be made in conjunction with road and culvert stabilization. Large woody debris should be enhanced to increase microhabitat for macroinvertebrates and to increase the trapping of adult salmon carcasses (5-25 years). ***Sediment:*** it is crucial that remaining roads and culverts be maintained to standards which minimize or eliminate local, steep slope, water movements which would otherwise induce enhanced sediment deposition into creeks and streams (20-200 year cycles). ***Water quality:*** Changes in solar quality and quantity will modify algal community structure and productivity and production (5-25 years). Continuous data logger thermistors should be

installed in the creek to define temperature profiles. *Nutrients:* revegetation of the upslope and riparian areas will reduce nutrient washout and diminish nutrient loading into surface waters; this may result, together with increased canopy cover and shading, in reduced summer and autumn periphyton production. This is likely to be minimized through nutrient loading originating from Brohm Lake. An assessment of winter periphyton production should be conducted. ***Riparian and immediate upslope forest:*** Small tributaries and ephemeral streams, which provide lateral shelter, rearing habitat and act as a feedstock production area, must be protected and revegetated where necessary; care should be taken to ensure that stream crossings are designed, installed and maintained with respect to protection of trophic in-stream attributes. A survey of ephemeral streams should be made; damaged stream habitat should be restored. *Production of large wood:* the long term perspective should be the production of mature and old-growth forest structure for the production of new wood. Upstream production and subsequent downstream transport, through stream washout and landslides, delivers large structural elements to local reaches (100-300 year horizon). *Trophic and organic food production:* mature and old-growth forest and riparian zone vegetation restores natural inputs from terrestrial ecosystems (40-80 years); introduction of leaf litter is essential for provision of structural substrate on which bacterial and protozoan communities develop; macroinvertebrates derive a significant portion of their nutrition from this microbiotic community (5-10 years). Fish gut studies should be conducted to determine what food resources are being used as the primary nutrition source. The creation of specific microhabitat, which provides for the specific requirements of selected algal and micro and macroinvertebrate populations, must be created when channel morphologies are altered (1-10 year cycles); increasing pool habitat will also create conditions essential for leaf litter accumulation and likely enhance shredder populations. *Shading:* re-establishment of riparian canopy will ultimately reintroduce light as a factor limiting primary production, which will eventually return to predisturbance values (5-20 year cycle). *Rooting systems:* growth of woody vegetation on stream banks, and the concomitant root network, results in enhanced stream bank integrity (20-80 years). *Nutrient modification:* successional processes occurring as riparian plant communities develop can, in some situations, enhance nutrient filtering capability; however, subsurface hydrologic flows are complex and may be little influenced by riparian root structures (20-80 year cycles). The presence of Highway 99 does present the potential for the introduction of exogenous substances into the lower reaches. Care should be taken to ensure that road drainage and other undesirable chemical substances do not directly enter the creek. The most likely threat to the creek is from an accidental spill of toxic compounds, following a vehicle accident. No exotic species were observed.

5.14.11 RAP Overview

The Riparian Assessment Procedure field crew found no recent clearcut areas directly adjacent to Brohm River during their reconnaissance. Therefore, no assessment of riparian vegetation was conducted.

There may be opportunities for riparian vegetation enhancement or bioengineering work in conjunction with fish habitat enhancement, channel and bank stabilization, or other proposals for this creek. Such investigations will form part of the Year 3 program.

5.15 Important Rivers and Creeks in the Squamish Nation Traditional Territory

Fish and wildlife harvesting/habitat maintenance has been and continues to be an essential part of the Squamish Nation traditional Aboriginal way of life. Hunting, fishing and gathering activities are not only economic activities of the past, but also, in large part, define today's Squamish Nation Aboriginal culture and spirituality.

The rivers and creeks listed in **bold** type are considered prioritized.

Clendenning Creek
Elaho River
- 80 mile Creek
- 31 mile Creek
- 28.5 mile Creek
Sims Creek
Squamish River
Polaym #I.R.9
Chuck Chuck Creek #I.R.8
Turbid Creek
Shovelnose Creek
Highfalls Creek
- lower runs through
Skowishin #I.R. 7
Ashlu River
Skowishin, #I.R. 10
(graveyard a few miles
before Ashlu bridge)
Crooked Falls Creek
Madden Creek
Mawby Creek
Zenith Creek
Tantalus Creek
Cloudburst Creek
Pillchuck Creek
Evans Creek
Soo River
Green River
21 Mile Creek
Callaghan River
Brandywine Creek
Roe Creek
Chance Creek
Marble Creek
Rubble Creek
Conroy Creek
Swift Creek
Dryden Creek
Hop Rank Creek
Cheakamus River
Wedge Creek
Fitzsimmons Creek
Culliton Creek
Cheekye River
Mashiter Creek
Ring Creek
Mamquam River
Skookum Creek
Crawford Creek
Ratfuse Creek
Stawamus River
Mesilloct Creek
Hixon Creek
Grand Creek
Indian River
Fries Creek
Mill Creek
Woodfibre Creek
Potlatch Creek
Ellesmere Creek
McNab Creek

5.16 Important Logging Roads in the Squamish Nation Traditional Territory

Upper Squamish logging road runs through Cheakamus #I.R. 11
Ashlu road
Elaho road
Stawamus road, Indian River road
Mamquam road
Brohm Ridge road

5.17 Important Drinking Water Area in the Squamish Nation Traditional Territory

Cheekye, Cheakamus I.R. #11 ground wells supports the local community. Ashlu Creek once supported a historic kinship community of the Squamish Nation. The Mashiter Creek and Stawamus River supports the local aboriginal and non-aboriginal community.

5.18 Pilot Project

As part of Year Two, a pilot riparian revegetation project was initiated on an upper reach on Chance Creek. This work was carried out in November in order to ensure that whips (small branches cut from trees) were dormant. Six members of the original team cut whips of willow, alder and cottonwood from a forest access road at a similar elevation. In all, 2,500 whips were cut, flagged and planted along both sides of Chance Creek in reach 13 over 500 m distance adjacent to the creek.

The purpose of this work was to train the crews in the methods of whip cutting and planting. There was also an experimental component to this pilot project. Traditionally whips are cut in late winter and stored till the ground thaws in the spring and then replanted. It was our intention to see if whips cut and planted in late fall would survive. If so, this will extend the period of employment for the restoration project from late winter (when more whips will be cut) to late fall. In addition, survival rates for the various species planted will be learned.

5.19 Chance Creek Whip Collection Project

Introduction:

The whip collection project on Chance creek was a continuation of the 1996 WRP project. Three species of tree whips were collected to be used for restoring clearcut areas; Red Alder, Black cottonwood and Willow. The whips were collected as near to the planting area as possible to reduce the introduction of new pathogens to the area and to reduce variation in altitude. Beneath power-lines and on deactivated logging roads were the best areas for collection as there were high densities of all three desired species. Collection was done in March so that the trees were still in a dormant state and they could be buried under snow to remain dormant until planting time.

Materials and Methods:

Two crews of five members collected the whips for five days. It took three days for transportation and storage. There was approximately 1.5m of snow at collection site 1, -3m at the storage site and -4m at collection site 2. It was therefore necessary to use snowshoes for walking around and snowmobiles for transportation of crew and whips. The whips were cut to obtain the maximum amount of buds within < 1 m length and diameter range of 0.5 - 2.5 cm. The whip length of 1 m can be cut in half before planting. The willow whips were tied In bundles of 20, The alder and cottonwood were tied in bundles of 10. The bundles were then placed in large garbage bags and tied shut to protect the buds. The willow bags weighed approximately 30 - 35 Kg, the alder and cottonwood bags weighed approximately 10 - 15 Kg. A large storage hole was dug In the snow roughly halfway between the collection sites in a sheltered ravine. The pit was approximately 5m by 4m by 2m deep. The location was chosen to provide the maximum amount of time of snow cover. Collection site 1 was located near the mouth of Chance creek, the pit was about 3,5 Km Up the mountain from site 1, Collection site 2 was about 2 Km up from the pit near the first bridge across Chance creek.

Results:

Table 5.19-1 Inventory of whips and bags of whips by species.

	Alder	Cottonwood	Willow	Total
no. whips in bags	4890.00	2150.00	7760.00	14800.00
no. whips cut in half	9780.00	4300.00	15520.00	29600.00
no. bags site 1	48.00	54.00	65.00	167.00
no. bags site 2	50.00	0.00	0.00	50.00

Discussion:

Several problems arose during the project that were exacerbated by the weather. Collection on the first and second days were slow due to the lack of large sheers on the first day and the shears breakingon the second day. Cutting proceeded rapidly after better quality sheers were purchased.

Transporting the whips proved the be the greatest challenge. The snowmobiles used were recreational vehicles not meant for heavy work. only one of them had a trailer hitch and we had only one small sled to transport the whips on. A maximum of only 5 - 7 bags of whips, depending on the species, could be moved at one time. Due to heavy rain and soft snow travel, time from site 1 to the pit on day 6 was 45 min. (i.e., we were only able to move 6 bags per hour or 42 bags per day to the pit in this fashion). It would have taken more than a week to complete the job using this method. A storm front moved in that night and caused enough runoff to create an 8m wide waterfall across the logging road that brought enough debris with it to make the road dangerous and impassable.

We were forced to stop work until the weather cleared. Due to the risk of injury, time constraints and lack of adequate snowmobiles and sleds it was decided that a helicopter would be required to complete the project within budget. The closest the helicopter could deposit the whips to the pit was at a road fork about 0.5 Km from the pit. The helicopter was able to carry up to 300 Kg of cargo at one time. It took five trips from site 1 and one trip from site 2 to transport all 217 bags of whips, this took 1.6 hours. Due to the fact that we had only one snowmobile that day, one crew of five stayed to complete storage of the whips using the snowmobile for transporting them. The whips were covered by approximately 1 m of snow.

5.20 Forestry Related Activities

TENURE / LICENSEE	CREEKS	ACTIVITY	SYSTEM	LOCATION	DATE	MISC. INFORMATION
TERMINAL FOREST PRODUCTS LTD.	CHANCE CREEK	PRUNING	HANDSAW	3 KM.	97	92G 095, BLK. 25
		SPACING	POWERSAW	3 KM.	99	92G 095, BLK. 30
		LOGGING	GRAPPLE	6.2 KM.	97	92G 095, BLK. 21-3
		LOGGING	GRAPPLE	5 KM	97	92G 095, BLK. 3-006 NOTE: .85 KM OFF CREEK
		LOGGING	GRAPPLE	5 KM	98	92G 095, 3-010 NOTE: 3.16 KM FROM HWY TO TURNOFF; 7.08 KM FROM TURNOFF TO BLK 3-010
		LOGGING	GRAPPLE	5 KM	98	92G 095, 3-001 NOTE: 2.2 KM OFF CREEK
		LOGGING	GRAPPLE	3 KM	99	92G 095, 3-004
		LOGGING	GRAPPLE	2.25 KM	99	92G 095, 3-005
	PILLCHUCK CREEK					
	CLOUDBURST CREEK					
	EVANS CREEK					
SMALL BUSINESS FOREST ENTERPRISE PROGRAM	BROHM RIVER	SPACING	POWERSAW	9.4 KM. FROM HWY. 99	97	92G 085, BLK. 59 NOTE: 3 KM. APPROX. FROM BROHM CR.
		SPACING	POWERSAW	5.15 KM FROM HWY. 99	98	92G 085, BLK. 26
		SPACING	POWERSAW	3.95 KM FROM HWY. 99	98	92G 085, BLK. 28
		SPACING	POWERSAW	3.95 KM FROM HWY. 99	98	92G 085, BLK. 29
		SPACING	POWERSAW	1.5 KM FROM HWY. 99 TO TURN OFF	98	92G 085, BLK. 98 NOTE: 8.22 KM FROM TURN-OFF AT BROHM MAIN TO BLK. 98
		SPACING	POWERSAW	5.65 KM FROM HWY. 99	98	92G 085, BLK. 23
		SPACING	POWERSAW	1.5 KM FROM HWY. 99 TO TURN OFF	98	92G 085, BLK. 54 NOTE: 8.22 KM FROM TURN-OFF AT BROHM MAIN TO BLK. 54
TERMINAL FOREST PRODUCTS LTD.	CRAWFORD CREEK	BRUSHING	POWERSAW	6.5 KM FROM MAMQUAM R.	97	92G 076, BLK. 100
		BRUSHING	POWERSAW		98	92G 066, BLK. 135
		BRUSHING	POWERSAW	6.95 KM FROM MAMQUAM R.	98	92G 076, BLK. 73
		PLANTING	MANUAL		97	92J 066, BLK. 135
TERMINAL FOREST PRODUCTS	CHEEKEYE RIVER	SPACING	POWERSAW	1.25 KM FROM HWY 99	97	92G 085, BLK. 59 NOTE: 6.35 KM FROM TURNOFF TO BLK. 59

5.21 Contacts

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5.22 Wildlife Considerations

Introduction

Riparian areas are generally more productive, complex and diverse than up slope areas. The high abundance and diversity of plant and wildlife species occurring in these habitats are a reflection of productive growing conditions and variety of unique habitat elements. These habitat elements include deciduous trees, large coniferous trees, snags, coarse woody debris (CWD) and prolific herb and shrub

growth. The diverse tree, shrub and herb habitats provide a rich source of insects for small birds, mammals and amphibians, numerous nesting opportunities for passerines, foraging opportunities for bears and browse for ungulates (Thurmond *et al.* 1995, Cohen 1993 and Davis *et al.* 1996, as cited in CWS 1996). Riparian habitats tend to have a higher abundance and diversity of small mammals than upland areas (Galindo-Leal *et al.* 1993; McComb *et al.* 1993). These small mammal populations are in turn an excellent prey source for wildlife species such as fisher and spotted owl. Dead and dying trees provide nest sites for cavity nesters such as woodpeckers, small owls and flying squirrels. Large coniferous trees not only provide large limbs for nesting by raptors and marbled murrelet, but also intercept snow in deep snowfall areas providing wintering areas for fisher, deer and other wildlife species. Downed wood (i.e., CWD) is used as feeding, resting and breeding sites for many species of wildlife, as well as security or thermal cover (Stocek 1994, as cited in CWS 1996).

Riparian habitats also provide a key role in maintaining linkages between low elevation and high elevation habitats. When these habitats are uninterrupted, they can provide travel across landscapes for many species. Deer and bears are known to undergo altitudinal migrations to take advantage of the changing availability of herbaceous plants and berry-producing shrubs.

In prescribing riparian vegetation enhancements, riparian habitat requirements of key wildlife species inhabiting the watersheds must be considered. The riparian habitat requirements of:

a) species listed in the draft Forest Practices Code 'Identified Wildlife' List; b) species on the B.C. Ministry of Environment's red and blue-lists; c) of important large game species; and d) species of particular regional concern, were investigated. Specific habitat requirements may influence riparian vegetation prescriptions within the watershed. Appendix I summarizes moderate and high priority species described in the following report.

Methods

No field work on wildlife occurrence and habitat utilization was conducted in the watershed. Information on wildlife use and presence in the watershed was based on existing information, discussions with B.C. Ministry of Environment personnel, known distribution and habitat requirements, and various sources of anecdotal information. For each wildlife species, a review of habitat requirements, particularly riparian habitat, was conducted. Each wildlife species was rated as having either low, moderate or high priority in the watershed. The priority rating for each species was based on: a) importance of riparian habitats; b) abundance within the watershed; and c) regional priorities of the B.C. Ministry of Environment.

5.22.1 Key Wildlife Species Occurring In The Squamish River Watershed

Mammals

Keen's Long-eared Myotis (*Myotis keenii*) - Red-listed

Status and Distribution

Keen's long-eared myotis is restricted to the Pacific Coastal region. Most of the world's population is thought to live in British Columbia's coastal forests. In British Columbia, it has been found as far north as the Stikine River, on the Queen Charlotte Islands and Vancouver Island. To date, it has not been recorded in the watershed (Nagorsen and Brigham 1993). However, this species is extremely difficult to survey, especially because of its similarity to the more common western long-eared myotis (Firman *et al.*

1993). Keen's long-eared myotis may well be common in coastal forests (Nagorsen and Brigham 1993). This bat species is likely to occur in the Squamish River watershed. **Priority in watershed = MODERATE.**

Riparian Habitat Requirements

From distribution records, it appears that Keen's long-eared myotis is restricted to old-growth forests within the Coastal Western Hemlock biogeoclimatic zone and does not occur at higher elevations. Rock crevices such as mines, cliffs and rocks, and cavities in snags are used as roosting areas (Nagorsen and Brigham 1993). The presence of suitable roost sites may be a limiting factor. Key foraging areas are over open areas such as wetlands, stream and creek corridors and natural forest openings (Brigham 1993).

Riparian Vegetation Prescriptions

To maintain suitable roosting habitats for Keen's long-eared myotis, a long-term supply of snags must be provided in riparian management areas. Nurse tree shelterwoods, where hardwoods act as a nurse crop, result in both an acceptable growth of shade tolerant conifers and a supply of snags as the hardwoods die out.

Townsend's Big-eared Bat (*Plecotus townsendii* ssp. *townsendii*) - Blue-listed

Status and Distribution

Townsend's big-eared bat is found throughout the western United States with isolated populations in the southern Great Plains, Ozarks and Appalachians. In British Columbia, this bat is distributed throughout southern sections, although its status in many areas is unclear (Nagorsen and Brigham 1993). The absence of records in the Squamish River watershed is likely due to lack of sampling and observer effort. The watershed has the potential to support viable populations of this species. **Priority in watershed = MODERATE.**

Riparian Habitat Requirements

Townsend's big-eared bat is associated with coastal forests and has been found at elevations ranging from sea level to 1,070 metres. The primary management concern is for protection of winter hibernacula and summer roost sites (Nagorsen and Brigham 1993). Important summer roost sites are caves, old mines and buildings, with buildings used more often in humid coastal areas. Unlike Keen's long-eared myotis, cavities in snags do not appear to be used as roost sites. However, their use of buildings suggests that under more natural conditions, tree cavities may be used (Kunz and Martin 1982, as cited in Brigham 1993). In a recent study in the B.C. interior, Townsend's big-eared bats were most frequently caught in small areas of wet habitat associated with streams, lakes and small marshes dominated by willow, cottonwood and birch (Holroyd *et al.* 1994).

Riparian Vegetation Prescriptions

Provision of a long-term supply of snags in the riparian management area may benefit Townsend's big-eared bat. Nurse tree shelterwoods, where hardwoods act as a nurse crop, result in both an acceptable growth of shade tolerant conifers and a supply of snags as the hardwoods die out.

Fisher (*Martes pennanti* ssp. *pacifica*) - Blue-listed, Identified Wildlife

Status and Distribution

The fisher is found throughout mainland portions of British Columbia except for south central (i.e., Okanagan) and southwestern (i.e., Kootenays) regions. It is not found on Vancouver Island, the Queen Charlotte Islands or most smaller coastal islands (Cowan and Guiguet 1965). Harvest data suggest that fisher populations are extremely low and widely dispersed in the Lower Mainland Region (Banci 1989). Deep snow, especially prevalent in coastal areas, impedes movement and restricts their winter distribution. Although specific information on the distribution of fisher in the watershed is not available, it likely occurs at very low densities. **Priority in watershed = MODERATE.**

Riparian Habitat Requirements

Much of the literature suggests that fisher are closely associated with riparian and dense wetland forest types primarily in areas with adjacent mature and old-growth forests. In a study in the Williams Lake area of British Columbia, fishers used sub-hygric (riparian-associated) and hygric (riparian) moisture regimes more frequently than expected, based upon availability (Weir 1993). Riparian habitats are important foraging areas and also act as movement corridors for fisher movement or dispersal. Fisher's are also known to inhabit transition areas between different types of habitats, particularly those with mixed habitat and structural stages (Banci 1989). They appear reluctant to cross wide open spaces and remain within forests with closed overhead cover. Winter resting sites are associated with large coarse woody debris (CWD) and large spruce with spruce broom rust, often located in riparian habitats. Large and well distributed CWD permits movement in high snowfall areas. Maternal den sites in British Columbia are almost entirely found in large, decadent cottonwood in riparian habitats (Banci 1989). Encouragement of a well developed shrub understorey will provide habitats for fisher prey (BCE 199?a).

Riparian Vegetation Prescriptions

Enhancement of riparian habitats for fisher must ensure that important habitat features such as CWD, mixed species forests, and winter rest and maternal dens sites in large spruce and cottonwood are provided. Large diameter CWD must be retained in riparian management areas. Retention and possible additions of LWD for fish habitat enhancements are compatible with enhancement objectives for fisher. Planting of black cottonwood and Sitka spruce in nurse tree shelterwoods and conifer clusters should ensure that rest and den sites are provided in the future. Nurse tree shelterwoods and planting of conifer clusters will provide mixed species forests preferred by fishers. Enhancement of existing shrub vegetation will improve habitats for small wildlife species preyed on by fishers.

Wolverine (*Gulo gulo* ssp. *luscus*) - Blue-listed

Status and Distribution

The wolverine occurs throughout the province, frequenting wooded and mountainous areas to sub-alpine and alpine habitats. British Columbia is the top producer of wolverine pelts in North America (BCE 199?b). Although the status of wolverine within the watershed is not known, it likely occurs at very low densities. **Priority in watershed = LOW.**

Riparian Habitat Requirements

The primary habitat requirements of wolverines appears to be large tracts of relatively undisturbed wilderness and diverse habitats which support a robust prey source. Forested riparian areas are likely important corridors for movement and dispersal.

Riparian Vegetation Prescriptions

Because wolverines have few specific habitat requirements, prescriptions are difficult to recommend. Any prescription which increases the diversity of habitats and plant communities and ultimately prey populations will benefit wolverines.

Grizzly Bear (*Ursus arctos* ssp. *horribilis*) - Blue-listed, Identified Wildlife

Status and Distribution

The grizzly bear is distributed throughout mainland portions of British Columbia, with the exception of the lower Fraser River valley, the grassland plateaus of the southern Interior, and the Peace River lowlands. Human encroachment has limited the value of grizzly bear habitats throughout most of the Lower Mainland Region. Grizzly bear populations are expected to be low to very low in the Squamish River watershed. **Priority in the watershed - MODERATE.**

Riparian Habitat Requirements

MOE (1995) describe grizzly bears food preferences as including a wide range of herbaceous vegetation such as skunk cabbage, sweet vetch (*Hedysarum* spp.), roots, sedges, horsetails, grasses, and berries as well as insects and grubs, small and large mammals, carrion and fish. Areas with concentrated food supplies include floodplain and riparian areas, clearcuts and upland meadows. Riparian areas and their rich assemblage of herbaceous vegetation are particularly important as foraging areas in early spring when high elevation areas are still covered by snow. A recent study of grizzly bears in the Flathead River drainage found that although riparian habitat covered only 8.5% of the study area, average use per individual bear (77 radio-collared bears) was 40% during spring (McLellan and Hovey 1993). Riparian areas again become important in summer and fall when a variety of berries ripen. Riparian habitats are also utilized as corridors for movement, dispersal and altitudinal migration.

Riparian Vegetation Prescriptions

Uninterrupted, forested riparian habitats are important in providing movement corridors for grizzly bears between lower and upper elevation foraging areas. Most riparian vegetation prescriptions will ensure that a continuous band of riparian vegetation is created. Cluster planting of conifers will also benefit grizzly bears. A principle objective of cluster planting is to maintain gaps in the canopy so that bear foraging opportunities will be provided over the long-term (McLennan 1993). Enhancement of berry-producing shrubs will provide an important food source, especially in late summer and fall.

Black Bear (*Ursus americanus* ssp. *altifrontalis*) - Large game species

Status and Distribution

Black bears are found throughout the British Columbia mainland, Vancouver Island, the Queen Charlotte Islands and many of the larger coastal islands. Black bears are a common resident of the Squamish River watershed. **Priority in the watershed = MODERATE.**

Riparian Habitat Requirements

Black bears utilize a wide range of habitats. Riparian habitats are particularly important because they provide an abundance of herbaceous vegetation in the spring and berries in the summer and fall. Large trees growing in riparian areas may provide large cavities used as den sites by black bears. Riparian habitats are also utilized as corridors for movement, dispersal and altitudinal migration.

Riparian Vegetation Prescriptions

Riparian vegetation prescriptions such as nurse tree shelterwoods and conifer clusters will ensure that a continuous band of riparian vegetation is created, providing corridors for black bear movement. Cluster planting of conifers will also benefit black bears in providing canopy openings where preferred forage species such as herbs and berry-producing shrubs can grow. Enhancement or augmentation of berry-producing shrubs will provide an important food source, especially in late summer and fall.

Moose (*Alces alces* ssp. *andersoni*) - Large game species

Status and Distribution

Moose have gradually extended their range westward in recent years and are occurring with increasing frequency in coastal areas. Populations in the Squamish River watershed are thought to be very low. The highest moose densities in the Squamish River watershed appear to be in the vicinity of Sims and Glendemming Creek and the Elaho River (MOE staff, pers. comm., 1997). **Priority in the watershed - MODERATE.**

Riparian Habitat Requirements

Moose feed on a variety of herbaceous and aquatic plants in summer. Floodplain areas, lakes, marshes and swamps are particularly favored habitats. In winter, moose browse extensively on a variety of shrub species which are particularly prolific in riparian habitats.

Riparian Vegetation Prescriptions

Augmentation of existing shrub vegetation will increase the availability of winter browse for moose. Nurse tree shelterwoods and conifer clusters will result in dense conifer patches and stands which will provide cover in winter. Planting of tree species such as western red cedar, which has high snow interception capabilities, would be most beneficial.

Black-tailed Deer (*Odocoileus hemionus* ssp. *columbianus*) - Large game species

Status and Distribution

In British Columbia, black-tailed deer are found on the western slope of the Coast Range from the International Boundary to Rivers Inlet. The eastern end of their range is approximately Boston Bar, Lillooet Lake and Pemberton Meadows. In these areas, it interbreeds with the mule deer (ssp. *hemionus*) resulting in a population of mixed characteristics. Black-tailed deer is the only subspecies occurring in the Squamish River watershed. It is found at moderate to high abundance in most areas of the watershed. **Priority in watershed = MODERATE.**

Riparian Habitat Requirements

Both mule and black-tailed deer forage on a wide variety of herbaceous plant species and young shoots of a variety of shrubs (e.g., red huckleberry and salal). These plants are often most abundant in productive and moist riparian habitats. Deer also undergo altitudinal movements, migrating to mountain tops and high valleys during the summer and back to lower elevations in winter. Riparian habitats act is important movement corridors. Mature coniferous dominated forest stands and their ability to intercept snow are important wintering areas for deer (MOE 1989a).

Riparian Vegetation Prescriptions

Any riparian vegetation prescription which maintains a continuous riparian corridor will benefit deer undergoing altitudinal movements. Nurse tree shelterwoods and conifer clusters which result in dense conifer stands will provide cover in winter. Planting of tree species such as western red cedar, which has high snow interception capabilities, would be most beneficial to deer.

Mountain Goat (*Oreamnos americanus* ssp. *americanus*) - Identified Wildlife

Status and Distribution

Mountain goats are found throughout mainland British Columbia in suitable terrain but do not occur on Vancouver Island or the Queen Charlotte Islands (Cowan and Guiguet 1965). They are expected to occur at low to moderate densities at higher elevations in the watershed (MOE 1989b). **Priority in watershed = LOW.**

Riparian Habitat Requirements

Preferred habitat types range from coastal and interior forest through subalpine spruce and fir to alpine areas. The only common habitat requirement is steep, rocky terrain. Mountain goats do not have any specific requirements for riparian habitats.

Riparian Vegetation Prescriptions

None recommended.

Birds

American Bittern (*Botaurus lentiginosus*) - Blue-listed, Identified Wildlife

Status and Distribution

In British Columbia, the American bittern occurs locally from Osoyoos and Creston northwards to approximately 80 kilometres north of Prince George (Campbell *et al.* 1990). It is generally absent from coastal areas with the exception of eastern Vancouver Island and the lower Fraser River valley. It is most common in extensive wetland areas on the Fraser River and in the Pitt-Addington Wildlife Management Area. Because the availability of suitable habitat within the watershed is not known, its status is unclear. **Priority in watershed = LOW.**

Riparian Habitat Requirements

The American bittern is most frequently found in wetland habitats dominated by species such as cattail and bulrushes but will also occur in moist meadows, swamps and wet alder or willow thickets. It occurs rarely in upland sites such as alfalfa fields (Campbell *et al.* 1990) or open fields where it forages for voles, mice and grasshoppers (Godfrey 1986).

Riparian Vegetation Prescriptions

None recommended.

Great Blue Heron (*Ardea herodias* ssp. *fannini*) - Blue-listed

Status and Distribution

The great blue heron occurs throughout the southern half of British Columbia and is particularly common in coastal areas and along large interior lakes. It occurs in low numbers at lower elevations throughout the watershed. Most records are of non-breeding individuals. Nesting has only been observed in the lower portions of the Squamish River watershed (Gebauer 1995). **Priority in watershed = MODERATE.**

Riparian Habitat Requirements

Great blue herons generally forage in open canopy areas along a wide variety of wetlands. Nesting often occurs within dense deciduous forest stands in riparian areas, or in close proximity to wetland foraging areas. Mature coniferous trees are also occasionally utilized for nesting.

Riparian Vegetation Prescriptions

Creation of nurse tree shelterwoods and hardwood stands adjacent to creeks and streams may provide future nesting habitats for great blue heron. Creation of forested riparian stands is particularly important on floodplain habitats and adjacent to areas with significant wetlands such as marshes and lakes. Enhancement of fish populations will benefit great blue herons.

Green Heron (*Butorides virescens*) - Blue-listed

Status and Distribution

In Canada, green herons breed only in southwestern British Columbia, and southern Ontario, Quebec and New Brunswick. In British Columbia, the green heron is found regularly in the lower Fraser River valley from the Fraser River Delta east to Hope and on Vancouver Island from Victoria north to Campbell River. It also occurs and has been known to breed in the vicinity of Alta and Green Lakes in the Whistler area (Ricker *et al.* 1996). Because of the absence of suitable habitats, green herons are not expected to occur in any abundance in other areas of the Squamish River watershed. However, green herons are in the midst of a range expansion in British Columbia and may expand into unoccupied areas in the future. **Priority in Watershed = LOW.**

Riparian Habitat Requirements

The green heron is found primarily at the edges of waterbodies such ponds, rivers, sloughs, and lakes, but also uses marshes, sewage ponds, bays, irrigation ditches, beaches, inlets, city parks and golf courses (Campbell *et al.* 1990). Preferred breeding habitats include freshwater and brackish sloughs, slow-moving rivers, and lakes, all with dense willow, crabapple or alder thickets along the shore. An increasing number of green heron records are coming from small wetlands in forested settings.

Riparian Vegetation Prescriptions

In areas with suitable aquatic habitat, prescriptions such as nurse tree shelterwoods, hardwood stands and augmentation of stream side shrub thickets are expected to provide nesting habitats for green herons. Enhancement of fish populations will also benefit green herons.

Harlequin Duck (*Histrionicus histrionicus*) - Species of regional concern

Status and Distribution

In Canada, the breeding range of the harlequin duck is divided into two widely separated parts: a) western areas from the Yukon through most of British Columbia, except for the Peace River lowlands, and the Rocky Mountain areas of Alberta; and b) eastern areas from southeastern Baffin Island through eastern Labrador and Quebec, all of Newfoundland and the Gaspe Peninsula in New Brunswick (Godfrey 1986). In British Columbia, the documented breeding range of the harlequin duck on the coast includes only Vancouver Island, the Sumallo River, the Fraser River lowlands and the Queen Charlotte Islands. It is a scattered breeder in the interior. During the winter, it is found primarily in coastal areas (Campbell *et al.* 1990). Harlequin ducks are known to occur in moderate numbers in the Squamish River watershed during the summer (Ken Wright, CWS, pers. comm., 1997). In the breeding season, they may occur from sea level to more than 2,000 m elevation along suitable creeks and rivers. **Priority in watershed = HIGH.**

Riparian Habitat Requirements

Harlequin ducks are dependent on creeks and rivers and associated riparian habitats in the breeding season. A study in the U.S. Rocky Mountains region (Cassirer *et al.* 1996) identified second order or larger streams containing reaches with average gradient of 1% to 7%, riffle habitat, clear water, gravel to boulder-sized substrate, and forested bank vegetation as being important for harlequin ducks. Additional site characteristics included overhanging bank vegetation, woody debris, loafing sites, absence of human activity and inaccessibility. Nest sites are most often located in dense streamside vegetation, overturned root wads, log jams, on rocks and sometimes tree cavities (Cassirer 1993). Mature to old-growth cedar and hemlock vegetation appears to be an important habitat component (Cassirer and Groves 1990). Harlequin ducks feed primarily on aquatic invertebrates. Overhanging stream vegetation is important in providing an invertebrate food source, and escape and security cover.

Riparian Vegetation Prescriptions

Enhancement of harlequin duck habitat requires stabilizing of small stream and creek channels and increasing shading by planting riparian vegetation. Riparian prescriptions such as nurse tree shelterwoods, conifer clusters and shrub augmentation will improve harlequin duck habitats. Stabilizing stream banks using bioengineering methods will also be beneficial. Fish habitat prescriptions which result in availability of LOD, pools, clear water and increases in invertebrate populations will benefit this species. Presence of a forested riparian management zone and a stable, productive creek are required.

Marbled Murrelet (*Brachyramphus marmoratus* ssp. *marmoratus*) - Red-listed, Identified Wildlife

Status and Distribution

Marbled murrelets occur along the entire northern Pacific Coast from the Gulf of Alaska south to central California. Although they generally occur close to coastal areas, they are known to range inland in the vicinity of large lakes at least 75 km from the sea (e.g., Harrison Lake) (Campbell *et al.* 1990). Because of the proximity of the Squamish River watershed to coastal areas, they are expected to nest at moderate densities in suitable habitats in southern areas. **Priority in watershed = HIGH.**

Riparian Habitat Requirements

Marbled murrelets have a unique preference for nesting on large limbs of conifers in old-growth and mature forests and do not necessarily have a specific requirement for riparian habitats. However, because of high productivity in riparian habitats, these areas can produce, more rapidly than adjacent areas, trees that are suitable for nesting.

Riparian Vegetation Prescriptions

Nurse tree shelterwoods and conifer clusters which incorporate tree species such as Sitka spruce and western red cedar may provide some nesting opportunities in the future.

Turkey Vulture (*Cathartes aura* ssp. *teter*) - Blue-listed

Status and Distribution

The turkey vulture occurs in most areas of continental North America. In British Columbia, populations are concentrated on eastern Vancouver Island, the southwestern mainland coast, the lower Fraser River valley and the Okanagan (Campbell *et al.* 1990). Records of individuals in the Squamish River valley and Whistler area are likely of non-breeding individuals. **Priority in watershed = LOW.**

Riparian Habitat Requirements

No specific requirements for riparian habitats.

Riparian Vegetation Prescriptions

None recommended.

Bald Eagle (*Haliaeetus leucocephalus*) - Species of regional concern

Status and Distribution

Although bald eagles are found throughout British Columbia most breeding is concentrated in coastal areas (Campbell *et al.* 1990). This species is known to occur at very high concentrations along the Squamish River, near Brackendale, in late fall and winter. Bald eagles are also known to nest within the watershed. **Priority in watershed = HIGH.**

Riparian Habitat Requirements

Bald eagles utilize large trees such as Sitka spruce, western red cedar and black cottonwood in riparian areas as perch and nest sites, and vantage points for scavenging dead and dying salmon. Because of high productivity in riparian habitats, these areas can produce, more rapidly than adjacent areas, trees that are suitable for nesting.

Riparian Vegetation Prescriptions

Nurse tree shelterwoods and conifer clusters which incorporate tree species such as Sitka spruce, western red cedar and black cottonwood will provide nesting and perching opportunities in the future.

Northern Goshawk (*Accipiter gentilis* ssp. *atricapillus*) - Identified Wildlife

Status and Distribution

Northern goshawks are present throughout forested areas of Canada. In British Columbia they are found throughout the mainland as well as Vancouver Island and the Queen Charlotte Islands. The subspecies occurring on Vancouver Island, the Queen Charlotte Islands and some of the smaller coastal islands (i.e., ssp. *laingii*) is red-listed by the B.C. Ministry of Environment. Northern goshawks are expected to occur at moderate densities throughout forested areas of the Squamish River watershed. **Priority in watershed = MODERATE.**

Riparian Habitat Requirements

Productive and moist, mature and old growth forest are of highest value to northern goshawk. Open stand structure with large mature trees and well developed understorey are considered to be the habitats having the greatest value. The goshawk has no specific requirements for riparian habitats other than that preferred habitats are often found in moister sites.

Riparian Vegetation Prescriptions

Prescriptions such as nurse tree shelterwoods and conifer clusters will enhance habitats of northern goshawk. Augmentation of riparian shrub vegetation will result in increases in prey abundance.

American Peregrine Falcon (*Falco peregrinus* ssp. *anatum*) - Red-listed

Status and Distribution

The American peregrine falcon breeds across interior areas of British Columbia. Another subspecies, Peale's peregrine falcon (ssp. *pealei*) is resident on Vancouver Island, the Queen Charlotte Islands and in coastal areas. There are a few non-breeding records of peregrine falcon in the lower Squamish River watershed. No records have been documented in other areas. **Priority in watershed = LOW.**

Riparian Habitat Requirements

The American peregrine falcon typically breeds on cliffs and forages over open areas such as large wetlands. As such, it has no specific requirements for forested riparian habitats.

Riparian Vegetation Prescriptions

None recommended.

Short-eared Owl (*Asio flammeus* ssp. *flammeus*) - Blue-listed

Status and Distribution

Short-eared owls have a cosmopolitan distribution and are one of the world's mostly widely distributed owls. In North America, they breed throughout Alaska, Canada, the northern United States and Hawaii. Short-eared owls are highly migratory, vacating the northern part of their range in winter. Concentrations of short-eared owls occur in southwestern British Columbia during winter in suitable habitats. Suitable habitats are limited in the watershed. **Priority in watershed = LOW.**

Riparian Habitat Requirements

In British Columbia, short-eared owls are almost always associated with large expanses of prairie, grassland, bushy meadows, agricultural areas, bogs and fresh and salt water marshes. No requirements for forested riparian habitats are known. Records of this species in the Squamish River watershed are of non-breeding individuals in open habitats.

Riparian Vegetation Prescriptions

None recommended.

Spotted Owl (*Strix occidentalis* ssp. *caurina*) - Red-listed

Status and Distribution

The spotted owl is resident along the Pacific Coast from southwestern British Columbia to southern California. It also occurs in the mountains of some of the southern States. This species has been recorded in several areas of the Squamish River watershed (Blackburn *et al.* 1996). **Priority in watershed = MODERATE.**

Riparian Habitat Requirements

The spotted owl is dependent on mature and old-growth forests for the maintenance of healthy populations. Diverse, productive riparian forests are an important component of the overall home range of this species. Thomas (1979), as cited in Knight (1988) noted that riparian habitats were the primary breeding and foraging areas for spotted owls in the Blue Mountains of Washington and Oregon. Blackburn *et al.* (1996) summarize the habitat requirements of spotted owls as: a) multilayered, multi-species canopy dominated by large overstorey trees; b) moderate to high canopy closure; c) moderate to high diversity of large trees with various deformities such as large cavities, broken tops and dwarf mistletoe infection; d) numerous large snags; and e) large accumulations of fallen trees and CWD on the ground.

Riparian Vegetation Prescriptions

Prescriptions such as nurse tree shelterwoods and conifer clusters will enhance habitats of spotted owl. Augmentation of riparian shrub vegetation and retention of CWD will result in increases in prey abundance. The value of these habitats is limited if adjacent old-growth forests have been removed.

Vaux's Swift (*Chaetura vauxi*) - Species of regional concern

Status and Distribution

Vaux's swifts occur across all southern parts of British Columbia from Vancouver Island to Elko in the east Kootenays, and northwest through Horsefly to Telegraph Creek (Godfrey 1986). They have not been reported from the Queen Charlotte Islands (Campbell *et al.* 1990). Vaux's swifts are known to occur in the Squamish River watershed at moderate densities. **Priority in watershed = MODERATE.**

Riparian Habitat Requirements

Vaux's swifts nest in tree cavities, particularly in large, decadent black cottonwood, bigleaf maple and large western red cedar (Summers and Gebauer 1995). Since suitable nesting cavities are often associated with riparian habitats, these areas are of particular importance.

Riparian Vegetation Prescriptions

Nurse tree shelterwoods and conifer clusters which incorporate tree species such as western red cedar, black cottonwood and bigleaf maple may provide some nesting opportunities in the future.

Amphibians

Tailed Frog (*Ascaphus truei*) - Blue-listed

Status and Distribution

The tailed frog occurs along the Pacific Coast from southwestern Alaska to northern California and in a few scattered locations on the western slope of the Rocky Mountains. In British Columbia it has been found most frequently in the Lower Mainland Region (Green and Campbell 1984). Although its status in many areas of the Lower Mainland Region is unclear, it likely occurs in suitable habitat throughout the Squamish River watershed. **Priority in watershed = HIGH.**

Riparian Habitat Requirements

The tailed frog is dependent on cold, clear, unsilted mountain streams. These streams are often small, fast-flowing and darkly shaded. Degradation and sedimentation of these habitats by logging and other activities can severely impact tailed frog populations. When tailed frogs are found in logged streams, it is usually because unlogged areas remain immediately upstream (Bury and Corn 1988, as cited in Bunnell and Dupuis 1993). Although streams and creeks are the key habitat requirement, adjacent forested areas are also utilized, especially during winter rains.

Riparian Vegetation Prescriptions

Enhancement of tailed frog habitat requires stabilizing of small stream and creek channels and increasing shading by planting riparian vegetation. Riparian prescriptions such as nurse tree shelterwoods, hardwood stands, and conifer clusters will improve tailed frog habitats. Stabilizing stream banks using bioengineering methods will also be beneficial.

5.22.2 Recommended Riparian Vegetation Prescriptions For High Priority Species

High Priority Species

- Harlequin Duck
- Marbled Murrelet
- Bald Eagle
- Tailed Frog

Bioengineering

Stabilization of creek and stream banks will ensure that destruction of riparian vegetation by flooding and other mass processes is reduced. Stable creeks with well developed riparian vegetation will benefit species such as the tailed frog and harlequin duck, which depend on these habitats.

Coarse Woody Debris

Placement and/or maintenance of large diameter CWD in riparian habitats will benefit numerous small mammal species and amphibians by providing resting, denning and foraging areas. Partially submerged dead woody material (i.e., LOD) should be retained as habitat features for aquatic and some terrestrial wildlife species such as harlequin duck and tailed frog. Coarse woody debris is also important to fisher as resting areas.

Nurse Tree Shelterwoods

Nurse tree shelterwoods provide both an initial deciduous forest component and an eventual coniferous forest component. As deciduous trees mature and decay, they provide cavity nesting opportunities, foraging opportunities for woodpeckers, chickadees and other birds, and contribute to the supply of CWD. As conifers mature in the deciduous forest understorey, the riparian management area becomes of increasing value to a number of wildlife species such as marbled murrelet, bald eagle and Vaux's swift. Mature conifers, especially western red cedar provide cover from deep winter snowfalls for species such as deer and fisher. The resulting edge and mixed forest habitats are suitable hunting and breeding areas for northern goshawk and spotted owl.

Trees planted as part of nurse tree shelterwoods also stabilize stream and creek banks and provide shading preferred by tailed frogs and harlequin ducks. Tree species of high value to wildlife include black cottonwood (e.g., fisher, cavity nesters such as Vaux's swift, bats, bald eagle), western red cedar (e.g., roosting, nesting, cover), Sitka spruce (e.g., fisher, cavity nesters) and bigleaf maple (e.g., cavity nesters such as Vaux's swift). Conifers within nurse tree shelterwoods should be planted in clusters.

Conifer Clusters

Planting of conifer clusters also benefits a wide variety of wildlife species. A principle objective of the conifer cluster planting is to maintain canopy gaps within which herb and shrub communities can grow. The resulting diverse and abundant shrub and herb growth will benefit species such as black bears and deer. These habitats will also result in a rich source of insects for small birds, mammals and amphibians and numerous nesting opportunities for passerines. Increased prey populations will be provided for species such as northern goshawk, fisher and spotted owl. Function and value of conifer clusters once they have matured will be similar to conifers growing in nurse tree shelterwoods. Recommended tree species include Sitka spruce, western red cedar and Douglas-fir. Subalpine fir, amabalis fir, western hemlock and mountain hemlock are less desirable because of their shorter life spans and rapid decay rates.

Shrub Augmentation

Maintenance of a robust and diverse shrub understorey will benefit a wide variety of wildlife species. Shrubs are important to moose and deer in winter. Berry-producing shrubs are of high value to black bear, particularly in summer and fall. Increases in small mammal, bird and other wildlife populations will benefit predators such as fisher, spotted owl and northern goshawk. Shrubs will also provide streamside cover for species such as harlequin duck and tailed frog.

Table 5.22-1 Summary of riparian habitat requirements and recommended riparian vegetation prescriptions for wildlife species of regional significance.

Species	Status & Distribution	Riparian Habitat Requirements	Recommended Riparian Vegetation Prescriptions
MAMMALS			
Keen's Long-eard Myotis	Unknown	snags for roost sites	nurse tree shelterwoods
Townsend's Big-eared Bat	Unknown	nothing specific	none
Fisher	Low densities	a) CWD for rest sites b) mixed forest and edge habitats c) large cottonwood and spruce for winter rest and maternal den sites	a) nurse tree shelterwoods with cottonwood and spruce b) hardwood stands including cottonwood c) clustered spruce plantings where suitable d) provision of CWD e) augmentation of existing shrub vegetation
Wolverine	Very low densities	high habitat diversity	all prescriptions which increase habitat diversity and wildlife use
Grizzly Bear	Low to very low densities	a) continuous riparian corridor b) high diversity and density of herbaceous plants and berry-producing shrubs	a) all prescriptions which contribute to a continuous riparian corridor b) augmentation of existing shrubs, particularly berry-producing shrubs c) cluster planting of conifers resulting in canopy openings and prolific herb and shrub growth

Species	Status & Distribution	Riparian Habitat Requirements	Recommended Riparian Vegetation Prescriptions
Black Bear	High densities	a) continuous riparian corridor b) high diversity and density of herbaceous plants and berry-producing shrubs c) large veteran conifers for denning	a) all prescriptions which contribute to a continuous riparian corridor b) augmentation of existing shrubs, particularly berry-producing shrubs c) cluster planting of confiers resulting in canopy openings and prolific herb and shurb growth d) planting of conifers such as western hemlock and western red cedar
Moose	Very low densities	a) high shrub diversity and density b) marshes, swamps, lake margins	augmentation of existing shrubs
Black-tailed Deer and Mule Deer	Moderate densities	a) high shrub and herb density b) dense conifer (e.g., cedar) cover in winter c) continuous riparian corridors	a) all prescriptions which contribute to a continuous riparian corridor b) augmentation of existing shrubs c) planting of conifers such as western red cedar (i.e., nurse tree shelterwoods and conifer clusters) for winter cover
Mountain Goat	Low densities - at higher elevations	high habitat diversity	all prescriptions which increase habitat diversity and wildlife use
BIRDS			
American Bittern	Unknown: likely absent due to absence of suitable habitats	open shrub, cattail and bulrush wetlands along streams, rivers or lakes	none

Species	Status & Distribution	Riparian Habitat Requirements	Recommended Riparian Vegetation Prescriptions
Great Blue Heron	Low densities - concentrations along the lower Squamish River	deciduous dominated forests adjacent to streams, creeks and other wetlands	prescriptions such as nurse shelterwoods and hardwood stands adjacent to wetland areas
Green Heron	Extremely low densities - occurs locally in Whistler area and floodplain of Squamish River	slow moving streams, lakes and other wetlands with availability of shrub and forest habitats for nesting	a) nurse tree shelterwoods and hardwood stands adjacent to wetland areas b) augmentation of stream side shrub vegetation
Marbled Murrelet	Unknown densities - likely more common in Squamish River watershed	mature or first-growth confierous trees for nesting	nurse tree shelterwoods and conifer clusters utilizing species such as western red cedar and Sitka spruce, where appropriate
Turkey Vulture	Low densities: most commonly sighted in lower portions of the Squamish River watershed	no specific requirements	none
Northern Goshawk	Moderate densities	productive and moise, mature and old growth forest	a) nurse tree shelterwood and conifer clusters b) augmentation of riparian shrub vegetation
American Peregrine Falcon	Very low densities	no specific requirements	none
Short-eared Owl	Very low densities: occurs mainly in migration	no specific requirements	none

Species	Status & Distribution	Riparian Habitat Requirements	Recommended Riparian Vegetation Prescriptions
Spotted Owl	Low densities	productive and moist, mature and old growth forest	a) nurse tree shelterwood and conifer clusters b) augmentation of riparian shrub vegetation
AMPHIBIANS			
Tailed Frog	Unknown: likely occurs at moderate densities	clear, cold, unsilted streams with dense riparian vegetation	a) nurse tree shelterwood, hardwood stand and conifer clusters for stabilizing stream bank and providing cover b) bioengineering techniques to stabilize stream banks

6.0 FUTURE WORK PROGRAMS

This first year conditional assessment produced a list of candidate drainages for restoration and trained First Nation technicians in the methods and procedures used in Level One assessments. Before restoration works can begin, more detailed studies are required in fisheries, hydrology, water quality, and terrestrial/riparian studies to better delineate which areas need restoration and how it should be done. Additional training programs also need to be offered focussing on Level Two and Three assessments. The following sections give more detail on each area of further study.

6.1 Fisheries

Over the course of the project there was a wide array of data collected for individual drainages that were short-listed as possible targets for rehabilitation. Information collected ranged from observations of impacted riparian habitat made from a helicopter with no biological information collected to Level One Habitat Surveys (MELP and MOF, 1994) with some spot electroshocking to determine which fish species are present. Accordingly, there is a great range of data that needs to be collected to address information gaps.

The critical need to adequately evaluate the success of watershed restoration projects has been expressed in a number of papers (e.g., Keeley and Walters, 1994; Mellina and Hinch, 1995; Lichatowich et.al., 1995, Hartman and Miles, 1995). To facilitate financial accountability and adaptive management monitoring and evaluation are required. The three objectives of monitoring and evaluation are (from Lichatowich et.al., 1995): (1) to determine if project objectives were achieved; (2) to monitor key ecological variables that will give early warning of a potential problem; and (3) to learn from the experience and improve future restoration projects.

In general, there should be no restoration work done on any of these drainages until a number of decisions are made regarding the potential for success or failure. Mellina and Hinch (1995) provide an excellent review of eight types of experimental designs that could be used to facilitate watershed restoration project evaluation. These authors discuss the assumptions, advantages and disadvantages of each experimental design and recommend their preferred choice for program wide evaluation. Mellina and Hinch (1995) recommend a paired watershed approach, where physically and biologically similar logged watersheds are paired; one would receive restoration treatments and the other would remain as an untreated control. Ideally, the two watersheds would be matched with a third unlogged (or unlogged upstream section) watershed to provide baseline data on a similar pristine environment. Restoration

treatments should also be staggered in time (staircase design) to control for time-treatment interactions (Mellina and Hinch, 1995).

Future assessment and work requirements for short-listed watercourses varies greatly relative to the amount of information that was collected in this study. Over the course of the program, information collected ranged from helicopter reconnaissance to Level One Habitat Surveys (MELP and MOF, 1994) with limited spot electroshocking to determine fish presence. All assessments would be focussed to address the four main questions as posed in the WRP Fish Habitat Assessment manual (MELP and MOF, 1994; see Section 2.4.1. of this report for more explanation). Assessment methods would also follow MELP and MOF (1994), although it should be noted this is an interim document subject to change.

Work necessary to further evaluate the need and feasibility of restoration on specific watercourses or to begin detailed planning of restoration projects can be subdivided into four categories. A brief explanation of the rationale for the work proposed on short-listed watercourses under each category is presented below.

Initial Ground Inspection

In areas with opportunities for restoration, initial ground inspections will be necessary. The objective of the initial ground reconnaissance would be to confirm impacts and prescribe subsequent assessment requirements. Because some of these areas are difficult to access, it will occasionally be more efficient to conduct Level One assessments, as described below, in conjunction with the initial ground inspection.

Level One Assessments

Level One of the fish habitat assessment uses existing information to characterize the condition of fisheries resources and to identify information needs. If necessary, field surveys are used to collect more information. Both sources are then combined to diagnose habitat conditions (MELP and MOF, 1994).

The Level One habitat and fish distribution assessment is a quick walk-through of selected stream reaches in which the surveyor visually estimates habitat conditions. The strategy is to make quick observations of habitat conditions in areas you know or suspect to be of special concern. In conjunction with the Level One Habitat Assessment, it is useful to know if and which fish species are present in the survey reach and in what relative abundance. This information can be obtained by a number of techniques including spot electroshocking, minnow trapping and seining coinciding with the Level One habitat survey.

Level Two Assessments

A Level Two assessment is required when there is no current information identifying areas of special concern or where monitoring is needed. The Level Two habitat assessment uses a more statistically rigorous sampling design, but, otherwise, the information is similar to a Level One assessment. A Level Two habitat survey is normally carried out along with a Level Two fish survey to link patterns of fish use with habitat conditions (MELP and MOF, 1994). A more detailed explanation of Level Two assessments is included in MELP and MOF, 1994. The Level Two assessments will provide baseline data for restoration and facilitate post treatment evaluation.

Restoration Plan

In the priority watersheds selected for restoration, a detailed plan should be developed to document the habitat improvement project. The plan would define measurable objectives for the work in order evaluate if the intended result was achieved and would include:

- Project description and purpose statement with objectives.
- Detailed description of how the project will be monitored and evaluated defining background data collection requirements, what specific data will be collected during monitoring to indicate fish related ecosystem changes and identifying a monitoring schedule.
- Description of fish habitat improvement methods to be applied, drawings showing existing conditions and proposed treatment, logistics for implementation and the implementation schedule.
- Cost estimate for the proposed restoration treatment and all planned monitoring.

At the conclusion of the implementation phase, a progress report for the restoration project with "as built" drawings and photographic documentation of the treatment should be required in preparation for the monitoring phase. Actual cost of the treatment would be documented for comparison with the estimated cost and to facilitate cost-benefit analysis.

6.2 Hydrology and Geomorphology

Prior to construction of any enhancement works, further assessment of the candidate creeks is warranted. This assessment should include a Channel Assessment Procedure (Level Two CWAP), a terrain analysis,

and a Gulley Assessment Procedure to evaluate the channel reaches and gulleys. The results of these studies would provide valuable detailed information on the channel and gulley stability and an indication of the risk of potential hazards and their impact on proposed creek remediation works. An action plan should also be developed to stabilize the creek channels. Headwater lakes should be evaluated with respect to augmenting summer flows by installing small dams and outlet structures. All crossings including bridges and culverts should be inspected to find out if the bridge or culvert can pass the 100 year peak flows and to make recommendations for any improvements. In addition, a watershed hydrological model should be developed to model the impact of logging on peak flows for each watershed.

6.3 Water Quality

The objectives proposed for the water quality component during the second year of this program are to:

1. Characterize the catchments, flow regimens, water chemistry, optical properties, periphyton, benthic invertebrates, and salmonids at sites in streams proposed for ecological restoration.

2. Classify these streams according to the above characteristics.

3. Develop models relating the various river characteristics (i.e., classification group) to environmental factors.

Periphyton and Environmental Parameters

Long recognized as one of the major contributors to primary production in lotic systems, the periphyton community has been shown to respond rapidly to alterations in habitat and water quality. Enhanced velocity can increase shear stress and suspended solids concentration which can lead to scouring of this community, which, in turn, can significantly reduce food sources for invertebrates. Eutrophication, diminished flows and velocity, reductions in water quality and invertebrate habitat degradation can result in significant increases in periphyton biomass or alterations in community structure (i.e., species abundance changes or shifts in species composition). Any of these alterations also has the potential to significantly modify the proximate composition or biochemical profiles of the community which can lead to changes in the community's nutritional value, especially for invertebrates. These periphyton community nutritional changes can thus have direct or indirect trophic effects on higher order vertebrate consumers (i.e., salmonid and non-salmonid fish, birds, amphibians, etc.). Biggs (1990) notes that "...there is a need

to provide water managers with more quantitative information on periphyton community types, and their habitat preferences, if they are to be considered when there are competing demands for water use."

Characterization and Classification of Benthic Invertebrate Communities

Invertebrates are known to process allochthonous and autochthonous organic carbon, which influences periphyton growth, nutrient spiralling, and availability of food for fish and birds through their secondary production. Their relatively long life spans and sedentary nature, ease of sampling (compared with fish), increasingly well known ecology and habitat requirements, have resulted in their use as biological indicators of water quality and ecosystem health. The second year objectives in determining the health of the streams targeted for restoration are:

1. Characterize macro-invertebrate communities in terms of their taxonomic richness, diversity, density, and biomass under "average" conditions of velocity and depth. The sampling will be conducted under normal spring, summer and late summer-autumn low flow conditions.

2. Streams will be grouped according to their invertebrate communities.

3. An assessment will be made correlating the relationship between invertebrate communities and selected environmental parameters.

4. Investigate the value of community-level invertebrate characteristics (i.e., biotic indices, diversity, taxonomic richness) and common taxa as indicators of water quality.

Magnitude of Effects of Substrate Particle Size, Recent Flooding, and Catchment Disturbance on Benthic Invertebrates

Substrate size and recent flooding have been shown to be important influences on invertebrate abundance and taxonomic richness. Previous studies have demonstrated that invertebrate abundance increases with substrate size up to cobble size, then decreases at boulder and bedrock sizes. Numerous studies have demonstrated that major floods can substantially reduce taxonomic richness, invertebrate biomass, and densities. These studies provide indications of the magnitude of floods required to significantly alter invertebrate habitat and community structure; however, there is a paucity of information on the effects of various flood stages, in different stream types, from which mechanisms effecting benthic invertebrates can be deduced and evaluated. This aspect of the program will use data from the streams in Lillooet and

Squamish River catchments to quantify the magnitude of the influences of selected factors on invertebrate community structure. In particular, the threshold levels at which physical factors exert a strong influence on invertebrate community characteristics will be defined, including total density and biomass, taxonomic richness, biomass of taxonomic/feeding groups, and densities of common taxa.

6.4 Riparian Zones

The following steps will be necessary in the upcoming phases of the Watershed Restoration Program to evaluate the riparian zones. The Riparian Assessment Procedure, currently under review, will be used as a key document for this work. Tasks will likely include:

1. Broad-brush biophysical mapping of the selected creek systems.

2. Development of overall management objectives, in consultation with stakeholders, in a larger context that dovetails with management programs for targeted environmental parameters (e.g., fisheries enhancement, wildlife habitat management, forest management, water resource management, etc.).

3. Selection of specific target sites for remediation, based on the overall management objectives.

4. Detailed biophysical inventories of target sites.

5. Development of a series of site-specific management alternatives.

6. Refinement of site-specific management objectives based on the possible alternatives.

7. Selection of the preferred alternative, based on these site-specific objectives.

8. Development of this alternative into a specific management project.

9. Identification of ways and means to complete the project.

6.5 Future Training Programs

Further training programs will be developed based on the future studies as listed above. A prime objective of next years training will be to expand the number of trainees to ensure that members from a broad cross-section of the community are included. To facilitate this, a survey form will be sent to forest licenses and anyone else the Committee recommends.

6.6 Year Three Activities

Year Two marks the end of the assessment phase of the watershed restoration project. In Year Three, the prescriptions developed and presented in this report will begin to be implemented. These prescriptions will be undertaken over a five year period with the first year of restoration concentrating on stabilizing the drainages. The amount of activities that will be undertaken in Year Three will depend on the final budget. At the time of printing this report, that figure was not available. As a result, a detailed work schedule will have to be developed at a later date once the budget is fixed.

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7.1 Forestry References

Pacific Forest Products Limited
Forest Development Plan
Soo T.S.A. 1996 - 2000

Mainland Contract
Cutblock 514 Rutherford Creek
F.L. A19216 Soo T.S.A.,
Vancouver Region
Squamish District

Pre-Harvest Silviculture Prescription **(DRAFT)**
Region: Vancouver
District: Squamish
T.S.A.: Soo
Licence: T0763
Licensee: MacMillan Bloedel Ltd.
C.P.: B
Block: 260
Location: Samson Creek
Date Completed: 94-04-21
Prepared By: Dan Carson R.P.F.

Lillooet River Watershed Restoration Project, &
Squamish River Watershed Restoration Project
Prepared for the Lillooet River Watershed Committee
December, 1996

Richmond Plywood Corporation Limited
Development Plan for F.L. A 20541
1996-2000
(DRAFT)

Prepared for: Agency and Public Review
By: Thomas R. Cole R.P.F.

Halray Logging Ltd.
F.L. A 19217
1995-1999 Development Plan

Prepared by: Intensive Forest Management Ltd.
Box 385
Pemberton B.C., V0N 2L0
Phone: (604) 894-6004
Fax: (604) 894-6516

First Nations Traditional Territories /
Administrative Boundaries /
Squamish Forest District
Licensee Chart
Squamish Forest District

Produced By: Squamish Forest District
Land Information Management
02/02/96

Squamish Forest District
Small Business Forest Enterprise Plan
1996-2000
Development Plan

Squamish Forest District
Small Business Forest Enterprise Plan
1996-2000
Recreation and Other Values

Squamish Forest District
Small Business Forest Enterprise Plan
1996-2000
Access Management Plan

Squamish Forest District

Small Business Forest Enterprise Program
Development Plan
1996-2000

Prepared by: Julian Grzybowski, R.P.F.,
Small Business Officer

Terminal Forest Products Ltd.

Chance - Roe Creek
Forest License A192215
Chart Area 3

Canadian Forest Products Ltd.

FLA19213
1996-2000 Forest Development Plan

Registered Professional Forester: Hershel Boydston

Canadian Forest Products Ltd.
P.O. Box 49420
Bentall Postal Station
Vancouver, B.C.
V7X 1B5

Produced by: Timberline
Forest Inventory Consultants
Suite 302-958 West 8th Ave.
Vancouver, B.C. Canada
V5Z 1E5

International Forest Products Ltd.

FLA19209
1996-2000 Development Plan

International Forest Products Limited
P.O. Box 49114
Bentall Postal Station
Vancouver, B.C.
V7X 1H7

Five Year Silviculture Plan 1995-1999
Pruning Schedule 1997-1999
Amendment Date: Dec. 13th, 1995
District Manager: J.P. Kuster

Five Year Silviculture Plan 1995-1999
Brushing Schedule 1997-1999
Amendment Date: Dec. 13th, 1995
District Manager: J.P. Kuster

Five Year Silviculture Plan 1995-1999
Planting Schedule 1997-1999
Amendment Date: Dec. 13th, 1995
District Manager: J.P. Kuster

Five Year Silviculture Plan 1995-1999
Spacing Schedule 1997-1999
Amendment Date: Dec. 13th, 1995
District Manager: J.P. Kuster

Five Year Silviculture Plan 1995-1999
Fertilization Schedule 1997-1999
Amendment Date: Dec. 13th, 1995
District Manager: J.P. Kuster

Squamish Forest District
Five Year Silviculture Plan
Proposed Silviculture Treatments
1996-1997

Produced by: Inventory Branch
Ministry of Forests
Province of B.C.

Squamish Forest District

Two Year Silviculture Plan
1995-1996 / 1996-1997

Produced by: Inventory Branch
Ministry of Forests
Province of B.C.

APPENDIX A
Water Quality QA/QC

A. Water Quality QA/QC

A.1 Standards

All standards were made according to Standard Methods for the Analysis of Water and Wastewater (18th ed.) in consultation with Dr. Malcolm Clark of the Ministry of Environment, Lands and Parks (MELP). Subsamples of each standard were analyzed by MB Research. All laboratory analyses were conducted by Zenon Laboratories Ltd.

A.2 Quality Assurance/Quality Control

The collection of baseline data is essential if future decisions regarding waterways are to be made in an informed manner. This data is meaningful only if it is known how they was collected, by whom, when, how samples were handled and preserved before analysis, how they were analyzed, and how data were documented and verified. Errors in any of these steps can result in meaningless data or in their misinterpretation. Quality Assurance/ Quality Control (QA/QC) measures are implemented to ensure comparability of all data between sampling dates, years, different labs and to provide a basis for comparison of different waterways. The QA/QC measures implemented in this study are modelled after those recommended by the Quality Assurance Work Group under the Canada-British Columbia Monitoring Agreement. These measures are intended "to ensure that all environmental data...are to a significant degree accurate, precise, complete, representative and comparable" (Clark, 1994). This program will evolve to include innovative techniques and procedures as they arise.

The 1995 QA/QC program included, but was not limited to, the use and revision of the following procedures:

1. Sample collection:

    - Contamination was minimized by first rinsing the bottle under water prior to opening and by opening and closing the bottle under water.

2. Field/lab measurement methods:

    - Instrument calibration and maintenance:
      dissolved oxygen meter, light meter, pH meter and conductivity meter were calibrated before and after use and records maintained.

    - The equipment was checked and maintained on a regular basis. The dissolved oxygen and conductivity meters were serviced and calibrated by a qualified technician.

    - An accuracy check was incorporated into each test performed.

3. Appropriateness of sample containers:

    - New 1 L poly bottles were used

    - A specific bottle was designated and pre-labelled for each site.

4. Laboratory analysis:

   - Performed with apparatus listed above according to procedures prescribed for the use of each in apparatus manuals and in Standard Methods for The Examination of Water and Wastewater (APHA, 1992).

   - All reagents (eg. pH buffers) were stored in a cool, dark, dry place to maximize shelf life in accordance with manufacturer's instructions.

5. Field and laboratory record keeping:

   - Procedures were documented and noted with each data set.

6. Use of sample controls, replicate sample and standard solutions:

   - The use of reagent blanks, replicates and standard solutions is standard laboratory practice.

   - Conductivity standards were made according to Standard Methods for the Analysis of Water and Wastewater (18th ed.)

7. Documentation of changes in techniques used for sample collection, handling, analysis and storage:

   - All field and laboratory procedures were documented including changes in location of sample collection.

8. Review of data:

   - Data is reviewed regularly for aberrations, both as a QA/QC check on data and to provide a method of early detection of activities deleterious to instrument or water quality.

9. Review and/or implementation of innovative procedures:

   - Scientific literature is reviewed regularly, and Ministry specialists consulted to ensure that up-to-date, appropriate techniques are utilized.

Fish Gut Analysis

In order to determine what juvenile salmonids were eating during the late autumn, a series of electro-shocking studies were conducted in tributaries of the Lillooet River. The fish obtained were identified to species, sized and a representative sample were obtained and preserved in formalin. The fish were returned to the laboratory and their gut contents removed, placed in plastic bags and sent to the DFO laboratory in West Vancouver for content analysis.

Following is the outline of a letter sent to Dr. Colin Levings, DFO, West Vancouver Laboratory, requesting Federal support for the analysis of the stomach contents in juvenile salmonids obtained from

selected streams in the Lillooet and Squamish River watersheds. It was proposed that the gut contents would be analyzed by the West Vancouver laboratory.

Dr. Colin Levings
West Vancouver Laboratory
4160 Marine Drive
West Vancouver, B.C.
V7V 1N6

October 23, 1995

Re: Gut Analysis of Juvenile Salmonids - Squamish and Lillooet Rivers

Dear Colin:

On behalf of the Ministry of Environment, Lands and Parks and other stakeholders I would like to solicit your group's support for our project examining water quality and fishery habitat in the Squamish and Lillooet River watersheds. As I indicated during our phone conversation we would like to have your group examine the invertebrates contained in the stomachs of the young salmonids we have sent you.

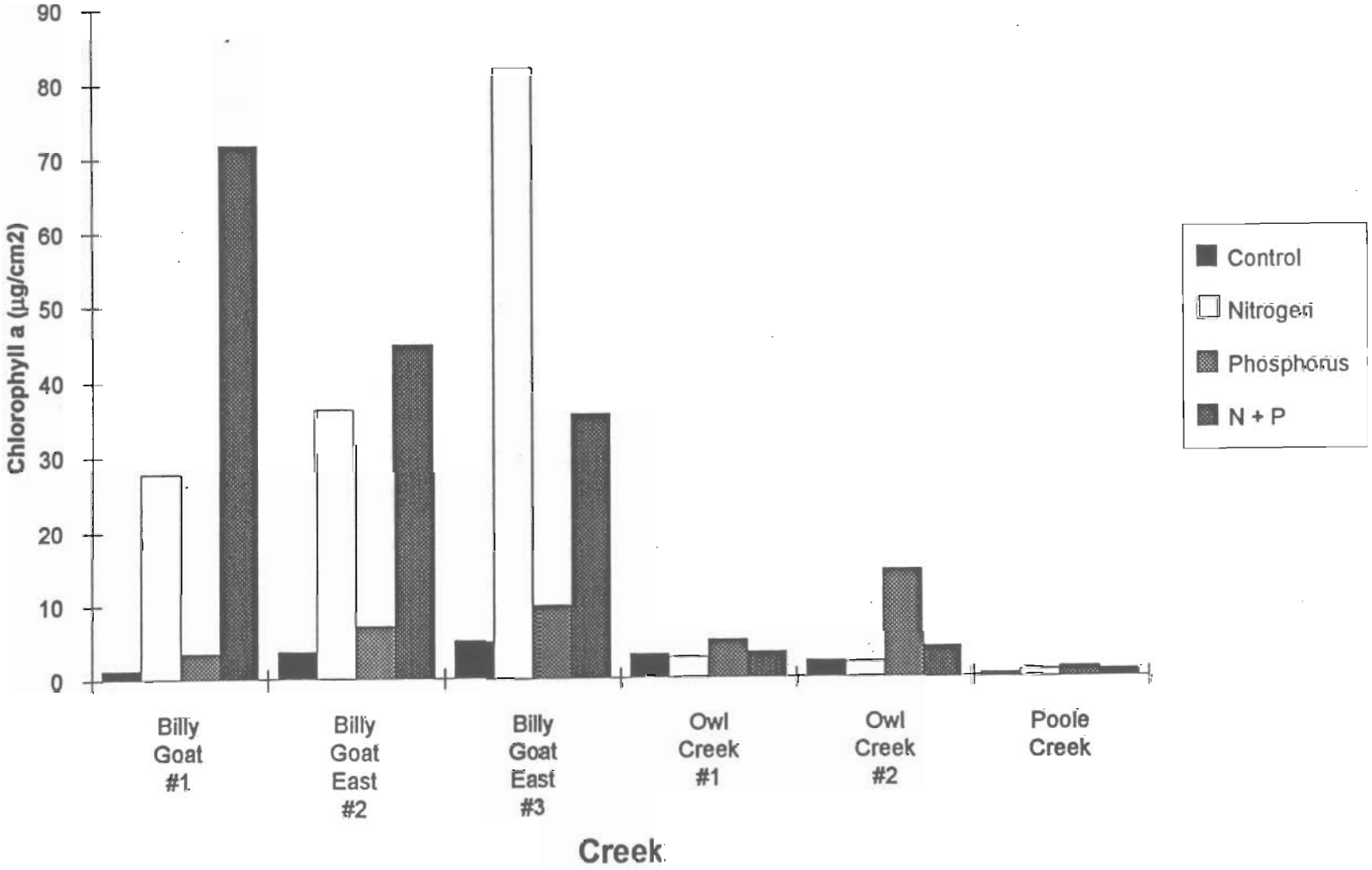
The project is designed to examine which streams in the above two watersheds, which have been affected by timber harvesting, could be restored to support healthy spawning and rearing salmonid populations. It would be of considerable importance to future management strategies if we had some estimate of what existing salmonid populations were consuming; at present there does not appear to be any information concerning trophic levels in these rivers or their tributaries. The project is being administered by the MELP and is supported by numerous other agencies, including DFO.

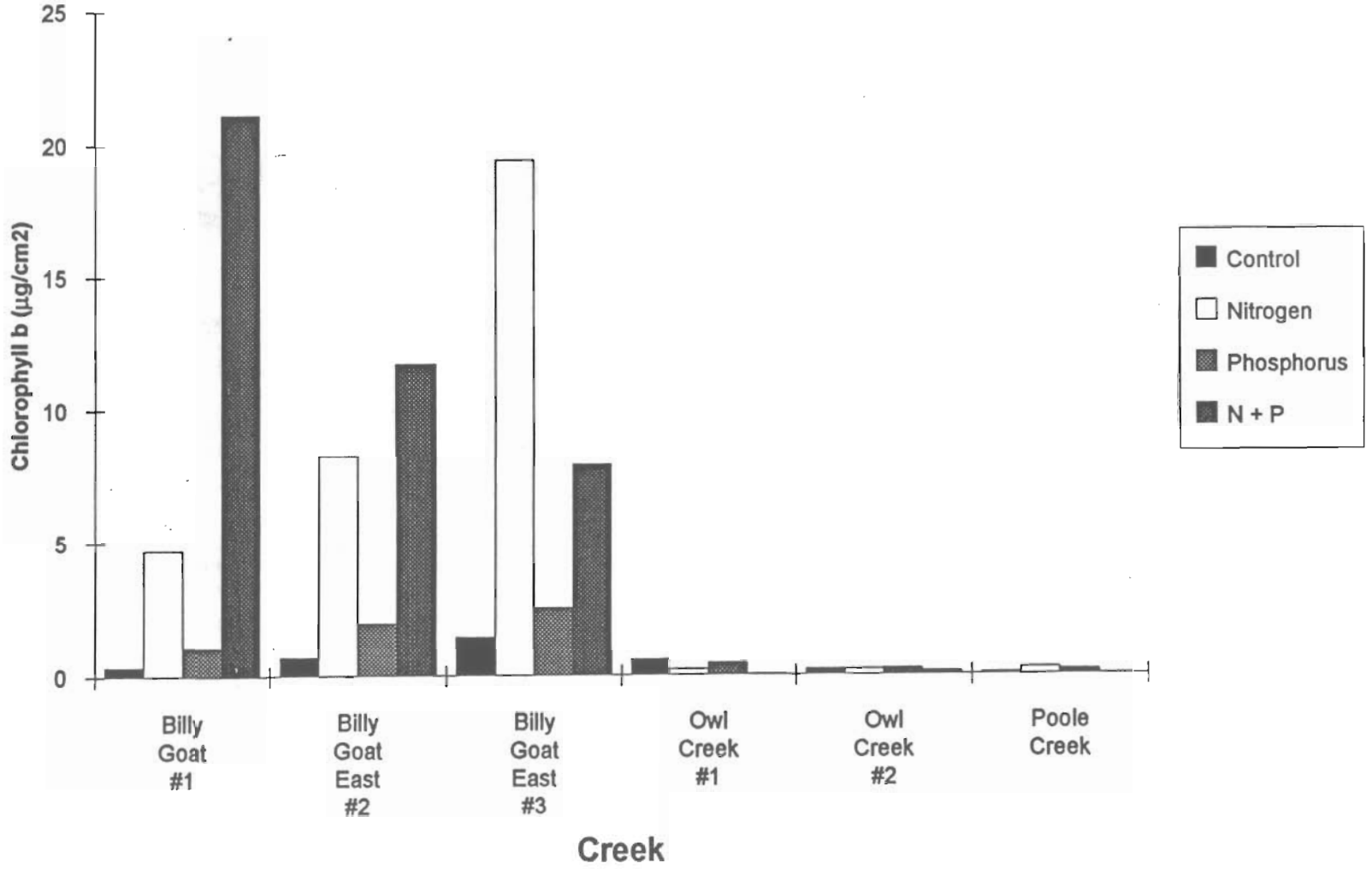
We would be pleased to discuss paying for the analyses, if this is required. Should you have any questions concerning the nature of the project I would be pleased to discuss this with you. I would enjoy having coffee in the near future to let you know what we are doing in these two watersheds. Thank you again for your continued support of our activities.

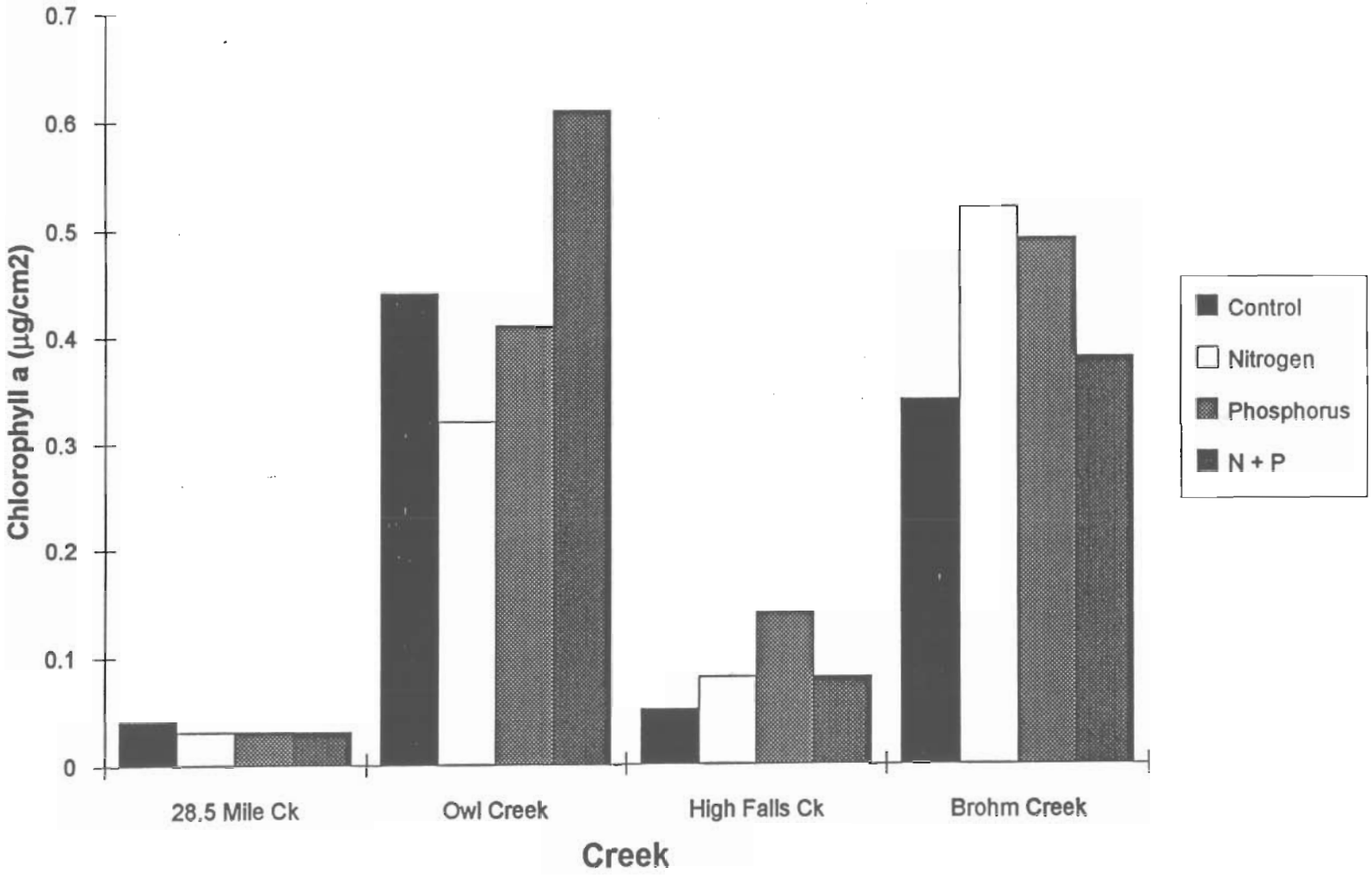
Sincerely,

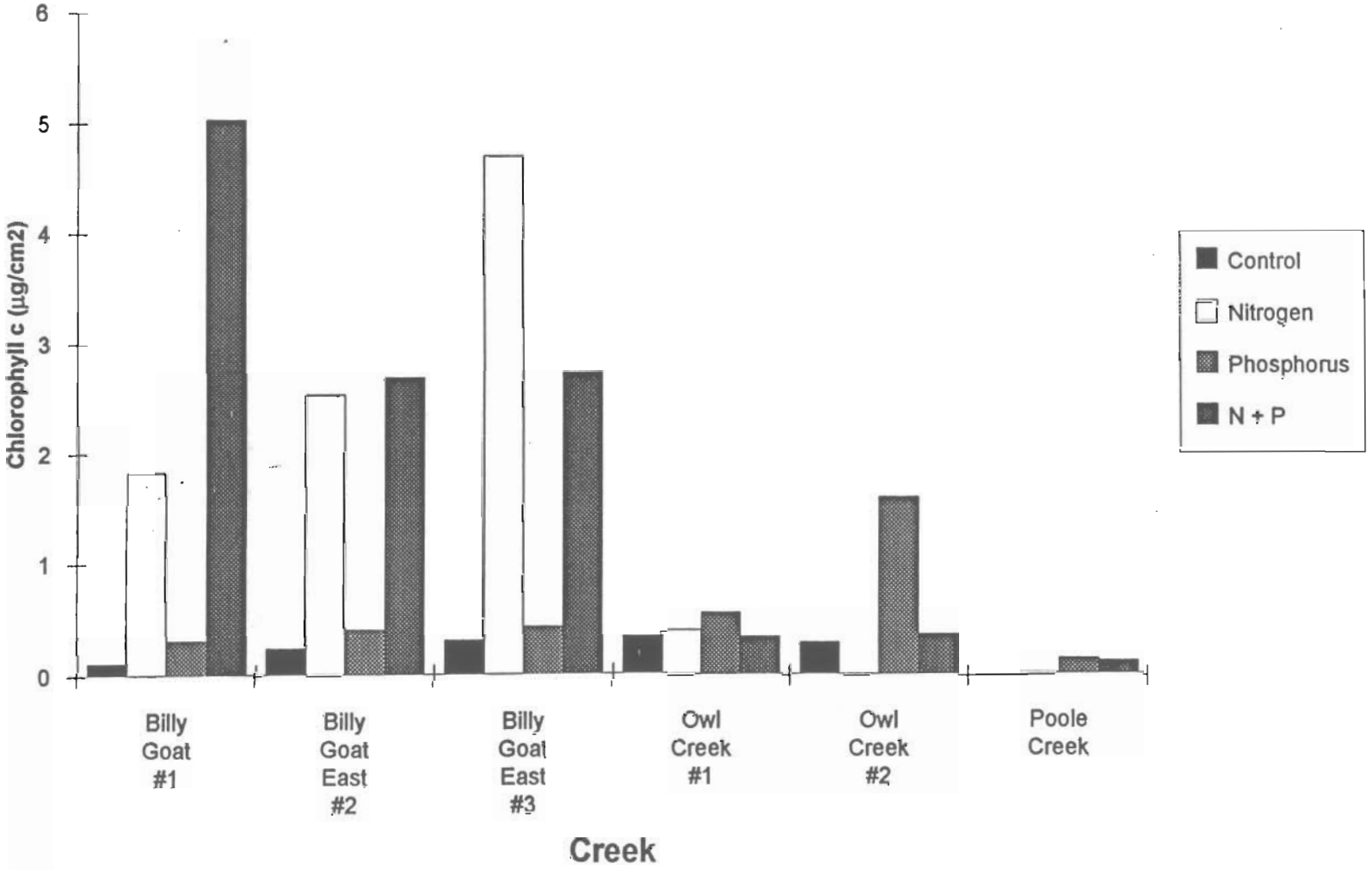
Wm. P. Lucey
Aquatic Ecologist

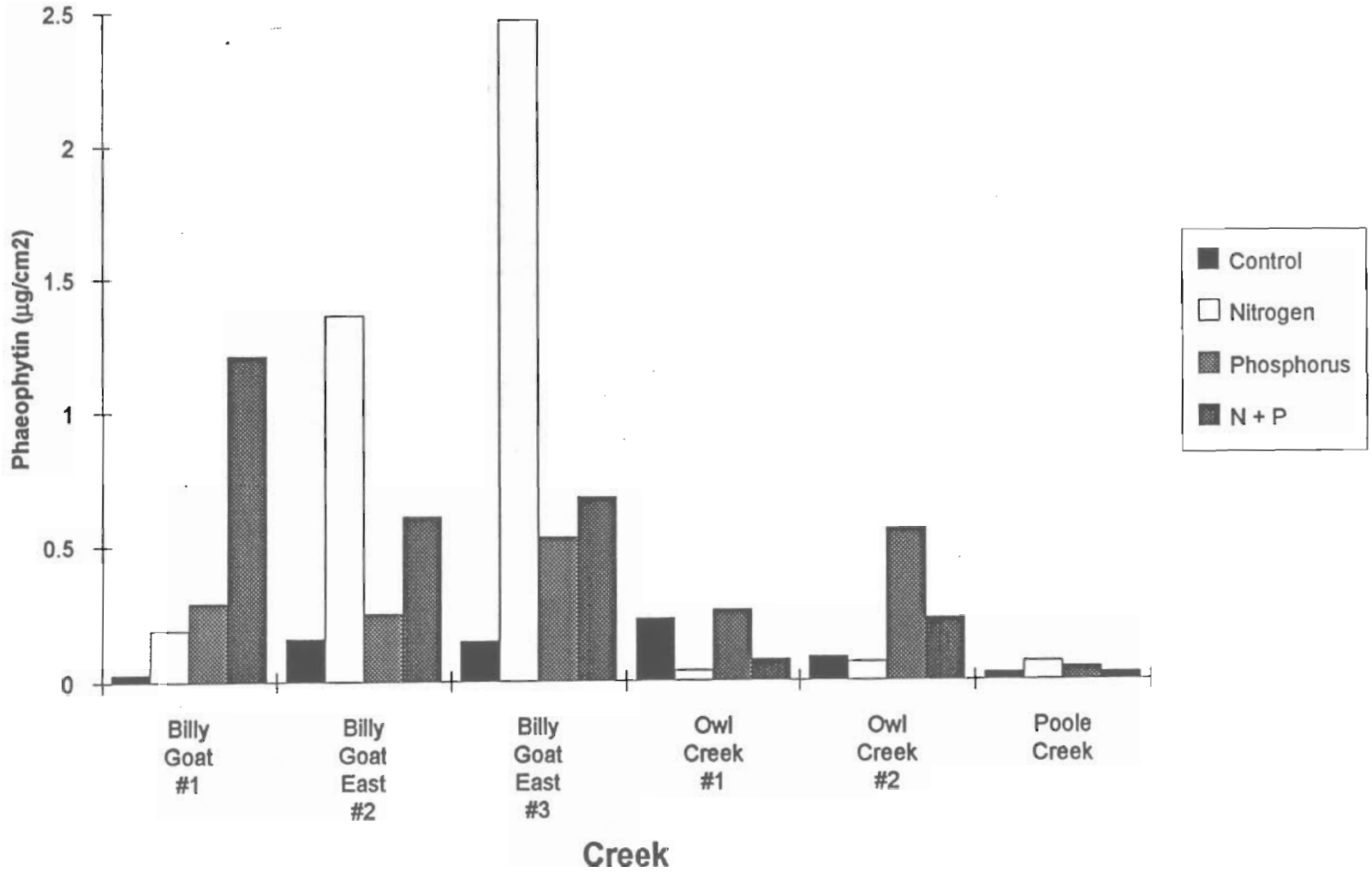
APPENDIX B
Nutrient Pot Results

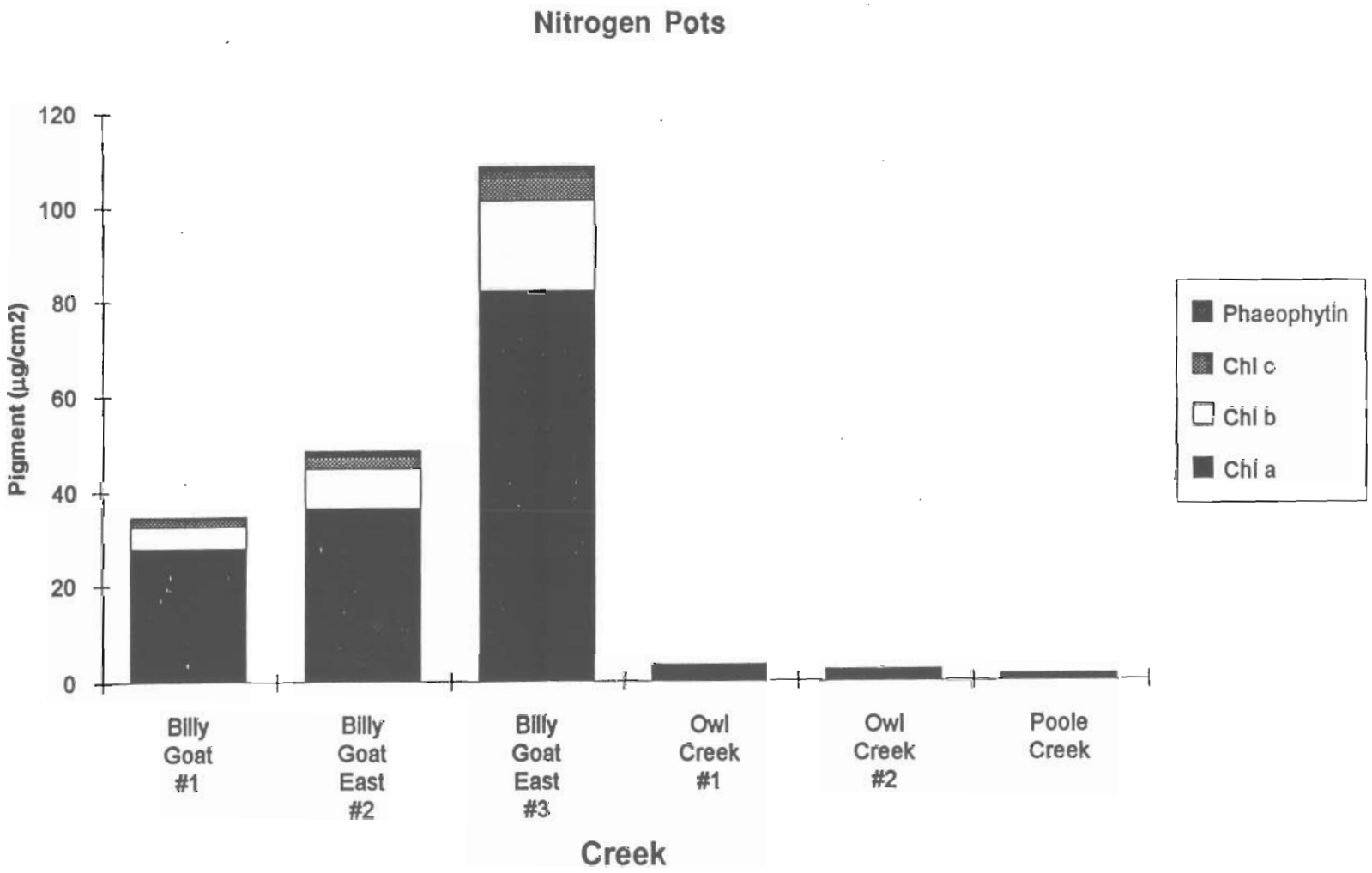

Chlorophyll a (µg/cm2)
90
80
70
60
50
40
30
20
10
0
Billy Goat #1
Billy Goat East #2
Billy Goat East #3
Owl Creek #1
Owl Creek #2
Poole Creek
Creek
Control
Nitrogen
Phosphorus
N + P

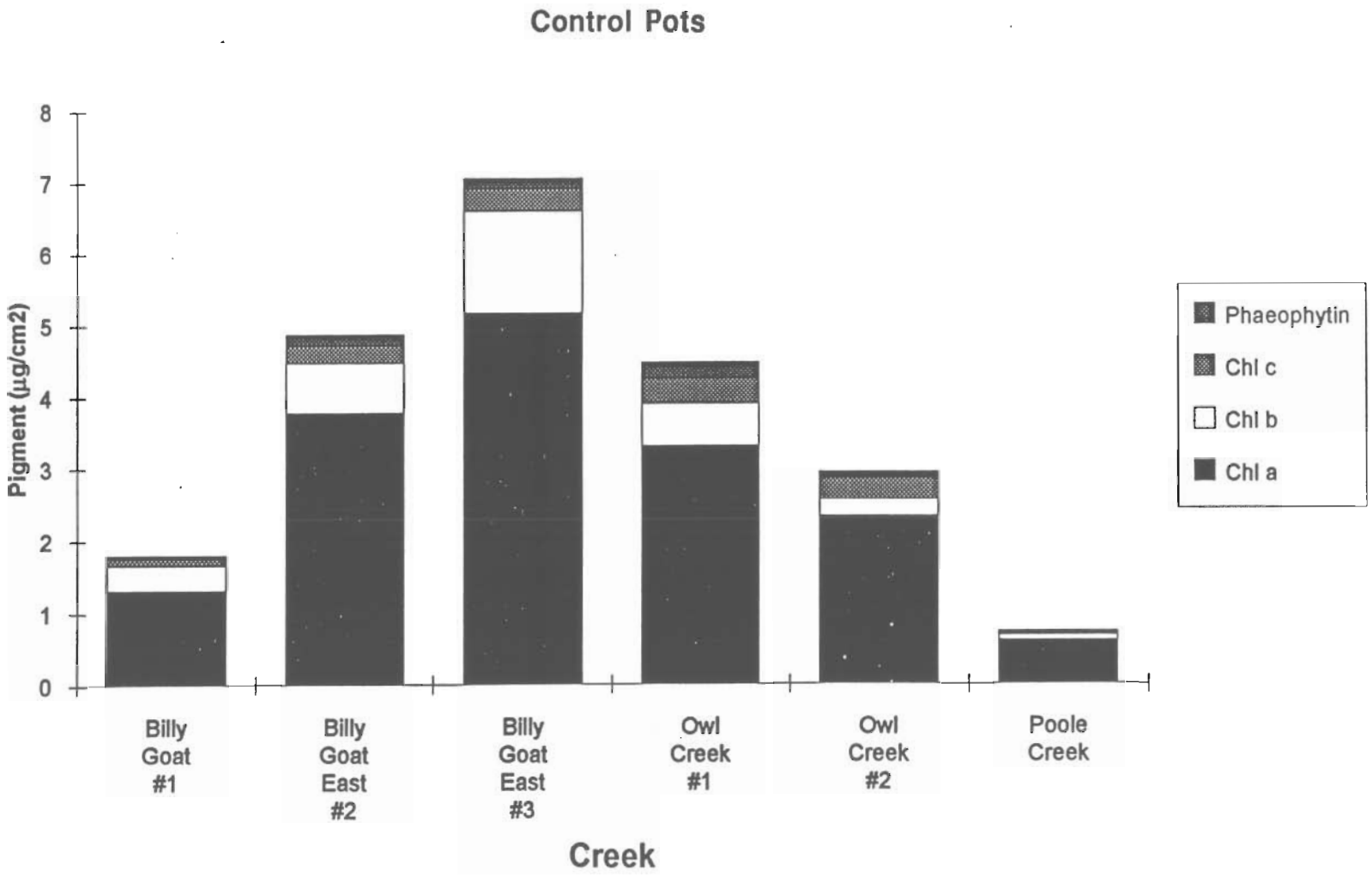

25
20
15
10
5
0
Chlorophyll b (µg/cm2)
Billy Goat #1
Billy Goat East #2
Billy Goat East #3
Owl Creek #1
Owl Creek #2
Poole Creek
Creek
Control
Nitrogen
Phosphorus
N + P

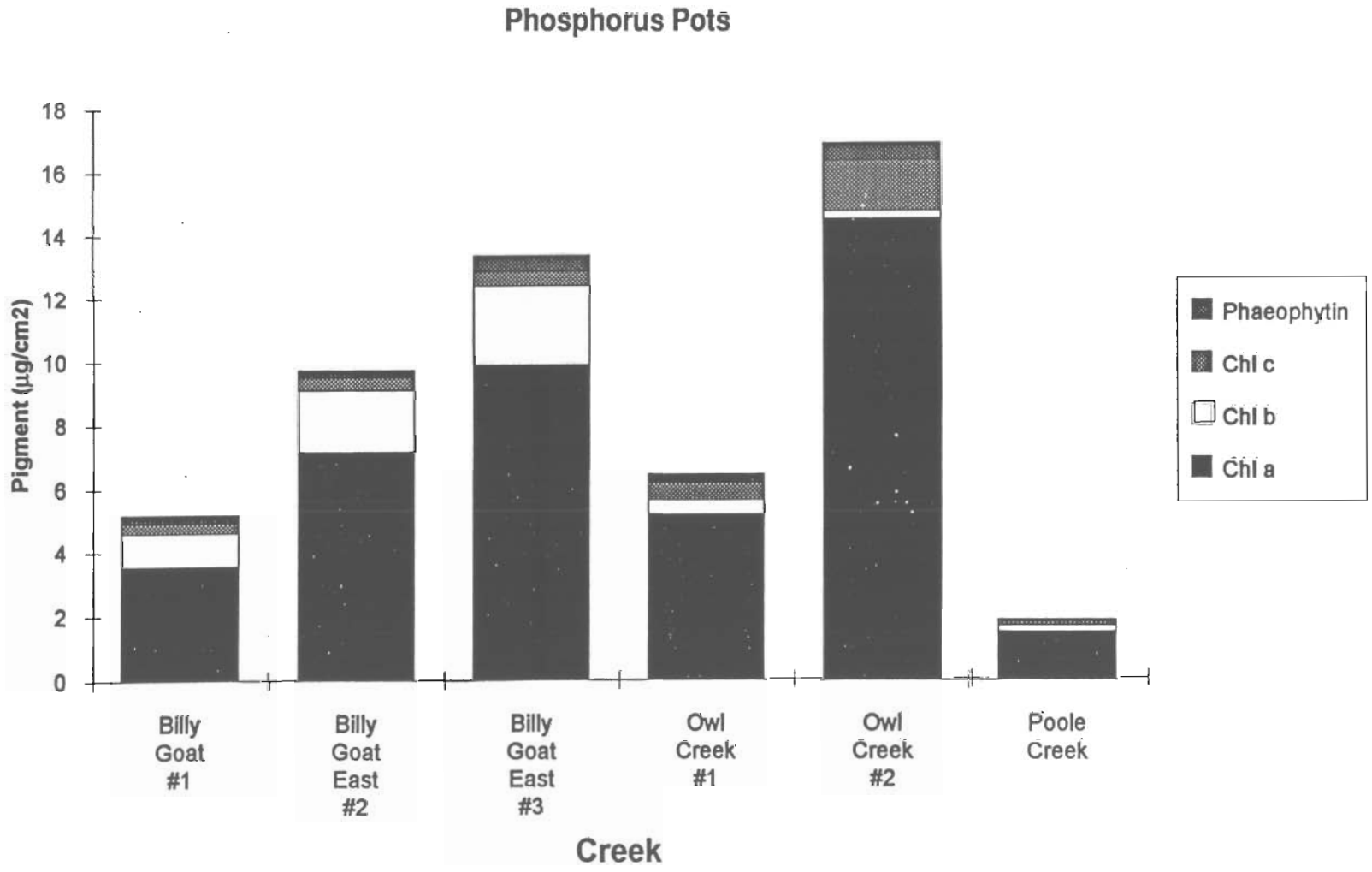

0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Chlorophyll a (µg/cm2)
28.5 Mile Ck
Owl Creek
High Falls Ck
Brohm Creek
Creek
Control
Nitrogen
Phosphorus
N + P

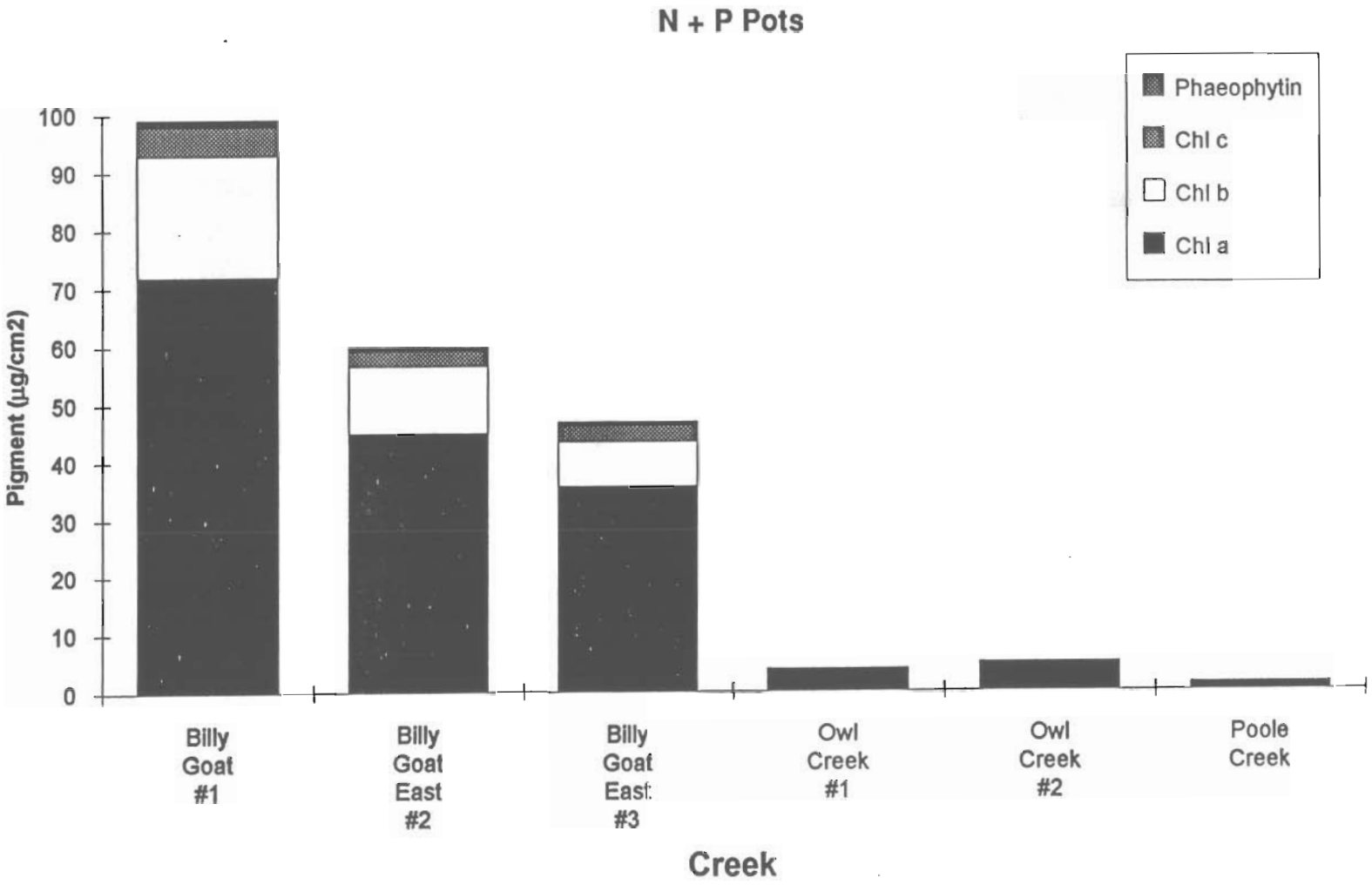

Chlorophyll c (µg/cm2)
6
5
4
3
2
1
0
Billy Goat #1
Billy Goat East #2
Billy Goat East #3
Owl Creek #1
Owl Creek #2
Poole Creek
Creek
Control
Nitrogen
Phosphorus
N + P


Phaeophytin (µg/cm2)
2.5
2
1.5
1
0.5
0
Billy Goat #1
Billy Goat East #2
Billy Goat East #3
Owl Creek #1
Owl Creek #2
Poole Creek
Creek
Control
Nitrogen
Phosphorus
N + P

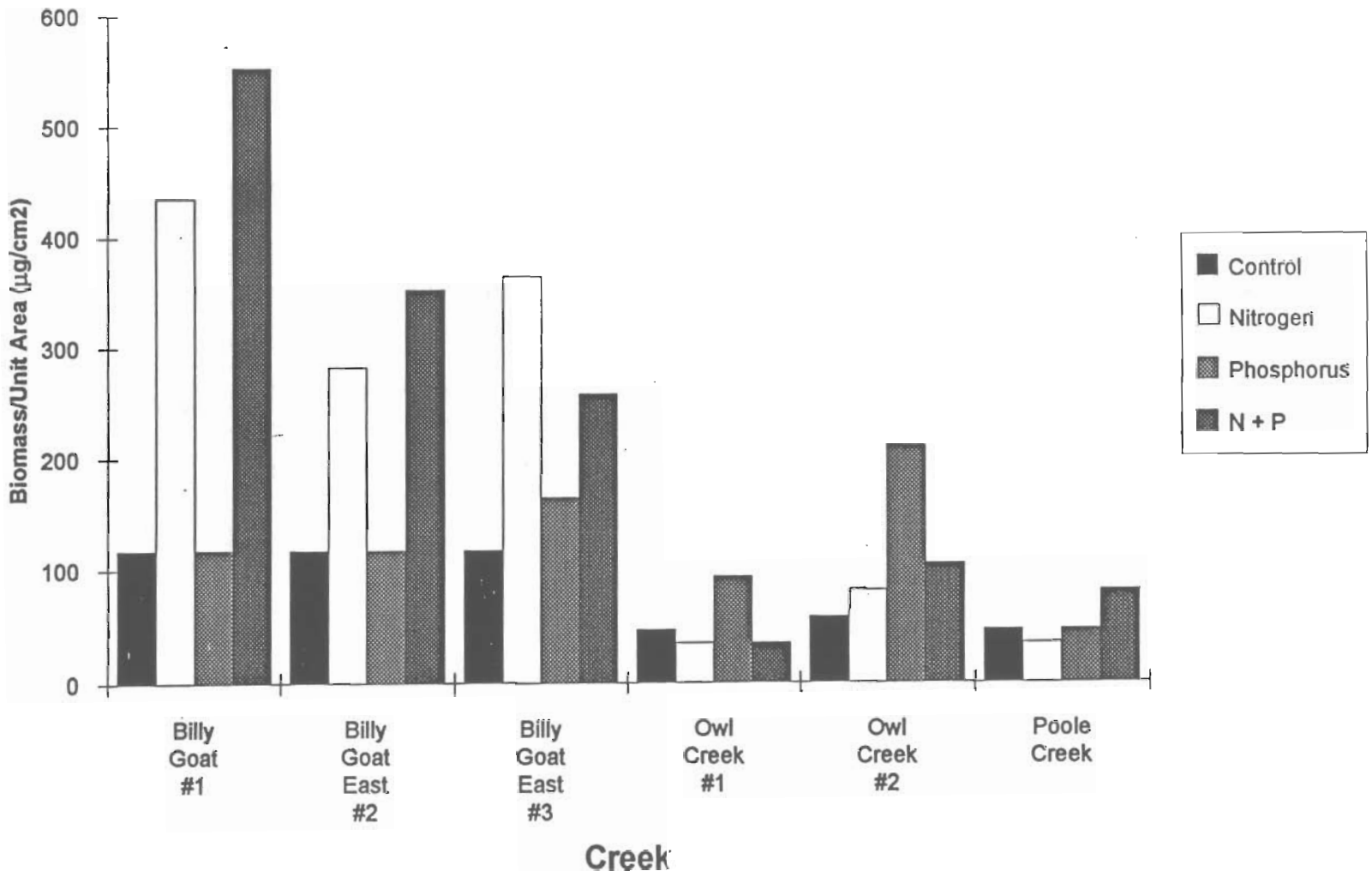

Nitrogen Pots
Pigment (µg/cm2)
120
100
80
60
40
20
0
Billy Goat #1
Billy Goat East #2
Billy Goat East #3
Owl Creek #1
Owl Creek #2
Poole Creek
Creek
Phaeophytin
Chl c
Chl b
Chl a


Control Pots
Pigment (µg/cm2)
8
7
6
5
4
3
2
1
0
Phaeophytin
Chl c
Chl b
Chl a
Billy Goat #1
Billy Goat East #2
Billy Goat East #3
Owl Creek #1
Owl Creek #2
Poole Creek
Creek


Phosphorus Pots
Pigment (µg/cm2)
18
16
14
12
10
8
6
4
2
0
Billy Goat #1
Billy Goat East #2
Billy Goat East #3
Owl Creek #1
Owl Creek #2
Poole Creek
Creek
Phaeophytin
Chl c
Chl b
Chl a


N + P Pots
Phaeophytin
Chl c
Chl b
Chl a
Pigment (µg/cm2)
100
90
80
70
60
50
40
30
20
10
0
Billy Goat #1
Billy Goat East #2
Billy Goat East #3
Owl Creek #1
Owl Creek #2
Poole Creek
Creek

Date	Site	Parameter	Control	Nitrogen	Phosphorus	N + P
1-Nov-95	Billy Goat #1	Biomass (Dry Wt - Fixed Wt)	10	37	10	47
1-Nov-95	Billy Goat East	Biomass (Dry Wt - Fixed Wt)	10	24	10	30
1-Nov-95	Billy Goat East	Biomass (Dry Wt - Fixed Wt)	10	31	14	22
1-Nov-95	Owl Creek #1	Biomass (Dry Wt - Fixed Wt)	4	3	8	3
1-Nov-95	Owl Creek #2	Biomass (Dry Wt - Fixed Wt)	5	7	18	9
1-Nov-95	Poole Creek	Biomass (Dry Wt - Fixed Wt)	4	3	4	7
1-Nov-95	Billy Goat #1	Biomass Dry Wt (mg)	19	72	18	80
1-Nov-95	Billy Goat East	Biomass Dry Wt (mg)	21	51	22	53
1-Nov-95	Billy Goat East	Biomass Dry Wt (mg)	24	79	41	50
1-Nov-95	Owl Creek #1	Biomass Dry Wt (mg)	13	7	16	10
1-Nov-95	Owl Creek #2	Biomass Dry Wt (mg)	9	18	45	18
1-Nov-95	Poole Creek	Biomass Dry Wt (mg)	15	13	11	27
1-Nov-95	Billy Goat #1	Biomass Fixed Wt (mg)	9	35	8	33
1-Nov-95	Billy Goat East	Biomass Fixed Wt (mg)	11	27	12	23
1-Nov-95	Billy Goat East	Biomass Fixed Wt (mg)	14	48	27	28
1-Nov-95	Owl Creek #1	Biomass Fixed Wt (mg)	9	4	8	7
1-Nov-95	Owl Creek #2	Biomass Fixed Wt (mg)	4	11	27	9
1-Nov-95	Poole Creek	Biomass Fixed Wt (mg)	11	10	7	20
1-Nov-95	Billy Goat #1	Biomass/ Unit Area (µg/cm2)	117.6	435.3	117.6	553
1-Nov-95	Billy Goat East	Biomass/ Unit Area (µg/cm2)	117.6	282.4	117.6	353
1-Nov-95	Billy Goat East	Biomass/ Unit Area (µg/cm2)	117.6	364.7	164.7	258.8
1-Nov-95	Owl Creek #1	Biomass/ Unit Area (µg/cm2)	47.1	35.3	94.1	35.3
1-Nov-95	Owl Creek #2	Biomass/ Unit Area (µg/cm2)	58.8	82.4	211.8	105.9
1-Nov-95	Poole Creek	Biomass/ Unit Area (µg/cm2)	47.1	35.3	47.1	82.4
1-Nov-95	Billy Goat #1	Chl a (µg/cm2)	1.31	27.8	3.52	71.8
1-Nov-95	Billy Goat East	Chl a (µg/cm2)	3.78	36.4	7.14	44.9
1-Nov-95	Billy Goat East	Chl a (µg/cm2)	5.17	82.1	9.86	35.6
1-Nov-95	Owl Creek #1	Chl a (µg/cm2)	3.31	2.87	5.18	3.52
1-Nov-95	Owl Creek #2	Chl a (µg/cm2)	2.33	2.13	14.5	4.25
1-Nov-95	Poole Creek	Chl a (µg/cm2)	0.6	1.07	1.48	1.09


600
500
400
300
200
100
0
Biomass/Unit Area (µg/cm2)
Billy Goat #1
Billy Goat East #2
Billy Goat East #3
Owl Creek #1
Owl Creek #2
Poole Creek
Creek
Control
Nitrogen
Phosphorus
N + P

1-Nov-95	Billy Goat #1	Chl b (µg/cm2)	0.35	4.71	1.08	21.1
1-Nov-95	Billy Goat East	Chl b (µg/cm2)	0.7	8.26	1.94	11.7
1-Nov-95	Billy Goat East	Chl b (µg/cm2)	1.43	19.4	2.53	7.89
1-Nov-95	Owl Creek #1	Chl b (µg/cm2)	0.6	0.24	0.46	0.04
1-Nov-95	Owl Creek #2	Chl b (µg/cm2)	0.24	0.24	0.26	0.15
1-Nov-95	Poole Creek	Chl b (µg/cm2)	0.09	0.27	0.19	0.01
1-Nov-95	Billy Goat #1	Chl c (µg/cm2)	0.11	1.83	0.31	5.03
1-Nov-95	Billy Goat East	Chl c (µg/cm2)	0.24	2.54	0.41	2.69
1-Nov-95	Billy Goat East	Chl c (µg/cm2)	0.31	4.7	0.43	2.73
1-Nov-95	Owl Creek #1	Chl c (µg/cm2)	0.34	0.4	0.55	0.34
1-Nov-95	Owl Creek #2	Chl c (µg/cm2)	0.29	0	1.59	0.36
1-Nov-95	Poole Creek	Chl c (µg/cm2)	0.01	0.01	0.14	0.12
1-Nov-95	Billy Goat #1	Phaeophytin a (µg/cm2)	0.03	0.19	0.29	1.21
1-Nov-95	Billy Goat East	Phaeophytin a (µg/cm2)	0.16	1.36	0.25	0.61
1-Nov-95	Billy Goat East	Phaeophytin a (µg/cm2)	0.15	2.47	0.53	0.68
1-Nov-95	Owl Creek #1	Phaeophytin a (µg/cm2)	0.23	0.04	0.26	0.08
1-Nov-95	Owl Creek #2	Phaeophytin a (µg/cm2)	0.09	0.07	0.56	0.23
1-Nov-95	Poole Creek	Phaeophytin a (µg/cm2)	0.03	0.07	0.05	0.03
7-Oct-95	28.5 Mile Ck	Chl a (µg/cm2)	0.04	0.03	0.03	0.03
7-Oct-95	Owl Creek	Chl a (µg/cm2)	0.44	0.32	0.41	0.61
7-Oct-95	High Falls Ck	Chl a (µg/cm2)	0.05	0.08	0.14	0.08
7-Oct-95	Brohm Creek	Chl a (µg/cm2)	0.34	0.52	0.49	0.38

APPENDIX C
List of Water Licences from B.C. MELP Water Licencing System

Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
----- SOURCE: Cuppage Creek left of Lillooet River -----						
	----- 92.J.055.2.2 A -----					
C041097	0296723	100 AC OF L 821 LILLOOET DIST	PERKINS PHILLIP & HOWARD C BOX 158 PEMBERTON BC V0N2L0	1970/07/07	DOM IRR	1,500.00 GD 100.00 AF
----- SOURCE: Hering Creek right of North Creek -----						
	----- 92J/NW(11-b) A -----					
C056822	0367374	43 AC OF L 2219 LILLOOET DIST	ALBERT JOHN K H FRIEDL HERMAN C/O MRS DAGMAR ALBERT 21 2688 150 ST SURREY BC V4P1P1	1980/10/16	IRR	43.00 AF

---------- Total of 135 Licences Reported ----------

Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
----- SOURCE: Thomson Creek left of Lillooet River -----						
----- 92.J.056.1.1 C -----						
C032169	0270754	L 167 LILLOOET DIST	VAN LOON MARTIN L & ANDREA N RR 1 PEMBERTON BC V0N2L0 ------ VAN LOON ANTONIUS J & CORNELIUS A RR 1 PEMBERTON BC V0N2L0	1966/11/07	DOM	1,500.00 GD
C064464	2000449	200 AC OF L 167 & 597 LILLOOET DIST PLAN 35707	VAN LOON MARTIN L & ANDREA N RR 1 PEMBERTON BC V0N2L0 ------ VAN LOON ANTONIUS J & CORNELIUS A RR 1 PEMBERTON BC V0N2L0	1985/12/06	IRR	200.00 AF
C070035	2001281	LOT B OF DL 167 168 169 2721 & 2722 LILLOOET DIST PLAN 35707	VAN LOON JOHN G RR 1 PEMBERTON BC V0N2L0	1989/12/12	IRR	60.00 AF
----- SOURCE: Wolverine Creek left of Lillooet River -----						
----- 92.J.056.1.1 B -----						
C041096	0300482	PWRHOUSE SITE IN BLK A OF L 813 LILLOOET DIST	SCHOOL DISTRICT NO 48 HOWE SOUND BOX 250 SQUAMISH BC V0N3G0	1970/11/19	PRCOM	2.00 CS

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
		----- 92J/NW(11-a) B -----				
C110015	0290432	A PWRHOUSE SITR IN LOT 1 OF DL 1158 2636 LILLOOET DISTRICT PLAN 35384	&LANNON ELIZABETH A ESTATE OF C/O BLACK STEPHEN M RR 1 PEMBERTON BC V0N2L0	1969/10/07	PRRES	1.25 CS
C110253	0267830	BLK A OF DL 1156 & BLK A OF DL 1174 L 1 OF DL 1158 & DL 2636 PLAN 35384 LILLOOET DIST	&LANNON ELIZABETH A ESTATE OF C/O BLACK STEPHEN M RR 1 PEMBERTON BC V0N2L0	1966/03/04	DOM IRR	1,000.00 GD 210.00 AF
C110254	2002031	BLK A OF DL 1155 LILLOOET DIST	BLACK STEPHEN M RR 1 PEMBERTON BC V0N2L0	1966/03/04	IRR	90.00 AF
		----- SOURCE: Johnny Sandy Creek left of Lillooet River -----				
		----- 92.J.046.3.4 B -----				
C059790	2000109	W 20 CHAINS OF DL 169 LILLOOET DIST EXC PLAN 20376	LOS ZDENEK & DELORES F RR 1 PEMBERTON BC V0N2L0	1983/04/29	DOM	500.00 GD
		----- SOURCE: Tater Creek left of Lillooet River -----				
		----- 92.J.056.1.1 E -----				
C070032	2001280	LOT B OF DL 167 168 169 2721 & 2722 LILLOOET DIST PLAN 35707	VAN LOON JOHN G RR 1 PEMBERTON BC V0N2L0	1989/12/12	DOM IRR	500.00 GD 100.00 AF

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
		-- SOURCE: Salmon Creek right of Lillooet River (South Fork) -----				
		---- 92.J.046.3.3 A -----				
C065213	2000526	40 AC OF L 1 OF DL 168 LILLOOET DIST PLAN 9155 EXC PLAN 9156	HELLEVANG ELMER O CEDAR GROVE FARMS RR 1 PEMBERTON BC V0N2L0	1986/05/21	IRR	40.00 AF
		----- SOURCE: Lillooet River (South Fork) right of Lillooet River -----				
		----- 92.J.046.3.3 B -----				
2107687	2001793	DL 1290B LILLOOET DISTRICT	KUURNE MARKKU & ROXANNA RR 1 SALMON SL COMP 4 PEMBERTON BC V0N2L0	1994/02/02	IRR	20.00 AF
		----- SOURCE: Hillaby Creek right of Lillooet River (South Fork) -----				
		----- 92J/NW(11-a) D -----				
C106960	0268653	DL'S 815 & 1167 LILLOOET DISTRICT	PERKINS PHILLIP & HOWARD C BOX 158 PEMBERTON BC V0N2L0 ------ AGERTON ENTERPRISES LTD D N H ENTERPRISES LTD BOX 158 PEMBERTON BC V0N2L0	1966/04/22	IRR	100.00 AF

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
C064472	0239918	SEE FILE	MCLEOD CREEK RANCH RR 1 PEMBERTON BC V0N2L0	1961/12/11	DOM IRR	1,000.00 GD 60.00 AF
C070040	2001202	L 1 OF DL 173 LILLOOET DIST PLAN 18218	CALLAWAY AMY D RR 1 PEMBERTON BC V0N2L0	1989/07/19	IRR	10.00 AF
C070041	2001200	L 1 OF DL 168 LILLOOET DIST PLAN 9155 EXCEPT PLAN 9156	HELLEVANG ELMER O RR 1 PEMBERTON BC V0N2L0	1989/07/19	IRR	70.00 AF
C070044	2001201	N 330 FT OF DL 170 LILLOOET DIST PLAN B4408	VAN BEEM LUCIEN W C & DORIS F L RR 1 PEMBERTON BC V0N2L0	1989/07/19	IRR	30.00 AF
C070045	2001203	PART OF DL 170 LILLOOET DIST PLAN B4593	LANNON ROY RR 1 PEMBERTON BC V0N2L0	1989/07/19	IRR	50.00 AF
----- SOURCE: Gingerbread Creek left of Lillooet River -----						
----- 92.J.046.3.4 A -----						
C064459	2000421	THOSE PARTS OF L 2673, 1538 & 170 GP 1 NWD SHOWN ON PLAN 1538	LANNON ROY RR 1 PEMBERTON BC V0N2L0	1985/09/19	IRR	50.00 AF
----- SOURCE: Lillooet River right of Lillooet Lake -----						
----- 92.J.046.3.4 C -----						
C049822	0341972	80 AC OF THOSE PARTS OF L 170, 1538 & 2673 LILLOOET DIST SHOWN ON PLAN B4593 & B5182	LANNON ROY RR 1 PEMBERTON BC V0N2L0	1977/06/26	IRR	80.00 AF

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
----- SOURCE: Lillooet River right of Lillooet Lake -----						
		----- 92.J.046.2.1 A -----				
C017943	0167108	ALL THE LANDS WITHIN THE BDYS OF	PEMBERTON VALLEY DYKING DISTRICT C/O E FERGUSON BOX 235 PEMBERTON BC V0N2L0	1947/01/31	LDIMP	0.00 TF
		----- 92.J.046.2.3 A -----				
C017943	0167108	ALL THE LANDS WITHIN THE BDYS OF	PEMBERTON VALLEY DYKING DISTRICT C/O E FERGUSON BOX 235 PEMBERTON BC V0N2L0	1947/01/31	LDIMP	0.00 TF
--- SOURCE: Fowler Creek left of Lillooet River -----						
		-- 92.J.046.3.2 E -----				
C017730	0165874	L 178 LILLCOOT DIST	JACKS TERRY WHITESTONE RD RR 1 MADEIRA PARK BC V0N2H0	1947/01/20	DOM	1,000.00 GD
----- SOURCE: Lillooet River right of Lillooet Lake -----						
		-- 92.J.046.3.2 D -----				
C017943	0167108	ALL THE LANDS WITHIN THE BDYS OF	PEMBERTON VALLEY DYKING DISTRICT C/O E FERGUSON BOX 235 PEMBERTON BC V0N2L0	1947/01/31	LDIMP	0.00 TF

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
	----- 92.J.046.3.2 C -----					
C017943	0167108	ALL THE LANDS WITHIN THE BDYS OF	PEMBERTON VALLEY DYKING DISTRICT C/O E FERGUSON BOX 235 PEMBERTON BC V0N2L0	1947/01/31	LDIMP	0.00 TF
	----- 92.J.046.3.2 B -----					
C017943	0167108	ALL THE LANDS WITHIN THE BDYS OF	PEMBERTON VALLEY DYKING DISTRICT C/O E FERGUSON BOX 235 PEMBERTON BC V0N2L0	1947/01/31	LDIMP	0.00 TF
	----- 92.J.046.3.2 A -----					
C051921	0341040	100 AC OF THOSE PARTS OF L 2675 & L 171 LILLOOET DIST SHOWN ON PLAN B 12676	MCLEOD CREEK RANCH RR 1 PEMBERTON BC V0N2L0	1977/03/31	DOM IRR	1,000.00 GD 100.00 AF
	SOURCE: McLeod Creek left of Lillooet River -----					
	----- 92.J.046.3.4 D -----					
C061784	2000442	SEE FILE	MCLEOD CREEK RANCH RR 1 PEMBERTON BC V0N2L0	1985/11/21	IRR	290.00 AF

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
C060931	2000020	10 AC OF L 2 OF L 177 LILLOOET DIST PLAN 5406	RONAYNE EDMOND RR 1 PEMBERTON BC V0N2L0	1982/06/08	IRR	10.00 AF
C060942	2000021	10 AC OF L A OF L 177 & 179 LILLOOET DIST PLAN 27619	RONAYNE JOHN W RR 1 PEMBERTON BC V0N2L0	1982/06/08	IRR	10.00 AF

----- SOURCE: Ryan River right of Lillooet River -----

----- 92.J.045 A -----

Z102125	2000946	A POWERHOUSE SITE SITUATED ON UCL LILLOOET DIST	SUMMIT POWER CORP 300 171 WATER ST VANCOUVER BC V6B1A7	1989/12/01	PRGEN	741.00 CS

----- SOURCE: Lillooet River right of Lillooet Lake -----

----- 92.J.036.4.3 C -----

C017943	0167108	ALL THE LANDS WITHIN THE BDYS OF	PEMBERTON VALLEY DYKING DISTRICT C/O E FERGUSON BOX 235 PEMBERTON BC V0N2L0	1947/01/31	LDIMP	0.00 TP

----- SOURCE: Gamelin Creek left of Lillooet River -----

----- 92.J.036.4.3 A -----

C055452	0355778	10 AC OF BLK 4,5 & 6 OF L 183 LILLOOET DIST PLAN 1417	RONAYNE JOHN W & LINDA M RR 1 PEMBERTON BC V0N2L0	1979/11/23	IRR	10.00 AF

Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
----- SOURCE: Ross Creek right of Ryan River -----						
----- 92.J.036.4.3 B -----						
C026385	0222963	S 1320' OF S 1/2 L 183 LILLOOET DIST PLAN DD 1465	ROSS CARL A BOX 252 PEMBERTON BC V0N2L0	1958/11/12	DOM	1,000.00 GD
C065263	2000490	50 AC OF S 1320' OF S 1/2 L 183 LILLOOET DIST PLAN DD 1465	ROSS CARL A BOX 252 PEMBERTON BC V0N2L0	1986/04/01	DOM IRR	1,000.00 GD 50.00 AF
C065264	2000490	S 1320' OF S 1/2 L 183 LILLOOET DIST PLAN DD 1465	ROSS CARL A BOX 252 PEMBERTON BC V0N2L0	1986/04/01	PRRES	1.20 CS
----- SOURCE: Punch Creek right of Ryan River -----						
----- 92.J.046.2.1 B -----						
C059734	2000100	10 AC OF L 3 OF DL 182 LILLOOET DIST PLAN 9411	MILLER DONALD P RR 1 PEMBERTON BC V0N2L0	1983/03/15	IRR	10.00 AF
----- SOURCE: Vans Creek right of Ryan River -----						
----- 92.J.046.1.4 A -----						
C060778	2000019	10 AC OF THAT PART OF L 179 LILLOOET DIST SHOWN ON PLAN B3541 EXC PLAN 8954	RONAYNE CLIFFORD & MARY RR 1 PEMBERTON BC V0N2L0	1982/06/08	IRR	10.00 AF

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
SOURCE: Miller Creek right of Lillooet River						
92.J.036.4.2 B						
C051338	0342277	L 2 OF L 188 LILLOOET DIST PLAN 16193	GILMORE ROBERT W & MARY E RR 1 PEMBERTON BC V0N2L0	1977/11/07	DOM	500.00 GD
92.J.036.4.2 D						
C069883	2000874	L 3 PLAN 16193 & L 15 17 & 18 PLAN 1477 ALL OF DL 188 LILLOORT DIST	GILMORE DOROTHY S BOX 336 PEMBERTON B C V0N2L0	1988/03/30	IRR	200.00 AF
92.J.036.4.2 B						
C106460	2001710	L 7 DL 188 AND 498 LILLOOET DISTRICT PLAN 1477	STAEHLI ADOLPH RR 1 PEMBERTON BC V0N2L0	1993/04/08	SW	1,500.00 GD
92.J.036.4.2 A						
C058301	0245918	THAT PART OF L 9 PLAN 1477 WITHIN L 498 LILLOOET DIST LYING E OF SLY PROLONGATION OF W BDY OF L 2 PLAN 11020	TALBOT LORRY E & ELIZABETH BOX 94 PEMBERTON B C V0N2L0	1962/09/10	DOM	1,500.00 GD
92.J.036.4.1 C						
Z103608	2001917	A POWERHOUSE SITE WITHIN UCL LILLOOET DISTRICT	CPC CASCADE POWER CORPORATION 1350 409 GRANVILLE ST VANCOUVER BC V6C1T2	1991/10/16	PRGEN	91.81 CS

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
C108204	0370743	L A OF DL 211 LILLOOET DISTRICT 39509	PLANO'BRIEN WILLIAM E BOX 545 PEMBERTON BC V0N2L0	1966/01/10	IRR	29.54 AF
----- SOURCE: Pemberton Creek right of Lillooet River -----						
----- 92.J.036.2.2 D -----						
C061785	2000345	L 203 & L 239 LILLOOET DIST COVERED BY WATERS OF ONE MILE LAKE	PEMBERTON VILLAGE OF BOX 100 PEMBERTON BC V0N2L0	1985/04/18	LDIMP	2.00 CS
----- 92.J.036.2.2 A -----						
C026463	0224866	ALL THE LANDS WITHIN THE BDYS OF	PEMBERTON VILLAGE OF BOX 100 PEMBERTON BC V0N2L0	1959/04/14	MWKLA	25,550,000.00 GY
Z102122	2001375	LANDS WITHIN THE BOUNDARIES OF THE CORP OF THE VILLAGE OF PEMBERTON	PEMBERTON VILLAGE OF BOX 100 PEMBERTON BC V0N2L0	1990/07/05	MWKLA	40,150,000.00 GY
----- 92.J.036.2.2 B -----						
C029836	0251118	ALL THE LANDS WITHIN THE BDYS OF	PEMBERTON NORTH IMPROVEMENT DISTRICT C/O IVAN KNOWLES BOX 219 PEMBERTON BC V0N2L0	1963/12/31	MWKLA	36,500,000.00 GY

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
		----- 92.J.016.1.1 V -----				
C055199	0355881	THAT PART OF L 4363 GP 1 NWD HELD UNDER BC RLY LEASE # 925	POTETZ JOHANN GD WHISTLER BC V0N1B0	1980/01/10	DOM	500.00 GD
		----- 92.J.016.1.1 E -----				
C047504	0330759	THAT PART OF L 2245 GP 1 NWD HELD UNDER BC RLY LEASE # 1051	MELSNESS BERT PO BOX 304 WHISTLER BC V0N1B0	1976/06/01	DOM	500.00 GD
C047505	0340065	THAT PART OF L 2246 GP 1 NWD HELD UNDER BC RLY LEASE #134	FAIRHURST MICHAEL 12620 NO 3 RD RICHMOND BC V7A1X5	1976/06/01	DOM	500.00 GD
C048342	0340054	THAT PART OF L 2246 GP 1 NWD HELD UNDER BC RLY LEASES #466 & 857	CHAPLIN WILLIAM E & JEAN E 2630 RUPLI RD WESTBANK BC V4T1R3	1976/08/03	DOM	1,500.00 GD
		----- SOURCE: Lillooet River right of Lillooet Lake -----				
		----- 92.J.037 D -----				
C064703	0267106	52 AC OF L 214 LILLOOET DIST	STURDY WALTER J PO BOX 165 PEMBERTON BC V0N2L0	1966/01/10	IRR	104.00 AF

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
----- SOURCE: Alta Creek right of Green Lake -----						
----- 92.J.016.1.J F -----						
C069896	2001015	UNDERTAKING OF MUN OF WHISTLER WITHIN BC RLY R/W DL 1755 GP 1 NWD RBF PLAN 1066	WHISTLER RESORT MUNICIPALITY OF 4325 BLACKCOMB WAY WHISTLER BC V0N1B4	1988/08/29	LDTMP	0.00 TF
----- SOURCE: Rainbow Creek left of Alta Lake -----						
----- 92.J.016.1.1 H -----						
F016573	0072286	L 2110 GP 1 NWD	SAXTON JOAN 5781 NEWTON WYND VANCOUVER B C V6T1H6	1926/10/01	DOM	2,000.00 GD
----- SOURCE: Scotia Creek left of Alta Lake -----						
----- 92.J.016.1.1 F -----						
F003412	0265319	L 4363 GP 1 NWD	BC RAIL LTD PO BOX 8770 VANCOUVER BC V6B4X6	1913/09/18	PROCR	40,000.00 GD
F007977	0070104	THE UNDERTAKING OF THE LICENSEE WITHIN L 2246 AND 4363 GP 1 NWD	BC RAIL LTD PO BOX 8770 VANCOUVER BC V6B4X6	1927/09/13	WWKOT	20,000.00 GD

02/02/96 14:50 ☎604 660 8926 BC ENVIRON. LMR 046/055

Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
	----- 92.J.016.1.1 N -----					
C065460	0355405 SEE FILE		WHISTLER RESORT ASSOCIATION WHISTLER GOLF CLUB 4010 WHISTLER WAY WHISTLER BC V0N1B4	1979/09/24	LDIMP	72,000.00 GD
	----- 92.J.016.1.1 M -----					
C065460	0355405 SEE FILE		WHISTLER RESORT ASSOCIATION WHISTLER GOLF CLUB 4010 WHISTLER WAY WHISTLER BC V0N1B4	1979/09/24	LDIMP	72,000.00 GD
	----- 92.J.016.1.1 K -----					
C065460	0355405 SEE FILE		WHISTLER RESORT ASSOCIATION WHISTLER GOLF CLUB 4010 WHISTLER WAY WHISTLER BC V0N1B4	1979/09/24	LDIMP	72,000.00 GD
----- SOURCE: Twentyone Mile Creek left of Alta Creek -----						
	--- 92.J.016.1.3 E -----					
C065210	2000404 WITHIN THE BDYS		WHISTLER RESORT MUNICIPALITY OF 4325 BLACKCOMB WAY WHISTLER BC V0N1B4	1985/08/22	WWRLA	1,095,000,000.00 GY

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
----- SOURCE: Alta Creek right of Green Lake -----						
----- 92.J.016.1.3 H -----						
2102110	2001255	L 4 DL 1757 PL 13529 & L 1 DL 1756 PL 13114 & BLK A & DL 2105 GRP 1 NWD & \	BURRARD INTERNATIONAL HOLDINGS LTD O'MARA DOUG 1500 1030 W GEORGIA ST VANCOUVER BC V6E2Y3	1989/09/26	LDIMP	02.00 AF
----- SOURCE: Agnew Creek left of Alta Creek -----						
----- 92.J.016.1.3 B -----						
C036903	0259724	WITHIN THE BDYS	WHISTLER RESORT MUNICIPALITY OF 4325 BLACKCOMB WAY WHISTLER BC V0N1B4	1964/11/30	WWKLA	74,025,000.00 GY
C043692	0316478	WITHIN THE BDYS	WHISTLER RESORT MUNICIPALITY OF 4325 BLACKCOMB WAY WHISTLER BC V0N1B4	1973/03/06	WWKLA	24,272,500.00 GY
----- SOURCE: Crabapple Creek right of Alta Creek -----						
----- 92.J.016.1.1 W -----						
C065460	0355405	SEE FILE	WHISTLER RESORT ASSOCIATION WHISTLER GOLF CLUB 4010 WHISTLER WAY WHISTLER BC V0N1B4	1979/09/24	LDIMP	72,000.00 GD

02/02/96 14:50 ☎604 660 8926 BC ENVIRON. LMR ☑044/055

Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
SOURCE: Fitzsimmons Creek right of Green Lake						
		92.J.016.1.1 Z				
C101683	2001489	PROJECT OF THE LICENSEE WITHIN THAT PART OF DL 5275 GP 1 NWD SHOWN AS PARK ON PLAN LMP 219	WHISTLER RESORT MUNICIPALITY OF 4325 BLACKCOMB WAY WHISTLER BC V0N1B4	1991/04/08	LDIMP	0.00 TF
		92.J.016.1.2 D				
C106607	2001068	UNSURVEYED CROWN LAND NWD HELD UNDER A DEVELOPMENT AGREEMENT WITH THE MINISTRY OF CROWN LANDS	FORTRESS MOUNTAIN RESORTS LTD BLACKCOMB SKIING ENT 4545 BLACKCOMB WAY WHISTLER BC V0N1B4	1994/08/30	SNOW STONP	4,856.00 AF 4.42 AF
C069915	2000810	UCL GP 1 NWD HELD UNDER A DEV AGREEMENT WITH MIN OF CROWN LANDS	FORTRESS MOUNTAIN RESORTS LTD BLACKCOMB SKIING ENT 4545 BLACKCOMB WAY WHISTLER BC V0N1B4	1987/08/21	SNOW	6.37 AF
SOURCE: Baxter Creek right of ZZ Lake (14946)						
		92.J.016.3.1 A				
C046241	0270141 L 7302	GP 1 NWD	WHISTLER RAINBOW PROPERTIES LTD PO BOX 1339 WHISTLER BC V0N1B0	1966/07/05	ENTPR	5,000.00 GD

02/02/96 14:49 ☎604 660 6926 BC ENVIRON. LMR 043/055

Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
		----- 92.J.016.1.2 E -----				
C069998	2001176	UNSURVEYED CROWN LAND NEW WESTMINSTER DIST HELD UNDER DEVELOP AGREEMENT WITH MIN OF CROWN LANDS	BLACKCOMB SKIING ENTERPRISES LTD 4545 BLACKCOMB WAY WHISTLER BC V0N1B4	1989/06/19	SNOW	8.45 AF
		----- SOURCE: Lost Creek right of Blackcomb Creek -----				
		----- 92.J.016.1.4 A -----				
C050990	0369787	L 4889 GP 1 NWD	WHISTLER RESORT MUNICIPALITY OF 4325 BLACKCOMB WAY WHISTLER BC V0N1B4	1982/01/18	LDIMP	96,000.00 GD
		----- SOURCE: Blackcomb Creek right of Fitzsimmons Creek -----				
		----- 92.J.016.1.4 E -----				
C065364	2000780	LAND WITH THE BDYS OF	WHISTLER RESORT MUNICIPALITY OF 4325 BLACKCOMB WAY WHISTLER BC V0N1B4	1987/06/04	WMKLA	438,000,000.00 GY
		----- 92.J.016.1.4 F -----				
C104749	2001605	UNSURVEYED CROWN LAND NWD HELD UNDER A DEVELOPMENT AGREEMENT WITH THE PROVINCE OF BC DATED 9TH MAY 1979	BLACKCOMB SKIING ENTERPRISES LTD 4545 BLACKCOMB WAY WHISTLER BC V0N1B4	1992/03/18	SNOW STOND	2,305.00 AF 25.00 AF

02/02/96 14:49 ☎604 660 8926 BC ENVIRON. LMR 042/058

Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
----- SOURCE: Green Lake on Green River -----						
----- 92.J.016.1.3 X -----						
C108126	2001827	L A DL 1756 1757 1758 2105 3859 GP 1 NWD PLAN LMP 19576	GREEN LAKE PROJECTS INC. 1800 - 1030 GEORGIA ST W VANCOUVER BC V6E2Y3	1994/05/03	WTRNG	179.00 AF
----- SOURCE: Fitzsimmons Creek right of Green Lake -----						
----- 92.J.016.1.4 C -----						
C064432	2000311	L 3859 GP 1 NWD REF PLAN 1240	WHISTLER RESORT MUNICIPALITY OF 4325 BLACKCOMB WAY WHISTLER BC V0N1B4	1984/11/27	LDIMP	0.00 TF
----- 92.J.016.1.4 B -----						
C064432	2000311	L 3859 GP 1 NWD REF PLAN 1240	WHISTLER RESORT MUNICIPALITY OF 4325 BLACKCOMB WAY WHISTLER BC V0N1B4	1984/11/27	LDIMP	0.00 TF
----- SOURCE: Horstman Creek left of Blackcomb Creek -----						
----- 92.J.016.1.2 F -----						
C102115	2001215	DL 7693, 7694, THAT PART OF DL 3903 LAN LMP 6007, L 1 OF DL 3859 PLAN 20714 AND THOSE PARTS OF DL 3859 4105 & 4889 PLAN LMP 5944 ALL GP 1 NWD HELD UNDER LEASE NO 235033	PCANADIAN PACIFIC HOTELS CORP 104-900 W GEORGIA ST VANCOUVER BC V6C2W6	1989/07/31	WTRNG	67.50 AF

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
C069891	2001031	PWRHOUSE SITE ON BLK B OF L 3364 GP 1 NWD PLAN 18705 HELD UNDER LANDS LEASE NO 232570	HOLLANDER EDWARD MBURER GILLIAN PO BOX 715 WHISTLER BC V0N1B0	1988/09/08	PRRRS	1.05 CS
		----- 92.J.026.2.1 C -----				
C108131	2001260	BLK A OF DL 3364 GP 1 NWD	WILLIAMS DONNA M PO BOX 752 WHISTLER BC V0N1B0	1989/09/28	IRR	10.00 AF
C106409	0290137	BLK A OF L 3364 GP 1 NWD	WILLIAMS DONNA M PO BOX 752 WHISTLER BC V0N1B0	1969/08/12	DOM	500.00 GD
		----- SOURCE: Green River right of Lillooet River -----				
		---- 92.J.016.4.1 A ----				
C038781	0305722	L 2072 GP 1 NWD EXC RD	SABRE TRANSPORT LTD BOX 5 WHISTLER BC V0N1B0	1971/07/22	PROCE	1,000.00 GD
		----- SOURCE: Sixteen Mile Creek left of Green River -----				
		----- 92.J.016.3.2 E -----				
C108279	2001647	DL 4104 GRP 1 NWD HELD UNDER LANDS LE 2404297	FIVEDGEMONT DRILLING & BLASTING (1982) BOX 281 WHISTLER BC V0N1B0	1994/06/14	PROCE	1,200.00 GD

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
--- SOURCE: Soo River right of Green River -----						
----- 92.J.026 A -----						
C103580	2001174	A POWERHOUSE SITE ON DISTRICT LOT 780 7 GROUP 1, NEW WESTMINSTER DISTRICT	EXECUTIVE HOUSE POWER CORPORATION C/O 777 DOUGLAS ST VICTORIA BC V8W2B5 ------ WHISTLER HYDRO INC C/O 777 DOUGLAS ST VICTORIA BC V8W2B5 ------ BLAKEY ENERGY RESOURCES INC C/O 777 DOUGLAS ST VICTORIA BC V8W2B5 ------ MAGRATH ENERGY CORPORATION C/O 777 DOUGLAS ST VICTORIA BC V8W2B5	1989/06/02	PRGEN	583.00 CS
----- SOURCE: Johnson Creek left of Green River -----						
----- 92.J.026.2.1 B -----						
C069890	2001031	BLK B OF DL 3364 GP 1 NWD PLAN 18705 HELD UNDER LANDS LEASE NO 232570	HOLLANDER EDWARD NEURER GILLIAN PO BOX 715 WHISTLER BC V0N1B0	1988/09/08	DOM	500.00 GD

02/02/96 14:45 ☎604 660 5926 BC ENVIRON. LMR ☎039/055

Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
----- SOURCE: Gold Creek right of Lillooet River -----						
		----- 92.J.027.3.4 A -----				
C028706	0251653	IR #S 1 & 10 EXC BC RLY MOUNT CURRIE LILLOOET DIST	MOUNT CURRIE INDIAN BAND 987-557-7996 BOX 165 MOUNT CURRIE BC V0N2K0 ------ INDIAN & NORTHERN AFFAIRS CANADA 300 1550 ALBERNI ST VANCOUVER BC V6G3C5 ------ MOUNT CURRIE INDIAN BAND 987-557-8005 BOX 165 MOUNT CURRIE BC V0N2K0	1963/08/28	WWKOT	100,000.00 GD
----- SOURCE: ZZ Creek (69008) right of Green River -----						
		----- 92.J.027.3.3 A -----				
2107822	2001804	LEASE AGREEMENT WITH VILLAGE OF PEMBERTON - POSSIBLY WITHIN DL 206 LILLOOET DIST	PEMBERTON VALLEY GOLF & COUNTRY CLUB PO BOX 547 PEMBERTON BC V0N2L0	1994/03/04	WIRRG	100.00 AF
----- SOURCE: Rutherford Creek left of Green River -----						
		----- 92.J.026 B -----				
2103586	2001923	A POWERHOUSE SITE WITHIN DL 1549 LILLOOET DIST	CPC CASCADE POWER CORPORATION 1350 409 GRANVILLE ST VANCOUVER BC V6C1T2	1991/10/16	PRGEN	106.00 CS

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
----- 92J/10E(a) M -----						
C047197	0320286	BLK B OF L 4586 LILLOOET DIST	MCCOOK-WEIR FLORENCE E 840 FENWICK PL PORT MOODY BC V3H1C1	1974/06/24	DOM	500.00 GD
----- 92J/10E(a) K -----						
C058515	0360363	BLK A OF L 4587 LILLOOET DIST	ORES ALOIS 3368 DALEBRIGHT DRIVE BURNABY B C V5A3E5	1981/04/13	DOM	500.00 GD
----- SOURCE: Phelix Creek left of Birkenhead Lake -----						
----- 92.J.057 A -----						
C038267	0300024	L 2683 LILLOOET DIST	THOMPSON ROBERT W BOX 578 PEMBERTON BC V0N2L0	1970/08/17	DOM	500.00 GD

BC ENVIRON LAN 0004 000 5926 T441 92.J.057

Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
----- SOURCE: Tanksy Creek left of East Phelix Creek -----						
-- -- 92.J.057 F -----						
C109275	2000149	DL 969 LILLOOET DISTRICT EXCEPT PLAN KAP 51260	MOLNAR TIBOR & CHRISTINA BOX 12 D'ARCY BC V0N1L0	1983/09/14	IRR	283.00 AF
C109276	2002016	DL 741 LILLOOET DISTRICT	MOLNAR TIBOR & CHRISTINA BOX 12 D'ARCY BC V0N1L0	1983/09/14	IRR	80.00 AF
-- -- SOURCE: Tisza Creek left of East Phelix Creek -----						
----- 92J/10B(a) N -----						
C109806	2000877	L A OF DL 969 LILLOOET DIST PLAN KAP51260	MOLNAR TIBOR & CHRISTINA BOX 12 D'ARCY BC V0N1L0	1988/04/11	DOM IRR	500.00 GD 20.00 AF
C109807	2000877	L A OF DL 969 LILLOOET DIST PLAN KAP51260	MOLNAR TIBOR & CHRISTINA BOX 12 D'ARCY BC V0N1L0	1988/04/11	PRRES	0.60 CS
----- SOURCE: Baroja Brook right of East Phelix Creek -----						
----- 92J/10E(a) T -----						
C051835	0164223	L 2156 LILLOOET DIST	MCLINTOCK ROBERT 12302 FLETCHER ST MAPLE RIDGE BC V2X6K9	1978/06/12	DOM	500.00 GD

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
---- SOURCE: Greer Creek right of East Phelix Creek -----						
		----- 92.J.057 E -----				
C109285	0290352	DL 741 LILLOOET DISTRICT	MOLNAR TIBOR & CHRISTINA BOX 12 D'ARCY BC V0N1L0	1969/09/19	DOM TRR	500.00 GD 80.00 AF
		----- 92.J.057 D -----				
C018265	0285869	L 497 LILLOOET DIST	BINARSON FREDERICK S BOX 636 PEMBERTON BC V0N2L0	1969/06/30	DOM	1,000.00 GD
		----- 92.J.057 C -----				
C054702	0365930	A PWRHOUSE SITE SITUATED ON UCL WITHIN THE VICINITY OF L 497 LILLOOET DIST	BINARSON FREDERICK S BOX 636 PEMBERTON BC V0N2L0	1979/07/05	PRRES	0.50 CS
		----- 92.J.057 L -----				
C109285	0290352	DL 741 LILLOOET DISTRICT	MOLNAR TIBOR & CHRISTINA BOX 12 D'ARCY BC V0N1L0	1969/09/19	DOM TRR	500.00 GD 80.00 AF
----- SOURCE: Toupol Creek right of Tanksy Creek -----						
		92.J.057 G -----				
C109278	2000146	DL 969 LILLOOET DISTRICT EXCEPT PLAN KAP 51260	MOLNAR TIBOR & CHRISTINA BOX 12 D'ARCY BC V0N1L0	1983/09/08	DOM	500.00 GD

Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
		----- 92.J.047.4.4 N -----				
2105198	2001660	L 4 DL 1577 LILL DIST PL 31674	VAN VOORST LORINE P R - 1100 NILLAR CREEK RD WHISTLER BC V0N1B1	1992/08/07	DOM	500.00 GD
		----- 92.J.047.4.4 K -----				
C072720	2001402	THAT PT OF L 1252 SHOWN ON PLAN B4587 LILLOOET DIST EXC PLAN 31674	BOURHIS HUGH S R PO BOX 337 PEMBERTON BC V0N2L0	1990/09/13	DOM IRR	500.00 GD 5.00 AF
		----- 92.J.047.4.4 L -----				
2105184	2001655	DL 4671 GP 1 NWD	BEAUMONT VERA A PO BOX 332 PEMBERTON BC V0N2L0	1992/08/07	DOM	500.00 GD
----- SOURCE: Rogowski Creek left of Birkenhead Lake -----						
		----- 92.J.057 K -----				
C051593	0323224	L B OF L 4895 LILLOOET DIST PLAN 21690	BIRKENHEAD LAKE ESTATES LTD 832 YOUNETTE DR W VANCOUVER B C V7T1S9	1974/06/06	W/KOT	25,000.00 GD
C051922	0300783	L A OF L 4895 LILLOOET DIST PLAN 21690	COMBS NORMAN 11091 BOND BLVD DELTA BC V4E1M8	1971/02/17	DOM	500.00 GD

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
----- SOURCE: Spetch Creek left of Birkenhead River -----						
		----- 92.J.047.2.1 A -----				
C104105	0316667	1.5 AC OF L 2220 LILLOOET DIST	WHISTLER WATER INC 3600 BAINBRIDGE AVE BURNABY BC V5A2T4	1973/03/29	DOM BOTTL IRR	500.00 GD 215,381.47 GD 1.50 AF
----- SOURCE: Happy Brook left of Poole Creek -----						
		----- 92.J.047.2.3 A -----				
C047317	0329045	L 2667 LILLOOET DIST	PROCHASKA VICTOR BOX 416 PEMBERTON B C V0N2L0	1975/06/24	DOM	500.00 GD
----- SOURCE: Collins Brook right of Poole Creek -----						
		----- 92.J.047.4.1 A -----				
C041098	0316013	PART OF L 1547 LILLOOET DIST LYING S OF BC RLY R/W (PLAN A9)	COLLINS DAVID R & LEONA L BOX 104 DARCY BC V0N1L0	1972/10/20	DOM	1,000.00 GD
----- SOURCE: Poole Creek left of Birkenhead River -----						
		----- 92.J.047.4.1 B -----				
C042329	0316014	10 AC THAT PART OF L 1547 LILLOOET DIST LYING S OF BC RLY CO R/W (PLAN A9)	COLLINS DAVID R & LEONA L BOX 104 DARCY BC V0N1L0	1972/10/20	IRR	10.00 AF

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	POC	Quantity/Units
----- SOURCE: Birkenhead River left of Lillooet Lake -----						
		----- 92.J.037 C -----				
C049981	0341013	L 905 LILLOOET DIST	FISHERIES & OCEANS CANADA 400 - 555 W HASTINGS ST VANCOUVER BC V6B5G3	1977/03/24	CONUS	10.00 CS
----- SOURCE: Jason Creek right of Birkenhead River -----						
		----- 92.J.037 B -----				
F004206	0265129	12 AC OF L 1543 LILLOOET DIST	WALKER GEORGE R & VERA M BOX 280 PEMBERTON BC V0N2L0	1912/07/29	IRR	18.00 AF
F004207	0265129	L 1543 LILLOOET DIST	WALKER GEORGE R & VERA M BOX 280 PEMBERTON BC V0N2L0	1912/07/29	DOM	500.00 GD
----- SOURCE: Owl Creek right of Birkenhead River -----						
		----- 92.J.037.3.2 A -----				
C102405	2001462	MINERAL CLAIMS ART-BOB #1 & #2 WITHINSABRE TRANSPORT LTD UCL AND DL 2668 & 955 LILLOOET DIST	BOX 5 WHISTLER BC V0N1B0	1991/02/21	PROCE	100,000.00 GD

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
		----- 92J/7E(a) R -----				
2102120	2000933	A POWERHOUSE SITE SITUATED ON UCL LILLOOET DIST	FORCE MORTICE ENERGY LTD 300 1497 MARINE DR W VANCOUVER BC V7T1B8	1989/08/25	PRGEN	100.00 CS
C072739	2001294	BLK B OF DL 8296 LILLOOET DIST HELD UNDER CROWN LEASE NO 231239	USCOPAZZO ANGELO & SOLANGE 85 E 10TH AVE VANCOUVER BC V5V1E2	1990/01/25	DOM	500.00 GD
		----- 92J/7H(a) B -----				
C060691	2000056	L 2699 LILLOOET DIST	THIESSEN HAROLD J 7491 BROADMOOR BLVD RICHMOND BC V7A1A8	1982/09/29	DOM	500.00 GD
C060692	2000056	A PWRHOUSE SITE SITUATED IN L 2699 LILLOOET DIST	THIESSEN HAROLD J 7491 BROADMOOR BLVD RICHMOND BC V7A1A8	1982/09/29	PRRES	1.88 CS
----- SOURCE: Peq Creek left of Xit'olacw Lake -----						
		----- 92.J.037 E -----				
C054862	0355713	IR #6 PEMBERTON LILLOOET DIST	MOUNT CURRIE INDIAN BAND 987-557-8001 BOX 165 MOUNT CURRIE BC V0N2K0 ------ INDIAN & NORTHERN AFFAIRS CANADA 300 1550 ALBERNI ST VANCOUVER BC V6G3C5	1979/11/13	WMROT	75,000.00 GD

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
		----- 92.J.028 D -----				
C027100	0234792	PARCEL A OF L 4901 LILLOOET DIST PLAN 11938	HEATHER JEAN PROPERTIES LTD BOX 220 PEMBERTON BC V0N2L0	1976/05/22	DOM PRCOM	500.00 GD 0.60 CS
		----- 92.J.028 C -----				
C059511	0330693	PARCEL A OF L 4901 LILLOOET DIST PLAN 11938; & L 4901 LILLOOET DIST EXC PLAN 11938 & BCHPA R/W (PLAN A-1705)	HEATHER JEAN PROPERTIES LTD BOX 220 PEMBERTON BC V0N2L0	1976/05/21	WWKOT	32,000.00 GD
		----- 92.J.028 F -----				
C034210	0277825	A PWRHOUSE SITE IN PARCEL A OF L 4901 LILLOOET DIST PLAN 11938	HEATHER JEAN PROPERTIES LTD BOX 220 PEMBERTON BC V0N2L0	1976/05/22	PRCOM	1.34 CS
		----- SOURCE: Roy Creek left of Lillooet Lake -----				
		----- 92J/7E(a) C -----				
C026509	0232942	L 8287 LILLOOET DIST	SCOBIE WILLIAM H PO BOX 201 PEMBERTON B C V0N2L0	1960/09/09	DOM	500.00 GD
		----- SOURCE: Joffre Creek left of Lillooet Lake -----				
		----- 92J/7E(a) D -----				
C038448	0305151	BLK A OF L 8296 LILLOOET DIST	BELEZNAY STEPHEN C & DOROTHY G 4569-45A AVENUE DELTA B C V4K1N3	1971/04/20	DOM	500.00 GD

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
C069223	0342222	BLK D OF L 8562 LILLOOET DIST	TOPLASS DERICK J & STEVE A 8684 116TH ST DELTA BC V4C5V9	1977/10/21	DOM	500.00 GD
C069224	0317924	BLK B OF L 8562 LILLOOET DIST	HAUFSCHILD LUTZ K N GUAY LYSE M A G 1461 NELSON AVE WEST VANCOUVER BC V7T2G9	1973/10/01	DOM	500.00 GD
C069225	0310885	BLK C OF L 452 LILLOOET DIST	NICKERSON DAVID R BOX 15 PEMBERTON BC V0N2L0	1972/09/22	DOM	500.00 GD
C069226	0310886	BLK B OF L 452 LILLOOET DIST	NOVAKOWSKI DAVID P & M ROBERTA 6490 142ND ST SURREY BC V3W5M6	1972/09/22	DOM	500.00 GD
C069957	2001050	BLK C DL 8562 LILLOOET DIST HELD UNDER CL 232874	RYAN PATRICK J & EDNA P 14689 ASHFORD PLACE SURREY B C V3R6P5	1988/11/07	DOM	500.00 GD

----- SOURCE: Catiline Creek left of Lillooet Lake -----

----- 92.J.028 B -----

C050297	0323080	PARCEL A L 4901 GP 1 NWD PLAN 11938 & L 4901 GP 1 NWD EXC PLAN 11938 & BC H & PA R/W (PLAN A-1705)	HEATHER JEAN PROPERTIES LTD BOX 220 PEMBERTON BC V0N2L0	1974/05/14	WWKOT	12,000.00 GD

----- SOURCE: McCullock Creek left of Lillooet Lake -----

----- 92.J.028 E -----

C027100	0234792	PARCEL A OF L 4901 LILLOOET DIST PLAN 11938	HEATHER JEAN PROPERTIES LTD BOX 220 PEMBERTON BC V0N2L0	1976/05/22	DOM PRCON	500.00 GD 0.60 CS

Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
C070028	2001163	DL 8295 LILLOOET DIST HELD UNDER CL 231354	BEKKER JACOB S WESTON MARGO PO BOX 75 PEMBERTON BC V0N2L0	1989/05/23	ENTPR IRR	3,000.00 GD 2.00 AF
----- SOURCE: Twin One Creek left of Lillooet Lake -----						
----- 92.J.028 A -----						
C070061	2000355	BLK C OF L 452 LILOOET DIST HELD UNDER LEASE 16533 ON WHICH IS SITUATED A POWERHOUSE	NICKERSON DAVID R BOX 15 PEMBERTON BC V0N2L0	1985/05/28	PRRES	1.79 CS
C070094	2001213	BLK A OF DL 8562 LILLOOET DIST HELD UNDER LEASE NO 233209	PARKER LAURENCE B 2275 HAVERSLEY AVE COQUITLAM BC V3J1W3	1989/07/29	DOM	500.00 GD
C069219	2000376	BLK F OF L 8497 LILLOOET DIST	WILLIAMS ROBERT D C/O BOX 519 PEMBERTON BC V0N2Z0	1985/07/15	DOM	500.00 GD
C069220	0310195	BLK D OF L 8497 LILLOOET DIST	GREVILLE JAMES M 204-1966 COQUITLAM AVE PORT COQUITLAM BC V3B7P8	1972/06/08	DOM	500.00 GD
C069221	0310194	BLK R OF DL 8497 LLD	DALE MARK A & PASCALE TANNAR TERRENCE J & BEVERLEY 1257 MILL ST NORTH VANCOUVER BC V7K1V3	1972/06/08	DOM	500.00 GD
C069222	0309282	BLK A OF L 8497 LILLOOET DIST	MCLEOD WILLIAM A 302 1160 BURRARD ST VANCOUVER BC V6Z2E8	1971/11/19	DOM	500.00 GD

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
----- SOURCE: Allenby Creek left of Little Lillooet Lake -----						
		----- 92.J.008 A -----				
C046018	0328187	L 945 GP 1 NWD	FOREST DISTRICT - SQUAMISH BOX 1970 SQUAMISH BC V0N3G0 ------ FORESTS MINISTRY OF PARLIAMENT BUILDINGS VICTORIA BC V8V1X4	1974/12/11	ENTPR	2,000.00 GD
----- SOURCE: Faure Creek left of Lillooet Lake -----						
		----- 92.J.018 A -----				
C051794	0355167	BLK D OF L 2179 LILLOOET DIST	SCHBUCH ONDREJ 86 ST GEORGES AVE NORTH VANCOUVER B C V7L3G7	1979/08/17	DOM	500.00 GD
C069951	2001016	BLK B DL 8497 LILLOOET LAND DIST HELD UNDER LAND LEASE 232927	EVANS DAVID L 348 N DOLLARTON HIGHWAY NORTH VANCOUVER BC V7G1N1	1988/09/02	DOM	500.00 GD
----- SOURCE: Twin Two Creek left of Lillooet Lake -----						
		----- 92.J.028 G -----				
C070027	2001163	DL 8295 LILLOOET DIST HELD UNDER CL 231354	DEKKER JACOB S WESTON MARGO PO BOX 75 PEMBERTON BC V0N2L0	1989/05/23	PRCON	2.00 CS

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
----- SOURCE: Sloquet Creek right of Lillooet River -----						
----- 92G/NE(9-f) G -----						
C061652	2000225	PLACER LEASE 10565	ATKINSON LES 7618 EIDER ST MISSION B C V2V5A7	1984/05/08	MNPLC	0.00 CS
----- SOURCE: ZZ Creek (68835) left of Lillooet River -----						
----- 92G/NE(16-c) W -----						
Z107664	2001791	L 1747 GP 1 NWD	TRETHEWEY E ALAN 35220 CASSIAR AVE ABBOTSFORD BC V2S5R4	1994/01/27	DOM PRRKS	500.00 GD 0.12 CS
----- SOURCE: Rogers Creek left of Lillooet River -----						
----- 92G/NE(16-e) T -----						
Z102126	2000692	A POWERHOUSE SITE WITHIN UCL NWD	ENTRAMAR LTD PO BOX 6630 STN D CALGARY AB T2P2E4	1990/10/24	PRGEN	2,500.00 KW
----- SOURCE: Musgrave Creek right of Lillooet River -----						
----- 92.J.008 D -----						
C069954	2000789	LAND HELD UNDER MINERAL CLAIM CU MOLY 2 LILLOOET LAND DIST	NAGY GEORGE L PO BOX 518 PEMBERTON BC V0N2L0	1987/07/20	WKCMP MNPLC	2,000.00 GD 0.20 CS

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Ministry Of Environment (B.C.)
Water Licencing System

Report Requested By : NDILORENZO
Date Report Requested : 1996/02/02 13:21
Report Sorted By : Source Hierarchy
Selection Criteria
START : SO302 - Lillooet River left of Harrison Lake
END : SO23080 - Meager Creek right of Lillooet River
TRIBUTARIES : Y

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
----- SOURCE: ZZ Creek (65621) right of ZZ Lake (65622) -----						
----- 92J/SW(3-c) G -----						
Z104545	2001938 TWO POWERHOUSE'S WITHIN UCL NWD		KMC ENERGY CORP 3975 LORAINE AVE NORTH VANCOUVER BC V7R4C1	1992/04/14	PRGEN STOPR	137.70 CS 13.78 AF
----- SOURCE: ZZ Creek (65616) right of High Falls Creek -----						
----- 92J/SW(3-c) F -----						
Z104545	2001936 TWO POWERHOUSE'S WITHIN UCL NWD		KMC ENERGY CORP 3975 LORAINE AVE NORTH VANCOUVER BC V7R4C1	1992/04/14	PRGEN STOPR	137.70 CS 13.78 AF
----- SOURCE: High Falls Creek left of Squamish River -----						
----- 92G/14g A -----						
Z104545	2001938 TWO POWERHOUSE'S WITHIN UCL NWD		KMC ENERGY CORP 3975 LORAINE AVE NORTH VANCOUVER BC V7R4C1	1992/04/14	PRGEN STOPR	117.70 CS 13.78 AF
----- SOURCE: Chuck Chuck Creek left of Squamish River -----						
----- 92G/NW(14-1) A -----						
C057707	0368870 L 1186 GP 1 NWD		HAY PETER 168-810 BROADWAY VANCOUVER BC V5Z1J8	1981/06/26	DOM	1,000.00 GD

----- Total of 77 Licences Reported -----

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
----- SOURCE: Ewing Creek left of Squamish River -----						
----- 8233 D -----						
C028369	0249303	PARCEL A OF IR #7 SKOWISHIN GP 1 NWD REF PLAN 4800	BC HYDRO & POWER AUTHORITY PWR SUPPLY BUS. SERVICES 6911 SOUTHPOINT DR (E08) BURNABY BC V3N4X8	1963/04/25	DOM	1,000.00 GD
----- SOURCE: High Falls Creek left of Squamish River -----						
----- 92G/NW(14-f) U -----						
Z104545	2001938	TWO POWERHOUSE'S WITHIN UCL NWD	KMC ENERGY CORP 3975 LORAINE AVE NORTH VANCOUVER BC V7R4C1	1992/04/14	PRGEN STOPR	137.70 CS 13.78 AF
----- SOURCE: XX Creek (05616) right of High Falls Creek -----						
----- 92G/NW(14-f) V -----						
Z104545	2001938	TWO POWERHOUSE'S WITHIN UCL NWD	KMC ENERGY CORP 3975 LORAINE AVE NORTH VANCOUVER BC V7R4C1	1992/04/14	PRGEN STOPR	137.70 CS 13.78 AF
----- 92J/SW(3-c) E -----						
Z104545	2001938	TWO POWERHOUSE'S WITHIN UCL NWD	KMC ENERGY CORP 3975 LORAINE AVE NORTH VANCOUVER BC V7R4C1	1992/04/14	PRGEN STOPR	137.70 CS 13.78 AF

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
C061680	0366109	MIN UNDERTAKING OF THE LICENSEE WITHIN UCL HELD UNDER MC HAWK 1 MIN CLAIM 1542(8) & HAWK 2 MIN CLAIM 1543(8) GP 1 NWD	SLIMS' EXPLORATION CO LTD 2055 COMO LAKE AVE COQUITLAM BC V3J3R4	1980/03/04	WKCHP MNORR	5,000.00 GD 10,000.00 GD
----- SOURCE: Marten Creek right of Ashlu Creek -----						
	----- 92G/NW(14-E) P -----					
C070023	2000891	N 1/2 OF L 5 BLK 20 DL 759 GP 1 NWD PLAN 6707	GOLAIY FRANK & JEAN BOX 372 SQUAMISH BC V0N3G0	1988/04/28	BOTTL	10,000.00 GD
----- SOURCE: Wonna Creek left of Squamish River -----						
	----- 8233 Q -----					
C103687	2001535	DL 1517 GP 1 NWD	DICKINSON WILLIAM R PO BOX 2341 SQUAMISH BC V0N3G0	1991/06/24	DOM	500.00 GD
----- SOURCE: Gull Spring on Gull Brook -----						
	----- 8233 R -----					
C104747	2001611	DL 1517 GP 1 NWD	DICKINSON WILLIAM R PO BOX 2341 SQUAMISH BC V0N3G0	1992/04/29	DOM	500.00 GD

Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
----- SOURCE: Pillchuck Creek left of Squamish River -----						
		----- 8233 G -----				
C109836	0305619	L 2 OF DL 993 & 1512 GP 1 NWD PLAN 21704	WINCKLER GUNTER & HELGA E BOX 80 SQUAMISH BC V0N3G0	1971/07/05	DOM SW	1,000.00 GD 250.00 GD
C041340	0316134	A PWRHOUSE SITE WITHIN L 2248 GP 1 NWD	MAGEE HELEN M PO BOX 80 SQUAMISH BC V0N3G0	1972/11/21	PRCOM	3.00 CS
----- SOURCE: Sigurd Creek right of Ashlu Creek -----						
		----- 92G/NW(14-f) W -----				
Z104869	2001943	A POWERHOUSE SITE WITHIN DL 984 NWD	ASHLU POWER CO 260 1075 W GEORGIA ST VANCOUVER BC V6E3C9	1992/05/11	PRGEN	60.00 CS
----- SOURCE: Ashlu Creek right of Squamish River -----						
		----- 92G/NW(14-f) Q -----				
Z102052	2001913	A POWERHOUSE SITE WITHIN UCL NWD IN THE VICINITY OF ASHLU CANYON	WESTERN PACIFIC POWERGEN CORP PO BOX 250 DELTA BC V4K3N7	1991/08/16	PRGEN	812.00 CS

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
		----- 92G/NW(14-f) H -----				
Z102203	2001264	A POWERHOUSE SITE SITUATED ON DL 1180 GRP 1 NWD	ORCHARD RESOURCES INC 700 815 W HASTINGS ST VANCOUVER BC V6C1B4	1989/10/25	PRGEN	290.00 CS
		----- 92G/NW(14-f) S -----				
Z103619	2001564	A POWERHOUSE SITE WITHIN UCL NEW WESTMINSTER DISTRICT IN THE VICINITY OF ASHLU CANYON	SAMPOWER ELECTRIC CORPORATION 1425 1130 WEST PENDER ST VANCOUVER BC V6E4A4	1991/10/15	PRGRN STOPR	847.50 CS 270.00 AF
		----- SOURCE: Roaring Creek right of Ashlu Creek -----				
		----- 92G/NW(14-e) C -----				
C049987	0340338	A PWRHOUSE SITE SIT IN MC 10684K (ASH) GP 1 NWD	SLIMS' EXPLORATION CO LTD 2055 COMO LAKE AVE COQUITLAM BC V3J3R4	1976/10/05	PRCOM	1.07 CS
		----- 92G/NW(14-e) D -----				
C054865	0366170	A PWRHOUSE SITE SIT ON MC 10684K GP 1 NWD	SLIMS' EXPLORATION CO LTD 2055 COMO LAKE AVE COQUITLAM BC V3J3R4	1980/03/03	PRCOM	10.00 CS
		----- SOURCE: Coin Creek right of Ashlu Creek -----				
		----- 92G/NW(14-e) B -----				
C061679	0366109	SEE FILE	SLIMS' EXPLORATION CO LTD 2055 COMO LAKE AVE COQUITLAM BC V3J3R4	1980/03/04	PRCOM	11.43 CS

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
----- SOURCE: Cloudburst Creek right of Pillchuck Creek -----						
----- 8233 B -----						
C102363	2001438	BLK C DL 1513 GP 1 NWD PLAN 18073 EXCEPT THE W 10 METERS THEREOF	GARCIA ERNESTO PO BOX 402 BRACKENDALE BC V0N1H0	1991/01/07	DOM	500.00 GD
----- 8233 C -----						
Z110242	2002132	BLK 14 L 1034 GP 1 NWD PLAN 4352	OQUIST GLEN E & ALLAN F BOX 2015 BRACKENDALE BC V0N1H0	1995/09/20	PRCON	200.00 AN
C048527	0238048	8 AC OF BLK 14 OF L 1034 GP 1 NWD PLAN 4352	OQUIST GLEN E & ALLAN F BOX 2015 BRACKENDALE BC V0N1H0	1961/08/21	DOM IRR	500.00 GD 8.00 AF
C048528	0341576	8 AC OF BLK 15 OF L 1034 GP 1 NWD PLAN 4352	GRAY GERALD S BOX 447 BRACKENDALE BC V0N1H0	1961/08/21	IRR	8.00 AF
Z110243	2002131	BLK 14 L 1034 GP 1 NWD PLAN 4352	OQUIST GLEN E & ALLAN F BOX 2015 BRACKENDALE BC V0N1H0	1995/09/20	DOM	500.00 GD
----- SOURCE: Ryan Brook left of Pillchuck Creek -----						
----- 8233 F -----						
C032647	0270618	BLK A OF L 4315 GP 1 NWD	MCKERNAN KATHERINE 10980 128A ST SURREY BC V3T3G2	1966/09/29	DOM	500.00 GD

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
		----- 8232 N -----				
C010507	0263371	L 5947 GP 1 NWD	LEVETTE CAMPS LTD C/O KRISTY ROSS 1023 CALVERHALL ST N VANCOUVER BC V7L1Y4	1965/07/07	WWKOT	2,400.00 GD
		----- 8232 M -----				
C010507	0263371	L 5947 GP 1 NWD	LEVETTE CAMPS LTD C/O KRISTY ROSS 1023 CALVERHALL ST N VANCOUVER BC V7L1Y4	1965/07/07	WWKOT	2,400.00 GD
----- SOURCE: McGregor Brook left of Cloudburst Creek -----						
		----- 8233 H -----				
C019715	0305888	BLK B OF L 1513 GP 1 NWD	LYNN JOANNE BOX 135 BRACKENDALE BC V0N1H0	1971/08/19	DOM	1,000.00 GD
		----- 8233 T -----				
C107758	2001797	BLK D OF DL 1513 GP 1 NWD PLAN 18073	EDWARDS ERIC J TURNER JANICE L PO BOX 327 GARIBALDI HIGHLANDS BC V0N1T0	1994/02/14	DOM	500.00 GD

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
		----- 8232 T -----				
C030507	0263371	L 5947 GP 1 NWD	LEVETTE CAMPS LTD C/O KRISTY ROSS 1023 CALVERHALL ST N VANCOUVER BC V7L1Y4	1965/07/07	WWKOT	2,400.00 GD
		----- 8232 S -----				
C030507	0263371	L 5947 GP 1 NWD	LEVETTE CAMPS LTD C/O KRISTY ROSS 1023 CALVERHALL ST N VANCOUVER BC V7L1Y4	1965/07/07	WWKOT	2,400.00 GD
		----- 8232 R -----				
C030507	0263371	L 5947 GP 1 NWD	LEVETTE CAMPS LTD C/O KRISTY ROSS 1023 CALVERHALL ST N VANCOUVER BC V7L1Y4	1965/07/07	WWKOT	2,400.00 GD
		----- 8232 Q -----				
C030507	0263371	L 5947 GP 1 NWD	LEVETTE CAMPS LTD C/O KRISTY ROSS 1023 CALVERHALL ST N VANCOUVER BC V7L1Y4	1965/07/07	WWKOT	2,400.00 GD
		----- 8232 P -----				
C030507	0263371	L 5947 GP 1 NWD	LEVETTE CAMPS LTD C/O KRISTY ROSS 1023 CALVERHALL ST N VANCOUVER BC V7L1Y4	1965/07/07	WWKOT	2,400.00 GD

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
		----- 92.J.005.4.4 H -----				
C061773	2000390 L 5652 GP 1 NWD		ALLEN BRIAN E BOX 623 WHISTLER BC V0N1B0	1985/07/30	DOM	500.00 GD
		----- 92.J.005 D -----				
Z110367	2002140 UNSURVEYED CROWN LAND		CERKA JOHN M PRRETT JOHN B PO BOX 250 WHISTLER BC V0N1B0	1995/10/31	BOTTL	10,000.00 GD
----- SOURCE: Brandywine Creek right of Daisy Lake -----						
		----- 92.J.005 A -----				
C020547	0188168 L 3558 GP 1 NWD		PARKS BRANCH SOUTH COAST REGION 1610 MOUNT SEYMOUR RD NORTH VANCOUVER BC V7G1L3 --- ENVIRONMENT LANDS & PARKS MINISTRY OF PARLIAMENT BUILDINGS VICTORIA BC V8V1X4	1951/04/03	DOM	1,000.00 GD
----- SOURCE: Levette Lake on Evans Creek -----						
		----- 8232 U -----				
C030507	0263171 L 5947 GP 1 NWD		LEVETTE CAMPS LTD C/O KRISTY ROSS 1023 CALVERHALL ST N VANCOUVER BC V7L1Y4	1965/07/07	WWKOT	2,400.00 GD

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
C033519	0277120	ALL THE LANDS WITHIN THE BDYS OF	WHISTLER RESORT MUNICIPALITY OF 4325 BLACKCOMB WAY WHISTLER BC V0N1B4	1967/09/22	WMKLA	36,500,000.00 GY
C059777	2000061	ALL THE LANDS WITHIN THE BDYS OF	WHISTLER RESORT MUNICIPALITY OF 4325 BLACKCOMB WAY WHISTLER BC V0N1B4	1982/10/04	WMKLA	912,500,000.00 GY
----- SOURCE: Franz Creek left of Whistler Creek -----						
----- 92.J.006 C -----						
C064419	2000468	UCL GP 1 NWD SHOWN ON PLAN ATTACHED	WHISTLER MOUNTAIN SKI CORPORATION BOX 67 WHISTLER BC V0N1B0	1986/02/05	SNOW	202.00 AF
----- SOURCE: Whistler Creek left of Nita Lake -----						
----- 92.J.006.3.3 D -----						
C109596	0316051	CROWN LAND GP 1 NWD AS SHOWN ON THE ATTACHED PLAN HELD UNDER AGREEMENT WITH THE PROVINCE DATED 30TH SEPTEMBER 1982	WHISTLER MOUNTAIN SKI CORPORATION BOX 67 WHISTLER BC V0N1B0	1972/10/26	RNTPR	4,000.00 GD
--- SOURCE: Cheakamus River left of Daisy Lake -----						
----- 92.J.005.4.4 J -----						
C065444	2000862	L 4216 GP 1 NWD	FETHERSTONHAUGH LYALL E BOX 345 WHISTLER B C V0N1B0	1988/02/29	DOM	500.00 GD

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
----- SOURCE: Alpha Lake on Millar Creek -----						
----- 92.J.005.4.4 F -----						
C053804	0355161	L 5667 GP 1 NWD	WOODS NIGEL BOX 213 WHISTLER BC V0N1B0	1979/08/16	DOM	500.00 GD
----- SOURCE: Deirnes Creek left of Alpha Lake -----						
----- 92.J.006.3.3 M -----						
C064451	2000484	L 3556 GP 1 NWD STRATA PLAN VR755	STRATA CORP PLAN VR755 C/O TED RALFE 2007 ALPHALAKE VILLAGE WHISTLER BC V0N1B2	1986/03/10	LDIMP	0.00 TF
----- SOURCE: Boyd Creek right of Whistler Creek -----						
----- 92.J.006.3.3 J -----						
C064418	2000433	UCL GP 1 NWD SHOWN ON PLAN ATTACHED	WHISTLER MOUNTAIN SKI CORPORATION BOX 67 WHISTLER BC V0N1B0	1985/10/28	SNOW	202.00 AF
----- SOURCE: Whistler Creek left of Nita Lake -----						
----- 92.J.006.3.3 A -----						
C031190	0262410	ALL THE LANDS WITHIN THE BDYS OF	WHISTLER RESORT MUNICIPALITY OF 4325 BLACKCOMB WAY WHISTLER BC V0N1B4	1965/05/18	WMKLA	54,750,000.00 GY

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
----- SOURCE: Callaghan Creek right of Cheakamus River -----						
	----- 92.J.005.3.2 A -----					
C031309	0262432 L 6962 GP 1 NWD		CITY CENTER HOMES LTD C/O B SCRAGG 5516 CYPRESS ST VANCOUVER BC V6N3R6	1965/05/19	WWKOT	2,500.00 GD
----- SOURCE: Vanwest Brook right of Millar Creek -----						
	----- 92.J.005.4.4 G -----					
C055896	0366171 L 4119 & 4120 GP 1 NWD		VAN WEST WATER UTILITY CORP 46 BLACK TUSK DR PINECREST WHISTLER BC V0N1B1	1980/03/07	PPROT	1,000.00 GD
	----- 92.J.005.4.4 A -----					
C030256	0256638 STL 9091P, GP 1 NWD		PACIFIC FOREST PRODUCTS LIMITED 1000 1040 W GEORGIA ST VANCOUVER BC V6E4K4	1964/05/22	WWKOT	5,000.00 GD
--- SOURCE: Alpha Creek left of Millar Creek -----						
	----- 92.J.005.4.4 B -----					
C059299	0365169	UNDERTAKING OF THE LICENSEE WITHIN NO. 5.06/1983 AND ANY SUBSTITUTIONS THEREOF OR AMENDMENTS THERETO	ALPHA CREEK WWKS LTD C/O JOHN CERKA PO BOX 640 GARIBALDI HIGHLANDS BC V0N1B0	1979/02/14	WWKLA	107,492,500.00 GY

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
		----- SOURCE: Daisey lake Creek left of Daisy Lake -----				
		----- 92.G.095.3.4 H -----				
C072741	2001314	L 1 OF DL 3671 GP 1 NWD PLAN 18863	SEA TO SKY RETREAT CO LTD 486 W 26 AVE VANCOUVER BC V5Y2K2	1990/02/26	DOM	4,000.00 GD
		----- SOURCE: Brew Creek right of Daisy Lake -----				
		----- 92.J.005.1.2 C -----				
C059532	0369342	UNDERTAKING OF LICENSEE AS SET OUT IN CPCN NO. 889/1994 & ANY SUBSTITUTION THEREOF OR AMENDMENT THERETO	BLACK TUSK VILLAGE STR CORP PLAN VR129 295 FULFORD-GANGES RD SALT SPRING BC V8K2K6	1981/10/21	WMKLA	17,155,000.00 GY
		----- SOURCE: Cheakamus River left of Daisy Lake -----				
		----- 92.J.005.1.2 F -----				
Z107775	2001801	CONSERVATION PROJECT WITHIN CHEAKAMUS RIVER NWD	FISHERIES BRANCH 10334 152A ST SURREY BC V3R7P8 ------ ENVIRONMENT LANDS & PARKS MINISTRY OF PARLIAMENT BUILDINGS VICTORIA BC V8V1X4	1994/02/16	CONUS	800.00 CS

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
----- SOURCE: Cheakamus River left of Squamish River -----						
---- 92.G.095.3.1 F -----						
F006047	0072168	L 2662 GP 1 NWD	FULFORD LUMBER CO LTD C/O BOX 680 SQUAMISH BC V0N3G0	1926/10/04	DOM	500.00 GD
----- SOURCE: Freeman Creek right of Cheakamus River -----						
--- 92.G.095.3.1 A -----						
C014767	0142449	L 2663 GP 1 NWD	BC HYDRO & POWER AUTHORITY PWR SUPPLY BUS. SERVICES 6911 SOUTHPOINT DR (E08) BURNABY BC V3N4X8	1940/11/08	DOM	1,000.00 GD
----- SOURCE: Rubble Creek left of Cheakamus River -----						
--- 92.G.095.3.2 L -----						
Z101989	2001574	LOT 1, EXCEPT PART IN STATUTORY RIGHT OF WAY PLAN 15442, DISTRICT LOT 311 PLAN 7212	PERRETT JON 546 BLACK TUSK DR WHISTLER BC V0N1B0	1991/12/03	BOTTL	5,000.00 GD
---- 92.G.095.3.2 A -----						
C022284	0204670	THR POWER UNDERTAKING OF THE CO NWD	BC HYDRO & POWER AUTHORITY PWR SUPPLY BUS. SERVICES 6911 SOUTHPOINT DR (E08) BURNABY BC V3N4X8	1954/09/20	PRGEN	700,000.00 AF

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
		----- 92.G.095.3.2 J -----				
2102872	2001912	A POWERHOUSE SITE WITHIN DL 3113 NEW WESTMINSTER DISTRICT	RMC ENERGY CORP 3975 LORAINE AVE NORTH VANCOUVER BC V7R4C1	1992/04/14	PRGEN	1.00 CS
		----- SOURCE: Cheakamus River left of Squamish River -----				
		----- 92.G.095.3.4 A -----				
C022284	0204670	THE POWER UNDERTAKING OF THE CO NWD	BC HYDRO & POWER AUTHORITY PWR SUPPLY BUS. SERVICES 6911 SOUTHPOINT DR (E08) BURNABY BC V3N4X8	1954/09/20	PRGEN	700,000.00 AF
C022285	0204670	STOR FOR C 22284 CHEAKAMUS R & RUBBLE CR	BC HYDRO & POWER AUTHORITY PWR SUPPLY BUS. SERVICES 6911 SOUTHPOINT DR (E08) BURNABY BC V3N4X8	1954/09/20	STOPR	45,000.00 AF
2110107	2001985	THE POWER UNDERTAKING OF THE LICENSEE AT THE CHEAKAMUS GENERATING STATION WITHIN PARCEL A OF IR NO 7 SKOWISHIN GRP 1 NWD	BC HYDRO & POWER AUTHORITY PWR SUPPLY BUS. SERVICES 6911 SOUTHPOINT DR (E08) BURNABY BC V3N4X8	1995/08/29	PRGEN	2,295.00 CS
		----- SOURCE: Roe Creek left of Shadow Lake -----				
		----- 92.G.095.3.4 G -----				
C069888	2000969	UNDERTAKING OF THE LICENSEE	AQUA 1 BEVERAGE COMPANY INC 135B RIVERSIDE DR NORTH VANCOUVER BC V7H1T6	1988/06/16	BOTTL	20,000.00 GD

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
		----- 8233 S -----				
C105800	0264777	L A BLK A L 2659 GP 1 NWD PLAN 16309	WHISTLERS MOTHERS HOTEL & RESTAURANT 902 1030 GEORGIA ST W VANCOUVER BC V6E2Y3	L1965/09/28	PRRES	3.00 CS
C105799	0264777	L 1 BLK A L 2659 GP 1 NWD PLAN 16309	WHISTLERS MOTHERS HOTEL & RESTAURANT 902 1030 GEORGIA ST W VANCOUVER BC V6E2Y3	L1965/09/28	DOM	500.00 GD
		----- SOURCE: Chance Creek right of Cheakamus River -----				
		----- 92.G.095.3.1 D -----				
F005607	0012302	S 1/2 OF L 2661 GP 1 NWD	FULFORD LUMBER CO LTD C/O BOX 680 SQUAMISH BC V0N3G0	1919/07/15	DOM	500.00 GD
		----- 92.G.095.3.1 H -----				
C056052	0230783	PWRHOUSE SITE LOCATED WITHIN L 2661 GP 1 NWD	ATTORNEY GENERAL MINISTRY OF PARLIAMENT BUILDINGS VICTORIA BC V8V1X4	1960/05/02	PRCOM	7.50 CS
		----- SOURCE: Crane Creek right of Cheakamus River -----				
		----- 92.G.095.3.1 E -----				
F006046	0072168	L 2662 GP 1 NWD	FULFORD LUMBER CO LTD C/O BOX 680 SQUAMISH BC V0N3G0	1926/10/04	DOM	500.00 GD

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
C057709	0368388	A PWRHOUSE SITE ON THAT PART OF L 1 OF L 1249 GP 1 NWD PLAN 4698 LYING E OF BCR R/W PLAN 1040	TRETHEWAY DONNA L BOX 2005 SQUAMISH BC V0N3G0	1981/04/16	PRRES	1.25 CS
		----- 8232 X -----				
C038659	0296465	L 2605 GP 1 NWD	BRUBACHER WARREN H & JANICE L BOX 215 BRACKENDALE BC V0N1H0	1970/05/22	DOM	500.00 GD
----- SOURCE: Hut Creek right of Cheakamus River -----						
		----- 8232 L -----				
C029843	0252142	L 6995 GP 1 NWD	FERRIS JOHN D & SUSAN E LOWERY B PO BOX 603 SQUAMISH BC V0N3G0	1963/09/17	WWKOT	1,000.00 GD
C029844	0252142	L 6995 GP 1 NWD	FERRIS JOHN D & SUSAN E LOWERY B PO BOX 603 SQUAMISH BC V0N3G0	1963/09/17	PONDS	15,000.00 GD
----- SOURCE: Conroy Creek left of Cheakamus River -----						
		----- 8233 K -----				
C065235	2000729	UNDERTAKING OF LICENSEE	AQUA 1 BEVERAGE COMPANY INC 1358 RIVERSIDE DR NORTH VANCOUVER BC V7H1T6	1987/01/23	BOTTL	22,000.00 GD

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Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
		----- 8232 H -----				
F020209	0247501	4.77 AC OF L A & B OF L 1244 GP 1 NWD PLAN 5179	SCHOOL DISTRICT NO 44 NORTH VANCOUVER NORTH VANCOUVER OUTDOOR SCHOOL PO BOX 250 BRACKENDALE B C V0N1H0	1962/12/12	IRR	4.77 AF
		----- SOURCE: Swift Creek left of Cheakamus River -----				
		----- 8232 F -----				
C028360	0238540	BLK 10 OF L 1249 GP 1 NWD PLAN 4698	ROSS GORDON C BOX 1009 BRACKENDALE BC V0N1H0	1961/09/18	DOM	500.00 GD
		----- 8232 BB -----				
C045280	0328109	PWRHOUSE SITE WITHIN BLK 10 OF L 1249 GP 1 NWD PLAN 4698	ROSS GORDON C BOX 1009 BRACKENDALE BC V0N1H0	1974/11/18	PRRES	1.50 CS
		----- 8232 EE -----				
C057708	0360387	7 AC OF THAT PART OF L 1 L 1249 GP 1 NWD PLAN 4698 LYING E OF BC RLY R/W (PLAN 1040)	TRETHEWAY DONNA L BOX 2005 SQUAMISH BC V0N3G0	1981/04/16	DOM IRR	500.00 GD 7.00 AF

02/02/96 14:36 ☎604 660 8926 BC ENVIRON. LMR 007/055

Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
---- SOURCE: Brooks Creek left of Brohm River -----						
	----- 8232 HH -----					
C061639	2000125	A PWRHOUSR SITE SITUATED ON UCL NWD & THE LICENCE IS APPURT-ENANT TO L 1956 & 7093 NWD	KEVMAC DEVELOPMENTS CORP C/O DAYTON MINING CORP 1610 200 BURRARD ST VANCOUVER BC V6C3L6	1982/08/27	PRCON	2.00 CS
----- SOURCE: Brohm River right of Cheekye River -----						
	----- 8232 GG -----					
C061638	2000050	L 1956 & 7093 GP 1 NWD	KEVMAC DEVELOPMENTS CORP C/O DAYTON MINING CORP 1610 200 BURRARD ST VANCOUVER BC V6C3L6	1982/08/27	DOM	1,000.00 GD
----- SOURCE: Cheakamus River left of Squamish River -----						
	----- 8232 JJ -----					
C069983	2001197	TO THE CONSERV PROJ OF THE LICENSEE WITHIN L B BLK 11 DL 1244 GP 1 NWD PLAN 5179	FISHERIES & OCEANS CANADA 400 - 555 W HASTINGS ST VANCOUVER BC V6B5G3 ------ SCHOOL DISTRICT NO 44 NORTH VANCOUVER NORTH VAN OUTDOOR SCHOOL BOX 250 BRACKENDALE BC V0N1H0	1989/06/20	CONUS	15.00 CS

02/02/96 14:36 ☎604 660 8926 BC ENVIRON. LMR 006/033

Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
----- SOURCE: Lynn Brook right of Dryden Creek -----						
----- 8231B K -----						
F052930	0277514	L 2 OF SEC 14 TP 50 RCM PLAN 15842	MACDONALD WILLIAM A BOX 203 SQUAMISH BC V0N3G0	1968/01/23	LDINP	1,500.00 GD
----- 8231B J -----						
F052930	0277514	L 2 OF SEC 14 TP 50 RCM PLAN 15842	MACDONALD WILLIAM A BOX 203 SQUAMISH BC V0N3G0	1968/01/23	LDINP	1,500.00 GD
----- SOURCE: Dryden Creek left of Squamish River -----						
----- 8231B C -----						
F020092	0152341	THAT PART OF PARCEL A REF PLAN 616 OF SEC 14 TP 50 RCM LYING W OF THR TRANSMISSION LINE R/W SHOWN ON REF PLAN 2623 & EXC REF PLAN 1815	DRAGE MELVYN S & IRENE F PO BOX 1963 SQUAMISH B C V0N3G0	1944/04/25	DOM	1,000.00 GD
F020093	0152340	PARCEL 1 OF SEC 14 TP 50 RCM REF PLAN 1815	LEWIS RONALD W & DOLORES Y BOX 404 BRACKENDALE B C V0N1H0	1944/04/25	DOM	1,000.00 GD
----- SOURCE: Cheekye River left of Cheakamus River -----						
----- 8232 CC -----						
C046906	0329485	L 1 OF BLK A OF L 1818 GP 1 NWD PLAN 3565	DUBECK HARVEY R & TANIS H GD GOLDBRIDGE BC V0K1P0	1975/09/15	DOM	500.00 GD

02/02/96 14:36 ☎604 660 8926 BC ENVIRON. LMR 005/005

Licence Number	File Number	Appurtenancy	Licensee/Applicant	Priority YYYY/MM/DD	PUC	Quantity/Units
---- SOURCE: Meighan Creek left of Squamish River -----						
----- 8231A G -----						
C027696	0243956	ALL THE LANDS WITHIN THE BDYS OF	SQUAMISH DISTRICT OF BOX 310 SQUAMISH BC V0N3G0	1962/09/24	SEWG	10,000.00 GD
----- SOURCE: Hop Ranch Creek left of Squamish River -----						
----- 8231B A -----						
F003174	0265349	10 AC OF S 1/2 OF NW 1/4 OF SEC 14 TP 50 ECM	HOP RANCH CR BOX 1741 SQUAMISH B C V0N3G0	1910/06/20	DOM IRR	1,500.00 GD 25.00 AF
----- SOURCE: Norman Brook right of Dryden Creek -----						
----- 8231B F -----						
C056051	0237466	L 4 OF SEC 14 TP 50 ECM PLAN 13991	BARR NORMAN R & DORREN M BOX 335 SQUAMISH B C V0N3G0	1961/07/17	LDIMP	4,000.00 GD
---- SOURCE: Dryden Creek left of Squamish River -----						
----- 8231B E -----						
F020094	0237293	L 3 OF SEC 14 TP 50 ECM PLAN 12179	MARCOUX EMILIEN & GRACE M PO BOX 58 BRACKENDALE B C V0N1H0	1961/06/20	DOM	500.00 GD

02/02/96 14:35 ☎604 660 8926 BC ENVIRON. LMR 004/055

Upstream/Downstream Users Ministry Of Environment (B.C.)
Water Licencing System

Report Requested By : MDILORENZO
Date Report Requested : 1996/02/02 13:18
Report Sorted By : Source Hierarchy
Selection Criteria
START : SO15685 - Squamish River on Salt Water
END : MO62635 - Elaho River right of Squamish River
TRIBUTARIES : Y

02/02/96 14:35 ☎604 660 8926 BC ENVIRON. LWR 003/003

APPENDIX D
Employment Notification

Intensive Forest Management Ltd.

Box 385, Pemberton, B.C., V0N 2L0

Tel: (604) 894-6004 Fax: (604) 894-6516

DATE: May 10, 1996

FAX TO:

From: Tim Napier

Total Number of Pages (including cover page) _____1____.

The Lillooet River Watershed Committee, will be looking very shortly for 25 candidates for Forest Renewal projects in the Pemberton area (Also, to the same extent in the Squamish area). 50 % of these should be displaced Forest workers. Subject to funding, the possible start-up date will be June 1st, 1996.

Priority is given to displaced / unemployed Forestry workers that may be interested in getting training and work, primarily in watershed assessment, fisheries enhancement (and other aspects of Forest Renewal jobs including spacing, brush control in other potential projects.). The work is projected to last about 4-5 months during the summer & Fall field season . Rates, and job descriptions have not yet been finaled. The initial 25 people will very likely expand as we hear about more projects being approved.

Please have anybody who is possibly interested in this sort of work and re-training to send up a resume to me.

Members of the "first nation" are also given a high priority. After May 27, we will be expanding our search for interested people to the community at large, including students.

Thank you very much... Tim Napier

Forest Companies and Related Businesses

A fax or a letter (attached) was sent to each of the following companies during the second week in May, 1996 with phone calls made the following week:

Black Mount Logging
Brohm Creek Logging (Halray Logging)
C.A. Ross
Canadian Forest Products
Cascade Industries Ltd (Dave Walker Contracting)
Cat Lake Contracting
Continental Pole
CRB Logging
D & S Log Salvage
Dave Blundell Contracting
Diamond Head Construction
Doug Horth Contracting
Elaho Logging Limited
Eve Holdings Limited
Forestland Industries
GBA Logging Limited (Wood River Contracting)
Gilham Poling Ltd
Glacier Lake Logging Co. Ltd.
Harnor Logging
Howe Sound Forest Products Ltd.
Interfor
J.A. Contracting/R&R Cedar
JGT Falling Co. Ltd
J.Wolf Falling & Bucking
Jim Raymond Logging
L & W Talbot Logging
LeBlanc Brothers Logging (Daisy Lake Timber, Echo Lake Contracting, Lizzie Bay Logging)
Lineham Logging
MacMillan Bloedel Limited
Magee Contracting
Molnar, Tibor
Mount Currie Logging
N & N Contracting
N'Quatrqua Logging Co. Ltd
P. Staehli & Son Contracting
Pat Quigley Log Hauling
Perkins Brothers Logging
PhareOne Resources
Philip Tourand and Son Contracting
RK Contracting

Richmond Plywood Corporation Limited
Robert Thomson Contracting
Scott Paper Limited
Soo Forest Products
Spa Logging
Spruce Creek Contracting
Squamish Mills (Squamish Timber Co. Ltd)
Terminal Forest Products
Terry Arsenault & Sons Contracting
Wim Tewinkel
Thuro Logging
Triple C Logging
Valleau Logging
Viking Forest Products
West Barr Contracting (Tyko Timber)
Allen Woods

APPENDIX E
FHAP Field Data

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: 96/08/01
Temperature: 13*C @ 8:40

Watershed: ____ SQUAMISH
Weather: _____ SUNNY
Survey Crew: ___ REBECCA, PAUL, SCOTT, JAMIE

Sub-Basin: _____ BROHM CREEK
Discharge (m3 /s): not measured
Subsampling Fractions. ___ R/G/C
(R / P / G / C / O)

	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Mean Depth Bankfull (m)	Mean Depth Water (m)			Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max. Depth (m)	Pools Only Crest (m)	Pools Only Residual (m)	Pools Only Pool Type	Bed Material Type Dom.	Bed Material Type Sub- Dom.	Spawning Gravel ?	
1	1	0	C-1	1	100	4.5	1.5	0.2	0.3	0.5	11.8	9.5	N/A	N/A	N/A	N/A	B	C	L	AR
2	1	100	R-1	1	100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	C	G	H	AR
3	1	200	C-2	1	40	5	1.1	0.3	0.3	0.3	17	7.4	N/A	N/A	N/A	N/A	C	B	L	AR
4	1	240	R-2	1	125	N/A	1.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	G	C	H	AR
5	1	365	R-2	1	40	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	C	B	L	AR
6	1	405	R-2	1	143	1	1.3	0.5	0.45	0.3	16	7	N/A	N/A	N/A	N/A	C	G	L	AR
7	1	548	R-2	1	na	2	2	0.8	0.6	0.3	8	5.9	N/A	N/A	N/A	N/A	B	C	N	N/A
8	2	0	R-1	1	0	2	1.3	0.8	0.6	0.3	8	5.9	N/A	N/A	N/A	N/A	B	C	N	N/A
9	2	36	R-1	1	36	2	1.3	0.2	0.2	0.5	27	6	N/A	N/A	N/A	N/A	C	G	H	AR
10	2	78	C-1	1	42	4	1.7	0.3	0.2	0.5	28.2	12.3	N/A	N/A	N/A	N/A	C	G	H	AR
11	3	0	C-1	1	60	4	1.7	0.3	0.2	0.5	28.2	12.8	N/A	N/A	N/A	N/A	C	G	H	AR
12	3	60	R-1	1	na	2	1.45	0.25	0.65	0.25	15.5	7.6	N/A	N/A	N/A	N/A	C	G	L	AR
13	4	0	R-1	1	0	2	1.4	0.2	0.6	0.3	15.5	7.6	N/A	N/A	N/A	N/A	C	G	L	AR
14	4	200	R-1	1	200	2	1.3	0.3	0.2	0.3	40	5.3	N/A	N/A	N/A	N/A	C	G	L	AR
15	4	273	R-1	1	73	1	0.7	0.2	0.2	0.2	15.5	10.8	N/A	N/A	N/A	N/A	C	G	H	AR
16	5	0	G-1	1	0	1	0.7	0.2	0.2	0.2	15.5	10.8	N/A	N/A	N/A	N/A	C	G	H	AR
17	5	200	G-1	1	419	1	1.3	0.2	0.3	0.3	12.7	7.6	N/A	N/A	N/A	N/A	C	G	H	AR
18	5	419	R-1	1	na	2.5	1.8	0.5	0.6	0.3	25	3.8	N/A	N/A	N/A	N/A	C	B	N	N/A
19	6	0	R-1	1	200	2.5	1.8	0.5	0.6	0.3	25	3.8	N/A	N/A	N/A	N/A	C	B	N	N/A
20	6	200	C-1	1	75	4.5	1.5	0.2	0.3	0.3	21.4	7	N/A	N/A	N/A	N/A	C	C	N	N/A

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/08/01
Temperature: _____ 13 @ 8:40

Watershed: __ SQUAMISH
Weather: ____ SUNNY
Survey Crew: _ REBECCA, PAUL, SCOTT, JAMIE

Sub-Basin: _____ BROHM CREEK
Discharge (m3 /s): not measured
Subsampling Fractions: _____ R/G/C
(R / P / G / C / O)

	Total LWD Tally	Functional LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 - 20 cm	20 - 50 cm	> 50 cm	Cover Type	%	Cover Type	%	Type	Access	Length (m)		Type	Structure	Canopy Closure			
1	20	10	10	0	OV	25	SWD	25	N	N	N	N	M	YF	3	N		P. 1, 3, 4
2	0	0	0	0	IV	40	SWD	25	N	N	N	N	M	YF	4	N		P. 1, 3, 4
3	20	10	5	5	SWD	30	OV	25	SC	P	45	N	M	YF	3	N		P. 1, 3, 4
4	0	0	0	0	OV	40	C	10	N	N	N	N	M	YF	3	N		P. 1, 3, 4
5	0	0	0	0	N/A	N/A	N/A	N/A	SC	P	40	N	M	YF	3	N		P. 1, 3, 4
6	15	5	5	5	OV	30	SWD	15	N	N	N	N	M	YF	3	N		P. 1, 3, 4
7	10	0	5	5	OV	40	IV	5	N	N	N	MC	M	YF	4	N		IV ALGAE
8	0	0	0	0	OV	30	IV	5	SC	P	N/A	DW	M	YF	2	N		SEE FIELD NOTESP.5
9	10	3	5	2	SWD	35	OV	30	SC	G	N/A	DW	M	YF	2	N		CHANNEL SPLITS
10	50	20	20	10	SWD	40	IV	10	N	N	N	DW	M	YF	2	N		IV ALGAE
11	50	20	20	10	SWD	50	OV	20	N	N	N	PD	M	YF	2	N		ALSO DW FIELD NOTES P. 5&6
12	50	22	20	10	SWD	50	OV	20	SC	G	NA	PD	M	YF	2	N		SC: G; % UNDERCUT BANKS; H/AR
13	0	0	0	0	SWD	50	OV	20	N	N	N	DW	M	YF	2	N		FIELD NOTES P. 6&7
14	12	8	2	2	SWD	50	OV	20	N	N	N	DW	M	YF	2	N		FISH OBSERVED
15	4	2	2	0	IV	30	SWD	25	N	N	N	DW	M	YF	2	N		17M DFO ALGAE BUCKETS
16	0	0	0	0	IV	35	SWD	15	N	N	N	DW	M	YF	2	N		LOTS OF ALGAE
17	3	1	1	1	IV	50	OV	10	N	N	N	DW	M	YF	2	N		P.2,7,8
18	6	3	2	1	OV	5	SWD	5	N	N	N	DW	M	YF	2	N		
19	0	0	0	0	OV	5	SWD	5	SC	P	N/A	MC	M	YF	5	N		SC ON RIGHT AT 13M (DRY)
20	8	4	3	1	OV	25	SWD	15	N	N	N	DW	M	YF	5	N		SEE FIELD NOTES

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: 96/08/01
Temperature: 13*C 8:40

Watershed: ___ SQUAMISH
Weather: _____ SUNNY
Survey Crew: _ REBECCA, PAUL, SCOTT, JAMIE

Sub-Basin: _____ BROHM CREEK
Discharge (m3 /s): not measured
Subsampling Fractions: ___ R/G/C
(R / P / G / C / O)

	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Mean Depth Bankfull (m)	Mean Depth Water (m)			Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max. Depth (m)	Pools Only Crest (m)	Pools Only Residual (m)	Pools Only Pool Type	Bed Material Type Dom.	Bed Material Type Sub- Dom.	Bed Material Type Spawning Gravel ?	
1	6	275	R-2	1	na	2	1.8	0.1	0.3	0.8	20	7	NA	NA	NA	NA	C	G	H	AR
2	7	0	R-1	1	118	2	1.8	0.1	0.3	0.8	20	7	NA	NA	NA	NA	C	G	H	AR
3	7	118	C-1	1	na	8	2	0.5	0.3	0.2	20	7.9	NA	NA	NA	NA	B	C	L	AR
4	8	0	C-1	1	200	8	2	0.5	0.3	0.2	20	7.9	NA	NA	NA	NA	B	C	N	N/A
5	8	200	G-1	1	62	1	N/A	N/A	N/A	N/A	N/A	N/A	NA	NA	NA	NA	G	G	H	AR
6	8	262	C-2	1	na	8	1.3	0.1	0.5	0.5	12.6	8.4	NA	NA	NA	NA	B	C	H	AR
7	9	0	R-1	1	na	N/A	1.3	0.1	0.5	0.5	12.6	8.4	NA	NA	NA	NA	B	C	L	AR
8	9	140	R-1	1	140	2.5	1.8	0.3	0.3	0.3	21	6.3	NA	NA	NA	NA	B	C	N	N/A
9	9	215	C-1	1	75	5	0.95	0.25	0.35	0.15	26	7.4	NA	NA	NA	NA	C	G	H	AR
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				

note : mean depth and mean width was not measured in Reach 8 at 200m.

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: 96/08/01
Temperature: 13 @ 8:40

Watershed: __ SQUAMISH
Weather: ____ SUNNY
Survey Crew: _ REBECCA, PAUL, SCOTT, JAMIE

Sub-Basin: _____ BROHM CREEK
Discharge (m3 /s): not measured
Subsampling Fractions: _____ R/G/C
(R / P / G / C / O)

	Total LWD Tally	Functional LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 - 20 cm	20 - 50 cm	> 50 cm	Cover Type	%	Cover Type	%	Type	Access	Length (m)		Type	Structure	Canopy Closure			
1	10	0	0	10	IV	15	OV	5	N	N	N	DW	M	YF	2	N		ALGAE P. 8&9
2	0	0	0	0	N/A	N/A	N/A	N/A	N	N	N	DW	M	YF	2	N		FIELD NOTES P.9
3	20	10	5	5	IV	10	SWD	5	N	N	N	PD	M	YF	4	N		FIELD NOTES P.9
4	0	0	0	0	OV	10	IV	10	N	N	N	DW	M	YF	3	N		LOTS OF FISH FIELD NOTES P. 10
5	80	30	30	20	OV	35	SWD	15	N	N	N	PD	M	YF	4	N		P. 10
6	0	0	0	0	OV	35	SWD	15	N	N	N	PD	M	YF	4	N		P. 10
7	0	0	0	0	OV	30	SWD	10	N	N	N	N	M	YF	2	N		P. 10
8	20	10	8	2	OV	5	SWD	5	SC	P	N/A	DW	M	YF	2	N		ON LEFT P. 10
9	0	0	0	0	SWD	80	OV	70	TRIB FROM LAKE			N	M	YF	2	CV		ON RIGHT TRIB FROM LAKE
10																		LOTS OF FRY P. 11
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: 96/08/02
Temperature: 13*C 9:07AM

Watershed: ___ SQUAMISH
Weather: _____ SUNNY/CLOUDY
Survey Crew: _ JAMEY, PAUL, REBECCA, SCOTT

Sub-Basin: _____ BROHM CREEK
Discharge (m3 /s): not measured
Subsampling Fractions: ___ R/C
(R / P / G / C / O)

							Mean Depth				Mean Width		Pools Only				Bed Material Type			
	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Bankfull (m)	Water (m)			Bankfull (m)	Wetted (m)	Max. Depth (m)	Crest (m)	Residual (m)	Pool Type	Dom.	Sub- Dom.	Spawning Gravel ?	
1	10	0	R-1	1	0	1	1.6	0.25	0.35	0.8	26	7.4	NA	NA	NA	N/A	G	G	H	AR
2	10	230	R-1	1	230	3	0.9	0.1	0.2	0.3	13	7.7	NA	NA	NA	N/A	C	C	N	N/A
3	10	626	R-1	1	396	2	2.4	0.2	0.2	0.4	17.3	11	NA	NA	NA	N/A	B	C	N	N/A
4	11	0	C-1	1	0	9	2.8	0.35	0.8	0.35	17.8	11.2	0.8	0	0.8	U	B	S	N	N/A
5	11	193	C-1	1	193	4	2.65	0.6	0.65	0.45	13.2	5.5	NA	NA	NA	N/A	C	B	N	N/A
6	12	0	C-1	1	0	10	2.65	0.6	0.65	0.45	13.2	5.5	NA	NA	NA	N/A	C	B	N	N/A
7	12	182	C-1	1	182	21	3	0.2	0.1	0.8	20.5	12.8	NA	NA	NA	N/A	B	C	N	N/A
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/08/02
Temperature: _____ 13 @ 9:07

Watershed: __ SQUAMISH
Weather: ____ SUNNY/CLOUDY
Survey Crew: JAMEY, PAUL, SCOTT, REBECCA

Sub-Basin: _____ BROHM CREEK
Discharge (m3 /s): not measured
Subsampling Fractions: _____ R/C
(R / P / G / C / O)

	Total LWD Tally	Functional LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 - 20 cm	20 - 50 cm	> 50 cm	Cover Type	%	Cover Type	%	Type	Access	Length (m)		Type	Structure	Canopy Closure			
1	0	0	0	0	OV	80	SWD	80	N	N	N	N	M	YF	2	N		P.11
2	10	3	5	2	OV	20	C	5	N	N	N	DW	M	YF	3	N		P.13
3	2	0	2	0	OV	5	SWD	5	N	N	N	DW	M	YF	3	N		P14
4	20	10	8	2	SWD	40	B	5	LAKE TRIB LEFT			DW	M	YF	3	N		POOL HAS NO CREST&
5	6	2	2	2	SWD	45	OV	5	N	N	N	MC	M	YF	3	C		TRIB FROM LEFT @ 6M
6	0	0	0	0	B	10	SWD	10	SC	N	N/A	DW	M	YF	1	N		SC ON LEFT
7	>30	>10	>10	>10	SWD	30	B	10	N	N	N	DW	M	YF	2	JM/C		NO ANADROMOUS FISH;
8																		GRADIENT >29 % PAST
9																		THIS POINT
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		

Level 1 - Habitat Survey Data Form

Forest District: ____ SQUAMISH
Watershed: __ SQUAMISH
Sub-Basin: _____ BROHM CREEK TRIBS
NTS map sheet: _____
Weather: ____ SUNNY
Discharge (m3 /s): not measured
Survey Date: _____ 96/08/06
Survey Crew: _ PAUL, JAMEY, SCOTT, REBECCA
Subsampling Fractions: _____ R/C
Temperature: _____ 14 oC
(R / P / G / C / O)

	Total LWD Tally	Functional LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 - 20 cm	20 - 50 cm	> 50 cm	Cover Type	%	Cover Type	%	Type	Access	Length (m)		Type	Structure	Canopy Closure			
1	30	10	10	10	OV	30	SWD	30	N	N	N	N	C	MF	3	BR		P.18 GOOD SPAWNING LOTS FRY
2	0	0	0	0	OV	0	SWD	0	N	N	N	N	D	PS	1	CV		NEED TO BE CLEANED OF SOME LWD
3	0	0	0	0	SWD	90	OV	75	N	N	N	N	M	PS	3	CV		P. 19
4																		ON LAKE SIDE BEFORE
5																		HIGHWAY 99 P 20
6																		
7																		
8																		
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18																		
19																		
20																		

Level 1 - Habitat Survey Data Form

Forest District: _____ Squamish
NTS map sheet: _____
Survey Date: _____ 96/08/13
Temperature: _____ 12

Watershed: _____ Squamish
Weather: _____ Sunny
Survey Crew: ___ Paul, Scott, Jamey, Rebecca

Sub-Basin: _____ Pilchuk Creek
Discharge (m3 /s): not measured
Subsampling Fractions: ___ G/R
(R / P / G / C / O)

	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Mean Depth Bankfull (m)	Mean Depth Water (m)			Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max. Depth (m)	Pools Only Crest (m)	Pools Only Residual (m)	Pools Only Pool Type	Bed Material Type Dom.	Bed Material Type Sub- Dom.	Bed Material Type Spawning Gravel ?	
1	1	0	G-1	1	0	1	>5	>1	>2	>1	16	13.9	N	N	N	N/A	S	S	N	N/A
2	1	204	G-1	1	204	1	2.5	0.75	1	0.75	16	14	N	N	N	N/A	S	S	N	N/A
3	1	417	G-1	1	213	1	1.9	0.4	0.4	0.4	23	17.6	N	N	N	N/A	S	G	L	AR
4	1	575	G-1	1	158	1	1.5	0.5	0.45	0.5	19	11.7	N	N	N	N/A	S	S	N	N/A
5	1	612	R-1	1	37	2	1.8	0.1	0.1	0.3	27	12.8	N	N	N	N/A	G	S	L	AR
6	1	705	R-1	1	93	2	1.6	0.1	0.1	0.1	27.3	12.9	N	N	N	N/A	G	S	L	AR
7	1	926	G-2	1	221	1	1.1	0.3	0.25	0.25	19.2	14	N	N	N	N/A	G	S	L	AR
8	1	1126	G-2	1	200	1	1.8	0.7	0.8	0.7	16.4	15.4	N	N	N	N/A	S	S	N	N/A
9																				
10																				
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18																				
19																				
20																				

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
Watershed: __ SQUAMISH
Sub-Basin: _____ PILCHUK CREEK
NTS map sheet: _____
Weather: ____ SUNNY
Discharge (m3 /s): not measured
Survey Date: _____ 96/08/13
Survey Crew: PAUL, SCOTT, JAMEY, REBECCA
Subsampling Fractions: _____ G/R
Temperature: _____ 12
(R / P / G / C / O)

	Total LWD Tally	Functional LWD Tally			Cover		Cover		Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 -	20 -	> 50		%		%	Type	Access	Length		Type	Structure	Canopy			
1	2	0	2	0	OV	2	SWD	1	NA	NA	N/A	N	D	PS	1	BR		p.32 - @132m beaver dam
2	35	10	15	10	OV	1	SWD	1	NA	NA	N/A	N	D	PS	0	N		p.32
3	2	0	2	0	IV	60	OV	10	NA	NA	N/A	N	M	YF	0	N		p.33
4	0	0	0	0	IV	50	OV	10	NA	NA	N/A	N	M	YF	1	N		p.33
5	0	0	0	0	IV	80	C	10	NA	NA	N/A	MC	M	YF	0	N		p.33
6	0	0	0	0	IV	80	OV	5	NA	NA	N/A	MC	M	YF	0	N		p.34
7	5	5	0	0	IV	60	SWD	5	NA	NA	N/A	N	M	YF	0	N		p.34 - beaver dam
8	0	0	0	0	OV	5	SWD	5	SC	N	N/A	N	M	YF	1	BR		p.34 - SC at 1108m on left
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/07/09
Temperature: _____ 13 C @ 10:15am

Watershed: ____ Squamish
Weather: _____ Sunny / Clouds
Survey Crew: ___ Paul, Rebecca, Jamey, Scott, Bettina

Sub-Basin: _____ Pilchuck Creek
Discharge (m3 /s): not measured
Subsampling Fractions: ___ G/C
(R / P / G / C / O)

	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Mean Depth Bankfull (m)	Mean Depth Water (m)			Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max. Depth (m)	Pools Only Crest (m)	Pools Only Residual (m)	Pools Only Pool Type	Bed Material Type Dom.	Bed Material Type Sub- Dom.	Spawning Gravel ?	
1	2	0	G-1	1	0	3	2.5	0.65	1	0.7	26.1	15.9	N	N	N	N/A	S	S	N	N/A
2	2	154	G-1	1	154	3	2.8	0.5	0.6	0.8	25.5	15	N	N	N	N/A	S	S	N	N/A
3	2	300	G-1	1	146	3	2	1	0.5	0.45	15	10.9	N	N	N	N/A	S	S	N	N/A
4	2	410	G-1	1	110	3	1.9	0.3	0.4	0.3	25	16.5	N	N	N	N/A	S	C	L	AR
5	2	510	C-1	1	100	4.5	1.6	0.1	0.1	0.1	13	10	N	N	N	N/A	G	S	H	AR
6	2	543	G-2	1	33	4	N/A	N/A	N/A	N/A	N/A	N/A	N	N	N	N/A	S	S	N	N/A
7	2	630	G-2	1	87	4	N/A	N/A	N/A	N/A	N/A	N/A	N	N	N	N/A	S	S	N	N/A
8	3	0	C-1	1	210	4	3.4	0.4	0.1	0.3	>25	9.4	N	N	N	N/A	G	S	H	AR
9	3	210	C-1	1	145	6	1.5	0.1	0.1	0.5	30	26	N	N	N	N/A	C	G	L	AR
10	3	355	C-1	1	NA	8	3.8	0.1	0.5	0.3	12	4.5	N	N	N	N/A	C	B	N	N/A
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/07/09
Temperature: _____ 13 C @ 10:15 am

Watershed: __ SQUAMISH
Weather: ____ SUNNY/CLOUDS
Survey Crew: _ PAUL, JAMEY, SCOTT, REBECCA,BETTINA

Sub-Basin: _____ PILCHUCK CREEK
Discharge (m3 /s): not measured
Subsampling Fractions: _____ G/C
(R / P / G / C / O)

	Total LWD Tally	Functional LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 -	20 -	> 50	Cover	%	Cover	%	Type	Access	Length		Type	Structure	Canopy			
1	1	0	1	0	IV	40	SWD	20	N/A	N/A	N/A	N	D	PS	1	BR		p.10&11
2	4	2	2	0	IV	60	SWD	40	N/A	N/A	N/A	N	M	PS	1	N		p.11
3	22	10	10	2	IV	60	SWD	40	N/A	N/A	N/A	N	M	PS	1	N		p.11&12
4	9	4	4	1	SWD	50	OV	35	SC	P	N/A	JM	D	PS	1	N		p.13 - beaver dams
5	15	5	5	5	OV	80	IV	10	N/A	N/A	N/A	N	M	PS	1	N		
6	30	10	10	15	SWD	50	OV	20	SC	G	N/A	JM	M	PS	1	N		
7	5	3	2	0	IV	90	SWD	40	N/A	N/A	N/A	N	SH	SHR	1	N		p.14
8	80	30	30	20	OV	40	SWD	15	SC	G	N/A	N	M	PS	1	N		p.15
9	2	0	1	1	OV	5	N/A	N/A	SC	P	N/A	N	M	PS	1	C		p.16, pools due to log jam
10	0	0	0	0	OV	5	B	5	N/A	N/A	N/A	N	M	PS	1	BR		p.16 @ bridge
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/07/10
Temperature: _____ 13 C @ 8:40

Watershed: __ Squamish
Weather: ____ Sunny
Survey Crew: _ Paul, Scott, Rebecca, Jamey

Sub-Basin: _____ Pilchuck Creek
Discharge (m3 /s): not measured
Subsampling Fractions: ___ C/O
(R / P / G / C / O)

	Reach Number	Distance 0	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Mean Depth Bankfull (m)	Mean Depth Water (m)			Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max. Depth (m)	Pools Only Crest (m)	Pools Only Residual (m)	Pools Only Pool Type	Bed Material Type Dom.	Bed Material Type Sub- Dom.	Bed Material Type Spawning Gravel ?	
1	4	0	C-1	1	0	11	2.2	0.7	0.4	0.5	9.5	4.5	N	N	N	N/A	B	C	N	N/A
2	4	55	C-1	1	55	11	2.2	0.4	0.7	0.4	9.2	4	N	N	N	N/A	B	C	N	N/A
3	4	77	C-1	1	22	11	2.2	0.3	0.8	0.3	9	3	N	N	N	N/A	B	C	N	N/A
4	5	680	C-1	1	680	>45	N/A	NA	N/A	N/A	N/A	N/A	N	N	N	N/A	B	C	N	N/A
5																				
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Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/07/10
Temperature: _____ 13 C @ 8:40

Watershed: __ SQUAMISH
Weather: ____ SUNNY
Survey Crew: PAUL, SCOTT, JAMEY, REBECCA

Sub-Basin: _____ PILCHUCK CREEK
Discharge (m3 /s): not measured
Subsampling Fractions: _____ C/O
(R / P / G / C / O)

	Total LWD Tally	Functional LWD Tally			Cover		Cover		Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 -	20 -	> 50	Cover	%	Cover	%	Type	Access	Length		Type	Structure	Canopy			
1	0	0	0	0	C	10	B	5	N/A	N/A	N/A	N	M	PS	1	N		p.17
2	0	0	0	0	OV	40	B	5	N/A	N/A	N/A	N	M	PS	2	N		p.17
3	2	1	1	0	OV	20	B	5	N/A	N/A	N/A	N	M	MF	2	F		p.17 - waterfall starts
4	>100	0	0	0	OV	40	B	5	N/A	N/A	N/A	N	M	MF	3	F		p.18 - R 5 is a waterfall
5																		
6																		
7																		
8																		
9																		
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11																		
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18																		
19																		
20																		

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: 96/08/06
Temperature: 14

Watershed: __ SQUAMISH
Weather: ____ SUNNY
Survey Crew: _ REBECCA, PAUL, SCOTT, JAMIE

Sub-Basin: _____ BROHM CREEK TRIBS
Discharge (m3 /s): not measured
Subsampling Fractions: ___ R/C
(R / P / G / C / O)

							Mean Depth				Mean Width		Pools Only				Bed Material Type			
	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Bankfull (m)	Water (m)			Bankfull (m)	Wetted (m)	Max. Depth (m)	Crest (m)	Residual (m)	Pool Type	Dom.	Sub- Dom.	Spawning Gravel ?	
1	trib #1	@ B	R-1	1	NA	2	1.05	0.3	0.2	0.1	7.7	5	NA	NA	NA	na	G	S	H	R
2	trib #2	5	C-1	1	NA	6	0.7	0.2	0.3	0.2	2.5	2.5	NA	NA	NA	na	R	R	N	NA
3	trib #3	35	G-1	1	NA	3	0.4	0.2	0.2	0.2	4.2	4.2	NA	NA	NA	na	B	S	N	NA
4																				
5	TRIB#1 IS THE INFLOW OF WATER INO BROHM LAKE. WAP HAS DONE TESTS HEREAS WELL																			
6	TRIB#2 IS THE OUTFLOW WHICH ENTERS BROHM RIVER AT THE TOP OF R#10 ON THE RIGHT HAND BANK																			
7																				
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/17/11
Temperature: _____ 14 C @ 9:30

Watershed: __ Squamish
Weather: ____ Sunny
Survey Crew: _ Paul, Scott, Jamey, Rebecca

Sub-Basin: _____ Pilchuck Creek
Discharge (m3 /s): not measured
Subsampling Fractions: ___ R/G/C
(R / P / G / C / O)

	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Mean Depth Bankfull (m)	Mean Depth Water (m)			Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max. Depth (m)	Pools Only Crest (m)	Pools Only Residual (m)	Pools Only Pool Type	Bed Material Type Dom.	Bed Material Type Sub- Dom.	Bed Material Type Spawning Gravel ?	
1	6	0	R-1	1	0	3	N/A	N/A	N/A	N/A	N/A	N/A	N	N	N	N/A	C	G	L	R
2	6	324	R-1	1	324	2.5	2.6	0.5	0.6	0.6	14	6.8	0.6	0.13	0.47	S	S	S	N	N/A
3	6	402	R-1	1	78	2	1.4	0.3	0.4	0.2	20.4	8	N	N	N	N/A	B	C	N	N/A
4	6	723	R-1	1	321	2.5	1.5	N/A	N/A	N/A	N/A	N/A	N	N	N	N/A	C	G	L	R
5	6	869	R-1	1	146	2	N/A	N/A	N/A	N/A	N/A	N/A	N	N	N	N/A	G	S	H	R
6	6	905	R-1	1	36	1.5	N/A	N/A	N/A	N/A	N/A	N/A	N	N	N	N/A	G	S	H	R
7	6	923	R-1	1	18	1	1.8	0.4	0.2	0.1	13	4.2	N	N	N	N/A	G	S	H	R
8	6	979	R-1	1	56	1	N/A	N/A	N/A	N/A	N/A	N/A	N	N	N	N/A	C	G	L	R
9	6	996	R-1	1	17	1.5	N/A	N/A	N/A	N/A	N/A	N/A	N	N	N	N/A	C	G	L	R
10	6	1023	G-1	1	27	2	0.8	N/A	N/A	N/A	N/A	N/A	N	N	N	N/A	C	G	L	R
11	6	1080	G-1	1	57	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N	N	N	N/A	C	G	L	R
12	6	1107	G-1	1	27	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N	N	N	N/A	C	G	L	R
13	6	1123	G-1	1	16	2.5	N/A	N/A	N/A	N/A	N/A	N/A	N	N	N	N/A	C	G	L	R
14	6	1187	R-2	1	64	2	N/A	N/A	N/A	N/A	N/A	N/A	N	N	N	N/A	C	G	L	R
15	6	1387	R-2	1	200	3.5	1.6	0.2	0.6	0.3	11	5.5	N	N	N	N/A	C	N/A	N	N/A
16	6	1587	R-2	1	200	2	1.6	0.2	0.6	0.4	8.8	4.4	N	N	N	N/A	C	G	L	R
17																				
18																				
19																				
20																				

Level 1 - Habitat Survey Data Form

Forest District: SQUAMISH
Watershed: SQUAMISH
Sub-Basin: PILCHUCK CREEK
NTS map sheet: _____
Weather: SUNNY
Discharge (m3 /s): not measured
Survey date : 96/07/11
Survey Crew: PAUL, SCOTT, JAMEY, REBECCA
Subsampling Fractions: R/G/C
Temperature: 14 C @ 9:30
(R / P / G / C / O)

	Total LWD Tally	Functio nal LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 -	20 -	> 50	Cover	%	Cover	%	Type	Access	Length		Type	Structure	Canopy			
1	0	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N	M	PS	3	N		p.21
2	>100	>30	>30	>30	OV	30	N/A	N/A	N/A	N/A	N/A	JM	M	PS	3	N		p.21
3	12	0	12	0	OV	30	SWD	2	GROUND WATER			N	M	PS	4	N		p.24
4	>200	>50	>50	>100	OV	30	SWD	20	N/A	N/A	N/A	JM	M	YF	4	N		Data was put
5	>20	0	>10	>10	OV	20	SWD	15	SC	P	N/A	N	M	YF	4	N		directly onto
6	>100	0	>50	>50	OV	20	SWD	10	N/A	N/A	N/A	JM	M	YF	4	N		sheets.
7	>100	0	>50	>50	OV	20	B	15	N/A	N/A	N/A	JM	M	YF	5	N		
8	>100	0	>50	>50	OV	20	SWD	15	N/A	N/A	N/A	JM	M	YF	5	N		
9	>100	0	>50	>50	OV	20	SWD	15	N/A	N/A	N/A	JM	M	YF	5	N		
10	10	5	5	0	SWD	30	C	5	SC	P	N/A	N	M	YF	4	N		
11	0	0	0	0	N/A	N/A	N/A	N/A	SC	P	N/A	N	M	YF	4	CV		CV off road.
12	0	0	0	0	N/A	N/A	N/A	N/A	SC	P	N/A	N	M	YF	4	N		lots of LWD everywhere
13	0	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N	M	YF	4	N		
14	0	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N	M	YF	4	N		
15	>100	>30	>30	>30	OV	40	SWD	10	N/A	N/A	N/A	JM	M	YF	4	X		JM over chute -> X
16	>300	>100	>100	>100	OV	70	SWD	50	SC	P	N/A	JM	M	YF	1	N		
17																		
18																		
19																		
20																		

Form 4

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/07/12
Temperature: _____ 12 C @ 10:15

Watershed: __ Squamish
Weather: ____ Sunny
Survey Crew: Paul, Rebecca, Jamey, Scott, Bettina

Sub-Basin: _____ Pilchuck Creek
Discharge (m3 /s): not measured
Subsampling Fractions: ___ R/G/C
(R / P / G / C / O)

	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Mean Depth Bankfull (m)	Mean Depth Water (m)	Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max. Depth (m)	Pools Only Crest (m)	Pools Only Residual (m)	Pools Only Pool Type	Bed Material Type Dom.	Bed Material Type Sub- Dom.	Bed Material Type Spawning Gravel ?
1	7	0	R-1	1	213	3	1.7	0.4 0.7 0.3	11	5.5	N	N	N	N/A	B	C	N N/A
2	7	213	C-1	1	55	4	1.4	0.3 0.4 0.3	10.3	5.8	N	N	N	N/A	B	C	N N/A
3	7	268	G-1	1	70	2.5	2	0.7 0.6 0.4	13.4	7.2	N	N	N	N/A	G	S	H R
4	7	338	C-2	1	63	4.5	1.7	0.4 0.5 0.2	6.5	4.4	N	N	N	N/A	B	C	N N/A
5	7	401	R-2	1	257	3.5	2.2	0.2 0.4 0.3	8	4.7	N	N	N	N/A	C	G	L R
6	7	658	R-2	1	na	3	1.8	0.2 0.3 0.1	30	20	N	N	N	N/A	C	G	L R
7	8	0	G-1	1	0	2	2	0.7 0.8 0.5	11.5	5.3	N	N	N	N/A	G	S	H R
8	8	80	G-1	1	80	1	1.9	N/A N/A N/A	N/A	N/A	N	N	N	N/A	G	S	H R
9	8	210	G-1	1	130	1.5	1.8	0.3 0.2 0.1	6.3	3.8	N	N	N	N/A	C	G	L R
10																	
11																	
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20																	

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/07/12
Temperature: _____ 12 @ 10:15 AM

Watershed: __ SQUAMISH
Weather: ____ SUNNY
Survey Crew: PAUL, SCOTT, REBECCA, JAMEY, BETTINA

Sub-Basin: _____ PILCHUCK CREEK
Discharge (m3 /s): not measured
Subsampling Fractions: _____ R/G/C
(R / P / G / C / O)

	Total LWD Tally	Functional LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 -	20 -	> 50	Cover	%	Cover	%	Type	Access	Length		Type	Structure	Canopy			
1	>300	>100	>100	>100	OV	70	SWD	50	N/A	N/A	N/A	JM	M	YF	3	X		p.25
2	10	2	3	5	B	80	OV	70	N/A	N/A	N/A	N	M	YF	3	N		p.26
3	>100	>20	>30	>40	OV	60	SWD	15	SC	P	N/A	JM	M	YF	3	N		p.26
4	>100	>30	>30	>40	OV	40	SWD	5	SC	P	N/A	JM	M	YF	3	N		p.27
5	>100	>30	>30	>40	OV	20	SWD	5	N/A	N/A	N/A	N	M	YF	3	BR		p.27
6	>100	>30	>30	>40	OV	20	SWD	10	SC	P	N/A	N	M	YF	3	N		p.28
7	20	5	5	10	OV	30	SWD	30	N/A	N/A	N/A	N	M	YF	3	N		p.28 - deer tracks spotted
8	0	0	0	0	C	15	N/A	N/A	SC	P	N/A	N	M	YF	3	N		n/a
9	0	0	0	0	OV	40	C	10	N/A	N/A	N/A	N	M	YF	3	BR		SC to lake (Pilchuck)
10																		
11																		
12																		
13																		
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Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/17/15
Temperature: _____ 13 C @ 11:00

Watershed: ___ Squamish
Weather: ____ Sunny
Survey Crew: _ Paul, Rebecca, Jamie, Scott

Sub-Basin: _____ Pilchuck Creek
Discharge (m3 /s): not measured
Subsampling Fractions: ___ R/G/C
(R / P / G / C / O)

								Mean Depth			Mean Width		Pools Only				Bed Material Type		
	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Bankfull (m)	Water (m)			Bankfull (m)	Wetted (m)	Max. Depth (m)	Crest (m)	Residual (m)	Pool Type	Dom.	Sub- Dom.	Spawning Gravel ?
1	9	0	G-1	1	55	2	2.8	0.3	0.3	0.2	19	11.5	N	N	N	N/A	S	G	L R
2	9	55	C-1	1	52	5	2.2	N/A	N/A	N/A	N/A	N/A	N	N	N	N/A	C	G	L R
3	9	107	G-2	1	55	1	2.4	0.3	0.3	0.3	7.2	4	N	N	N	N/A	G	S	H R
4	9	162	R-1	1	127	2.5	2.3	0.3	0.1	0.1	9.8	4.6	N	N	N	N/A	C	G	L R
5	9	289	C-2	1	53	20	N/A	N/A	N/A	N/A	N/A	N/A	N	N	N	N/A	B	C	N N/A
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18																			
19																			
20																			

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: 96/07/15
Temperature: 13 C @ 11:00

Watershed: __ SQUAMISH
Weather: ____ SUNNY
Survey Crew: _ PAUL, JAMEY, SCOTT, REBECCA

Sub-Basin: _____ PILCHUCK CREEK
Discharge (m3 /s): not measured
Subsampling Fractions: _____ R/G/C
(R / P / G / C / O)

	Total LWD Tally	Functional LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 -	20 -	> 50	Cover	%	Cover	%	Type	Access	Length		Type	Structure	Canopy			
1	3	0	3	0	SWD	15	OV	10	N/A	N/A	N/A	N	M	YF	4	BR		p.30
2	>150	>50	>50	>50	SWD	15	OV	10	N/A	N/A	N/A	JM	M	YF	4	X		p.30
3	0	0	0	0	SWD	25	OV	15	N/A	N/A	N/A	N	M	YF	4	N		p.30
4	>100	>30	>20	>50	OV	15	C	5	N/A	N/A	N/A	JM	M	YF	4	X		p.30
5	>150	>50	>50	>50	OV	80	SWD	2	N/A	N/A	N/A	JM	M	YF	4	F		p.31 - @ bridge we ended too steep.
6																		
7																		Reachs 10 to 12 were not
8																		done due to 20% grade.
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		

Level 1 - Habitat Survey Data Form

Forest District: ____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/08/09
Temperature: _____ NO WATER

Watershed: SQUAMISH
Weather: _ SUNNY
Survey Cre JAMEY, SCOTT, REBECCA

Sub-Basin: _____ LEVIT LAKE TRIBS
Discharge (m3 /s): not measured
Subsampling Fractions: ____ C
(R / P / G / C / O)

	Total LWD Tally	Functional LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 - 20 cm	20 - 50cm	> 50 cm	Cover Type	%	over Type	% 0	Type	Access	Length (m)		Type	Structure	Canopy Closure			
1	4	0	2	2	SWD	80	B	40	N	N	N	N	C	YF	4	N		P#18
2	5	0	3	2	SWD	60	B	5	N	N	N	N	C	MF	4	N		P#18
3	16	10	6	0	SWD	90	IV	80	N	N	N	N	SH	SHR	1	CV		P#19
4																		
5																		
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Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/08/09
Temperature: _____ no water

Watershed: _____ SQUAMISH
Weather: _____ SUNNY
Survey Crew: ____ JAMEY, SCOTT, REBECCA

Sub-Basin: _____ LEVIT LAKE TRIBS
Discharge (m3 /s): not measured
Subsampling Fractions: ___ C
(R / P / G / C / O)

							Mean Depth				Mean Width		Pools Only				Bed Material Type			
	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Bankfull (m)	Water (m)			Bankfull (m)	Wetted (m)	Max. Depth (m)	Crest (m)	Residual (m)	Pool Type	Dom.	Sub- Dom.	Spawning Gravel ?	
1	trib1	NA	C-1	1	NA	22	0.2	0.01	0.01	0.01	1.8	0.5	N	N	N	N	C	G	L	R
2	trib2	NA	C-1	1	NA	20	0.4	0	0	0	2.3	0	N	N	N	N	C	B	N	NA
3	inflow	NA	G-1	1	NA	0.5	0.6	0	0	0	40	0	N	N	N	N	S	S	N	NA
4	from																			
5	lake																			
6																				
7																				
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18																				
19																				
20																				

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/07/22
Temperature: _____ 12C @ 11:20

Watershed: _ SQUAMISH
Weather: ___ SUNNY
Survey Crew: PAUL, JAMEY, SCOTT, REBECCA

Sub-Basin: _____ CHANCE CREEK
Discharge (m3 /s): _____
Subsampling Fractions: ___ R / G
(R / P / G / C / O)

							Mean Depth				Mean Width		Pools Only				Bed Material Type			
	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Bankfull (m)	Water (m)			Bankfull (m)	Wetted (m)	Max. Depth (m)	Crest (m)	Residual (m)	Pool Type	Dom.	Sub- Dom.	Spawning Gravel ?	
1	1	0	R-1	1	115	2	2.3	0.4	0.8	0.7	11.4	8.7	N	N	N	NA	B	C	N	NA
2	1	115	R-1	1	na	1	2	0.4	0.5	0.3	12.5	7.5	N	N	N	NA	C	B	N	NA
3	2	0	R-1	1	0	1.2	1.7	0.4	0.5	0.3	12.5	7.5	N	N	N	NA	C	B	N	NA
4	2	95	G-1	1	95	2	1.4	0.4	0.3	0.2	13	9.6	N	N	N	NA	C	B	N	NA
5	2	127	G-1	1	32	2	1.5	NA	NA	NA	NA	NA	N	N	N	NA	C	C	N	NA
6	2	138	R-1	1	11	2	NA	NA	NA	NA	NA	NA	N	N	N	NA	C	C	N	NA
7	2	154	R-1	1	16	2	1.5	0.4	0.5	0.4	14	8	N	N	N	NA	C	C	N	NA
8	2	180	R-1	1	26	2	NA	NA	NA	NA	NA	NA	N	N	N	NA	C	C	N	NA
9	2	230	R-1	1	50	2	NA	NA	NA	NA	NA	NA	N	N	N	NA	C	B	N	NA
10	2	310	R-1	1	80	3	NA	NA	NA	NA	17	4.9	N	N	N	NA	C	B	N	NA
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				

Level 1 - Habitat Survey Data Form

Forest District: ____ SQUAMISH Watershed: _ SQUAMISH Sub-Basin: _____ CHANCE CREEK
NTS map sheet: _____ Weather: ___ SUNNY Discharge (m3 /s): _____
Survey date : 96/07/22 Survey Cre PAUL, SCOTT, JAMEY, REBECCA Subsampling Fractions: ____ R/G
Temperature 12 @ 11:20 (R / P / G / C / O)

	Total LWD Tally	Functio nal LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 - 20 cm	20 - 50 cm	> 50 cm	Cover Type	%	over Type	%	Type	Access	Length (m)		Type	Structure	Canopy Closure			
1	4	0	4	0	OV	40	SWD	10	N	N	N	N	M	MF	3	N		field notes p.33a,33b
2	0	0	0	0	OV	40	IV	10	N	N	N	N	M	MF	3	BR		trainbridge
3	0	0	0	0	OV	25	IV	5	N	N	N	N	M	MF	4	DW		field notes p.34
4	0	0	0	0	OV	40	IV	5	SC	G	NA	N	M	MF	1	DW		
5	0	0	0	0	SWD	5	NA	NA	SC	G	NA	N	M	MF	1	DW		
6	0	0	0	0	NA	NA	NA	NA	N	N	N	N	M	MF	1	DW		
7	0	0	0	0	OV	80	SWD	10	SC(trib)	G	NA	N	M	MF	1	N		trib. on right
8	0	0	0	0	OV	95	SWD	15	N	N	N	MC	M	MF	1	N		braiding
9	0	0	0	0	OV	95	SWD	15	N	N	N	MC	M	MF	1	N		braiding ends
10	0	0	0	0	IV	2	NA	NA	N	N	N	N	M	MF	1	F		waterfalls begin
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		

Form 4 **Fish Habitat Assessment - Page 1**

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/07/23
Temperature: _____ 12C @ 10:40

Watershed: ___ SQUAMISH
Weather: ____ SUNNY
Survey Crew: _ PAUL, JAMEY, SCOTT, REBECCA

Sub-Basin: _____ CHANCE CREEK
Discharge (m3 /s): _____
Subsampling Fractions: ___ R / G / O
(R / P / G / C / O)

							Mean Depth				Mean Width		Pools Only				Bed Material Type			
	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Bankfull (m)	Water (m)			Bankfull (m)	Wetted (m)	Max. Depth (m)	Crest (m)	Residual (m)	Pool Type	Dom.	Sub- Dom.	Spawning Gravel ?	
1	3	0	O-1	1	345	>25	NA	NA	NA	NA	NA	NA	N	N	N	NA	NA	NA	N	NA
2	4	0	O-1	1	1682	>18	NA	NA	NA	NA	NA	NA	N	N	N	NA	B	C	N	NA
3	5	0	R-1	1	90	2	3.4	0.4	0.4	0.4	17	9.3	N	N	N	NA	C	G	L	R
4	5	90	G-1	1	113	1	3	NA	NA	NA	16	10.3	2.3	0.4	1.9	U	C	G	L	R
5	5	203	R-2	1	177	2	3.6	0.6	1.5	1.6	23	17	N	N	N	NA	C	C	N	NA
6	5	380	R-2	1	114	2	2	NA	NA	NA	NA	NA	N	N	N	NA	C	C	N	NA
7	5	494	R-2	1	68	2	1.6	NA	NA	NA	21	17	N	N	N	NA	C	C	N	NA
8	5	562	R-2	1	18	2	1.4	0.3	0.4	0.4	15.3	7.4	N	N	N	NA	C	G	L	R
9	5	580	R-2	1	na	1.5	2.2	0.4	0.5	0.3	26	9	N	N	N	NA	C	B	N	NA
10	6	0	R-1	1	220	2	2.7	0.1	0.2	0.1	22.2	6.4	N	N	N	NA	C	B	N	NA
11	6	220	R-1	1	85	3	2.3	0.15	0.3	0.3	35	10	N	N	N	NA	C	B	N	NA
12	6	305	C-1	1	na	7	2.6	0.1	0.2	0.3	7.3	3.5	N	N	N	NA	C	B	N	NA
13	7	0	C-1	1	300	>10	3.8	NA	NA	NA	NA	NA	N	N	N	NA	B	C	N	NA
14	7	300	C-1	1	714	12	NA	NA	NA	NA	NA	NA	N	N	N	NA	B	C	N	NA
15	7	1014	C-1	1	na	>10	NA	NA	NA	NA	NA	NA	N	N	N	NA	B	C	N	NA
16	8	0	C-1	1	505	>15	NA	NA	NA	NA	NA	NA	N	N	N	NA	B	C	N	NA
17	9	0	C-1	1	584	>15	NA	NA	NA	NA	NA	NA	N	N	N	NA	B	C	N	NA
18	10	0	C-1	1	211	NA	NA	0.6	0.5	0.5	8.8	7.6	N	N	N	NA	B	C	N	NA
19	11	0	C-1	1	103	13	NA	0.4	0.6	0.8	9	5.3	N	N	N	NA	B	C	N	NA
20																				

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
Watershed: __ SQUAMISH
Sub-Basin: _____ CHANCE CREEK
NTS map sheet: _____
Weather: ____ SUNNY
Discharge (m3 /s): _____
Survey date : 96/07/23
Survey Crew PAUL, SCOTT, JAMEY, REBECCA
Subsampling Fractions: _____ R/G/O
Temperature: _____ 12C @ 10:40
(R / P / G / C / O)

	Total LWD Tally	Functio nal LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 - 20 cm	20 - 50 cm	> 50 cm	Cover Type	%	Cover Type	%	Type	Access	Length (m)		Type	Structure	Canopy Closure			
1	0	0	0	0	NA	NA	NA	NA	N	N	N	N	M	MF	1	F		waterfall:field notes p.35
2	>2000	0	0	>2000	OV	5	IV	5	N	N	N	N	M	MF	1	F/C		waterfall,cascades,velocity barriers,back of p.36
3	20	10	10		SWD	5	OV	5	N	N	N	PD	M	MF	1	N		field notes p.36
4	0	0	0	0	OV	20	SWD	3	N	N	N	DW	M	MF	0	N		p.36
5	0	0	0	0	OV	5	SWD	2	N	N	N	DW	M	MF	0	N		p.36
6	25	10	10	5	OV	26	SWD	2	N	N	N	PD	M	MF	0	N		p.36
7	70	20	20	30	OV	2	SWD	2	N	N	N	MC	M	MF	0	MC		H/R side channel.p.36
8	50	10	10	30	OV	2	SWD	2	SC	P	36	MC/PD	M	MF	0	MC		extremely unstable p.36
9	30	10	10	10	SWD	1	NA	NA	NA	NA	NA	PD	M	MF	0	N		Reach 6 was too steep & had velocity barrier
10	60	20	20	20	B	15	OV	1	NA	NA	NA	PD	M	MF	0	N		therefore not accessible due to safety issue
11	NA	NA	NA	NA	B	15	NA	NA	NA	NA	NA	N	M	MF	0	C		
12	NA	NA	NA	NA	B	15	NA	NA	NA	NA	NA	N	M	MF	0	N		p.37 No measurements done due to safety
13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	N	M	MF	N	N		re: Reaches 6 to 11
14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	N	M	MF	N	N		
15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	N	NA	NA	NA	C		
16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	N	NA	NA	NA	C		
17	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	N	NA	NA	NA	C		
18	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	N	NA	NA	NA	C		
19	90	30	30	30	NA	NA	NA	NA	NA	NA	NA	JM	NA	NA	NA	X		
20																		

Level 1 - Habitat Survey Data Form

Forest District: SQUAMISH
NTS map sheet:
Survey Date: 96/07/26
Temperature: 10C @ 10:40

Watershed: SQUAMISH
Weather: SUNNY
Survey Crew: PAUL, JAMEY, SCOTT, REBECCA BETTINA, JUDY

Sub-Basin: CHANCE CREEK
Discharge (m3 /s):
Subsampling Fractions: C / R
(R / P / G / C / O)

							Mean Depth				Mean Width		Pools Only				Bed Material Type			
	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Bankfull (m)	Water (m)			Bankfull (m)	Wetted (m)	Max. Depth (m)	Crest (m)	Residual (m)	Pool Type	Dom.	Sub- Dom.	Spawning Gravel ?	
1	12	0	C-1	1	0	4	1.1	0.4	0.6	0.3	8.7	5.7	N	N	N	NA	B	C	N	NA
2	Trib at	0m on	right	NA	NA	4	0.7	0.1	0.2	0.1	4.5	3	N	N	N	NA	B	C	N	NA
3	12	72	C-1	1	72	5	1	0.4	0.4	0.6	13.2	8.5	N	N	N	NA	B	C	N	NA
4	12	346	C-1	1	274	4	1.4	0.4	0.3	0.4	7.4	6.2	N	N	N	NA	C	B	N	NA
5	12	504	R-1	1	158	3.5	1.9	0.4	0.3	0.4	8	6.3	N	N	N	NA	C	B	L	R
6	13	154	O-1	1	154	>40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	B	C	N	NA
7	14	604	O-1	1	604	>25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	B	C	N	NA
8	15	206	O-1	1	206	>40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	B	C	N	NA
9	16	351	C-1	1	351	>30	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	B	C	N	NA
10	17	475	P-1	1	475	1	NA	NA	NA	NA	NA	NA	SWAMPY	AREAS			S	S	N	NA
11	18	204	C-1	1	204	6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	C	G	L	R
12	19	270	O-1	1	270	>30	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	C	B	N	NA
13	20	378	O-1	1	378	>20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	B	C	N	NA
14	21	104	O-1	1	104	>20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	B	C	N	NA
15	22	0	O-1	1	NA	>20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	B	C	N	NA
16	23	0	O-1	1	NA	>21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	B	C	N	NA
17	24	0	O-1	1	NA	>22	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	B	C	N	NA
18	25	0	O-1	1	NA	>29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	B	B	N	NA
19	26	0	O-1	1	NA	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	S	G	L	R
20																				

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
Watershed: __ SQUAMISH
Sub-Basin: _____ CHANCE CREEK
NTS map sheet: _____
Weather: ____ SUNNY
Discharge (m3 /s): _____
Survey date : 96/07/26
Survey Crew PAUL, SCOTT, JAMEY, REBECCA
Subsampling Fractions: _____ C/R
Temperature: _____ 10C @ 10:40
BETTINA, JUDY
(R / P / G / C / O)

	Total LWD Tally	Functio nal LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 - 20 cm	20 - 50 cm	> 50 cm	Cover Type	%	Cover Type	%	Type	Access	Length (m)		Type	Structure	Canopy Closure			
1	0	0	0	0	SWD	30	OV	5	Trib on	right ban	NA	N	M	MF	0	F		clearcut on left bank
2	5	3	2	0	0	0	0	0	N	N	NA	N	SH	INIT	0	N		Trib. dries up at 163m
3	10	2	5	3	SWD	40	OV	10	SC	P	32	JM	M	MF	1	N		on left
4	8	4	2	2	OV	25	C	10	N	N	NA	JM	M	MF	1	N		JM is at 288m
5	12	5	5	2	OV	40	C	30	N	N	NA	PD	M	MF	2	N		see pages 41 & 42
6	NA	NA	NA	NA	B	20	NA	NA	N	N	NA	N	SH	INIT	0	F		canyon; some measurements
7	NA	NA	NA	NA	B	20	NA	NA	N	N	NA	N	SH	INIT	0	F		not taken due to safety
8	NA	NA	NA	NA	B	20	NA	NA	N	N	NA	N	M	MF	5	F		
9	NA	NA	NA	NA	OV	10	NA	NA	N	N	NA	N	M	MF	4	N		
10	NA	NA	NA	NA	IV	45	NA	NA	N	N	NA	N	M	MF	0	N		stagnant water
11	NA	NA	NA	NA	OV	10	NA	NA	N	N	NA	N	M	MF	2	N		
12	NA	NA	NA	NA	B	20	NA	NA	N	N	NA	N	M	MF	1	F		
13	NA	NA	NA	NA	B	20	NA	NA	N	N	NA	N	M	MF	1	F		
14	NA	NA	NA	NA	B	20	NA	NA	N	N	NA	N	M	MF	1	F		
15	NA	NA	NA	NA	B	20	NA	NA	N	N	NA	N	M	MF	1	F		tree line
16	NA	NA	NA	NA	B	20	NA	NA	N	N	NA	N	0	0	0	F		
17	NA	NA	NA	NA	B	20	NA	NA	N	N	NA	N	0	0	0	F		
18	NA	NA	NA	NA	B	20	NA	NA	N	N	NA	N	0	0	0	F		
19	NA	NA	NA	NA	B	NA	NA	NA	N	N	NA	N	0	0	0	F		lake no fish in it, 3C with
20																		icebergs at mouth

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: 96/07/15; 96/08/21
Temperature: 14 @ 9:20 (Aug 21/96)
14 @ 14:30 (July 15/96)

Watershed: _ SQUAMISH
Weather: ___ SUNNY
Survey Crew: PAUL, JAMEY, SCOTT, REBECCA

Sub-Basin: _____ CLOUDBURST CREEK
Discharge (m3 /s): not measured
Subsampling Fractions: ___ GLIDE
(R / P / G / C / O)

							Mean Depth		Mean Width		Pools Only				Bed Material Type		
	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Bankfull (m)	Water (m)	Bankfull (m)	Wetted (m)	Max. Depth (m)	Crest (m)	Residual (m)	Pool Type	Dom.	Sub- Dom.	Spawning Gravel ?
1	1	0	G-1	1	0	1	1.6	0.6 1 0.8	19	9	N	N	N	NA	S	S	N NA
2	1	160	G-1	1	160	1	1.7	0.5 1 0.6	7.9	5.8	N	N	N	NA	S	S	N NA
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	
15																	
16																	
17																	
18																	
19																	
20																	

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
Watershed: __ SQUAMISH
Sub-Basin: _____ CLOUDBURST CREEK
NTS map sheet: _____
Weather: ____ SUNNY
Discharge (m3 /s): not measured
Survey Date: _____ 96/07/15; 96/08/21
Survey Crew: PAUL, JAMEY, SCOTT, REBECCA
Subsampling Fractions: _____ GLIDE
(R / P / G / C / O)
Temperature: _____ 14 @ 9:20 (Aug 21/96)
14 @ 14:30 (July 15/96)

	Total LWD Tally	Functional LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 - 20 cm	20 - 50 cm	> 50 cm	Cover Type	%	Cover Type	%	Type	Access	Length (m)		Type	Structure	Canopy Closure			
1	0	0	0	0	SWD	40	OV	40	N	N	NA	N	M	YF	1	B		PG.1, pg.7& 7a (96/07/15)
2	6	1	4	1	SWD	70	OV	45	N	N	NA	N	M	YF	1	BD		pg.8 (96/08/21)
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		

Level 1 - Habitat Survey Data Form

Forest District: SQUAMISH
NTS map sheet:
Survey Date: 96/08/21
Temperature: 12

Watershed: SQUAMISH
Weather: SUNNY
Survey Crew: PAUL, REBECCA, SCOTT

Sub-Basin: CLOUDBURST CREEK
Discharge (m3 /s): NOT MEASURED
Subsampling Fractions: GLIDES
(R / P / G / C / O)

							Mean Depth				Mean Width		Pools Only				Bed Material Type			
	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Bankfull (m)	Water (m)			Bankfull (m)	Wetted (m)	Max. Depth (m)	Crest (m)	Residual (m)	Pool Type	Dom.	Sub- Dom.	Spawning Gravel ?	
1	2	0	G-1	1	0	1	1.7	0.5	1	0.6	7.9	5.8	N	N	N	NA	S	S	N	NA
2	2	126	G-1	1	126	1	NA	NA	NA	NA	NA	NA	N	N	N	NA	S	S	N	NA
3	2	293	G-1	1	167	1	1	0.2	0	0.1	13.8	5.9	N	N	N	NA	S	S	N	NA
4	2	342	G-1	1	50	1	2.35	0.4	0	0.3	14.3	8.5	N	N	N	NA	S	S	N	NA
5	3	0	G-1	1	0	1	2.6	0.6	0	0.3	23	13.5	N	N	N	NA	S	S	N	NA
6	3	117	G-1	1	117	1	NA	NA	NA	NA	NA	NA	N	N	N	NA	S	S	N	NA
7	3	295	G-1	1	178	0.5	1.8	0.3	0	0.3	7.2	3.3	N	N	N	NA	S	S	N	NA
8	3	496	G-1	1	201	0.5	0.65	0.1	0	0.2	>30	4.2	N	N	N	NA	S	S	N	NA
9	3	702	G-1	1	206	0.5	1.2	0.1	0	0.1	>30	4.2	N	N	N	NA	S	S	N	NA
10	4	0	G-1	1	0	0.5	1.2	0.1	0	0.1	>30	4.2	N	N	N	NA	S	S	N	NA
11	4	281	G-1	1	281	0.5	1.2	0.1	0	0.1	23.6	5.6	N	N	N	NA	S	S	N	NA
12	4	422	G-1	1	141	1	2.2	0.2	1	0.2	15.7	5.4	N	N	N	NA	S	S	N	NA
13	4	607	G-1	1	275	1	1.1	0.1	0	0.1	13.4	7.4	N	N	N	NA	S	G	L	AR
14	4	853	G-1	1	156	1	1.2	0.2	0	0.2	12.8	6.6	N	N	N	NA	S	G	L	AR
15	5	0	G-1	1	0	1	1.2	0.2	0	0.2	12.8	6.6	N	N	N	NA	S	G	L	AR
16	5	146	G-1	1	146	1	1.25	0.3	0	0.2	12.4	5.4	N	N	N	NA	S	G	H	AR
17	5	270	G-1	1	124	0.5	1.1	0.3	0	0.2	12	9.3	N	N	N	NA	S	S	N	NA
18	5	373	G-1	1	103	1	NA	NA	NA	NA	NA	NA	N	N	N	NA	S	S	N	NA
19	5	527	G-1	1	154	1	1	0.1	0	0.1	13.9	8.1	N	N	N	NA	S	G	L	AR
20	5	757	G-1	1	230	1	0.95	0.2	0	0.2	6	2.9	N	N	N	NA	G	G	H	AR

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
Watershed: __ SQUAMISH
Sub-Basin: _____ CLOUDBURST CREEK
NTS map sheet: _____
Weather: ____ SUNNY
Discharge (m3 /s): NOT MEASURED
Survey Date: _____ 96/08/21
Survey Crew: _____ PAUL, REBECCA, SCOTT
Subsampling Fractions: _____ GLIDES
Temperature: _____ 12
(R / P / G / C / O)

	Total LWD Tally	Functional LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 - 20 cm	20 - 50 cm	> 50 cm	Cover Type	%	Cover Type	%	Type	Access	Length (m)		Type	Structure	Canopy Closure			
1	4	4	0	0	SWD	70	OV	45	N	N	NA	N	M	YF	1	BR		p.8
2	6	1	4	1	SWD	100	OV	45	N	N	NA	BD	D	PS	1	N		p.8
3	4	0	4	0	OV	80	SWD	60	N	N	NA	N	M	YF	2	N		p.8
4	0	0	0	0	SWD	85	OV	35	N	N	NA	BD	M	YF	1	X		p.9 - barriers at this flow
5	2	1	0	1	SWD	85	NA	NA	N	N	NS	N	M	YF	1	N		p.9
6	1	0	0	1	SWD	65	OV	2	SC	P	NA	N	D	YF	1	N		p.10
7	1	1	0	0	SWD	80	IV	5	N	N	NA	N	M	YF	1	N		p.10 - at 319m dry SC on right
8	16	6	8	2	SWD	90	IV	90	N	N	NA	N	M	YF	1	N		p.10 - dry trib. on left
9	6	1	2	3	SWD	85	OV	75	Tributary		NA	N	M	YF	1	N		p.11
10	7	2	3	2	SWD	90	IV	80	N	N	NA	N	M	YF	1	N		p.11
11	8	2	4	2	SWD	90	IV	90	N	N	NA	N	M	YF	1	N		p.11
12	3	0	3	0	SWD	75	OV	10	N	N	NA	N	M	YF	1	N		p.12
13	13	5	6	2	IV	95	SWD	90	N	N	NA	N	M	YF	1	N		p.12
14	25	10	10	5	SWD	90	IV	80	Tributary on left		NA	N	M	YF	1	N		p.12
15	4	1	1	2	SWD	90	IV	80	N	N	NA	N	M	YF	1	N		p.13
16	6	2	2	2	SWD	75	OV	15	N	N	NA	N	M	YF	1	N		p.13
17	1	0	1	0	SWD	70	C	15	N	N	NA	BD	M	YF	2	X		p.13-barriers at this flow
18	8	4	2	2	SWD	45	OV	5	N	N	NA	N	M	YF	0	N		p.13-this area is a large pond
19	9	3	3	3	IV	60	C	15	N	N	NA	N	M	YF	3	N		p.14-dry SC at 570 on left
20	6	2	2	2	SWD	55	OV	5	N	N	NA	N	M	YF	0	N		p.14

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: 96/09/03
Temperature: NO WATER

Watershed: ___ SQUAMISH
Weather: _____ CLOUDY
Survey Crew: _ PAUL, JAMIE, JUDY
SCOTT,REBECCA

Sub-Basin: _____ EVANS CREEK
Discharge (m3 /s): not measured
Subsampling Fractions: ___ R/B
(R / P / G / C / O)

							Mean Depth				Mean Width		Pools Only				Bed Material Type			
	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Bankfull (m)	Water (m)			Bankfull (m)	Wetted (m)	Max. Depth (m)	Crest (m)	Residual (m)	Pool Type	Dom.	Sub- Dom.	Spawning Gravel ?	
1	1	33	G-1	1	33	0	2	0.8	0.85	0.8	16	6.9	na	na	na	na	S	G	L	AR
2	1	299	NA	1	266	3	0.8	0	0	0	4.8	0	na	na	na	na	S	S	N	NA
3	1	831	NA	1	532	2	1	0	0	0	10.4	0	na	na	na	na	G	C	H	AR
4	1	1065	NA	1	234	2	2	0	0	0	8.5	0	na	na	na	na	C	G	L	AR
5	1	1315	NA	1	250	2.5	1	0	0	0	11	0	na	na	na	na	C	G	L	AR
6	1	1515	NA	1	200	2	1.7	0	0	0	8	0	na	na	na	na	S	C	L	AR
7	1	1700	NA	1	185	3	2.2	0	0	0	11.2	0	na	na	na	na	C	G	L	AR
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				

Level 1 - Habitat Survey Data Form

Forest District: ____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/09/03
Temperature: _____ NO WATER

Watershed: SQUAMISH
Weather: _ CLOUDY
Survey Cre PAUL, JA AMEY, JUDY
SCOTT, REBECCA

Sub-Basin: _____ EVANS CREEK
Discharge (m3 /s): NOT MEASURED
Subsampling Fractions: _____
(R / P / G / C / O)

	Total LWD Tally	Functional LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 - 20 cm	20 - 50cm	> 50 cm	Cover Type	%	Cover Type	%	Type	Access	Length (m)		Type	Structure	Canopy Closure			
1	33	10	17	6	SWD	60	OV	40	N	N	N	JM/EB	M	YF	1	N		P#6a
2	13	1	7	5	SWD	80	IV	80	N	N	N	JM/EB	D	YF	2	N		P#5a
3	3	0	3	0	SWD	25	C	10	N	N	N	EB	D	PS	1	N		P#4a
4	14	5	4	5	SWD	80	C	10	N	N	N	JM/EB	M	YF	1	N		P#4a
5	8	2	5	1	SWD	90	OV/IV	20	SC	P	51	JM/EB	M	YF	1	X		P#3a
6	0	0	0	0	IV	25	SWD	10	N	N	N	EB	M	YF	1	N		P#1a
7	0	0	0	0	IV	10	SWD	5	N	N	N	EB	M	PS	1	N		P#1a
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		

ITPRLANGUAGE.PCL

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/08/22
Temperature: _____ 14

Watershed: _ SQUAMISH
Weather: ___ SUNNY
Survey Crew: PAUL, REBECCA, SCOTT

Sub-Basin: _____ CLOUDBURST
Discharge (m3 /s): NOT MEASURED
Subsampling Fractions: ___ G/C/O
(R / P / G / C / O)

							Mean Depth		Mean Width		Pools Only				Bed Material Type			
	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Bankfull (m)	Water (m)	Bankfull (m)	Wetted (m)	Max. Depth (m)	Crest (m)	Residual (m)	Pool Type	Dom.	Sub- Dom.	Spawning Gravel ?	
1	6	0	G-1	1	0	1	1.5	0.4	7.2	4.1	N	N	N	NA	S	G	L	AR
2	6	473	G-1	1	143	0.5	0.6	0.1	24.7	24.7	N	N	N	NA	S	S	N	NA
3	7	0	G-1	1	0	1	>1.5	1	25.6	25.6	N	N	N	NA	S	S	N	NA
4	7	242	G-1	1	242	1	0.8	0.3	>30	19.6	N	N	N	NA	G	S	H	AR
5	7	360	G-1	1	108	1	NA	NA	NA	NA	N	N	N	NA	G	S	H	AR
6	7	470	G-1	1	120	2	1.45	0.2	14	7	N	N	N	NA	S	G	H	AR
7	8	0	G-1	1	0	2	1.5	0.2	14	7	N	N	N	NA	S	G	H	AR
8	8	270	G-1	1	270	1	0.9	0.2	6.9	4.5	N	N	N	NA	G	G	H	AR
9	8	505	G-1	1	235	1	1.1	0.2	8.4	6.7	N	N	N	NA	S	G	L	AR
10	9	0	G-1	1	0	1	1.1	0.2	8.4	6.7	N	N	N	NA	S	G	L	AR
11	9	55	G-1	1	55	1	1.7	0.4	8.9	4	N	N	N	NA	S	G	L	AR
12	10	0	G-1	1	0	1	1.7	0.4	8.9	4	N	N	N	NA	S	G	L	AR
13	10	92	G-1	1	92	1	0.9	0.2	5.4	3.1	N	N	N	NA	S	S	N	NA
14	11	0	G-1	1	0	1	0.9	0	6.2	0	N	N	N	NA	S	S	N	NA
15	11	300	O-1	1	300	1	NA	NA	NA	NA	N	N	N	NA	S	S	NA	NA
16	11	725	G-1	1	425	1	0.8	0.4	9.8	8.2	N	N	N	NA	S	G	L	AR
17	12	0	O-1	1	0	1	0.8	0	9.8	0	N	N	N	NA	C	G	L	AR
18	12	76	O-1	1	76	6	0.7	0	>30	0	N	N	N	NA	C	G	L	AR
19	13	0	O-1	1	0	>6	0.95	0	>30	0	N	N	N	NA	C	B	N	NA
20	13	146	C-1	1	146	>15	0.85	0.1	8.1	3.8	N	N	N	NA	C	B	N	NA

Level 1 - Habitat Survey Data Form

Forest District: SQUAMISH
NTS map sheet:
Survey Date: 96/08/22
Temperature: 14

Watershed: SQUAMISH
Weather: SUNNY
Survey Crew: PAUL, REBECCA, SCOTT

Sub-Basin: CLOUDBURST CREEK
Discharge (m3 /s): NOT MEASURED
Subsampling Fractions: G/C/O
(R / P / G / C / O)

	Total LWD Tally	Functional LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 - 20 cm	20 - 50 cm	> 50 cm	Cover Type	%	Cover Type	%	Type	Access	Length (m)		Type	Structure	Canopy Closure			
1	21	7	7	7	SWD	20	OV	20	SC	P	NA	N	M	YF	2	N		p.15-on right bank
2	4	0	4	0	SWD	100	OV	5	N	N	NA	BD	M	YF	2	X		p.15&16-beaver dam 15m high
3	0	0	0	0	OV	5	IV	5	N	N	NA	N	M	YF	2	N		p.16
4	6	4	1	1	SWD	35	OV	5	N	N	NA	N	M	YF	1	N		p.16
5	80	25	30	25	SWD	60	OV	15	N	N	NA	N	M	YF	1	N		p.17-fry observed
6	2	2	0	0	SWD	60	OV	20	N	N	NA	N	M	YF	3	BR		p.17-fry observed
7	7	2	2	3	SWD	60	OV	20	N	N	NA	N	M	YF	3	N		p.18
8	1	0	1	0	OV	60	SWD	40	N	N	NA	N	M	YF	2	N		p.18
9	3	1	1	1	OV	65	SWD	10	N	N	NA	N	D	PS	4	N		p.18
10	0	0	0	0	OV	65	SWD	10	N	N	NA	N	D	PS	4	N		p.18
11	1	0	1	0	OV	60	SWD	20	N	N	NA	N	D	PS	4	N		p.18
12	0	0	0	0	OV	60	SWD	20	N	N	NA	N	D	PS	4	N		p.19
13	2	2	0	0	SWD	35	OV	10	N	N	NA	N	D	PS	2	N		p.19
14	0	0	0	0	NA	NA	NA	NA	Tributary on left		NA	N	NA	NA	NA	no water		p.19-no cover pasteur***
15	0	0	0	0	SWD	5	IV	5	N	N	NA	N	D	PS	3	N		puddles of murky water, p. 20
16	0	0	0	0	OV	5	SWD	1	N	N	NA	N	M	YF	1	N		p.19 on back of page
17	0	0	0	0	OV	5	SWD	1	N	N	NA	N	M	YF	1	N		p.21
18	0	0	0	0	SWD	10	OV	1	N	N	NA	MC	M	YF	1	N		p.21
19	12	4	4	4	SWD	2	B	1	N	N	NA	MC	M	YF	2	F		at 87m creek goes under ground
20	0	0	0	0	B	5	SWD	2	N	N	NA	BW	M	YF	5	F		p.20

***Note for line 13 - Start of Reach 11: Cloudburst is no longer supplied by water from the main channel. A good flow comes from tributary on left. Crew followed it until 104 meters good cover & substrate for spawning in trib.

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/08/07
Temperature: NOT MEASURED

Watershed: _____ SQUAMISH
Weather: _____ SUNNY
Survey Crew: _____ PAUL, JAMIE, SCOTT, REBECCA

Sub-Basin: _____ EVANS CREEK
Discharge (m3 /s): NOT MEASURED
Subsampling Fractions: ___ R
(R / P / G / C / O)

	Reach Number	Distance (m)	Habitat Unit Type	Habitat Unit Cat.	Length (m)	Gradient (%)	Mean Depth Bankfull (m)	Mean Depth Water (m)			Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max. Depth (m)	Pools Only Crest (m)	Pools Only Residual (m)	Pools Only Pool Type	Bed Material Type Dom.	Bed Material Type Sub- Dom.	Bed Material Type Spawning Gravel ?	
1	2	0	NA	1	NA	1	2.3	0	0	0	5	0	NA	NA	NA	NA	C	G	H	AR
2	2	45	NA	1	NA	1	NA	0	0	0	NA	0	NA	NA	NA	NA	G	G	H	AR
3	2	100	NA	1	NA	1	0.8	0	0	0	10	0	NA	NA	NA	NA	G	G	H	AR
4	3	0	NA	1	NA	1	NA	0	0	0	NA	0	NA	NA	NA	NA	G	G	H	AR
5	3	90	NA	1	NA	3	0.6	0	0	0	7.6	0	NA	NA	NA	NA	C	G	H	AR
6	3	225	NA	1	NA	1	1	0	0	0	8.6	0	NA	NA	NA	NA	G	G	H	AR
7	3	273	NA	1	NA	1	0.6	0	0	0	7.6	0	NA	NA	NA	NA	C	G	H	AR
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				

Note : habitat could be either R or G depending on height of water. This was difficult to assess due to lack of water at the time the survey was conducted.

Level 1 - Habitat Survey Data Form

Forest District: ____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/08/07
Temperature not measured

Watershed: SQUAMISH
Weather: __ SUNNY
Survey Crew: _____ PAUL, JAMEY, SCOTT, REBECCA

Sub-Basin: _____ EVANS CREEK
Discharge (m3 /s): not measured
Subsampling Fractions: _____
(R / P / G / C / O)

	Total LWD Tally	Functional LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 - 20 cm	20 - 50cm	> 50 cm	Cover Type	%	over Type	%	Type	Access	Length (m)		Type	Structure	Canopy Closure			
1	0	0	0	0	OV	40	IV	35	N	N	N	N	M	YF	2	C		P#7a
2	0	0	0	0	OV	60	IV	30	N	N	N	N	M	YF	3	N		P#7a
3	2	0	2	0	OV	10	IV	10	SC	P	40	N	M	YF	3	N		P#7a
4	0	0	0	0	OV	60	SWD	50	N	N	N	N	M	YF	2	N		P#8a
5	6	2	4	0	OV	100	SWD	70	N	N	N	N	M	YF	2	N		P#8a
6	4	0	4	0	OV	95	SWD	35	N	N	N	N	M	YF	2	N		P#8a
7	0	0	0	0	OV	35	SWD	5	N	N	N	N	M	YF	2	N		P#9a
8																		
9	NOTE : HABITAT UNIT COULD BE EITHER R OR G DEPENDING ON HEIGHT OF WATER,																	
10	HOWEVER, THIS WAS DIFFICULT TO ASSESS DUE TO LACK OF WATER AT THE TIME																	
11	THE SURVEY WAS CONDUCTED																	
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/08/14
Temperature: not measured

Watershed: ___ SQUAMISH
Weather: _____ SUNNY
Survey Crew: _ PAUL, JAMEY, SCOTT, REBECCA

Sub-Basin: _____ EVANS CREEK
Discharge (m3 /s): not measured
Subsampling Fractions: _____
(R / P / G / C / O)

							Mean Depth				Mean Width		Pools Only				Bed Material Type			
	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Bankfull (m)	Water (m)			Bankfull (m)	Wetted (m)	Max. Depth (m)	Crest (m)	Residual (m)	Pool Type	Dom.	Sub- Dom.	Spawning Gravel ?	
1	4	0	NA	1	46	3.5	0.4	0	0	0	5.8	0	NA	NA	NA	NA	C	G	L	AR
2	4	46	R-1	1	54	NA	NA	0	0.05	0	NA	3.3	NA	NA	NA	NA	C	C	N	NA
3	4	100	C-1	1	310	6	1.2	0	0.03	0	16	0.3	NA	NA	NA	NA	B	C	N	NA
4	4	410	C-1	1	na	15	0.5	0	0.05	0	1	0.4	NA	NA	NA	NA	R	R	N	NA
5																				
6																				
7																				
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				

Level 1 - Habitat Survey Data Form

Forest District: ____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/08/14
Temperature not measured

Watershed: SQUAMISH
Weather: _ SUNNY
Survey Cre PAUL, SCOTT, JAMEY, REBECCA

Sub-Basin: _____ EVANS CREEK
Discharge (m3 /s): not measured
Subsampling Fractions: _____
(R / P / G / C / O)

	Total LWD Tally	Functional LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 - 20 cm	20 - 50cm	> 50 cm	Cover Type	%	over Type	%	Type	Access	Length (m)		Type	Structure	Canopy Closure			
1	5	1	3	1	OV	45	SWD	40	SC	P	90	N	M	YF	3	N		P#9a no water
2	0	0	0	0	NA	0	NA	0	N	N	N	N	M	YF	3	N		P#9a puddles of water with fish
3	20	5	10	5	SWD	45	OV	25	N	N	N	N	M	YF	3	N		P#10a
4	65	20	30	15	SWD	70	OV	30	N	N	N	N	M	YF	3	F		P#10a falls > 8m, no more anadromous
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		

Level 1 - Habitat Survey Data Form

Forest District: SQUAMISH
NTS map sheet:
Survey Date: 96/08/15
Temperature: not measured

Watershed: SQUAMISH
Weather: SUNNY
Survey Crew: PAUL, SCOTT, JAMIE, REBECCA

Sub-Basin: EVANS CREEK
Discharge (m3 /s):
Subsampling Fractions:
(R / P / G / C / O)

	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Mean Depth Bankfull (m)	Mean Depth Water (m)			Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max. Depth (m)	Pools Only Crest (m)	Pools Only Residual (m)	Pools Only Pool Type	Bed Material Type Dom.	Bed Material Type Sub- Dom.	Bed Material Type Spawning Gravel ?	
1	5	0	C-1	1	143	8	0.6	NA	0.01	NA	9.4	0.1	NA	NA	NA	NA	B	C	N	NA
2	5	143	C-1	1	na	15	1.1	NA	NA	NA	10.2	NA	NA	NA	NA	NA	B	C	N	NA
3	6	0	C-1	1	54	38	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	B	C	N	NA
4	6	54	R-1	1	57	1	1.2	0.1	0.1	0.1	7.3	1.4	NA	NA	NA	NA	B	C	N	NA
5	6	111	C-2	1	na	62	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	R	R	N	NA
6	7	0	G-1	1	122	1	0.5	0.1	0.1	0.1	3.7	1.9	NA	NA	NA	NA	S	S	N	NA
7	7	122	G-1	1	107	1	1	0.5	0.7	0.4	8	5.5	NA	NA	NA	NA	S	S	N	NA
8	7	229	G-1	1	na	1	0.8	0.2	0.2	0.2	7.6	3.8	NA	NA	NA	NA	S	G	L	R
9	8	0	R-1	1	0	3	0.9	0.2	0.2	0.2	9.4	1.2	NA	NA	NA	NA	C	B	N	NA
10	8	101	R-1	1	101	3	1	0.1	0.2	0.1	8	1.5	NA	NA	NA	NA	B	C	N	NA
11	9	112	G-1	1	112	1	1.2	0.4	0.4	0.4	12	4.9	NA	NA	NA	NA	S	S	N	NA
12	10	EVANS LAKE, WERE UNABLE TO MEASURE																		
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				

Level 1 - Habitat Survey Data Form

Forest District: ____ SQUAMISH
Watershed: SQUAMISH
Sub-Basin: _____ EVANS CREEK
NTS map sheet: _____
Weather: _ SUNNY
Discharge (m3 /s): not measured
Survey date : 96/08/15
Survey Cre PAUL, SCOTT, JAMEY, REBECCA
Subsampling Fractions: _____
Temperature not measured
(R / P / G / C / O)

	Total LWD Tally	Functio nal LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 - 20 cm	20 - 50cm	> 50 cm	Cover Type	%	over Type	%	Type	Access	Length (m)		Type	Structure	Canopy Closure			
1	60	20	20	20	OV	80	SWD	70	N	N	N	JM	M	YF	4	N		P#10a
2	10	2	5	3	OV	70	SWD	30	N	N	N	N	M	YF	2	F		P#10a
3	> 50	> 15	> 15	> 20	SWD	100	OV	15	N	N	N	JM	M	YF	2	X/F		P#11a
4	0	0	0		B	50	IV	15	N	N	N	N	M	YF	2	F		P#11a fish in pool
5	0	0	0		NA	NA	NA	NA	N	N	N	N	M	YF	1	F		P#12a
6	6	2	2	2	OV	60	SWD	50	N	N	N	N	M	YF	1	N		P#12a
7	8	4	2	2	OV	60	SWD	45	N	N	N	N	M	PS	1	N		p#12a
8	0	0	0		OV	40	SWD	30	N	N	N	N	M	PS	1	C		P#13a
9	0	0	0		OV	20	B	20	N	N	N	N	M	YF	3	N		P#13a
10	> 100	35	35	30	B	20	OV	10	N	N	N	JM	M	YF	2	BR		p#13a
11	30	10	10	10	IV	60	OV	5	N	N	N	N	M	YF	0	N		p#14a
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/08/27
Temperature: _____ 15 @ 10:00 am

Watershed: ___ SQUAMISH
Weather: _____ SUNNY WITH CLOUDS
Survey Crew: _ PAUL, SCOTT, REBECCA

Sub-Basin: _____ EVANS CREEK
Discharge (m3 /s): not measured
Subsampling Fractions: _____
(R / P / G / C / O)

							Mean Depth				Mean Width		Pools Only				Bed Material Type			
	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Bankfull (m)	Water (m)			Bankfull (m)	Wetted (m)	Max. Depth (m)	Crest (m)	Residual (m)	Pool Type	Dom.	Sub- Dom.	Spawning Gravel ?	
1	11	0	na	NA	0	3	0.5	0	0	0	7.3	0	NA	NA	NA	NA	C	G	H	R
2	11	160	C-1	1	160	6	0.6	0.1	0.2	0.1	4.2	1.6	0.2	0	0.2	U	C	G	H	R
3	11	220	NA	NA	60	6	0.6	0	0	0	3.8	0	NA	NA	NA	NA	C	G	L	R
4	11	283	C-1	1	63	13	0.6	0	0	0	4.3	0.4	NA	NA	NA	NA	C	G	L	R
5	12	0	C-1	1	0	13	0.6	0	0.1	0	4.3	0.4	NA	NA	NA	NA	C	G	L	R
6	12	100	C-1	1	100	18	0.6	0.2	0.25	0.2	5.5	3.2	0.25	0.02	0.23	U	R	C	L	R
7	12	225	NA	NA	125	19	0.3	0	0	0	9.6	0	NA	NA	NA	NA	C	B	N	NA
8	12	317	C-1	1	92	16	0.7	0	0.1	0	4.7	0.8	NA	NA	NA	NA	B	C	N	NA
9	12	377	C-1	1	60	11	0.7	0.1	0.1	0.1	3.6	2	NA	NA	NA	NA	B	C	N	NA
10	13	0	C-1	1	0	11	0.7	0.1	0.1	0.1	3.6	2	NA	NA	NA	NA	B	C	N	NA
11	13	82	C-1	1	82	14	0.5	0	0	0	11.1	0.7	NA	NA	NA	NA	C	B	N	NA
12	13	127	C-1	1	45	22	0.7	0	0.1	0	5.9	0.6	NA	NA	NA	NA	C	B	N	NA
13	14	0	NA	NA	0	38	NA	0	0	0	5.9	0	NA	NA	NA	NA	R	B	N	NA
14	14	94	C-1	1	94	17	0.6	0	0.1	0	8.7	0.5	NA	NA	NA	NA	C	B	L	R
15	14	193	C-1	1	99	18	0.7	0.1	0.3	0.1	3.9	0.8	NA	NA	NA	NA	B	C	N	NA
16	14	272	NA	NA	79	11	0.5	0	0	0	6.8	0	NA	NA	NA	NA	C	G	L	R
17																				
18																				
19																				
20																				

Level 1 - Habitat Survey Data Form

Forest District: ____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/08/27
Temperature: _____ 15 @ 10:00 AM

Watershed: SQUAMISH
Weather: _ SUNNY WITH CLOUDS
Survey Cre PAUL, SCOTT, REBECCA

Sub-Basin: _____ EVANS CREEK
Discharge (m3 /s): not measured
Subsampling Fractions: _____
(R / P / G / C / O)

	Total LWD Tally	Functional LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 - 20 cm	20 - 50cm	> 50 cm	Cover Type	%	over Type	%	Type	Access	Length (m)		Type	Structure	Canopy Closure			
1	14	2	8	4	OV	80	SWD	60	N	N	N	N	M	YF	4	BR		Footbridge
2	14	1	8	5	SWD	40	C	10	N	N	N	N	M	YF	4	N		
3	7	3	4	0	SWD	70	OV	40	N	N	N	N	M	YF	3	N		
4	2	0	2	0	SWD	60	OV	10	N	N	N	N	M	YF	4	N		Trib on left bank
5	8	0	0	8	SWD	60	OV	10	N	N	N	N	M	YF	4	N		Trib on left bank
6	15	4	4	8	SWD	40	OV	1	N	N	N	N	M	YF	4	N		
7	7	0	2	5	SWD	55	OV	5	N	N	N	N	M	YF	3	N		
8	24	8	8	8	SWD	25	B	15	N	N	N	N	M	YF	3	N		
9	12	2	6	4	SWD	60	OV	5	N	N	N	N	M	YF	3	N	P#12/Roll E#2	
10	12	5	2	5	SWD	60	OV	5	N	N	N	N	M	YF	3	N		
11	23	0	7	16	SWD	45	OV	5	N	N	N	N	M	YF	2	N		
12	6	1	3	2	SWD	35	OV	5	N	N	N	N	M	YF	2	BR		
13	0	0	0	0	NA	NA	NA	NA	N	N	N	N	M	YF	1	F		waterfall around 15m
14	17	5	10	2	SWD	85	OV	70	N	N	N	N	M	YF	3	N		
15	7	0	0	7	SWD	45	OV	35	N	N	N	N	M	YF	3	N		
16	9	3	3	3	SWD	85	OV	15	N	N	N	N	M	YF	3	CV		
17																		
18																		
19																		
20																		

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/08/28
Temperature: not measured

Watershed: ___ SQUAMISH
Weather: _____ SUNNY
Survey Crew: _ PAUL, JAMEY, SCOTT,REBECCA, BETTINA

Sub-Basin: _____ EVANS CREEK
Discharge (m3 /s): not measured
Subsampling Fractions: _____
(R / P / G / C / O)

	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Mean Depth Bankfull (m)	Mean Depth Water (m)			Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max. Depth (m)	Pools Only Crest (m)	Pools Only Residual (m)	Pools Only Pool Type	Bed Material Type Dom.	Bed Material Type Sub- Dom.	Spawning Gravel ?	
1	15	0	C-1	1	0	45	NA	0	0	0	5.3	0	NA	NA	NA	NA	R	NA	N	NA
2	15	15	C-1	1	15	11	0.6	0	0	0	5	0	NA	NA	NA	NA	G	C	L	R
3	15	137	C-1	1	122	13	0.7	0	0	0	10.4	0	NA	NA	NA	NA	C	G	L	R
4	15	180	C-1	1	43	18	0.9	0.1	0.1	0.1	4.9	1.5	NA	NA	NA	NA	R	B	N	NA
5	16	0	C-1	1	0	18	0.9	0.1	0.1	0.1	4.9	1.5	NA	NA	NA	NA	R	B	N	NA
6	16	100	C-1	1	100	11	1	0.1	0.2	0.1	4.9	1	NA	NA	NA	NA	R	C	N	NA
7	16	152	C-1	1	52	6	0.35	0	0.05	0	5	1.1	NA	NA	NA	NA	B	C	N	NA
8	16	200	C-1	1	48	9	0.45	0	0.1	0	6.8	0.7	NA	NA	NA	NA	G	S	H	R
9	16	317	C-1	1	117	16	0.6	0	0.1	0	2.7	0.5	NA	NA	NA	NA	B	C	N	NA
10	17	0	C-1	1	100	16	0.6	0	0.1	0	2.7	0.5	NA	NA	NA	NA	B	C	N	NA
11	17	100	R-1	1	96	3	0.9	0.2	0.4	0.2	7.6	2.5	NA	NA	NA	NA	G	B	H	R
12	17	196	R-1	1	na	1	0.4	0	0.1	0	10	0.4	NA	NA	NA	NA	G	B	H	R
13	18	0	NA	1	50	1	0.4	0	0	0	10	0	NA	NA	NA	NA	G	B	H	R
14	18	50	C-1	1	63	13	0.45	0.2	0.26	0.2	4	4	0.25	0.01	0.24	U	R	C	N	NA
15	18	113	R-2	1	252	2	0.4	0	0.1	0	22.5	0.4	NA	NA	NA	NA	G	C	H	R
16	18	365	R-2	1	na	1	0.55	0	0.05	0	2.6	0.7	NA	NA	NA	NA	C	B	N	NA
17	19	0	R-1	1	70	1	0.55	0	0.05	0	2.6	0.7	NA	NA	NA	NA	C	B	N	NA
18	19	70	G-1	1	na	0	0.25	0	0.05	0	8.7	0.3	NA	NA	NA	NA	S	S	N	NA
19	20	0	G-1	1	0	0	0.25	0	0.05	0	8.7	0.3	NA	NA	NA	NA	S	S	N	NA
20	20	121	G-1	1	121	0	0.7	0.2	0.4	0.2	30	3.4	NA	NA	NA	NA	S	S	N	NA

Level 1 - Habitat Survey Data Form

Forest District: ____ SQUAMISH
NTS map sheet: _____
Survey Date: 96/08/28
Temperature not measured

Watershed: SQUAMISH
Weather: _ SUNNY
Survey Cre PAUL, JAMEY, SCOTT, REBECCA, BETTINA

Sub-Basin: _____ EVANS CREEK
Discharge (m3 /s): not measured
Subsampling Fractions: _____
(R / P / G / C / O)

	Total LWD Tally	Functional LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 - 20 cm	20 - 50cm	> 50 cm	Cover Type	%	over Type	%	Type	Access	Length (m)		Type	Structure	Canopy Closure			
1	0	0	0	0	OV	50	NA	NA	N	N	N	N	M	YF	4	F		this is a waterfall
2	21	6	14	1	OV	100	SWD	45	N	N	N	N	M	YF	4	BR		
3	5	3	2	0	OV	30	SWD	25	N	N	N	N	M	YF	3	N		
4	17	3	6	8	OV	10	C	5	N	N	N	N	M	YF	2	BR		
5	25	10	10	5	SWD	100	OV	45	N	N	N	JM	M	YF	2	X		
6	7	1	4	2	SWD	85	OV	75	N	N	N	N	M	PS	3	N		
7	43	7	21	15	SWD	75	OV	65	N	N	N	N	M	YF	3	N		
8	5	5	0	0	OV	70	SWD	60	N	N	N	N	M	YF	3	BR		
9	> 50	> 10	> 20	> 20	SWD	100	OV	70	N	N	N	N	M	YF	3	N		
10	40	3	30	7	OV	100	SWD	35	N	N	N	N	M	PS	3	N		
11	25	5	10	10	SWD	45	OV	35	N	N	N	JM	M	YF	2	N		
12	NA	NA	NA	NA	SWD	45	OV	35	N	N	N	N	M	YF	2	N		
13	18	6	6	6	SWD	15	NA	NA	N	N	N	N	M	YF	2	N		
14	23	3	17	3	SWD	100	OV	95	N	N	N	MC	M	YF	3	CV		
15	> 30	> 10	> 10	> 10	SWD	90	OV	90	N	N	N	N	M	PS	4	CV		
16	17	6	9	2	SWD	90	OV	90	N	N	N	N	M	PS	4	N		
17	> 65	> 50	5	10	SWD	90	OV	60	N	N	N	N	M	YF	4	N		
18	0	0	0	0	SWD	90	OV	10	N	N	N	N	M	YF	1	N		
19	0	0	0	0	IV	40	SWD	10	N	N	N	N	M	YF	0	N		This area widens into a
20	0	0	0	0	IV	60	OV	5	N	N	N	N	SH	SHR	0	CV		pond- great wildlife habitat (i.e., marshland)

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: 96/08/28
Temperature: not measured

Watershed: ___ SQUAMISH
Weather: _____ SUNNY
Survey Crew: _ PAUL, JAMEY, SCOTT, REBECCA, BETTINA

Sub-Basin: _____ EVANS CREEK
Discharge (m3 /s): not measured
Subsampling Fractions: _____
(R / P / G / C / O)

							Mean Depth				Mean Width		Pools Only				Bed Material Type			
	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Bankfull (m)	Water (m)			Bankfull (m)	Wetted (m)	Max. Depth (m)	Crest (m)	Residual (m)	Pool Type	Dom.	Sub- Dom.	Spawning Gravel ?	
1	21	0	G-1	1	67	1	0.7	0.1	0.3	0.1	10.6	3.4	N	N	N	N	S	S	N	NA
2	21	67	G-1	1	201	1	0.5	0.1	0.2	0.1	14.5	1.8	N	N	N	N	G	S	N	NA
3	21	268	R-1	1	71	2	0.5	0.1	0.2	0.1	8.6	3.6	N	N	N	N	B	C	N	NA
4	21	339	R-1	1	na	3	0.75	0.2	0.5	0.2	7.2	3.2	N	N	N	N	S	S	N	NA
5																				
6																				
7																				
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16																				
17																				
18																				
19																				
20																				

Level 1 - Habitat Survey Data Form

Forest District: ____ SQUAMISH
NTS map sheet: _____
Survey Date: 96/08/28
Temperature not measured

Watershed: SQUAMISH
Weather: _ SUNNY
Survey Cre PAUL, JAMEY, SCOTT, REBECCA, BETTINA

Sub-Basin: _____ EVANS CREEK
Discharge (m3 /s): not measured
Subsampling Fractions: _____
(R / P / G / C / O)

	Total LWD Tally	Functional LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 - 20 cm	20 - 50cm	> 50 cm	Cover Type	%	over Type	%	Type	Access	Length (m)		Type	Structure	Canopy Closure			
1	0	0	0	0	IV	40	SWD	20	N	N	N	N	M	YF	2	N		
2	13	13	0	0	SWD	45	OV	30	N	N	N	N	M	YF	2	N		
3	0	0	0	0	IV	85	SWD	70	N	N	N	N	SH	SHR	0	N		
4	12	4	3	5	SWD	25	OV	5	N	N	N	N	C	YF	1	BR		Cabin on right
5																		actually a dock,
6																		Levitt lake starts
7																		fish observed in lake:
8																		but no shocking
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/09/16
Temperature: _____ 10.3 C

Watershed: _ SQUAMISH
Weather: ___ OVERCAST
Survey Crew: PAUL, JAMEY, NED

Sub-Basin: _____ CRAWFORD CREEK
Discharge (m3 /s): not measured
Subsampling Fractions: ___ R / C / P
(R / P / G / C / O)

							Mean Depth		Mean Width		Pools Only				Bed Material Type		
	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Bankfull (m)	Water (m)	Bankfull (m)	Wetted (m)	Max. Depth (m)	Crest (m)	Residual (m)	Pool Type	Dom.	Sub- Dom.	Spawning Gravel ?
1	1	0	C-1	1	0	4	1.7	0.2 0 0.7	22	19	N	N	N	N/A	B	C	L AR
2	1	179.3	C-1	1	179.3	4	1	0.8 1 0.4	15.2	12	N	N	N	N/A	B	C	L AR
3	1	310	C-1	1	130.7	4	2	1.5 2 1.5	20	10	N	N	N	N/A	B	C	L AR
4	1	341	P-1	1	31	0	>4	3.5 4 3.5	20	16	>4	0.5	>3.5	S	B	C	L AR
5																	
6																	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	
15																	
16																	
17																	
18																	
19																	
20																	

Level 1 - Habitat Survey Data Form

Forest District: ____ SQUAMISH
Watershed: _ SQUAMISH
Sub-Basin: _____ CRAWFORD CREEK
NTS map sheet: _____
Weather: ___ OVERCAST
Discharge (m3 /s): not measured
Survey date : 96/09/16
Survey Cre PAUL, JAMEY, NED
Subsampling Fractions: _____
Temperature: _____ 10.3 C
(R / P / G / C / O)

	Total LWD Tally	Functional LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 - 20 cm	20 - 50 cm	> 50 cm	Cover Type	%	over Type	%	Type	Access	Length (m)		Type	Structure	Canopy Closure			
1	2	0	1	1	B/C	8	OV	1	N	N	N/A	C,EB	M	YF	2	N		pg. 1
2	0	0	0	0	B/C	10	OV	3	N	N	N/A	C,EB	M	YF	4	N		
3	0	0	0	0	B	10	OV	3	N	N	N/A	C,EB	M	YF	1	C		
4	0	0	0	0	DP	60	OV	5	N	N	N/A	EB	M	YF	1	N		
5																		
6																		
7																		
8																		
9																		
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13																		
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16																		
17																		
18																		
19																		
20																		

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/09/17
Temperature: _____ 11

Watershed: ___ SQUAMISH
Weather: _____ SUNNY
Survey Crew: _ PAUL, JAMEY, NED

Sub-Basin: _____ CRAWFORD CREEK
Discharge (m3 /s): not measured
Subsampling Fractions: ___ R/P/G/C/O
(R / P / G / C / O)

							Mean Depth			Mean Width		Pools Only				Bed Material Type		
	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Bankfull (m)	Water (m)		Bankfull (m)	Wetted (m)	Max. Depth (m)	Crest (m)	Residual (m)	Pool Type	Dom.	Sub- Dom.	Spawning Gravel ?
1	5	242	C-1	1	242	6	>10	0.3	0.8	0.3	14.1	12.2	N	N	N	N/A	C	B	L	A/R
2	6	0	C-1	1	0	6	>10	0.3	0.8	0.3	14.1	12.2	N	N	N	N/A	C	B	L	A/R
3	6	155	C-1	1	155	4	4	0.4	0.5	0.6	11.7	10	N	N	N	N/A	C	B	H	A/R
4	6	186	C-1	1	31	5	5	0.3	0.4	0.3	25.5	22.5	N	N	N	N/A	C	B	L	A/R
5	7	0	C-1	1	0	5	5	0.3	0.4	0.3	25.5	22.5	N	N	N	N/A	C	B	L	A/R
6	7	163	R-1	1	163	4	2	0.4	0.6	0.5	16.3	12.7	N	N	N	N/A	C	B	L	A/R
7	7	340	R-1	1	177	5	2.5	0.3	0.5	0.4	20.6	17.7	N	N	N	N/A	C	B	L	A/R
8	8	0	P-1	1	0	5	2.5	0.3	0.5	0.4	20.8	17.7	N	N	N	N/A	C	B	L	A/R
9	8	125	P-1	1	125	4	1	0.4	0.3	0.4	17.3	12.2	N	N	N	N/A	C	B	L	A/R
10	9	0	P-1	1	0	4	1	0.4	0.3	0.4	17.3	12.2	N	N	N	N/A	C	B	L	A/R
11	9	191	C-1	1	191	8	1.5	0.6	0.9	0.3	25	20	N	N	N	N/A	C	B	L	A/R
12	10	0	C-1	1	0	8	1.5	0.6	0.9	0.3	25	20	N	N	N	N/A	C	B	L	A/R
13	10	155	G-1	1	155	4	1	0.4	0.8	0.4	11.8	8.1	N	N	N	N/A	C	B	H	A/R
14	10	270	R-1	1	115	5	1	0.1	0.5	0.3	14.4	11.3	N	N	N	N/A	C	B	L	A/R
15	11	0	R-1	1	0	5	1	0.1	0.5	0.3	14.4	11.3	N	N	N	N/A	C	B	L	A/R
16	11	100	R-1	1	100	3	2	0.1	0.4	0.5	20.1	10.5	N	N	N	N/A	C	B	H	A/R
17	12	0	R-1	1	0	3	2	0.1	0.4	0.5	20.1	10.5	N	N	N	N/A	C	B	H	A/R
18	12	154	R-1	1	154	3	0.5	0.4	0.7	0.4	22.2	20.9	N	N	N	N/A	C	B	L	A/R
19	13	0	R-1	1	0	3	0.5	0.4	0.7	0.4	22.2	20.9	N	N	N	N/A	C	B	L	A/R
20	13	129	R-1	1	129	3	2	N/A	N/A	N/A	17.5	14	N	N	N	N/A	C	B	H	A/R

note: no data collected for Reaches 2, 3, 4 due to inaccessibility (canyon).

Level 1 - Habitat Survey Data Form

Forest District: ____ SQUAMISH
Watershed: _ SQUAMISH
Sub-Basin: _____ CRAWFORD CREEK
NTS map sheet: _____
Weather: ___ SUNNY
Discharge (m3 /s): not measured
Survey date : 96/09/17
Survey Cre PAUL, JAMEY, NED
Subsampling Fractions: ____ R/P/G/C/O
Temperature: _____ 11 C
(R / P / G / C / O)

	Total LWD Tally	Functio nal LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 - 20 cm	20 - 50 cm	> 50 cm	Cover Type	%	over Type	%	Type	Access	Length (m)		Type	Structure	Canopy Closure			
1	1	0	1	0	B	4	OV	2	SC	N	2	N	M	YF	10	C		pg. 2
2	1	0	1	0	B	4	OV	2	SC	N	2	N	M	YF	10	C		
3	1	0	1	0	B	5	OV	5	N	N	N/A	N	M	YF	3	N		
4	0	0	0	0	B	3	OV	5	N	N	N/A	N	M	YF	2	N		
5	0	0	0	0	B	3	OV	5	N	N	N/A	N	M	YF	2	N		
6	25	0	10	15	CB	3	OV	1	N	N	N/A	N	M	YF	3	N		
7	20	6	10	4	B	1	OV	2	SC	N	0.5	N	M	YF	3	N		
8	20	6	10	4	B	1	OV	2	SC	N	0.5	N	M	YF	3	N		
9	15	0	10	5	B	1	OV	1	N	N	N/A	N	M	YF	2	F		
10	10	0	10	0	B	1	OV	1	N	N	N/A	N	M	YF	2	F		
11	50	0	45	5	B	3	OV	1	SC	N	N/A	N	M	YF	0	C		
12	50	0	45	5	B	3	OV	1	SC	N	N/A	N	M	YF	0	C		
13	1	0	1	0	B	1	OV	4	N	N	N/A	N	M	YF	3	N		
14	4	1	2	1	B	1	OV	2	SC	N	N/A	N	M	YF	0	N		
15	4	1	2	1	B	1	OV	2	SC	N	2.5	N	M	YF	0	N		
16	5	1	3	1	B	1	OV	4	N	N	N/A	N	M	YF	1	N		
17	5	1	3	1	B	1	OV	4	N	N	N/A	N	M	YF	1	N		
18	7	2	4	1	LWD	2	OV	3	N	N	N/A	LS	M	YF	6	N		
19	7	2	4	1	LWD	2	OV	3	N	N	N/A	LS	M	YF	6	N		
20	20	2	15	3	LWD	3	OV	1	SC	N	1	N	M	YF	6	N		

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/09/17
Temperature: _____ 11

Watershed: _ SQUAMISH
Weather: ___ SUNNY
Survey Crew: PAUL, JAMEY, NED

Sub-Basin: _____ CRAWFORD CREEK
Discharge (m3 /s): NOT MEASURED
Subsampling Fractions: ___ R/P/G/C
(R / P / G / C / O)

								Mean Depth				Mean Width		Pools Only				Bed Material Type			
	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Bankfull (m)	Water (m)			Bankfull (m)	Wetted (m)	Max. Depth (m)	Crest (m)	Residual (m)	Pool Type	Dom.	Sub- Dom.	Spawning Gravel ?	
1	14	172	R-1	1	172	6	1	0.2	1	0.2	16.5	13.3	N	N	N	N/A	C	B	L	A/R
2	15	0	R-1	1	0	6	1	0.2	1	0.2	16.5	13.3	N	N	N	N/A	C	B	L	A/R
3	15	170	R-1	1	170	2	1.5	0.3	0	0.3	21.6	17	N	N	N	N/A	C	B	L	A/R
4	15	470	G-1	1	470	3	3	0.8	1	0.4	13.3	10.8	N	N	N	N/A	C	B	L	A/R
5	16	0	G-1	1	0	3	3	0.8	1	0.4	13.3	10.8	N	N	N	N/A	C	B	L	A/R
6																				
7																				
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				

Level 1 - Habitat Survey Data Form

Forest District: ____ SQUAMISH
Watershed: _ SQUAMISH
Sub-Basin: _____ CRAWFORD CREEK
NTS map sheet: _____
Weather: ___ SUNNY
Discharge (m3 /s): NOT MEASURED
Survey date : 96/09/17
Survey Cre PAUL, JAMEY, NED
Subsampling Fractions: ____ R/P/G/C
(R / P / G / C / O)
Temperature: _____ 11 C

	Total LWD Tally	Functio nal LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 - 20 cm	20 - 50 cm	> 50 cm	Cover Type	%	over Type	%	Type	Access	Length (m)		Type	Structure	Canopy Closure			
1	10	3	6	1	LWD	1	OV	2	SC	N	3	N	M	YF	0	N		pg. 3
2	10	3	6	1	LWD	1	OV	2	SC	N	3	N	M	YF	0	N		
3	30	5	15	10	LWD	2	OV	4	SC	N	1	N	M	YF	1	N		
4	12	3	5	4	B	5	OV	1	N	N	N/A	N	M	YF	0	N		
5	12	3	5	4	B	5	OV	1	N	N	N/A	N	M	YF	0	N		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/19/18
Temperature: _____ 11

Watershed: _ SQUAMISH
Weather: ___ OVERCAST
Survey Crew: PAUL, JAMEY, NED

Sub-Basin: _____ CRAWFORD CREEK
Discharge (m3 /s): _____
Subsampling Fractions: ___ R/P/G/C/O
(R / P / G / C / O)

	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Mean Depth Bankfull (m)	Mean Depth Water (m)	Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max. Depth (m)	Pools Only Crest (m)	Pools Only Residual (m)	Pools Only Pool Type	Bed Material Type Dom.	Bed Material Type Sub- Dom.	Bed Material Type Spawning Gravel ?
1	15	0	R	1	0	6	1.5	0.3 1 0.4	13	9.6	N	N	N	N/A	C	B	L A/R
2	15	40	R	1	40	7	1.5	0.5 1 0.3	13	9.6	N	N	N	N/A	C	B	L A/R
3	16	0	C	1	0	7	1.5	0.5 1 0.3	13	9.6	N	N	N	N/A	C	B	L A/R
4	16	81	R	1	81	4	0.8	0.3 1 0.5	17.5	10.3	N	N	N	N/A	C	B	L A/R
5	16	100	C	1	100	4	1	0.3 0 0.5	11.4	10	N	N	N	N/A	C	B	L A/R
6	17	0	C	1	0	4	1	0.3 0 0.5	11.4	10	N	N	N	N/A	C	B	L A/R
7	17	96	C	1	96	8	>10	0.6 1 0.4	12.8	9.4	N	N	N	N/A	B	C	L A/R
8	17	157	C	1	157	6	0.5	0.4 0 0.7	14.8	12.6	N	N	N	N/A	C	B	L A/R
9	17	200	R	1	200	5	2	0.6 0 0.1	10.2	8	N	N	N	N/A	C	B	L A/R
10	18	0	R	1	0	5	2	0.6 0 0.1	10.2	8	N	N	N	N/A	C	B	L A/R
11	18	34	C	1	34	5	1	0.3 1 0.4	14.3	12.1	N	N	N	N/A	C	B	L A/R
12	18	130	R	1	130	7	0.8	0.4 0 0.3	9.9	7.6	N	N	N	N/A	C	B	L A/R
13	18	312	R	1	312	5	1	0.4 0 0.2	12.2	9.5	N	N	N	N/A	C	B	L A/R
14	19	0	R	1	0	5	1	0.4 0 0.2	12.2	9.5	N	N	N	N/A	C	G	L A/R
15	19	143	R	1	143	5	0.5	0.3 0 0.3	13.8	9.2	N	N	N	N/A	C	G	L A/R
16	19	208	R	1	208	4	1	0.3 0 0.3	11.3	10.8	N	N	N	N/A	C	G	H A/R
17	20	0	R	1	0	4	1	0.3 0 0.3	11.3	10.8	N	N	N	N/A	C	G	H A/R
18	20	59	R	1	59	4	1.5	0.2 0 0.2	>30	5.8	N	N	N	N/A	C	G	L A/R
19	20	152	R	1	152	7	2	0.4 0 0.5	10.1	8.4	N	N	N	N/A	C	G	L A/R
20	20	230	R	1	230	4	1	0.4 0 0.4	9	4.5	N	N	N	N/A	C	G	L A/R

Level 1 - Habitat Survey Data Form

Forest District: ____ SQUAMISH
Watershed: _ SQUAMISH
Sub-Basin: _____ CRAWFORD CREEK
NTS map sheet: _____
Weather: ___ OVERCAST
Discharge (m3 /s): NOT MEASURED
Survey date : 96/09/18
Survey Cre PAUL, JAMEY, NED
Subsampling Fractions: ____ R/P/G/C/O
Temperature: _____ 11 C
(R / P / G / C / O)

	Total LWD Tally	Functio nal LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 - 20 cm	20 - 50 cm	> 50 cm	Cover Type	%	over Type	%	Type	Access	Length (m)		Type	Structure	Canopy Closure			
1	0	0	0	0	B	4	OV	2	N	N	N/A	N	M	YF	1	N		pg. 4
2	0	0	0	0	B	3	OV	2	SC	N	2	N	M	YF	1	N		sc on left
3	0	0	0	0	B	3	OV	2	SC	N	2	N	M	YF	1	N		stream bank
4	1	0	1	0	B	2	OV	1	SC	N	2	N	M	YF	0	N		some R
5	4	1	3	0	B	2	OV	2	SC	N	1	N	M	YF	2	N		present only
6	4	1	3	0	B	2	OV	2	SC	N	1	N	M	YF	2	N		2%
7	4	1	3	0	B	4	OV	0	N	N	N/A	N	M	YF	1	C		chute 61m
8	0	0	0	0	B/C	3	OV	3	N	N	N/A	N	M	YF	10	C		long gradient
9	0	0	0	0	B/C	3	OV	4	SC	N	2	N	M	YF	4	N		>15
10	0	0	0	0	B/C	3	OV	4	SC	N	2	N	M	YF	4	N		log jams
11	1	0	1	0	B	3	OV	5	SC	N	2.5	N	M	YF	4	N		braiding
12	0	0	0	0	B	1	OV	3	N	N	N/A	N	M	YF	4	N		22m not
13	12	5	6	1	LWD	1	OV	2	SC	N	1.5	N	M	YF	2	N		barrier
14	0	0	0	0	B	1	OV	2	SC	N	1.5	N	M	YF	2	N		
15	24	15	9	0	LWD	2	OV	1	SC	N	0.5	N	M	YF	1	N		
16	9	2	3	4	LWD/	2	OV	2	SC	N	0.3	N	M	YF	2	N		
17	9	2	3	4	LWD	1	OV	2	SC	N	0.3	N	M	YF	2	N		
18	9	2	7	0	LWD	1	OV	1	SC	P	1	N	M	YF	0	N		
19	2	0	2	0	C	5	OV	5	N	N	N/A	N	M	YF	50	N		
20	0	0	0	0	C	3	OV	6	SC	P	1	N	M	YF	70	N		

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/19/18
Temperature: _____ 11

Watershed: _ SQUAMISH
Weather: ___ OVERCAST
Survey Crew: PAUL, JAMEY, NED

Sub-Basin: _____ CRAWFORD CREEK
Discharge (m3 /s): _____
Subsampling Fractions: ___ R/P/G/C/O
(R / P / G / C / O)

							Mean Depth				Mean Width		Pools Only				Bed Material Type			
	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Bankfull (m)	Water (m)			Bankfull (m)	Wetted (m)	Max. Depth (m)	Crest (m)	Residual (m)	Pool Type	Dom.	Sub- Dom.	Spawning Gravel ?	
1	20	360	R	1	130	3	1.5	0.3	0	0.3	11	8	N	N	N	N/A	C	G	H	A/R
2	20	512	R	1	152	4	2	0.2	0	0.2	17.4	13.2	N	N	N	N/A	C	G	H	A/R
3	21	0	C	1	0	4	2	0.2	0	0.2	17.4	13.2	N	N	N	N/A	C	G	L	A/R
4	21	200	R	1	200	6	0.5	0.4	0	0.1	8.3	4	N	N	N	N/A	C	G	L	A/R
5	21	301	R	1	101	4	1	0.3	0	0.3	16.5	12.5	N	N	N	N/A	C	G	L	A/R
6	22	0	R	1	0	4	1	0.3	0	0.3	16.5	12.5	N	N	N	N/A	C	G	L	A/R
7	22	77	R	1	77	4	0.5	0.4	0	0.1	12.3	4.7	N	N	N	N/A	C	G	L	A/R
8	23	0	R	1	0	4	0.5	0.4	0	0.1	12.3	4.7	N	N	N	N/A	C	G	L	A/R
9	23	30	R	1	30	4	1	0.3	0	0.3	12.6	5.1	N	N	N	N/A	C	G	L	A/R
10	23	137	G	1	107	2	0.5	0.3	0	0.3	20	5.2	N	N	N	N/A	G	S	L	A/R
11	23	314	R	1	207	8	1	0.2	0	0.2	9.7	6.4	N	N	N	N/A	C	G	L	A/R
12	24	0	R	1	0	8	1	0.2	0	0.2	9.7	6.4	N	N	N	N/A	C	G	L	A/R
13	24	124	R	1	124	5	1	0.1	0	0.1	12.1	2	N	N	N	N/A	C	G	L	A/R
14	24	293	R	1	168	6	1	0.3	0	0.3	35	2.5	N	N	N	N/A	C	G	L	A/R
15	24	417	C	1	124	7	1	0.6	1	0.6	20	3.5	N	N	N	N/A	C	B	L	A/R
16	25	0	C	1	0	17	1	0.6	1	0.6	20	3.5	N	N	N	N/A	C	B	L	A/R
17																				
18																				
19																				
20																				

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
Watershed: __ SQUAMISH
Sub-Basin: _____ CRAWFORD CREEK
NTS map sheet: _____
Weather: ____ OVERCAST
Discharge (m3 /s): NOT MEASURED
Survey date : 96/09/18
Survey Crew PAUL, JAMEY, NED
Subsampling Fractions: _____ R/P/G/C/O
Temperature: _____ 11 C
(R / P / G / C / O)

	Total LWD Tally	Functio nal LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 - 20 cm	20 - 50 cm	> 50 cm	Cover Type	%	Cover Type	%	Type	Access	Length (m)		Type	Structure	Canopy Closure			
1	8	0	6	2	C	3	OV	5	N	N	N/A	N	M	YF	30	N		pg. 5
2	6	2	3	1	C	2	OV	1	N	N	N/A	EB	M	MF	10	N		Log jam at 284 ls
3	6	2	3	1	B	3	OV	2	N	N	N/A	EB	M	MF	15	N		not a barrier to fish.
4	12	3	9	0	LWD	1	OV	1	N	N	N/A	N	M	MF	2	N		Slide at 0 133 ls
5	12	3	9	0	LWD	1	OV	1	N	N	N/A	N	M	MF	1	N		not a barrier,created
6	12	3	9	0	LWD	1	OV	0	N	N	N/A	N	M	MF	1	N		scour pool behind lg. rocks.
7	30	8	5	15	LWD	3	OV	0	N	N	N/A	N	M	MF	0	C		Braiding starts
8	30	8	5	15	LWD	3	OV	0	N	N	N/A	N	M	MF	0	C		at 0m on reach22.
9	>50	NA	NA	NA	LWD	5	OV	1	N	N	N/A	MC	M	MF	1	X		Major log jams
10	39	30	9	0	LWD/	5	OV	3	N	N	N/A	MC	M	MF	3	N		but water braids
11	2	1	1	0	C	1	OV	3	SC	G	1.5	MC	M	MF	4	N		extensively again.
12	2	1	1	0	C	1	OV	3	SC	G	1.5	MC,EB	M	MF	4	N		
13	>100	NA	NA	NA	LWD	6	OV	0	N	N	N/A	N	M	MF	1	N		
14	6	0	3	3	LWD/	3	OV	0	N	N	N/A	MC,flood	M	MF	0	N		Gradient greater
15	3	0	3	0	B	3	OV	0	N	N	N/A	flooding	M	MF	0	C		than 15'.
16																		
17																		
18																		
19																		
20																		

Level 1 - Habitat Survey Data Form

Forest District: _____ Squamish
NTS map sheet: _____
Survey Date: _____ 96/09/19
Temperature: _____ 10

Watershed: __ Squamish
Weather: ____ overcast
Survey Crew: Jamey, Ned, Paul

Sub-Basin: _____ Cheekye
Discharge (m3 /s): not measured
Subsampling Fractions: ___ R/C
(R / P / G / C / O)

	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Mean Depth Bankfull (m)	Mean Depth Water (m)			Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max. Depth (m)	Pools Only Crest (m)	Pools Only Residual (m)	Pools Only Pool Type	Bed Material Type Dom.	Bed Material Type Sub- Dom.	Spawning Gravel ?	
1	1	0	C-1	1	0	5	1.5	0.3	0.50	0.3	>50	11.5	N	N	N	NA	C	B	L	AR
2	1	112	C-1	1	112	8	0.6	0.4	0.8	0.5	33.4	9.3	N	N	N	NA	C	B	L	AR
3	2	0	C-1	1	0	8	0.6	0.4	0.8	0.5	33.4	9.3	N	N	N	NA	C	B	L	AR
4	2	104	C-1	1	104	7	0.5	0.3	0.7	0.1	39	10.5	N	N	N	NA	C	B	L	AR
5	2	393	C-1	1	289	4	2	0.3	0.5	0.3	>50	12	N	N	N	NA	C	B	L	AR
6	2	923	C-1	1	530	5	0.8	0.1	0.6	0.3	>50	7.5	N	N	N	NA	C	B	L	AR
7	3	0	C-1	1	0	5	0.8	0.1	0.6	0.3	>50	7.5	N	N	N	NA	C	B	L	AR
8	3	271	C-1	1	271	7	1	0.3	0.3	0.3	>50	15.1	N	N	N	NA	C	B	L	AR
9	3	439	C-1	1	168	5	3	0.5	0.7	0.3	39	12	N	N	N	NA	C	B	L	AR
10	4	0	C-1	1	0	5	3	0.5	0.7	0.3	39	12	N	N	N	NA	C	B	L	AR
11	4	200	C-1	1	200	5	1.5	0.3	0.6	0.4	41	8.8	N	N	N	NA		B	L	AR
12	4	417	C-1	1	217	6	3	0.4	0.4	0.4	35	7.3	N	N	N	NA	C	B	L	AR
13	5	0	C-1	1	0	6	3	0.4	0.4	0.4	35	7.3	N	N	N	NA	C	B	L	AR
14	5	170	C-1	1	170	8	2.5	0.5	0.8	0.4	19.5	12.4	N	N	N	NA	C	B	L	AR
15	5	426	C-1	1	256	5	10	0.5	0.8	0.4	13.4	9.4	N	N	N	NA	C	B	L	AR
16	6	0	C-1	1	0	5	10	0.5	0.8	0.4	13.4	9.4	N	N	N	NA	C	B	L	AR
17	6	110	C-1	1	110	6	1.5	0.2	0.8	0.6	35.1	5.5	N	N	N	NA	C	B	L	AR
18	7	0	C-1	1	0	6	1.5	0.2	0.8	0.6	35.1	5.5	N	N	N	NA	C	B	L	AR
19	7	244	C-1	1	244	8	0.3	NA	NA	NA	45.1	3	N	N	N	NA	C	B	L	AR
20	7	475	C-1	1	231	5	1	0.3	0.7	0.4	35	4.5	N	N	N	NA	C	B	L	AR

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/09/19
Temperature: _____ 10

Watershed: __ SQUAMISH
Weather: ____ OVERCAST
Survey Crew: JAMEY, NED, PAUL

Sub-Basin: _____ CHEEKYE
Discharge (m3 /s): not measured
Subsampling Fractions: _____ R/C
(R / P / G / C / O)

	Total LWD Tally	Functional LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 -	20 - 50cm	> 50	Cover	%	Cover	%	Type	Access	Length		Type	Structure	Canopy			
1	0	0	0	0	B	1	NA	NA	N	N	N	FLOOD	M	YF	0	N		pg1 at 104m-braiding starts
2	1	0	1	0	B	1	NA	NA	N	N	N	FLOOD	M	YF	0	N		190m-hydro wires
3	1	0	1	0	B	1	NA	NA	N	N	N	FLOOD	M	YF	0	N		LWD deposited on flood bank,
4	4	0	4	0	B	0.5	NA	NA	N	N	N	FLOOD	M	YF	0	N		not in water-398m
5	0	0	0	0	B	1	NA	NA	N	N	N	FLOOD	M	YF	0	N		braiding stops
6	0	0	0	0	B	1	NA	NA	N	N	N	FLOOD	M	YF	0	N		braiding continues throughout
7	0	0	0	0	B	1	NA	NA	N	N	N	FLOOD	M	YF	0	N		in different places due to
8	1	0	1	0	B	3	NA	NA	N	N	N	FLOOD	M	YF	0	N		past flooding
9	0	0	0	0	B	3	NA	NA	N	N	N	FLOOD	M	YF	0	N		
10	0	0	0	0	B	3	NA	NA	N	N	N	FLOOD	M	YF	0	N		
11	2	0	2	0	B	1	NA	NA	N	N	N	FLOOD	M	YF	0	N		
12	0	0	0	0	B	2	NA	NA	N	N	N	FLOOD	M	YF	0	N		
13	0	0	0	0	B	2	NA	NA	N	N	N	FLOOD	M	YF	2	N		
14	0	0	0	0	B	3	NA	NA	N	N	N	FLOOD	M	YF	2	N		
15	0	0	0	0	B	2	NA	NA	N	N	N	FLOOD	M	YF	0	N		
16	0	0	0	0	B	2	NA	NA	N	N	N	N	M	YF	0	N		
17	0	0	0	0	B	1	NA	NA	N	N	N	N	M	YF	0	N		
18	0	0	0	0	B	1	NA	NA	N	N	N	FLOOD	M	YF	0	N		
19	0	0	0	0	B	1	NA	NA	N	N	N	FLOOD	M	YF	0	N		
20	0	0	0	0	B	1	NA	NA	N	N	N	FLOOD	M	YF	0	N		

Level 1 - Habitat Survey Data Form

Forest District: _____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/09/19
Temperature: _____ 10

Watershed: _ SQUAMISH
Weather: ___ OVERCAST
Survey Crew: JAMEY, PAUL, NED

Sub-Basin: _____ CHEEKYE
Discharge (m3 /s): not measured
Subsampling Fractions: ___ R/C
(R / P / G / C / O)

							Mean Depth				Mean Width		Pools Only				Bed Material Type			
	Reach Number	Distance (m)	Habitat Type	Unit Cat.	Length (m)	Gradient (%)	Bankfull (m)	Water (m)			Bankfull (m)	Wetted (m)	Max. Depth (m)	Crest (m)	Residual (m)	Pool Type	Dom.	Sub- Dom.	Spawning Gravel ?	
1	8	0	C-1	1	0	5	1	0.3	1	0.4	35	4.5	N	N	N	N	C	B	L	AR
2	8	156	C-1	1	156	5	0.5	0.5	1	0.2	12	3.8	N	N	N	N	C	B	L	AR
3	9	0	C-1	1	0	5	0.5	0.5	1	0.2	12	3.8	N	N	N	N	C	B	L	AR
4	9	240	C-1	1	240	7	1	0.3	0	0.3	>50	9.3	N	N	N	N	C	B	L	AR
5	9	408	C-1	1	408	6	1	0.3	1	0.2	>50	6.1	N	N	N	N	C	B	L	AR
6	10	0	C-1	1	0	6	1	0.3	1	0.2	>50	6.1	N	N	N	N	C	B	L	AR
7	10	180	C-1	1	180	7	1	0.2	1	0.1	>50	6.4	N	N	N	N	C	B	L	AR
8	11	0	C-1	1	0	7	1	0.2	1	0.1	>50	6.4	N	N	N	N	C	B	L	AR
9	11	180	C-1	1	180	7	0.8	0.2	1	0.1	25	3.6	N	N	N	N	C	B	L	AR
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				

Level 1 - Habitat Survey Data Form

Forest District: ____ SQUAMISH
NTS map sheet: _____
Survey Date: _____ 96/09/19
Temperature: _____ 10

Watershed: _ SQUAMISH
Weather: ___ OVERCAST
Survey Crew: JAMEY, PAUL, NED

Sub-Basin: _____ CHEEKYE
Discharge (m3 /s): NOT MEASURED
Subsampling Fractions: ____ R/C
(R / P / G / C / O)

	Total LWD Tally	Functional LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators	Riparian Vegetation			Barriers	Film / Frame Number	Comments
		10 -	20 - 50cm	> 50	Cover	%	over	%	Type	Access	Length		Type	Structure	Canopy			
1	0	0	0	0	B	1	NA	NA	N	N	N	FLOOD	M	YF	0	N		pg2 LWD is on
2	0	0	0	0	B	2.5	NA	NA	SC	P	0.5	FLOOD	M	YF	0	N		high banks, deposited
3	0	0	0	0	B	2.5	NA	NA	SC	P	0.5	FLOOD	M	MF	0	N		there by previous
4	2	2	0	0	B	1	NA	NA	N	N	N	FLOOD	M	MF	0	N		floods
5	0	0	0	0	B	1.5	NA	NA	SC	N	1	FLOOD	M	MF	0	N		140m-fry sighted
6	0	0	0	0	B	1.5	NA	NA	SC	N	1	FLOOD	M	MF	0	N		R-8
7	3	2	1	0	B	1	NA	NA	N	N	N	FLOOD	M	MF	0	N		braiding again in R-9
8	3	2	1	0	B	1	NA	NA	N	N	N	FLOOD	M	MF	0	N		
9	0	0	0	0	B	1	NA	NA	SC	N	0.3	FLOOD	M	MF	0	N		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		

APPENDIX F
CAP Field Data

APPENDIX G
WAP Field Data

APPENDIX H
RAP Field Data

Pillchuck Creek Field Data Summary Table								
Reach	Bankfull		Slope	Average Rock	Relative	Power	Sensitivity	Channel
	Width (m)	Depth (m)	(%)	D (m)	Roughness	Index	Rating	Condition
1	15	2	0.5	Fines	-	-	L	Stable
2	14.58	1.46	0.83	0.02	0.02	17.76	L	Stable
3	-	-	-	-	-	-	-	-
4	10.18	2.18	21	1.34	0.61	466.04	L	-
5	-	-	-	-	-	-	H	-
6	-	-	-	-	-	-	H	-
7	-	-	-	-	-	-	H	-
8	7.24	1.10	2.8	0.33	0.30	22.30	M	Stable
9	5.37	0.70	1	0.27	0.38	3.76	L	Stable
10	7.52	0.76	8.6	0.36	0.47	49.15	M	Stable

Channel
Type
Riffle-pool
Riffle-pool
-
Cascade-pool
Cascade-pool
Cascade-pool
Cascade-pool
Riffle-pool
Riffle-pool
Riffle-pool

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Quality Assurance/Quality Control Form

Stream: Pillchuck Creek Date: _____ Crew: Stephen Coleman, Brian LaCas, Jeff Westlake

		Bank Full		Channel					Bank			Logging	Large
	Reach #	Width (m)	Depth (m)	Slope (%)	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m)	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)	Past/Present (Y/N)	Woody Debris (Y/N)
QA/QC	1 (Bridge)	15.1	2	0.5	S	Fines	Fines	0	0	0	-	Y	N
QA/QC	1	14.7	1.9	0.5	S	Fines	Fines	0	4 m bank 0% slope	4 m bank 0% slope	-	N	N
Original Results									5 m bank 80%				
QA/QC	2 (Bridge)	9.6	2.25	<1	S	Fines	Fines	0	unconnected slide	1.5 m bank 0%	L: 0 m R: >60 m	Y	N
Original Results													
QA/QC 1	4 (Bridge)	4.7	1.7	7.5%	S	Boulder	0.4	0	Vert	Vert	0	Y	N
QA/QC 2	4	7.3	1.7	15%	S	Boulder	0.4	0	Vert	Vert	L: 50 m; R: 15 m	y	Y (non-functioning)
Original Results													

Drainage Structures Quality Assurance/Quality Control Form

Stream: Pillchuck Date: Sept. 20/ Crew: Stephen Coleman, Brian LaCas, Jeff Westlake

Bridge: Bottom R1

Location of structure:

Original		Quality Assurance Check	
Type of bridge:		Type of bridge:	wooden
Width of bridge:		Width of bridge:	5
Clearspan width:		Clearspan width:	9.6
Clearance:		Clearance:	7.25

Drainage Structures Quality Assurance/Quality Control Form

Stream: Pillchuck Date: Sept. 20/ Crew: Stephen Coleman, Brian LaCas, Jeff Westlake

Bridge: Reach Break 1-2

Location of structure:

Original		Quality Assurance Check	
Type of bridge:		Type of bridge:	wooden
Width of bridge:		Width of bridge:	5
Clearspan width:		Clearspan width:	9.6
Clearance:		Clearance:	7.25

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: _____ Date: _____ Crew: _____

Reach #: _____

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)	Stream Code
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m)	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)			
1																
2																
3																
4																
5																

Field data checked by: _____

Electronic data entry checked by: _____

Reviewed by: _____

Notes and Observations

Average channel width, W_a (m #DIV/0!
Average channel depth, d (m): #DIV/0!
Average channel gradient, S (#DIV/0!
Average Rock, D (m): #DIV/0!
Average Gravel Bar Width (m): #DIV/0!

Channel Type: Riffle-pool

Relative roughness (D/d): #DIV/0!
Power index (W_a d S): #DIV/0!

Hillslope-valley flat connectio L
Average Valley Width: H
Upstream Disturbance: H

Sensitivity Rating: H

Squamish River Watershed Restoration Program/Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: PILCHUCK Date: 9/7/96 Crew: JEN, DAN, AL, STEVE, NED

Reach #: 2

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m)	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1	200	21	2.7	0.5				Silt	0	0			100	N	
2	401	15.6	1.5					Silt	0	0			100	N	
3	507	13	0.75	1				Silt/gravel	0.04	0			100	N	
4	544	8.7	0.9	1				gravel	0.05	0			100	N	
5															

Field data checked by: _____

Electronic data entry checked by: _____

Reviewed by: _____

Notes and Observations

Logging regenerated

Average channel width, W_b (m) 14.58
Average channel depth, d (m): 1.46
Average channel gradient, S (0.83
Average Rock, D (m): 0.02
Average Gravel Bar Width (m): 0

Relative roughness (D/d): 0.02
Power Index (W_b d S): 17.76

Hillslope-valley flat connection L
Average Valley Width: H
Upstream Disturbance: H

Sensitivity Rating: H

Channel Type: Riffle-pool

Squamish River Watershed Restoration Program *Forest Renewal B.C.*
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: _____ Date: _____ Crew: _____

Reach #: _____

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m)	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1															
2															
3															
4															
5															

Field data checked by: _____

Electronic data entry checked by: _____

Reviewed by: _____

Notes and Observations

Average channel width, W_b (m) #DIV/0!
Average channel depth, d (m): #DIV/0!
Average channel gradient, S (#DIV/0!
Average Rock, D (m): #DIV/0!
Average Gravel Bar Width (m): #DIV/0!

Channel Type: Riffle-pool

Relative roughness (D/d): #DIV/0!
Power Index (W_b d S): #DIV/0!

Hillslope-valley flat connection L
Average Valley Width: H
Upstream Disturbance: H

Sensitivity Rating: H

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: PILCHUCK Date: 07/16/96 Crew: JEN, NED, DAN, STEVE

Reach #: 4

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	3	4.9	1.2	11	120				1.1	0	62	75	> 1000	Y	
2	41	9	2.7	14	120				2	0	99	58	> 1000	Y	
3	71	10.2	2.7	30	125				1.2	0	68	100	> 1000	Y	
4	103	15.1	1.5	34	140				1	0	65	90	> 1000	N	
5	142	11.7	2.8	16	145				1.4	0	72	95	> 1000	N	

Field data checked by: _____

Electronic data entry checked by: _____

Reviewed by: _____

Notes and Observations

Average channel width, W_b (m) 10.18
Average channel depth, d (m): 2.18
Average channel gradient, S (21
Average Rock, D (m): 1.34
Average Gravel Bar Width (m): 0

Channel Type: Riffle-pool

Relative roughness (D/d): 0.61
Power index (W_b d S): 466.04

Hillslope-valley flat connection L
Average Valley Width: H
Upstream Disturbance: H

Sensitivity Rating: H

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: _____ Date: _____ Crew: _____

Reach #: _____

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m)	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1															
2															
3															
4															
5															

Field data checked by: _____

Electronic data entry checked by: _____

Reviewed by: _____

Notes and Observations

Average channel width, W_b (m) #DIV/0!
Average channel depth, d (m): #DIV/0!
Average channel gradient, S (#DIV/0!
Average Rock, D (m): #DIV/0!
Average Gravel Bar Width (m): #DIV/0!

Channel Type: Riffle-pool

Relative roughness (D/d): #DIV/0!
Power index (W_b d S): #DIV/0!

Hillslope-valley flat connection L
Average Valley Width: H
Upstream Disturbance: H

Sensitivity Rating: H

Squamish River Watershed Restoration Program/Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: _____ Date: _____ Crew: _____

Reach #: _____

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m)	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1															
2															
3															
4															
5															

Field data checked by: _____

Electronic data entry checked by: _____

Reviewed by: _____

Notes and Observations

Average channel width, W_b (m) #DIV/0!
Average channel depth, d (m): #DIV/0!
Average channel gradient, S (#DIV/0!
Average Rock, D (m): #DIV/0!
Average Gravel Bar Width (m): #DIV/0!

Channel Type: Riffle-pool

Relative roughness (D/d): #DIV/0!
Power Index (W_b d S): #DIV/0!

Hillslope-valley flat connection L
Average Valley Width: H
Upstream Disturbance: H

Sensitivity Rating: H

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: _____ Date: _____ Crew: _____

Reach #: _____

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m)	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1															
2															
3															
4															
5															

Field data checked by: _____

Electronic data entry checked by: _____

Reviewed by: _____

Notes and Observations

Average channel width, W_b (m) #DIV/0!
Average channel depth, d (m): #DIV/0!
Average channel gradient, S (#DIV/0!
Average Rock, D (m): #DIV/0!
Average Gravel Bar Width (m): #DIV/0!

Channel Type: Riffle-pool

Relative roughness (D/d): #DIV/0!
Power index (W_b d S): #DIV/0!

Hillslope-valley flat connection L
Average Valley Width: H
Upstream Disturbance: H

Sensitivity Rating: H

Squamish River Watershed Restoration Program/Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Pillchuck Date: 9/19/96 Crew: Jen, Mike, Dan, George

Reach #: 8

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	0	10	1	3	430	167	Stable	Cobble	0.25	1.8	85	5	20	N	N
2	61	5.1	0.9	3	430	140	S	Gravel	0.4	0	95	57	20	N	Y
3	169	8.3	0.9	3	425	160	A	Cobble	0.4	2.1	70	48	200	N	Y
4	217	5.1	1.1	2	420	150	S	Cobble	0.4	0	80	60	40	N	Y
5	900	7.7	1.6	3	395	212	S	Silt	0.2	0	68	70	50	N	Y

Field data checked by: _____

Electronic data entry checked by: _____

Reviewed by: _____

Notes and Observations

Average channel width, W_b (m) 7.24
Average channel depth, d (m): 1.1
Average channel gradient, S (2.8
Average Rock, D (m): 0.33
Average Gravel Bar Width (m): 0.78

Relative roughness (D/d): 0.3
Power index (W_b d S): 22.2992

Hillslope-valley flat connection M
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Channel Type: Riffle-pool

Squamish River Watershed Restoration Program/Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Pillchuck Date: 9/19/96 Crew: Jen, Dan, Mike, George

Reach #: 9

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	20	4.7	0.9	1	430	140	Stable	Cobble	0.2	0.9	4	17	20	N	N
2	50	6.8	0.5	1	430	98	S	Cobble	0.3	0	14	5	200	N	N
3	70	4.6	0.7	1	430	40	S	Cobble	0.3	0	14	24	200	N	N
4															
5															

Field data checked by: _____

Electronic data entry checked by: _____

Reviewed by: _____

Notes and Observations

Average channel width, W_b (m) 5.36667
Average channel depth, d (m): 0.7
Average channel gradient, S (I
Average Rock, D (m): 0.26667
Average Gravel Bar Width (m): 0.3

Channel Type: Riffle-pool

Relative roughness (D/d): 0.38095
Power Index (W_b d S): 3.75667

Hillslope-valley flat connection L
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: L

Squamish River Watershed Restoration Program/Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Pillchuck Date: 9/19/96 Crew: Jen, Dan, Mike, George

Reach #: 10

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	144	7.4	0.7	3	440	50	Stable	Gravel	0.2	1.6	17	5	75	N	Y
2	302	4.6	1.1	19	445	350	Stable	Boulder	0.4	0	45	37	300	N	Y
3	471	8.2	0.8	9	460	90	Aggraded	Gravel	0.1	2.8	32	85	30	N	Y
4	629	9.2	0.8	7	480	130	Aggraded	Sand	1	2.8	9	33	75	N	Y
5	767	8.2	0.4	5	490	120	Aggraded	Boulder	0.1	4.8	25	20	600	N	Y

Field data checked by: _____

Electronic data entry checked by: _____

Reviewed by: _____

Notes and Observations

Average channel width, W_b (m) 7.52
Average channel depth, d (m): 0.76
Average channel gradient, S (8.6
Average Rock, D (m): 0.36
Average Gravel Bar Width (m): 2.4

Relative roughness (D/d): 0.47
Power index (W_b d S): 49.15

Hillslope-valley flat connection M
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Channel Type: Riffle-pool

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: _____ Date: _____ Crew: _____

Reach #: _____

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m)	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1															
2															
3															
4															
5															

Field data checked by: _____

Electronic data entry checked by: _____

Reviewed by: _____

Notes and Observations

Average channel width, W_b (m) #DIV/0!
Average channel depth, d (m): #DIV/0!
Average channel gradient, S (#DIV/0!
Average Rock, D (m): #DIV/0!
Average Gravel Bar Width (m): #DIV/0!

Channel Type: Riffle-pool

Relative roughness (D/d): #DIV/0!
Power Index (W_b d S): #DIV/0!

Hillslope-valley flat connection L
Average Valley Width: H
Upstream Disturbance: H

Sensitivity Rating: H

Squamish River Watershed Restoration Program/Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: _____ Date: _____ Crew: _____

Reach #: _____

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m)	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1															
2															
3															
4															
5															

Field data checked by: _____

Electronic data entry checked by: _____

Reviewed by: _____

Notes and Observations

Average channel width, W_b (m) #DIV/0!
Average channel depth, d (m): #DIV/0!
Average channel gradient, S (#DIV/0!
Average Rock, D (m): #DIV/0!
Average Gravel Bar Width (m): #DIV/0!

Channel Type: Riffle-pool

Relative roughness (D/d): #DIV/0!
Power index (W_b d S): #DIV/0!

Hillslope-valley flat connection L
Average Valley Width: H
Upstream Disturbance: H

Sensitivity Rating: H

Steve Transfer

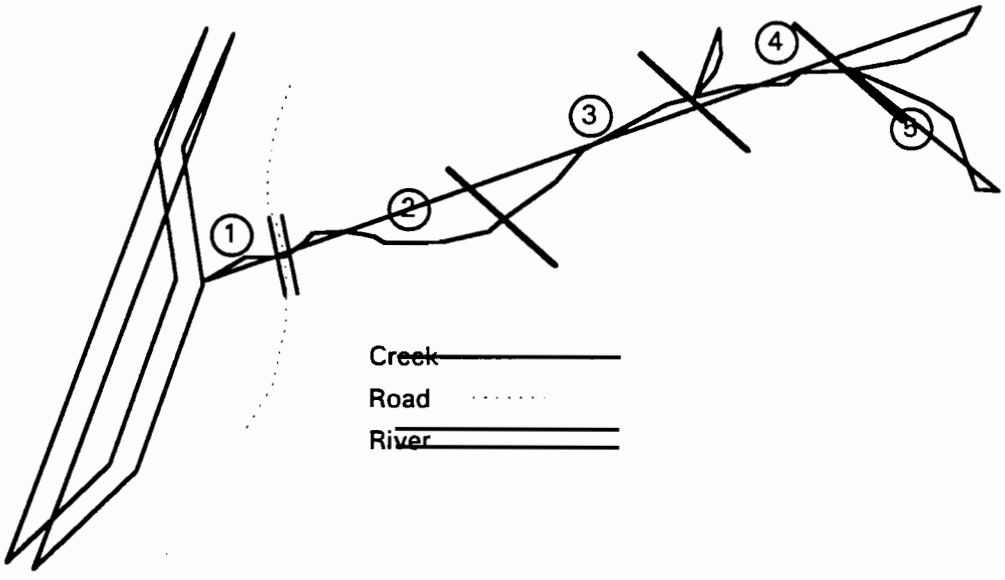
Pilchuck xls

(16)

Reach Marker Checklist

Stream: PILCHUCK Date: _____ Crew: _____

Reach #	Flag		Plate		Photo		Map	
	Left bank	Right bank	Left bank	Right bank	Upstream	Downstream	Marked	GPS
1	*	*					*	
2	*	*					*	
3	*	*	*		*	*	*	
4	*	*	*	*	*	*	*	
5	*	*	*	*	*	*	*	
6	*	*	*	*	*	*	*	
7	*	*	*	*	*	*	*	
8	*	*	*	*	*	*	*	
9								
10	*	*					*	
11	*	*					*	
12	*	*					*	
13								
14								
15								
16								
17								
18								
19								
20								



Chance Creek Field Data Summary Table

Reach	Bankfull Width (m)	Depth (m)	Slope (%)	Average Rock D (m)	Relative Roughness	Power Index	Sensitivity Rating	Channel Condition	Channel Type
1	11.2	1	3	1	1	33.6	H	0	Riffle-pool
2	10	2	2	0.4	0.2	40	H	0	Riffle-pool
3	7.3	1	6	0.7	0.7	43.8	H	0	Riffle-pool
4	-	-	-	-	-	-	L	0	Step-pool
5	16.47	1.4	3.67	0.43	0.31	84.53	M	0	Riffle-pool
6	28.26	1.56	2.6	0.82	0.53	114.62	H	0	Riffle-pool
7	7.14	1.4	9.8	1.14	0.81	97.96	M	0	Step-pool
8	8.98	1.14	7	0.78	0.68	71.66	M	0	Cascade-pool
9	10.26	1.16	5.8	0.80	0.69	69.03	H	0	Cascade-pool
10	11.98	0.88	3.6	0.62	0.70	37.95	M	Aggraded	Riffle-pool
11	7.63	1.7	14.33	0.67	0.39	186.00	H	Stable	Riffle-pool
12	7.37	0.87	6.67	0.57	0.65	42.56	H	Stable	Riffle-pool
13	11.7	1.5	7.5	0.60	0.40	131.63	H	Stable	Riffle-pool
14	5.46	1.02	15	0.46	0.45	83.54	H	Stable	Step Pool
15	5.8	0.88	11.2	0.38	0.43	57.16	L	Stable	Step Pool

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Quality Assurance/Quality Control Form

Stream: Chance Creek Date: October 4, 1996 Crew: Al Lewis, Stephen Coleman

	Reach #	Bank Full		Channel						Bank			Logging	Large
		Width (m)	Depth (m)	Slope (%)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m)	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)	Past/Present (Y/N)	Woody Debris (Y/N)
QA/QC 1	15	9	1	6.5		Stable	C,G	0.5	-	15	-15	10	Y	Y
QA/QC 2	15	3	1	6		Stable	C,B	0.6	-	100	Vert	5	N	N
Original Results	15	5.8	0.88	11.2		Stable	Cobble	0.38	-	45.6	66.2	100	Y	-
QA/QC 1	5	36.5	0.8	2		Aggraded	C,G,B	0.5	20	2 m bank	2 m bank	>100	N	N
QA/QC 2	5	43	0.8	2		Aggraded	C,G,B	0.5	17	3 m bank	2 m bank	>100	N	N
Original Results	5	16.47	1.40	3.67		-	-	0.43	-	48.67	16.33	100	Y	-
QA/QC 1	6	37	2	3		Aggraded	C,B,G	0.5	>12	3 m bank	3 m bank	>100	N	Y
QA/QC 2	6	35	>2	3.5		Aggraded	C,B,G	0.7	12	3 m bank	3 m bank	>100	N	Y
Original Results	6	28.26	1.56	2.6		-	-	0.82	-	69.5	37.5	100	Y	-

There is further QAQC data available - see Brian LaCas

Drainage Structures Data Summary Sheet					
Stream:	Chance	Date:	07/19/96	Crew:	Al, Jen,
					Ned,
Reach #:	top of reach 5				George
Location of structure:					
Bridges			**Culverts**		
Type of bridge:		log	Type of culvert:		
Width of bridge:		6.4	Shape of culvert:		
Clearspan width:		11.8	Length of culvert:		
Clearance:		2.9	Diameter of culvert:		

Drainage Structures Data Summary Sheet					
Stream:	Chance	Date:		Crew:	
Reach #:	top of reach 1				
	data not yet taken				
Location of structure:					
Bridges			**Culverts**		
Type of bridge:		railway	Type of culvert:		
Width of bridge:			Shape of culvert:		
Clearspan width:			Length of culvert:		
Clearance:			Diameter of culvert:		

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Chance Date: 07/18/96 Crew: Al, Dan, Ned, Jen

Reach #: 2

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1															
2															
3															
4															
5	356	10	2	2	420				0.4	0	> 150	84		N	

Notes and Observations

Average channel width, W_b (m): 10 **Channel Type:** Riffle-pool
Average channel depth, d (m): 2
Average channel gradient, S (%): 2
Average Rock, D (m): 0.4
Average Gravel Bar Width (m): 0

Relative roughness (D/d): 0.2
Power Index (W_b d S): 40

Hillslope-valley flat connection: L
Average Valley Width: H
Upstream Disturbance: H

Sensitivity Rating: H

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Chance Date: 07/22/96 Crew: Al, Jen, Ned, George

Reach #: 3

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m)	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1															
2															
3															
4															
5	305	7.3	1	6	345				0.7	0	62	70	100	N	

Field data checked by: _____

Electronic data entry checked by: _____

Reviewed by: _____

Notes and Observations

reach consists of canyon, falls- step- pool
reach break : man - made barrier of logs , old pipeline

Average channel width, W_b (m): 7.3
Average channel depth, d (m): 1
Average channel gradient, S (%): 6
Average Rock, D (m): 0.7
Average Gravel Bar Width (m): 0

Channel Type: Riffle-pool

Relative roughness (D/d): 0.7
Power Index (W_b d S): 43.8

Hillslope-valley flat connection: M
Average Valley Width H
Upstream Disturbance: H

Sensitivity Rating: H

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Chance Date: 07/17/96 Crew: Al, Jen, Ned, Dan

Reach #: 1

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	151	11.2	1	3	420				1	0	60	52	> 100	N	
2															
3															
4															
5															

Notes and Observations

Reach break : railway bridge

Average channel width, W_b (m): 11.2
Average channel depth, d (m): 1
Average channel gradient, S (%): 3
Average Rock, D (m): 1
Average Gravel Bar Width (m): 0

Channel Type: Riffle-pool

Relative roughness (D/d): 1
Power Index (W_b d S): 33.6

Hillslope-valley flat connection: M
Average Valley Width: H
Upstream Disturbance: H

Sensitivity Rating: H

Squamish River Watershed Restoration Program Forest Renewal B.C.

Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Chance Date: 07/22/96 Crew:

Reach #: 4

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1															
2															
3															
4															
5															

Field data checked by:

Electronic data entry checked by:

Reviewed by:

Notes and Observations

Reach consists of , waterfalls- step - pool

Reach break : end of canyon, falls

Average channel width, W_b (m): #####

Channel Type: Step-pool

Average channel depth, d (m): #####

Average channel gradient, S (%): #####

Average Rock, D (m): #####

Average Gravel Bar Width (m): #####

Relative roughness (D/d): #####

Power Index (W_b d S): #####

Hillslope-valley flat connection:

Average Valley Width

Upstream Disturbance:

Sensitivity Rating:

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Chance Date: 07/19/96 Crew: Al, Jen, Nedd, George

Reach #: 5

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	348	13.6	1.3	5	550				0.3	0	91	5	100	Y	
2	474	16.1	1.6	4	550				0.6	0	26	22	100	Y	
3	605	19.7	1.3	2	560				0.4	0	29	22	100	Y	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Reach break : road crossing via log/gravel bridge

Average channel width, W_b (m): 16.47
Average channel depth, d (m): 1.4
Average channel gradient, S (%): 3.67
Average Rock, D (m): 0.43
Average Gravel Bar Width (m): 0

Relative roughness (D/d): 0.31
Power Index (W_b d S): 84.53

Hillslope-valley flat connection: M
Average Valley Width L
Upstream Disturbance: H

Sensitivity Rating: M

Channel Type: Riffle-pool
Channel Code: RPc

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Chance Date: 07/19/96 Crew: Al, Jen, Ned, George

Reach #: 6

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	69	31.3	2.1	2	565				0.5	17.5	95	48	100	Y	
2	145	43.4	1	2	565				0.8	0	69	61	100	Y	
3	205	37.5	1.4	4	565				0.8	0	90	39	100	Y	
4	266	14.1	1.7	2	565				1	0	24	2	100	Y	
5	303	15	1.6	3	565				1	0	< 1	< 1	100	Y	

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Reach break : tributary on left bank - ephemeral Wb = 13.4, Db = 1.4, S = 4

Average channel width, W_b (m): 28.26
Average channel depth, d (m): 1.56
Average channel gradient, S (%): 2.6
Average Rock, D (m): 0.82
Average Gravel Bar Width (m): 3.5

Channel Type: Riffle-pool

Relative roughness (D/d): 0.53
Power Index (W_b d S): 114.62

Hillslope-valley flat connection: M
Average Valley Width H
Upstream Disturbance: H

Sensitivity Rating: H

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Chance Date: 07/19/96 Crew: Al, Ned, Jen, George

Reach #: 7

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	175	4.6	2.4	2	580				0.7	0	100	75	4.6	N	
2	395	10.9	1	8	600				0.9	0	90	39	12.9	Y	
3	291	8.8	1.1	16	565				1.8	0	83	100	9.8	N	
4	482	5.4	1.5	16	585				0.9	0	95	72	5.4	N	
5	671	6	1	7	600				1.4	0	85	17	100	N	

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Reach break : tributary on right bank Wb = 4.7, Db = 0.8, S = 15

Average channel width, W_b (m): 7.14
Average channel depth, d (m): 1.4
Average channel gradient, S (%): 9.8
Average Rock, D (m): 1.14
Average Gravel Bar Width (m): 0

Channel Type: Step-pool
Channel Code: SPb

Relative roughness (D/d): 0.81
Power Index (W_b d S): 97.96

Hillslope-valley flat connection: M
Average Valley Width L
Upstream Disturbance: H

Macro: Hillslp
Macro: Alluv
Macro: Disturb

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Chance Date: 07/23/96 Crew: Al, Ned, George, Dan, Jen

Reach #: 8

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	101	6.1	0.9	4	610				1	0	79	79	300	N	
2	204	12.2	1.2	4	620				0.6	0	81	89	300	N	
3	300	8.8	1	4	625					0	33	98	300	N	
4	407	7.9	1.4	4	635				0.6	0	24	51	300	N	
5	505	9.9	1.2	19	640				0.9	0	3	39	300	Y	

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

check photos for reach break

Average channel width, W_b (m): 8.98
Average channel depth, d (m): 1.14
Average channel gradient, S (%): 7
Average Rock, D (m): 0.775
Average Gravel Bar Width (m): 0

Channel Type: Cascade-pool

Relative roughness (D/d): 0.67982456
Power Index (W_b d S): 71.6604

Hillslope-valley flat connection: M — Macro: Hillslp
Average Valley Width L — Macro: Alluv
Upstream Disturbance: M — Macro: Disturb

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Chance Date: 07/23/96 Crew: Al, Ned, Dan, Jen, George

Reach #: 9

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	100	9.3	1	6	655				0.9	0	1	36	300	Y	
2	200	10.2	1.5	3	660				0.9	1.1	4	65	100	Y	
3	300	8.6	1.4	7	665				0.9	0	26	-2	100	Y	
4	392	16.3	1	5	675				0.9	8	-9	54	200	Y	
5	584	6.9	0.9	8	685				0.4	0	8	9	100	Y	

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

check photos for reach break

Average channel width, W_b (m): 10.26
Average channel depth, d (m): 1.16
Average channel gradient, S (%): 5.6
Average Rock, D (m): 0.8
Average Gravel Bar Width (m): 1.82

Channel Type: Cascade-pool

Relative roughness (D/d): 0.68965517
Power Index (W_b d S): 69.02928

Hillslope-valley flat connection: M
Average Valley Width L
Upstream Disturbance: H

Sensitivity Rating: H

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: CHANCE Date: 07/24/96 Crew: JEN, NED, CASS

Reach #: 10

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	46	9.1	0.7	4	690		Aggraded		0.6	1	51	57	12	N	
2	80	9.8	0.7	6	715	290	Aggraded	Cobble	0.6	1.5	45	150	20	N	
3	125	9.7	1	1	720	260	Aggraded	Cobble	0.5	1.1	90	5	30	Y	
4	162	10	1	4	725	280	Aggraded	Cobble	0.6	2.2	70	90	10	Y	
5	211	21.3	1	3	730	270	Aggraded	Cobble	0.8	6.7	90	46	25	Y	

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Reach break : beginning of canyon, change in slope

Average channel width, W_b (m): 11.98
Average channel depth, d (m): 0.88
Average channel gradient, S (%): 3.6
Average Rock, D (m): 0.62
Average Gravel Bar Width (m): 2.5

Channel Type: Riffle-pool
Channel Code: RPc-w

Relative roughness (D/d): 0.70455
Power Index (W_b d S): 37.9526

Hillslope-valley flat connection: M Macro: Hillslp
Average Valley Width L Macro: Alluv
Upstream Disturbance: H Macro: Disturb

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Chance Date: 07/23/96 Crew: Al, Ned, Jen, Dan, George

Reach #: 11

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1	14	6.3	1.6	9	730	300	Stable	Boulder	0.5	0	98	87	6.3	Y	
2	51	9	2	13	735	310	Stable	Boulder	0.8	0	70	110	11	N	
3	103	7.6	1.5	21	740	20	Stable	Bedrock	0.7	0	120	110	7.6	N	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Reach break : waterfall, end of canyon, beginning of new cutblock on right bank

Average channel width, W_b (m): 7.63
Average channel depth, d (m): 1.7
Average channel gradient, S (%): 14.33
Average Rock, D (m): 0.67
Average Gravel Bar Width (m): 0

Channel Type: Riffle-pool

Relative roughness (D/d): 0.39
Power Index (W_b d S): 186.00

Hillslope-valley flat connection: H Macro: Hillslp
Average Valley Width L Macro: Alluv
Upstream Disturbance: H Macro: Disturb

Sensitivity Rating: H

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Chance Date: 07/24/96 Crew: Jen, Ned, Cass

Reach #: 12

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	100	6.1	1	4	755	250	Stable	cobble	0.6	0	-4	58	> 400	Y	
2	200	8.4	0.6	10	760	270	Stable	cobble/gravel	0.5	0.9	44	2	> 200	Y	
3	300	7.6	1	6	765	260	Stable	cobble/gravel	0.6	0	-1	-1	150	Y	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Reach break : increase in slope

Average channel width, W_b (m): 7.37
Average channel depth, d (m): 0.87
Average channel gradient, S (%): 6.67
Average Rock, D (m): 0.57
Average Gravel Bar Width (m): 0.30

Channel Type: Riffle-pool
RPc-w

Relative roughness (D/d): 0.65
Power Index (W_b d S): 42.56

Hillslope-valley flat connection: M
Average Valley Width L
Upstream Disturbance: H

Macro: Hillslp
Macro: Alluv
Macro: Disturb

Sensitivity Rating: H

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Chance Date: 07.24/96 Crew: Jen, Ned, Cass

Reach #: 13

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	45	9	1.5	9	775	270	Stable	Cobble	0.7	2.9	22	12	200	Y	
2	154	14.4	1.5	6	785	290	Aggraded	Gravel	0.5	0	43	23	200	Y	
3															
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Reach break : tributary on left bank

Average channel width, W_b (m): 11.7
Average channel depth, d (m): 1.5
Average channel gradient, S (%): 7.5
Average Rock, D (m): 0.6
Average Gravel Bar Width (m): 1.45

Channel Type: Riffle-pool

Relative roughness (D/d): 0.4
Power Index (W_b d S): 131.63

Hillslope-valley flat connection: M Macro: Hillslp
Average Valley Width L Macro: Alluv
Upstream Disturbance: H Macro: Disturb

Sensitivity Rating: H

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Chance Date: 07/24/96 Crew: Jen, Ned, Cass

Reach #: 14

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect (degrees)	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	131	6.5	0.9	10	800	350	Stable	Cobble	1	0	62	98	25	Y	
2	188	4.2	1.5	16	810	290	Stable	Cobble	0.6	0	102	110	42	Y	
3	395	2.9	1.1	35	865	350	Stable	Bedrock	0	0	140	116	2.9	Y	
4	576	6.9	0.8	9	935	40	Aggraded	Cobble/gravel	0.3	1	4	16	300	Y	
5	604	6.8	0.8	5	935	20	Aggraded	Cobble	0.4	0	14	10	> 300	Y	

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

reach consists mainly of falls - step- pools
Reach break : top of falls, gravel road crossing creek via cross ditch

Average channel width, W_b (m): 5.46
Average channel depth, d (m): 1.02
Average channel gradient, S (%): 15
Average Rock, D (m): 0.46
Average Gravel Bar Width (m): 0.2

Channel Type: Step Pool
Channel Code: SPb-w

Relative roughness (D/d): 0.45098039
Power Index (W_b d S): 83.538

Hillslope-valley flat connection: H
Average Valley Width L
Upstream Disturbance: H

Sensitivity Rating: H

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Chance Date: 07/24/96 Crew: Jen, Ned, Cass

Reach #: 15

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	30	3.9	0.6	3	925	70	Stable	Cobble	0.4	0	52	1	50	Y	
2	56	7	0.5	6	930	20	Stable	Cobble	0.3	0	56	40	20	Y	
3	100	5.3	1.1	26	935	290	Stable	Bedrock	0.5	0	130	140	5.3	Y	
4	123	7.7	1	7	940	290	Aggraded	Sand	0.3	1.8	4	60	25	Y	
5	305	5.1	1.2	14	945	290	Stable	Cobble	0.4	0	-14	90	200	Y	

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Reach break:end of cut block
no logging past this point

Average channel width, W_b (m): 5.8
Average channel depth, d (m): 0.88
Average channel gradient, S (%): 11.2
Average Rock, D (m): 0.38
Average Gravel Bar Width (m): 0.36

Channel Type: Step Pool
Channel Code: SPb-w

Relative roughness (D/d): 0.43181818
Power Index (W_b d S): 57.1648

Hillslope-valley flat connection: M
Average Valley Width L
Upstream Disturbance: L

Macro: Hillslp
Macro: Alluv
Macro: Disturb

Sensitivity Rating: L

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Chance Date: 07/25/96 Crew: Jen, Ned, Cass

Reach #: 16

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)	Stream Code
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)			
1																
2																
3																
4																
5																

Field data checked by: _____

Electronic data entry checked by: _____

Reviewed by: _____

Notes and Observations

Unable to take measurements as reach consists of waterfalls
149m Reach break : end of falls

Average channel width, W_b (m): #DIV/0!
Average channel depth, d (m): #DIV/0!
Average channel gradient, S (%): #DIV/0!
Average Rock, D (m): #DIV/0!
Average Gravel Bar Width (m): #DIV/0!

Relative roughness (D/d): #DIV/0!
Power Index (W_b d S): #DIV/0!

Hillslope-valley flat connection: Macro: Hillslp
Average Valley Width Macro: Alluv
Upstream Disturbance: Macro: Disturb

Sensitivity Rating:

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Chance Date: 07/25/96 Crew: Jen, Ned, Cass

Reach #: 17

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)	Stream Code
1	0	2.4	1	8	954	East	Stable		0.2					N		
2	50	6.3	0.7	5	1020	80	Stable	Cobble	0.5	2	2	11	200	N		
3	130	4.5	0.8	16	1035	360	Stable	Boulder	0.5	0	10	9	20	N		
4	172	2.6	1.1	17	1040	280	Stable	Boulder	0.4	0	45	44	300	N		
5	180	3	0.7	2	1040	290	Stable	Sand	0.02	0	13	54	800	N		

Field data checked by: _____

Electronic data entry checked by: _____

Reviewed by: _____

Notes and Observations

reach consists of small falls, riffles, pools
Reach break : slope decreases, area becomes swampy

Average channel width, W_b (m): 3.76
Average channel depth, d (m): 0.86
Average channel gradient, S (%): 9.6
Average Rock, D (m): 0.324
Average Gravel Bar Width (m): 0.5

Channel Type: Cascade-pool
Channel Code: CPb

Relative roughness (D/d): 0.37674419
Power Index (W_b d S): 31.04256

Hillslope-valley flat connection: M
Average Valley Width L
Upstream Disturbance: L

Macro: Hillslp
Macro: Alluv
Macro: Disturb

Sensitivity Rating: L

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Chance Date: 07/25/96 Crew: Jen, Ned, Cass

Reach #: 18

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)	Stream Code
1	0	3.1	0.7	0	1152	North	Stable	Sand	0	0				N		
2	49	4.3	1	0	1040	270	Stable	Sand	0.02	0	6	-1	900	N		
3	66	8.2	1	0	1045	360	Stable	Sand	0.3	0	-1	4	1200	N		
4																
5																

Field data checked by: _____

Electronic data entry checked by: _____

Reviewed by: _____

Notes and Observations

Reach break : side channel on left bank

Average channel width, W_b (m): 5.2
Average channel depth, d (m): 0.9
Average channel gradient, S (%): 0
Average Rock, D (m): 0.10666667
Average Gravel Bar Width (m): 0

Relative roughness (D/d): 0.11851852
Power Index (W_b d S): 0

Hillslope-valley flat connection: L Macro: Hillslp
Average Valley Width L Macro: Alluv
Upstream Disturbance: L Macro: Disturb

Sensitivity Rating: L

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Chance Date: 07/25/96 Crew: Jen, Ned, Cass

Reach #: 19

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)	Stream Code
1	185	2.3	1.1	4	1040	50	Stable	Sand	0.05	0	-4	0	1400	N		
2	230	7.8	0.8	1	1040	50	Stable	Cobble	0.02	0	-4	-1	12	N		
3	334	2.1	0.5	7	1045	340	Stable	Gravel	0.08	1.8	-7	-1	1400	N		
4																
5																

Field data checked by: _____

Electronic data entry checked by: _____

Reviewed by: _____

Notes and Observations

reach consists of braiding channels
Reach break : braiding ends, beginning of canyon

Average channel width, W_b (m): 4.07
Average channel depth, d (m): 0.8
Average channel gradient, S (%): 4
Average Rock, D (m): 0.05
Average Gravel Bar Width (m): 0.6

Relative roughness (D/d): 0.0625
Power Index (W_b d S): 13.01

Channel Type:

Hillslope-valley flat connection: M
Average Valley Width L
Upstream Disturbance: L

Macro: Hillslp
Macro: Alluv
Macro: Disturb

Sensitivity Rating: L

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Chance Date: 07/24/96 Crew: Al, Dan

Reach #: 20

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)	Stream Code
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)			
1	0	8	1.4	74		West			0.2	0	1	4				
2																
3																
4																
5	111															

Field data checked by: _____

Electronic data entry checked by: _____

Reviewed by: _____

Notes and Observations

111m Reach break : tribuary on left bank from lake

Average channel width, W_b (m): 8
Average channel depth, d (m): 1.4
Average channel gradient, S (%): 74
Average Rock, D (m): 0.2
Average Gravel Bar Width (m): 0

Relative roughness (D/d): 0.14285714
Power Index (W_b d S): 828.8

Hillslope-valley flat connection: H Macro: Hillslp
Average Valley Width L Macro: Alluv
Upstream Disturbance: L Macro: Disturb

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Chance Date: 07/24/96 Crew: Al, Dan

Reach #: 21

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)	Stream Code
1	0	4.6	0.7	18	1085	WNW			0.4	0	-2	2				
2																
3																
4																
5	483															

Field data checked by: _____

Electronic data entry checked by: _____

Reviewed by: _____

Notes and Observations

Reach break : side channel on left bank

Average channel width, W_b (m): 4.6
Average channel depth, d (m): 0.7
Average channel gradient, S (%): 18
Average Rock, D (m): 0.4
Average Gravel Bar Width (m): 0

Relative roughness (D/d): 0.57142857
Power Index (W_b d S): 57.96

Hillslope-valley flat connection: H
Average Valley Width L
Upstream Disturbance: L

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Chance Date: 07/25/96 Crew: Al, Dan

Reach #: 22

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)	Stream Code
1	0	6.6	0.4	30	1068	North			0.4	0	18	28		N		
2																
3																
4																
5																

Field data checked by: _____

Electronic data entry checked by: _____

Reviewed by: _____

Notes and Observations

Reach break : tributary on right bank

Average channel width, W_b (m): 6.6
Average channel depth, d (m): 0.4
Average channel gradient, S (%): 30
Average Rock, D (m): 0.4
Average Gravel Bar Width (m): 0

Relative roughness (D/d): 1
Power Index (W_b d S): 79.2

Hillslope-valley flat connection: H
Average Valley Width L
Upstream Disturbance: L

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Chance Date: 07/25/96 Crew: Al, Dan

Reach #: 23

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)	Stream Code
1	0	15.6	1.6	18	1278	N			0.7	0	22	24		N		
2																
3																
4																
5																

Field data checked by: _____

Electronic data entry checked by: _____

Reviewed by: _____

Notes and Observations

Average channel width, W_b (m): 15.6
Average channel depth, d (m): 1.6
Average channel gradient, S (%): 18
Average Rock, D (m): 0.7
Average Gravel Bar Width (m): 0

Relative roughness (D/d): 0.4375
Power Index (W_b d S): 449.28

Hillslope-valley flat connection: H
Average Valley Width L
Upstream Disturbance: L

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Chance Date: 07/24/96 Crew: Al, Dan

Reach #: 24

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)	Stream Code
1	0	7.3	1.3	26	1386	North			0.3	0	44	14		N		
2																
3																
4																
5																

Field data checked by: _____

Electronic data entry checked by: _____

Reviewed by: _____

Notes and Observations

Reach break : snow line

Average channel width, W_b (m): 7.3
Average channel depth, d (m): 1.3
Average channel gradient, S (%): 26
Average Rock, D (m): 0.3
Average Gravel Bar Width: 0

Relative roughness (D/d): 0.23076923
Power Index (W_b d S): 246.74

Hillslope-valley flat connection: H
Average Valley Width L
Upstream Disturbance: L

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Chance Date: 07/24/96 Crew: Al, Dan

Reach #: 25

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)	Stream Code
1	0	7.1	1.2	26	1386	North			0.3	0	44	14	0	N		
2																
3																
4																
5	16															

Field data checked by: _____

Electronic data entry checked by: _____

Reviewed by: _____

Notes and Observations

Reach break : mouth of lake

Average channel width, W_b (m): 7.1
Average channel depth, d (m): 1.2
Average channel gradient, S (%): 26
Average Rock, D (m): 0.3
Average Gravel Bar Width: 0

Relative roughness (D/d): 0.25
Power Index (W_b d S): 221.52

Hillslope-valley flat connection: H
Average Valley Width L
Upstream Disturbance: L

Sensitivity Rating: M

Cloudburst Creek Field Data Summary Table

Reach	Bankfull		Slope	Average Rock	Relative	Power	Sensitivity	Channel	Channel
	Width (m)	Depth (m)	(%)	D (m)	Roughness	Index	Rating	Condition	Type
1	7.8	1.43	1	0.03	0.02	11.18	L	Stable	Riffle-pool
2	10.64	0.66	0.8	0.02	0.03	5.62	L	Stable	Riffle-pool
3	17.92	0.84	1.1	0	0	16.56	L	Stable	Riffle-Pool
4	14.76	0.96	0.2	0.04	0.04	2.83	M	Stable	Riffle-Pool
5	12.36	0.88	0	0.06	0.07	0	L	Stable	Riffle-Pool
6	16.4	1.1	0	0	0	0	L	Stable	Riffle-pool
7	26.88	1.04	0.7	0.06	0.05	19.57	L	Stable	Riffle-pool
8	11.22	0.84	0.3	0.18	0.21	2.83	L	Stable	Riffle-pool
9	9.6	0.77	0	0.23	0.30	0	M	Stable	Riffle-pool
10	4.27	0.77	0.5	0.2	0.26	1.64	M	Stable	Riffle-pool
11	23.9	1.28	0.5	0.12	0.09	15.30	M	Stable	Riffle-pool
12*	-	-	-	-	-	-	-	-	-
13	15.32	2.08	13.6	1.06	0.51	433.37	H	Aggraded	Step-pool

* Creek flows underground for reach 12.

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Quality Assurance/Quality Control Form

Stream: Cloudburst Creek Date: _____ Crew: Stephen Coleman, Brian LaCas, Jeff Westlake

	Reach #	Bank Full		Channel					Bank			Logging	Large
		Width (m)	Depth (m)	Slope (%)	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m)	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)	Past/Present (Y/N)	Woody Debris (Y/N)
QA/QC 1	1	12	0.9	<1	S	Fines	Fines	-	Swamp	Swamp	-	N	Y
QA/QC 2	1	9	0.7	<1	S	Fines	Fines	-	Swamp	Swamp	-	N	Y
Original Results													
Pass/Fail													
QA/QC	Olsen	8.5	0.8	<1	S	Fines	Fines	-	1 m bank	1 m bank	L: 200 m; R: >200 m	Y	Small
Original Result	12?												
Pass/Fail													
QA/QC	13	8.4	1	Vert	A	Boulder	>1 m	-	(-)	(-)	*	N	Y
Original Results													
Pass/Fail													

* see prescription section for details - this is where the debris flow occurred

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: CLOUDBURST Date: 08/13/96 Crew: JEN, GEORGE, DAN, ISAAC

Reach # 1

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Be Material	Channel Largest Roc Diameter (m	Channel Total Gravel Bar Width (m	Bank Left Bank Slope (%)	Bank Right Ban Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody ebris (Y/N)
1	100	10.4	1.8	1	45	82	Stable	SILT	0	0	3	45	300	N	
2	137	5.4	1.4	1	45	82	Stable	SILT	0	0	9	26	3000	N	
3	160	7.6	1.1	1	50	98	Stable	SILT	0.1	0	5	8	3000	N	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: SJC

Notes and Observations

Reach break: gravel road crossing via wood bridge

Average channel width, W_b (m): 7.8
Average channel depth, d (m): 1.43
Average channel gradient, S (%): 1
Average Rock, D (m): 0.03
Average Gravel Bar Width (m): 0

Channel Type: Riffle-pool

Relative roughness (D/d): 0.02
Power Index (W_b d S): 11.18

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: L

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: CLOUDBURST Date: 08/13/96 Crew: JEN, DAN, GEORGE, ISAAC

Reach #: 2

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Roc Diameter (m	Channel Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	100	13.8	0.5	1	50	120	Stable	SILT	0	0	9	23	3000	N	
2	157	11.3	0.9	0	50	101	Stable	SILT	0	0	10	21	3000	N	
3	258	9.9	0.6	1	55	139	Stable	SILT	0	0	17	3	3000	N	
4	325	8.6	0.6	1	55	91	Stable	SAND	0	0	10	13	3000	N	
5	343	9.6	0.7	1	60	68	Stable	SAND	0.1	8	18	12	3000	N	

Field data checked by:

Electronic data entry checked by: SJC

Reviewed by: SJC

Notes and Observations

Reach break:

Average channel width, W_b (m): 10.64
Average channel depth, d (m): 0.66
Average channel gradient, S (%): 0.8
Average Rock, D (m): 0.02
Average Gravel Bar Width (m): 1.6

Channel Type: Riffle-pool

Relative roughness (D/d): 0.03
Power Index (W_b d S): 5.62

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: L

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: CLOUDBURST Date: 08/13/96 Crew: JEN, DAN, GEORGE, ISAAC

Reach #: 3

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Roc Diameter (m	Channel Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	94	10.2	0.7	1	65	100	Stable	SILT	0	0	11	13	3000	Y	
2	200	12.7	1	1	65	100	Stable	SILT	0	0	8	16	3000	Y	
3	397	32	1	2	70	142	Stable	SILT	0	0	4	22	3000	N	
4	557	15.4	0.7	1	70	142	Stable	SILT	0	0	14	16	3000	N	
5	656	19.3	0.8	0.5	75	111	Stable	SILT	0	0	8	13	3000	N	

Field data checked by:

Electronic data entry checked by: SJC

Reviewed by: SJC

Notes and Observations

Reach break: ephemeral tributary on left bank

Average channel width, W_b (m): 17.92
Average channel depth, d (m): 0.84
Average channel gradient, S (%): 1.1
Average Rock, D (m): 0
Average Gravel Bar Width (m): 0

Channel Type: Riffle-Pool

Relative roughness (D/d): 0
Power Index (W_b d S): 16.56

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: L

Squamish River Watershed Restoration Program Forest Renewal B.C.

Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Cloudburst Date: 08/14/96 Crew: Jen, Dan, George, Isaac

Reach #: 4

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	175	17.3	0.8	0	75	120	Stable	Silt	0	0	20	20	3000	N	
2	311	13.1	0.9	1	80	112	Stable	Silt	0	0	7	3	3000	N	
3	359	18.4	1.4	0	80	139	Stable	Silt	0	0	9	12	3000	Y	Y
4	556	11.9	0.9	0	80	218	Aggraded	Silt	0.1	4.7	16	8	3000	Y	
5	638	13.1	0.8	0	80	232	Stable	Silt	0.1	0	3	11	3000	Y	

Field data checked by:

Electronic data entry checked by: SJC

Reviewed by: SJC

Notes and Observations

4.4 1st gravel bar in creek, another 7m upstream 4m across

4.3 1st logs in creek

Reach break : tributary on left bank, bed material changes to gravel

Average channel width, W_b (m): 14.76

Average channel depth, d (m): 0.96

Average channel gradient, S (%): 0.2

Average Rock, D (m): 0.04

Average Gravel Bar Width (m): 0.94

Channel Type: Riffle-Pool

Relative roughness (D/d): 0.04

Power Index (W_b d S): 2.83

Hillslope-valley flat connection: L

Average Valley Width: L

Upstream Disturbance: H

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Cloudburst Date: 08/14/96 Crew: Jen, Dan, George, Isaac

Reach #: 5

Cross-Section	Distance fro Reach Botto (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1	78	18.8	0.8	0	80	151	Stable	Silt	0	0	7	16	3000	N	
2	145	14.9	0.7	0	80	189	Aggraded	Gravel	0.1	4.1	7	10	3000	N	
3	235	10.3	1.1	0	80	149	Stable	Gravel	0.1	0	4	6	3000	N	
4	355	13.4	1.2	0	85	109	Stable	Silt	0	0	9	2	3000	N	
5	553	4.4	0.6	0	85	118	Stable	Gravel	0.1	0	2	2	3000	N	

Field data checked by:

Electronic data entry checked by: SJC

Reviewed by: SJC

Notes and Observations

bed material mostly gravel
5.3 measurement taken 2m above new beaver dam
water a little clearer - no oil

Average channel width, W_b (m): 12.36
Average channel depth, d (m): 0.88
Average channel gradient, S (%): 0
Average Rock, D (m): 0.06
Average Gravel Bar Width (m): 0.82

Channel Type: Riffle-Pool

Relative roughness (D/d): 0.07
Power Index (W_b d S): 0

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: L

Sensitivity Rating: L

Squamish River Watershed Restoration Program Forest Renewal B.C.

Channel Assessment Procedure (CAP) Field Data Entry Form

Stream : Cloudburst Date: 08/15/96 Crew: Jen, Dan, George, Isaac

Reach #: 6

Cross-Section	Distance fro Reach Botto (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	106	16.7	1.4	0	85	119	Stable	Silt	0	0	11	28	3000	N	
2	208	15.2	1	0	85	144	Stable	Silt	0	0	2	36	3000	N	
3	320	24.3	1	0	85	197	Stable	Silt	0	4.8	7	10	3000	N	
4	425	14.6	1.1	0	85	197	Stable	Silt	0	0	14	3	3000	N	
5	475	11.2	1	0	85	188	Stable	Silt	0	0	12	3	3000	N	

Field data checked by:

Electronic data entry checked by: SJC

Reviewed by: SJC

Notes and Observations

6.3 gravel bar is composed of mud

Average channel width, W_b (m): 16.4
Average channel depth, d (m): 1.1
Average channel gradient, S (%): 0
Average Rock, D (m): 0
Average Gravel Bar Width (m): 0.96

Channel Type: Riffle-pool

Relative roughness (D/d): 0
Power Index (W_b d S): 0

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: L

Sensitivity Rating: L

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Cloudburst Date: 08/15/96 Crew: Jen, Dan, George, Isaac

Reach #: 7

Cross-Section	Distance fro Reach Botto (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1	1	26.2	1.4	0	85	188	Stable	Silt	0	0	12	4	3000	N	
2	108	41.1	1.1	0	85	158	Stable	Silt	0	0	14	9	3000	N	
3	246	30.1	1.1	0.5	90	145	Stable	Silt/gravel	0.1	10	4	5	2500	N	
4	400	19.6	0.8	1	95	142	Stable	Silt	0.03	0	11	5	2500	N	
5	487	17.4	0.8	2	95	142	Stable	Gravel	0.15	0	11	4	2500	N	

Field data checked by:

Electronic data entry checked by: SJC

Reviewed by: SJC

Notes and Observations

7.1 pond above active beaver dam

7.3 gravel bar measurement is amount of land between side channels

Average channel width, W_b (m): 26.88
Average channel depth, d (m): 1.04
Average channel gradient, S (%): 0.7
Average Rock, D (m): 0.06
Average Gravel Bar Width (m): 2

Channel Type: Riffle-pool

Relative roughness (D/d): 0.05
Power Index (W_b d S): 19.57

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: L

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Cloudburst Date: 08/15/96 Crew: Jen, Dan, George, Isaac

Reach #: 8

Cross-Section	Distance fro Reach Botto (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	78	10.2	0.8	0.5	100	119	Stable	Gravel	0.2	0	6	14	2250	N	
2	227	15.8	0.8	0.5	100	138	Stable	Silt	0.2	0	22	6	2250	N	
3	305	9.7	1.1	0	100	109	Stable	Gravel	0.2	0	3	5	2200	N	
4	380	13.3	0.7	0	105	119	Stable	Gravel	0.1	1.8	5	4	2200	Y	
5	534	7.1	0.8	0.5	105	124	Stable	Sand	0.2	0	1	1	2200	Y	

Field data checked by:

Electronic data entry checked by: SJC

Reviewed by: SJC

Notes and Observations

8.4 house on right bank

clearing on both sides of creek, house on left bank

Average channel width, W_b (m): 11.22
Average channel depth, d (m): 0.84
Average channel gradient, S (%): 0.3
Average Rock, D (m): 0.18
Average Gravel Bar Width (m): 0.36

Channel Type: Riffle-pool

Relative roughness (D/d): 0.21
Power Index (W_b d S): 2.83

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: L

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Cloudburst Date: 08/15/96 Crew: Jen, Dan, George, Isaac

Reach #: 9

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging	Large
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Be Material	Largest Roc Diameter (m	Total Gravel Bar Width (m	Left Bank Slope (%	Right Ban Slope (%)	Valley Flat Width (m)	Past/Present (Y/N)	Woody ebris (Y/N)
1	25	14.8	0.6	0	105	111	Stable	gravel	0.2	5.4	89	1	2000	Y	N
2	50	7.5	0.9	0	105	110	Stable	gravel	0.2	0	87	2	2000	Y	N
3	64	6.5	0.8	0	105	105	Stable	gravel	0.3	0	96	2	2000	Y	N
4															
5															

Field data checked by:

Electronic data entry checked by: SJC

Reviewed by: SJC

Notes and Observations

9.1 clearing on right bank, Wb includes land between side channel

Average channel width, W_b (m): 9.6
Average channel depth, d (m): 0.77
Average channel gradient, S (%): 0
Average Rock, D (m): 0.23
Average Gravel Bar Width (m): 1.8

Channel Type: Riffle-pool

Relative roughness (D/d): 0.30
Power Index (W_b d S): 0

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Cloudburst Date: 08/15/96 Crew: Jen, Dan, George, Isaac

Reach #: 10

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging	Large
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Be Material	Largest Roc Diameter (m	Total Gravel Bar Width (m	Left Bank Slope (%	Right Ban Slope (%)	Valley Flat Width (m)	Past/Present (Y/N)	Woody ebris (Y/N)
1	25	5.1	1	0.5	105	110	Stable	gravel	0.3	0	4	3	2100	Y	N
2	50	4	0.7	0.5	105	89	Stable	gravel	0.2	0	4	3	2100	Y	N
3	90	3.7	0.6	0.5	110	89	Stable	sand	0.1	0	3	1	2200	Y	N
4															
5															
							Stable								

Field data checked by:

Electronic data entry checked by: SJC

Reviewed by: SJC

Notes and Observations

clearing on both sides of creek throughout reach
cow pasture
Reach break is a bridge

Average channel width, W_b (m): 4.27
Average channel depth, d (m): 0.77
Average channel gradient, S (%): 0.5
Average Rock, D (m): 0.2
Average Gravel Bar Width (m): 0

Channel Type: Riffle-pool

Relative roughness (D/d): 0.26
Power Index (W_b d S): 1.64

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Cloudburst Date: 08/15/96 Crew: Jen, Dan

Reach #: 11

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1	100	14.2	0.9	0.5	110	131	Stable	Gravel	0.1	5	5	4	2100	Y	
2	200	30.9	1.3	0.5	110	112	Stable	Silt	0	0	96	2	2000	N	
3	357	35.4	1.4	0.5	110	84	Stable	Silt	0	0	5	3	2000	N	
4	439	33.4	1.5	0.5	110	84	Stable	Silt	0	0	1	4	2000	N	
5	725	5.6	1.3	0.5	115	128	Aggraded	Cobble	0.5	5.3	5	3	2100	Y	

Field data checked by:

Electronic data entry checked by: SJC

Reviewed by: SJC

Notes and Observations

11.1 logging indicated is a field on the right bank

11.5 cobble in creek washed in from road during high flows, clearing with houses on right bank

Average channel width, W_b (m): 23.9
Average channel depth, d (m): 1.28
Average channel gradient, S (%): 0.5
Average Rock, D (m): 0.12
Average Gravel Bar Width (m): 2.06

Relative roughness (D/d): 0.09
Power Index (W_b d S): 15.30

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Channel Type: Riffle-pool

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Cloudburst Date: 08/19/96 Crew: Jen, Dan, Isaac

Reach #: 12

Cross-Section	Distance fro Reach Botto (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1	62			5	120	163	none	cobble						Y	
2															
3															
4															
5															

Field data checked by:

Electronic data entry checked by: SJC

Reviewed by: SJC

Notes and Observations

no channel, no water, flows underground

Average channel width, W_b (m):
Average channel depth, d (m):
Average channel gradient, S (%):
Average Rock, D (m):
Average Gravel Bar Width (m):

Channel Type:
Channel Code:

Relative roughness (D/d):
Power Index (W_b d S):

Hillslope-valley flat connection:
Average Valley Width:
Upstream Disturbance:

Sensitivity Rating:

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Cloudburst Date: 08/19/96 Crew: Jen, Dan, Isaac

Reach #: 13

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1	30	23.3	2	7	125	219	Aggraded	Cobble	0.7	7.9	-3	5	600	N	
2	70	30.7	2.3	14	130	163	Aggraded	Cobble	1.4	14.3	16	-8	600	N	
3	125	8.8	3.2	8	140	190	Aggraded	Boulder	1.1	1.8	-7	-18	600	N	
4	140	6.5	2.1	17	145	212	Aggraded	Cobble	1.2	0.5	-14	-3	600	N	
5	149	7.3	0.8	22	155	210	Stable	Cobble	0.9	0	150	150	7.3	N	

Field data checked by:

Electronic data entry checked by: SJC

Reviewed by: SJC

Notes and Observations

Reach break : stream becomes channelized, enters canyon, slope increases

Average channel width, W_b (m): 15.32
Average channel depth, d (m): 2.08
Average channel gradient, S (%): 13.6
Average Rock, D (m): 1.06
Average Gravel Bar Width (m): 4.9

Channel Type: Step-pool

Relative roughness (D/d): 0.50961538
Power Index (W_b d S): 433.37216

Hillslope-valley flat connection: H
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: H

Evans Creek Field Data Summary Table

Reach	Bankfull		Slope	Average Rock	Relative	Power	Sensitivity	Channel	Channel
	Width (m)	Depth (m)	(%)	D (m)	Roughness	Index	Rating	Condition	Type
1	15.3	2.40	1	0.07	0.03	36.72	L	Stable	Riffle-pool
2	9.58	1.40	0.7	0.22	0.16	9.39	L	Stable	Riffle-pool
3	8.9	0.80	1	0.13	0.16	7.12	L	Stable	Riffle-pool
4	6.18	0.90	1	0.25	0.28	5.56	L	Stable	Riffle-pool
5	11.1	1.26	12	0.54	0.43	167.83	M	Stable	Cascade-pool
6	8.4	1.80	26.33	0.67	0.37	398.16	M	Stable	Cascade-pool
7	3.83	1.37	26	0.43	0.32	136.21	M	Stable	Cascade-pool
8	6.15	0.95	0.5	0.30	0.32	2.92	L	Stable	Swamp
9	4.6	0.87	7.33	0.43	0.50	29.24	M	Stable	Cascade-pool
10	10.83	0.73	3	0.33	0.45	23.83	M	Stable	Riffle-pool
11	-	-	-	-	-	-	-	-	Lake
12	4.5	0.68	7.5	0.30	0.44	22.78	M	Stable	Cascade-pool
13	5.85	0.53	15	0.43	0.81	46.07	M	Stable	Cascade-pool
14	9.23	0.63	14	0.30	0.47	81.87	M	Stable	Cascade-pool
15	6.47	0.73	15.33	0.37	0.50	72.71	M	Stable	Cascade-pool
16	7.07	0.57	13.67	0.30	0.53	54.73	M	Stable	Cascade-pool
17	4.85	0.68	8.75	0.28	0.41	28.65	L	Stable	Riffle-pool
18	6.93	0.87	2.67	0.27	0.31	16.02	L	Stable	Riffle-pool
19	3.5	0.85	1.5	0.33	0.38	4.46	L	Stable	Riffle-pool
20	8.5	1.30	0	0.00	0.00	0	L	Stable	Pond
21	3.4	1.20	0	0.00	0.00	0	L	Stable	Pond
22	8.33	1.07	2.33	0.30	0.28	20.74	L	Stable	Riffle-pool

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Quality Assurance/Quality Control Form

Stream: _____ Date: _____ Crew: _____

	Reach #	Bank Full		Channel						Bank			Logging	Large
		Width (m)	Depth (m)	Slope (%)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m)	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)	Past/Present (Y/N)	Woody Debris (Y/N)
QA/QC 1														
QA/QC 2														
Original Results														
Pass/Fail														
QA/QC 1														
QA/QC 2														
Original Results														
Pass/Fail														
QA/QC 1														
QA/QC 2														
Original Results														
Pass/Fail														

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: EVANS Date: 08/21/96 Crew: DAN, JEN, GEORGE, ISAAC

Reach #: 1

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m)	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1	5	14.5	4	0.5	15	214	Stable	SAND	0	0	23	22	> 1000	N	Y
2	80	13.8	1.5	2	15	195	STABLE	SAND	0	0	1	1	> 1000	N	Y
3	138	17.6	1.7	0.5	15	236	STABLE	SAND	0.2	0	2	3	> 1000	N	Y
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Reach break : end of backwash from Squamish river

Average channel width, W_b (m): 15.3
Average channel depth, d (m): 2.40
Average channel gradient, S (%): 1
Average Rock, D (m): 0.07
Average Gravel Bar Width (m): 0

Channel Type: Riffle-pool

Relative roughness (D/d): 0.03
Power Index (W_b d S): 36.72

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: L

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: EVANS Date: 08/21/96 Crew: DAN, JEN, GEORGE, ISAAC

Reach #: 2

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	108	11.8	2.1	0.5	15	178	Stable	COBBLE	0.1	0	16	-4	> 1000	N	Y
2	197	5.8	0.9	2	20	196	Stable	SAND	0	0	16	20	> 1000	N	N
3	358	11.8	1.3	0	20	229	Stable	SAND	0	0	14	-2	> 1000	N	Y
4	873	10.1	1.4	0.5	25	225	Stable	COBBLE	0.5	0	14	2	> 1000	N	Y
5	1500	8.4	1.3	0.5	35	186	Stable	COBBLE	0.5	0	22	0	> 1000	N	N

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

2.5 paved road on right bank

1526m - Reach break : paved road crosses creek via double culvert

Average channel width, W_b (m): 9.58
Average channel depth, d (m): 1.40
Average channel gradient, S (%): 0.7
Average Rock, D (m): 0.22
Average Gravel Bar Width (m): 0

Channel Type: Riffle-pool

Relative roughness (D/d): 0.16
Power Index (W_b d S): 9.3884

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: L

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: EVANS Date: 08/22/96 Crew: GEORGE, JEN, NED, ISAAC, NED

Reach #: 3

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	53	9	0.9	0	20	195	Stable	GRAVEL	0.05	3.6	8	9	> 1000	Y	Y
2	100	8.8	0.7	2	20	195	Stable	COBBLE	0.2	3.3	12	14	> 1000	Y	Y
3	140				20	196	Stable								Y
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

creek runs adjacent to gravel pit for entire reach
3.3 rusty cable in creek
Logging indicated is clearing at gravel pit on right bank
Reach break : old confluence of Evans with Cheakamus side channel

Average channel width, W_b (m): 8.9
Average channel depth, d (m): 0.80
Average channel gradient, S (%): 1
Average Rock, D (m): 0.13
Average Gravel Bar Width (m): 3.45

Channel Type: Riffle-pool

Relative roughness (D/d): 0.16
Power Index (W_b d S): 7.12

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: L

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: EVANS Date: 08/22/96 Crew: GEORGE, JEN, NED, ISAAC, DAN

Reach #: 4

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	50	6	0.9	1	25	154	Stable	CLAY	0.4	1.7	12	54	> 1000	Y	Y
2	100	5.3	1	2	20	192	STABLE	COBBLE	0.3	0	10	9	> 1000	N	Y
3	150	6.1	0.9	0	25	136	STABLE	GRAVEL	0.1	0	3	44	> 1000	N	Y
4	182	7.3	0.8	2	25	136	STABLE	GRAVEL	0.2	3.3	5	68	> 1000	N	N
5	223			0	25	136	STABLE			3.5			> 1000	N	N

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

4.1 logging on right bank is clearing for gravel pit
132m LWD jam 4m long
Reach break is grave el road crossing creek- n o drainage structure

Average channel width, W_b (m): 6.18
Average channel depth, d (m): 0.90
Average channel gradient, S (%): 1
Average Rock, D (m): 0.25
Average Gravel Bar Width (m): 1.7

Channel Type: Riffle-pool

Relative roughness (D/d): 0.28
Power Index (W_b d S): 5.56

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: L

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: EVANS Date: 08/22/96 Crew: NED, JEN, DAN, ISAAC, GEORGE

Reach #: 5

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m)	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1	100	10.7	1.4	12	35	155	Stable	COBBLE	0.5	1.6	64	44	> 1000	N	Y
2	200	12.3	1.3	12	40	124	STABLE	COBBLE	0.4	0	58	95	> 1000	N	Y
3	300	9.3	1.1	4	45	141	STABLE	BOULDER	0.6	0	47	18	> 1000	N	N
4	352	14.2	1	26	50	141	STABLE	COBBLE	0.6	0	47	52	> 1000	N	Y
5	363	9	1.5	6	50	168	STABLE	COBBLE	0.6	0	86	43	9	N	Y

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

89m series of LWD jams for 24 m
189m LWD jam
210m LWD jams for 22 m
Reach break : increase in slope

Average channel width, W_b (m): 11.1
Average channel depth, d (m): 1.26
Average channel gradient, S (%): 12
Average Rock, D (m): 0.54
Average Gravel Bar Width (m): 0.32

Channel Type: Cascade-pool

Relative roughness (D/d): 0.43
Power Index (W_b d S): 167.83

Hillslope-valley flat connection: H
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: EVANS Date: 08/22/96 Crew: DAN, GEORGE, JEN, NED, ISAAC

Reach #: 6

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	42	6.7	1.7	32	60	147	Stable	BED ROCK	0	0	136	62	20	N	N
2	113	4.1	1.1	5	65	147	STABLE	COBBLE	1	0	15	71	50	N	Y
3	210	14.4	2.6	42	80	132	STABLE	BOULDER	1	0	42	17	50	N	Y
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

200m LWD jam for 7m
Reach break: increase in slope

Average channel width, W_b (m): 8.4
Average channel depth, d (m): 1.80
Average channel gradient, S (%): 26.33
Average Rock, D (m): 0.67
Average Gravel Bar Width (m): 0

Channel Type: Cascade-pool

Relative roughness (D/d): 0.37
Power Index (W_b d S): 398.16

Hillslope-valley flat connection: H
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: EVANS Date: 08/22/96 Crew: JEN, DAN, NED, ISAAC, GEORGE

Reach #: 7

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m)	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1	40	4.8	0.9	19	90	112	Stable	COBBLE	0.4	0	122	75	1000	N	N
2	60	3	1.5	45	100	126	STABLE	BEDROCK	0.4	0	115	150	3	N	Y
3	95	3.7	1.7	14	110	145	STABLE	BOULDER	0.5	0	125	46	20	N	Y
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

60m waterfall
71m LWD jam 3m deep
Reach break : change in slope- from waterfalls to swamp

Average channel width, W_b (m): 3.83
Average channel depth, d (m): 1.37
Average channel gradient, S (%): 26
Average Rock, D (m): 0.43
Average Gravel Bar Width (m): 0

Channel Type: Cascade-pool

Relative roughness (D/d): 0.32
Power Index (W_b d S): 136.21

Hillslope-valley flat connection: H
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: EVANS Date: 08/21/96 Crew: JEN, DAN, ISAAC, GEORGE

Reach #: 8

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	70	5.2	0.9	0.5	100	161	Stable	SILT	0	0	1	1	700	N	
2	140	7.1	1	0.5	100	134	STABLE	SILT	0.5	0	48	63	15	N	
3	233				100	172	A	COBBLE	0.4					N	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

reach consists of swampy/ marshy area, stream meanders.
Reach break : gravel road crossing creek via culvert, change of slope

Average channel width, W_b (m): 6.15
Average channel depth, d (m): 0.95
Average channel gradient, S (%): 0.5
Average Rock, D (m): 0.30
Average Gravel Bar Width (m): 0

Channel Type: Swamp

Relative roughness (D/d): 0.32
Power Index (W_b d S): 2.92

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: L

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: EVANS Date: 08/21/96 Crew: JEN, DAN, GEORGE, ISAAC

Reach #: 9

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m)	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1	30	4.8	0.7	9	105	143	Stable	COBBLE	0.4	0	1	12	400	N	N
2	48	4.7	0.9	7	105	143	STABLE	COBBLE	0.5	0	36	28	30	N	Y
3	53	4.3	1	6	105	143	STABLE	BOULDER	0.4	0	91	74	20	N	Y
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Reach break: foot bridge causing LWD jam

Average channel width, W_b (m): 4.6
Average channel depth, d (m): 0.87
Average channel gradient, S (%): 7.33
Average Rock, D (m): 0.43
Average Gravel Bar Width (m): 0

Channel Type: Cascade-pool

Relative roughness (D/d): 0.50
Power Index (W_b d S): 29.24

Hillslope-valley flat connection: M
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: EVANS Date: 08/21/96 Crew: JEN, DAN, ISAAC, GEORGE

Reach #: 10

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m)	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1	30	11.3	0.5	4	110	129	Stable	COBBLE	0.5	3.8	4	15	50		
2	60	11.2	0.5	2	110	141	STABLE	COBBLE	0.3	0	18	30	100		
3	112	10	1.2		93	141	STABLE	GRAVEL	0.2	0	2	57			
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

foot path runs adjacent to creek for entire reach
Reach break: Evans lake

Average channel width, W_b (m): 10.83
Average channel depth, d (m): 0.73
Average channel gradient, S (%): 3
Average Rock, D (m): 0.33
Average Gravel Bar Width (m): 1.27

Relative roughness (D/d): 0.45
Power Index (W_b d S): 23.83

Hillslope-valley flat connection: M
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Channel Type: Riffle-pool

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: EVANS Date: 08/26/96 Crew: DAN, GEORGE, ISAAC

Reach #: 11

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Gravel Bar Width (m)	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1															
2															
3															
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Evans lake- approximately 410m from reach break 10 to reach break 11
Reach break : creek enters lake

Average channel width, W_b (m): #DIV/0!
Average channel depth, d (m): #DIV/0!
Average channel gradient, S (%): #DIV/0!
Average Rock, D (m): #DIV/0!
Average Gravel Bar Width (m): #DIV/0!

Relative roughness (D/d): #DIV/0!
Power Index (W_b d S): #DIV/0!

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: L

Channel Type: Lake

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: EVANS Date: 08/26/96 Crew: DAN, GEORGE, ISAAC

Reach #: 12

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	28	6.4	0.7	3	110	130	Stable	COBBLE	0.2	0	1	1	900	N	
2	159	3.5	0.4	6	110	128	STABLE	COBBLE	0.3	3.4	12	28	1000	N	
3	220	3.8	0.9	6	110	119	STABLE	COBBLE	0.3	0	7	12	1000	N	
4	289	4.3	0.7	15	115	151	STABLE	COBBLE	0.4	0	32	18	500	N	
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

18m cable in trees
28m foot bridge- not constricting flow
159m pool with fish, water uphill begins running underground
186m bridge
242m bridge
268m LWD
Reach break : ephemeral tributary on left bank

Average channel width, W_b (m): 4.5
Average channel depth, d (m): 0.68
Average channel gradient, S (%): 7.5
Average Rock, D (m): 0.30
Average Gravel Bar Width (m): 0.85

Relative roughness (D/d): 0.44
Power Index (W_b d S): 22.78

Hillslope-valley flat connection: M
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Channel Type: Cascade-pool

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: EVANS Date: 08/26/96 Crew: DAN, GEORGE, ISSAC

Reach #: 13

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m)	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1	97	5.5	0.6	14	130	103	Stable	COBBLE	0.5	0	28	54	400	N	
2	225	9.6	0.7	19	150	130	STABLE	BOULDER	0.5	0	48	92	200	N	
3	317	4.7	0.5	16	165	122	STABLE	BOULDER	0.3	0	33	71	200	N	
4	377	3.6	0.3	11	175	188	STABLE	BOULDER	0.4	0	64	73	100	N	
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Ephemeral tributary on left bank near bottom end of reach
126m black hose in pool
156m pool
180m LWD
349m LWD

Average channel width, W_b (m): 5.85
Average channel depth, d (m): 0.53
Average channel gradient, S (%): 15
Average Rock, D (m): 0.43
Average Gravel Bar Width (m): 0

Relative roughness (D/d): 0.81
Power Index (W_b d S): 46.07

Hillslope-valley flat connection: H
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Channel Type: Cascade-pool

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: EVANS Date: 08/27/96 Crew: DAN, GEORGE, ISAAC

Reach #: 14

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody ebris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m)	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1	82	11.1	0.4	11	195	141	Stable	COBBLE	0.3	0	57	61	200	N	
2	94	10.7	0.9	14	200	142	STABLE	COBBLE	0.2	0	35	57	100	N	
3	127	5.9	0.6	17	205	144	STABLE	BOULDER	0.4	0	62	62	100	N	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Reach break: gravel road crossing creek via wood bridge; 7 m long, 6.5m wide, 2.4 m deep.

Average channel width, W_b (m):	9.23
Average channel depth, d (m):	0.63
Average channel gradient, S (%):	14
Average Rock, D (m):	0.30
Average Gravel Bar Width (m):	0
Relative roughness (D/d):	0.47
Power Index (W_b d S):	81.87
Hillslope-valley flat connection:	M
Average Valley Width:	L
Upstream Disturbance:	M
Sensitivity Rating:	M

Channel Type: Cascade-pool

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: EVANS Date: 08/27/96 Crew: DAN, GEORGE, ISAAC

Reach #: 15

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody ebris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m)	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1	94	8.7	0.8	17	230	150	Stable	BOULDER	0.4	0	72	59	100	N	Y
2	199	3.9	0.6	18	250	168	STABLE	BOULDER	0.3	0	54	81	50	N	Y
3	272	6.8	0.8	11	265	105	STABLE	BOULDER	0.4	0	58	56	100	N	Y
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

132m tire in creek
Reach break old bridge- wood

Average channel width, W_b (m): 6.47
Average channel depth, d (m): 0.73
Average channel gradient, S (%): 15.33
Average Rock, D (m): 0.37
Average Gravel Bar Width (m): 0

Channel Type: Cascade-pool

Relative roughness (D/d): 0.50
Power Index (W_b d S): 72.71

Hillslope-valley flat connection: H
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: EVANS Date: 08/27/96 Crew: DAN, GEORGE, ISAAC

Reach #: 16

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	43	5.9	0.5	12	270	180	Stable	COBBLE	0.3	0	56	46	100	N	Y
2	137	10.4	0.5	18	275	158	STABLE	COBBLE	0.2	0	81	22	50	N	Y
3	170	4.9	0.7	11	280	120	STABLE	COBBLE	0.4	0	99	68	50	N	Y
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

58m LWD
101m LWD

Average channel width, W_b (m): 7.07
Average channel depth, d (m): 0.57
Average channel gradient, S (%): 13.67
Average Rock, D (m): 0.30
Average Gravel Bar Width (m): 0

Channel Type: Cascade-pool

Relative roughness (D/d): 0.53
Power Index (W_b d S): 54.73

Hillslope-valley flat connection: H
Average Valley Width: L
Upstream Disturbance: L

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: EVANS Date: 08/28/96 Crew: DAN, GEORGE, ISSAC

Reach #: 17

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m)	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1	100	4.9	0.6	14	290	180	Stable	BOULDER	0.4	0	74	90	100	N	Y
2	152	5	0.8	6	300	105	STABLE	COBBLE	0.2	0	79	52	200	N	Y
3	200	6.8	0.5	9	305	120	STABLE	COBBLE	0.3	0	17	28	1000	N	Y
4	312	2.7	0.8	6	320	120	STABLE	COBBLE	0.2	0	47	97	500	N	N
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Reach break: gravel road crossing creek via wood bridge; length 5.7m, width 4.7m, depth 1.3m

Average channel width, W_b (m): 4.85
Average channel depth, d (m): 0.68
Average channel gradient, S (%): 8.75
Average Rock, D (m): 0.28
Average Gravel Bar Width (m): 0

Channel Type: Riffle-pool

Relative roughness (D/d): 0.41
Power Index (W_b d S): 28.65

Hillslope-valley flat connection: M
Average Valley Width: L
Upstream Disturbance: L

Sensitivity Rating: L

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: EVANS Date: 08/28/96 Crew: DAN, GEORGE, ISAAC

Reach #: 18

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody ebris (Y/N)
1	50	3.2	0.7	3	320	122	Stable	BOULDER	0.3	0	60	83	100	N	Y
2	100	7.6	0.9	4	320	122	STABLE	BOULDER	0.3	0	45	65	150	N	Y
3	196	10	1	1	330	118	STABLE	COBBLE	0.2	0	15	22	400	N	Y
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

130m LWD
158m old bridge

Average channel width, W_b (m): 6.93
Average channel depth, d (m): 0.87
Average channel gradient, S (%): 2.67
Average Rock, D (m): 0.27
Average Gravel Bar Width (m): 0

Channel Type: Riffle-pool

Relative roughness (D/d): 0.31
Power Index (W_b d S): 16.02

Hillslope-valley flat connection: M
Average Valley Width: L
Upstream Disturbance: L

Sensitivity Rating: L

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: EVANS Date: 08/28/96 Crew: DAN, GEORGE, ISAAC

Reach #: 19

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	50	4	0.9	1	330	132	Stable	COBBLE	0.4	0	81	102	100	N	Y
2	113	3	1	2	335	154	STABLE	COBBLE	0.3	0	29	40	250	N	Y
3	212	3.4	0.8	2	340	200	STABLE	COBBLE	0.3	0	42	11	450	N	Y
4	365	3.6	0.7	1	360	152	STABLE	COBBLE	0.3	0	35	55	1000	N	Y
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

42m LWD
142m old oil barrel
150m SWD jam
Reach break: logging road crossing creek via culvert

Average channel width, W_b (m): 3.5
Average channel depth, d (m): 0.85
Average channel gradient, S (%): 1.5
Average Rock, D (m): 0.33
Average Gravel Bar Width (m): 0

Channel Type: Riffle-pool

Relative roughness (D/d): 0.38
Power Index (W_b d S): 4.46

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: L

Sensitivity Rating: L

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: EVANS Date: 08/28/96 Crew: DAN, GEORGE, ISAAC

Reach #: 20

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1		8.5	1.3	0	355	56	Stable	SILT	0	0	5	4	1000	N	Y
2															
3															
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Reach break : gravel road crossing the creek via wood bridge
- beginning of pond

Average channel width, W_b (m): 8.5
Average channel depth, d (m): 1.30
Average channel gradient, S (%): 0
Average Rock, D (m): 0.00
Average Gravel Bar Width (m): 0

Relative roughness (D/d): 0.00
Power Index (W_b d S): 0

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: L

Sensitivity Rating: L

Channel Type: Pond

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: EVANS Date: 08/28/96 Crew: DAN, GEORGE, ISAAC

Reach #: 21

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	121	3.4	1.2	0	360	62	Stable	SILT	0	0	5	2	1000	N	Y
2															
3															
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Reach break : end of pond, gravel road crossing creek via culvert

Average channel width, W_b (m): 3.4
Average channel depth, d (m): 1.20
Average channel gradient, S (%): 0
Average Rock, D (m): 0.00
Average Gravel Bar Width (m): 0

Relative roughness (D/d): 0.00
Power Index (W_b d S): 0

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: L

Sensitivity Rating: L

Channel Type: Pond

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: EVANS Date: 08/26/96 Crew: DAN, GEORGE, ISAAC

Reach #: 22

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	67	9.2	0.9	1	360	90	Stable	COBBLE	0.4	0	26	14	1000	N	Y
2	268	8.6	1.1	3	360	132	STABLE	COBBLE	0.3	0	44	15	300	N	Y
3	339	7.2	1.2	3	360	160	STABLE	COBBLE	0.2	0	11	30	500	N	Y
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Reach break : lake

Average channel width, W_b (m): 8.33
Average channel depth, d (m): 1.07
Average channel gradient, S (%): 2.33
Average Rock, D (m): 0.30
Average Gravel Bar Width (m): 0

Channel Type: Riffle-pool

Relative roughness (D/d): 0.28
Power Index (W_b d S): 20.74

Hillslope-valley flat connection: M
Average Valley Width: L
Upstream Disturbance: L

Sensitivity Rating: L

Crawford Creek Field Data Summary Table

Reach	Bankfull		Slope	Average Rock	Relative	Power	Sensitivity	Channel	Channel
	Width (m)	Depth (m)	(%)	D (m)	Roughness	Index	Rating	Condition	Type
1	15.3	0.76	5.6	0.56	0.74	65.12	M	Stable	Cascade-pool
2	21.67	1.87	10.33	0.83	0.45	417.93	M	Stable	Cascade-pool
3	18.38	1.16	8	0.52	0.45	170.57	M	Stable	Riffle-pool
4	14.84	0.64	3	0.46	0.72	28.49	M	Stable	Riffle-pool
5	-	-	-	-	-	-	-	-	Canyon
6	13.63	0.53	4.33	0.50	0.94	31.51	M	Stable	Cascade-pool
7	-	-	-	-	-	-	-	-	-
8	17.48	0.98	3.2	0.76	0.78	54.82	M	Aggraded	Riffle-pool
9	12.77	1.70	13.17	0.50	0.29	285.76	M	Aggraded	Cascade-pool
10	21.77	1.43	2.67	0.77	0.53	83.20	M	Aggraded	Riffle-pool
11	17.92	1.16	3.7	0.64	0.55	76.91	M	Aggraded	Riffle-pool
12	20.17	1.23	1.33	0.33	0.27	33.16	M	Aggraded	Riffle-pool
13	18.57	1.30	2	0.50	0.38	48.27	M	Aggraded	Riffle-pool
14	19.4	1.50	1.83	0.60	0.40	53.35	M	Aggraded	Riffle-pool
15	21.14	1.22	1.6	0.50	0.41	41.27	M	Stable	Riffle-pool
16	14.57	1.53	2.67	0.63	0.41	59.56	M	Stable	Riffle-pool
17	17.5	1.40	7	0.68	0.48	171.50	M	Stable	Riffle-pool
18	12.46	1.30	9.8	0.62	0.48	158.74	M	Stable	Cascade-pool
19	11.9	1.28	5.4	0.52	0.41	82.25	M	Stable	Riffle-pool
20	11.23	1.03	2	0.33	0.32	23.22	M	Stable	Riffle-pool
21	14.08	1.00	3.6	0.42	0.42	50.69	M	Stable	Riffle-pool
22	16.3	1.22	3	0.52	0.43	59.66	M	Stable	Riffle-pool
23	12.05	1.30	2.5	0.45	0.35	39.16	M	Stable	Riffle-pool
24	13.73	0.80	2	0.43	0.53	21.96	M	Stable	Riffle-pool
25	14.9	0.60	7.67	0.73	1.22	68.54	M	Aggraded	Cascade-pool
26	19.53	2.60	10.67	0.47	0.18	541.72	M	Stable	Riffle-pool
27	-	-	-	-	-	-	-	-	-
28	12.08	1.14	14.5	0.50	0.44	199.68	M	Stable	Cascade-pool

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Quality Assurance/Quality Control Form

Stream: Crawford Creek Date: _____ Crew: _____

	Reach #	Bank Full		Channel						Bank			Logging	Large
		Width (m)	Depth (m)	Slope (%)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m)	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)	Past/Present (Y/N)	Woody Debris (Y/N)
QA/QC 1														
QA/QC 2														
Original Results														
QA/QC 1														
QA/QC 2														
Original Results														
QA/QC 1														
QA/QC 2														
Original Results														

Observations Data Sheet

Stream: CRAWFORD Date: 3/9/96 Crew: NED, DAN, ISAAC, GEORGE JEN, MIKE

Reach #:

Obs. #	Hip Chain (m)	Description	Measurements (e.g., gradient, Wb, etc.)	Photo		
				Roll #	Photo #	Notes
Reach 1	9	side channel rejoins main channel	76 m long			
	51	erosion of gravel bank , tree down				
	139	steel cable in creek	1/2 inch diameter			
	300	runoff from road causing gravel bar	2m across			
	317	cable in creek	1/2 inch diameter			
	341	log bridge	L = 9.1m W = 9.2m D = 5.2m	1	4up, 5down	
Reach 2	100	erosion of right gravel bank				
		small alders sluffing into creek				
	143	LWD- individual logs not constricting				
		flow				
	170	LWD jams on both sides of creek	covering 1/2 of total width of creek			
	208	trib on right bank	Wb = 6.1 Db = 0.6 S = 63%			
Reach 3	40	run off from clear cut, wide fan of cobble				
	243	waterfall	40m high			

Observations Data Sheet

Stream:	CRAWFORD				Date:	3/9/96	Crew:	NED, DAN, ISAAC, GEORGE			
								JEN, MIKE			
Reach #:											
Obs. #	Hip Chain	Description				Measurements					
	(m)					(e.g., gradient, Wb, etc.)					Roll #
Reach 1	9	side channel rejoins main channel				76 m long					
	51	erosion of gravel bank , tree down									
	139	steel cable in creek				1/2 inch diameter					
	300	runoff from road	causing gravel bar			2m across					
	317	cable in creek				1/2 inch diameter					
	341	log bridge				L = 9.1m W = 9.2m D = 5.2m					1
Reach 2	100	erosion of right gravel bank									
		small alders sluffing into creek									
	143	LWD- individual logs not constricting									
		flow									
	170	LWD jams on both sides of creek				covering 1/2 of total width of creek					
	208	trib on right bank				Wb = 6.1 Db = 0.6 S = 63%					
Reach 3	40	run off from clear cut, wide fan of cobble									
	243	waterfall				40m high					

Observation sheet

Photo	
Photo #	Notes
4up, 5down	

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: CRAWFORD Date: 3/9/96 Crew: NED, DAN, ISAAC, GEORGE

Reach #: 1

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	0	17.8	0.8	5	530	180	Stable	BOULDER	0.4	1.8	7	8	2000	N	Y
2	102	17.9	0.7	4	535	190	STABLE	BOULDER	0.6	0	2	58	2000	N	Y
3	200	20.5	0.8	7	540	200	STABLE	BOULDER	0.8	0	10	19	3000	N	Y
4	300	11.2	0.8	7	545	231	STABLE	BOULDER	0.5	0	52	42	3000	N	N
5	341	9.1	0.7	5	585	210	STABLE	BOULDER	0.5	0	30	110	40	N	N

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

5.1 pool under bridge
Reach break : gravel road crossing stream via log bridge

Average channel width, W_b (m): 15.3
Average channel depth, d (m): 0.76
Average channel gradient, S (%): 5.6
Average Rock, D (m): 0.56
Average Gravel Bar Width (m): 0.36

Relative roughness (D/d): 0.74
Power Index (W_b d S): 65.12

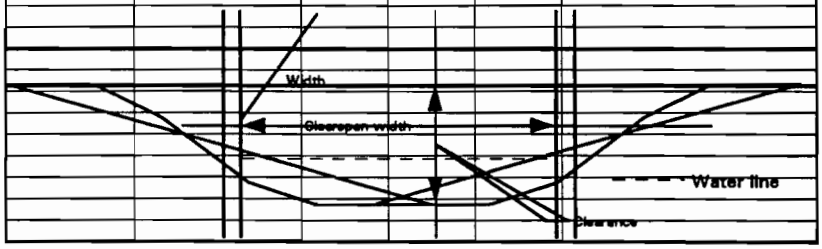
Hillslope-valley flat connection: M
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: M

Channel Type: Cascade-pool

Drainage Structures Data Summary Sheet					
Stream:	CRAWFORD	Date:	4/9/96	Crew:	JEN, DAN, NED, GEORGE, ISAAC
Reach #:	1				
Location of structure:					
Bridges			**Culverts**		
Type of bridge:	WOOD/GRAVEL		Type of culvert:		
Width of bridge:	9.2		Shape of culvert:		
Clearspan width:	9.2		Length of culvert:		
Clearance:	5.2		Diameter of culvert:		

Drainage Structures Data Summary Sheet					
Stream:	Crawford	Date:	96/09/10	Crew:	Dan, Jen, George, Isaac
Reach #:	Reach break 15				
Location of structure:					
Bridges			**Culverts**		
Type of bridge:	wood & gravel		Type of culvert:		
Width of bridge:	5		Shape of culvert:		
Clearspan width:	14.3		Length of culvert:		
Clearance:	3.7		Diameter of culvert:		



Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: CRAWFORD Date: 4/9/96 Crew: JEN, DAN, NED, MIKE, GEORGE, ISAAC

Reach # 2

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	50	19	1.5	12	585	172	Stable	Boulder	0.6	2.2	34	34	50	Y	N
2	100	22.4	2	6	590	205	Aggraded	Boulder	0.8	14.9	23	52	60	Y	Y
3	208	23.6	2.1	13	595	214	Stable	Boulder	1.1	5.4	150	15	26	Y	Y
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Reach break : tributary on right bank/ beginning of canyon

Average channel width, W_b (m): 21.67
Average channel depth, d (m): 1.87
Average channel gradient, S (%): 10.33
Average Rock, D (m): 0.83
Average Gravel Bar Width (m): 7.5

Relative roughness (D/d): 0.45
Power Index (W_b d S): 417.93

Hillslope-valley flat connection: H
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: M

Channel Type: Cascade-pool

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: CRAWFORD Date: 4/9/96 Crew: JEN, DAN, NED, MIKE, GEORGE, ISAAC

Reach #: 3

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	60	27.9	1.8	8	600	205	Aggraded	Cobble	0.8	10	87	53	30	Y	
2	157	13.4	1.1	4	610	290	Stable	Cobble	0.7	0.4	96	140	20	N	
3	278	13.2	0.7	11	650	220	Stable	Cobble	0.4	3.6	120	98	30	N	
4	364	18.7	1.6	13	680	250	Stable	Cobble	0.3	5.6	96	76	20	N	
5	724	18.7	0.6	4	690		Stable	Cobble	0.4	0.5	55	62	40	Y	

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

3.1 logging = regen. on right bank 12m high
243m waterfalls 40m high

Average channel width, W_b (m): 18.38
Average channel depth, d (m): 1.16
Average channel gradient, S (%) 8
Average Rock, D (m): 0.52
Average Gravel Bar Width (m): 4.02

Relative roughness (D/d): 0.45
Power Index (W_b d S): 170.57

Hillslope-valley flat connection: M
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: M

Channel Type: Riffle-pool

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: CRAWFORD Date: 5/9/96 Crew: DAN, NED, GEORGE

Reach # 4

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	74	12	0.5	1	690	254	Stable	Cobble	0.3	1.3	25	54	20	Y	Y
2	137	20.5	0.4	4	690	268	Aggraded	Cobble	0.5	8.6	18	3	60	Y	N
3	220	14.8	0.6	5	695		Aggraded	Cobble	0.4	3.2	30	65	40	Y	N
4	313	11.4	0.6	2	695	290	Stable	Cobble	0.5	0	58	74	40	Y	Y
5	388	15.5	1.1	3	700	280	Stable	Cobble	0.6	3.8	72	92	50	Y	Y

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Reach break : tributary on right bank

Average channel width, W_b (m): 14.84
Average channel depth, d (m): 0.64
Average channel gradient, S (%): 3
Average Rock, D (m): 0.46
Average Gravel Bar Width (m): 3.38

Relative roughness (D/d): 0.72
Power Index (W_b d S): 28.49

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: M

Channel Type: Riffle-pool

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: CRAWFORD Date: 5/9/96 Crew: DAN, NED, ORGE

Reach # 5

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	242	13.1	0.5	3	710	212	Stable	Cobble	0.5	1.3	38	68	40	Y	Y
2															
3															
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Whole reach consists of canyon

Average channel width, W_b (m): 13.1
Average channel depth, d (m): 0.50
Average channel gradient, S (%) 3
Average Rock, D (m): 0.50
Average Gravel Bar Width (m): 1.3

Channel Type: Riffle-pool

Relative roughness (D/d): 1.00
Power index (W_b d S): 19.65

Hillslope-valley flat connection: M
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: CRAWFORD Date: 5/9/96 Crew: DAN, NED, GEORGE

Reach # 6

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	112	13.8	0.3	5	710	246	Stable	Boulder	0.5	0	15	21	100	Y	N
2	195	12	0.7	3	715	246	Stable	Boulder	0.6	0	15	22	100	Y	N
3	230	15.1	0.6	5	715	250	Stable	Boulder	0.4	4	10	12	100	Y	N
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Average channel width, W_b (m): 13.63
Average channel depth, d (m): 0.53
Average channel gradient, S (% 4.33
Average Rock, D (m): 0.50
Average Gravel Bar Width (m): 1.33

Relative roughness (D/d): 0.94
Power Index (W_b d S): 31.51

Hillslope-valley flat connection L
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: M

Channel Type: Cascade-pool

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: _____ Date: _____ Crew: _____

Reach #: _____

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging	Large
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m)	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)	Past/Present (Y/N)	Woody Debris (Y/N)
1															
2															
3															
4															
5															

Electronic data entry checked by: _____

Reviewed by: _____

Notes and Observations

Average channel width, W_b (m): #DIV/0!
Average channel depth, d (m): #DIV/0!
Average channel gradient, S (%): #DIV/0!
Average Rock, D (m): #DIV/0!
Average Gravel Bar Width (m): #DIV/0!

Relative roughness (D/d): #DIV/0!
Power Index (W_b d S): #DIV/0!

Hillslope-valley flat connection: M
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Channel Type: Riffle-pool

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Crawford Date: 9/9/96 Crew: Jen, Dan, George

Reach #: 8

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	72	18.2	0.7	4.5	730	219	Aggraded	Cobble	0.9	3.1	7	8	800	Y	Y
2	130	16.5	0.9	3	730	215	Aggraded	Cobble	0.7	6.6	9	51	600	Y	N
3	197	14.8	0.3	4	735	267	Stable	Cobble	0.6	0	8	19	200	Y	N
4	214	18	1.4	2.5	735	267	Aggraded	Cobble	0.7	3.1	8	21	180	Y	Y
5	354	19.9	1.6	2	735	239	Aggraded	Cobble	0.9	5.2	39	23	800	Y	N

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

142 run - off on right bank
222m tributary on right bank Wb = 1, Db = .3, S = 2
233m run - off on left bank
243m tributary on right bank Wb = 1.3, Db = 0.3, S = 3
354m Reach Break : tributary on left bank Wb = 3.0, Db = 0.9, S = 39

Average channel width, W_b (m): 17.48
Average channel depth, d (m): 0.98
Average channel gradient, S (%): 3.2
Average Rock, D (m): 0.76
Average Gravel Bar Width (m): 3.6

Relative roughness (D/d): 0.78
Power Index (W_b d S): 54.82

Channel Type: Riffle-pool

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Crawford Date: 9/9/96 Crew: Jen, Dan, George

Reach # 9

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	58	11.6	1.8	2	735	200	Aggraded	Cobble	0.5	0	26	52	400	Y	
2	79	10.3	1.5	0.5	735	200	Aggraded	Cobble	0.6	3.1	150	140	10.3	Y	
3	133	16.4	1.8	37	740	194	Stable	Bedrock	0.4	2	26	31	300	Y	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

45m LWD- jam across 100% of creek with c bble build- up
68m Trib on left bank - ephemeral
9.1 measurement taken right above log jam
133m Reach Break : top of waterfall, canyon ends

Average channel width, W_b (m): 12.77
Average channel depth, d (m): 1.70
Average channel gradient, S (%): 13.17
Average Rock, D (m): 0.50
Average Gravel Bar Width (m): 1.7

Relative roughness (D/d): 0.29
Power Index (W_b d S): 285.76

Hillslope-valley flat connection: H
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: M

Channel Type: Cascade-pool

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Crawford Date: 9/9/96 Crew: Jen, Dan, George

Reach # 10

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	78	16.6	0.8	3	740	220	Aggraded	Cobble	0.5	4.3	36	34	200	Y	
2	131	32.4	1.8	3	745	223	Aggraded	Cobble	0.5	7.6	26	5	500	Y	
3	191	16.3	1.7	2	750	202	Stable	Bedrock	1.3	0	29	19	600	Y	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

2m tributary on left bank - ephemeral, windfall across creek every 4m for 50m
11m run off on left bank
78m LWD - jam across 33% of creek
128m 5m buffer zone ends
146m tributary on right bank - ephemeral
191 Reach break : waterfall / tributary on left bank Wb = 3.4, Db = 0.8, S = 29

Channel Type: Riffle-pool

Average channel width, W_b (m): 21.77
Average channel depth, d (m): 1.43
Average channel gradient, S (%): 2.67
Average Rock, D (m): 0.77
Average Gravel Bar Width (m): 3.97

Relative roughness (D/d): 0.53
Power Index (W_b d S): 83.20

Hillslope-valley flat connection: M
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Crawford Date: 9/9/96 Crew: Jen, Dan, George

Reach #: 11

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1	67	23.1	1.4	1.5	755	226	Aggraded	Cobble	0.7	8	19	17	500	Y	
2	146	15.5	0.9	4	755	220	Stable	Cobble	0.6	0	22	52	400	Y	
3	232	16.2	1.3	4	760	233	Aggraded	Cobble	0.6	10.2	26	48	150	Y	N
4	252	19.3	0.9	6	760	233	Stable	Cobble	0.6	2.6	21	48	150	Y	
5	303	15.5	1.3	3	760	233	Aggraded	Cobble	0.7	0	18	45	150	Y	N

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

97m LWD - jam across 40% of creek bed
266m run off on right bank
Reach break : 302m tributary enters creek at 3 points on right bank

Average channel width, W_b (m): 17.92
Average channel depth, d (m): 1.16
Average channel gradient, S (%): 3.7
Average Rock, D (m): 0.64
Average Gravel Bar Width (m): 4.16

Channel Type: Riffle-pool

Relative roughness (D/d): 0.55
Power Index (W_b d S): 76.91

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Crawford Date: 10/9/96 Crew: Dan, Jen, George, Isaac

Reach #: 12

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	50	16.9	0.9	2	760	344	Aggraded	Cobble	0.4	2.7	37	26	100	Y	Y
2	96	21.2	1.3	1	765	264	Aggraded	Cobble	0.3	8.5	32	17	100	Y	Y
3	116	22.4	1.5	1	765	230	Aggraded	Cobble	0.3	10	25	36	100	Y	Y
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations
59m run off from right bank
Reach break : tributary on right bank Wb = 1.1, Db = 0.6, S = 36

Average channel width, W_b (m): 20.17
Average channel depth, d (m): 1.23
Average channel gradient, S (%): 1.33
Average Rock, D (m): 0.33
Average Gravel Bar Width (m): 7.07

Channel Type: Riffle-pool

Relative roughness (D/d): 0.27
Power Index (W_b d S): 33.16

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Crawford Date: 10/9/96 Crew: Dan, Jen, George, Isaac

Reach #: 13

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	50	16.1	1.1	1	765	244	Aggraded	Cobble	0.5	3.3	29	22	100	Y	N
2	100	18.5	1.3	3	770	246	Aggraded	Cobble	0.4	4.4	58	32	90	Y	N
3	154	21.1	1.5	2	770	276	Aggraded	Cobble	0.6	5.5	74	12	90	Y	Y
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

120m LWD - jam for 10m
154m LWD - trees sluffed into creek from eroding bank creating log jam
Reach break : connected slide of clay/gravel material

Average channel width, W_b (m): 18.57
Average channel depth, d (m): 1.30
Average channel gradient, S (%): 2
Average Rock, D (m): 0.50
Average Gravel Bar Width (m): 4.4

Channel Type: Riffle-pool

Relative roughness (D/d): 0.38
Power Index (W_b d S): 48.27

Hillslope-valley flat connection: M
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Crawford Date: 10/9/96 Crew: Dan, Jen, George, Isaac

Reach #: 14

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	55	24.4	1.4	2	770	240	Aggraded	Cobble	0.7	10.6	44	22	100	Y	Y
2	110	15.5	1.5	2	770	235	Aggraded	Cobble	0.6	6.9	40	33	100	Y	N
3	140	18.3	1.6	1.5	770	243	Stable	Cobble	0.5	0	11	19	100	Y	N
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

110m tributary on left bank - ephemeral
140m tributary on left bank - ephemeral
186m tributary on right bank Wb = 4.3, Db = .6, S = 42

Average channel width, W_b (m): 19.4
Average channel depth, d (m): 1.50
Average channel gradient, S (%): 1.83
Average Rock, D (m): 0.60
Average Gravel Bar Width (m): 5.83

Relative roughness (D/d): 0.40
Power Index (W_b d S): 53.35

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: M

Channel Type: Riffle-pool

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Crawford Date: 10/9/96 Crew: Jen, Dan, Isaac, George

Reach #: 15

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	52	21.1	0.8	1	770	258	Stable	Cobble	0.5	4.4	8	32	100	N	
2	101	25.6	0.8	1	770	272	Stable	Cobble	0.4	16.5	13	8	150	Y	
3	151	15.5	1.7	1.5	770	272	Stable	Cobble	0.4	7.6	40	11	150	Y	
4	210	29.2	1.4	2	775	232	Stable	Cobble	0.5	14	11	7	300	Y	
5	478	14.3	1.4	2.5	780	250	Stable	Cobble	0.7	0	18	14	300	Y	

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Reach break : gravel road crossing via wood/ gravel bridge

Average channel width, W_b (m): 21.14
Average channel depth, d (m): 1.22
Average channel gradient, S (%): 1.6
Average Rock, D (m): 0.50
Average Gravel Bar Width (m): 8.5

Channel Type: Riffle-pool

Relative roughness (D/d): 0.41
Power Index (W_b d S): 41.27

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Crawford Date: 10/9/96 Crew: Dan, Jen, Isaac, George

Reach #: 16

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	7	13.6	1.3	1	780	240	Stable	Boulder	0.7	0	18	14	300	Y	N
2	27	14.7	1.4	3	785	240	Stable	Boulder	0.6	3.9	29	-6	300	Y	N
3	42	15.4	1.9	4	785	240	Stable	Boulder	0.6	0	15	5	250	Y	N
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Reach break : tributary on left bank Wb = 7.6, Db = 0.8, S = 15

Average channel width, W_b (m): 14.57
Average channel depth, d (m): 1.53
Average channel gradient, S (%): 2.67
Average Rock, D (m): 0.63
Average Gravel Bar Width (m): 1.3

Channel Type: Riffle-pool

Relative roughness (D/d): 0.41
Power Index (W_b d S): 59.56

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Crawford Date: 11/9/96 Crew: Dan, Isaac, George, Mike

Reach #: 17

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1	30	21.5	1.4	5	785	229	Stable	Boulder	0.5	0	27	8	250	Y	N
2	41	19.8	1.7	6	785	232	Aggradedd	Boulder	0.7	6	22	10	450	Y	
3	92	10.7	1.3	9	785	234	Stable	Cobble	0.9	0.6	37	40	450	Y	
4	100	18	1.2	8	785	234	Stable	Cobble	0.6	2.8	62	80	450	Y	
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

41m tributary on left bank Wb = 1.9, Db = .4, S = 27
100m tributary on left bank Wb = 0.9, Db = 0.5, S = 28

Average channel width, W_b (m): 17.5
Average channel depth, d (m): 1.40
Average channel gradient, S (%): 7
Average Rock, D (m): 0.68
Average Gravel Bar Width (m): 2.35

Relative roughness (D/d): 0.48
Power Index (W_b d S): 171.50

Channel Type: Riffle-pool

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Crawford Date: 11/9/96 Crew: Dan, Isaac, George, Isaac

Reach #: 18

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	60	12.1	1.7	9	790	226	Stable	Boulder	0.5	1.3	82	90	400	Y	
2	125	18.5	1.3	10	795	220	Stable	Boulder	0.6	0	85	26	400	Y	
3	178	12.8	1.1	14	805	220	Stable	Boulder	0.7	2	13	50	1000	Y	
4	218	11.9	1.3	12	805	270	Stable	Boulder	0.8	1.7	48	25	1000	Y	
5	234	7	1.1	4	805	270	Stable	Cobble	0.5	0.9	43	24	1000	Y	

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

41m tributary on left bank
60m fish in creek
92m tributary on left bank
100m tributary on left bank Wb = .9, Db = .5 S = 28
135m tributary - ephemeral
234m Reach break : tributary Wb = 5.5, Db = .7, S = 43

Channel Type: Cascade-pool

Average channel width, W_b (m): 12.46
Average channel depth, d (m): 1.30
Average channel gradient, S (%): 9.8
Average Rock, D (m): 0.62
Average Gravel Bar Width (m): 1.18

Relative roughness (D/d): 0.48
Power Index (W_b d S): 158.74

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Crawford Date: 11/9/96 Crew: Dan, Isaac, George, Mike

Reach #: 19

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	51	14	1.3	7	810	178	Stable	Boulder	0.6	0	50	25	1000	Y	
2	115	11.3	1.1	10	810	170	Stable	Cobble	0.4	2.8	20	56	1000	Y	
3	180	12.2	1.6	3	820	170	Stable	Boulder	0.6	3.1	56	42	1000	Y	
4	255	10.2	1.3	4	825	192	Stable	Boulder	0.4	1.5	24	82	1000	Y	
5	320	11.8	1.1	3	830	180	Stable	Cobble	0.6	3.9	9	7	1000	Y	

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

20m tributary on left bank	Wb = < 1m	
40m tributary on left bank	Wb = < 1m	293m side channel
53m tributary on left bank - ephemeral	Wb = < 1m	320m reach break : tributary on left bank Wb = 3, Db = 0.4, S =9
160m tributary on left bank - ephemeral	Wb = < 1m	
213m tributary on left bank	Wb = < 1m	

Average channel width, W_b (m): 11.9
Average channel depth, d (m): 1.28
Average channel gradient, S (%): 5.4
Average Rock, D (m): 0.52
Average Gravel Bar Width (m): 2.26

Channel Type: Riffle-pool

Relative roughness (D/d): 0.41
Power Index (W_b d S): 82.25

Hillslope-valley flat connection: M
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Crawford Date: 11/9/96 Crew: Dan, George, Isaac

Reach #: 20

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	75	10.1	0.6	2	830	332	Stable	Cobble	0.4	3.6	30	8	100	N	N
2	134	14	1.2	2	830	210	Stable	Cobble	0.3	4.6	5	13	100	Y	N
3	180	9.6	1.3	2	830	168	Stable	Cobble	0.3	3.6	15	11	100	Y	N
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

22m LWD - jam
43m tributary on left bank- ephemeral Wb = 0.6, Db = 0.3, S = 5
134m tributary on left bank Wb = 2.2, Db = 0.3, S = 4
202m reach break : braiding channels begin7

Average channel width, W_b (m): 11.23
Average channel depth, d (m): 1.03
Average channel gradient, S (%): 2
Average Rock, D (m): 0.33
Average Gravel Bar Width (m): 3.93

Channel Type: Riffle-pool

Relative roughness (D/d): 0.32
Power Index (W_b d S): 23.22

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Crawford Date: 11/9/96 Crew: Dan, George, Isaac

Reach #: 21

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	40	10.3	0.9	2	835	190	Stable	Cobble	0.3	3.8	8	25	100	Y	N
2	121	16.8	1.1	3	835	210	Stable	Cobble	0.4	9.5	5	11	200	N	N
3	203	11.1	0.8	3	840	176	Stable	Cobble	0.3	5.1	6	3	400	N	N
4	320	15.8	1.4	7	845	190	Stable	Cobble	0.3	7.1	1	3	400	Y	N
5	544	16.4	0.8	3	850	200	Stable	Cobble	0.8	4.7	11	35	500	N	N

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

202m LWD
275m side channel
10 fish - 10c long
230m side channel on left bank

Average channel width, W_b (m): 14.08
Average channel depth, d (m): 1.00
Average channel gradient, S (%): 3.6
Average Rock, D (m): 0.42
Average Gravel Bar Width (m): 6.04

Channel Type: Riffle-pool

Relative roughness (D/d): 0.42
Power Index (W_b d S): 50.69

Hillslope-valley flat connection: L
Average Valley Width: M
Upstream Disturbance: H

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Crawford Date: 11/9/96 Crew: Dan, George, Isaac

Reach #: 22

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	124	25.8	1.7	3	85	228	Stable	Cobble	0.6	8.3	94	9	500	Y	N
2	225	15.7	1.3	3	855	150	Stable	Cobble	0.3	3.6	2	26	400	Y	N
3	281	14.1	1.1	3	855	170	Stable	Cobble	0.7	6.3	20	26	300	Y	N
4	310	15.1	1.1	3	855	160	Stable	Cobble	0.6	3.7	23	26	300	N	N
5	326	10.8	0.9	3	855	160	Stable	Cobble	0.4	4	5	7	200	N	N

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

29m LWD
73m side channel on left bank
198m LWD

Average channel width, W_b (m): 16.3
Average channel depth, d (m): 1.22
Average channel gradient, S (%): 3
Average Rock, D (m): 0.52
Average Gravel Bar Width (m): 5.18

Channel Type: Riffle-pool

Relative roughness (D/d): 0.43
Power Index (W_b d S): 59.66

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Crawford Date: 11/9/96 Crew: Dan, George, Isaac

Reach #: 23

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	50	12	1.1	3	855	210	Stable	Cobble	0.5	4.4	3	45	200	Y	N
2	80	12.1	1.5	2	860	210	Stable	Cobble	0.4	5.2	9	7	200	Y	N
3															
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations
LWD - jam 27m long

Average channel width, W_b (m): 12.05
Average channel depth, d (m): 1.30
Average channel gradient, S (%): 2.5
Average Rock, D (m): 0.45
Average Gravel Bar Width (m): 4.8

Channel Type: Riffle-pool

Relative roughness (D/d): 0.35
Power Index (W_b d S): 39.16

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Crawford Date: 09/16/96 Crew: Dan, George, Isaac, Mike

Reach #: 24

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	60	11.5	0.8	1	860	218	Stable	Cobble	0.5	2.3	8	5	200	N	N
2	172	12.2	0.9	2	860	190	Stable	Cobble	0.4	5.4	2	1	1000	Y	N
3	260	16.8	0.6	2	870	200	Stable	Cobble	0.4	1.5	2	0	1000	N	N
4	307	14.4	0.9	3	870	200	Stable	Cobble	0.4	3.2	3	1	1000	N	N
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

98m side channel on left bank
114m LWD
215m LWD
306m reach break : channel on left bank rejoins

Average channel width, W_b (m): 13.725
Average channel depth, d (m): 0.80
Average channel gradient, S (%): 2
Average Rock, D (m): 0.43
Average Gravel Bar Width (m): 3.1

Channel Type: Riffle-pool

Relative roughness (D/d): 0.53
Power Index (W_b d S): 21.96

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Crawford Date: 09/16/96 Crew: Dan, George, Isaac, Mike

Reach #: 25

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	80	13.3	1.8	5	870	138	Stable	Cobble	1	9.4	25	1	1000	Y	Y
2	145	19.6	0	13	875	152	Aggraded	Cobble	0.8	19.6	2	2	1000	Y	Y
3	200	11.8	0	5	880	120	Aggraded	Cobble	0.4	11.5	25	4	1000	Y	Y
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

44m LWD
122m channel runs underground
250m side channel or channel has been diverted due to bed load
Reach break : bridge L = 15.8, Cl = 4.0, W = 5.8

Average channel width, W_b (m): 14.9
Average channel depth, d (m): 0.60
Average channel gradient, S (%): 7.67
Average Rock, D (m): 0.73
Average Gravel Bar Width (m): 13.5

Relative roughness (D/d): 1.22
Power Index (W_b d S): 68.54

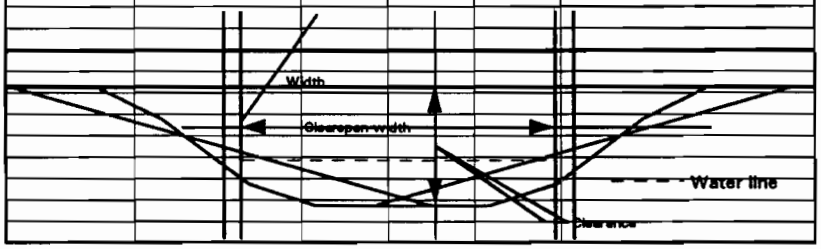
Channel Type: Cascade-pool

Hillslope-valley flat connection: M
Average Valley Width: M
Upstream Disturbance: H

Sensitivity Rating: M

Drainage Structures Data Summary Sheet					
Stream:	CRAWFORD	Date:	96/09/16	Crew:	Dan, George, Isaac, Mike
Reach #:	Reach break 25				
Location of structure:					
Bridges			**Culverts**		
Type of bridge:	wood & gravel		Type of culvert:		
Width of bridge:	5.8		Shape of culvert:		
Clearspan width:	15.8		Length of culvert:		
Clearance:	4		Diameter of culvert:		

Drainage Structures Data Summary Sheet					
Stream:		Date:		Crew:	
Reach #:					
Location of structure:					
Bridges			**Culverts**		
Type of bridge:			Type of culvert:		
Width of bridge:			Shape of culvert:		
Clearspan width:			Length of culvert:		
Clearance:			Diameter of culvert:		



Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Crawford Date: 09/16/96 Crew: Dan, George, Isaac, Mike

Reach #: 26

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	0	15.8	1.8	6	890	210	Stable	Cobble/Boulder	0.3	6	5	65	1000	N	Y
2	32	19.3	2.5	11	895	185	Stable	Cobble/Boulder	0.5	4.7	10	78	1000	Y	N
3	145	23.5	3.5	15	905	130	Stable	Cobble/Boulder	0.6	14.2	120	150	500	Y	N
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

145m Reach break : tributary on left bank

Average channel width, W_b (m): 19.53
Average channel depth, d (m): 2.60
Average channel gradient, S (%): 10.67
Average Rock, D (m): 0.47
Average Gravel Bar Width (m): 8.3

Channel Type: Riffle-pool

Relative roughness (D/d): 0.18
Power Index (W_b d S): 541.72

Hillslope-valley flat connection: H
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Crawford Date: 09/16/96 Crew: Dan, George, Isaac, Mike

Reach #: 27

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	44	34.6	1.4	15	915	109	Stable	Cobble	0.5	5.2	55	> 150	500	Y	Y
2															
3															
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

33m LWD - heavy
44m reach break : tributary on left bank

Average channel width, W_b (m): 34.6
Average channel depth, d (m): 1.40
Average channel gradient, S (%): 15
Average Rock, D (m): 0.50
Average Gravel Bar Width (m): 5.2

Relative roughness (D/d): 0.36
Power Index (W_b d S): 726.60

Channel Type: Riffle-pool

Hillslope-valley flat connection: M
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Crawford Date: 09/16/96 Crew: Dan, George, Isaac, Mike

Reach #: 28

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	110	13.8	1.5	15	925	80	Stable	Cobble	0.4	4.3	4	> 150	300	Y	N
2	250	15.7	1.2	14	945	110	Stable	Boulder	0.4	2.4	110	60	200	Y	N
3	300	10.2	0.9	16	950	90	Stable	Boulder	0.6	2.3	150	80	200	Y	N
4	350	9.8	0.7	13	960	120	Stable	Boulder	0.5	3.4	45	70	200	Y	N
5	400	10.9	1.4		965	80	Stable	Boulder	0.6	3.4	90	110	100	Y	N

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

110m oil, cans & plastic sheeting on left bank
167m LWD - heavy
Reach break : Waterfalls 50 - 70m tall

Average channel width, W_b (m): 12.08
Average channel depth, d (m): 1.14
Average channel gradient, S (%): 14.5
Average Rock, D (m): 0.50
Average Gravel Bar Width (m): 3.16

Relative roughness (D/d): 0.44
Power Index (W_b d S): 199.68

Channel Type: Cascade-pool

Hillslope-valley flat connection: H
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: M

Cheekeye River Data Summary Table

Reach	Bankfull		Slope	Average Rock	Relative	Power	Sensitivity	Channel	Channel
	Width (m)	Depth (m)	(%)	D (m)	Roughness	Index	Rating	Condition	Type
1	65.20	4.23	3	0.70	0.17	828.04	M	Aggraded	Riffle-pool
2	44.24	3.10	3.4	0.78	0.25	466.29	M	Aggraded	Riffle-pool
3	38.64	3.00	5	0.92	0.31	579.60	M	Aggraded	Riffle-pool
4	36.18	4.60	5.4	0.72	0.16	898.71	M	Aggraded	Riffle-pool
5	26.80	2.75	6	0.87	0.32	442.20	M	Aggraded	Riffle-pool
6	18.93	4.10	6	0.47	0.11	465.76	M	Aggraded	Riffle-pool
7	31.92	3.64	6.4	0.38	0.10	743.61	M	Aggraded	Riffle-pool
8	36.33	3.23	8	0.40	0.12	939.82	M	Aggraded	Riffle-pool
9	32.70	2.93	7	0.40	0.14	671.44	M	Aggraded	Riffle-pool
10	24.10	3.23	6	0.47	0.14	467.54	M	Aggraded	Riffle-pool
11	27.57	2.33	6	0.40	0.17	385.93	M	Aggraded	Riffle-pool
12	30.67	2.33	5.67	0.40	0.17	405.48	M	Aggraded	Riffle-pool
13	34.84	2.54	7.6	0.50	0.20	672.55	M	Aggraded	Riffle-pool
14	31.54	2.40	7	0.50	0.21	529.87	M	Aggraded	Riffle-pool
15	17.94	2.12	6.6	0.48	0.23	251.02	M	Stable	Riffle-pool

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Quality Assurance/Quality Control Form

Stream: Cheekeye Date: Crew:

	Reach #	Bank Full		Channel						Bank			Logging	Large
		Width (m)	Depth (m)	Slope (%)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m)	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)	Past/Present (Y/N)	Woody Debris (Y/N)
QA/QC 1														
QA/QC 2														
Original Results														
QA/QC 1														
QA/QC 2														
Original Results														
QA/QC 1														
QA/QC 2														
Original Results														

QAQC on Cheekeye done by Jeff and Steve - see notes for info

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Cheekeye Date: 96/09/18 Crew: Dan, Mike, Sarah

Reach #: 1

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	0	75.7	4.4	3	40	280	Aggraded	boulder	0.7	64.3	3	2	10,000	small	N
2	25	73.5	5	3	45	280	Aggraded	boulder	0.7	63	3	2	10,000	N	N
3	50	46.4	3.3	3	45	280	Aggraded	boulder	0.7	36.1	3	2	10,000	N	N
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

112m Reachbreak: bridge
Bridge width 7.2m, length 25.6m, depth 2.5m

Average channel width, W_b (m): 65.20
Average channel depth, d (m): 4.23
Average channel gradient, S (%): 3
Average Rock, D (m): 0.7
Average Gravel Bar Width (m): 54.47

Relative roughness (D/d): 0.17
Power Index (W_b d S): 828.04

Channel Type: Riffle-pool
RPg

Hillslope-valley flat connection: M
Average Valley Width: M
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Cheekeye Date: 96/09/18 Crew: Dan, Mike, Sara

Reach #: 2

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	0	23.2	4	3	45	300	Aggraded	boulder	0.8	8	45	80	10,000	N	N
2	50	33.4	4	3	45	270	Aggraded	cobble/boulder	0.7	16.1	43	-2	10000	N	N
3	101	39	2	3	45	270	Aggraded	cobble/boulder	1	26.1	23	30	10000	N	N
4	250	55	2.5	3	55	250	Aggraded	cobble/boulder	0.8	45	56	0	10000	N	N
5	876	70.6	3	5	85	280	Aggraded	cobble/boulder	0.6	61.6	0	0	10000	N	N

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

495m side channel on right bank
876m Reach break: old train bridge
Bridge width 3m, length 25.6m, depth 2.5m

Average channel width, W_b (m): 44.24
Average channel depth, d (m): 3.10
Average channel gradient, S (%): 3.4
Average Rock, D (m): 0.78
Average Gravel Bar Width (m): 31.36

Relative roughness (D/d): 0.25
Power index (W_b d S): 466.29

Channel Type: Riffle-pool
RPg

Hillslope-valley flat connection: M
Average Valley Width: M
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Cheekeye Date: 96/09/18 Crew: Dan, Mike, Sara

Reach #: 3

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	100	75	4	5	90	280	Aggraded	cobble/boulder	1	65	100	130	10,000	N	N
2	200	43.8	1.5	5	95	300	Aggraded	cobble/boulder	0.6	33.8	45	90	10000	N	N
3	300	32.4	3	5	105	230	Aggraded	cobble/boulder	1	27.4	10	25	10000	N	N
4	345	19	3	5	105	275	Aggraded	cobble/boulder	1	12	65	110	10000	N	N
5	375	23	3.5	5	110	275	Aggraded	cobble/boulder	1	14	20	90	10,000	Y	N

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

200m channel splits in two
375m Reach break: change in slope

Average channel width, W_b (m): 38.64
Average channel depth, d (m): 3.00
Average channel gradient, S (%): 5
Average Rock, D (m): 0.92
Average Gravel Bar Width (m): 30.44

Relative roughness (D/d): 0.31
Power Index (W_b d S): 579.60

Channel Type: Riffle-pool

Hillslope-valley flat connection: M
Average Valley Width: M
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Cheekeye Date: 96/09/18 Crew: Dan, Mike, Sara

Reach #: 4

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel ar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	100	62	5	5	120	320	Aggraded	cobble/boulder	0.8	47	20	43	10,000	N	N
2	200	34	3	7	130	248	Aggraded	cobble/boulder	0.8	23	10	68	10000	small	N
3	300	25.6	4	5	130	192	Aggraded	cobble/boulder	0.5	16.6	65	52	10000	small	N
4	360	34.1	6	5	135	210	Aggraded	cobble/boulder	0.5	27.4	100	130	10000	N	N
5	417	25.2	5	5	135	200	Aggraded	cobble/boulder	1	17.2	> 150	48	10000	N	N

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

417m Reach break: small canyon

Average channel width, W_b (m): 36.18
Average channel depth, d (m): 4.60
Average channel gradient, S (%): 5.4
Average Rock, D (m): 0.72
Average Gravel Bar Width (m): 26.24

Channel Type: Riffle-pool

Relative roughness (D/d): 0.16
Power Index (W_b d S): 898.71

Hillslope-valley flat connection: M
Average Valley Width: M
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Cheekeye Date: 96/09/18 Crew: Dan, Mike, Sara

Reach #: 5

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	100	16.5	2.5	5	140	175	Aggraded	cobble/boulde	1	5.3	30	150	10.000	N	N
2	200	37.1	3	7	145	198	Stable	cobble/boulde	1	22.1	55	24	10,000	N	N
3								cobble/boulde	0.6	4	100	150	10,000	N	N
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

157m side channel on right bank
428m Reach break 5: highway bridge
Bridge: 47m long, 15.6m wide, 15.2m high

Average channel width, W_b (m): 26.80
Average channel depth, d (m): 2.75
Average channel gradient, S (%): 6
Average Rock, D (m): 0.87
Average Gravel Bar Width (m): 10.47

Relative roughness (D/d): 0.32
Power Index (W_b d S): 442.20

Channel Type: Riffle-pool

Hillslope-valley flat connection: M
Average Valley Width: M
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Cheekeye Date: 96/10/08 Crew: ?

Reach #: 6

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	32	9.4	4.3	5	160	230	Aggraded	cobble	0.5	2.9	94	150	200	N	?
2	81	20.6	4.2	6	160	170	Aggraded	cobble	0.4	9.3	37	68	200	N	?
3	138	26.8	3.8	7	165	190	Aggraded	cobble	0.5	1.4	28	35	400	N	?
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

138m Reach break- braiding

Average channel width, W_b (m): 18.93
Average channel depth, d (m): 4.10
Average channel gradient, S (%): 6
Average Rock, D (m): 0.47
Average Gravel Bar Width (m): 4.53

Relative roughness (D/d): 0.11
Power Index (W_b d S): 465.76

Channel Type: Riffle-pool

Hillslope-valley flat connection: M
Average Valley Width: M
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Cheekeye Date: 96/10/08 Crew: ?

Reach #: 7

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	50	42.2	4.2	6	170	190	Aggraded	cobble	0.3	15.8	15	8	400	N	?
2	271	49.5	3.8	6	180	270	aggraded	cobble	0.3	20.3	22	11	5000	N	?
3	382	21.5	3.5	7	190	260	aggraded	cobble	0.4	9.2	14	11	5000	N	?
4	434	22.2	3.5	7	190	260	aggraded	cobble	0.5	10.4	37	15	5000	N	?
5	478	24.2	3.2	6	195	250	aggraded	cobble	0.4	9.8	12	150	1000	N	?

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

40m braiding
165m powerline crosses stream
408m rip-rap on left bank
464m end of rip-rap on left bank
465m Reach break: beginning of ravine

Average channel width, W_b (m): 31.92
Average channel depth, d (m): 3.64
Average channel gradient, S (%): 6.4
Average Rock, D (m): 0.38
Average Gravel Bar Width (m): 13.1

Relative roughness (D/d): 0.10
Power Index (W_b d S): 743.61

Channel Type: Riffle-pool

Hillslope-valley flat connection: M
Average Valley Width: H
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Cheekeye Date: 96/10/08 Crew: ?

Reach #: 8

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	110	32.1	3.3	8	205	280	Aggraded	cobble	0.4	8.7	85	65	100	N	?
2	132	28.6	2.8	8	205	280	aggraded	cobble	0.4	11.3	98	48	100	N	?
3	160	48.3	3.6	8	210	220	aggraded	cobble	0.4	12.5	50	43	100	N	?
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

41m bedrock on left bank
142m top of bedrock on left bank, start of ravine
158m Reach break: top end of bedrock, change in bed material

Average channel width, W_b (m): 36.33
Average channel depth, d (m): 3.23
Average channel gradient, S (%): 8
Average Rock, D (m): 0.4
Average Gravel Bar Width (m): 10.83

Channel Type: Riffle-pool

Relative roughness (D/d): 0.12
Power Index (W_b d S): 939.82

Hillslope-valley flat connection: M
Average Valley Width: M
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Cheekeye Date: 96/10/08 Crew: ?

Reach #: 9

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	67	24.5	2.8	8	215	?	Aggraded	cobble	0.3	7.6	22	15	1000	N	?
2	205	35.2	2.8	7	225	240	aggraded	cobble	0.4	22.3	11	12	1000	N	?
3	406	38.4	3.2	6	235	240	aggraded	cobble	0.5	30.5	44	120	400	N	?
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

300m 2 human tracks, 1 horse on left bank
310m bedrock on right bank
333m bedrock on left bank
408m Reach break: ?

Average channel width, W_b (m): 32.70
Average channel depth, d (m): 2.93
Average channel gradient, S (%): 7
Average Rock, D (m): 0.4
Average Gravel Bar Width (m): 20.13

Relative roughness (D/d): 0.14
Power index (W_b d S): 671.44

Hillslope-valley flat connection: M
Average Valley Width: M
Upstream Disturbance: M

Sensitivity Rating: M

Channel Type: Riffle-pool

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Cheekeye Date: 96/10/08 Crew: ?

Reach #: 10

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	100	33.5	2.9	6	245	190	Aggraded	cobble	0.4	13.2	120	38	400	N	?
2	133	35.6	3	6	245	190	aggraded	cobble	0.5	14.4	15	9	400	N	?
3	172	3.2	3.8	6	250	220	aggraded	cobble	0.5	19.3	12	5	400	N	?
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

3-4 fry spotted, log across stream
172m Reach break:trib on left bank

Average channel width, W_b (m): 24.10
Average channel depth, d (m): 3.23
Average channel gradient, S (%): 6
Average Rock, D (m): 0.47
Average Gravel Bar Width (m): 15.63

Relative roughness (D/d): 0.14
Power Index (W_b d S): 467.54

Channel Type: Riffle-pool

Hillslope-valley flat connection: M
Average Valley Width: M
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Cheekeye Date: 96/10/08 Crew: ?

Reach #: 11

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	38	24.3	2.4	6	250	220	Aggraded	cobble	0.4	11.3	10	12	400	N	?
2	84	22.8	2.2	6	250	210	aggraded	cobble	0.4	10.4	10	35	400	N	?
3	116	35.6	2.4	6	250	208	aggraded	cobble	0.4	9.8	9	18	400	N	?
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

170m Reach break: trib on right bank

Average channel width, W_b (m): 27.57
Average channel depth, d (m): 2.33
Average channel gradient, S (%): 6
Average Rock, D (m): 0.4
Average Gravel Bar Width (m): 10.5

Channel Type: Riffle-pool

Relative roughness (D/d): 0.17
Power Index (W_b d S): 385.93

Hillslope-valley flat connection: M
Average Valley Width: M
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Cheekeye Date: 96/10/08 Crew: ?

Reach #: 12

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	50	28.7	2.4	5	255	270	Aggraded	cobble	0.4	18.3	14	11	?	?	?
2	100	29.8	2.2	6	255	280	Aggraded	cobble	0.4	19.2	12	10	?	?	?
3	208	33.5	2.4	6	265	280	Aggraded	cobble	0.4	18.8	120	9	?	?	?
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Average channel width, W_b (m): 30.67
Average channel depth, d (m): 2.33
Average channel gradient, S (%): 5.67
Average Rock, D (m): 0.4
Average Gravel Bar Width (m): 18.77

Channel Type: Riffle-pool

Relative roughness (D/d): 0.17
Power Index (W_b d S): 405.48

Hillslope-valley flat connection: H
Average Valley Width: M
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.						
Channel Assessment Procedure (CAP) Field Data Entry Form						
Stream:	Cheekeye		Date:	96/10/08		
Reach #:	13					
Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Slope (%)	Elevation (m)	Aspect
1	50	48.8	2.5	7	270	260
2	130	45.1	3.4	8	275	221
3	254	33.2	2.4	8	280	160
4	358	22.6	2.1	8	295	180
5	408	24.5	2.3	7	295	200
					Notes and Observations	
	Electronic data entry checked by:		SJC			
		Reviewed by:	BDL			
Average channel width, W_b (m):			34.84		**Channel Type:**	
Average channel depth, d (m):			2.54			
Average channel gradient, S (%):			7.6			
Average Rock, D (m):			0.5			
Average Gravel Bar Width (m):			9.02			
Relative roughness (D/d):			0.20			
Power Index (W_b d S):			672.55			
Hillslope-valley flat connection:			H			
Average Valley Width:			M			
Upstream Disturbance:			M			
Sensitivity Rating:			M			

		Crew:				
Channel				Bank		
Channel	General Bed	Largest Rock	Total Gravel	Left Bank	Right Bank	Valley Flat
Condition	Material	Diameter (m)	Bar Width (m	Slope (%)	Slope (%)	Width (m)
Aggraded	cobble	0.4	9.8	10	36	?
aggraded	cobble	0.5	12.3	8	12	?
aggraded	cobble	0.5	4.8	8	10	?
aggraded	cobble	0.6	8.6	24	150	?
aggraded	cobble	0.5	9.6	22	150	?
Riffle-pool						

Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
?	?
?	?
?	?
?	?
?	?

Squamish River Watershed Restoration Program Forest Renewal B.C.						
Channel Assessment Procedure (CAP) Field Data Entry Form						
Stream:	Cheekeye		Date:	96/10/08		
Reach #:	14					
Cross-	Distance from	Bank Full				
Section	Reach Bottom	Width	Depth	Slope	Elevation	Aspect
	(m)	(m)	(m)	(%)	(m)	
1	200	42.6	2.5	5	305	260
2	400	28.6	2.3	7	320	221
3	670	35.2	2.6	8	340	160
4	860	28.7	2.4	9	355	180
5	1248	22.6	2.2	6	365	200
					Notes and Observations	
	Electronic data entry checked by:		SJC			
		Reviewed by:	BDL			
Average channel width, W_b (m):			31.54		**Channel Type:**	
Average channel depth, d (m):			2.40			
Average channel gradient, S (%):			7			
Average Rock, D (m):			0.5			
Average Gravel Bar Width (m):			14.48			
Relative roughness (D/d):			0.21			
Power Index (W_b d S):			529.87			
Hillslope-valley flat connection:			H			
Average Valley Width:			L			
Upstream Disturbance:			M			
Sensitivity Rating:			M			

Crew: ?

Channel				Bank		
Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m	Left Bank Slope (%)	Right Bank Width (m)	Valley Flat Width (m)
Aggraded	cobble	0.5	12.8	7	5	?
aggraded	cobble	0.4	8.6	6	8	?
aggraded	cobble	0.6	22.8	5	6	?
aggraded	cobble	0.6	19.6	15	7	?
aggraded	cobble	0.4	8.6	110	65	?
Riffle-pool						

Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
?	?
?	?
?	?
?	?
?	?

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Cheekeye Date: 96/10/08 Crew: ?

Reach #: 15

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	200	18.6	2	5	375	210	Stable	boulder	0.5	7.4	115	95	?	?	?
2	400	19.3	2.1	5	380	200	Stable	boulder	0.4	5.4	115	100	?	?	?
3	600	19.1	2.3	6	390	190	Stable	boulder	0.4	4.2	115	105	?	?	?
4	800	17.5	3.1	8	400	200	Stable	boulder	0.7	1.8	115	103	?	?	?
5	860	15.2	1.1	9	405	240	Stable	boulder	0.4	4	115	110	?	?	?

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Average channel width, W_b (m): 17.94
Average channel depth, d (m): 2.12
Average channel gradient, S (%): 6.6
Average Rock, D (m): 0.48
Average Gravel Bar Width (m): 4.56

Channel Type: Riffle-pool

Relative roughness (D/d): 0.23
Power Index (W_b d S): 251.02

Hillslope-valley flat connection: H
Average Valley Width: M
Upstream Disturbance: M

Sensitivity Rating: M

Brohm Creek Data Summary Table

Reach	Bankfull		Slope	Average Rock	Relative	Power	Sensitivity	Channel	Channel
	Width (m)	Depth (m)	(%)	D (m)	Roughness	Index	Rating	Condition	Type
1	12.80	1.22	5	0.74	0.61	78.08	L	Stable	Riffle-pool
2	16.87	0.93	4	0.27	0.29	62.97	M	Stable	Riffle-pool
3	17.43	1.47	2.33	0.33	0.23	59.66	M	Aggraded	Riffle-pool
4	15.92	0.78	1.5	0.34	0.44	18.63	L	Aggraded	Riffle-pool
5	16.34	1.64	2.2	0.48	0.29	58.95	M	Aggraded	Riffle-pool
6	15.10	1.00	4.5	0.64	0.64	67.95	M	Stable	Riffle-pool
7	13.20	0.93	2.67	0.67	0.71	32.85	M	Stable	Riffle-pool
8	12.40	1.07	4	1.30	1.22	52.91	M	Stable	Riffle-pool
9	11.65	1.35	4.5	0.55	0.41	70.77	M	Stable	Riffle-pool
10	11.86	1.56	6.8	0.70	0.45	125.81	M	Stable	Riffle-pool
11	13.87	1.53	8.67	0.87	0.57	184.27	M	Aggraded	ascade-pool
12	12.85	2.05	16.5	0.90	0.44	434.65	M	Stable	ascade-pool
13*	-	-	-	-	-	-	-	-	-
14	14.03	1.67	12.33	0.77	0.46	288.46	M	Stable	ascade-pool
15	10.37	0.83	9.33	0.47	0.56	80.63	M	Stable	ascade-pool
16	8.68	1.00	11	0.50	0.50	95.48	M	Stable	ascade-pool
17	6.60	0.87	17	0.80	0.92	97.24	M	Stable	Step-pool
18	7.13	1.13	5	0.70	0.62	40.42	M	Aggraded	ascade-pool
19	36.13	0.83	6.67	0.57	0.68	200.74	M	Stable	Riffle-pool
20	6.63	0.57	19.33	0.40	0.71	72.67	M	Stable	Step-pool
21	7.77	0.53	8.33	0.47	0.88	34.52	M	Stable	ascade-pool
22	5.73	1.03	12.33	0.30	0.29	73.07	H	Stable	Step-pool
23	7.10	0.90	22.67	0.17	0.19	144.84	M	Stable	Riffle-pool
24	10.27	0.97	6.67	0.73	0.76	66.16	M	Aggraded	ascade-pool
25	7.27	0.63	10.33	0.47	0.74	47.56	M	Stable	ascade-pool
26	4.60	0.17	6.67	0.83	5.00	5.11	M	Stable	Step-pool
27	6.20	0.30	16.67	0.97	3.22	31.00	M	Stable	Step-pool
28	7.40	0.40	9.67	0.90	2.25	28.61	M	Stable	Step-pool
29	7.10	0.17	10.5	0.63	3.80	12.43	L	Stable	Step-pool
30	4.63	0.13	18.5	0.57	4.25	11.43	M	Stable	Step-pool
31	4.57	0.10	11.33	0.60	6.00	5.18	M	Stable	Step-pool
32	5.90	0.20	11.67	0.67	3.33	13.77	M	Stable	Step-pool
33	7.50	1.50	23	0.20	0.13	258.75	M	Stable	Step-pool

Reach 13 classified as canyon, unsafe assess.

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Quality Assurance/Quality Control Form

Stream: _____ Date: _____ Crew: _____

	Reach #	Bank Full		Channel						Bank			Logging	Large
		Width (m)	Depth (m)	Slope (%)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m)	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)	Past/Present (Y/N)	Woody Debris (Y/N)
QA/QC 1														
QA/QC 2														
Original Results														
QA/QC 1														
QA/QC 2														
Original Results														
QA/QC 1														
QA/QC 2														
Original Results														

QAQC on Brohm done by Brian and Steve at 2, 11-12

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Brohm Date: 07/29/96 Crew: Ned, Josie, Dan

Reach #: 1

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1		13.3	1.4	6	145	160	Stable	boulder	1	0	30	65	100	N	
2		9.8	0.8	3	145	220	Degraded	boulder	1.2	0	9	28	100	N	
3		17.6	1.2	7	155	200	Stable	cobble	0.4	0	7	11	100	N	
4		13.1	0.9	4	155	215	Stable	cobble	0.5	0	55	10	100	N	
5		10.2	1.8	5	160	230	Stable	cobble	0.6	0	25	15	100	N	

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Average channel width, W_b (m): 12.80
Average channel depth, d (m): 1.22
Average channel gradient, S (%): 5
Average Rock, D (m): 0.74
Average Gravel Bar Width (m): 0

Relative roughness (D/d): 0.61
Power Index (W_b d S): 78.08

Channel Type: Riffle-pool

Hillslope-valley flat connection: L
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: L

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Brohm Date: 07/29/96 Crew: Ned, Josie, Dan

Reach #: 2

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1		10.7	0.9	4	160	300	Stable	cobble	0.3	0	12	30	100	N	
2		13.2	0.8	6	160	300	Stable	cobble	0.2	0	2	2	100	N	
3		26.7	1.1	2	165	130	Aggraded	cobble	0.3	1.2	12	-2	100	N	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Average channel width, W_b (m): 16.87
Average channel depth, d (m): 0.93
Average channel gradient, S (%): 4
Average Rock, D (m): 0.27
Average Gravel Bar Width (m): 0.4

Channel Type: Riffle-pool

Relative roughness (D/d): 0.29
Power Index (W_b d S): 62.97

Hillslope-valley flat connection: M
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Brohm Date: 07/29/96 Crew: Ned, Josie, Dan

Reach #: 3

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	15	13.9	1.6	3	165	180	Aggraded	cobble	0.4	6.6	-1	6	100	N	
2	30	26.2	1.3	3	165	150	Aggraded	cobble	0.2	17.5	-5	2	100	N	
3	43	12.2	1.5	1	165	160	Aggraded	cobble	0.4	0	0	-2	100	N	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Average channel width, W_b (m): 17.43
Average channel depth, d (m): 1.47
Average channel gradient, S (%): 2.33
Average Rock, D (m): 0.33
Average Gravel Bar Width (m): 8.03

Channel Type: Riffle-pool

Relative roughness (D/d): 0.23
Power Index (W_b d S): 59.66

Hillslope-valley flat connection: L
Average Valley Width: M
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Reach 4 Date: 07/30/96 Crew: Dan, Jen, Ned

Reach #: 4

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1	44	15.6	0.5	2	170	160	Aggraded	gravel	0.4	2.1	-5	-5	100	N	
2	90	7.4	0.9	0.5	170	150	Aggraded	cobble	0.3	3.1	3	-2	100	N	
3	130	18.7	0.9	1	175	140	Stable	gravel	0.1	0	-4	1	100	N	
4	170	19	0.8	3	175	90	Aggraded	cobble	0.5	13.7	-4	-6	100	N	
5	235	18.9	0.8	1	175	160	Stable	cobble	0.4	1	-6	16	100	N	

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Average channel width, W_b (m): 15.92
Average channel depth, d (m): 0.78
Average channel gradient, S (%): 1.5
Average Rock, D (m): 0.34
Average Gravel Bar Width (m): 3.98

Channel Type: Riffle-pool

Relative roughness (D/d): 0.44
Power Index (W_b d S): 18.63

Hillslope-valley flat connection: L
Average Valley Width: M
Upstream Disturbance: M

Sensitivity Rating: L

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Brohm Date: 07/30/96 Crew: Dan, Jen, Ned

Reach #: 5

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1	100	16.5	1.6	1	180	140	Aggraded	cobble	0.4	10.5	-1	54	16	N	
2	200	13.7	1.3	2	180	180	Aggraded	gravel	0.5	5	-4	76	13	N	
3	300	15.2	2.1	2	180	200	Aggraded	cobble	0.5	2	-2	84	15	N	
4	389	15.7	1.1	3	185	180	Aggraded	cobble	0.5	0	9	82	16	N	
5	404	20.6	2.1	3	185	210	Aggraded	cobble	0.5	12.6	1	83	20	N	

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Average channel width, W_b (m): 16.34
Average channel depth, d (m): 1.64
Average channel gradient, S (%): 2.2
Average Rock, D (m): 0.48
Average Gravel Bar Width (m): 6.02

Channel Type: Riffle-pool

Relative roughness (D/d): 0.29
Power Index (W_b d S): 58.95

Hillslope-valley flat connection: M
Average Valley Width: M
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Brohm Date: 07/30/96 Crew: Dan, Jen, Ned

Reach #: 6

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	50	19.2	1.2	4	190	180	Stable	cabble	0.6	0	72	-5	100	N	
2	100	13.5	0.7	2	190	210	Stable	cobble	0.8	0	64	9	100	N	
3	174	16	1.6	4	190	210	Stable	cobble	0.7	1	66	32	100	N	
4	212	9.8	0.7	12	195	220	Stable	cobble	0.5	0	4	-3	100	N	
5	250	17	0.8	0.5	195	180	Stable	gravel	0.6	6	-2	-3	100	N	

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Average channel width, W_b (m): 15.10
Average channel depth, d (m): 1.00
Average channel gradient, S (%): 4.5
Average Rock, D (m): 0.64
Average Gravel Bar Width (m): 1.4

Channel Type: Riffle-pool

Relative roughness (D/d): 0.64
Power Index (W_b d S): 67.95

Hillslope-valley flat connection: M
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Brohm Date: 07/30/96 Crew: Dan, Jen, Ned

Reach #: 7

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	47	12.5	0.8	1	200	170	Stable	cobble	0.6	2.5	65	1	40	N	
2	87	14.5	0.7	4	205	180	Stable	cobble	0.7	0	67	68	21	N	
3	123	12.6	1.3	3	205	180	Stable	cobble	0.7	0	44	54	18	N	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Average channel width, W_b (m): 13.20
Average channel depth, d (m): 0.93
Average channel gradient, S (%): 2.67
Average Rock, D (m): 0.67
Average Gravel Bar Width (m): 0.83

Channel Type: Riffle-pool

Relative roughness (D/d): 0.71
Power Index (W_b d S): 32.85

Hillslope-valley flat connection: M
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Brohm Date: 07/30/96 Crew: Dan, Jen, Ned

Reach #: 8

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	40	12.2	1.4	5	205	190	Stable	boulder	1.3	0	90	120	13	N	
2	80	11.5	1.1	5	210	180	Stable	boulder	1.2	0	150	130	12	N	
3	133	13.5	0.7	2	220	170	Stable	boulder	1.4	0	100	42	15	N	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Average channel width, W_b (m): 12.40
Average channel depth, d (m): 1.07
Average channel gradient, S (%): 4
Average Rock, D (m): 1.3
Average Gravel Bar Width (m): 0

Channel Type: Riffle-pool

Relative roughness (D/d): 1.22
Power Index (W_b d S): 52.91

Hillslope-valley flat connection: M
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Brohm Date: 07/29/96 Crew: Ned, Josie, Dan

Reach #: 9

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1													15	N	
2													11	N	
3													20	N	
4		13.1	0.9	4	155	200	Stable	cobble	0.5	0	55	10	15	N	
5		10.2	1.8	5	160	215	Stable	cobble	0.6	0	25	15	12	N	

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Average channel width, W_b (m): 11.65
Average channel depth, d (m): 1.35
Average channel gradient, S (%): 4.5
Average Rock, D (m): 0.55
Average Gravel Bar Width (m): 0

Channel Type: Riffle-pool

Relative roughness (D/d): 0.41
Power Index (W_b d S): 70.77

Hillslope-valley flat connection: M
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Brohm Date: 07/30/96 Crew: Dan, Jen, Ned

Reach #: 10

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	50	11.4	0.9	14	220	200	Stable	boulder	1.1	0	90	9	100	N	
2	150	16.1	0.7	3	230	190	Aggraded	cobble	0.5	3.7	4	9	100	N	
3	261	9.4	1.7	4	230	170	Stable	cobble	0.5	0	17	1	100	N	
4	367	10.1	0.8	2	235	220	Stable	cobble	0.8	0	4	12	100	N	
5	626	12.3	3.7	11	245	230	Stable	cobble	0.6	6.3	5	2	100	N	

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Average channel width, W_b (m): 11.86
Average channel depth, d (m): 1.56
Average channel gradient, S (%): 6.8
Average Rock, D (m): 0.7
Average Gravel Bar Width (m): 2

Channel Type: Riffle-pool

Relative roughness (D/d): 0.45
Power Index (W_b d S): 125.81

Hillslope-valley flat connection: M
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Brohm Date: 07/30/96 Crew: Dan, Jen, Ned

Reach #: 11

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	20	12.8	1.2	9	245	230	Aggraded	cobble	0.8	8.6	15	6	100	N	
2	45	19.3	1	3	245	250	Aggraded	cobble	0.6	12.7	4	6	100	N	
3	125	9.5	2.4	14	250	210	Stable	cobble	1.2	0	6	17	100	N	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Average channel width, W_b (m): 13.87
Average channel depth, d (m): 1.53
Average channel gradient, S (%): 8.67
Average Rock, D (m): 0.87
Average Gravel Bar Width (m): 7.1

Channel Type: Cascade-pool

Relative roughness (D/d): 0.57
Power Index (W_b d S): 184.27

Hillslope-valley flat connection: M
Average Valley Width: M
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Brohm Date: 07/31/96 Crew: Jen, Ned, Tammy, Issac

Reach #: 12

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	0	12	1.2	11	260	158	Stable	Cobble	0.6	5	96	2	>100	N	
2	100	13.7	2.9	22	265	360	Stable	Boulder	1.2	4	36	40	>100	N	
3															
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Average channel width, W_b (m): 12.85
Average channel depth, d (m): 2.05
Average channel gradient, S (%): 16.5
Average Rock, D (m): 0.9
Average Gravel Bar Width (m): 4.5

Channel Type: Cascade-pool

Relative roughness (D/d): 0.44
Power Index (W_b d S): 434.65

Hillslope-valley flat connection: H
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Brohm Date: Crew:

Reach #: 13

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)	Stream Code
1																
2																
3																
4																
5																

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Reach classified as canyon

Average channel width, W_b (m): #DIV/0!
Average channel depth, d (m): #DIV/0!
Average channel gradient, S (%): #DIV/0!
Average Rock, D (m): #DIV/0!
Average Gravel Bar Width (m): #DIV/0!

Channel Type: Canyon

Relative roughness (D/d): #DIV/0!
Power Index (W_b d S): #DIV/0!

Hillslope-valley flat connection:
Average Valley Width:
Upstream Disturbance:

Sensitivity Rating:

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Brohm Date: 6/8/96 Crew: Jen, Tammy, Ned

Reach #: 14

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	0	15	3.6	15	545	170	Stable	Boulder	0.8	0	56	120	30	N	
2	160	14	0.6	9	575	140	Stable	Boulder	0.8	0	62	70	40	N	
3	284	13.1	0.8	13	595	191	Stable	Cobble	0.7	3.2	33	30	50	N	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Average channel width, W_b (m): 14.03
Average channel depth, d (m): 1.67
Average channel gradient, S (%): 12.33
Average Rock, D (m): 0.77
Average Gravel Bar Width (m): 1.07

Relative roughness (D/d): 0.46
Power Index (W_b d S): 288.46

Hillslope-valley flat connection: H
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Channel Type: Cascade-pool

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Brohm Date: 07/31/96 Crew: Jen, Ned, Tammy

Reach #: 15

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1	0	9.6	0.7	10	595	198	Stable	Cobble	0.4	0	54	14	60	N	
2	57	9.6	0.9	6	600	151	Stable	Cobble	0.5	0	-5	4	200	N	
3	189	11.9	0.9	12	610	188	Stable	Bedrock	0.5	2	11	47	200	N	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Average channel width, W_b (m): 10.37
Average channel depth, d (m): 0.83
Average channel gradient, S (%): 9.33
Average Rock, D (m): 0.47
Average Gravel Bar Width (m): 0.67

Channel Type: Cascade-pool

Relative roughness (D/d): 0.56
Power Index (W_b d S): 80.63

Hillslope-valley flat connection: M
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Brohm Date: 07/31/96 Jen, Ned, Tammy Crew: Jen, Ned, Tammy

Reach #: 16

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	0	7.9	1.1	12	615	222	Stable	Cobble	0.4	0	12	90	200	N	
2	129	10.9	0.7	8	630	151	Stable	Boulder	0.6	0	4	4	300	N	
3	231	9.4	0.9	13	645	170	Stable	Boulder	0.8	0	44	4	250	N	
4	277	11.2	0.8	9	650	151	Stable	Cobble	0.4	4.1	140	150	15	N	
5	305	4	1.5	13	655	151	Stable	Bedrock	0.3	0	150	150	8	N	

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Average channel width, W_b (m): 8.68
Average channel depth, d (m): 1.00
Average channel gradient, S (%): 11
Average Rock, D (m): 0.5
Average Gravel Bar Width (m): 0.82

Relative roughness (D/d): 0.50
Power Index (W_b d S): 95.48

Hillslope-valley flat connection: H
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: M

Channel Type: Cascade-pool

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Brohm Date: 07/31/96 Crew: Jen, Ned, Tammy

Reach #: 17

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	23	6.2	1	14	660	170	Stable	Cobble	0.4	0	140	150	10	N	
2	100	7.2	0.6	20	670	170	Stable	Boulder	0.5	2	150	150	7.3	N	
3	193	6.4	1	17	680	158	Stable	Boulder	1.5	0	150	150	6.4	N	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Reach characteristics : deep canyon, waterfalls - step- rapids
Reach break : end of canyon

Average channel width, W_b (m): 6.60
Average channel depth, d (m): 0.87
Average channel gradient, S (%): 17
Average Rock, D (m): 0.8
Average Gravel Bar Width (m): 0.67

Channel Type: Step-pool

Relative roughness (D/d): 0.92
Power Index (W_b d S): 97.24

Hillslope-valley flat connection: H
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Brohm Date: 1/8/96 Crew: Jen, Al, Dan

Reach #: 18

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)	Stream Code
1	0	5.7	1.7	10	875	90	Aggraded	Cobble	0.8	0	20	15	100	N	Y	
2	17	8.2	0.7	3	880	180	Stable	Cobble	0.6	0	19	5	100	N		
3	31	7.5	1	2	880	170	Aggraded	Cobble		2.5	gravel road	4	100	N		
4																
5																

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Reach break : gravel road crossing via wood bridge

Average channel width, W_b (m): 7.13
Average channel depth, d (m): 1.13
Average channel gradient, S (%): 5
Average Rock, D (m): 0.7
Average Gravel Bar Width (m): 0.83

Channel Type: Cascade-pool

Relative roughness (D/d): 0.62
Power Index (W_b d S): 40.42

Hillslope-valley flat connection: M
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Brohm Date: 6/8/96 Crew: Jen, Ned, Dan, George, Isaac

Reach #: 19

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	60	90	1	8	805	10	Stable	Cobble	0.6	0	30	15	100	N	
2	130	12.8	0.9	3	810	159	Aggraded	Cobble	0.6	7.5	135	115	15	N	
3	190	5.6	0.6	9	815	160	Stable	Cobble	0.5	3	92	119	8	N	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

all logging in vicinity of creek has been reenerated to mature 2nd growth
Reach characteristics : rapids to flat in steps, small bedrock falls

Average channel width, W_b (m): 36.13
Average channel depth, d (m): 0.83
Average channel gradient, S (%): 6.67
Average Rock, D (m): 0.57
Average Gravel Bar Width (m): 3.5

Channel Type: Riffle-pool

Relative roughness (D/d): 0.68
Power Index (W_b d S): 200.74

Hillslope-valley flat connection: M
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Brohm Date: 6/8/96 Crew: Ned, Jen, Dan, Isaac, George

Reach #: 20

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	25	7.2	0.7	6	820	195	Stable	Bedrock	0.6	1.8	150	145	7.2	N	
2	52	5.4	0.5	32	825	195	Stable	Bedrock	0	0	93	86	5.9	N	
3	73	7.3	0.5	20	905	172	Stable	Boulder/cobb	0.6	1.8	90	65	100	N	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Reach characteristics : falls step pool, bedrock, ravine

Average channel width, W_b (m): 6.63
Average channel depth, d (m): 0.57
Average channel gradient, S (%): 19.33
Average Rock, D (m): 0.4
Average Gravel Bar Width (m): 1.2

Channel Type: Step-pool

Relative roughness (D/d): 0.71
Power Index (W_b d S): 72.67

Hillslope-valley flat connection: M
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Brohm Date: 6/8/96 Crew:

Reach #: 21

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	30	6.8	0.7	11	825	181	Stable	Bedrock	0.1	0	90	78	50	N	
2	60	8.8	0.5	7	825	181	Stable	Cobble	0.6	2.7	55	81	20	N	
3	157	7.7	0.4	7	835	171	Stable	Cobble	0.7	1.6	96	56	30	N	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

canyon opens, fairly regular slope, a few small falls
bed material mostly cobble, still bedrock in places

Average channel width, W_b (m): 7.77
Average channel depth, d (m): 0.53
Average channel gradient, S (%): 8.33
Average Rock, D (m): 0.47
Average Gravel Bar Width (m): 1.43

Channel Type: Cascade-pool

Relative roughness (D/d): 0.88
Power Index (W_b d S): 34.52

Hillslope-valley flat connection: M
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Brohm Date: 6/8/96 Crew: Ned, Jen, Dan, Isaac, George

Reach #: 22

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging	Large
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)	Past/Present (Y/N)	Woody Debris (Y/N)
1	33	4.7	0.5	6	840	195	Stable	Bedrock	0.3	0	76	92	5	N	
2	62	5.5	0.6	11	845	195	Stable	Boulder	0.2	0	92	141	6	Y	
3	113	7	2	20	910	207	Stable	Bedrock	0.4	0	78	84	7	Y	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Characteristics : bedrock falls - step - pool, channelized, almost exclusively bedrock, some deposits of sand/cobble in pools

Average channel width, W_b (m): 5.73
Average channel depth, d (m): 1.03
Average channel gradient, S (%): 12.33
Average Rock, D (m): 0.3
Average Gravel Bar Width (m): 0

Relative roughness (D/d): 0.29
Power Index (W_b d S): 73.07

Hillslope-valley flat connection: H
Average Valley Width: L
Upstream Disturbance: H

Sensitivity Rating: H

Channel Type: Step-pool

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Brohm Date: 6/8/96 Crew:

Reach #: 23

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	33	5.2	0.8	9	850	196	Stable	Bedrock	0.2	0	90	110	10	N	
2	60	5.1	1.2	9	850	210	Stable	Cobble	0.3	0	146	150	5.1	N	
3	113	11	0.7	50	860	191	Stable	Bedrock	0	0	125	39	11	Y	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Characteristics : mainly bedrock / canyon
Reach break : waterfall

Average channel width, W_b (m): 7.10
Average channel depth, d (m): 0.90
Average channel gradient, S (%): 22.67
Average Rock, D (m): 0.17
Average Gravel Bar Width (m): 0

Relative roughness (D/d): 0.19
Power Index (W_b d S): 144.84

Channel Type: Riffle-pool

Hillslope-valley flat connection: H
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Brohm Date: 6/8/96 Crew: Ned, Jen, Dan, Isaac, George

Reach #: 24

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	50	10.5	0.7	8	865	191	Aggraded	Cobble	1	5.4	63	54	25	N	
2	131	13	1.2	8	870	192	Aggraded	Cobble	0.6	9.4	62	36	15	N	Y
3	162	7.3	1	4	940	221	Stable	Cobble	0.6	0.7	150	48	16	Y	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

canyon opens
LWD - jam at measurement 2 diverting flow
130m tributary on right bank

Average channel width, W_b (m): 10.27
Average channel depth, d (m): 0.97
Average channel gradient, S (%): 6.67
Average Rock, D (m): 0.73
Average Gravel Bar Width (m): 5.17

Relative roughness (D/d): 0.76
Power Index (W_b d S): 66.16

Channel Type: Cascade-pool

Hillslope-valley flat connection: M
Average Valley Width: M
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Brohm Date: 6/8/96 Crew: Ned, Jen, Dan, Isaac, George

Reach #: 25

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	40	7.3	0.7	14	875	212	Stable	Bedrock	0.3	0	146	70	16	N	
2	81	5.6	0.4	9	885	230	Stable	Bedrock	0.5	0	122	99	8	N	
3	186	8.9	0.8	8	890	200	Stable	Cobble	0.6	0	122	84	10	N	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

36m tributary on right bank - ephemeral

Average channel width, W_b (m): 7.27
Average channel depth, d (m): 0.63
Average channel gradient, S (%): 10.33
Average Rock, D (m): 0.47
Average Gravel Bar Width (m): 0

Relative roughness (D/d): 0.74
Power Index (W_b d S): 47.56

Channel Type: Cascade-pool

Hillslope-valley flat connection: H
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: BROHM Date: 8/7/96 Crew: NED, DAN, ISAAC

Reach #: 26

Cross-Section	Distance from Reach Bottom (m)	Bank Full		Channel							Bank			Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
		Width (m)	Depth (m)	Slope (%)	Elevation (m)	Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel Bar Width (m)	Left Bank Slope (%)	Right Bank Slope (%)	Valley Flat Width (m)		
1	100	4.2	0.2	7	905	172	Stable	COBBLE	1	0	60	90	15	N	
2	160	4.3	0.1	5	915	220	STABLE	COBBLE	0.6	0	70	90	25	N	
3	240	5.3	0.2	8	925	200	STABLE	COBBLE	0.9	0	90	90	20	N	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Average channel width, W_b (m): 4.60
Average channel depth, d (m): 0.17
Average channel gradient, S (%) 6.67
Average Rock, D (m): 0.83
Average Gravel Bar Width (m): 0

Channel Type: Step-pool

Relative roughness (D/d): 5.00
Power Index (W_b d S): 5.11

Hillslope-valley flat connection: M
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Brohm Date: 8/7/96 Crew: Ned, Dan, Isaac

Reach #: 27

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	50	2.9	0.4	8	935	290	Stable	Cobble	1	0	40	70	15	N	
2	155	7.7	0.2	12	950	300	Stable	Cobble	1.1	0	70	40	20	N	
3	235	8	0.3	30	960	270	Stable	Cobble	0.8	0	30	10	100	N	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Average channel width, W_b (m): 6.20
Average channel depth, d (m): 0.30
Average channel gradient, S (%): 16.67
Average Rock, D (m): 0.97
Average Gravel Bar Width (m): 0

Relative roughness (D/d): 3.22
Power Index (W_b d S): 31.00

Hillslope-valley flat connection: H
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Channel Type: Step-pool

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: BROHM Date: 7/8/96 Crew: NED, DAN, ISAAC

Reach #: 28

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	40	8.1	0.6	8	965	210	Stable	COBBLE	1.1	0.6	10	15	25	N	
2	85	6.7	0.4	9	970	200	STABLE	COBBLE	1	0	15	9	40	Y	
3	102	7.4	0.2	12	975	195	STABLE	COBBLE	0.6	0	20	5	90	N	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

GPS M25 - REACH BREAK 28

Average channel width, W_b (m): 7.40
Average channel depth, d (m): 0.40
Average channel gradient, S (%): 9.67
Average Rock, D (m): 0.9
Average Gravel Bar Width (m): 0.2

Channel Type: Step-pool

Relative roughness (D/d): 2.25
Power Index (W_b d S): 28.61

Hillslope-valley flat connection: M
Average Valley Width: L
Upstream Disturbance: M

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: BROHM Date: 8/7/96 Crew: NED, DAN, ISAAC

Reach # 29

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	20	7.6	0.1	11	975	200	Stable	COBBLE	0.7	0.6	0.5	7	90	N	
2	60	5.9	0.2	10	985	250	STABLE	COBBLE	0.6	0	10	15	100	N	Y
3	177	7.8	0.2		1005	220	STABLE	COBBLE	0.6	0	30	50	80	N	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

52m - LWD JAM - 7m HIGH

Average channel width, W_b (m): 7.10
Average channel depth, d (m): 0.17
Average channel gradient, S (%) 10.5
Average Rock, D (m): 0.63
Average Gravel Bar Width (m): 0.2

Channel Type: Step-pool

Relative roughness (D/d): 3.80
Power Index (W_b d S): 12.43

Hillslope-valley flat connection: M
Average Valley Width: L
Upstream Disturbance: L

Sensitivity Rating: L

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: BROHM Date: 8/7/96 Crew: NED, DAN, ISAAC

Reach # 30

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel Bar Width (m)	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	77	3.4	0.1	12	1040	300	Stable	COBBLE	0.6	0	9	40	100	N	
2	107	4.4	0.1	25	1045	180	STABLE	COBBLE	0.4	0	15	60	200	N	
3	139	6.1	0.2		1050	170	STABLE	COBBLE	0.7	0	30	15	160	N	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Average channel width, W_b (m): 4.63
Average channel depth, d (m): 0.13
Average channel gradient, S (%): 18.5
Average Rock, D (m): 0.57
Average Gravel Bar Width (m): 0

Relative roughness (D/d): 4.25
Power Index (W_b d S): 11.43

Channel Type: Step-pool

Hillslope-valley flat connection: H
Average Valley Width: L
Upstream Disturbance: L

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: BROHM Date: 8/7/96 Crew: NED, DAN, ISAAC

Reach #: 31

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	Channel General Bed Material	Channel Largest Rock Diameter (m)	Channel Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	47	4	0.1	12	1055	260	Stable	BEDROCK	0.6	0	30	60	80	N	
2	70	4.2	0.1	9	1065	280	STABLE	COBBLE	0.7	0	8	10	120	N	
3		5.5	0.1	13	1070	300	STABLE	COBBLE	0.5	0	80	20	150	N	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Average channel width, W_b (m): 4.57
Average channel depth, d (m): 0.10
Average channel gradient, S (%): 11.33
Average Rock, D (m): 0.6
Average Gravel Bar Width (m): 0

Channel Type: Step-pool

Relative roughness (D/d): 6.00
Power Index (W_b d S): 5.18

Hillslope-valley flat connection: H
Average Valley Width: L
Upstream Disturbance: L

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: BROHM Date: 8/7/96 Crew: NED, DAN, ISAAC

Reach #: 32

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	80	4.1	0.1	14	1080	280	Stable	COBBLE	0.5	0	40	0	1000	N	
2	130	7.4	0.2	12	1090	300	STABLE	COBBLE	1.1	0	7	25	80	N	
3	260	6.2	0.3	9	1095	190	STABLE	COBBLE	0.4	1	30	10	100	N	
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Average channel width, W_b (m): 5.90
Average channel depth, d (m): 0.20
Average channel gradient, S (%): 11.67
Average Rock, D (m): 0.67
Average Gravel Bar Width (m): 0.33

Relative roughness (D/d): 3.33
Power Index (W_b d S): 13.77

Channel Type: Step-pool

Hillslope-valley flat connection: H
Average Valley Width: L
Upstream Disturbance: L

Sensitivity Rating: M

Squamish River Watershed Restoration Program Forest Renewal B.C.
Channel Assessment Procedure (CAP) Field Data Entry Form

Stream: Brohm Date: 7/8/96 Crew: Dan, Ned, Jen, Isaac, George

Reach #: 33

Cross-Section	Distance from Reach Bottom (m)	Bank Full Width (m)	Bank Full Depth (m)	Channel Slope (%)	Channel Elevation (m)	Channel Aspect	Channel Condition	General Bed Material	Largest Rock Diameter (m)	Total Gravel ar Width (m	Bank Left Bank Slope (%)	Bank Right Bank Slope (%)	Bank Valley Flat Width (m)	Logging Past/Present (Y/N)	Large Woody Debris (Y/N)
1	285	7.5	1.5	23	1180	260	Stable	Cobble	0.2	4	-4	9	60	N	
2															
3															
4															
5															

Electronic data entry checked by: SJC

Reviewed by: BDL

Notes and Observations

Characteristics : falls - step - rapids
Memory 35 on GPS

Average channel width, W_b (m): 7.50
Average channel depth, d (m): 1.50
Average channel gradient, S (%): 23
Average Rock, D (m): 0.2
Average Gravel Bar Width (m): 4

Relative roughness (D/d): 0.13
Power Index (W_b d S): 258.75

Hillslope-valley flat connection: M
Average Valley Width: M
Upstream Disturbance: L

Sensitivity Rating: M

Channel Type: Step-pool

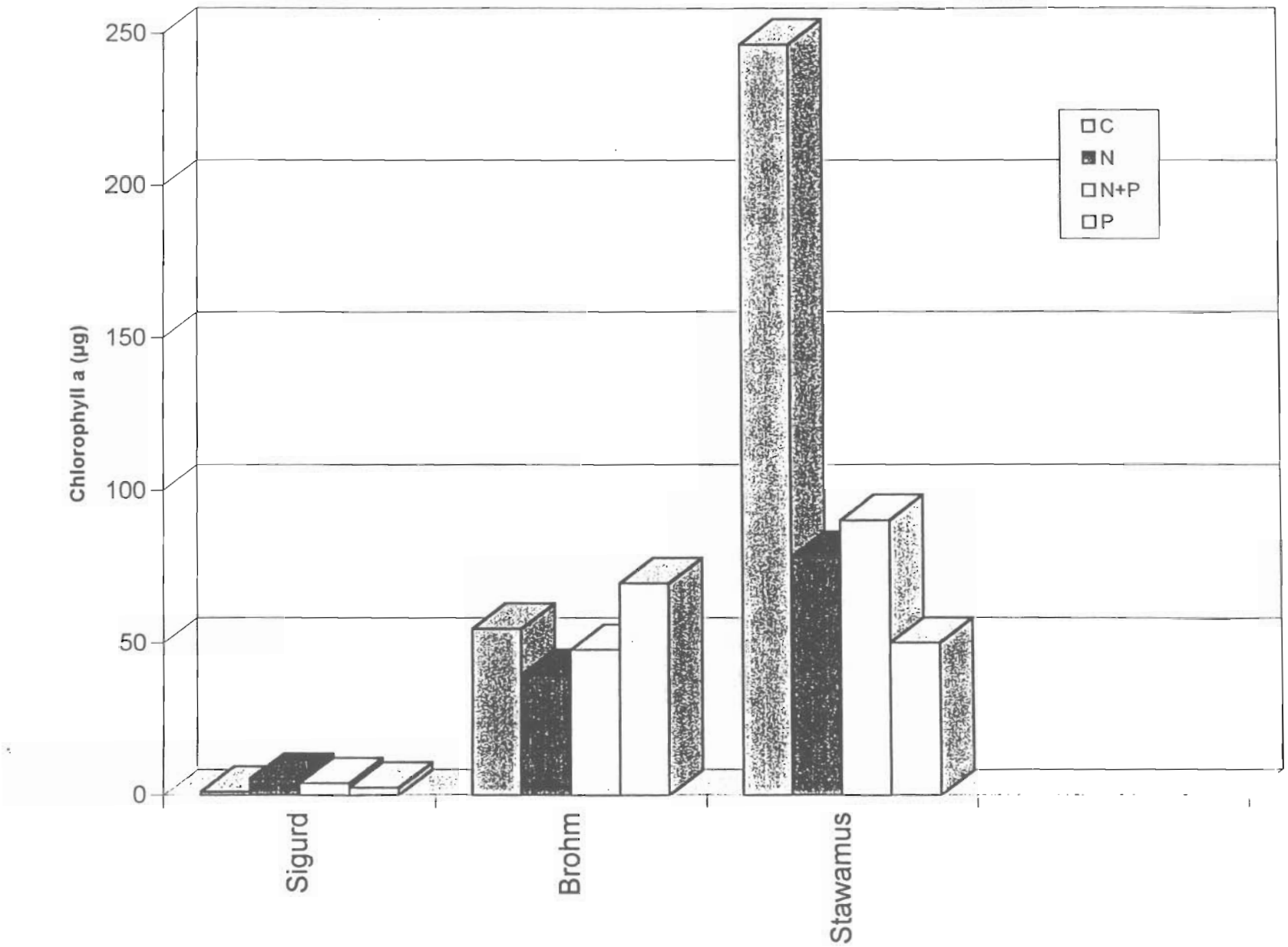


Figure 30 Chlorophyll a (corrected for phaeophytin) from periphyton growing on flower pots dosed with nutrients in streams of Squamish River system.

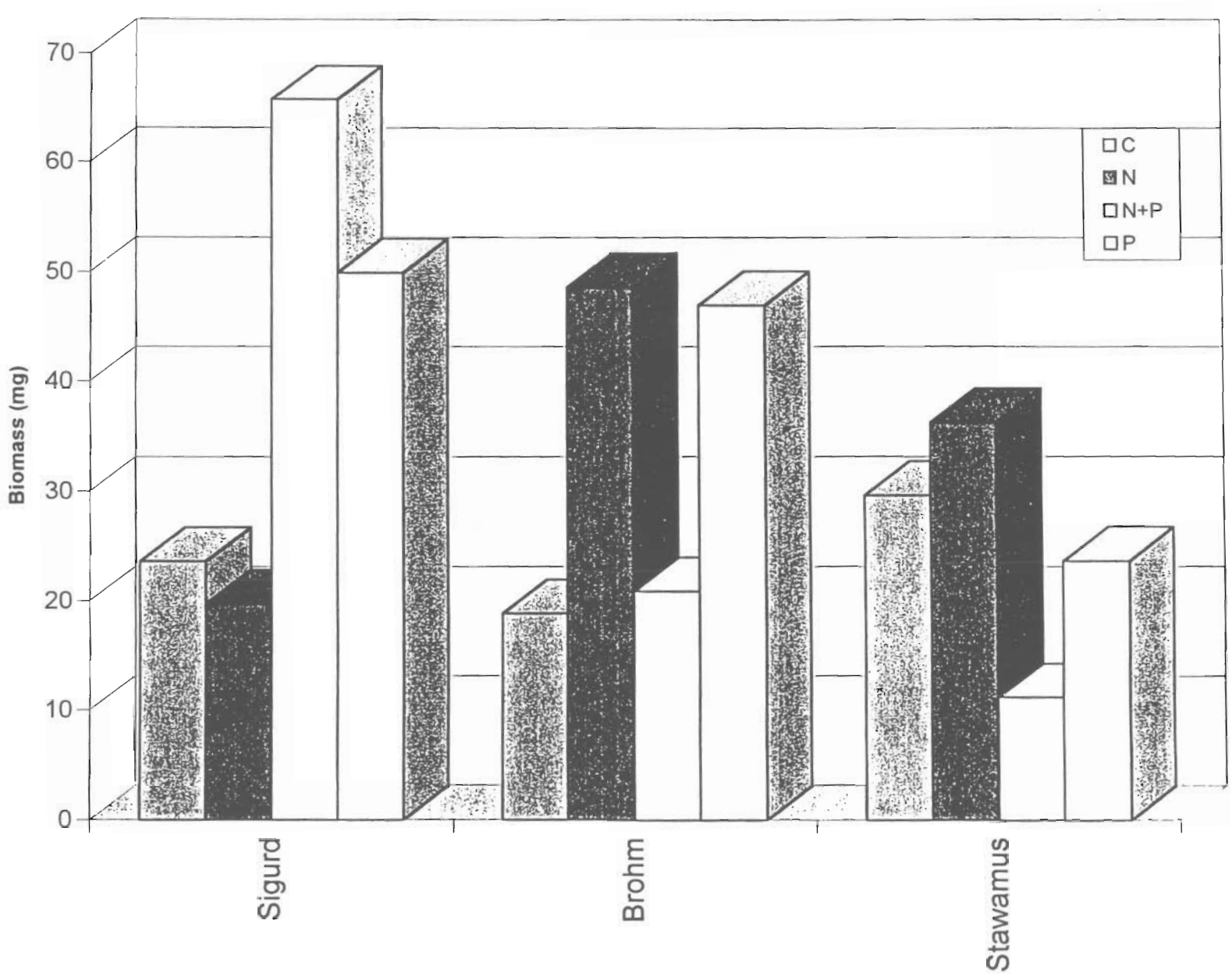


Figure 31 . Biomass of periphyton growing on flower pots dosed with nutrients in streams of the Squamish River system.

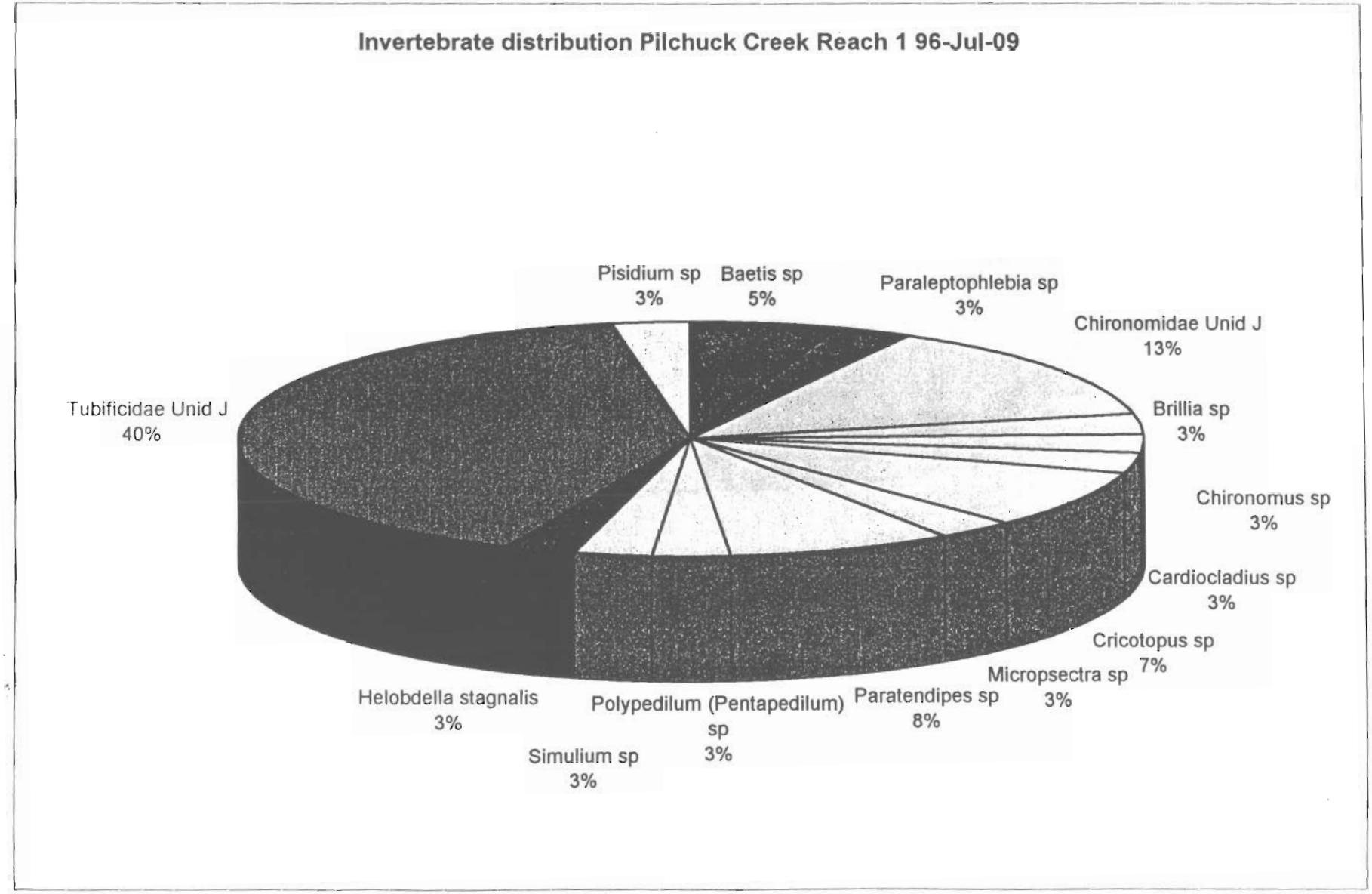

Invertebrate distribution Pilchuck Creek Reach 1 96-Jul-09
Pisidium sp 3%
Baetis sp 5%
Paraleptophlebia sp 3%
Chironomidae Unid J 13%
Brillia sp 3%
Chironomus sp 3%
Cardiocladius sp 3%
Cricotopus sp 7%
Micropsectra sp 3%
Paratendipes sp 8%
Polypedilum (Pentapedilum) sp 3%
Simulium sp 3%
Helobdella stagnalis 3%
Tubificidae Unid J 40%

Figure 1.

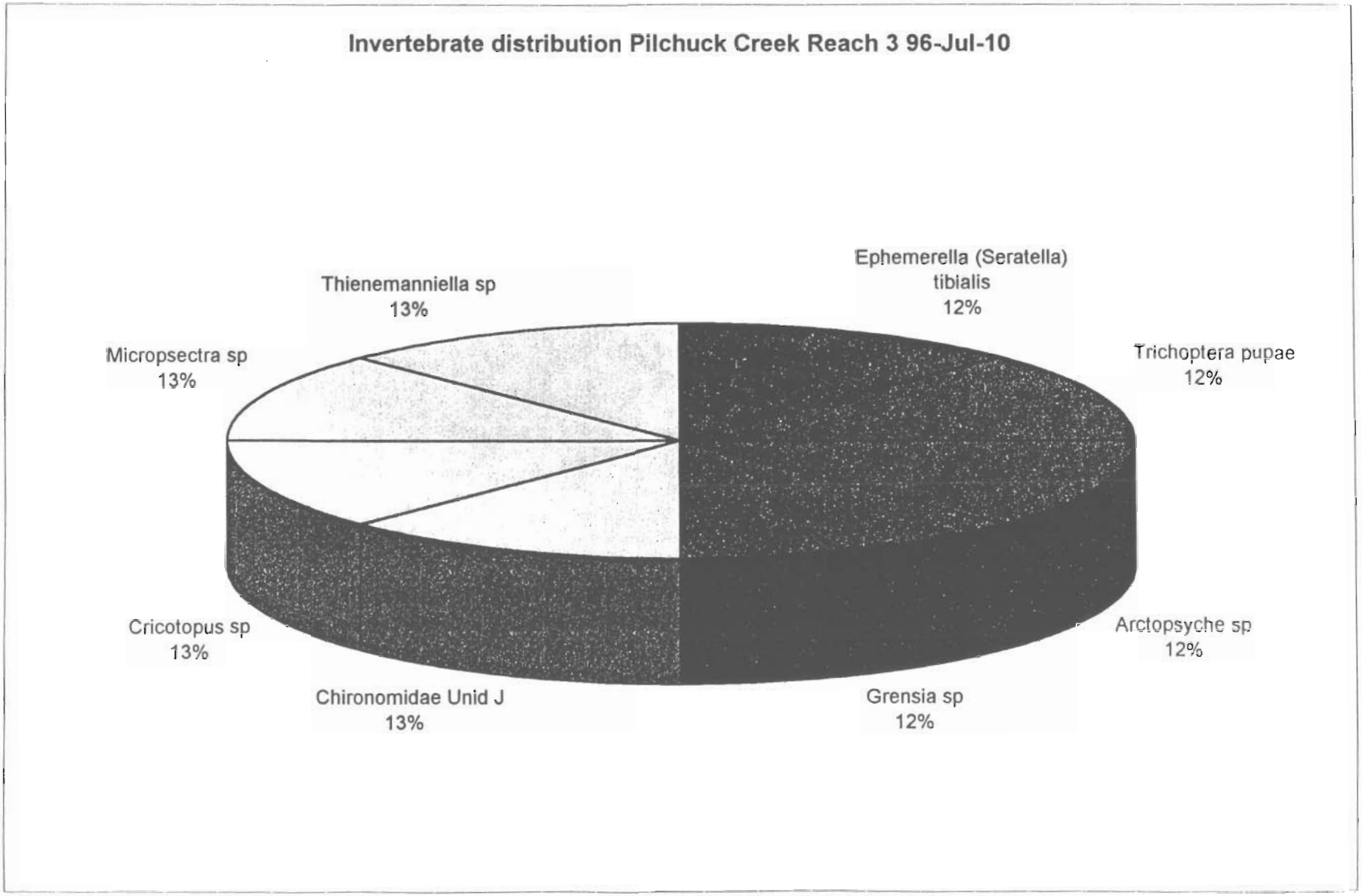

Invertebrate distribution Pilchuck Creek Reach 3 96-Jul-10
Ephemerella (Seratella) tibialis 12%
Thienemanniella sp 13%
Micropsectra sp 13%
Trichoptera pupae 12%
Cricotopus sp 13%
Arctopsyche sp 12%
Chironomidae Unid J 13%
Grensia sp 12%

Figure 2.

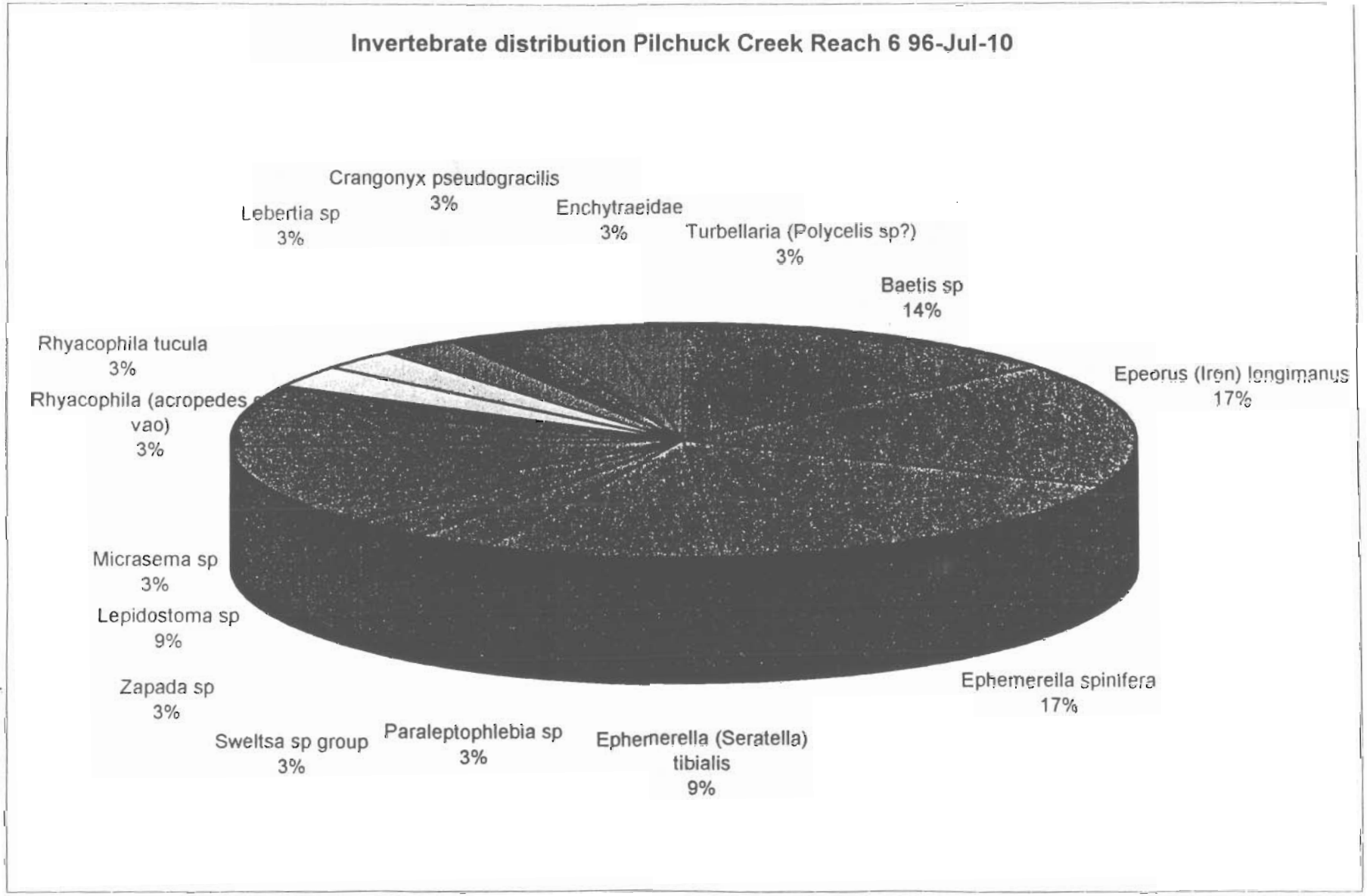
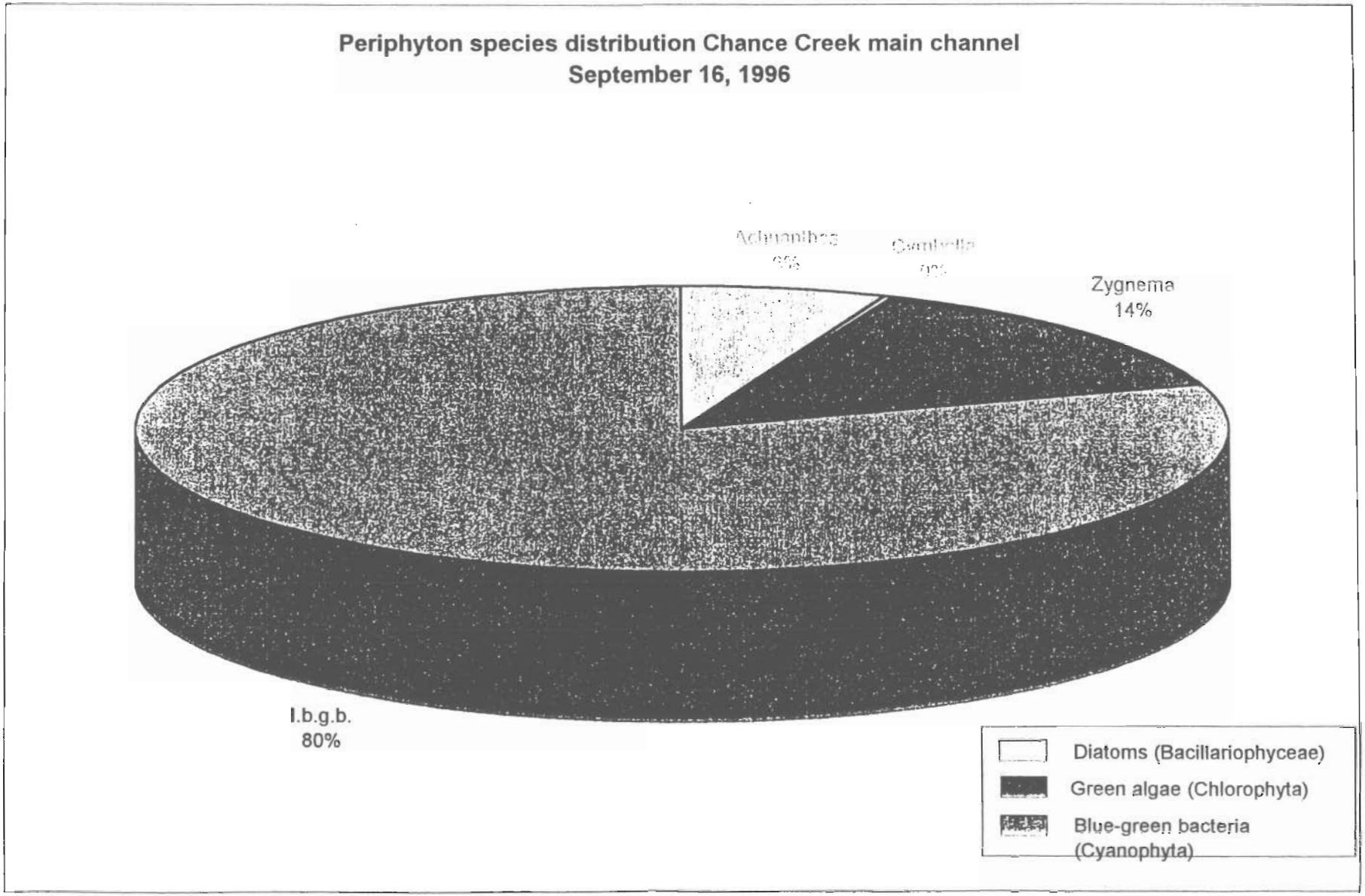


Figure 3. Invertebrate relative abundance (by Order) found in Pilchuck Creek, reach #6 96-Jul-10



Fi 4 Periphyton species and relative proportions (by major group) ıd on rock substrate in Chance Creek logged channel Septembe` 1996.

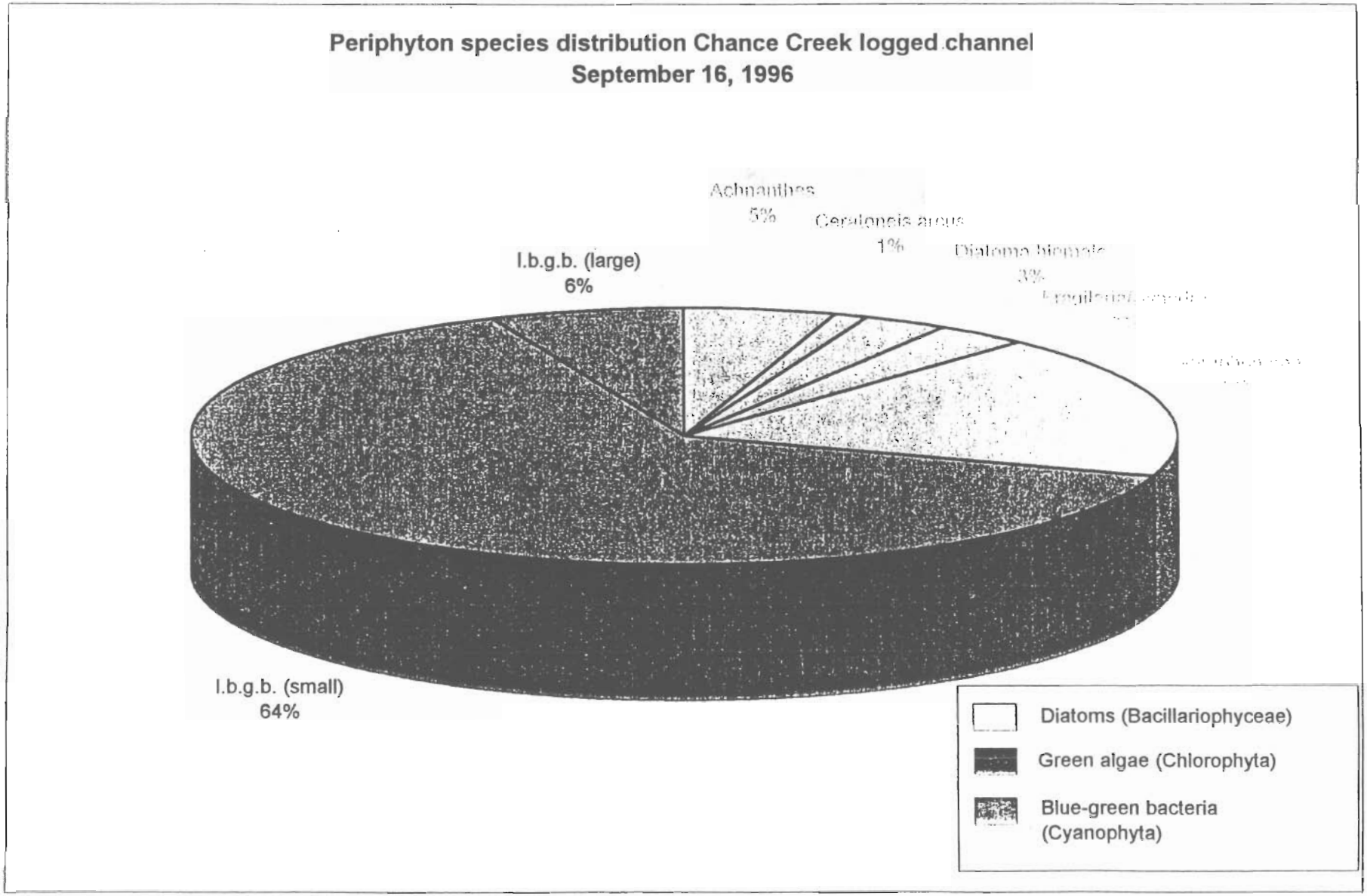


Figure 5 Periphyton species and relative proportions (by major group) found on rock substrate in Chance Creek logged channel September 16, 1996.

Chance Creek (96 Sept 19) main channel

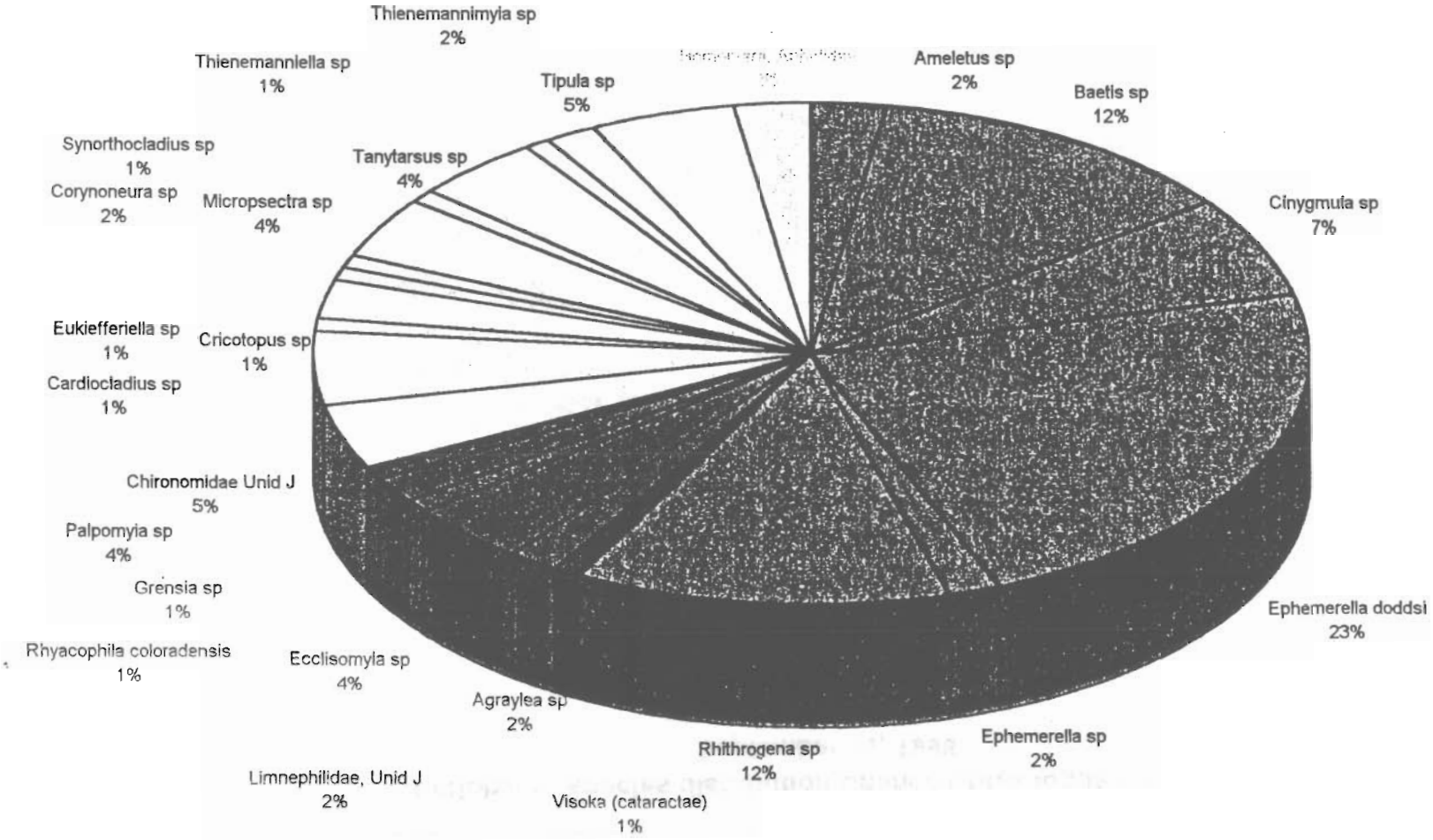


Figure 6 .

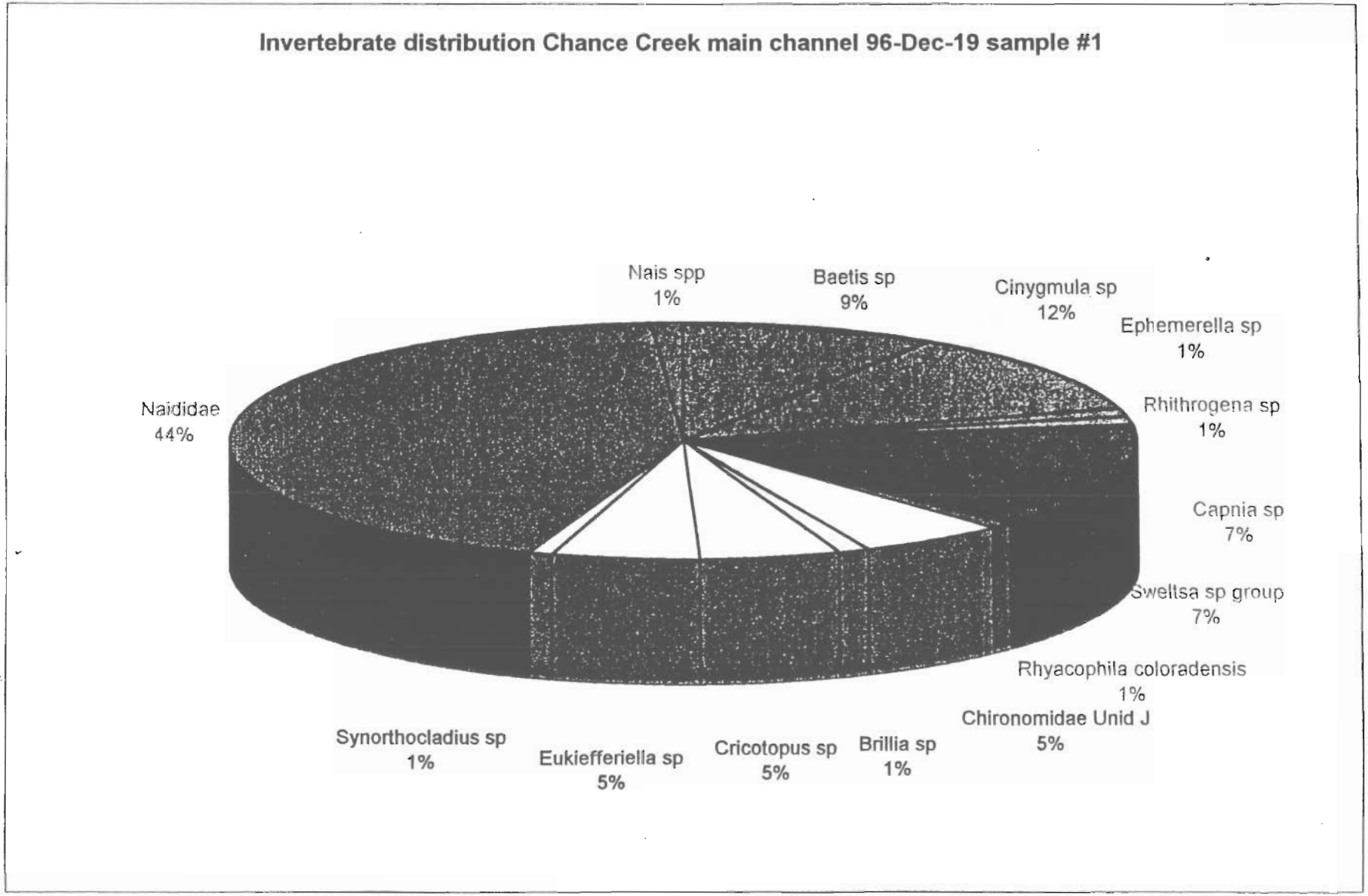


Figure 7 Invertebrate relative abundance (by Order) found in Chance Creek, main channel 96-Dec-19

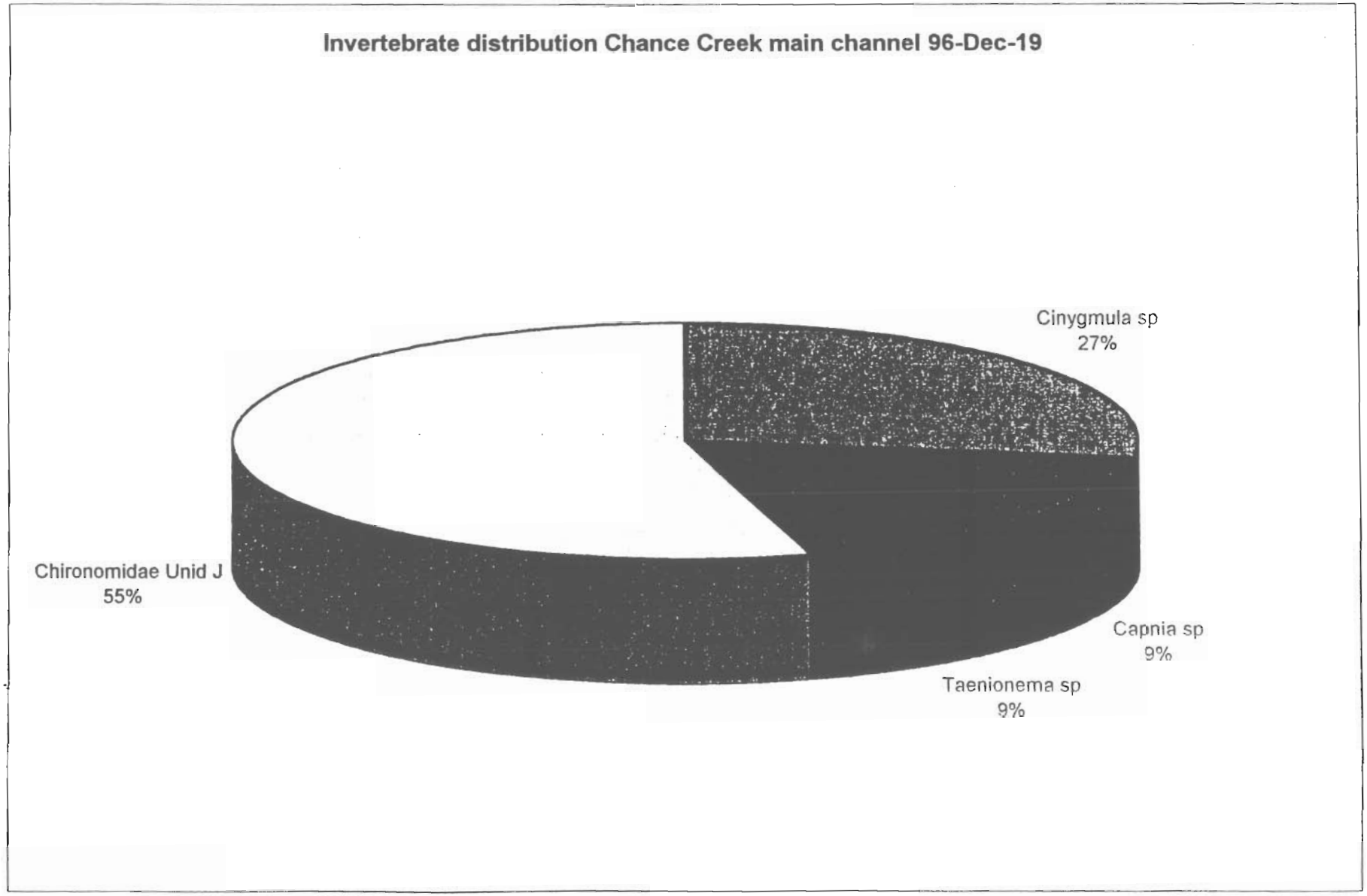


Figure 8. Invertebrate relative abundance (by Order) found in Chance Creek, main channel 96-Dec-19

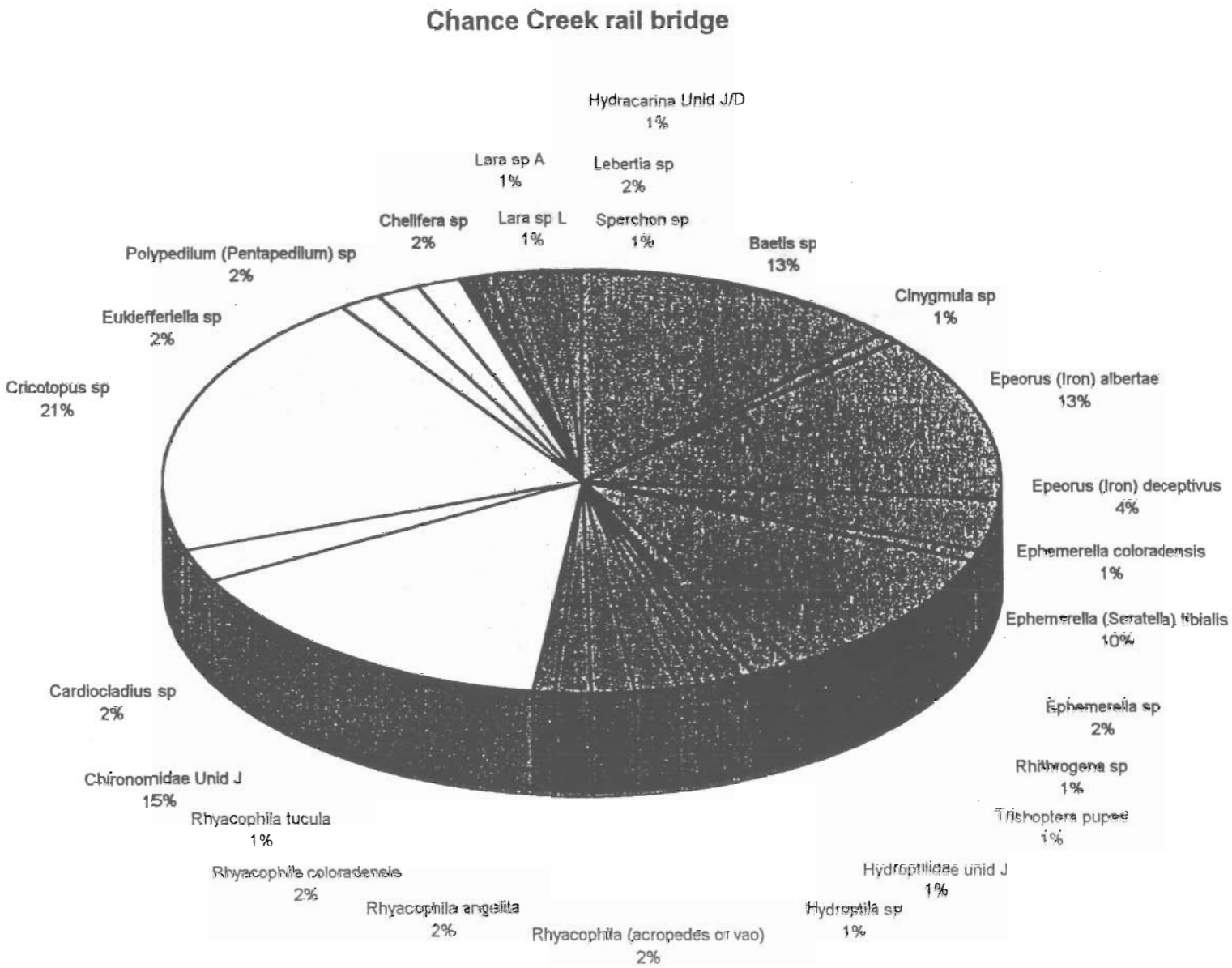

Chance Creek rail bridge
Hydracarina Unid J/D 1%
Lara sp A 1%
Lebertia sp 2%
Chelifera sp 2%
Lara sp L 1%
Sperchon sp 1%
Baetis sp 13%
Polypedilum (Pentapedilum) sp 2%
Clinygmula sp 1%
Eukiefferiella sp 2%
Epeorus (Iron) albertae 13%
Cricotopus sp 21%
Epeorus (Iron) deceptivus 4%
Ephemerella coloradensis 1%
Ephemerella (Seratella) tibialis 10%
Cardiocladius sp 2%
Ephemerella sp 2%
Rhithrogena sp 1%
Chironomidae Unid J 15%
Trichoptera pupae 1%
Rhyacophila tucula 1%
Hydroptilidae unid J 1%
Rhyacophila coloradensis 2%
Hydroptila sp 1%
Rhyacophila angelita 2%
Rhyacophila (acropedes or vao) 2%

Figure 9

Chance Creek reach # 1

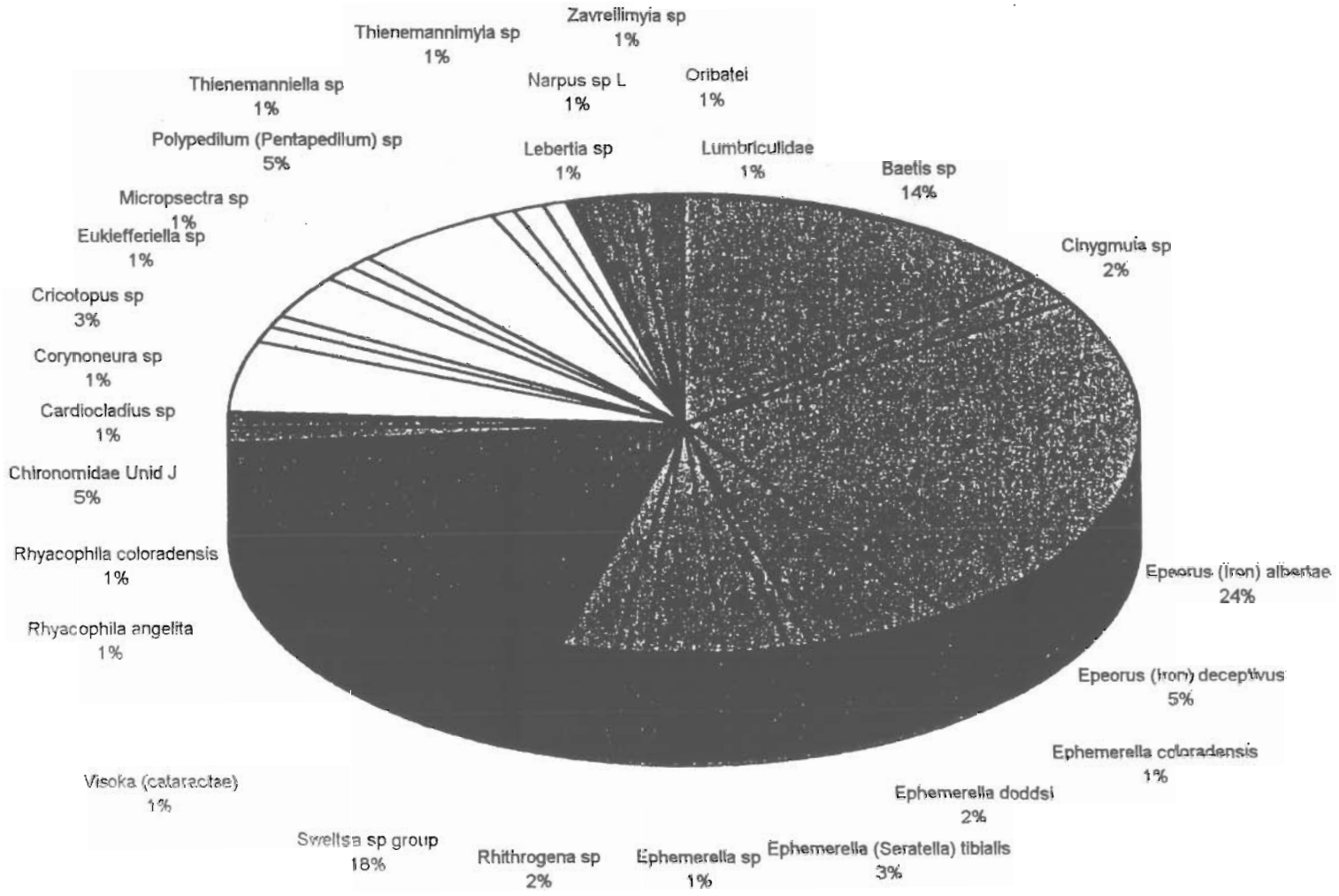


Figure 10

Invertebrate distribution Chance Creek, reach # 2 96-00-00

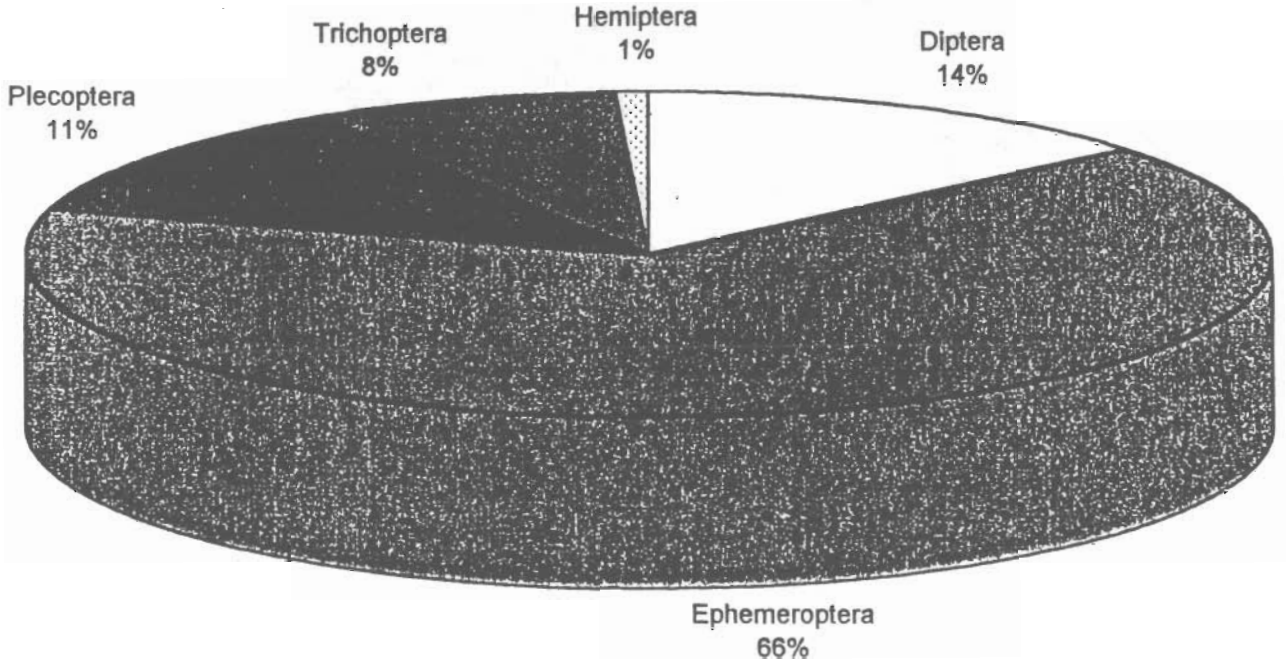


Figure I \ Invertebrate relative abundance (by Order) found in Chance Creek, reach # 2
96-00-00

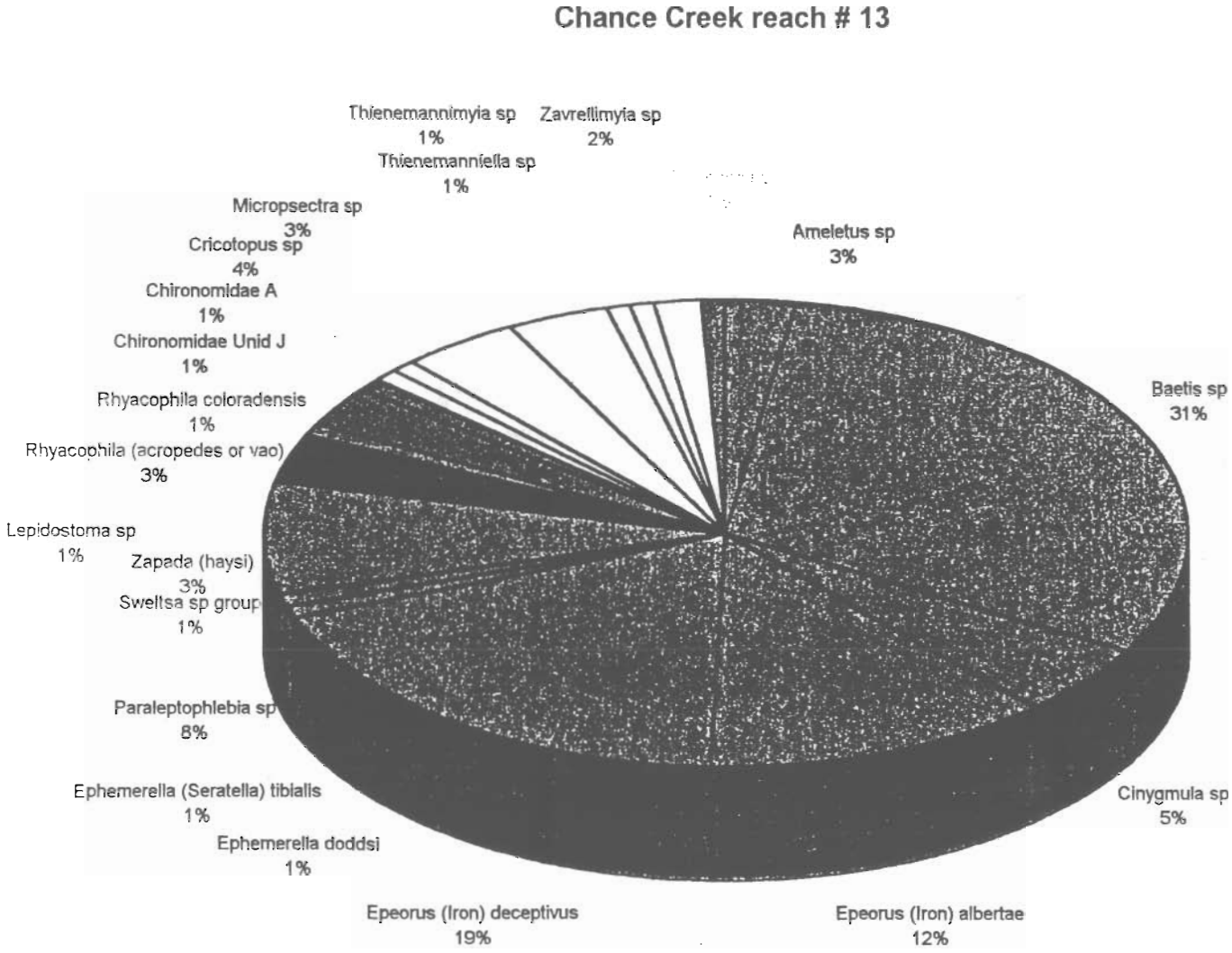

Chance Creek reach # 13
Thienemannimyia sp
1%
Zavrelimyia sp
2%
Thienemanniella sp
1%
Micropsectra sp
3%
Cricotopus sp
4%
Chironomidae A
1%
Chironomidae Unid J
1%
Rhyacophila coloradensis
1%
Rhyacophila (acropedes or vao)
3%
Lepidostoma sp
1%
Zapada (haysi)
3%
Sweltsa sp group
1%
Paraleptophlebia sp
8%
Ephemerella (Seratella) tibialis
1%
Ephemerella doddsi
1%
Epeorus (Iron) deceptivus
19%
Epeorus (Iron) albertae
12%
Cinygmula sp
5%
Baetis sp
31%
Ameletus sp
3%

Figure 12

Invertebrate distribution (by Order) Chance Creek, reach # 14 96-00-00

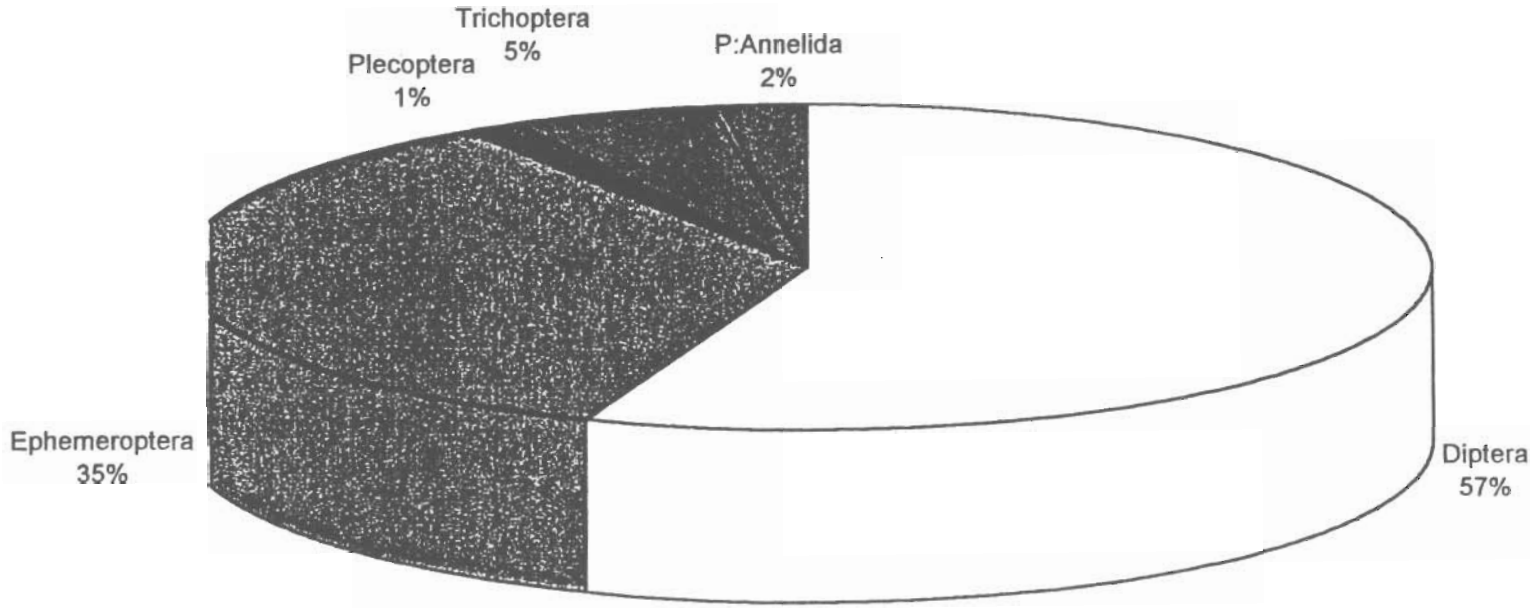


Figure 3 Invertebrate relative abundance (by Order) found in Chance Creek, reach # 14 96-00-00

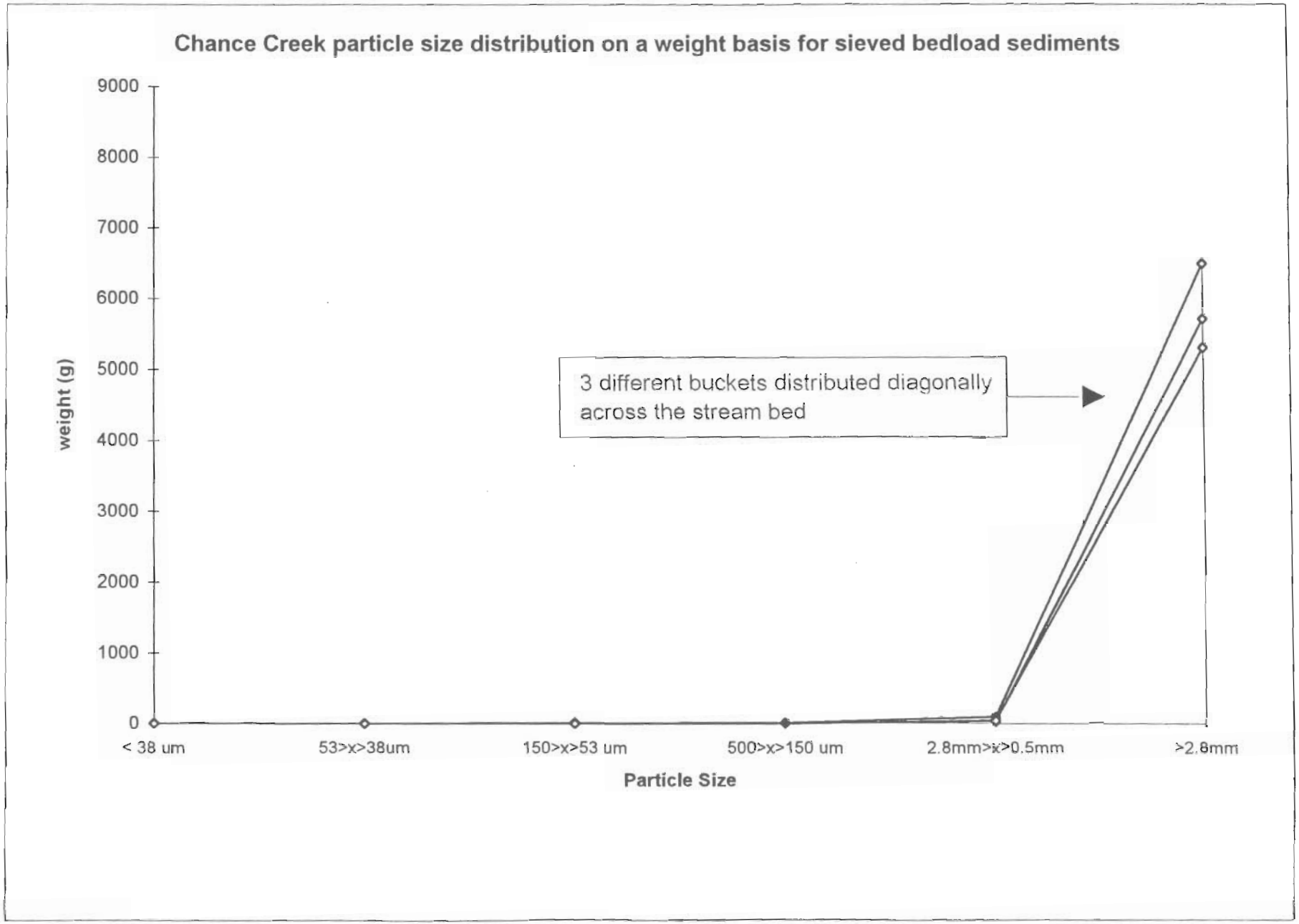


Figure 14 Chance Creek particle size distribution on a weight basis for sieved bedload sediments (after Beschta, 1996).

Cloudburst Creek Reach 5- Invertebrates by Order

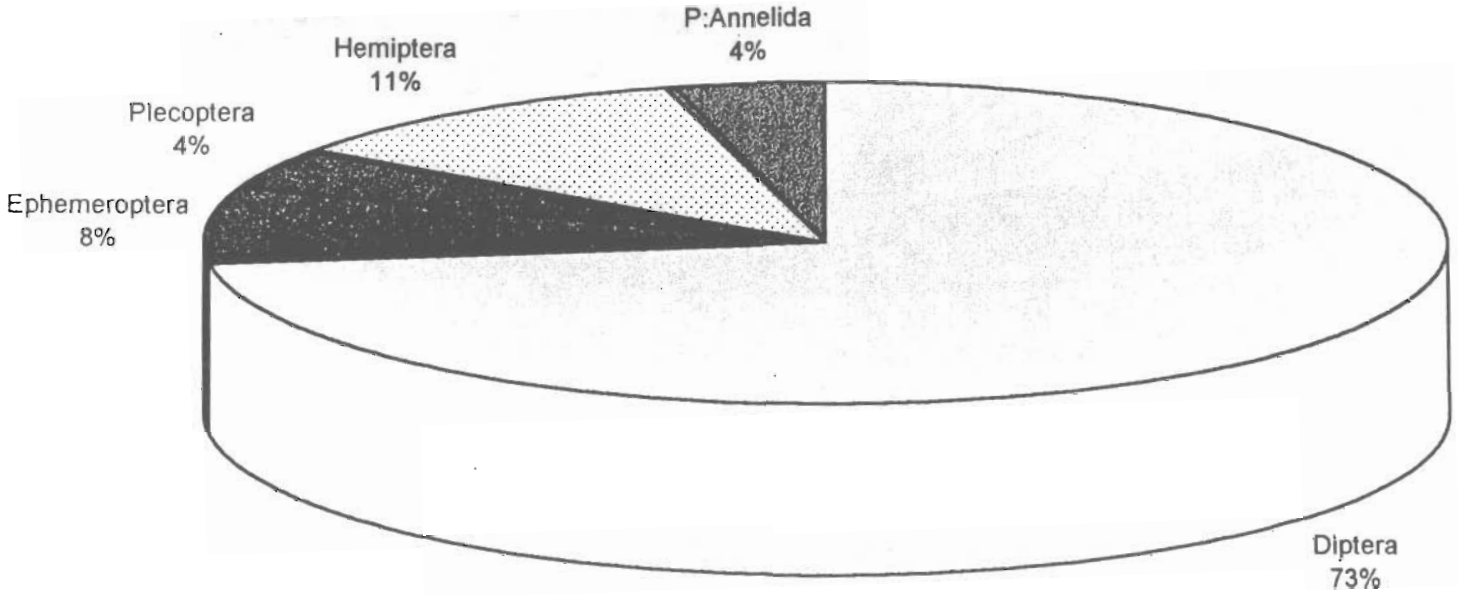


Figure: 15.

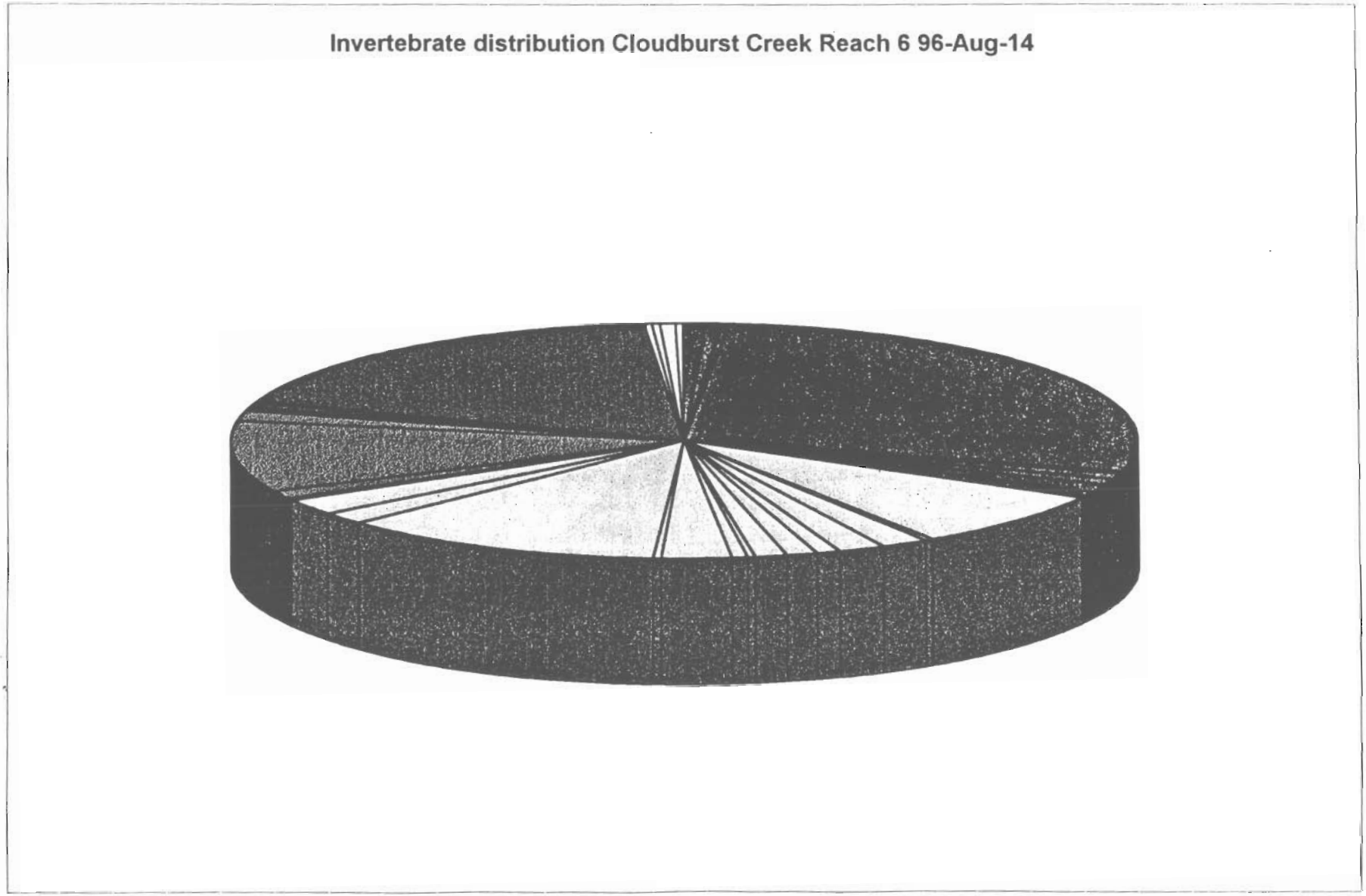

Invertebrate distribution Cloudburst Creek Reach 6 96-Aug-14

Figure 16.

Invertebrate distribution Cloudburst Creek Reach 10 96-Aug-19

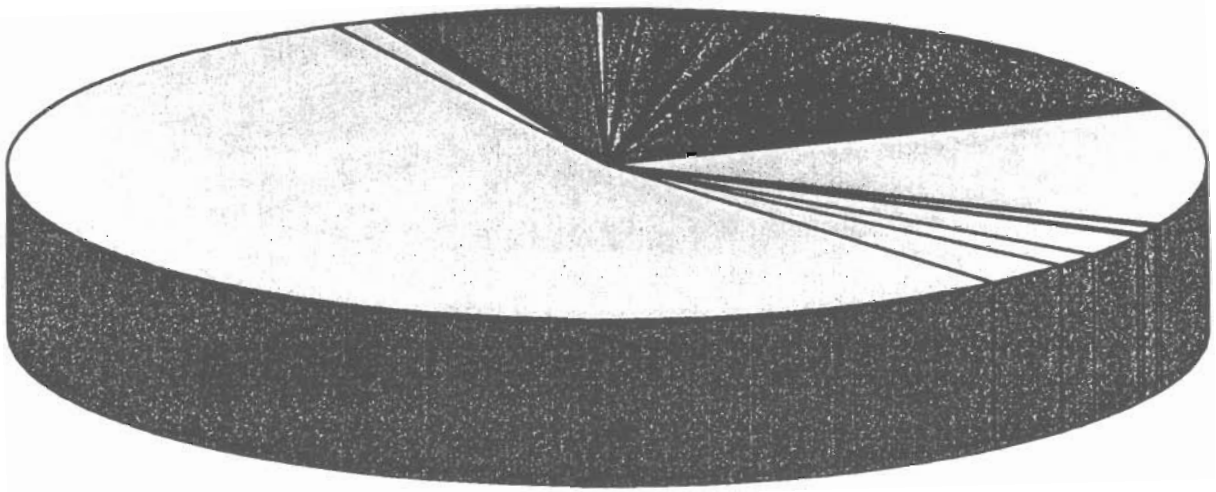


Figure 17.

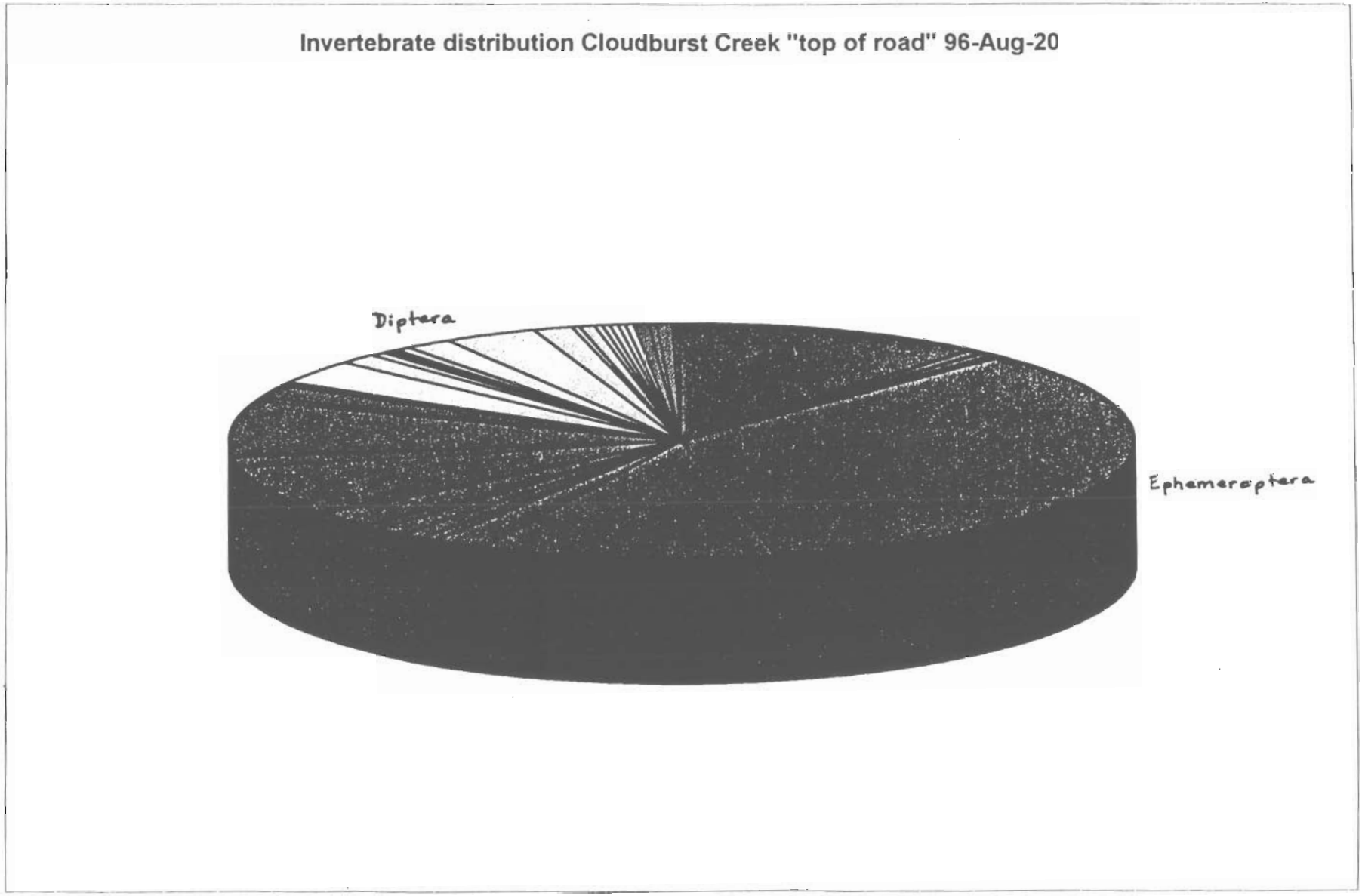

Invertebrate distribution Cloudburst Creek "top of road" 96-Aug-20
Diptera
Ephemeroptera

Figure 18.

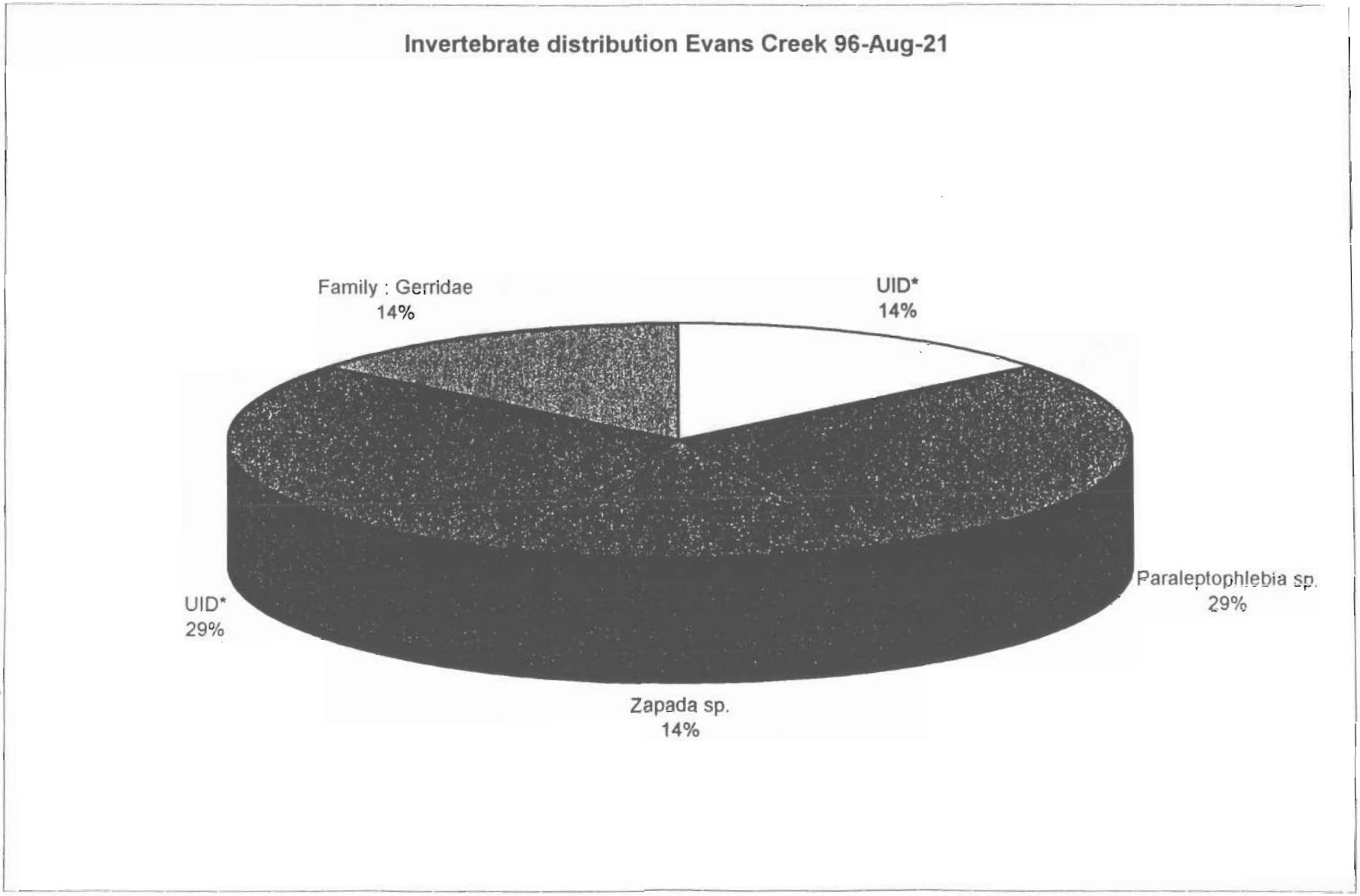


Figure 9. Invertebrate relative abundance (by Order) found in Evans Creek, reach #9 96-Aug-21

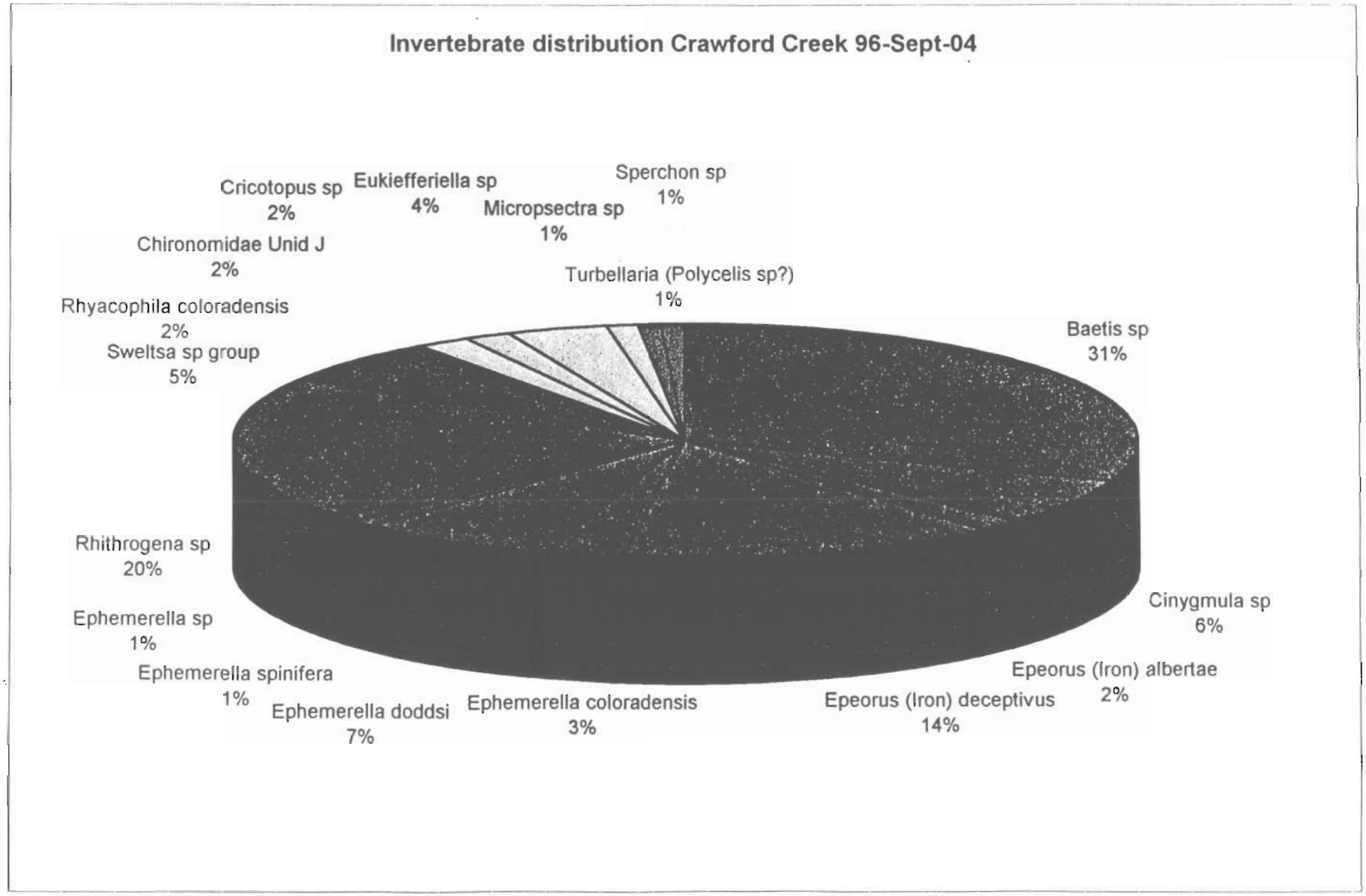

Invertebrate distribution Crawford Creek 96-Sept-04
Cricotopus sp 2%
Eukiefferiella sp 4%
Micropsectra sp 1%
Sperchon sp 1%
Chironomidae Unid J 2%
Turbellaria (Polycelis sp?) 1%
Rhyacophila coloradensis 2%
Sweltsa sp group 5%
Baetis sp 31%
Rhithrogena sp 20%
Ephemerella sp 1%
Cinygmula sp 6%
Ephemerella spinifera 1%
Epeorus (Iron) albertae 2%
Ephemerella doddsi 7%
Ephemerella coloradensis 3%
Epeorus (Iron) deceptivus 14%

Figure 21.

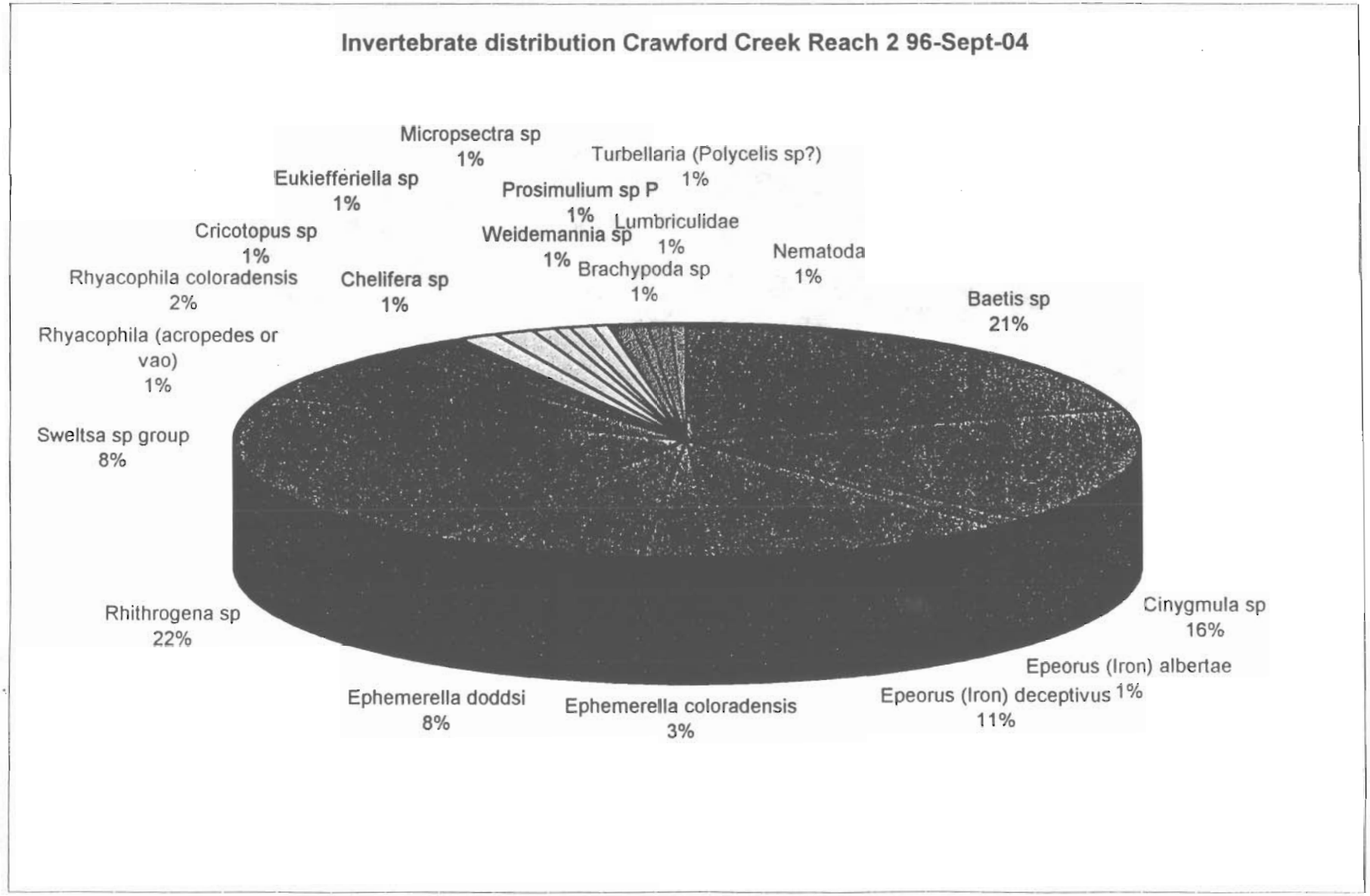

Invertebrate distribution Crawford Creek Reach 2 96-Sept-04
Micropsectra sp 1%
Turbellaria (Polycelis sp?) 1%
Eukiefferiella sp 1%
Prosimulium sp P 1%
Lumbriculidae 1%
Cricotopus sp 1%
Weidemannia sp 1%
Nematoda 1%
Brachypoda sp 1%
Rhyacophila coloradensis 2%
Chelifera sp 1%
Baetis sp 21%
Rhyacophila (acropedes or vao) 1%
Sweltsa sp group 8%
Rhithrogena sp 22%
Cinygmula sp 16%
Epeorus (Iron) albertae 1%
Epeorus (Iron) deceptivus 11%
Ephemerella doddsi 8%
Ephemerella coloradensis 3%

Figure 22.

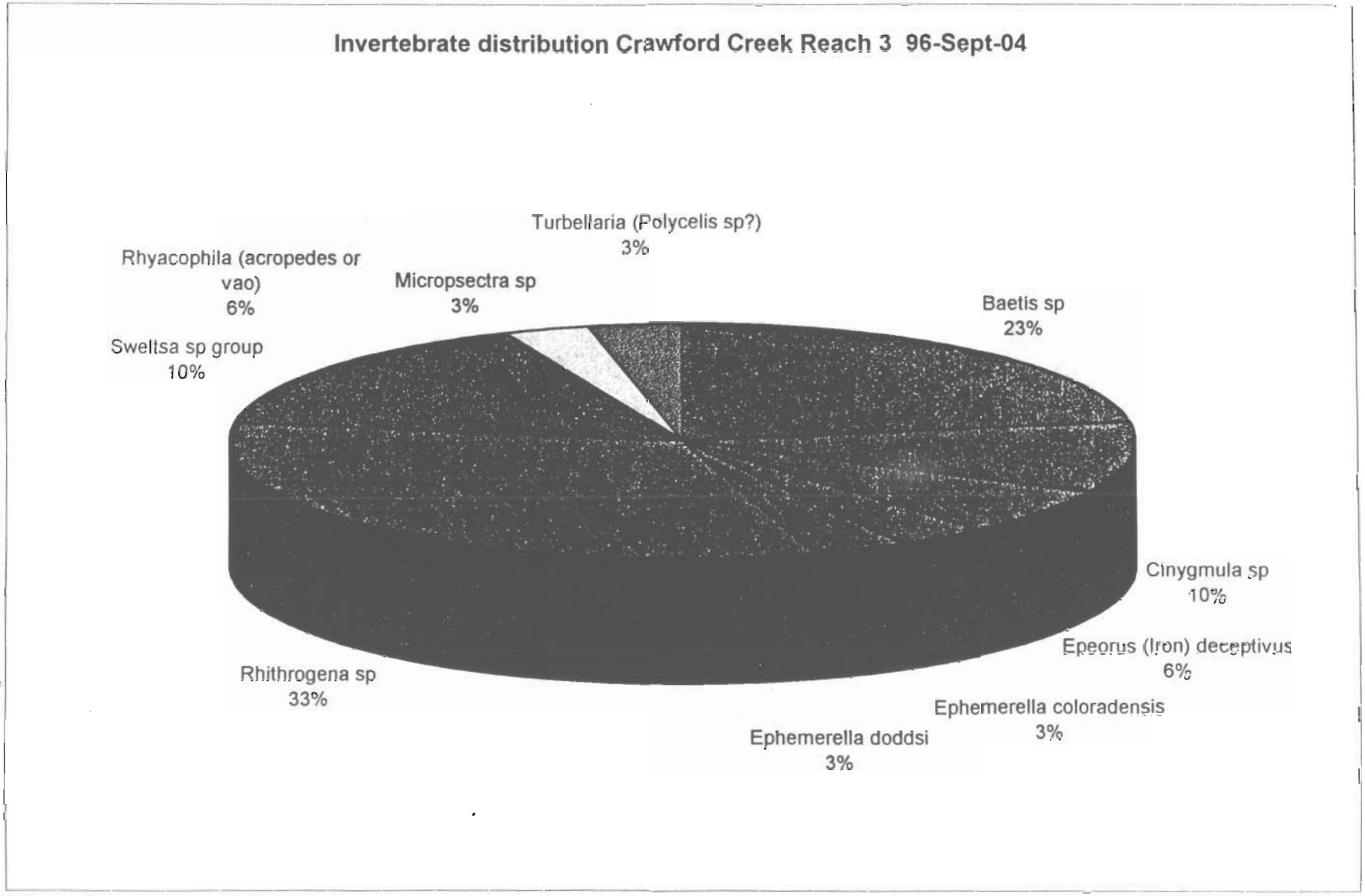

Invertebrate distribution Crawford Creek Reach 3 96-Sept-04
Turbellaria (Polycelis sp?)
3%
Rhyacophila (acropedes or vao)
6%
Micropsectra sp
3%
Baetis sp
23%
Sweltsa sp group
10%
Cinygmula sp
10%
Epeorus (Iron) deceptivus
6%
Rhithrogena sp
33%
Ephemerella coloradensis
3%
Ephemerella doddsi
3%

Figure 23.

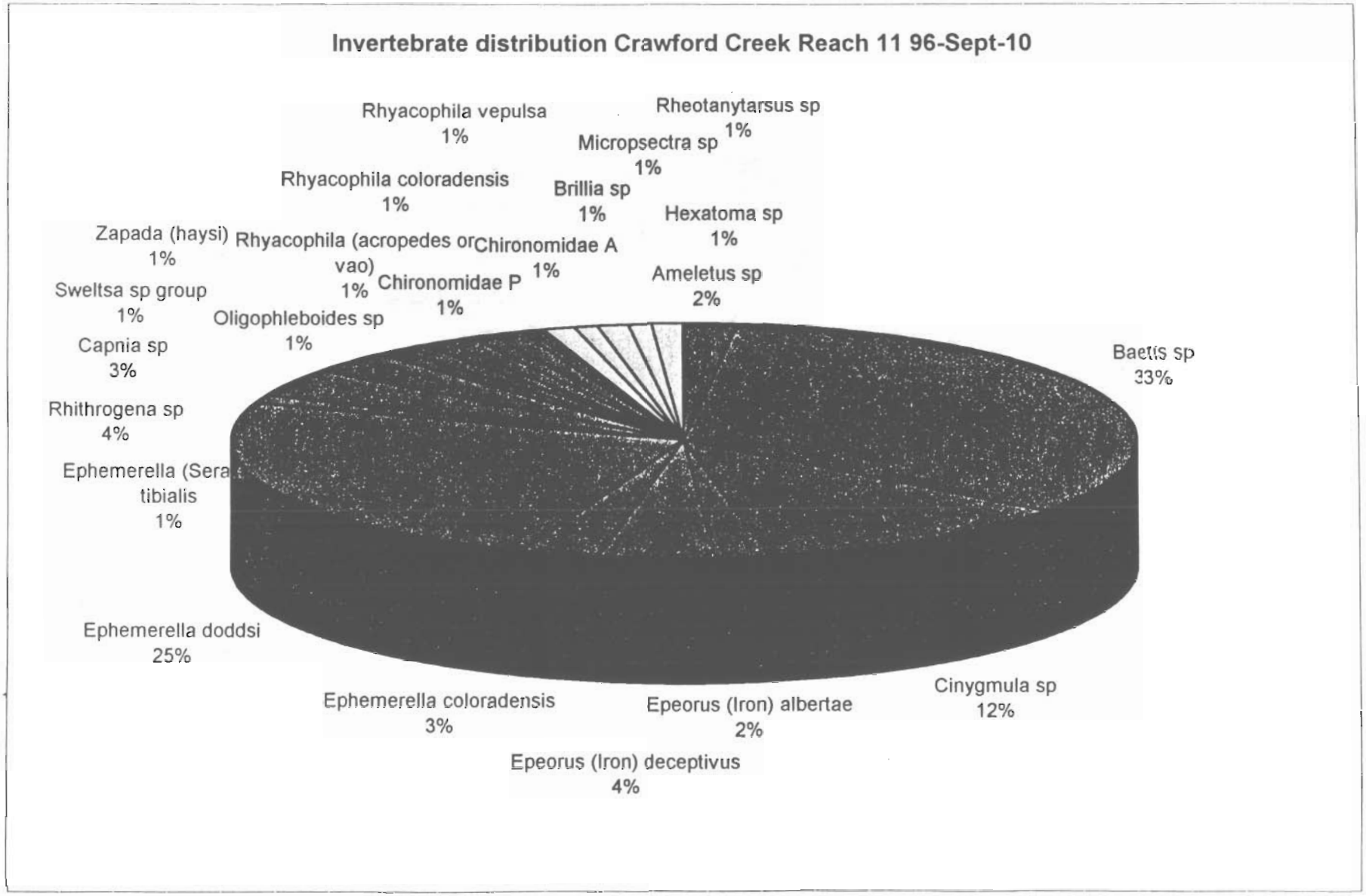

Invertebrate distribution Crawford Creek Reach 11 96-Sept-10
Rhyacophila vepulsa 1%
Rheotanytarsus sp 1%
Micropsectra sp 1%
Rhyacophila coloradensis 1%
Brillia sp 1%
Hexatoma sp 1%
Zapada (haysi) 1%
Rhyacophila (acropedes or vao) 1%
Chironomidae A 1%
Chironomidae P 1%
Ameletus sp 2%
Sweltsa sp group 1%
Oligophleboides sp 1%
Capnia sp 3%
Baetis sp 33%
Rhithrogena sp 4%
Ephemerella (Sera tibialis 1%
Ephemerella doddsi 25%
Ephemerella coloradensis 3%
Epeorus (Iron) albertae 2%
Cinygmula sp 12%
Epeorus (Iron) deceptivus 4%

Figure 25.

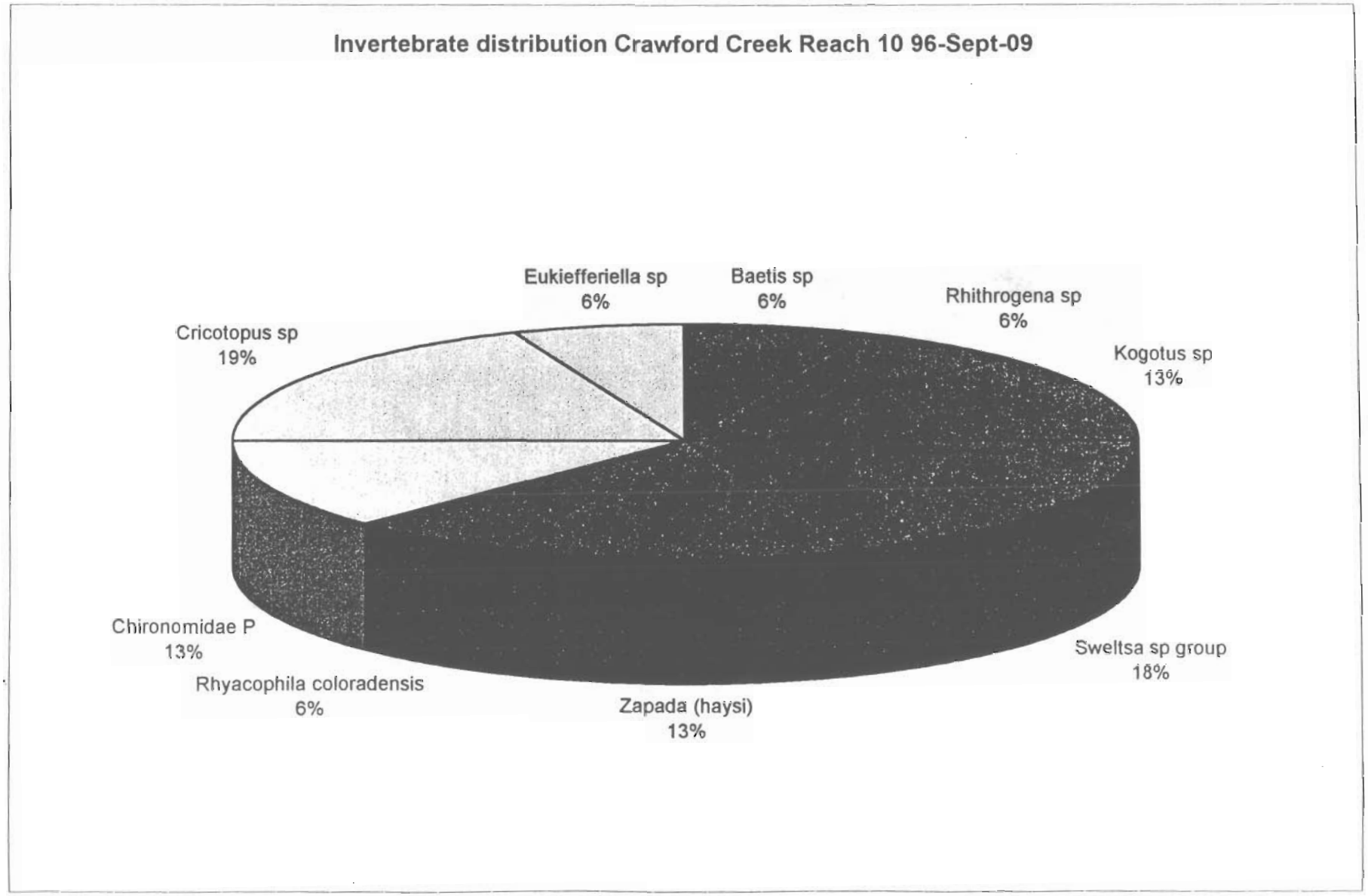

Invertebrate distribution Crawford Creek Reach 10 96-Sept-09
Eukiefferiella sp
6%
Baetis sp
6%
Rhithrogena sp
6%
Kogotus sp
13%
Cricotopus sp
19%
Chironomidae P
13%
Rhyacophila coloradensis
6%
Zapada (haysi)
13%
Sweltsa sp group
18%

Figure 24

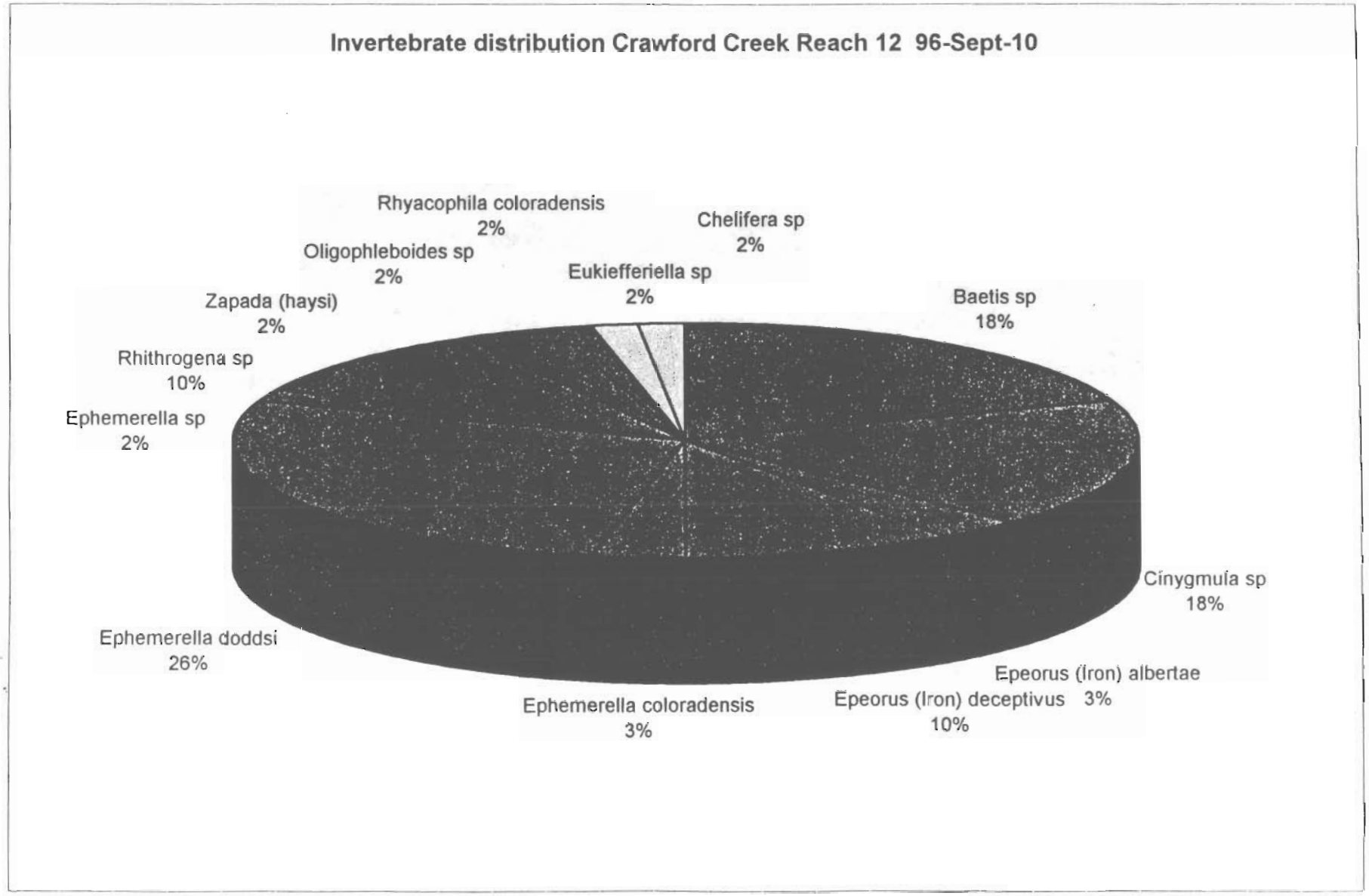

Invertebrate distribution Crawford Creek Reach 12 96-Sept-10
Rhyacophila coloradensis 2%
Chelifera sp 2%
Oligophleboides sp 2%
Eukiefferiella sp 2%
Zapada (haysi) 2%
Baetis sp 18%
Rhithrogena sp 10%
Ephemerella sp 2%
Cinygmula sp 18%
Ephemerella doddsi 26%
Epeorus (Iron) albertae
Ephemerella coloradensis 3%
Epeorus (Iron) deceptivus 10%
3%

Figure 26.

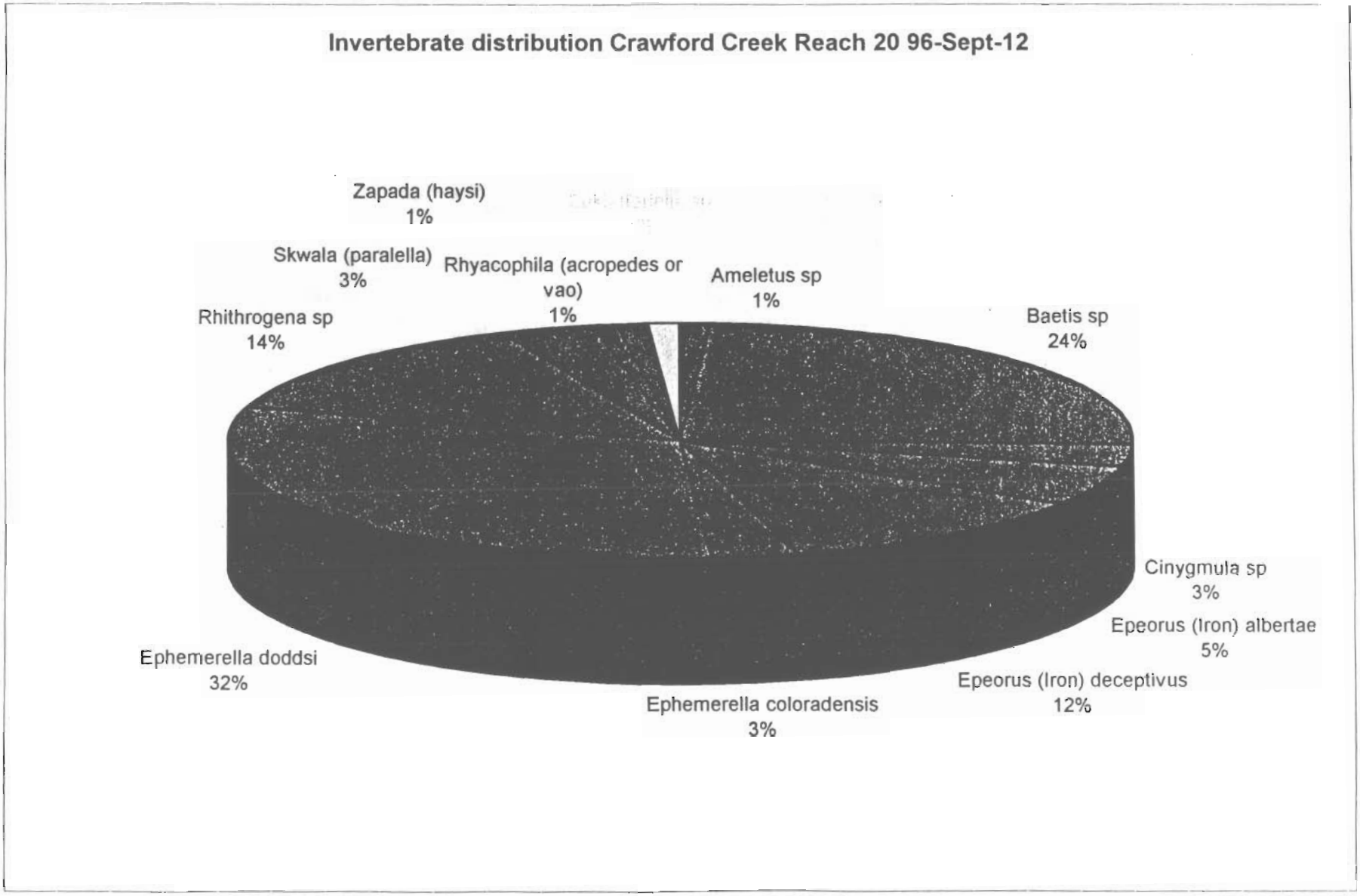

Invertebrate distribution Crawford Creek Reach 20 96-Sept-12
Zapada (haysi) 1%
Skwala (paralella) 3%
Rhyacophila (acropedes or vao) 1%
Ameletus sp 1%
Rhithrogena sp 14%
Baetis sp 24%
Cinygmula sp 3%
Epeorus (Iron) albertae 5%
Epeorus (Iron) deceptivus 12%
Ephemerella coloradensis 3%
Ephemerella doddsi 32%

Figure 27.

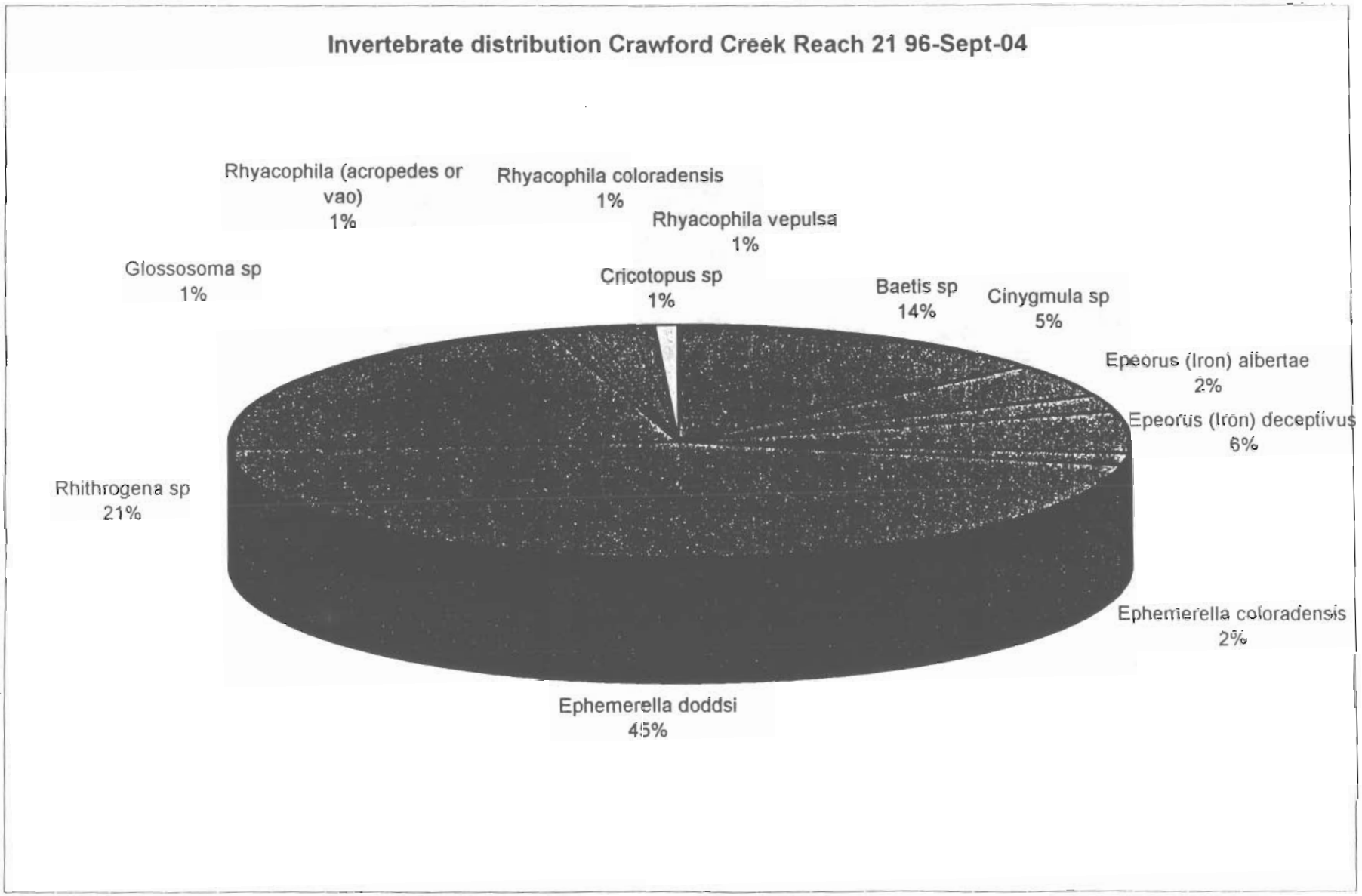

Invertebrate distribution Crawford Creek Reach 21 96-Sept-04
Rhyacophila (acropedes or vao) 1%
Rhyacophila coloradensis 1%
Rhyacophila vepulsa 1%
Glossosoma sp 1%
Cricotopus sp 1%
Baetis sp 14%
Cinygmula sp 5%
Epeorus (Iron) albertae 2%
Epeorus (Iron) deceptivus 6%
Rhithrogena sp 21%
Ephemerella coloradensis 2%
Ephemerella doddsi 45%

Figure 28.

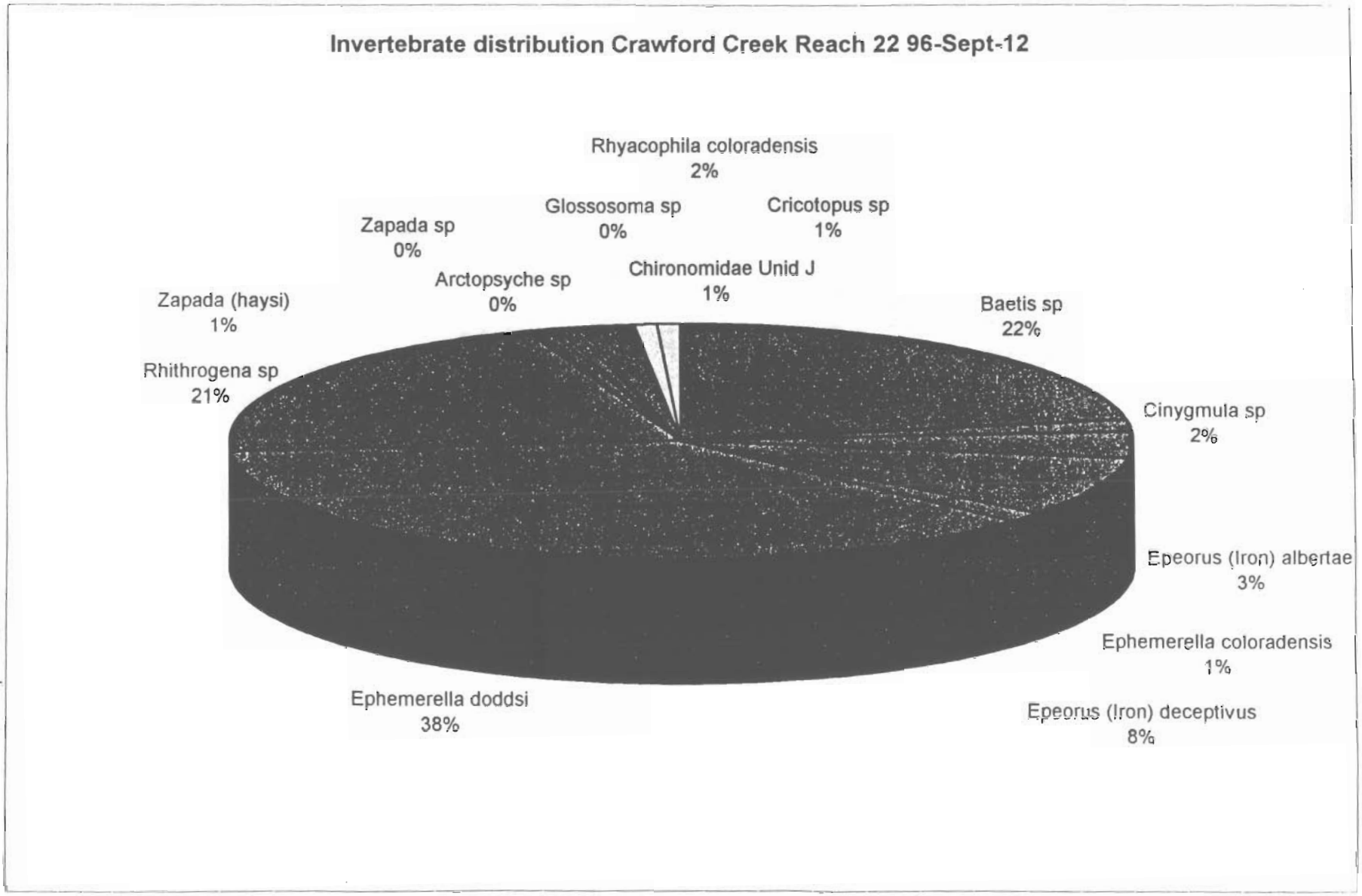

Invertebrate distribution Crawford Creek Reach 22 96-Sept-12
Rhyacophila coloradensis 2%
Glossosoma sp 0%
Cricotopus sp 1%
Zapada sp 0%
Chironomidae Unid J 1%
Arctopsyche sp 0%
Zapada (haysi) 1%
Baetis sp 22%
Rhithrogena sp 21%
Cinygmula sp 2%
Epeorus (Iron) albertae 3%
Ephemerella coloradensis 1%
Epeorus (Iron) deceptivus 8%
Ephemerella doddsi 38%

Figure 29.

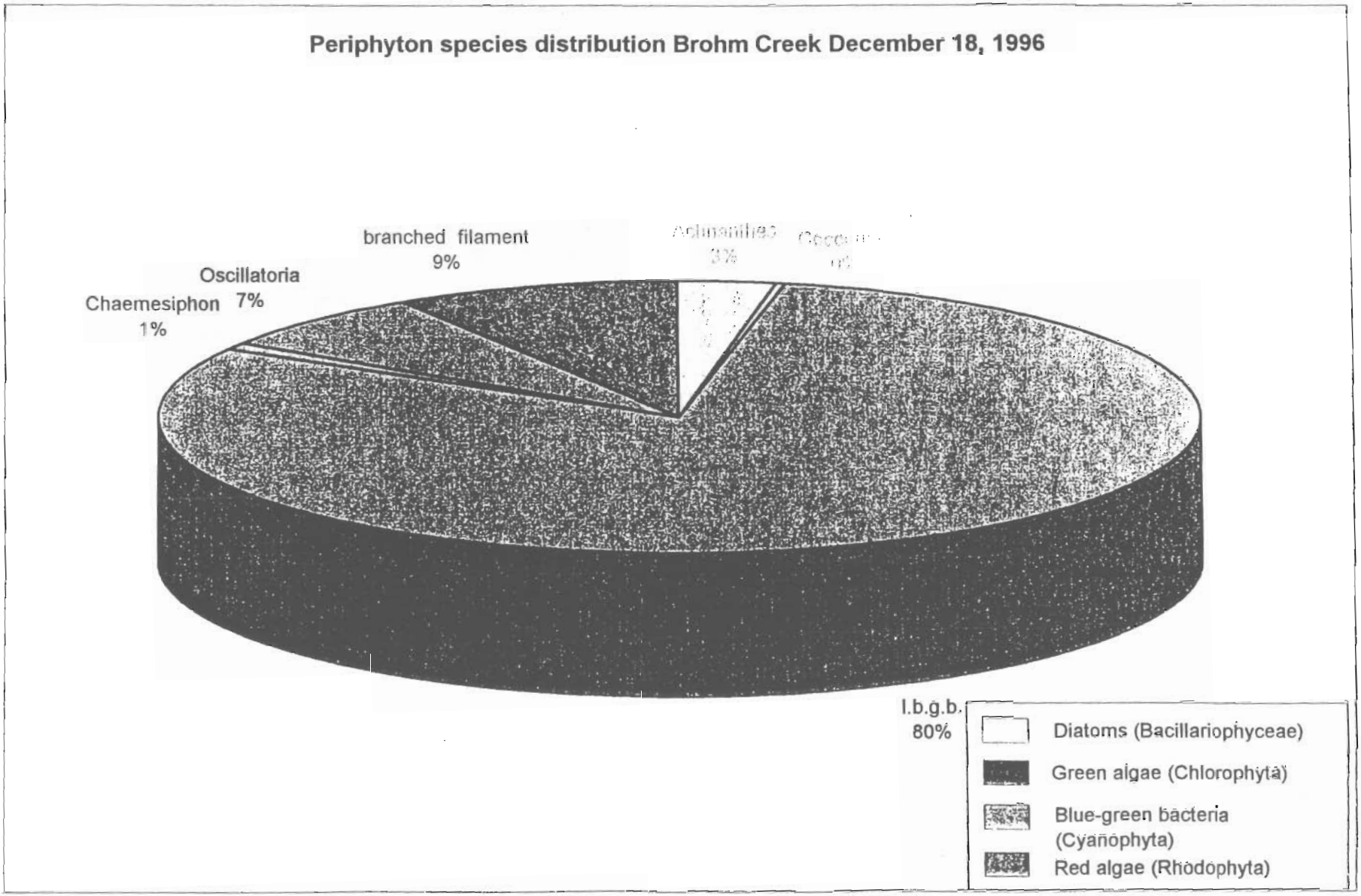


Figure 31 Periphyton species and relative proportions (by major group) found on rock substrate in Brohm Creek December 18, 1996.

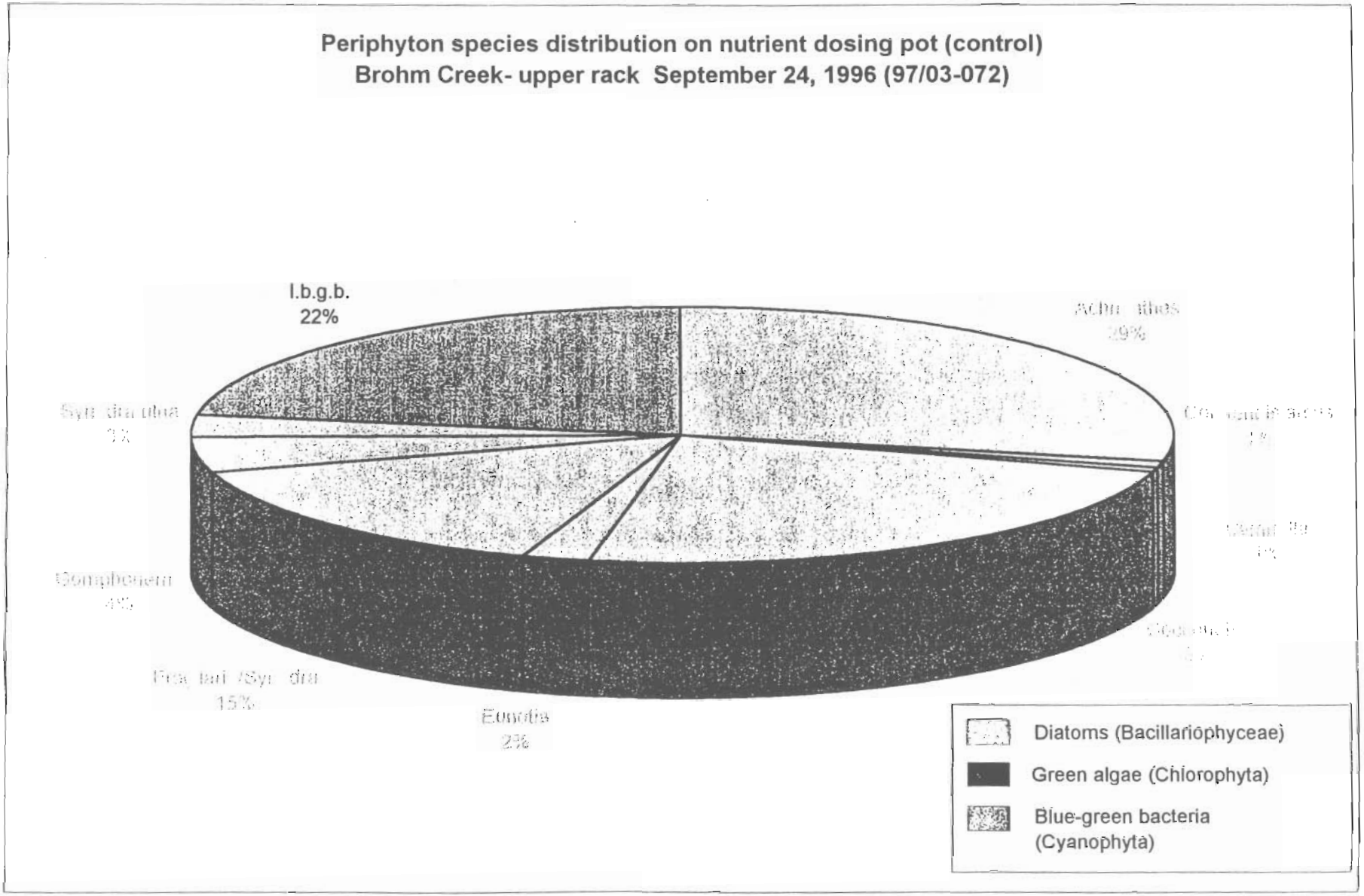


Figure33. Periphyton species and relative proportions (by major group) found on nutrient dosing pot (control) Brohm Creek- upper rack.

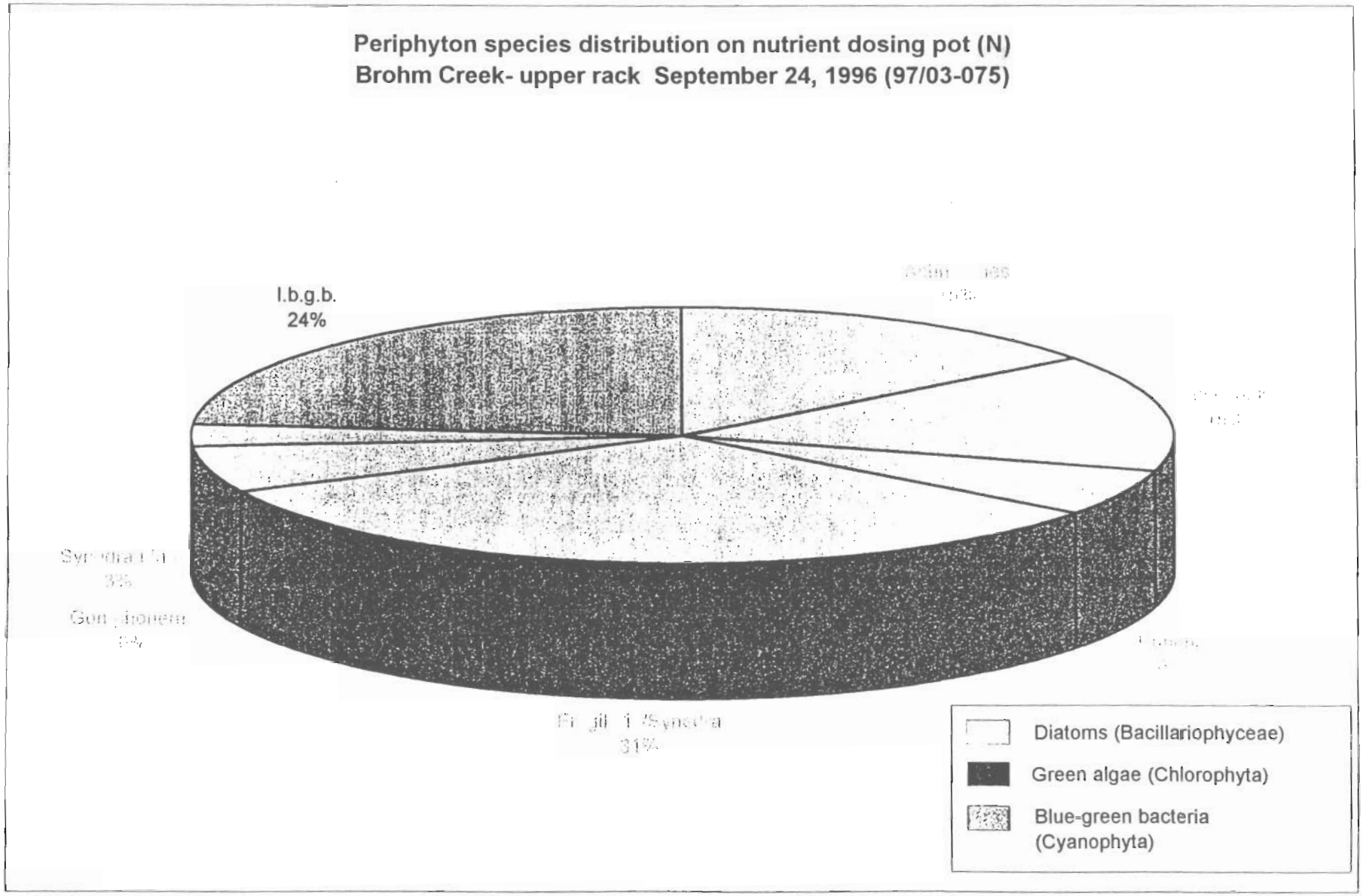


Figure 38 Periphyton species and relative proportions (by major group) found on nutrient dosing pot (N) Brohm Creek- upper rack.

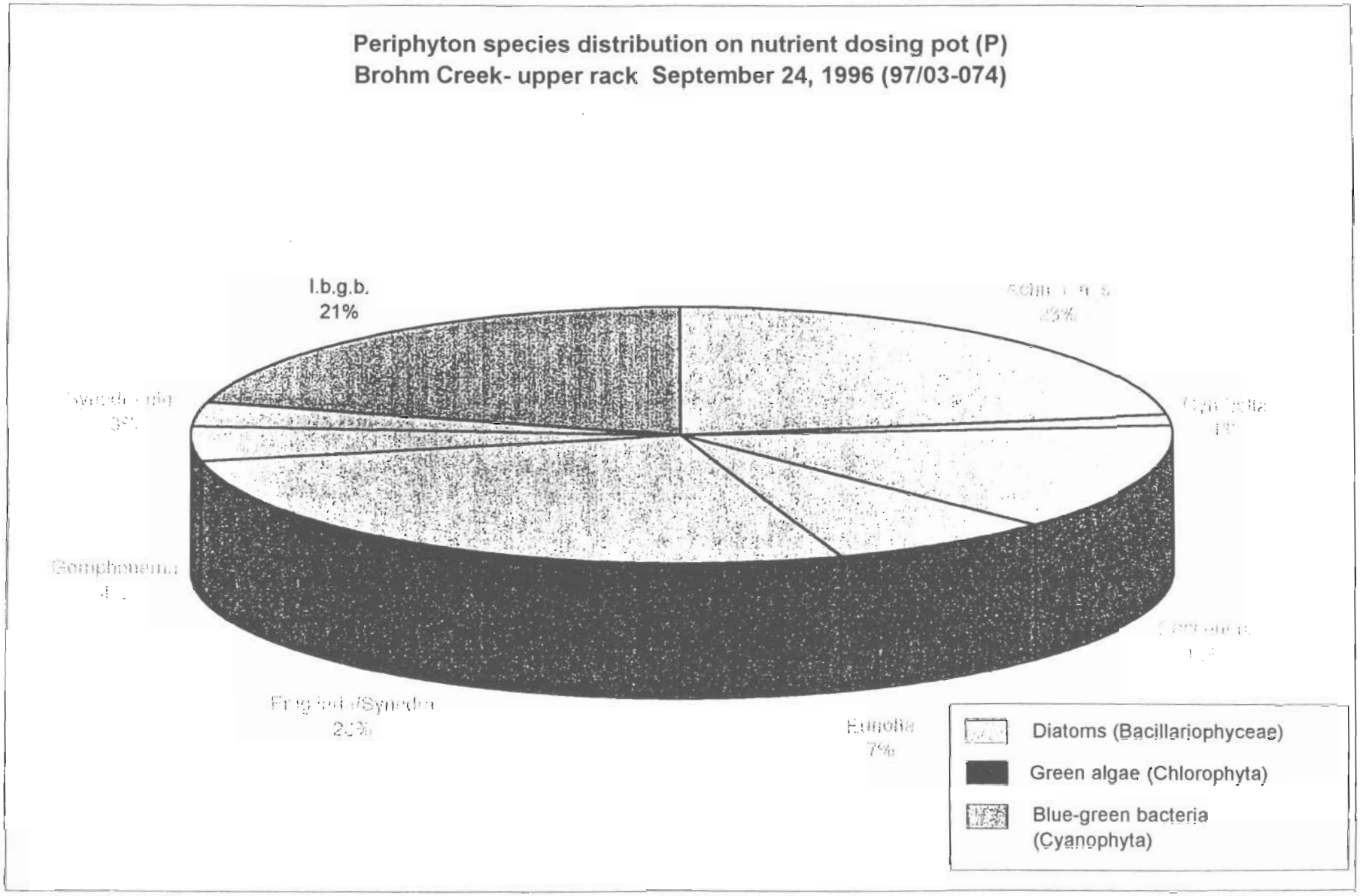


Figure 35 Periphyton species and relative proportions (by major group) found on nutrient dosing pot (P) Brohm Creek- upper rack.

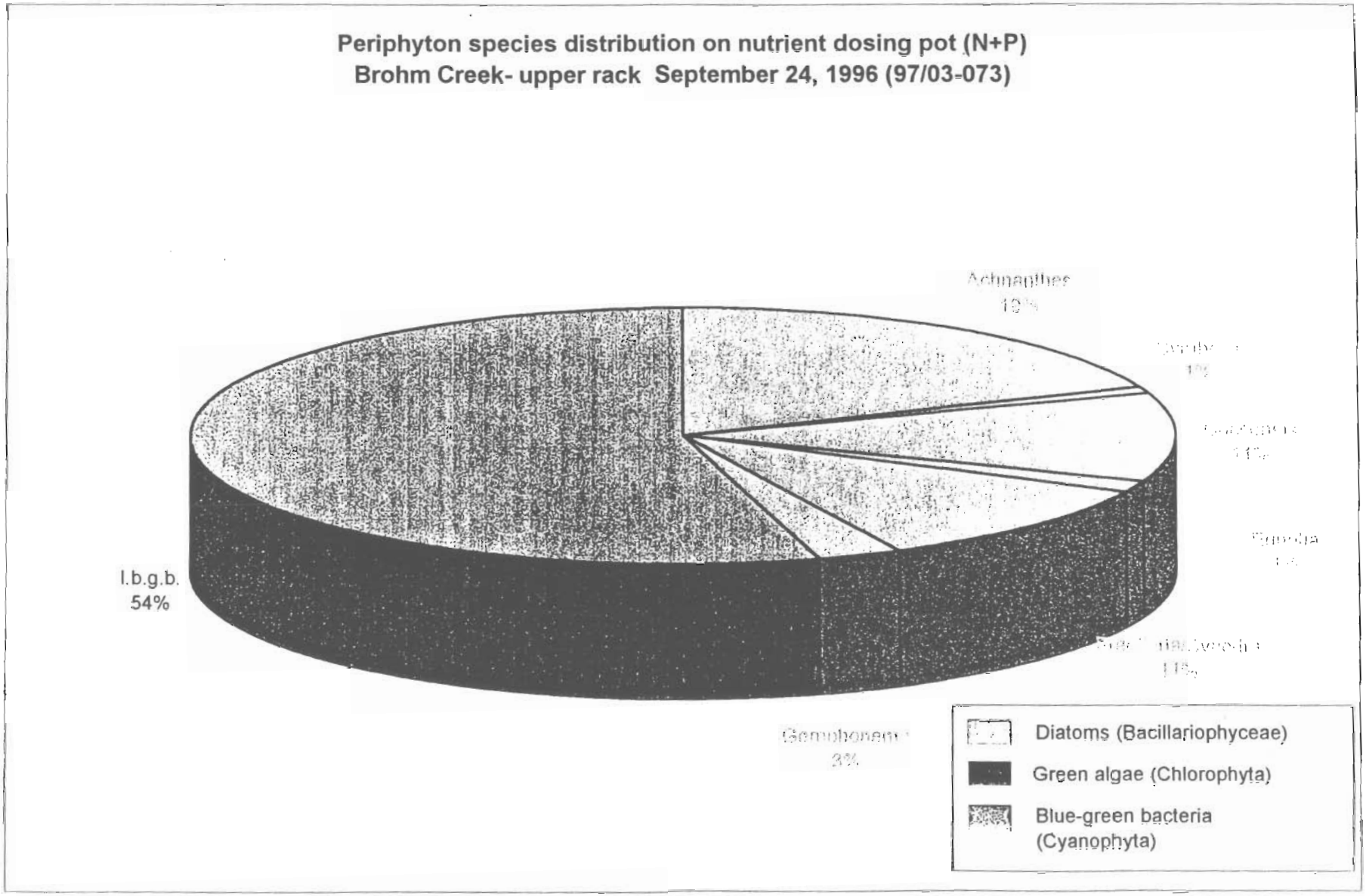


Figure 3. Periphyton species and relative proportions (by major group) found on nutrient dosing pot (N+P) Brohm Creek- upper rack.

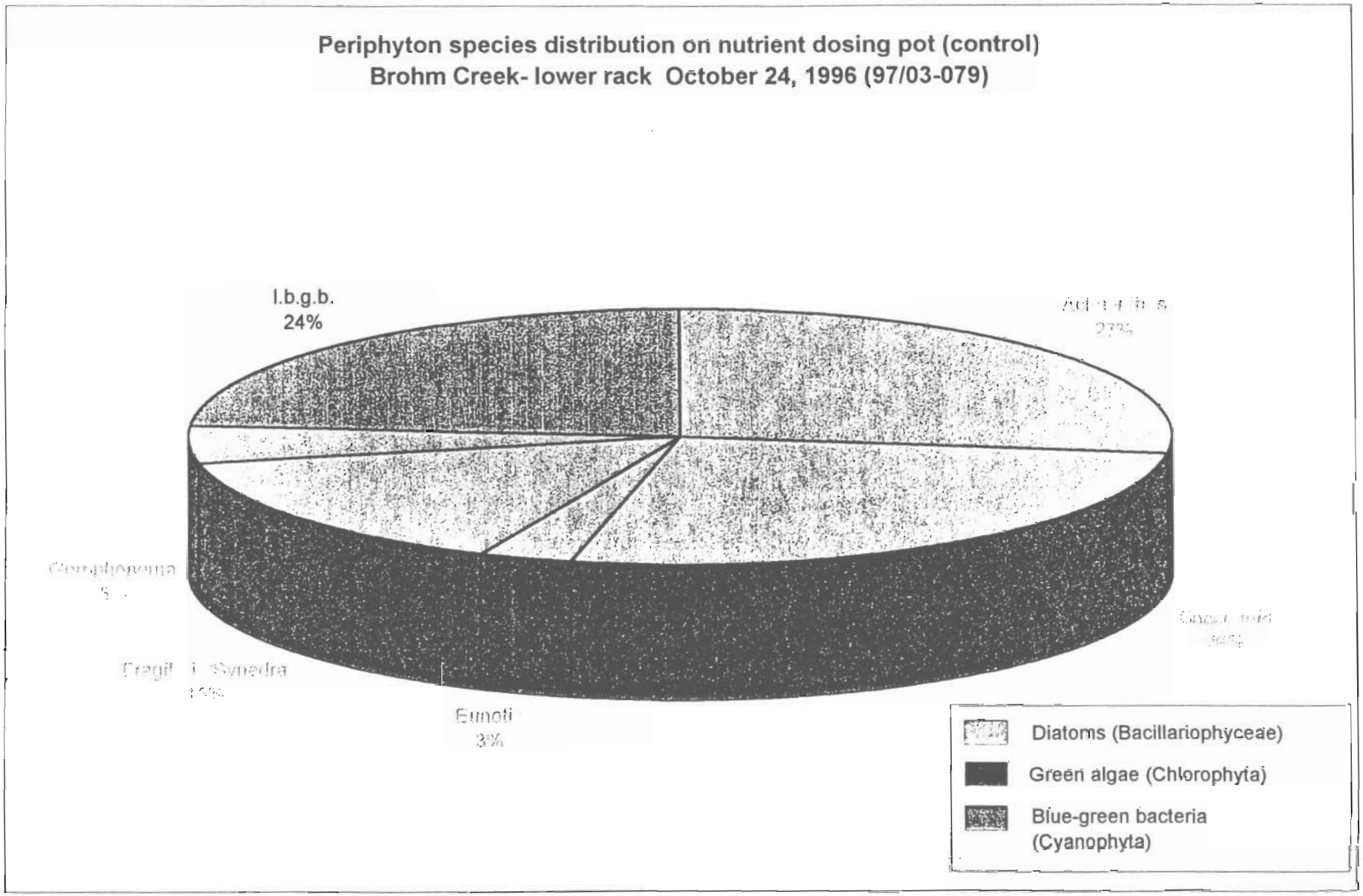


Figure 37. Periphyton species and relative proportions (by major group) found on nutrient dosing pot (control) Brohm Creek- lower rack

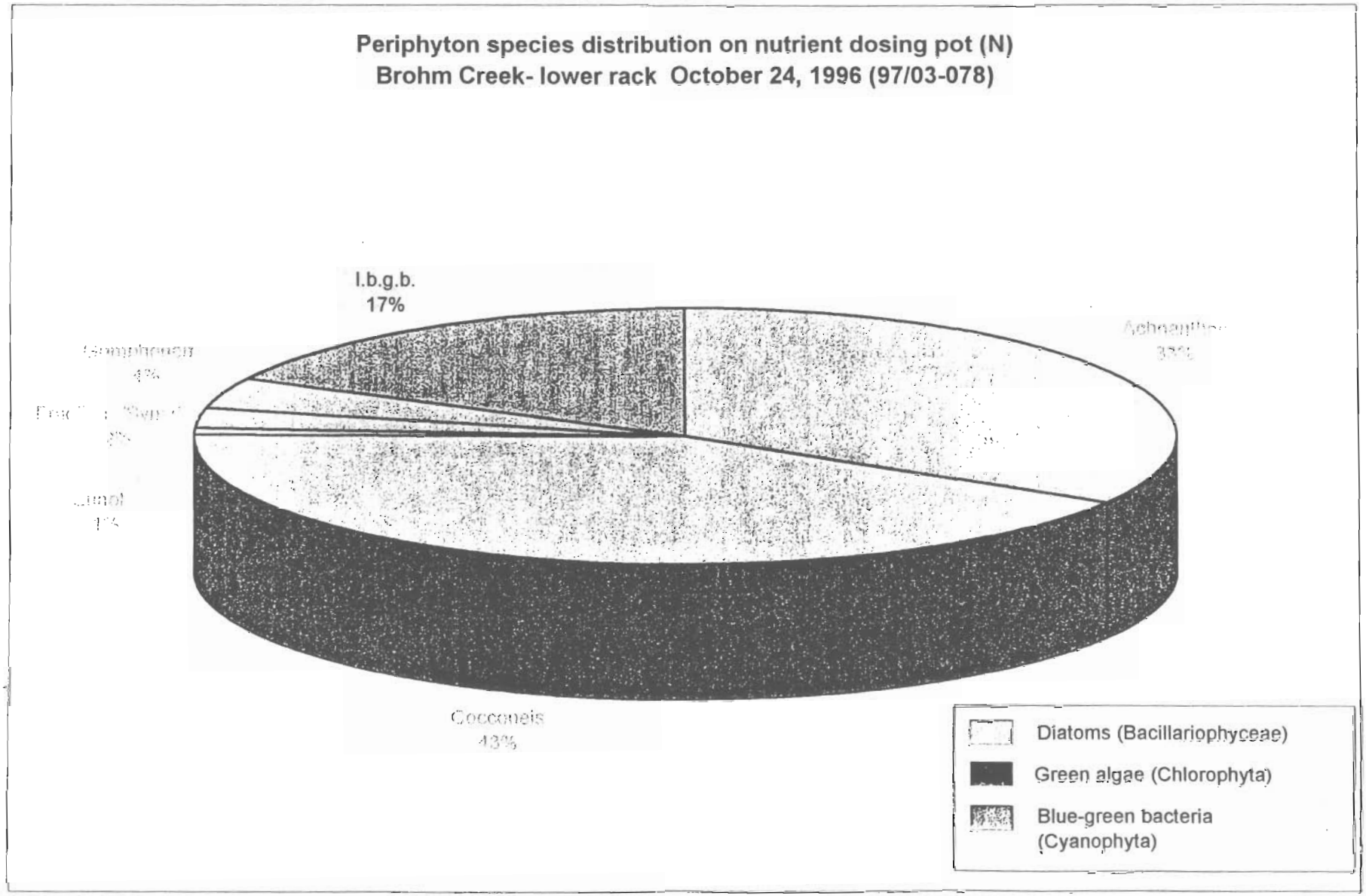


Figure38. Periphyton species and relative proportions (by major group) found on nutrient dosing pot (N) Brohm Creek - lower rack.

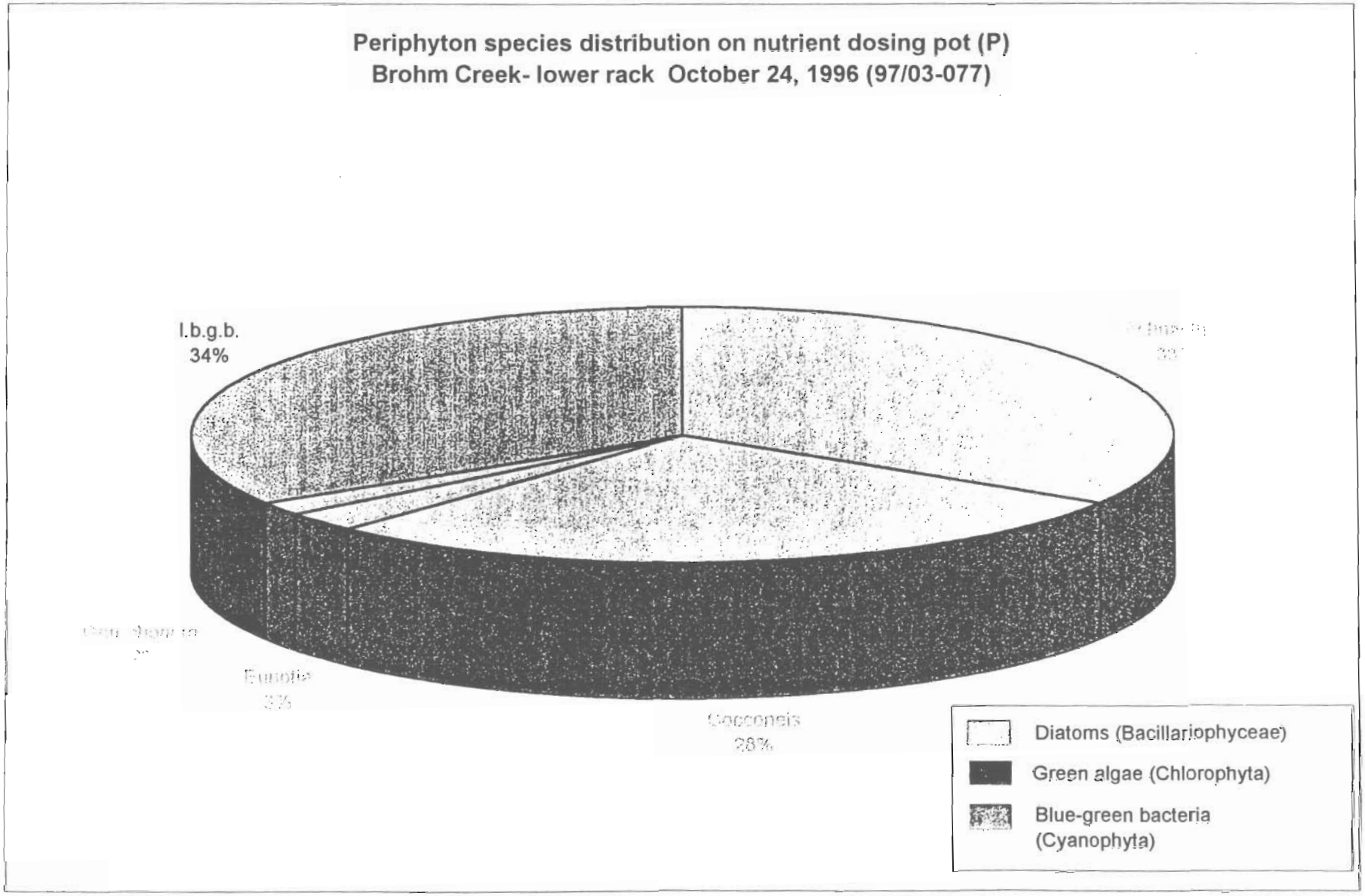


Figure 31. Periphyton species and relative proportions (by major group) found on nutrient dosing pot (P) Brohm Creek- lower rack.

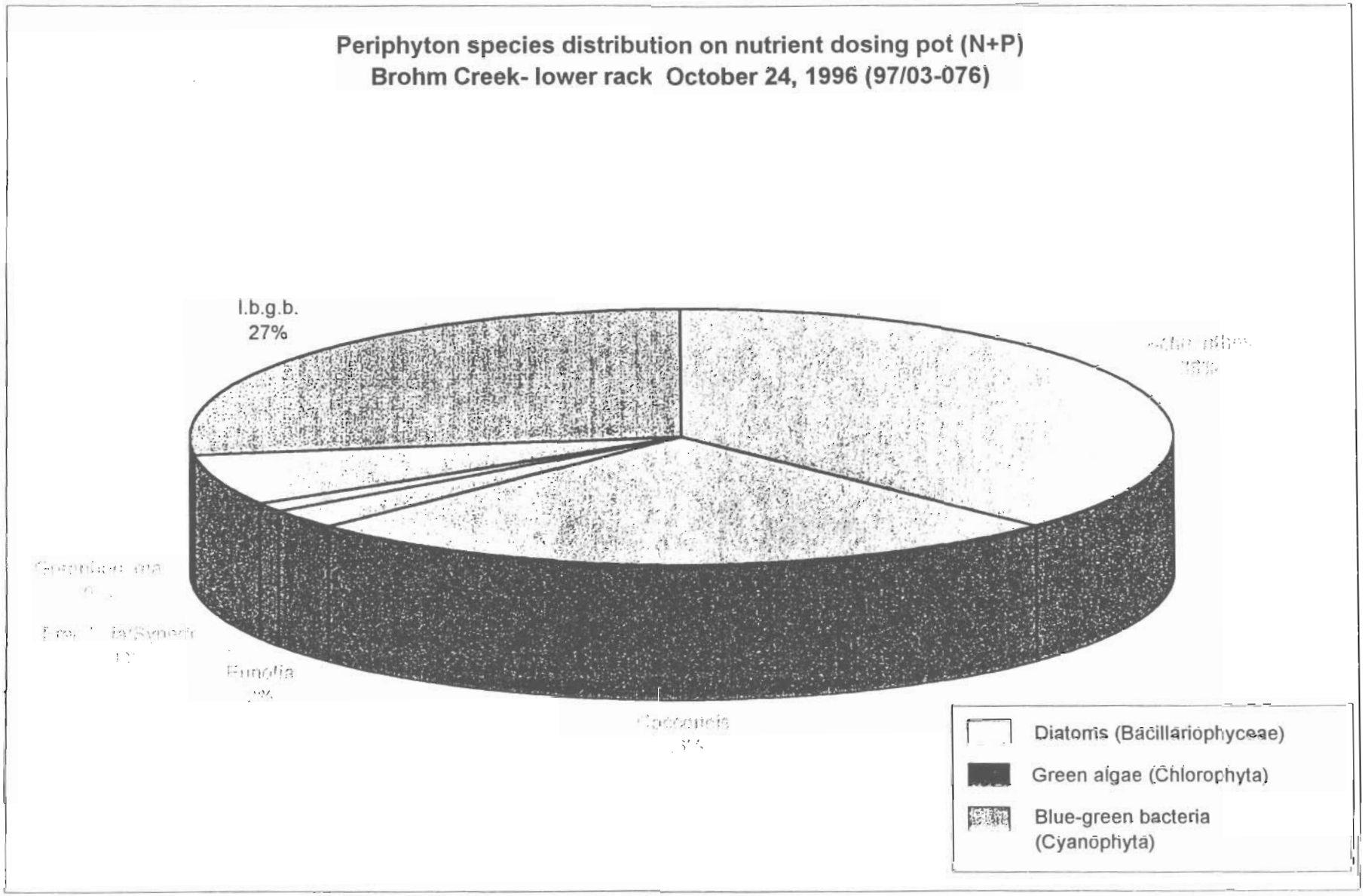


Figure 4o Periphyton species and relative proportions (by major group) found on nutrient dosing pot (N+P) Brohm Creek- lower rack.

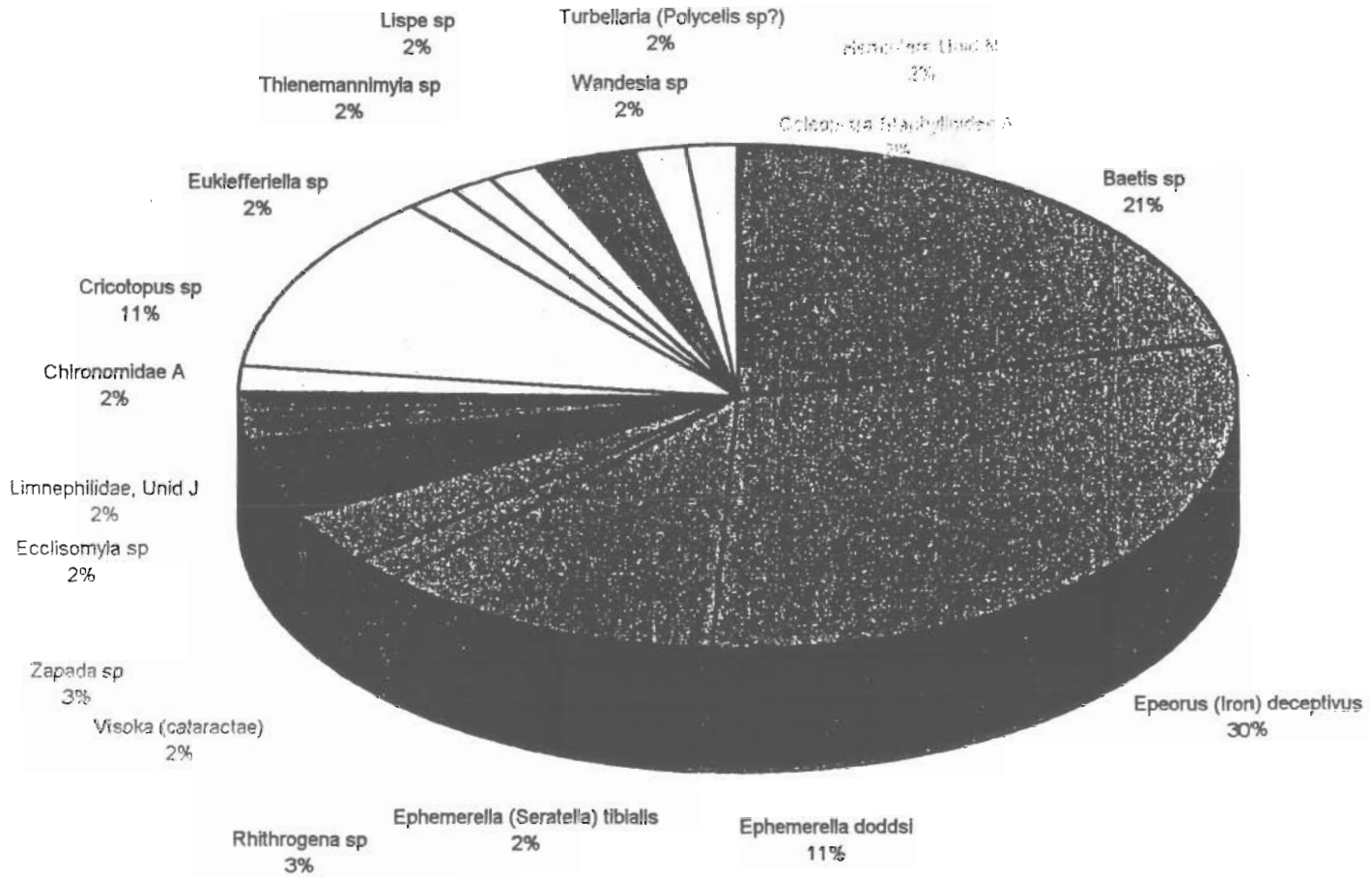

Brohm Creek 96 Sept 15 main channel
Lispe sp
2%
Turbellaria (Polycelis sp?)
2%
Thienemannimyia sp
2%
Wandesia sp
2%
Eukiefferiella sp
2%
Baetis sp
21%
Cricotopus sp
11%
Chironomidae A
2%
Limnephilidae, Unid J
2%
Ecclisomyia sp
2%
Zapada sp
3%
Visoka (cataractae)
2%
Epeorus (Iron) deceptivus
30%
Rhithrogena sp
3%
Ephemerella (Seratella) tibialis
2%
Ephemerella doddsi
11%

Figure 41.

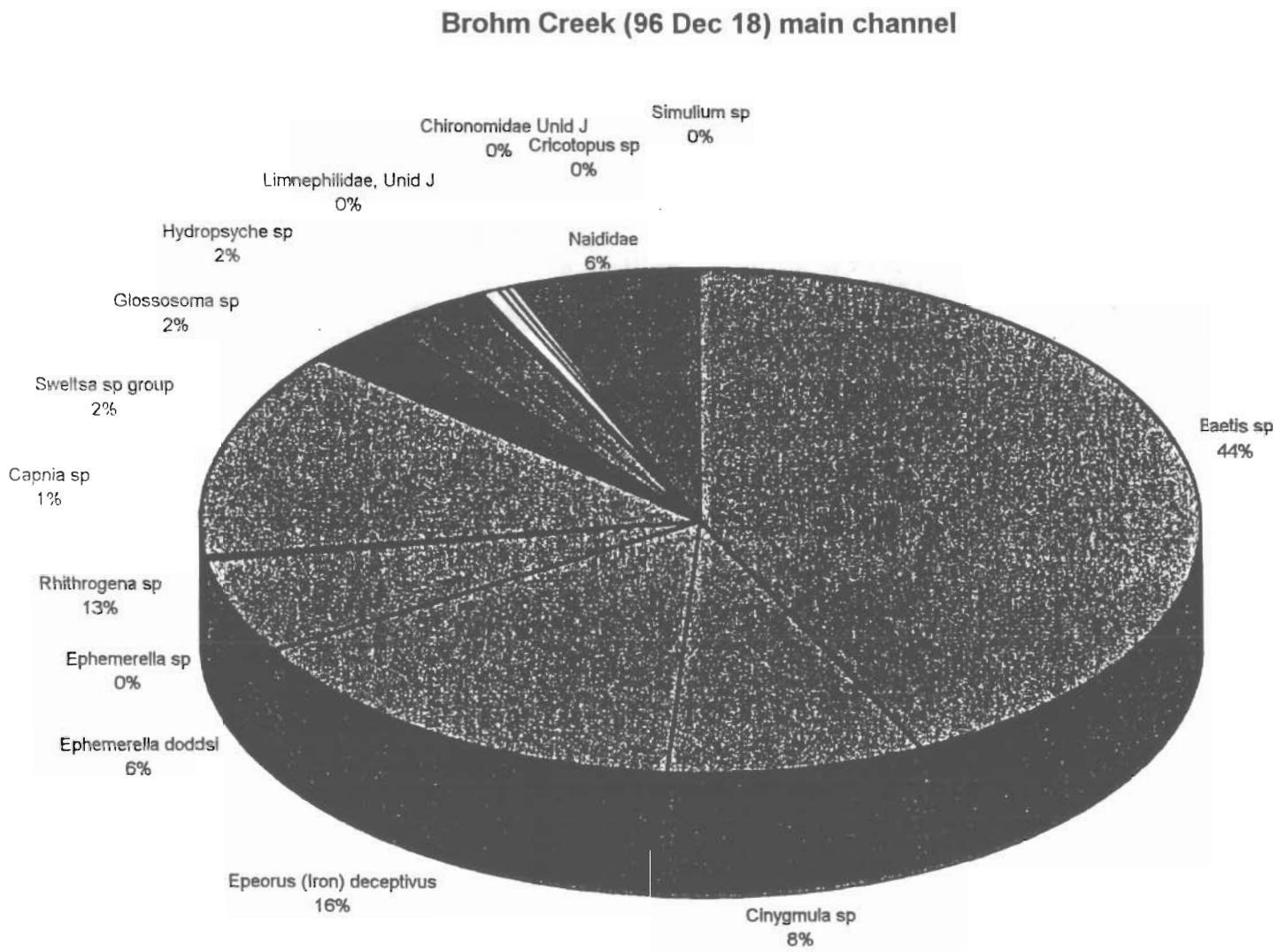

Brohm Creek (96 Dec 18) main channel
Simulium sp
0%
Chironomidae Unid J
0%
Cricotopus sp
0%
Limnephilidae, Unid J
0%
Hydropsyche sp
2%
Naididae
6%
Glossosoma sp
2%
Sweltsa sp group
2%
Baetis sp
44%
Capnia sp
1%
Rhithrogena sp
13%
Ephemerella sp
0%
Ephemerella doddsi
6%
Epeorus (Iron) deceptivus
16%
Cinygmula sp
8%

Figure 42.

Brohm Creek reach # 1(96 Sept)

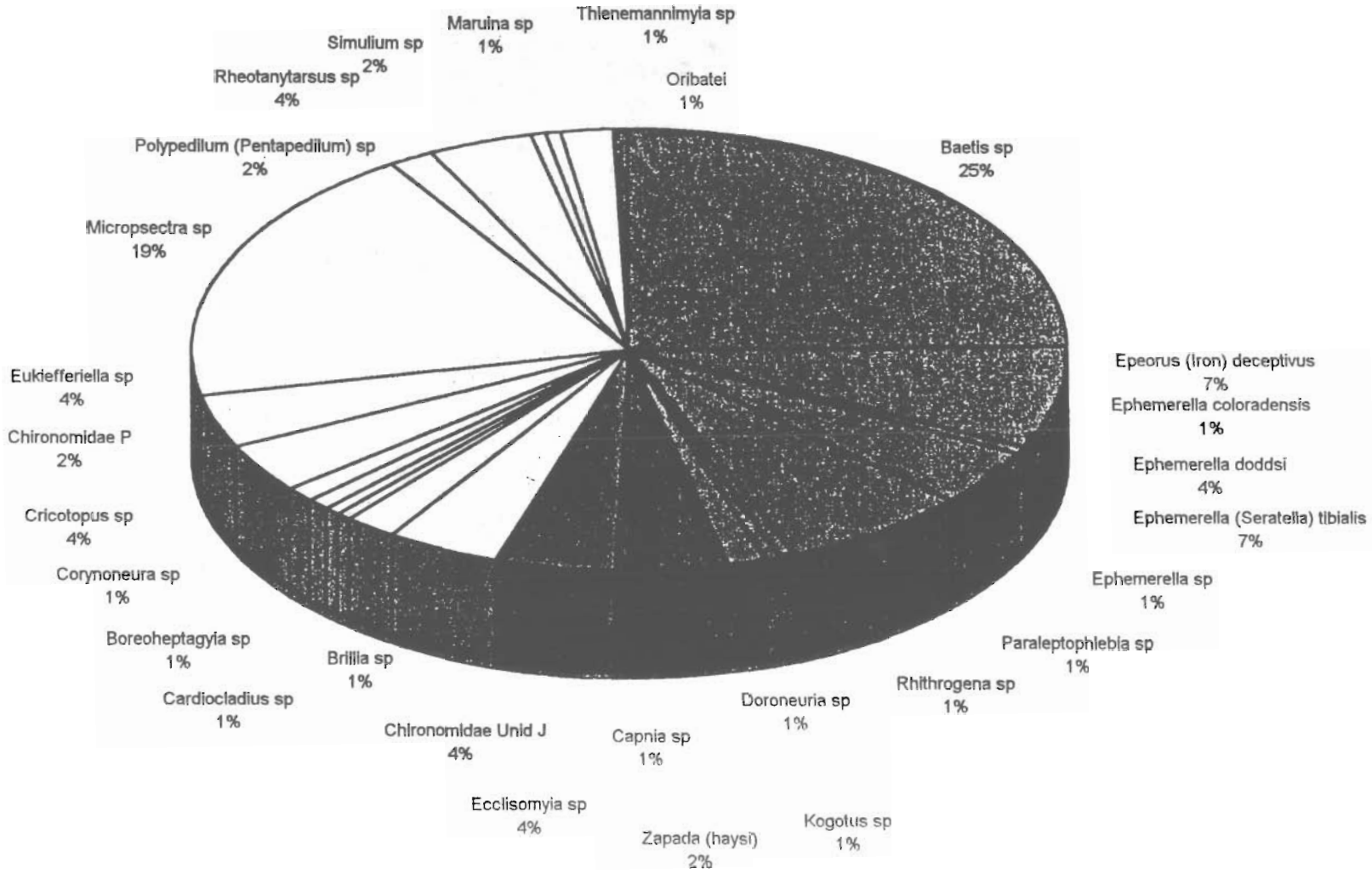


Figure 43

Brohm Creek reach # 2

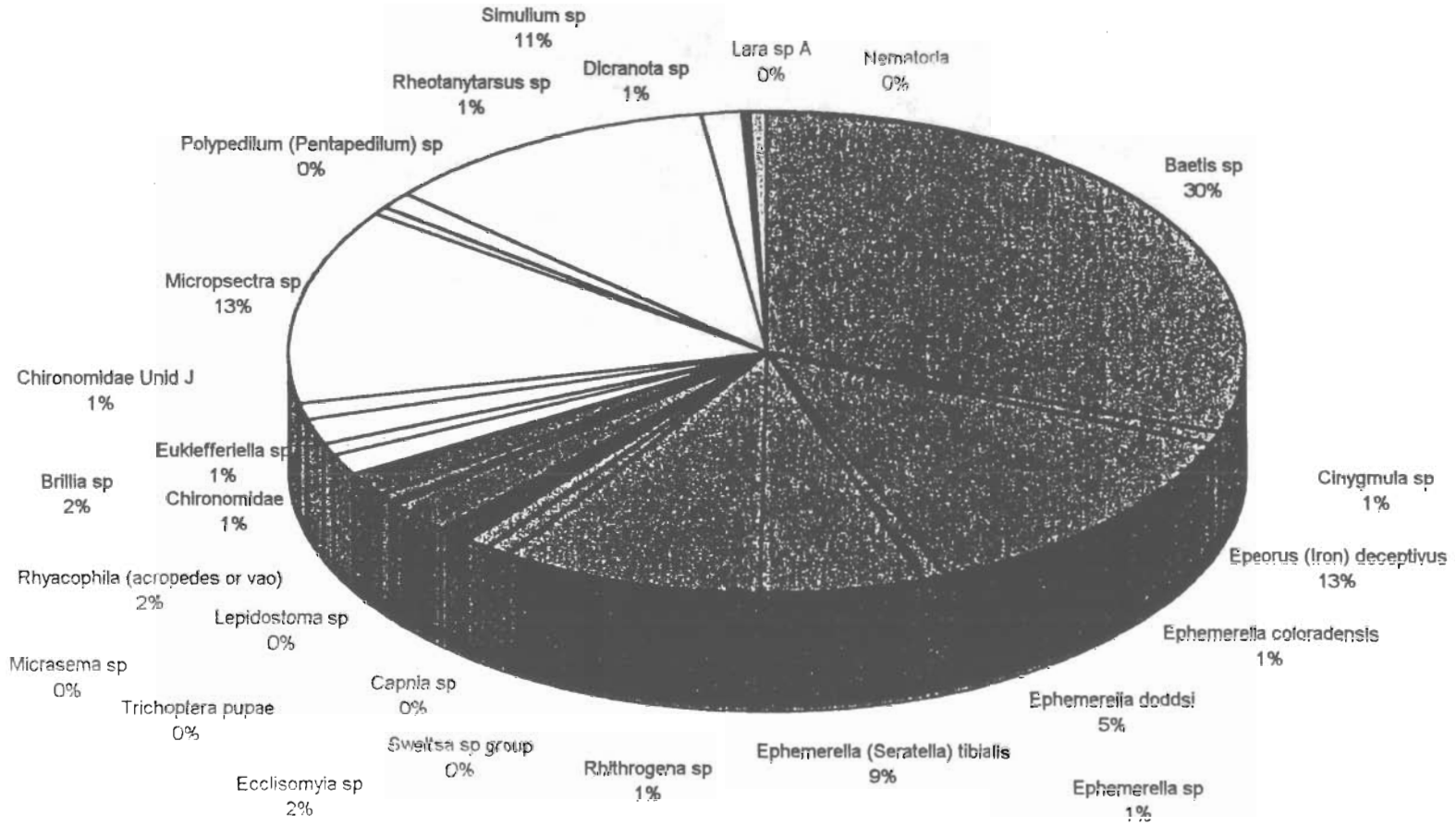


Figure 44.

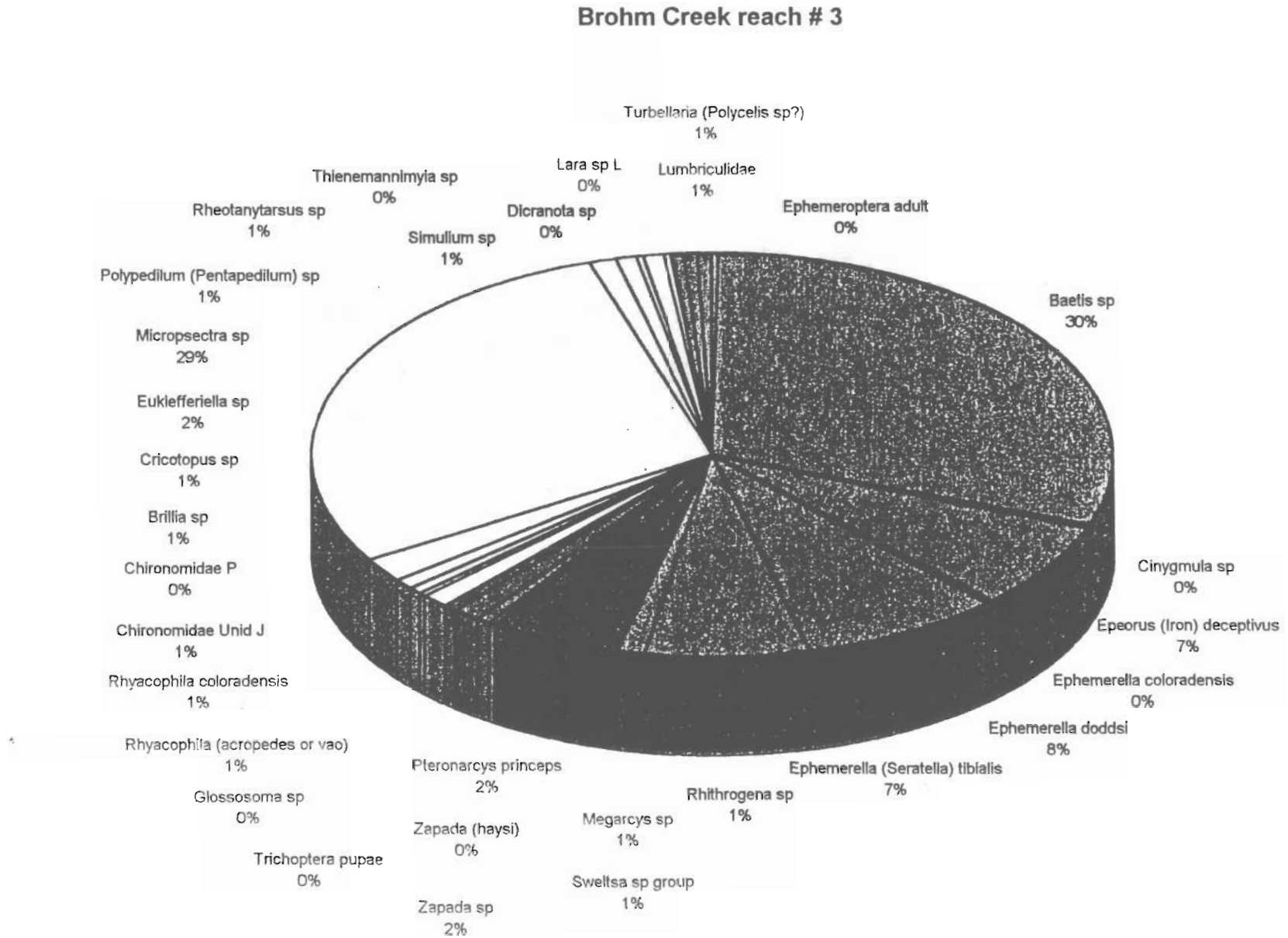

Brohm Creek reach # 3
Turbellaria (Polycelis sp?)
1%
Lara sp L
0%
Lumbriculidae
1%
Thienemannimyia sp
0%
Rheotanytarsus sp
1%
Dicranota sp
0%
Ephemeroptera adult
0%
Simulium sp
1%
Polypedilum (Pentapedilum) sp
1%
Baetis sp
30%
Micropsectra sp
29%
Euklefferiella sp
2%
Cricotopus sp
1%
Brillia sp
1%
Chironomidae P
0%
Cinygmula sp
0%
Chironomidae Unid J
1%
Epeorus (Iron) deceptivus
7%
Rhyacophila coloradensis
1%
Ephemerella coloradensis
0%
Ephemerella doddsi
8%
Rhyacophila (acropedes or vao)
1%
Pteronarcys princeps
2%
Ephemerella (Seratella) tibialis
7%
Glossosoma sp
0%
Rhithrogena sp
1%
Megarcys sp
1%
Zapada (haysi)
0%
Trichoptera pupae
0%
Sweltsa sp group
1%
Zapada sp
2%

Figure 45 .

Invertebrate distribution (by Order) Brohm River reach # 4 96-00-00 Jul-30

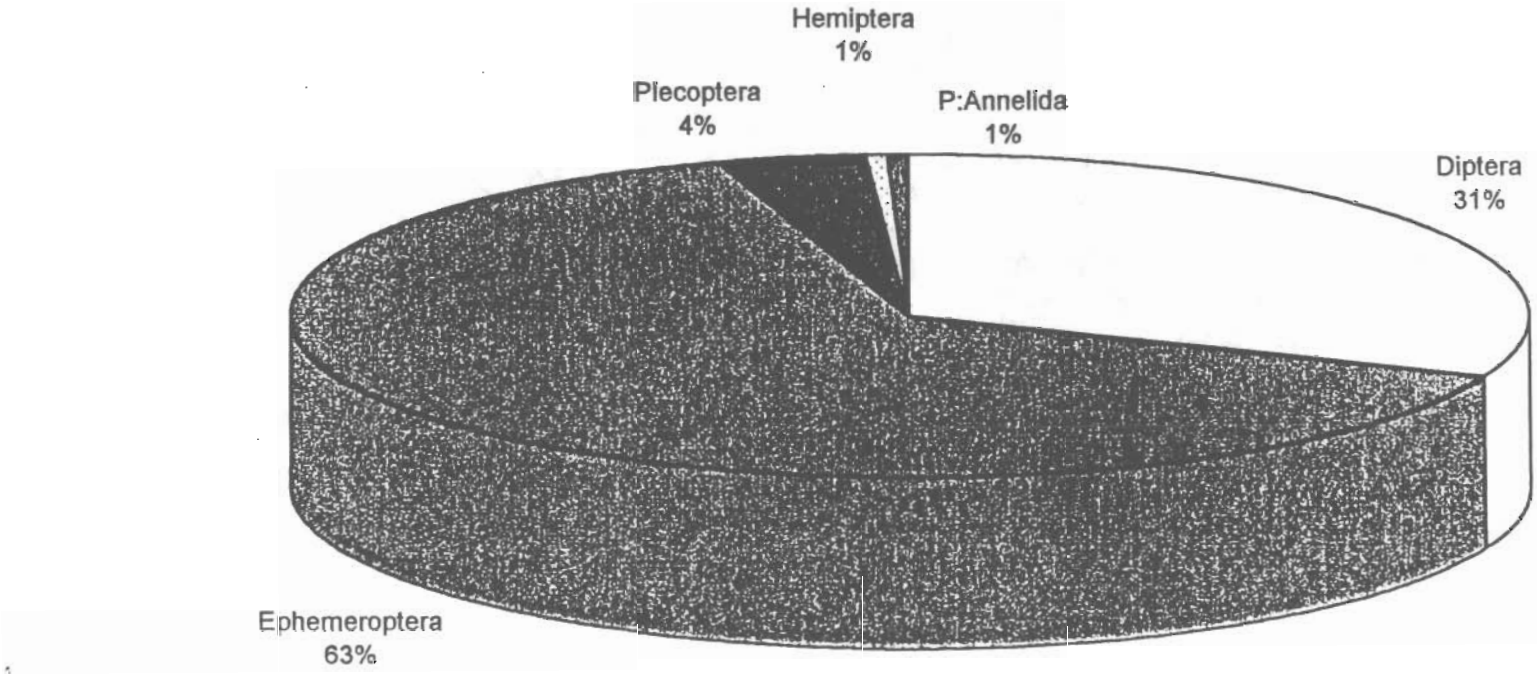


Figure 46 Invertebrate relative abundance (by Order) found in Brohm River reach # 4 96-00-00

Brohm Creek reach # 9

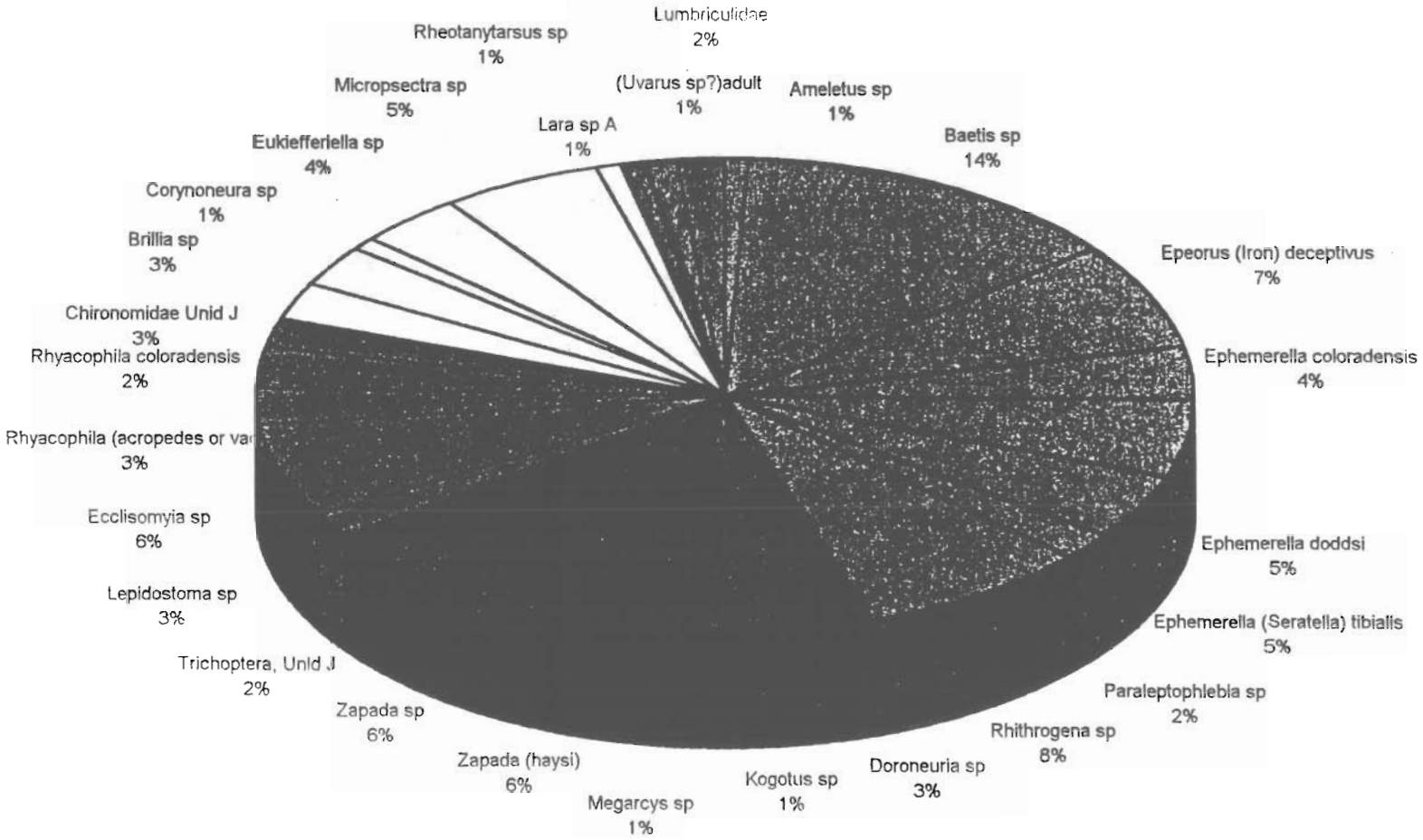


Figure 47

Brohm Creek reach # 10

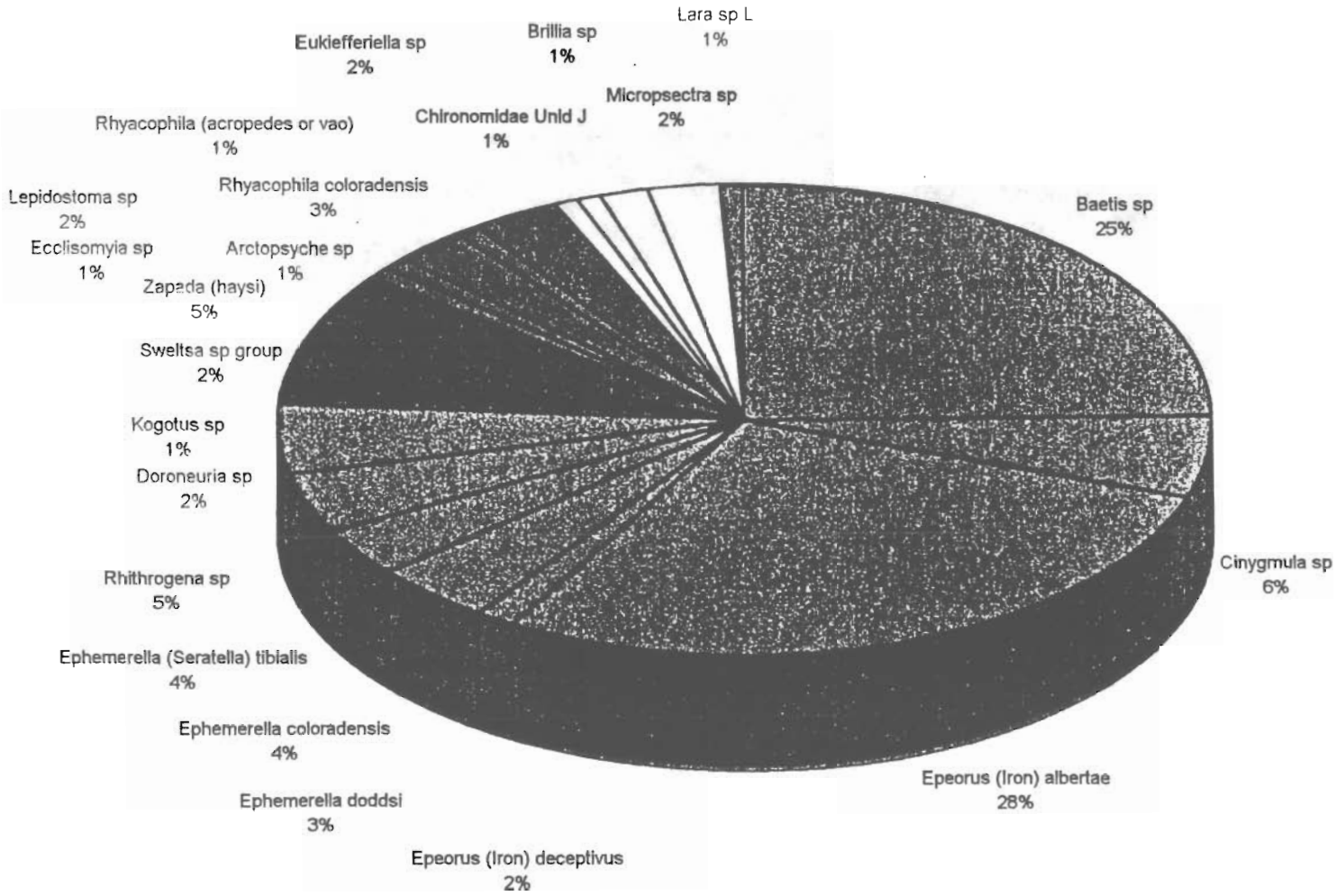


Figure 48

Brohm Creek Reach # 11

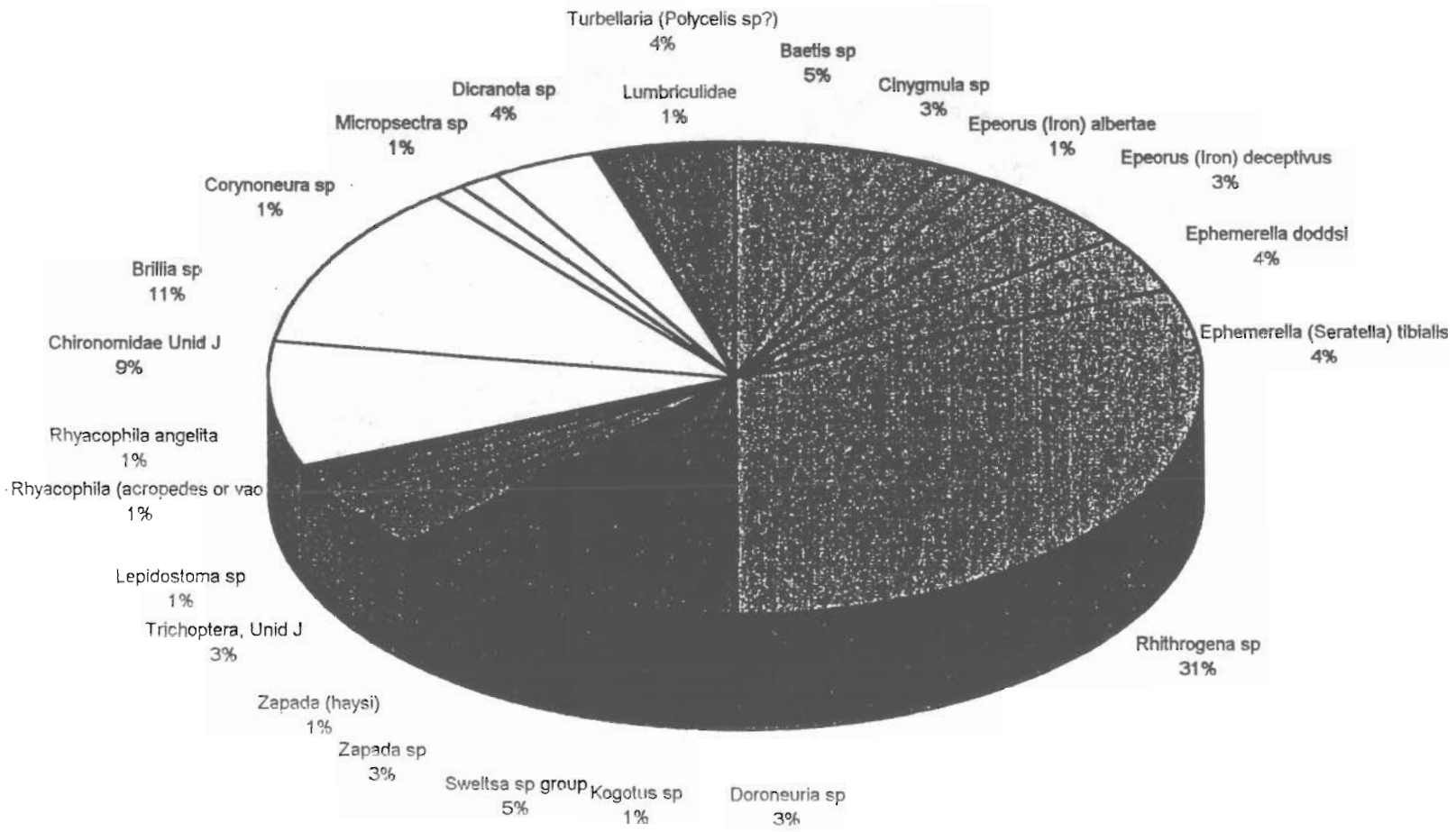


Figure 19

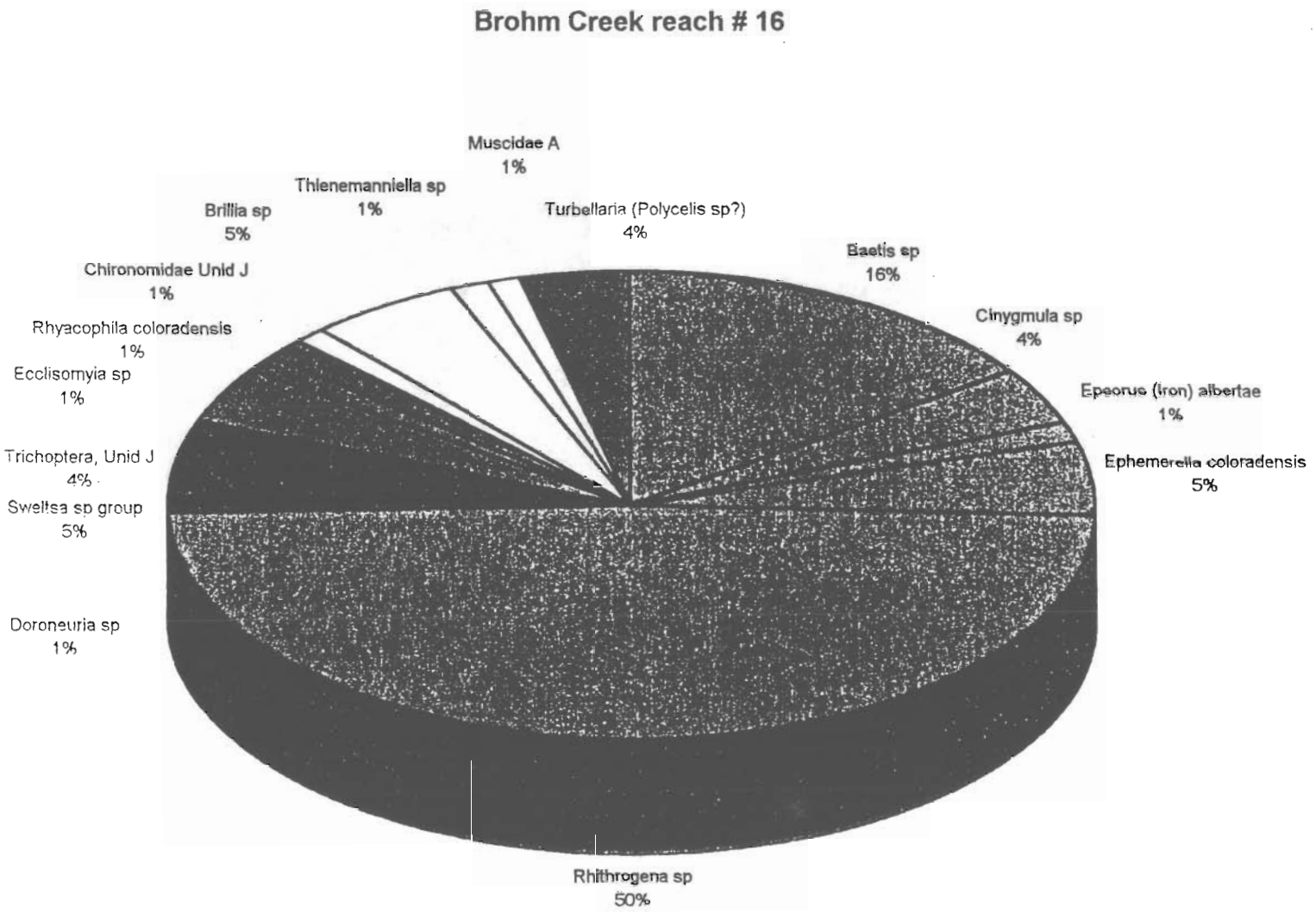

Brohm Creek reach # 16
Muscidae A
1%
Thienemanniella sp
1%
Brillia sp
5%
Turbellaria (Polycelis sp?)
4%
Baetis sp
16%
Chironomidae Unid J
1%
Cinygmula sp
4%
Rhyacophila coloradensis
1%
Ecclisomyia sp
1%
Epeorus (Iron) albertae
1%
Trichoptera, Unid J
4%
Ephemerella coloradensis
5%
Sweltsa sp group
5%
Doroneuria sp
1%
Rhithrogena sp
50%

Figure 50

Brohm Creek reach # 22

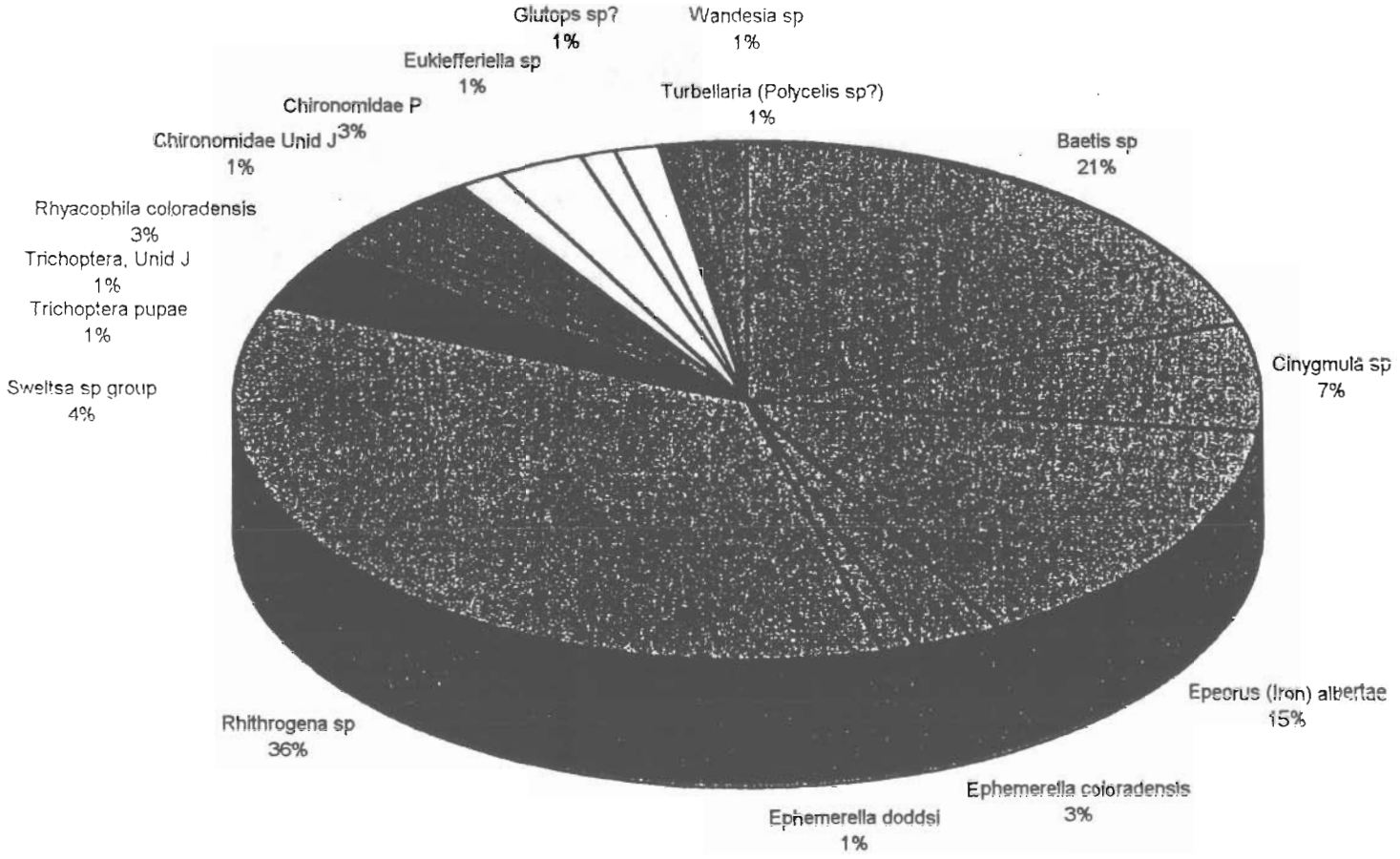


Figure 51.

Brohm Creek reach # 23

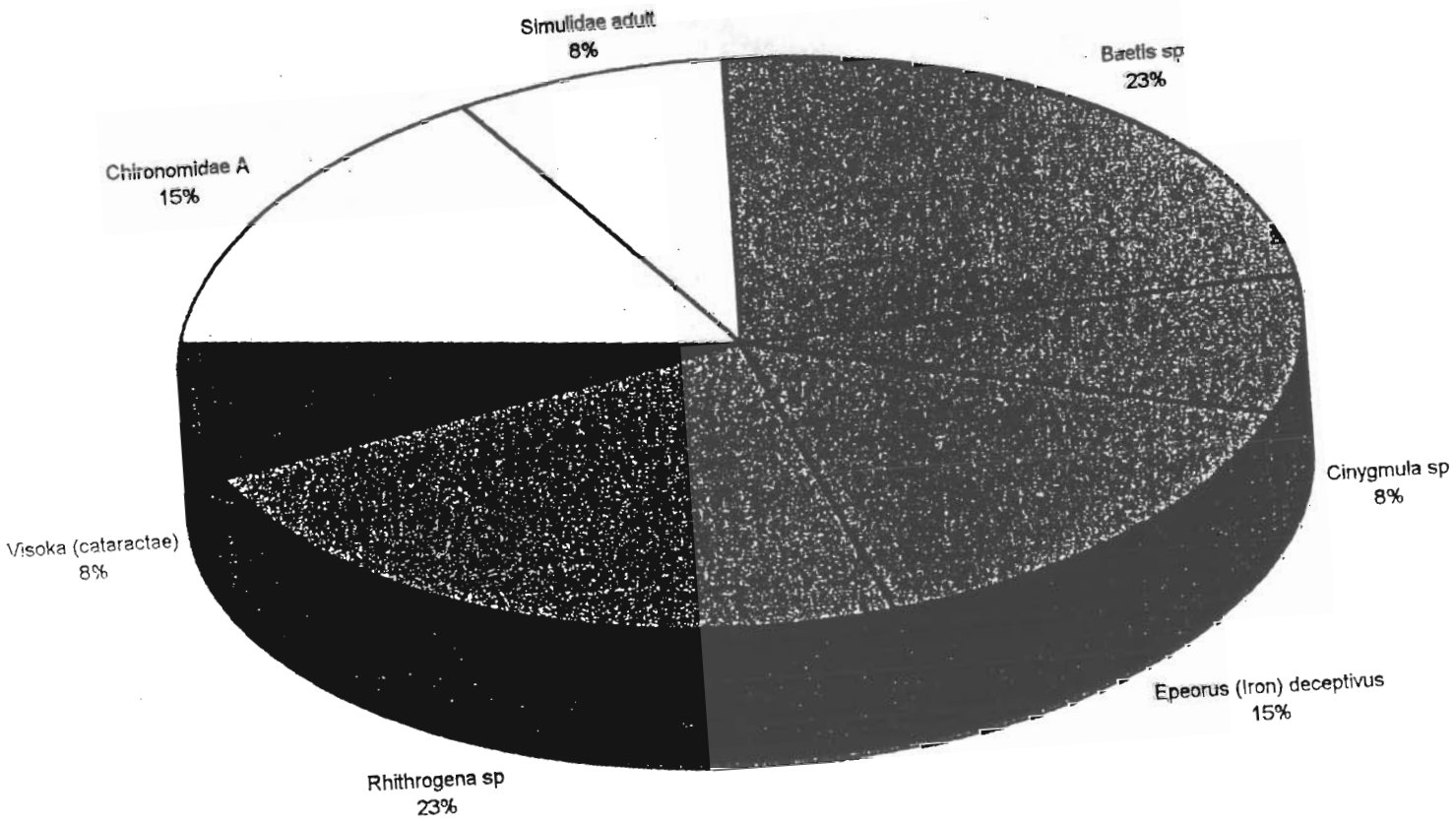


Figure 52

Brohm Creek reach # 24

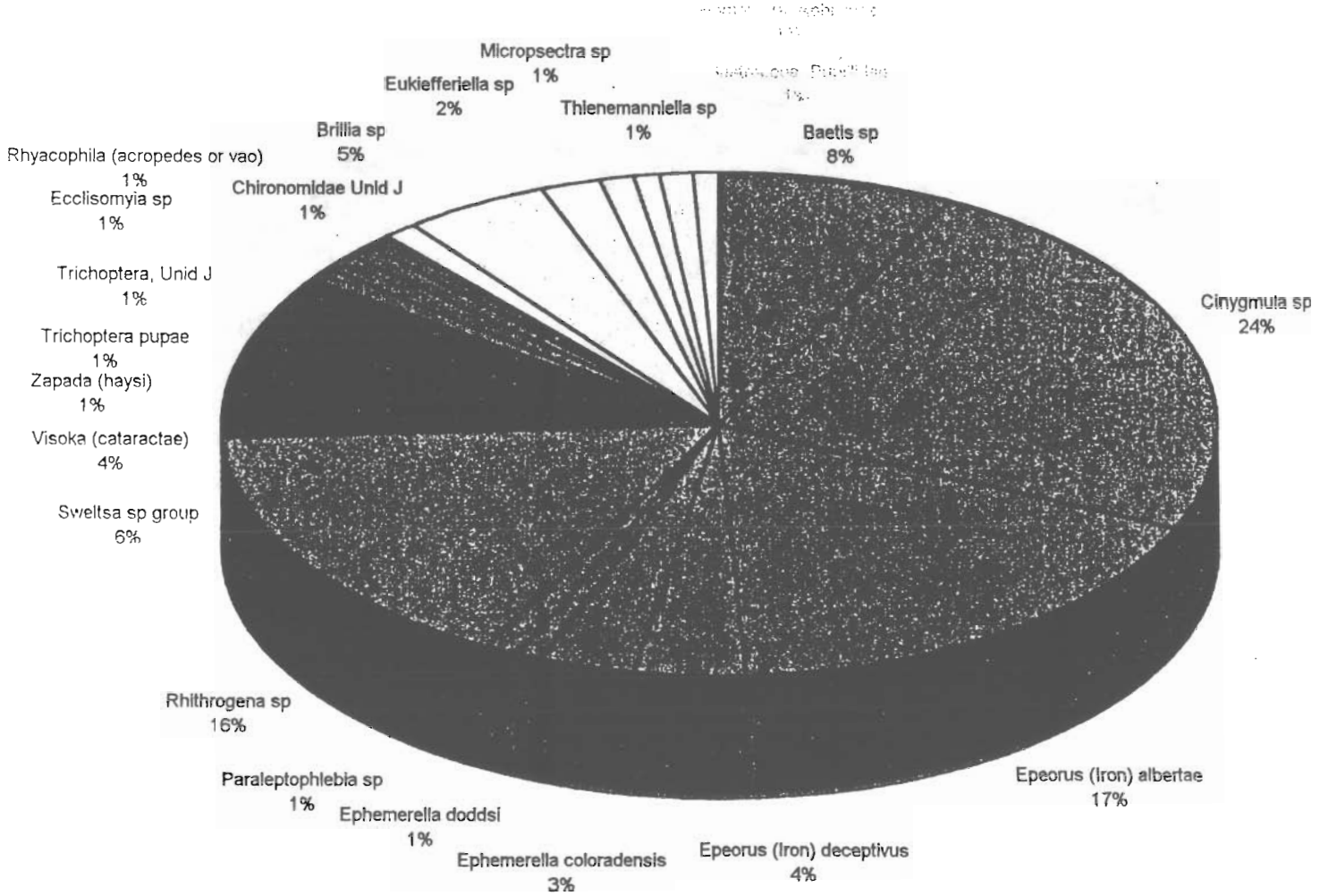


Figure 53

DATA SHEET 1: SUMMARY OF STREAM SEGMENT ASSESSMENTS (From Air Photos)

PROJ ID #		WATERCOURSE NAME: Chance Creek				AIR PHOTO INFORMATION: 30BCC94116 # 85-89							
DATE (YMD):			CREW: Squamish										
REACH #	OPENING #	SEGMENT #	SEGMENT LENGTH (m)	STREAM CLASS	RMA WIDTH (m	RVC VEG. CLASS	BGC ZONE/ SUBZONE	SITE SERIES	STRUCTURA STAGE	YEARS SINCE HARVEST	RVC LABEL	CANOPY COVER CLASS	OBSERVATIONS
5	1	A	662	S2	50	IBm	CWHds1	05	PS	21	IBmAct Dr[Cw]	5 (<20%)	
6	1	B	121	S2	50	IBm	CWHds1	05/06	PSd	21	IBmHw [BaCw]	5 (<20%)	
4	1	R	130	S2	50	3B	CWHds1	01	SHRts	~ 10	3B Dr [BaCwHw]	2 (70-89 %)	
14	2	R	145	S3	40	IBm	CWHds1	05	SHRIs	~ 10	IBm Ba[CwHw]	5 (<20%)	
14	2	L	145	S3	40	3B	CWHds1	06/12	SHRIs	~ 10	3B Cw[BaHw]	5 (<20%)	
14	3	R	373	S3	40	1Am	CWHds1	05/07	SHRIs	~ 10	1Am Ba [HwCw]	5 (<20%)	
14	3	L	373	S3	40	1Am	CWHds1	05/07	SHRIs	~ 10	1Am Ba [HwCw]	5 (<20%)	
15	4	R	199	S3	40	1Am	CWHds1	01/05	SHRIs	~ 10	1Am Ba [HwCwDr]	5 (<20%)	
15	4	L	199	S3	40	1Am	CWHds1	01/05	SHRIs	~ 10	1Am Dr[BaHwCw]	3 (40-69%)	
	TRIB	R	325	S4	20	1Am	CWHds1	07/12	SHRIs	~ 10	1Am Ba [HwDr]	5 (<20%)	
	TRIB	L	325	S4	20	1Am	CWHds1	07/12	SHRIs	~ 10	1Am Ba [HwDr]	5 (<20%)	

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 1)

WATERCOURSE NAME:	Chance
OPENING NAME:	1A
CREW:	RAP - Squamish
DATE(YMD):	96/07/12

STREAM SHADING				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Stream shading class	3	H	M	L
Biogeoclimatic zone*	2	others	ICH,CDF	BG,PP,IDF
Stream classification	3	S1	S2	S3,S4,S5,S6
Aspect of stream segment	5	NE-NW	NE-SE/NW-SW	SE-SW
TOTAL SCORE (max=25)	13			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	H			

* NOTE: biogeoclimatic zone should be double (i.e., 2, 6 or 10)

LARGE WOODY DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Layer 1A	1	>150	51-150	<50
Layer 1B	1	>100	50-100	<50
Layer 2	1	>200	75-200	<75
Layer 3	1	>400	200-400	<200
Layer 4	1	>600	300-600	<300
Stream classification*	10	S1	S5,S6	S2,S3,S4
TOTAL SCORE (max=35)	15			
OVERALL IMPACT (L=<17, M=17-23, H=24-28, VH>28	L			

* NOTE: stream class should be doubled (i.e., 2, 6 or 10)

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 2)

SMALL ORGANIC DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Relative effectiveness class	1	H,VH	M	L,VL
Change class*	2	Ci/Cn or Di/Dn	Cd and Di	Cd and Dd
Stream classification	3	S1	S2	S3,S4,S5,S6
TOTAL SCORE (max=20)	4			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: change class should be doubled (i.e., 2, 6 or 10)

SURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Surface filtering capacity	1	H	M	L
EITHER: RMA terrain stability class	n/a	1,2	3	4,5
OR: RMA slope class*	1	<35%	36-70%	>70%
Upslope sediment sources	1	none	few	significant
TOTAL SCORE (max=20)	3			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: either terrain stability class OR slope class should be doubled, but not both

SUBSURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Subsoil chemical filtering capacity class	1	H,VH	M	L,VL
Management area slope class	1	<35%	36-70%	>70%
Upslope chemical sources*	2	none	potentially	yes
TOTAL SCORE (max=20)	4			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: upslope chemical sources should be doubled (i.e., 2, 6 or 10)

DATA SHEET 4: SUMMARY OF OVERALL IMPACT SCORES (FROM DATA SHEET 2 FOR EACH STREAM SEGMENT)

WATERCOUSE NAME Chance creek				CREW: RAP			DATE (YMD): 96/07/29		
REACH #	OPENING #	SEGMENT #	STREAM SHADING	LARGE WOODY DEBRIS	SMALL ORGANIC DEBRIS	SURFACE SILTERING	SUBSOIL FILTERING	TOTAL SCORE	COMMENTS AND RECOMMENDATIONS FOR SITE VISITS BY SPECIALISTS
4	1R	1R	M (9)	H (23)	M (8)	L (6)	L (6)	52	
5	1A	1A	H (13)	L (15)	L (4)	L (3)	L (4)	39	
6	1B	1B	H (15)	L (15)	M (8)	L (4)	L (6)	48	
14	2R	2R	H (15)	VH (31)	M (12)	L (6)	L (6)	70	
14	2L	2L	H (15)	H (23)	M (12)	L (6)	L (6)	62	
14	3R	3R	H	H	M	L	M	68	
14	3L	3L	H (15)	VH (31)	M (12)	L (6)	M (8)	72	
15	4R	4R	H (15)	H (27)	M (8)	L (6)	L (6)	62	
15	4L	4L	H (15)	H (27)	M (8)	L (6)	L (6)	62	
NA	NA	TRIB R	M (15)	H (25)	L (8)	L (4)	L (6)	58	
NA	NA	TRIB L	M (15)	VH (29)	L (8)	L (4)	L (6)	62	

DATA SHEET 5: LARGE WOODY DEBRIS PLOT ASSESSMENT TABLE for 1/100 ha (10X10m plots)

WATERCOURSE: Chance		DATE (YMD)96/07/22	SURVEYOR:Micheal G.		PAGE _1__ OF 1
REACH #: 5		OPENING 1A	SEGMENT		SEGMENT LENGTH:250m
PLOT #	LAYER 1A (>22 cm)	LAYER 1B (>12.5, <22 cm)	LAYER 2 (>7.5, <12.5 CM)	LAYER 3 (0-<7.5 cm)	LAYER 4 (O, height=<1.3M)
1					
2					
3					
4	5	5	6	34	1
5	4	4	8	89	7
6	0	0	3	14	11
7					
8					
9					
10					
TOTALS:	9	9	17	137	19
total # plots:	3	3	3	3	3

PRESENT LWD STOCKING:	300
FUTURE LWD STOCKING:	300
FUTURE LWD STOCKING:	567
FUTURE LWD STOCKING:	4567
FUTURE LWD STOCKING:	633
TOTAL FUTURE LWD STOCKING:	6067

NOTES/COMMENTS:

STREAM: Chance REACH #: 5	DATE:(Y/M/D/H/M): 96/07/17/10/30 OPENIN 1A		BANK: L PLOT #: 4	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES	Alnus rubra			GENERAL CONDITION OF RIPARIAN ZONE: Alder stand, lots of dead wood Lots of organic material rotting
DOMINANT TREES	Alnus rubra			
MAIN CANOPY TREES				SOIL DESCRIPTIONS: Lots of organic material
SERAL TREES	Thuja plicata			
				SUBSTRATE (%): Lots organic debris
TOTAL TREES: % COVER:	60%			DECAYING WOOD: 15 BEDROCK: 1 MINERAL SOIL: 0 ORGANIC MATTER: 85 WATER: 0
TALL SHRUBS				APSECT OF PLOT: SITE SERIES: CWHms1/04/05/06/11
SHORT SHRUBS	Oplopanax horridus Rubus spectabilis Rubus parviflorus Ribes bracteosum Ameliancher alnifolia			OTHER COMMENTS: Side channel and pond on rear and upstream side of plot, ie/ water on 3 sides of plot
TOTAL SHRUBS: % COVER:	30%			
HERBS	Athyrium felix-femina Epilobium angustifolium Gymnocarpium dryopteris			
TOTAL HERBS: % COVER:	3%			
% COVER TOTAL VEGETATION:	93%			

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: 5	DATE:(Y/M/D/H/M): 96/07/16 OPENING 1A		BANK: L PLOT #: 5	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: Tall alders- shrubby below but fairly clear lots of LWD in stream - alders overhanging bank Deep pool in front of plot
DOMINANT TREES	Alnus rubra			
MAIN CANOPY TREES	Alnus rubra Populus balsamifera			SOIL DESCRIPTIONS: Lots of sand Strip of rocks- old stream channel? Humus under vegetation
SERAL TREES	Thuja plicata Tsuga heterophylla Chamaecyparis nootkatensis Pseudotsuga menziesii			SUBSTRATE (%):
TOTAL TREES: % COVER: 60%				DECAYING WOOD: 15 BEDROCK: 10 MINERAL SOIL: 25 ORGANIC MATTER: 50 WATER: 0
TALL SHRUBS	Salix scouleriana Viburnum edule Lonicera involucrata			APSECT OF PLOT: SITE SERIES: CWHms1/04/06
SHORT SHRUBS	Cirsium vulgare Rubus parviflorum Rubus spectabilis Rubus leucodermis Oplopanux horridus Vaccinium ovalifolium Ribes bracteosum			OTHER COMMENTS: unidentified grasses and mustards
TOTAL SHRUBS: % COVER: 5%				
HERBS	Anaphilis margaritacea Montia parifiora Aquilegia formosa Circaea alpina Gallium triflorum Epilobium angustifolium Lactuca muralis Claytonia sibirica			
TOTAL HERBS: % COVER: 5%				
% COVER TOTAL VEGETATION: 70%				

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: 5	DATE:(Y/M/D/H/M): 96/07/16 OPENING 1A		BANK: L PLOT #: 6	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	qty.			GENERAL CONDITION OF RIPARIAN ZONE: Very open- mostly fireweed No canopy, only one conifer > 3mtall Berry bushes generally smaller than other plots Lots of decaying wood
DOMINANT TREES				
MAIN CANOPY TREES	Abies amabilis			SOIL DESCRIPTIONS:
SERAL TREES	Tsuga heterophylla Thuja plicata Abies amabilis			SUBSTRATE (%):
TOTAL TREES: % COVER: 1%				DECAYING WOOD: 30 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 70 WATER: 0
TALL SHRUBS	Lonicera involucrata			APSECT OF PLOT: SE SITE SERIES: CWHms1/04/05/06
SHORT SHRUBS	Vaccinium ovalifolium Vaccinium parviflorum Ribes lacustre Rubus leucodermis Rubus parviflorum Rubus spectabilis Oplopanus horridus			OTHER COMMENTS: Channel very wide, wider than rest of the opening Heard some birds Unidentified grasses andd mustards photo 18 = channel photo 19 = plot
TOTAL SHRUBS: % COVER: 4%				
HERBS	Cornus canadensis Epilobium angustifolium Clintonia uniflora Anaphilis margaritacea Athyrium filix-femina Dryopteris expansa Lactuca muralis			
TOTAL HERBS: % COVER: 30%				
% COVER TOTAL VEGETATION: 35%				

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 1)

WATERCOURSE NAME:	Chance
OPENING NAME:	1B
CREW:	Squamish
DATE(YMD):	96/07/12

STREAM SHADING				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Stream shading class	5	H	M	L
Biogeoclimatic zone*	2	others	ICH,CDF	BG,PP,IDF
Stream classification	3	S1	S2	S3,S4,S5,S6
Aspect of stream segment	5	NE-NW	NE-SE/NW-SW	SE-SW
TOTAL SCORE (max=25)	15			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	H			

* NOTE: Biogeoclimatic zone should be doubled (i.e., 2, 6 or 10)

LARGE WOODY DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Layer 1A	1	>150	51-150	<50
Layer 1B	1	>100	50-100	<50
Layer 2	1	>200	75-200	<75
Layer 3	1	>400	200-400	<200
Layer 4	1	>600	300-600	<300
Stream classification*	10	S1	S5,S6	S2,S3,S4
TOTAL SCORE (max=35)	15			
OVERALL IMPACT (L=<17, M=17-23, H=24-28, VH>28	L			

* NOTE: stream class should be doubled (i.e., 2, 6 or 10)

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 2)

SMALL ORGANIC DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Relative effectiveness class	3	H,VH	M	L,VL
Change class*	2	Ci/Cn or Di/Dn	Cd and Di	Cd and Dd
Stream classification	3	S1	S2	S3,S4,S5,S6
TOTAL SCORE (max=20)	8			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	M			

* NOTE: change class should be doubled (i.e., 2, 6 or 10)

SURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Surface filtering capacity	1	H	M	L
EITHER: RMA terrain stability class	na	1,2	3	4,5
OR: RMA slope class*	2	<35%	36-70%	>70%
Upslope sediment sources	1	none	few	significant
TOTAL SCORE (max=20)	4			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: either terrain stability class OR slope class should be doubled, but not both

SUBSURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Subsoil chemical filtering capacity class	3	H,VH	M	L,VL
Management area slope class	1	<35%	36-70%	>70%
Upslope chemical sources*	2	none	potentially	yes
TOTAL SCORE (max=20)	6			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: upslope chemical sources should be doubled (i.e., 2, 6 or 10)

DATA SHEET 5: LARGE WOODY DEBRIS PLOT ASSESSMENT TABLE for 1/100 ha (10X10m plots)

WATERCOURSE: Chance		DATE (YMD)96/07/22	SURVEYOR:Michael G.		
REACH #:	6	OPENING 1B	SEGMENT		SEGMENT LENGTH:120m
PLOT #	LAYER 1A (>22 cm)	LAYER 1B (>12.5, <22 cm)	LAYER 2 (>7.5, <12.5 CM)	LAYER 3 (0-<7.5 cm)	LAYER 4 (O, height=<1.3M)
1					
2					
3					
4					
5					
6					
7					
8	0	2	19	128	5
9	0	0	12	37	14
10	6	4	2	5	1
TOTALS:	6	6	33	170	20
total # plots:	3	3	3	3	3

PRESENT LWD STOCKING:	200
FUTURE LWD STOCKING:	200
FUTURE LWD STOCKING:	1100
FUTURE LWD STOCKING:	5667
FUTURE LWD STOCKING:	667
TOTAL FUTURE LWD STOCKING:	7633

NOTES/COMMENTS:

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: 6	DATE:(Y/M/D/H/M): 96/07/15/10/40 OPENING 1B		BANK: L PLOT #: 7	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: Very healthy, alder stand, 5-10cm canopy Lots of dead wood Stream edge of plot dense shrubs rear of plot, open grass and alder
DOMINANT TREES	Alnus rubra			
MAIN CANOPY TREES	Alnus rubra			SOIL DESCRIPTIONS: Lots of organic matter
SERAL TREES	Thuja plicata Abies amabilis			SUBSTRATE (%):
TOTAL TREES: % COVER: 75%				DECAYING WOOD: 10 BEDROCK: 1 MINERAL SOIL: 0 ORGANIC MATTER: 90 WATER: 0
TALL SHRUBS	Rubus parviflorum Rubus spectabilis Cornus stolonifera Oplopanux horridus			APSECT OF PLOT: SE SITE SERIES: CWHms1/06
SHORT SHRUBS	Aruncus dioicus Ribes lacustre Vaccinium ovalifolium Actaea rubra			OTHER COMMENTS: Lots of grass, few species
TOTAL SHRUBS: % COVER: 5%				
HERBS	Claytonia sibirica Dicentra formosa Galium aparine Circaea alpina Athyrium felix-femina Lactuca muralis Epilobium angustifolium Streptopus amplexifolius Anaphilis margaritacea Asarum caudatum			
TOTAL HERBS: % COVER: 10%				
% COVER TOTAL VEGETATION:				

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: 6	DATE:(Y/M/D/H/M): 96/07/15/9/15 OPENING: 1B		BANK: L PLOT #: 8	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: Healthy 5-10m overstory alder, very few understory conifers Medium shrub cover on stream conifers end of plot Quite heavily shaded, little understory (but several sun spots)
DOMINANT TREES	Alnus rubra	69		
MAIN CANOPY TREES	Alnus rubra			SOIL DESCRIPTIONS: Thick litter layer, no mineral soil exposed
SERAL TREES	Thuja plicata Tsuga heterophylla Abies amabilis	1		SUBSTRATE (%):
TOTAL TREES: % COVER: 70%				DECAYING WOOD: 15 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 85 WATER: 0
TALL SHRUBS	Rubus parviflorus Sambucus racemosa Salix scouleriana Oplopanux horridus			APSECT OF PLOT: SE SITE SERIES: CWHms1/06
SHORT SHRUBS	Ribes lacustre Rubus spectabilis Aruncus dioicus Vaccinium uliginosum			OTHER COMMENTS: Un- identified blueberry?, no flowers/fruit Saw very large black bear on right bank ~100 ft from bank in clearing * 3 massive cedar stumps DBH (108, 115, 132)
TOTAL SHRUBS: % COVER: 5%				
HERBS	Smilacena stellata Cornus canadensis Epilobium angustifolium Galium trifolium Streptopus amplexifolius Tiarella trifoliata Dicentra formosa Lactuca muralis Athyrium felix-femina Claytonia sibirica			
TOTAL HERBS: % COVER: 5%				
% COVER TOTAL VEGETATION: 85%				

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: 6	DATE:(Y/M/D/H/M): 96/07/12/1/25 OPENING: 1B		BANK: L PLOT #: 9	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: Dense vegetation Good successional growth, tall alders (>10m) with fir understory Thick shrub cover, mostly shaded in plot
DOMINANT TREES	Alnus rubra			
MAIN CANOPY TREES	Tsuga heterophylla Abies amabilis			SOIL DESCRIPTIONS: Organic , lots of litter and twigs/wood
SERAL TREES	Thuja plicata			
				SUBSTRATE (%):
TOTAL TREES: % COVER: 35%				DECAYING WOOD: 20 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 80 WATER: 0
TALL SHRUBS	Oplopanax horridus Lonicera involucrata Salix scouleriana			APSECT OF PLOT: SE SITE SERIES: CWHms1/04
SHORT SHRUBS	Rubus parviflorus Ribes lacustre Aruncus dioicus Rubus spectabilis Vaccinium parviflorum			OTHER COMMENTS: Wide channel- lots of riffle Water shallow ie/ <1ft. deep and cold
TOTAL SHRUBS: % COVER: 60%				
HERBS	Epilobium angustifolium Anaphilis margaritacea Viola canadensis Tiarella trifoliata Smilacina racemosa Gallium triflorum Athyrium felix-femina Lactuca muralis			
TOTAL HERBS: % COVER: 5%				
% COVER TOTAL VEGETATION: 100%				

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: 6	DATE:(Y/M/D/H/M): 96/07/12/11/30 OPENING 1B		BANK: L PLOT #: 10	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: Healthy, wekk vegetated Lots of trees Lots of organic matter Plot starts at top of bank ~1.5m above stream, all rocks below
DOMINANT TREES	Alnus rubra			
MAIN CANOPY TREES	Thuja plicata Abies amabilis			SOIL DESCRIPTIONS: Very organic & humusy Lots of litter and dead wood
SERAL TREES	Abies grandis			
TOTAL TREES: % COVER: 10%				SUBSTRATE (%):
TALL SHRUBS	Oplopanax horridus Sambucus racemosa			DECAYING WOOD: 25 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 75 WATER: 0
SHORT SHRUBS	Rubus parviflorus Rubus spectabilis Ribes lacustre			APSECT OF PLOT: SSE 150 SITE SERIES: CWHms1/04/06
TOTAL SHRUBS: % COVER: 80%				OTHER COMMENTS: Heard some birds Lots of riffle- stream has lots of room to meander
HERBS	Smilacina racemosa Dicentra formosa Viola canadensis Tiarella trifoliata Athyrium filix-femina Anaphilis margaritacea Polystichum munitum Circaea alpina Gallium triflorum Osmorhiza chilensis			
TOTAL HERBS: % COVER: 10%				
% COVER TOTAL VEGETATION: 100%				

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 1)

WATERCOURSE NAME:	Chance
OPENING NAME:	1R
CREW:	Squamish
DATE(YMD):	96/07/22

STREAM SHADING				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Stream shading class	1	H	M	L
Biogeoclimatic zone*	2	others	ICH,CDF	BG,PP,IDF
Stream classification	3	S1	S2	S3,S4,S5,S6
Aspect of stream segment	3	NE-NW	NE-SE/NW-SW	SE-SW
TOTAL SCORE (max=25)	9			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	M			

* NOTE: biogeoclimatic zone should be doubled (i.e., 2, 6 or 10)

LARGE WOODY DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Layer 1A	3	>150	51-150	<50
Layer 1B	3	>100	50-100	<50
Layer 2	5	>200	75-200	<75
Layer 3	1	>400	200-400	<200
Layer 4	1	>600	300-600	<300
Stream classification*	10	S1	S5,S6	S2,S3,S4
TOTAL SCORE (max=35)	23			
OVERALL IMPACT (L=<17, M=17-23, H=24-28, VH>28	H			

* NOTE: stream class should be doubled (i.e., 2, 6 or 10)

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 2)

SMALL ORGANIC DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Relative effectiveness class	3	H,VH	M	L,VL
Change class*	2	Ci/Cn or Di/Dn	Cd and Di	Cd and Dd
Stream classification	3	S1	S2	S3,S4,S5,S6
TOTAL SCORE (max=20)	8			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	M			

* NOTE: change class should be doubled (i.e., 2, 6 or 10)

SURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Surface filtering capacity	3	H	M	L
EITHER: RMA terrain stability class	na	1,2	3	4,5
OR: RMA slope class*	2	<35%	36-70%	>70%
Upslope sediment sources	1	none	few	significant
TOTAL SCORE (max=20)	6			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: either terrain stability class OR slope class should be doubled, but not both

SUBSURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Subsoil chemical filtering capacity class	3	H,VH	M	L,VL
Management area slope class	1	<35%	36-70%	>70%
Upslope chemical sources*	2	none	potentially	yes
TOTAL SCORE (max=20)	6			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: upslope chemical sources should be doubled (i.e., 2, 6 or 10)

DATA SHEET 5: LARGE WOODY DEBRIS PLOT ASSESSMENT TABLE for 1/100 ha (10X10m plots)

WATERCOURSE: Chance		DATE (YMD)96/07/22	SURVEYOR:Micheal G		
REACH #: 6		OPENING 1R	SEGMENT		SEGMENT LENGTH:130m
PLOT #	LAYER 1A (>22 cm)	LAYER 1B (>12.5, <22 cm)	LAYER 2 (>7.5, <12.5 CM)	LAYER 3 (0-<7.5 cm)	LAYER 4 (O, height=<1.3M)
1	3	1	0	5	20
2	0	0	1	3	71
3	0	1	0	8	58
4					
5					
6					
7					
8					
9					
10					
TOTALS:	3	2	1	16	149
total # plots:	3	3	3	3	3
PRESENT LWD STOCKING:		100			
FUTURE LWD STOCKING:		67			
FUTURE LWD STOCKING:		33			
FUTURE LWD STOCKING:		533			
FUTURE LWD STOCKING:		4967			
TOTAL FUTURE LWD STOCKING:		5600			
NOTES/COMMENTS:					

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: 6	DATE:(Y/M/D/H/M): 96/07/17/1/30 OPENING 1R		BANK: R PLOT #: 1	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES	Tsuga heterophylla 2			GENERAL CONDITION OF RIPARIAN ZONE: On steep slope, lots of moss and short shrubs Fringe of veteran trees alnog edge of stream Lots of hemlock seedlings
DOMINANT TREES	Tsuga heterophylla			
MAIN CANOPY TREES	Tsuga heterophylla			SOIL DESCRIPTIONS: Lots of organic matter, moss
SERAL TREES	Abies amabilis Tsuga heterophylla			SUBSTRATE (%):
TOTAL TREES: % COVER: 7%				DECAYING WOOD: 10 BEDROCK: 1 MINERAL SOIL: 0 ORGANIC MATTER: 89 WATER: 0
TALL SHRUBS				APSECT OF PLOT: 250 SW SITE SERIES: CWHms1/04
SHORT SHRUBS	Menziesia ferruginea Vaccinium membracnaceum Linnaea borealis			OTHER COMMENTS: Leave strip not included in plot On edge of waterfall Log jam has blocked channel and diverted stream
TOTAL SHRUBS: % COVER: 40%				
HERBS	Cornus canadensis Epilobium angustifolium			
TOTAL HERBS: % COVER: 1				
% COVER TOTAL VEGETATION: 48%				

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: 6	DATE:(Y/M/D/H/M): OPENING 1R		BANK: R PLOT #: 2	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: Steep bank, strip of veteran trees along stream Lots of seedlings/saplings and huckleberry and moss
DOMINANT TREES	Abies amabilis Tsuga heterophylla			
MAIN CANOPY TREES				SOIL DESCRIPTIONS: Lots of organic matter, moss, dead wood
SERAL TREES	Thuja plicata Pseudotsuga menziesii Abies amabilis			SUBSTRATE (%):
TOTAL TREES: % COVER: 15%				DECAYING WOOD: 9 BEDROCK: 1 MINERAL SOIL: 0 ORGANIC MATTER: 90 WATER: 0
TALL SHRUBS				APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Vaccinium membranaceum Vaccinium parviflorum Linnaea borealis			OTHER COMMENTS: Leave strip not included in plot only 5m wide
TOTAL SHRUBS: % COVER: 40%				
HERBS	Epilobium angustifollium Cornus canadensis			
TOTAL HERBS: % COVER: 5%				
% COVER TOTAL VEGETATION: 60%				

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: 6	DATE:(Y/M/D/H/M): 96/07/17/2/30 OPENING 1R		BANK R PLOT #: 3	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES	Tsuga heterophylla 1			GENERAL CONDITION OF RIPARIAN ZONE: Very steep slope, lots of shrubs on edge of leave strip
DOMINANT TREES	Tsuga heterophylla			
MAIN CANOPY TREES				SOIL DESCRIPTIONS: Lots of organic debris
SERAL TREES	Tsuga heterophylla Abies amabilis Thuja plicata			SUBSTRATE (%):
TOTAL TREES: % COVER: 25%				DECAYING WOOD: 20 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 80 WATER: 0
TALL SHRUBS	Acer glabrum			APSECT OF PLOT: SW SITE SERIES: CWHms1/04
SHORT SHRUBS	Linnaea borealis Vaccinium membranaceum Vaccinium parviflorum Juniperus communis			OTHER COMMENTS: Birds Plot on edge of leave strip Too steep to log
TOTAL SHRUBS: % COVER: 60%				
HERBS	Epilobium angustifolium Cornus canadensis Aruncus dioicus			
TOTAL HERBS: % COVER: 10%				
% COVER TOTAL VEGETATION: 90%				

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 1)

WATERCOURSE NAME:	Chance
OPENING NAME:	2L
CREW:	Squamish
DATE(YMD):	96/07/18

STREAM SHADING				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Stream shading class	5	H	M	L
Biogeoclimatic zone*	2	others	ICH,CDF	BG,PP,IDF
Stream classification	5	S1	S2	S3,S4,S5,S6
Aspect of stream segment	3	NE-NW	NE-SE/NW-SW	SE-SW
TOTAL SCORE (max=25)	15			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	H			

*NOTE: biogeoclimatic zone should be doubled (i.e., 2, 6 or 10)

LARGE WOODY DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Layer 1A	1	>150	51-150	<50
Layer 1B	5	>100	50-100	<50
Layer 2	5	>200	75-200	<75
Layer 3	1	>400	200-400	<200
Layer 4	1	>600	300-600	<300
Stream classification*	10	S1	S5,S6	S2,S3,S4
TOTAL SCORE (max=35)	23			
OVERALL IMPACT (L=<17, M=17-23, H=24-28, VH>28	H			

*NOTE: stream class should be doubled (i.e., 2, 6 or 10)

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 2)

SMALL ORGANIC DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Relative effectiveness class	5	H,VH	M	L,VL
Change class*	2	Ci/Cn or Di/Dn	Cd and Di	Cd and Dd
Stream classification	5	S1	S2	S3,S4,S5,S6
TOTAL SCORE (max=20)	12			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	M			

*NOTE: change class should be doubled (i.e., 2, 6 or 10)

SURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Surface filtering capacity	3	H	M	L
EITHER: RMA terrain stability class	2	1,2	3	4,5
OR: RMA slope class*	na	<35%	36-70%	>70%
Upslope sediment sources	1	none	few	significant
TOTAL SCORE (max=20)	6			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

*NOTE: either terrain stability class OR slope class should be doubled, but not both

SUBSURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Subsoil chemical filtering capacity class	3	H,VH	M	L,VL
Management area slope class	1	<35%	36-70%	>70%
Upslope chemical sources*	2	none	potentially	yes
TOTAL SCORE (max=20)	6			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

*NOTE: upslope chemical sources should be doubled (i.e., 2, 6 or 10)

DATA SHEET 5: LARGE WOODY DEBRIS PLOT ASSESSMENT TABLE for 1/100 ha (10X10m plots)

WATERCOURSE: Chance		DATE (YMD)96/07/22	SURVEYOR:Michael G.		PAGE 1 OF 1
REACH #:		OPENING 2L	SEGMENT		SEGMENT LENGTH:145m
PLOT #	LAYER 1A (>22 cm)	LAYER 1B (>12.5, <22 cm)	LAYER 2 (>7.5, <12.5 CM)	LAYER 3 (0-<7.5 cm)	LAYER 4 (O, height=<1.3M)
1	7	1	4	40	73
2	0	0	0	0	106
3	0	0	0	10	27
4	0	0	0	0	14
5					
6					
7					
8					
9					
10					
TOTALS:	7	1	4	50	220
total # plots:	4	4	4	4	4

PRESENT LWD STOCKING:	175
FUTURE LWD STOCKING:	25
FUTURE LWD STOCKING:	100
FUTURE LWD STOCKING:	1250
FUTURE LWD STOCKING:	5500
TOTAL FUTURE LWD STOCKING:	6875

NOTES/COMMENTS:

DATA SHEET 5: LARGE WOODY DEBRIS PLOT ASSESSMENT TABLE for 1/100 ha (10X10m plots)

WATERCOURSE: Chance		DATE (YMD)96/07/22	SURVEYOR:Michael G.		PAGE 1 OF 1
REACH #:	14	OPENING 2L	SEGMENT		SEGMENT LENGTH:145m
PLOT #	LAYER 1A (>22 cm)	LAYER 1B (>12.5, <22 cm)	LAYER 2 (>7.5, <12.5 CM)	LAYER 3 (0-<7.5 cm)	LAYER 4 (O, height=<1.3M)
1	7	1	4	40	73
2	0	0	0	0	106
3	0	0	0	10	27
4	0	0	0	0	14
5					
6					
7					
8					
9					
10					
TOTALS:	7	1	4	50	220
total # plots:	4	4	4	4	4

PRESENT LWD STOCKING:	175
FUTURE LWD STOCKING:	25
FUTURE LWD STOCKING:	100
FUTURE LWD STOCKING:	1250
FUTURE LWD STOCKING:	5500
TOTAL FUTURE LWD STOCKING:	6875

NOTES/COMMENTS:

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: 14	DATE:(Y/M/D/H/M): 96/07/22 OPENING 2L		BANK: L PLOT #: 1	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: flat area, logged to edge shrub covered
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: Lots of organic matter
SERAL TREES	Thuja plicata Abies amabilis Tsuga heterophylla Alnus rubra			SUBSTRATE (%):
TOTAL TREES: % COVER:	20			DECAYING WOOD: 15 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 85 WATER: 0
TALL SHRUBS				APSECT OF PLOT: SITE SERIES:
SHORT SHRUBS	Menziesia ferruginea Vaccinium membraneceum			OTHER COMMENTS: Cap crew warned of bears coming this way over radio
TOTAL SHRUBS: % COVER:	30			
HERBS	Epilobium angustifolium Lysichition americanum Cornuc canadensis Clintonia uniflora Athyrium filix-femina Tiarella trifoliata			
TOTAL HERBS: % COVER:	20			
% COVER TOTAL VEGETATION:				

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance	DATE:(Y/M/D/H/M): 96/07/22	BANK: L	
REACH #: 14	OPENING: 2L	PLOT #: 1	

VEGETATION STRATUM	SPECIES	qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Thuja plicata	1			GENERAL CONDITION OF RIPARIAN ZONE: Lots of moss
	Tsuga mertensiana	4			
	Abies amabilis	2			
DOMINANT TREES					
MAIN CANOPY TREES					SOIL DESCRIPTIONS: Very organic , thick humus
SERAL TREES	Tsuga heterophylla				
	Alnus rubra				SUBSTRATE (%):
TOTAL TREES: % COVER: 40%					DECAYING WOOD: 50
TALL SHRUBS	Menziesia ferruginea				BEDROCK: 10
					MINERAL SOIL: 0
					ORGANIC MATTER: 65
					WATER: 20
SHORT SHRUBS	Rubus pedatus				APSECT OF PLOT: SE
	Vaccinium membrancaceum				SITE SERIES:
	Rubus spectabilis				OTHER COMMENTS:
	Vaccinium parvifolium				
	Veratrum viride				
	Lysichiton americanum				
TOTAL SHRUBS: % COVER: 30%					
HERBS	Streptopus amplexifolius				
	Athyrium filix-femina				
	Streptopus roseus				
	Cornus canadensis				
TOTAL HERBS: % COVER:					
% COVER TOTAL VEGETATION:					

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance	DATE:(Y/M/D/H/M): 96/07/22	BANK: L	
REACH #:	OPENING: 2L	PLOT #: 3	

VEGETATION STRATUM	SPECIES	qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES					GENERAL CONDITION OF RIPARIAN ZONE: logged to edge lots of dead wood shrubs
DOMINANT TREES					
MAIN CANOPY TREES					SOIL DESCRIPTIONS: lots of organic debris
SERAL TREES	Abies amabilis Thuja plicata Tsuga heterophylla				SUBSTRATE (%):
TOTAL TREES: % COVER:			5		DECAYING WOOD: 25 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 75 WATER: 0
TALL SHRUBS					APSECT OF PLOT: SE SITE SERIES:
SHORT SHRUBS	Rubus spectabilis Vaccinium ovalifolium Vaccinium membraneceum Menziesia ferruginea				OTHER COMMENTS:
TOTAL SHRUBS: % COVER:			25		
HERBS	Athyrium filix-femina Senecio triangularis Tiarella trifoliata Leptarrhena pyrolifolia Cornus canadensis				
TOTAL HERBS: % COVER:			20		
% COVER TOTAL VEGETATION:					

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance	DATE:(Y/M/D/H/M): 96/07/22	BANK: L	
REACH #:	OPENING: 2L	PLOT #: 4	

VEGETATION STRATUM	SPECIES	qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES					GENERAL CONDITION OF RIPARIAN ZONE:
DOMINANT TREES					lots of fireweed (>30%) cover very few trees, all very small, early successional stage logged to bank lots of dead wood
MAIN CANOPY TREES	Thuja plicata				SOIL DESCRIPTIONS:
SERAL TREES	Abies amabilis Tsuga heterophylla Thuja plicata Alnus rubra				organic soil - very dry
TOTAL TREES: % COVER:		1			SUBSTRATE (%):
TALL SHRUBS					DECAYING WOOD: 50 BEDROCK: 2 MINERAL SOIL: 0 ORGANIC MATTER: 48 WATER: 0
SHORT SHRUBS	Rubus spectabilis Rubus pedatus Vaccinium membraneceum Menziesia ferruginea				APSECT OF PLOT: SE SITE SERIES: OTHER COMMENTS: lots of sunlight, south facing slope
TOTAL SHRUBS: % COVER:		10			
HERBS	Epilobium angustifolium Clintonia uniflora Streptopus roseus Cornus canadensis Blechnum spicant Tiarella trifoliatum Epilobium hornimanii Athyrium filix-femina				
TOTAL HERBS: % COVER:		30			
% COVER TOTAL VEGETATION:		41			

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 1)

WATERCOURSE NAME:	Chance
OPENING NAME:	2R
CREW:	Squamish
DATE(YMD):	96/07/18

STREAM SHADING				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Stream shading class	5	H	M	L
Biogeoclimatic zone*	2	others	ICH,CDF	BG,PP,IDF
Stream classification	5	S1	S2	S3,S4,S5,S6
Aspect of stream segment	3	NE-NW	NE-SE/NW-SW	SE-SW
TOTAL SCORE (max=25)	15			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	H			

*NOTE: biogeoclimatic zone should be doubled (i.e., 2, 6 or 10)

LARGE WOODY DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Layer 1A	5	>150	51-150	<50
Layer 1B	5	>100	50-100	<50
Layer 2	5	>200	75-200	<75
Layer 3	5	>400	200-400	<200
Layer 4	1	>600	300-600	<300
Stream classification*	10	S1	S5,S6	S2,S3,S4
TOTAL SCORE (max=35)	31			
OVERALL IMPACT (L=<17, M=17-23, H=24-28, VH>28	VH			

* NOTE: stream class should be doubled (i.e., 2, 6 or 10)

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 2)

SMALL ORGANIC DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Relative effectiveness class	5	H,VH	M	L,VL
Change class*	2	Ci/Cn or Di/Dn	Cd and Di	Cd and Dd
Stream classification	5	S1	S2	S3,S4,S5,S6
TOTAL SCORE (max=20)	12			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	M			

* NOTE: change class should be doubled (i.e., 2, 6 or 10)

SURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Surface filtering capacity	3	H	M	L
EITHER: RMA terrain stability class	2	1,2	3	4,5
OR: RMA slope class*	na	<35%	36-70%	>70%
Upslope sediment sources	1	none	few	significant
TOTAL SCORE (max=20)	6			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: either terrain stability class OR slope class should be doubled, but not both

SUBSURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Subsoil chemical filtering capacity class	3	H,VH	M	L,VL
Management area slope class	1	<35%	36-70%	>70%
Upslope chemical sources*	2	none	potentially	yes
TOTAL SCORE (max=20)	6			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: upslope chemical sources should be doubled (i.e., 2, 6 or 10)

DATA SHEET 5: LARGE WOODY DEBRIS PLOT ASSESSMENT TABLE for 1/100 ha (10X10m plots)

WATERCOURSE: Chance		DATE (YMD): 96/07/22	SURVEYOR:Micheal G		PAGE 1 OF 1
REACH #: 14		OPENING 2R	SEGMENT		SEGMENT LENGTH:145m
PLOT #	LAYER 1A (>22 cm)	LAYER 1B (>12.5, <22 cm)	LAYER 2 (>7.5, <12.5 CM)	LAYER 3 (0-<7.5 cm)	LAYER 4 (O, height=<1.3M)
1	1	0	0	2	54
2	0	0	0	0	101
3	0	1	0	1	74
4	0	0	0	0	180
5					
6					
7					
8					
9					
10					
TOTALS:	1	1	0	3	409
total # plots:	4	4	4	4	4

PRESENT LWD STOCKING:	25
FUTURE LWD STOCKING:	25
FUTURE LWD STOCKING:	0
FUTURE LWD STOCKING:	75
FUTURE LWD STOCKING:	10225
TOTAL FUTURE LWD STOCKING:	10325

NOTES/COMMENTS:

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: 14	DATE:(Y/M/D/H/M): 96/07/18/1/00 OPENING: 2R		BANK: R PLOT #: 1	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES	Abies amabilis			GENERAL CONDITION OF RIPARIAN ZONE: Shrubby and healthy Veteran trees on opposite bank to provide shade Few veteran trees on edge of creek on either side
DOMINANT TREES	Abies amabilis			
MAIN CANOPY TREES	Alnus rubra			SOIL DESCRIPTIONS: Lots of oraganic matter
SERAL TREES	Abies amabilis Abies grandis Thuja plicata			SUBSTRATE (%):
TOTAL TREES: % COVER:	5%			DECAYING WOOD: 4 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 95 WATER: 0
TALL SHRUBS				APSECT OF PLOT: NW SITE SERIES:
SHORT SHRUBS	Menziesia ferruginea Vaccinium ovalifolium Rubus spectabilis			OTHER COMMENTS: Log jams across creek Junction of Chance Creek and tributary Mineral soil in stream (sand bank) Saw bear scat
TOTAL SHRUBS: % COVER:	40%			
HERBS	Cornus canadensis Gymnocarpium dryopteris Epilobium angustifolium Veratrum viride			
TOTAL HERBS: % COVER:	15%			
% COVER TOTAL VEGETATION:	60%			

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: 14	DATE:(Y/M/D/H/M): 96/07/22 OPENING: 2R		BANK: R PLOT #: 2	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: logged to edge of stream No canopy trees steep bank
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: Lots organic debris, dead wood
SERAL TREES	Abies amabilis Thuja plicata Tsuga heterophylla			SUBSTRATE (%):
TOTAL TREES: % COVER: 5%				DECAYING WOOD: 20 BEDROCK: 1 MINERAL SOIL: 0 ORGANIC MATTER: 80 WATER: 0
TALL SHRUBS				APSECT OF PLOT: NW 340 SITE SERIES:
SHORT SHRUBS	Menziesia ferruginea Vaccinium membranaceum Juniperus communis Vaccinium ovalifolium Rubus pedatus			OTHER COMMENTS: Sighted American dipper
TOTAL SHRUBS: % COVER: 20%				
HERBS	Epilobium angustifolium Streptopus amplexifolius Cornus canadensis Smilacina stellata Tiarella trifoliata			
TOTAL HERBS: % COVER: 5%				
% COVER TOTAL VEGETATION 40%				

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: 14	DATE:(Y/M/D/H/M): 96/07/22/10/55 OPENING 2R		BANK: R PLOT #: 3	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Abies amabilis 1			GENERAL CONDITION OF RIPARIAN ZONE: Early successional stage Lots of vegeatation, mostly shrubs and fireweed Logged to edge of creek, steep
DOMINANT TREES				
MAIN CANOPY TREES	Thuja plicata			SOIL DESCRIPTIONS: Organic
SERAL TREES	Tsuga heterophylla Abies amabilis Sorbus sitchensis			SUBSTRATE (%):
TOTAL TREES: % COVER: 5%				DECAYING WOOD: 10 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 88 WATER: 2
TALL SHRUBS	Menziesia ferruginea			APSECT OF PLOT: NW/W SITE SERIES:
SHORT SHRUBS	Rubus spectabilis Rubus parviflorus Rubus pedatus Juniperus communis			OTHER COMMENTS: Saw American dipper bird and rufus hummingbird heard many bird calls Small sidechannel through plots, ~ 1m wide Stream only ~ 3 m wide
TOTAL SHRUBS: % COVER: 65%				
HERBS	Epilobium angustifolium Tiarella trifoliata Clintonia uniflorum Athyrium filix-femina Blechnum spicant Streptopus roseus			
TOTAL HERBS: % COVER: 10%				
% COVER TOTAL VEGETATION 80%				

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: 14	DATE:(Y/M/D/H/M): 96/07/22 OPENING 2R		BANK: R PLOT #: 4	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: Cut to edge of stream All shrub covered dead wood very steep bank
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: Lots organic material
SERAL TREES	Alnus rubra Abies amabilis Tsuga heterophylla			
TOTAL TREES: % COVER:				SUBSTRATE (%):
TALL SHRUBS				DECAYING WOOD: 35 BEDROCK: 5 MINERAL SOIL: 0 ORGANIC MATTER: 60 WATER: 0
SHORT SHRUBS	Rubus pedatus Rubus spectabilis Vaccinium sp. Menziesia ferruginea			APSECT OF PLOT: NW SITE SERIES:
TOTAL SHRUBS: % COVER: 50%				OTHER COMMENTS: Small waterfalls and pools
HERBS	Athyrium felix-femina Tiarella trifoliata Epilobium angustifolium Orthilia secunda Blechnum spicant			
TOTAL HERBS: % COVER: 10%				
% COVER TOTAL VEGETATION:				

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 1)

WATERCOURSE NAME:	Chance
OPENING NAME:	3L
CREW:	Squamish
DATE(YMD):	96/07/25

STREAM SHADING				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Stream shading class	5	H	M	L
Biogeoclimatic zone*	2	others	ICH,CDF	BG,PP,IDF
Stream classification	5	S1	S2	S3,S4,S5,S6
Aspect of stream segment	3	NE-NW	NE-SE/NW-SW	SE-SW
TOTAL SCORE (max=25)	15			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	H			

* NOTE: biogeoclimatic zone should be double (i.e., 2, 6 or 10)

LARGE WOODY DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Layer 1A	5	>150	51-150	<50
Layer 1B	5	>100	50-100	<50
Layer 2	5	>200	75-200	<75
Layer 3	5	>400	200-400	<200
Layer 4	1	>600	300-600	<300
Stream classification*	10	S1	S5,S6	S2,S3,S4
TOTAL SCORE (max=35)	31			
OVERALL IMPACT (L=<17, M=17-23, H=24-28, VH>28	VH			

* NOTE: stream class should be doubled (i.e., 2, 6 or 10)

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 2)

SMALL ORGANIC DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Relative effectiveness class	5	H,VH	M	L,VL
Change class*	2	Ci/Cn or Di/Dn	Cd and Di	Cd and Dd
Stream classification	5	S1	S2	S3,S4,S5,S6
TOTAL SCORE (max=20)	12			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	M			

* NOTE: change class should be doubled (i.e., 2, 6 or 10)

SURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Surface filtering capacity	3	H	M	L
EITHER: RMA terrain stability class	2	1,2	3	4,5
OR: RMA slope class*	na	<35%	36-70%	>70%
Upslope sediment sources	1	none	few	significant
TOTAL SCORE (max=20)	6			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: either terrain stability class OR slope class should be doubled, but not both

SUBSURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Subsoil chemical filtering capacity class	5	H,VH	M	L,VL
Management area slope class	1	<35%	36-70%	>70%
Upslope chemical sources*	2	none	potentially	yes
TOTAL SCORE (max=20)	8			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	M			

* NOTE: upslope chemical sources should be doubled (i.e., 2, 6 or 10)

DATA SHEET 5: LARGE WOODY DEBRIS PLOT ASSESSMENT TABLE for 1/100 ha (10X10m plots)

WATERCOURSE:Chance		DATE (YMD)96/07/29	SURVEYOR:Michael G.		PAGE 1 OF 1
REACH #:		OPENING 3L	SEGMENT		SEGMENT LENGTH:373m
PLOT #	LAYER 1A (>22 cm)	LAYER 1B (>12.5, <22 cm)	LAYER 2 (>7.5, <12.5 CM)	LAYER 3 (0-<7.5 cm)	LAYER 4 (O, height=<1.3M)
1	0	0	0	0	54
2	0	0	0	0	29
3	0	0	0	2	1
4					
5					
6					
7					
8					
9					
10					
TOTALS:	0	0	0	2	84
total # plots:	3	3	3	3	3

PRESENT LWD STOCKING:	0
FUTURE LWD STOCKING:	0
FUTURE LWD STOCKING:	0
FUTURE LWD STOCKING:	67
FUTURE LWD STOCKING:	2800
TOTAL FUTURE LWD STOCKIN	2867

NOTES/COMMENTS:

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: 14	DATE:(Y/M/D/H/M): 96/07/25 OPENING: 3L		BANK: L PLOT #: 1	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: logged to edge both banks
DOMINANT TREES	Abies amabilis			
MAIN CANOPY TREES				SOIL DESCRIPTIONS: lots of organic material dry moss
SERAL TREES	Tsuga heterophylla			
				SUBSTRATE (%):
TOTAL TREES: % COVER: 10%				DECAYING WOOD: 30 BEDROCK: 2 MINERAL SOIL: 0 ORGANIC MATTER: 68 WATER: 0
TALL SHRUBS	Sorbus sitchensis			APSECT OF PLOT: SE SITE SERIES:
SHORT SHRUBS	Vaccinium ovalifolium Vaccinium membranaceum Menziesia ferruginea Rubus pedatus			OTHER COMMENTS:
TOTAL SHRUBS: % COVER: 60%				
HERBS	Cornus canadensis Epilobium angustifolium Clintonia uniflora			
TOTAL HERBS: % COVER: 5%				
% COVER TOTAL VEGETATION: 70%				

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: 14	DATE:(Y/M/D/H/M): 96/07/25 OPENING 3L		BANK: L PLOT #: 2	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: Logged to edge on both sides Steep bank
DOMINANT TREES	Abies amabilis			
MAIN CANOPY TREES				SOIL DESCRIPTIONS: Lots of organic material patches of dry dirt
SERAL TREES	Thuja plicata Tsuga heterophylla			
				SUBSTRATE (%):
TOTAL TREES: % COVER: 5%				DECAYING WOOD: 20 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 80 WATER: 0
TALL SHRUBS	Sorbus sitchensis			APSECT OF PLOT: NE SITE SERIES:
SHORT SHRUBS	Vaccinium membranaceum Rubus spectabilis Juniperus communis Menziesia ferruginea Rubus pedatus			OTHER COMMENTS:
TOTAL SHRUBS: % COVER: 20%				
HERBS	Epilobium angustifolium Cornus canadensis Gymnocarpium dryopteris Vaccinium ovalifolium			
TOTAL HERBS: % COVER: 40%				
% COVER TOTAL VEGETATION 65%				

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: 14	DATE:(Y/M/D/H/M): 96/07/23 OPENING 3L		BANK: L PLOT #: 3	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: Logged to edge of stream Plot on edge of road
DOMINANT TREES	Tsuga mertensiana			
MAIN CANOPY TREES				SOIL DESCRIPTIONS: Lots of organic matter
SERAL TREES				SUBSTRATE (%):
TOTAL TREES: % COVER: 2%				DECAYING WOOD: 20 BEDROCK: 15 MINERAL SOIL: 0 ORGANIC MATTER: 63 WATER: 2
TALL SHRUBS				APSECT OF PLOT: NE SITE SERIES:
SHORT SHRUBS	Vaccinium ovalifolium Vaccinium membranaceum			OTHER COMMENTS:
TOTAL SHRUBS: % COVER: 3%				
HERBS	Epilobium angustifolium Cornus canadensis Athyrium felix-femina			
TOTAL HERBS: % COVER: 20%				
% COVER TOTAL VEGETATION 25%				

DATA SHEET 5: LARGE WOODY DEBRIS PLOT ASSESSMENT TABLE for 1/100 ha (10X10m plots)

WATERCOURSE: Chance		DATE (YMD)96/07/29	SURVEYOR:Michael G		PAGE 1 OF 1
REACH #:		OPENING 3R	SEGMENT		
PLOT #	LAYER 1A (>22 cm)	LAYER 1B (>12.5, <22 cm)	LAYER 2 (>7.5, <12.5 CM)	LAYER 3 (0-<7.5 cm)	LAYER 4 (O, height=<1.3M)
1	0	0	0	5	57
2	0	0	1	9	34
3	0	0	0	1	59
4					
5					
6					
7					
8					
9					
10					
TOTALS:	0	0	1	15	150
total # plots:	3	3	3	3	3
PRESENT LWD STOCKING:		0			
FUTURE LWD STOCKING:		0			
FUTURE LWD STOCKING:		33			
FUTURE LWD STOCKING:		0			
FUTURE LWD STOCKING:		5000			
TOTAL FUTURE LWD STOCKING:		5533			
NOTES/COMMENTS:					

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: 14	DATE:(Y/M/D/H/M): 96/07/25 OPENING: 3R		BANK: R PLOT #: 1	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE:
DOMINANT TREES	Abies amabilis			
MAIN CANOPY TREES				SOIL DESCRIPTIONS:
SERAL TREES	Thuja plicata			SUBSTRATE (%):
TOTAL TREES: % COVER:	20%			DECAYING WOOD: 25 BEDROCK: 1 MINERAL SOIL: 0 ORGANIC MATTER: 74 WATER: 0
TALL SHRUBS				APSECT OF PLOT: NW SITE SERIES:
SHORT SHRUBS	Vaccinium membranaceum Rubus pedatus Menziesia ferruginea Rubus spectabilis			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:	45%			
HERBS	Epilobium angustifolium Cornus canadensis Tiarella trifoliata Veratrum viride Gymnocarpium dryopteris Streptopus roseus			
TOTAL HERBS: % COVER:	15%			
% COVER TOTAL VEGETATION	75%			

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #:	DATE:(Y/M/D/H/M): 96/07/25 OPENING: 3R		BANK: R PLOT #: 2	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: logged to edge steep bank
DOMINANT TREES	Abies amabilis			
MAIN CANOPY TREES				SOIL DESCRIPTIONS: lots of organic material
SERAL TREES	Tsuga mertensiana Tsuga heterophylla Alnus rubra			SUBSTRATE (%):
TOTAL TREES: % COVER: 5%				DECAYING WOOD: 30 BEDROCK: 5 MINERAL SOIL: 0 ORGANIC MATTER: 65 WATER: 0
TALL SHRUBS				APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Rubus pedatus Vaccinium ovalifolium Vaccinium membrancaceum Menziesia ferruginea Juniperus communis			OTHER COMMENTS:
TOTAL SHRUBS: % COVER: 20%				
HERBS	Cornus canadensis Epilobium angustifolium Athyrium felix-femina Tiarella trifoliata Arnica diversifolia			
TOTAL HERBS: % COVER: 25%				
% COVER TOTAL VEGETATION 60%				

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: 14	DATE:(Y/M/D/H/M): 96/07/28 OPENING: 3R		BANK: R PLOT #: 3	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE:
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS:
SERAL TREES	Abies amabilis Tsuga heterophylla Alnus rubra			SUBSTRATE (%):
TOTAL TREES: % COVER: 5%				DECAYING WOOD: BEDROCK: MINERAL SOIL: ORGANIC MATTER: WATER:
TALL SHRUBS	Sorbus sitchensis			APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Vaccinium membranaceum Vaccinium ovalifolium Menziesia ferruginea Juniperus communis			OTHER COMMENTS:
TOTAL SHRUBS: % COVER: 40%				
HERBS	Cornus canadensis Epilobium angustifolium			
TOTAL HERBS: % COVER: 5%				
% COVER TOTAL VEGETATION 80%				

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 1)

WATERCOURSE NAME:	Chance
OPENING NAME:	4L
CREW:	Squamish
DATE(YMD):	96/07/23

STREAM SHADING				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Stream shading class	5	H	M	L
Biogeoclimatic zone*	2	others	ICH,CDF	BG,PP,IDF
Stream classification	5	S1	S2	S3,S4,S5,S6
Aspect of stream segment	3	NE-NW	NE-SE/NW-SW	SE-SW
TOTAL SCORE (max=25)	15			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	H			

* NOTE: biogeoclimatic zone should be double (i.e., 2, 6 or 10)

LARGE WOODY DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Layer 1A	5	>150	51-150	<50
Layer 1B	5	>100	50-100	<50
Layer 2	5	>200	75-200	<75
Layer 3	1	>400	200-400	<200
Layer 4	1	>600	300-600	<300
Stream classification*	10	S1	S5,S6	S2,S3,S4
TOTAL SCORE (max=35)	27			
OVERALL IMPACT (L=<17, M=17-23, H=24-28, VH>28	H			

* NOTE: stream class should be doubled (i.e., 2, 6 or 10)

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 2)

SMALL ORGANIC DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Relative effectiveness class	1	H,VH	M	L,VL
Change class*	2	Ci/Cn or Di/Dn	Cd and Di	Cd and Dd
Stream classification	5	S1	S2	S3,S4,S5,S6
TOTAL SCORE (max=20)	8			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	M			

* NOTE: change class should be doubled (i.e., 2, 6 or 10)

SURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Surface filtering capacity	3	H	M	L
EITHER: RMA terrain stability class	2	1,2	3	4,5
OR: RMA slope class*	na	<35%	36-70%	>70%
Upslope sediment sources	1	none	few	significant
TOTAL SCORE (max=20)	6			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: either terrain stability class OR slope class should be doubled, but not both

SUBSURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Subsoil chemical filtering capacity class	3	H,VH	M	L,VL
Management area slope class	1	<35%	36-70%	>70%
Upslope chemical sources*	2	none	potentially	yes
TOTAL SCORE (max=20)	6			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: upslope chemical sources should be doubled (i.e., 2, 6 or 10)

DATA SHEET 5: LARGE WOODY DEBRIS PLOT ASSESSMENT TABLE for 1/100 ha (10X10m plots)

WATERCOURSE:Chance		DATE (YMD)96/07/24	SURVEYOR:Michael G.		PAGE 1 OF 1
REACH #:	15	OPENING 4L	SEGMENT		SEGMENT LENGTH:199m
PLOT #	LAYER 1A (>22 cm)	LAYER 1B (>12.5, <22 cm)	LAYER 2 (>7.5, <12.5 CM)	LAYER 3 (0-<7.5 cm)	LAYER 4 (O, height=<1.3M)
1	0	0	0	0	14
2	0	0	0	54	23
3	0	0	0	38	30
4					
5					
6					
7					
8					
9					
10					
TOTALS:	0	0	0	92	67
total # plots:	3	3	3	3	3

PRESENT LWD STOCKING:	0
FUTURE LWD STOCKING:	0
FUTURE LWD STOCKING:	0
FUTURE LWD STOCKING:	3067
FUTURE LWD STOCKING:	2233
TOTAL FUTURE LWD STOCKIN	5300

NOTES/COMMENTS:

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: 15	DATE:(Y/M/D/H/M): 96/07/23 OPENING 4L		BANK: L PLOT #: 1	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: Logged to edge Plot near road
DOMINANT TREES	Abies amabilis			
MAIN CANOPY TREES				SOIL DESCRIPTIONS: Lots organic matter
SERAL TREES	Thuja plicata Abies amabilis Tsuga heterophylla			SUBSTRATE (%):
TOTAL TREES: % COVER: 5%				DECAYING WOOD: 20 BEDROCK: 3 MINERAL SOIL: 0 ORGANIC MATTER: 77 WATER: 0
TALL SHRUBS	Sorbus sitchensis			APSECT OF PLOT: N SITE SERIES:
SHORT SHRUBS	Vaccinium ovalifolium Rubus pedatus Menziesia ferruginea			OTHER COMMENTS: Pile of logs on edge of plot and roadside
TOTAL SHRUBS: % COVER: 35%				
HERBS	Cornus canadensis			
TOTAL HERBS: % COVER: 2%				
% COVER TOTAL VEGETATION 40%				

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: 15	DATE:(Y/M/D/H/M): 96/07/23 OPENING: 4L		BANK: L PLOT #: 2	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: Logged to edge on both sides
DOMINANT TREES	Alnus rubra			
MAIN CANOPY TREES				SOIL DESCRIPTIONS: Lots of orangic matter
SERAL TREES	Alnus rubra Abies amabilis Tsuga heterophylla			SUBSTRATE (%):
TOTAL TREES: % COVER:				DECAYING WOOD: 5 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 95 WATER: 0
TALL SHRUBS	Sorbis sitchensis			APSECT OF PLOT: NE SITE SERIES:
SHORT SHRUBS	Vaccinium membranaceum Vaccinium ovalifolium Rubus pedatus Juniperus communis			OTHER COMMENTS: Low shrubs, a few alder patches along creek bank
TOTAL SHRUBS: % COVER:				
HERBS	Epilobium angustifolium Veritrum viride Lysichiton americanum Tiarella trifoliata Senecio triangularis			
TOTAL HERBS: % COVER:				
% COVER TOTAL VEGETATION:				

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: 15	DATE:(Y/M/D/H/M): 96/07/ 23 OPENING: 4L		BANK: L PLOT #: 3	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: Logged to edge of stream on both sides Lots of shrubs
DOMINANT TREES	Alnus rubra			
MAIN CANOPY TREES				SOIL DESCRIPTIONS: Lots of organic matter
SERAL TREES	Alnus rubra Abies amabilis Thuja plicata			SUBSTRATE (%):
TOTAL TREES: % COVER: 3%				DECAYING WOOD: 5 BEDROCK: 1 MINERAL SOIL: 0 ORGANIC MATTER: 94 WATER: 0
TALL SHRUBS	Sorbus sitchensis			APSECT OF PLOT: SE SITE SERIES:
SHORT SHRUBS	Menziesia ferruginea Vaccinium membranaceum Rubus pedatus Juniperus communis			OTHER COMMENTS: Mostly shrubs
TOTAL SHRUBS: % COVER: 75%				
HERBS	Epilobium angustifolium			
TOTAL HERBS: % COVER: 1%				
% COVER TOTAL VEGETATION 85%				

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 1)

WATERCOURSE NAME:	Chance
OPENING NAME:	4R
CREW:	Squamish
DATE(YMD):	96/07/23

STREAM SHADING				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Stream shading class	5	H	M	L
Biogeoclimatic zone*	2	others	ICH,CDF	BG,PP,IDF
Stream classification	5	S1	S2	S3,S4,S5,S6
Aspect of stream segment	3	NE-NW	NE-SE/NW-SW	SE-SW
TOTAL SCORE (max=25)	15			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	H			

* NOTE: biogeoclimatic zone should be double (i.e., 2, 6 or 10)

LARGE WOODY DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Layer 1A	5	>150	51-150	<50
Layer 1B	5	>100	50-100	<50
Layer 2	5	>200	75-200	<75
Layer 3	1	>400	200-400	<200
Layer 4	1	>600	300-600	<300
Stream classification*	10	S1	S5,S6	S2,S3,S4
TOTAL SCORE (max=35)	27			
OVERALL IMPACT (L=<17, M=17-23, H=24-28, VH>28	H			

* NOTE: stream class should be doubled (i.e., 2, 6 or 10)

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 2)

SMALL ORGANIC DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Relative effectiveness class	1	H,VH	M	L,VL
Change class*	2	Ci/Cn or Di/Dn	Cd and Di	Cd and Dd
Stream classification	5	S1	S2	S3,S4,S5,S6
TOTAL SCORE (max=20)	8			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	M			

* NOTE: change class should be doubled (i.e., 2, 6 or 10)

SURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Surface filtering capacity	3	H	M	L
EITHER: RMA terrain stability class	2	1,2	3	4,5
OR: RMA slope class*	na	<35%	36-70%	>70%
Upslope sediment sources	1	none	few	significant
TOTAL SCORE (max=20)	6			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: either terrain stability class OR slope class should be doubled, but not both

SUBSURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Subsoil chemical filtering capacity class	3	H,VH	M	L,VL
Management area slope class	1	<35%	36-70%	>70%
Upslope chemical sources*	2	none	potentially	yes
TOTAL SCORE (max=20)	6			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: upslope chemical sources should be doubled (i.e., 2, 6 or 10)

DATA SHEET 5: LARGE WOODY DEBRIS PLOT ASSESSMENT TABLE for 1/100 ha (10X10m plots)

WATERCOURSE : Chance		DATE (YMD)96/07/24	SURVEYOR:Michael G.		PAGE 1 OF 1
REACH #: 15		OPENING 4R	SEGMENT		SEGMENT LENGTH:199m
PLOT #	LAYER 1A (>22 cm)	LAYER 1B (>12.5, <22 cm)	LAYER 2 (>7.5, <12.5 CM)	LAYER 3 (0-<7.5 cm)	LAYER 4 (O, height=<1.3M)
1	0	0	0	71	10
2	0	0	0	34	56
3	0	0	0	6	110
4	1	1	0	3	9
5					
6					
7					
8					
9					
10					
TOTALS:	1	1	0	114	185
total # plots:	4	4	4	4	4

PRESENT LWD STOCKING:	25
FUTURE LWD STOCKING:	25
FUTURE LWD STOCKING:	0
FUTURE LWD STOCKING:	2850
FUTURE LWD STOCKING:	4625
TOTAL FUTURE LWD STOCKIN	7500

NOTES/COMMENTS:

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: 15	DATE:(Y/M/D/H/M): 96/07/23 OPENING: 4R		BANK: R PLOT #: 1	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: Logged to edge of stream Plot on edge of raod
DOMINANT TREES	Alnus rubra			
MAIN CANOPY TREES				SOIL DESCRIPTIONS: Lots of organic matter
SERAL TREES	Tsuga heterophylla Abies amabilis			SUBSTRATE (%):
TOTAL TREES: % COVER: 30%				DECAYING WOOD: 4 BEDROCK: 5 MINERAL SOIL: 0 ORGANIC MATTER: 90 WATER: 0
TALL SHRUBS	Sorbus sitchensis			APSECT OF PLOT: SE SITE SERIES:
SHORT SHRUBS	Menziesia ferruginea Vaccinium ovalifolium Rubus spectabilis			OTHER COMMENTS:
TOTAL SHRUBS: % COVER: 20%				
HERBS	Epilobium angustifolium Veritrum viride Cornus canadensis			
TOTAL HERBS: % COVER: 2%				
% COVER TOTAL VEGETATION 50%				

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: 15	DATE:(Y/M/D/H/M): 96/07/23 OPENING 4R		BANK: R PLOT #: 2	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: Logged to edge of both banks logging road adjacent to plot
DOMINANT TREES	Tsuga heterophylla Abies amabilis			
MAIN CANOPY TREES				SOIL DESCRIPTIONS: Lots of organic material
SERAL TREES	Tsuga heterophylla Abies amabilis Thuja plicata			SUBSTRATE (%):
TOTAL TREES: % COVER: 25%				DECAYING WOOD: 3 BEDROCK: 5 MINERAL SOIL: 0 ORGANIC MATTER: 70 WATER: 20
TALL SHRUBS	Sorbus sitchensis			APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Menziesia ferrunginea Vaccinium membranaceum Rubus spectabilis Rubus pedatus			OTHER COMMENTS: small island in plot
TOTAL SHRUBS: % COVER: 50%				
HERBS	Epilobium angustifolium Cornus canadensis Gymnocarpium dryopteris Blechum spicant Veritrum viride Juniperus communis			
TOTAL HERBS: % COVER: 10%				
% COVER TOTAL VEGETATION 75%				

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: 15	DATE:(Y/M/D/H/M): 96/07/23 OPENING: 4R		BANK: R PLOT #: 3	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: No canopy, plot on top of steep bank above creek Dry at edge of plot
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: Lots of organic material
SERAL TREES	Abies amabilis Tsuga heterophylla Tsuga plicata			SUBSTRATE (%):
TOTAL TREES: % COVER: 10%				DECAYING WOOD: 2 BEDROCK: 1 MINERAL SOIL: 0 ORGANIC MATTER: 97 WATER: 0
TALL SHRUBS	Sorbus sitchensis			APSECT OF PLOT: NW SITE SERIES:
SHORT SHRUBS	Vaccinium membranaceum Menziesia ferruginea Juniperus communis Rubus pedatus			OTHER COMMENTS: Hummingbird
TOTAL SHRUBS: % COVER: 30%				
HERBS	Epilobium angustifolium Orthilia secunda Goodyera oblongifolia Senecio triangularis Leptarrhena pyrolifolia			
TOTAL HERBS: % COVER: 5%				
% COVER TOTAL VEGETATION 50%				

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: 15	DATE:(Y/M/D/H/M): 96/07/23 OPENING: 4R		BANK: R PLOT #: 4	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES	Abies amabilis 2			GENERAL CONDITION OF RIPARIAN ZONE: Logged to edge
DOMINANT TREES	Abies amabilis			
MAIN CANOPY TREES				SOIL DESCRIPTIONS:
SERAL TREES	Abies amabilis Tsuga heterophylla			
				SUBSTRATE (%):
TOTAL TREES: % COVER: 20%				DECAYING WOOD: 10 BEDROCK: 5 MINERAL SOIL: 0 ORGANIC MATTER: 85 WATER: 0
TALL SHRUBS	Sorbus sitchensis			APSECT OF PLOT: NW SITE SERIES:
SHORT SHRUBS	Vaccinium membranaceum Menziesia ferruginea Rubus pedatus			OTHER COMMENTS:
TOTAL SHRUBS: % COVER: 35%				
HERBS	Epilobium angustifolium Veratrum viride Arnica latifolia Saxifrage (nelsoniana?)			
TOTAL HERBS: % COVER: 15%				
% COVER TOTAL VEGETATION 50%				

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 1)

WATERCOURSE NAME:	Chance
OPENING NAME:	Trib L
CREW:	Squamish
DATE(YMD):	96/07/25

STREAM SHADING				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Stream shading class	5	H	M	L
Biogeoclimatic zone*	2	others	ICH,CDF	BG,PP,IDF
Stream classification	5	S1	S2	S3,S4,S5,S6
Aspect of stream segment	3	NE-NW	NE-SE/NW-SW	SE-SW
TOTAL SCORE (max=25)	15			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	H			

* NOTE: biogeoclimatic zone should be double (i.e., 2, 6 or 10)

LARGE WOODY DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Layer 1A	5	>150	51-150	<50
Layer 1B	5	>100	50-100	<50
Layer 2	5	>200	75-200	<75
Layer 3	3	>400	200-400	<200
Layer 4	1	>600	300-600	<300
Stream classification*	10	S1	S5,S6	S2,S3,S4
TOTAL SCORE (max=35)	29			
OVERALL IMPACT (L=<17, M=17-23, H=24-28, VH>28	VH			

* NOTE: stream class should be doubled (i.e., 2, 6 or 10)

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 2)

SMALL ORGANIC DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Relative effectiveness class	1	H,VH	M	L,VL
Change class*	2	Ci/Cn or Di/Dn	Cd and Di	Cd and Dd
Stream classification	5	S1	S2	S3,S4,S5,S6
TOTAL SCORE (max=20)	8			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: change class should be doubled (i.e., 2, 6 or 10)

SURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Surface filtering capacity	1	H	M	L
EITHER: RMA terrain stability class	2	1,2	3	4,5
OR: RMA slope class*	na	<35%	36-70%	>70%
Upslope sediment sources	1	none	few	significant
TOTAL SCORE (max=20)	4			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: either terrain stability class OR slope class should be doubled, but not both

SUBSURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Subsoil chemical filtering capacity class	3	H,VH	M	L,VL
Management area slope class	1	<35%	36-70%	>70%
Upslope chemical sources*	2	none	potentially	yes
TOTAL SCORE (max=20)	6			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: upslope chemical sources should be doubled (i.e., 2, 6 or 10)

DATA SHEET 5: LARGE WOODY DEBRIS PLOT ASSESSMENT TABLE for 1/100 ha (10X10m plots)

WATERCOURSE:Chance		DATE (YMD)96/07/29	SURVEYOR:Michael G.		PAGE 1 OF 1
REACH #:	NA	OPENING Trib L	SEGMENT		SEGMENT LENGTH:325m
PLOT #	LAYER 1A (>22 cm)	LAYER 1B (>12.5, <22 cm)	LAYER 2 (>7.5, <12.5 CM)	LAYER 3 (0-<7.5 cm)	LAYER 4 (O, height=<1.3M)
1					
2	0	0	0	8	32
3	0	0	0	0	7
4	0	0	0	0	4
5	0	0	0	0	5
6					
7					
8					
9					
10					
TOTALS:	0	0	0	8	48
total # plots:	4	4	4	4	4

PRESENT LWD STOCKING:	0
FUTURE LWD STOCKING:	0
FUTURE LWD STOCKING:	0
FUTURE LWD STOCKING:	200
FUTURE LWD STOCKING:	1200
TOTAL FUTURE LWD STOCKIN	1400

NOTES/COMMENTS:

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: NA	DATE:(Y/M/D/H/M): 96/07/25/ OPENING: Trib L		BANK: L PLOT #: 2	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: Logged to bank Plot is between 2 tribs
DOMINANT TREES	Abies amabilis			
MAIN CANOPY TREES				SOIL DESCRIPTIONS: Organic matter
SERAL TREES	Abies amabilis Tsuga heterophylla Alnus rubra			SUBSTRATE (%):
TOTAL TREES: % COVER: 3%				DECAYING WOOD: 30 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 70 WATER: 0
TALL SHRUBS				APSECT OF PLOT: S SITE SERIES:
SHORT SHRUBS	Vaccinium ovalifolium Vaccinium membranaceum Juniperus communis Rubus spectabilis			OTHER COMMENTS:
TOTAL SHRUBS: % COVER: 30%				
HERBS	Cornus canadensis Clintonia uniflora Epilobium angustifolium Oplopanax horridus Athyrium felix-femina Epilobium munitum			
TOTAL HERBS: % COVER: 15%				
% COVER TOTAL VEGETATION 60%				

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: NA	DATE:(Y/M/D/H/M): 96/07/25 OPENING Trib L		BANK: L PLOT #: 3	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	qty.			GENERAL CONDITION OF RIPARIAN ZONE: Logged to edge of stream both banks
DOMINANT TREES	Abies amabilis			
MAIN CANOPY TREES				SOIL DESCRIPTIONS: Lots of organic matter
SERAL TREES	Thuja plicata Tsuga heterophylla Alnus rubra			SUBSTRATE (%):
TOTAL TREES: % COVER: 2%				DECAYING WOOD: 15 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 85 WATER: 0
TALL SHRUBS				APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Vaccinium membranaceum Menziesia ferruginiea Rubus spectabilis Rubus ovalifolium Juniperus communis			OTHER COMMENTS:
TOTAL SHRUBS: % COVER: 30%				
HERBS	Cornus canadensis Epilobium angustifolium Clintonia uniflora Gymnocarpium dryopteris			
TOTAL HERBS: % COVER: 40%				
% COVER TOTAL VEGETATION 75%				

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: NA	DATE:(Y/M/D/H/M): 96/07/25 OPENING: Trib L		BANK: L PLOT #: 4	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	qty.			GENERAL CONDITION OF RIPARIAN ZONE: Logged to edge of bank Lots of woody debris in stream gentle slope < 20%
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: Lots of organic
SERAL TREES	Abies amabilis			SUBSTRATE (%):
TOTAL TREES: % COVER: 2%				DECAYING WOOD: 4000% BEDROCK: 0% MINERAL SOIL: 0 ORGANIC MATTER: 6000% WATER: 0
TALL SHRUBS				APSECT OF PLOT: SE SITE SERIES:
SHORT SHRUBS	Rubus parviflorus Cornus stolonifera Rubus spectabilis			OTHER COMMENTS:
TOTAL SHRUBS: % COVER: 40%				
HERBS	Lysichiton americanum Athyrium felix-femina Tiarella uniflorum Epilobium angustifolium Epilobium minutum Gymnocarpium dryopteris			
TOTAL HERBS: % COVER: 35%				
% COVER TOTAL VEGETATION 80%				

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: NA	DATE:(Y/M/D/H/M): 96/07/25 OPENING: Trib L		BANK: L PLOT #: 5	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: Stream running through Moist , lots of herbs-sedges & ferns Open
DOMINANT TREES	Alnus rubra			
MAIN CANOPY TREES				SOIL DESCRIPTIONS: Moist, mossy
SERAL TREES	Tsuga heterophylla Abies amabilis			
				SUBSTRATE (%):
TOTAL TREES: % COVER: 1%				DECAYING WOOD: 20 BEDROCK: 2 MINERAL SOIL: 0 ORGANIC MATTER: 60 WATER: 20
TALL SHRUBS				APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Rubus spectabilis Vaccinium membranaceum Rubus pedatus Juniperus communis			OTHER COMMENTS: Side stream running through this plot
TOTAL SHRUBS: % COVER: 20%				
HERBS	Gymnocarpium dryopteris Juncus sp. Epilobium angustifolium Streptopus amplexifolius Lysichiton americanum			
TOTAL HERBS: % COVER: 40%				
% COVER TOTAL VEGETATION 60%				

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 1)

WATERCOURSE NAME:	Chance
OPENING NAME:	Trib R
CREW:	Squamish
DATE(YMD):	96/07/25

STREAM SHADING				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Stream shading class	5	H	M	L
Biogeoclimatic zone	2	others	ICH,CDF	BG,PP,IDF
Stream classification*	5	S1	S2	S3,S4,S5,S6
Aspect of stream segment	3	NE-NW	NE-SE/NW-SW	SE-SW
TOTAL SCORE (max=25)	15			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	H			

* NOTE: biogeoclimatic zone should be double (i.e., 2, 6 or 10)

LARGE WOODY DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Layer 1A	3	>150	51-150	<50
Layer 1B	5	>100	50-100	<50
Layer 2	5	>200	75-200	<75
Layer 3	1	>400	200-400	<200
Layer 4	1	>600	300-600	<300
Stream classification*	10	S1	S5,S6	S2,S3,S4
TOTAL SCORE (max=35)	25			
OVERALL IMPACT (L=<17, M=17-23, H=24-28, VH>28	H			

* NOTE: stream class should be doubled (i.e., 2, 6 or 10)

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 2)

SMALL ORGANIC DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Relative effectiveness class	1	H,VH	M	L,VL
Change class*	2	Ci/Cn or Di/Dn	Cd and Di	Cd and Dd
Stream classification	5	S1	S2	S3,S4,S5,S6
TOTAL SCORE (max=20)	8			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: change class should be doubled (i.e., 2, 6 or 10)

SURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Surface filtering capacity	1	H	M	L
EITHER: RMA terrain stability class	2	1,2	3	4,5
OR: RMA slope class*	na	<35%	36-70%	>70%
Upslope sediment sources	1	none	few	significant
TOTAL SCORE (max=20)	4			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: either terrain stability class OR slope class should be doubled, but not both

SUBSURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Subsoil chemical filtering capacity class	3	H,VH	M	L,VL
Management area slope class	1	<35%	36-70%	>70%
Upslope chemical sources*	2	none	potentially	yes
TOTAL SCORE (max=20)	6			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: upslope chemical sources should be doubled (i.e., 2, 6 or 10)

DATA SHEET 5: LARGE WOODY DEBRIS PLOT ASSESSMENT TABLE for 1/100 ha (10X10m plots)

WATERCOURSE:Chance		DATE (YMD)96/07/29	SURVEYOR:Michael G.		PAGE 1 OF 1
REACH #:	NA	OPENING Trib R	SEGMENT		SEGMENT LENGTH:325m
PLOT #	LAYER 1A (>22 cm)	LAYER 1B (>12.5, <22 cm)	LAYER 2 (>7.5, <12.5 CM)	LAYER 3 (0-<7.5 cm)	LAYER 4 (O, height=<1.3M)
1	7	2	0	99	44
2	0	0	0	15	7
3	0	0	0	0	2
4	0	0	0	14	38
5	0	0	0	0	69
6					
7					
8					
9					
10					
TOTALS:	7	2	0	128	160
total # plots:	5	5	5	5	5

PRESENT LWD STOCKING:	140
FUTURE LWD STOCKING:	40
FUTURE LWD STOCKING:	0
FUTURE LWD STOCKING:	2560
FUTURE LWD STOCKING:	3200
TOTAL FUTURE LWD STOCKIN	5800

NOTES/COMMENTS:

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: NA	DATE:(Y/M/D/H/M): 96/07/25 OPENING Trib R		BANK: R PLOT #: 1	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Tsuga heterophylla 3 Abies amabilis 4			GENERAL CONDITION OF RIPARIAN ZONE: Small buffer on right bank Left bank fair size buffer 25 m stream shading 85%
DOMINANT TREES	Abies amabilis Alnus rubra			
MAIN CANOPY TREES	Tsuga heterophylla Thuja plicata			SOIL DESCRIPTIONS: Small side channel (over flow) Mossy under trees
SERAL TREES				SUBSTRATE (%):
TOTAL TREES: % COVER: 55%				DECAYING WOOD: 5 BEDROCK: 3 MINERAL SOIL: 0 ORGANIC MATTER: 92 WATER: 0
TALL SHRUBS				APSECT OF PLOT: NW SITE SERIES:
SHORT SHRUBS	Vaccinium uliginosum Vaccinium membranaceum Rubus pedatus Rubus spectabilis Ribes bracteosum			OTHER COMMENTS:
TOTAL SHRUBS: % COVER: 5%				
HERBS	Gymnocarpium dryopteris Streptopus amplexifolius Athyrium felix-femina Cornus canadensis Tiarella unifoliata			
TOTAL HERBS: % COVER: 25%				
% COVER TOTAL VEGETATION 85%				

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: NA	DATE:(Y/M/D/H/M): 96/07/25 OPENING Trib R		BANK: R PLOT #: 2	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: Logged to edge of stream
DOMINANT TREES	Abies amabilis			
MAIN CANOPY TREES				SOIL DESCRIPTIONS: Lots of organic debris
SERAL TREES	Alnus rubra Tsuga heterophylla			
				SUBSTRATE (%):
TOTAL TREES: % COVER: 30%				DECAYING WOOD: 2 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 98 WATER: 0
TALL SHRUBS	Salix scouleriana			APSECT OF PLOT: N SITE SERIES:
SHORT SHRUBS	Rubus spectabilis Rubus pedatus Vaccinium membranaceum Vaccinium ovalifolium Juniperus communis			OTHER COMMENTS:
TOTAL SHRUBS: % COVER: 10%				
HERBS	Athyrium felix-femina Lysichiton americanum Anaphilis margaritacea Epilobium angustifolium Streptopus roseus			
TOTAL HERBS: % COVER: 40%				
% COVER TOTAL VEGETATION 80%				

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: NA	DATE:(Y/M/D/H/M): 96/07/25 OPENING Trib R		BANK: R PLOT #: 3	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: Logged to edge of stream , both banks
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: Lots of organic material
SERAL TREES	Alnus rubra			
				SUBSTRATE (%):
TOTAL TREES: % COVER: 1%				DECAYING WOOD: 30 BEDROCK: 10 MINERAL SOIL: 0 ORGANIC MATTER: 60 WATER: 0
TALL SHRUBS				APSECT OF PLOT: NE SITE SERIES:
SHORT SHRUBS	Rubus spectabilis Rubus pedatus Vaccinium membranaceum Vaccinium ovalifolium			OTHER COMMENTS:
TOTAL SHRUBS: % COVER: 30%				
HERBS	Epilobium angustifolium Gymnocarpium dryopteris Tiarella unifoliata Epilobium minutum Athyrium felix-femina Anaphalis margaritaceae			
TOTAL HERBS: % COVER: 45%				
% COVER TOTAL VEGETATION 76%				

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: NA	DATE:(Y/M/D/H/M): 96/07/25 OPENING Trib R		BANK: R PLOT #: 4	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: Clearcut to edge of creek on both banks Lots of woody debris creek
DOMINANT TREES	Tsuga heterophylla Abies amabilis			
MAIN CANOPY TREES				SOIL DESCRIPTIONS: organic
SERAL TREES	Alnus rubra			SUBSTRATE (%):
TOTAL TREES: % COVER: 5%				DECAYING WOOD: 25 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 75 WATER: 0
TALL SHRUBS				APSECT OF PLOT: NW SITE SERIES:
SHORT SHRUBS	Vaccinium membranceum Menziesia ferruginea Rubus spectabilis Ribes bracteosum			OTHER COMMENTS:
TOTAL SHRUBS: % COVER: 60%				
HERBS	Cornus canadensis Epilobium angustifolium Clintonia uniflora Lysichiton americanum			
TOTAL HERBS: % COVER: 20%				
% COVER TOTAL VEGETATION 85%				

PLOT VEGETATION DESCRIPTION FORM

STREAM: Chance REACH #: NA	DATE:(Y/M/D/H/M): 96/07/25 OPENING Trib R		BANK: R PLOT #: 5	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: Lots of Cornus canadensis Lots of seedlings Open Stream bends around plot
DOMINANT TREES				
MAIN CANOPY TREES	Alnus rubra			SOIL DESCRIPTIONS: A little dryer than left bank; organic
SERAL TREES	Thuja plicata Abies amabilis			SUBSTRATE (%):
TOTAL TREES: % COVER: 20%				DECAYING WOOD: 1000% BEDROCK: 0% MINERAL SOIL: 0 ORGANIC MATTER: 9000% WATER: 0
TALL SHRUBS				APSECT OF PLOT: NW SITE SERIES:
SHORT SHRUBS	Rubus spectabilis Vaccinium membranceum Rubus pedatus Juniperus communis			OTHER COMMENTS: Stream on 2 sides of plot
TOTAL SHRUBS: % COVER:				
HERBS	Cornus canadensis Epilobium angustifolium Gymnocarpium dryopteris Juncus sp.	5 10		
TOTAL HERBS: % COVER: 70%				
% COVER TOTAL VEGETATION:				

DATA SHEET 1: SUMMARY OF STREAM SEGMENT ASSESSMENTS (From Air Photos)

PROJ ID #	WATERCOURSE NAME: Crawford	AIR PHOTO INFORMATION:	PAGE 1 OF 1
DATE (YMD):	96/08/30 CREW: RAP		

REACH #	OPENING #	SEGMENT #	SEGMENT LENGTH (m)	STREAM CLASS	RMA WIDTH (m)	RVC VEG. CLASS	BGC ZONE/ SUBZONE	SITE SERIES	STRUCTURAL STAGE	YEARS SINCE HARVEST	RVC LABEL	CANOPY COVER CLASS	OBSERVATIONS
3	1	L	83	S2	50	1B(c)	CWHms1	01,04,05	PSc	20	PSc/Ba[Hm]		
4	2	L	400	S2	50	1C(c)	CWHms1	01,03,04,05,06,07,09	PSc	20	PSc/BaHm[CwHw]		
	3	R	400	S2	50	1B(c)	CWHms1	01,03,04,05,06,07	SHRts	15	SHRts/BaCw[HmHw]		
	3	L	332	S2	50	1B(c)	CWHms1	01,03,04,05,06,07,09	SHRts	15	SHRts/BaHm[HwYc]		
	4	L	178	S2	50	1B(c)	CWHmm2	01,03,04,05,06,07	SHRts	15	SHRts/BaHm[HwYc]		
	5	R	175	S2	50	1B(c)	CWHmm2	03,05,07,09	SHRts	15	SHRts/BaHw[Yc]		
	6	R	205	S2	50	1C(c)	CWHmm2	01,03,04,05,06,07,09	PSc	15	PSc/DrHw[Yc]		
	7	L	364	S2	50	1C(m)	CWHmm2	01,03,04,05,06,07	PSc	5	PSc/DrHw[Yc]		
	TRIB 8	L	267	S3	40	1	CWHmm2	04,05,07	INITv	2	N/A		

DATA SHEET 4: SUMMARY OF OVERALL IMPACT SCORES (FROM DATA SHEET 2 FOR EACH STREAM SEGMENT)

WATERCOUSE NAME CRAWFORD				CREW: Squamish			DATE (YMD): 96/08/30		
REACH #	OPENING #	SEGMENT #	STREAM SHADING	LARGE WOODY DEBRIS	SMALL ORGANIC DEBRIS	SURFACE SILTERING	SUBSOIL FILTERING	TOTAL SCORE	COMMENTS AND RECOMMENDATIONS FOR SITE VISITS BY SPECIALISTS
3	1L		H (15)	L (15)	L (6)	L (6)	M (8)	50	
4	2L		H (15)	L (15)	M (8)	L (6)	M (8)	52	
	3L		H (13)	M (21)	L (6)	L (4)	L (6)	50	
	3R		H (15)	H (25)	L (6)	M (12)	M (8)	66	
	4L		H (13)	H (23)	L (6)	L (4)	L (5)	51	
	5R		M (11)	H (25)	M (10)	L (4)	L (6)	56	
	6R		H (13)	M (20)	M (10)	M (10)	L (6)	59	
	7L		M (9)	M (17)	M (8)	L (6)	M (8)	48	
	TRIB8L		H (13)	L (15)	H (15)	L (6)	M (8)	57	

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 1)

WATERCOURSE NAME:	CRAWFORD
OPENING NAME:	1L
CREW:	RAP
DATE(YMD):	96/08/13

STREAM SHADING				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Stream shading class	5	H	M	L
Biogeoclimatic zone*	2	others	ICH,CDF	BG,PP,IDF
Stream classification	3	S1	S2	S3,S4,S5,S6
Aspect of stream segment	5	NE-NW	NE-SE/NW-SW	SE-SW
TOTAL SCORE (max=25)	15			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	H			

* NOTE: biogeoclimatic zone should be double (i.e., 2, 6 or 10)

LARGE WOODY DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Layer 1A	1	>150	51-150	<50
Layer 1B	1	>100	50-100	<50
Layer 2	1	>200	75-200	<75
Layer 3	1	>400	200-400	<200
Layer 4	1	>600	300-600	<300
Stream classification*	10	S1	S5,S6	S2,S3,S4
TOTAL SCORE (max=35)	15			
OVERALL IMPACT (L=<17, M=17-23, H=24-28, VH>28	L			

* NOTE: stream class should be doubled (i.e., 2, 6 or 10)

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 2)

SMALL ORGANIC DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Relative effectiveness class	1	H,VH	M	L,VL
Change class*	2	Ci/Cn or Di/Dn	Cd and Di	Cd and Dd
Stream classification	3	S1	S2	S3,S4,S5,S6
TOTAL SCORE (max=20)	6			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: change class should be doubled (i.e., 2, 6 or 10)

SURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Surface filtering capacity	3	H	M	L
EITHER: RMA terrain stability class	2	1,2	3	4,5
OR: RMA slope class*	NA	<35%	36-70%	>70%
Upslope sediment sources	1	none	few	significant
TOTAL SCORE (max=20)	6			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: either terrain stability class OR slope class should be doubled, but not both

SUBSURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Subsoil chemical filtering capacity class	5	H,VH	M	L,VL
Management area slope class	1	<35%	36-70%	>70%
Upslope chemical sources*	2	none	potentially	yes
TOTAL SCORE (max=20)	8			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	M			

* NOTE: upslope chemical sources should be doubled (i.e., 2, 6 or 10)

DATA SHEET 5: LARGE WOODY DEBRIS PLOT ASSESSMENT TABLE for 1/100 ha (10X10m plots)

WATERCOURSE: Chance		DATE (YMD): 08-30-97	SURVEYOR:		PAGE ___ OF ___
REACH #: 3		OPENING: 1	SEGMENT		SEGMENT LENGTH:
PLOT #	LAYER 1A (>22 cm)	LAYER 1B (>12.5, <22 cm)	LAYER 2 (>7.5, <12.5 CM)	LAYER 3 (0-<7.5 cm)	LAYER 4 (O, height=<1.3M)
1	4	4	0	2	1
2	2	1	7	3	14
3	5	3	2	14	16
4					
5					
6					
7					
8					
9					
10					
TOTALS:	11	8	9	19	30
total # plots:	3	3	3	3	3

PRESENT LWD STOCKING:	367 STEMS/HA
FUTURE LWD STOCKING:	267 STEMS/HA
FUTURE LWD STOCKING:	300 STEMS/HA
FUTURE LWD STOCKING:	633 STEMS/HA
FUTURE LWD STOCKING:	1000 STEMS/HA
TOTAL FUTURE LWD STOCKING:	2200 STEMS/HA

NOTES/COMMENTS:

PLOT VEGETATION DESCRIPTION FORM

STREAM: CRAWFORD REACH #: 3	DATE:(Y/M/D/H/M): 96/08/13 OPENING: 1L		BANK: L PLOT #: 1	
VEGETATION STRATUM	SPECIES	qty.	% COVER	DISTRIBUTION
VETERAN TREES	Tsuga mertensiana Thuja plicata	2 1		
DOMINANT TREES	Abies amabilis			
MAIN CANOPY TREES				
SERAL TREES				
TOTAL TREES: % COVER:			25	
TALL SHRUBS				
SHORT SHRUBS	Vaccinium uliginosum Vaccinium membranaceum Rubus pedatus			
TOTAL SHRUBS: % COVER:			40	
HERBS	Cornus canadensis Clintonia uniflora			
TOTAL HERBS: % COVER:			3	
% COVER TOTAL VEGETATION:			60	

OTHER ATTRIBUTES

GENERAL CONDITION OF RIPARIAN ZONE:
Almost 100% moss cover
Plot on edge of waterfall/ravine
Strip of veteran trees on edge

SOIL DESCRIPTIONS:
Lots of organic material

SUBSTRATE (%):

DECAYING WOOD:	5
BEDROCK:	0
MINERAL SOIL:	0
ORGANIC MATTER:	95
WATER:	0

APSECT OF PLOT: nw
SITE SERIES:

OTHER COMMENTS:

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: 3		DATE:(Y/M/D/H/M): 96/08/13 OPENING: 1L		BANK: L PLOT #: 2	
VEGETATION STRATUM	SPECIES	qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Tsuga mertensiana	2			GENERAL CONDITION OF RIPARIAN ZONE: Plot on edge of creek, pool/fall/pool Large log across creek Strip of veteran trees on edge of plot Lots of moss and vaccinium
DOMINANT TREES	Thuja plicata Abies amabilis				
MAIN CANOPY TREES	Abies amabilis				SOIL DESCRIPTIONS: Lots of organic material
SERAL TREES	Abies amabilis Tsuga mertensiana				SUBSTRATE (%):
TOTAL TREES: % COVER:			15		DECAYING WOOD: 3 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 97 WATER: 0
TALL SHRUBS					APSECT OF PLOT: N SITE SERIES:
SHORT SHRUBS	Juniperus communis Rubus pedatus Vaccinium uliginosum				OTHER COMMENTS:
TOTAL SHRUBS: % COVER:			40		
HERBS	Cornus canadensis Clintonia uniflora Athyrium filix-femina				
TOTAL HERBS: % COVER:			5		
% COVER TOTAL VEGETATION:			60		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford	DATE:(Y/M/D/H/M): 96/08/13	BANK: L	
REACH #: 3	OPENING: 1L	PLOT #: 3	

VEGETATION STRATUM	SPECIES	qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Abies amabilis	3			GENERAL CONDITION OF RIPARIAN ZONE: Plot on edge of ravine/falls Lots of moss, strip of veteran trees on edge Falls/pools/falls
	Tsuga mertensiana	4			
DOMINANT TREES	Abies amabilis				
MAIN CANOPY TREES	Tsuga mertensiana				SOIL DESCRIPTIONS: Lots of organic material
SERAL TREES					SUBSTRATE (%):
TOTAL TREES: % COVER:			40		DECAYING WOOD: 5 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 95 WATER: 0
TALL SHRUBS					APSECT OF PLOT: N SITE SERIES:
SHORT SHRUBS	Rubus pedatus Vaccinium uliginosum Menziesia ferruginea				OTHER COMMENTS: Very steep slope
TOTAL SHRUBS: % COVER:			40		
HERBS	Cornus canadensis Athyrium filix-femina Blechnum spicant				
TOTAL HERBS: % COVER:			5		
% COVER TOTAL VEGETATION:			65		

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 1)

WATERCOURSE NAME:	Crawford
OPENING NAME:	2L
CREW:	RAP
DATE(YMD):	96/08/13

STREAM SHADING				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Stream shading class	5	H	M	L
Biogeoclimatic zone*	2	others	ICH,CDF	BG,PP,IDF
Stream classification	3	S1	S2	S3,S4,S5,S6
Aspect of stream segment	5	NE-NW	NE-SE/NW-SW	SE-SW
TOTAL SCORE (max=25)	15			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	H			

* NOTE: biogeoclimatic zone should be double (i.e., 2, 6 or 10)

LARGE WOODY DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Layer 1A	1	>150	51-150	<50
Layer 1B	1	>100	50-100	<50
Layer 2	1	>200	75-200	<75
Layer 3	1	>400	200-400	<200
Layer 4	1	>600	300-600	<300
Stream classification*	10	S1	S5,S6	S2,S3,S4
TOTAL SCORE (max=35)	15			
OVERALL IMPACT (L=<17, M=17-23, H=24-28, VH>28	L			

* NOTE: stream class should be doubled (i.e., 2, 6 or 10)

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 2)

SMALL ORGANIC DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Relative effectiveness class	3	H,VH	M	L,VL
Change class*	2	Ci/Cn or Di/Dn	Cd and Di	Cd and Dd
Stream classification	3	S1	S2	S3,S4,S5,S6
TOTAL SCORE (max=20)	8			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	M			

* NOTE: change class should be doubled (i.e., 2, 6 or 10)

SURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Surface filtering capacity	3	H	M	L
EITHER: RMA terrain stability class	2	1,2	3	4,5
OR: RMA slope class*	NA	<35%	36-70%	>70%
Upslope sediment sources	1	none	few	significant
TOTAL SCORE (max=20)	6			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: either terrain stability class OR slope class should be doubled, but not both

SUBSURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Subsoil chemical filtering capacity class	5	H,VH	M	L,VL
Management area slope class	1	<35%	36-70%	>70%
Upslope chemical sources*	2	none	potentially	yes
TOTAL SCORE (max=20)	8			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	M			

* NOTE: upslope chemical sources should be doubled (i.e., 2, 6 or 10)

DATA SHEET 5: LARGE WOODY DEBRIS PLOT ASSESSMENT TABLE for 1/100 ha (10X10m plots)

WATERCOURSE: CRAWFORD		DATE (YMD) 96/08/13	SURVEYOR:MK/RJ		PAGE 1 OF 1
REACH #: 4		OPENING 2L	SEGMENT		SEGMENT LENGTH:400M
PLOT #	LAYER 1A (>22 cm)	LAYER 1B (>12.5, <22 cm)	LAYER 2 (>7.5, <12.5 CM)	LAYER 3 (0-<7.5 cm)	LAYER 4 (O, height=<1.3M)
1					
2	3	1	4	7	15
3	5	3	7	8	47
4	0	1	2	9	29
5	2	3	6	11	68
6	2	0	1	2	24
7	3	4	4	21	44
8	5	8	5	13	33
9	3	18	5	10	16
10	5	2	4	16	21
TOTALS:	28	40	38	97	297
total # plots:	9	9	9	9	9

PRESENT LWD STOCKING:	311 STEMS/HA
FUTURE LWD STOCKING:	444 STEMS/HA
FUTURE LWD STOCKING:	422 STEMS/HA
FUTURE LWD STOCKING:	1078 STEMS/HA
FUTURE LWD STOCKING:	3300 STEMS/HA
TOTAL FUTURE LWD STOCKING:	5244 STEMS/HA

NOTES/COMMENTS:

PLOT VEGETATION DESCRIPTION FORM

STREAM: CRAWFORD REACH #: 4	DATE:(Y/M/D/H/M): 96/08/13 OPENING: 2L		BANK: L PLOT #: 2	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty. 1			
VETERAN TREES	Tsuga mertensiana 1			GENERAL CONDITION OF RIPARIAN ZONE: On edge of waterfall End of opening is planted, stand 3m tall
DOMINANT TREES	Abies amabilis			
MAIN CANOPY TREES				SOIL DESCRIPTIONS: LOts of organic material, dry
SERAL TREES	Abies amabilis Tsuga heterophylla Thuja plicata			SUBSTRATE (%):
TOTAL TREES: % COVER:		20		DECAYING WOOD: 5 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 95 WATER: 0
TALL SHRUBS	Sorbus sitchensis Alnus crispa Salix leucida			APSECT OF PLOT: NW SITE SERIES:
SHORT SHRUBS	Vaccinium uliginosum Rubus pedatus Juniperus communis Menziesia ferruginea			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		30		
HERBS	Cornus canadensis Clintonia uniflora Streptopus roseus Epilobium angustifolium Anaphila margaritacea Gymnocarpium dryopteris Aruncus dioicus Platanthera unalascensis Arnica latifolia			
TOTAL HERBS: % COVER:		20		
% COVER TOTAL VEGETATION:		65		

PLOT VEGETATION DESCRIPTION FORM

STREAM: CRAWFORD	DATE:(Y/M/D/H/M): 96/08/13	BANK: L	
REACH #: 4	OPENING: 2L	PLOT #: 3	

VEGETATION STRATUM	SPECIES	qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Abies amabilis	1			GENERAL CONDITION OF RIPARIAN ZONE: Hardly any stream shading, only 1 tall tree Narrow strip of trees on bank edge all along opening
DOMINANT TREES					
MAIN CANOPY TREES	Abies amabilis Tsuga mertensiana				SOIL DESCRIPTIONS: Land slide 10m wide Lots of organic debris
SERAL TREES	Thuja plicata Tsuga mertensiana				SUBSTRATE (%):
TOTAL TREES: % COVER:			25		DECAYING WOOD: 3 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 97 WATER: 0
TALL SHRUBS	Alnus crispa				APSECT OF PLOT: NW SITE SERIES:
SHORT SHRUBS	Vaccinium uliginosum Rubus pedatus Ribes bracteosum Menziesia ferruginea				OTHER COMMENTS:
TOTAL SHRUBS: % COVER:			30		
HERBS	Galium triflorum Epilobium angustifolium Tiarella trifoliata Gymnocarpium dryopteris Rubus spectabilis Athyrium filix-femina				
TOTAL HERBS: % COVER:			15		
% COVER TOTAL VEGETATION:			70		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: 4	DATE:(Y/M/D/H/M): 96/08/14 OPENING: 2L		BANK: L PLOT #: 4	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: Lots of LWD Log jam in creek
DOMINANT TREES	Tsuga mertensiana			
MAIN CANOPY TREES				SOIL DESCRIPTIONS: LOts of organic soil
SERAL TREES	Abies amabilis Thuja plicata Tsuga heterophylla Tsuga mertensiana			
TOTAL TREES: % COVER:		5		SUBSTRATE (%):
TALL SHRUBS	Sorbus sitchensis			DECAYING WOOD: 30 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 70 WATER: 0
SHORT SHRUBS	Vaccinium ovalifolium Rubus spectabilis Menziesia ferruginea Viburnum edule Rubus pedatus			APSECT OF PLOT: NW SITE SERIES:
TOTAL SHRUBS: % COVER:		25		OTHER COMMENTS:
HERBS	Epilobium angustifolium Athyrium filix-femina Cornus canadensis Clintonia uniflora Veratrum viride			
TOTAL HERBS: % COVER:		25		
% COVER TOTAL VEGETATION:		50		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford	DATE:(Y/M/D/H/M): 96/08/14	BANK: L	
REACH # 4	OPENING: 2L	PLOT #: 5	
VEGETATION STRATUM	SPECIES qty. 2	% COVER	DISTRIBUTION
VETERAN TREES	Abies amabilis		
DOMINANT TREES			
MAIN CANOPY TREES			
SERAL TREES	Thuja plicata Tsuga heterophylla Tsuga mertensiana		
TOTAL TREES: % COVER:		30	
TALL SHRUBS	Alnus crispa		
SHORT SHRUBS	Rubus pedatus Rubus spectabilis Vaccinium uliginosum Linnaea borealis		
TOTAL SHRUBS: % COVER:		30	
HERBS	Athyrium filix-femina Gymnocarpium dryopteris Cornus canadensis Tiarella trifoliata Streptopus roseus Veratrum viride Lysichiton americanum Clintonia uniflora Senecio triangularis Anaphilis margaritacea Streptopus amplexifolius Viola glabella Arnica mollis Botrychium multifidum Fritillaria camschatcensis Viola canadensis Platanthera unalascensis Platanthera dilatata Parnassia fimbriata		
TOTAL HERBS: % COVER:		25	
% COVER TOTAL VEGETATION:		75	

OTHER ATTRIBUTES

GENERAL CONDITION OF RIPARIAN ZONE:
2 tall trees
fairly dense herb composition

SOIL DESCRIPTIONS:
organic

SUBSTRATE (%):

DECAYING WOOD:	5
BEDROCK:	0
MINERAL SOIL:	0
ORGANIC MATTER:	95
WATER:	0

APSECT OF PLOT: NW
SITE SERIES:

OTHER COMMENTS:

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: 4	DATE:(Y/M/D/H/M): 96/08/14 OPENING: 2L			BANK: L PLOT #: 6	
VEGETATION STRATUM	SPECIES	1 qty. 1	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Tsuga mertensiana Abies amabilis	1 1			GENERAL CONDITION OF RIPARIAN ZONE: 2 tall trees aty stream bank Thick with blueberry, not very diverse
DOMINANT TREES					
MAIN CANOPY TREES					SOIL DESCRIPTIONS: lots of organic debris
SERAL TREES	Abies amabilis				SUBSTRATE (%):
TOTAL TREES: % COVER:			15		DECAYING WOOD: 1 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 99 WATER: 0
TALL SHRUBS	Vaccinium uliginosum				APSECT OF PLOT: NW SITE SERIES:
SHORT SHRUBS	Rubus pedatus Menziesia ferruginea Juniperus communis				OTHER COMMENTS:
TOTAL SHRUBS: % COVER:			20		
HERBS	Cornus canadensis Clintonia uniflora Veratrum viride Lysichiton americanum				
TOTAL HERBS: % COVER:			20		
% COVER TOTAL VEGETATION:			50		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: 4	DATE:(Y/M/D/H/M): 96/08/14 OPENING 2L		BANK: Left 7	
VEGETATION STRATUM	SPECIES qty. 1	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Tsuga mertensiana			GENERAL CONDITION OF RIPARIAN ZONE: small buffer lots of LWD lots of blueberries
DOMINANT TREES				
MAIN CANOPY TREES	Abies amabilis Tsuga mertensiana			SOIL DESCRIPTIONS: lots of organic material
SERAL TREES	Tsuga heterophylla Thuja plicata			SUBSTRATE (%):
TOTAL TREES: % COVER:	25			DECAYING WOOD: 15 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 85 WATER: 0
TALL SHRUBS	Alnus crispa Sorbus sitchensis			APSECT OF PLOT: NW SITE SERIES:
SHORT SHRUBS	Rubus spectabilis Vaccinium uliginosum Rubus pedatus Menziesia ferruginea Juniperus communis			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:	40			
HERBS	Cornus canadensis Gymnocarpium dryopteris Streptopus roseus Veratrum viride Lysichiton americanum Tiarella trifoliata Athyrium filix-femina Oplopanax horridus			
TOTAL HERBS: % COVER:	20			
% COVER TOTAL VEGETATION:	70			

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH # 4	DATE:(Y/M/D/H/M): 96/08/14 OPENING: 2L		BANK: Left PLOT #: 8	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES	Tsuga mertensiana Abies amabilis			GENERAL CONDITION OF RIPARIAN ZONE: lots of moss cover plot taken on edge of steep bank vegetation shaded by terrain
DOMINANT TREES				
MAIN CANOPY TREES	Abies amabilis			SOIL DESCRIPTIONS: lots of organic material
SERAL TREES	Tsuga mertensiana			SUBSTRATE (%):
TOTAL TREES: % COVER:	10			DECAYING WOOD: 3 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 97 WATER: 0
TALL SHRUBS	Sorbus sitchensis			APSECT OF PLOT: NW SITE SERIES:
SHORT SHRUBS	Vaccinium uliginosum Rubus pedatus Rubus spectabilis			OTHER COMMENTS: lots of mosquitoes, flies
TOTAL SHRUBS: % COVER:	35			
HERBS	Viola palustrus Cornus canadensis Gymnocarpium dryopteris Blechnum spicant Streptopus roseus Lysichiton americanum			
TOTAL HERBS: % COVER:	15			
% COVER TOTAL VEGETATION:	55			

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH # 4	DATE:(Y/M/D/H/M): 96/08/13 OPENIN 2L		BANK: Left PLOT #: 9	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Tsuga mertensiana Abies amabilis			GENERAL CONDITION OF RIPARIAN ZONE: small strip of trees 3m higher than water level
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: lots of organic matter
SERAL TREES	Chamaecyparis nootkatensis Thuja plicata Abies amabilis			SUBSTRATE (%):
TOTAL TREES: % COVER:		20		DECAYING WOOD: 2 BEDROCK: 5 MINERAL SOIL: 0 ORGANIC MATTER: 93 WATER: 0
TALL SHRUBS	Alnus rubra Alnus crispa			APSECT OF PLOT: N SITE SERIES:
SHORT SHRUBS	Vaccinium uliginosum Vaccinium ovalifolium Rubus spectabilis Vaccinium membranaceum			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		50		
HERBS	Gymnocarpium dryopteris Athyrium filix-femina Streptopus amplexifolius Lysichiton americanum Orthilia secunda Clintonia uniflora Streptopus roseus Cornus canadensis Rubus pedatus Tiarella trifoliata Veratrum viride			
TOTAL HERBS: % COVER:		20		
% COVER TOTAL VEGETATION:		75		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: 4	DATE:(Y/M/D/H/M): 96/08/13 OPENING 2L		BANK: Left PLOT #: 10	
VEGETATION STRATUM	SPECIES 3 qty. 3	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Thuja plicata Abies amabilis			GENERAL CONDITION OF RIPARIAN ZONE: narrow strip of veteran trees on edge plot on edge of 7m drop off lots of moss cover- almost 100%
DOMINANT TREES	Abies amabilis			
MAIN CANOPY TREES				SOIL DESCRIPTIONS: lots of organic material
SERAL TREES	Taxus brevifolia Abies amabilis Tsuga mertensiana Thuja plicata			SUBSTRATE (%):
TOTAL TREES: % COVER:		30		DECAYING WOOD: 1 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 99 WATER: 0
TALL SHRUBS				APSECT OF PLOT: N SITE SERIES:
SHORT SHRUBS	Vaccinium uliginosum Rubus pedatus			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		35		
HERBS	Cornus canadensis Clintonia uniflora Blechnum spicant Veratrum viride Gymnocarpium dryopteris Streptopus roseus Tiarella trifoliata			
TOTAL HERBS: % COVER:		10		
% COVER TOTAL VEGETATION:		65		

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 1)

WATERCOURSE NAME:	Crawford
OPENING NAME:	3L
CREW:	Squamish
DATE(YMD):	96/08/22

STREAM SHADING				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Stream shading class	5	H	M	L
Biogeoclimatic zone*	2	others	ICH,CDF	BG,PP,IDF
Stream classification	3	S1	S2	S3,S4,S5,S6
Aspect of stream segment	3	NE-NW	NE-SE/NW-SW	SE-SW
TOTAL SCORE (max=25)	13			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	H			

* NOTE: biogeoclimatic zone should be double (i.e., 2, 6 or 10)

LARGE WOODY DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Layer 1A	5	>150	51-150	<50
Layer 1B	1	>100	50-100	<50
Layer 2	3	>200	75-200	<75
Layer 3	1	>400	200-400	<200
Layer 4	1	>600	300-600	<300
Stream classification*	10	S1	S5,S6	S2,S3,S4
TOTAL SCORE (max=35)	21			
OVERALL IMPACT (L=<17, M=17-23, H=24-28, VH>28	M			

* NOTE: stream class should be doubled (i.e., 2, 6 or 10)

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 2)

SMALL ORGANIC DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Relative effectiveness class	1	H,VH	M	L,VL
Change class*	2	Ci/Cn or Di/Dn	Cd and Di	Cd and Dd
Stream classification	3	S1	S2	S3,S4,S5,S6
TOTAL SCORE (max=20)	6			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: change class should be doubled (i.e., 2, 6 or 10)

SURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Surface filtering capacity	1	H	M	L
EITHER: RMA terrain stability class	2	1,2	3	4,5
OR: RMA slope class*	NA	<35%	36-70%	>70%
Upslope sediment sources	1	none	few	significant
TOTAL SCORE (max=20)	4			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: either terrain stability class OR slope class should be doubled, but not both

SUBSURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Subsoil chemical filtering capacity class	3	H,VH	M	L,VL
Management area slope class	1	<35%	36-70%	>70%
Upslope chemical sources*	2	none	potentially	yes
TOTAL SCORE (max=20)	6			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: upslope chemical sources should be doubled (i.e., 2, 6 or 10)

DATA SHEET 5: LARGE WOODY DEBRIS PLOT ASSESSMENT TABLE for 1/100 ha (10X10m plots)

WATERCOURSE: CRAWFORD		DATE (YMD)	SURVEYOR:		PAGE 1 OF 1
REACH #:		OPENING: 3L	SEGMENT		SEGMENT LENGTH:
PLOT #	LAYER 1A (>22 cm)	LAYER 1B (>12.5, <22 cm)	LAYER 2 (>7.5, <12.5 CM)	LAYER 3 (0-<7.5 cm)	LAYER 4 (O, height=<1.3M)
1	0	4	4	8	6
2	0	2	0	4	23
3	0	0	0	3	20
4	0	0	1	5	0
5	0	0	1	6	0
6	0	1	3	36	0
7					
8					
9					
10					
TOTALS:	0	7	9	62	49
total # plots:	6	6	6	6	6

PRESENT LWD STOCKING:	0
FUTURE LWD STOCKING:	117
FUTURE LWD STOCKING:	150
FUTURE LWD STOCKING:	1033
FUTURE LWD STOCKING:	817
TOTAL FUTURE LWD STOCKIN	2117

NOTES/COMMENTS:

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:	DATE:(Y/M/D/H/M): 96/08/22 OPENING 3L		BANK: Left PLOT #: 1	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES	0			GENERAL CONDITION OF RIPARIAN ZONE: healthy, well vegetated, lots of tall shrubs on plot edge along stream
DOMINANT TREES				
MAIN CANOPY TREES	Abies amabilis Tsuga mertensiana Tsuga heterophylla			SOIL DESCRIPTIONS: organic, moist
SERAL TREES	Chamaecyparis nootkatensis Tsuga heterophylla Gymnocarpium dryopteris Tsuga mertensiana Abies amabilis			SUBSTRATE (%):
TOTAL TREES: % COVER:		20		DECAYING WOOD: 10 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 90 WATER: 0
TALL SHRUBS	Alnus crispa Sorbus sitchensis			APSECT OF PLOT: NW SITE SERIES:
SHORT SHRUBS	Rubus spectabilis Rubus pedatus Vaccinium membranaceum Vaccinium uliginosum Menziesia ferruginea			OTHER COMMENTS: plot is on the edge of a natural avalanche chute
TOTAL SHRUBS: % COVER:		70		
HERBS	Cornus canadensis Lysichiton americanum Blechnum spicant Athyrium filix-femina Tiarella trifoliata Epilobium angustifolium			
TOTAL HERBS: % COVER:				
% COVER TOTAL VEGETATION:				

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:	DATE:(Y/M/D/H/M): 96/08/22 OPENING 3L		BANK: Left PLOT #: 2	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: well vegetated, lots of Vaccinium steep bank mossy logged to edge of bank
DOMINANT TREES				
MAIN CANOPY TREES	Abies amabilis			SOIL DESCRIPTIONS: organic, moist
SERAL TREES	Abies amabilis Tsuga mertensiana Tsuga heterophylla Chamaecyparus nootkatensis			SUBSTRATE (%):
TOTAL TREES: % COVER:		10		DECAYING WOOD: 5 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 95 WATER: 0
TALL SHRUBS	Alnus crispa			APSECT OF PLOT: NW SITE SERIES:
SHORT SHRUBS	Rubus pedatus Menziesia ferruginea Vaccinium uliginesum Vaccinium membranaceum			OTHER COMMENTS: grass
TOTAL SHRUBS: % COVER:		70		
HERBS	Gymnocarpium dryopteris Cornus canadensis Epilobium angustifolium Streptopus roseus Athyrium felix-femina Tiarella trifoliata			
TOTAL HERBS: % COVER:		15		
% COVER TOTAL VEGETATION:		75		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:	DATE:(Y/M/D/H/M): 96/08/22 OPENING 3L		BANK: Left PLOT #: 3	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: strip of seedlings along bank logged to edge of bank plot on edge of cliff
DOMINANT TREES				
MAIN CANOPY TREES	Chamaecyparis nootkatensis			SOIL DESCRIPTIONS: organic
SERAL TREES	Abies amabilis Tsuga mertensiana Tsuga heterophylla			SUBSTRATE (%):
TOTAL TREES: % COVER:		5		DECAYING WOOD: 30 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 70 WATER: 0
TALL SHRUBS				APSECT OF PLOT: NW SITE SERIES:
SHORT SHRUBS	Vaccinium membranaceum Vaccinium uliginosum Rubus pedatus Menziesia ferruginea			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		70		
HERBS	Epilobium angustifolium Cornus canadensis Athyrium filix-femina			
TOTAL HERBS: % COVER:		10		
% COVER TOTAL VEGETATION:		85		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:	DATE:(Y/M/D/H/M): 96/08/28 OPENING 3L		BANK: Left PLOT #: 4	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: logged to edge of bank large tree lying parallel to, and on bank edge well vegetated, sand and grass near edge
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: sand
SERAL TREES	Chamaecyparis nootkatensis Tsuga mertensiana Abies amabilis			SUBSTRATE (%):
TOTAL TREES: % COVER:		2		DECAYING WOOD: 20 BEDROCK: 0 MINERAL SOIL: 90 ORGANIC MATTER: 10 WATER: 0
TALL SHRUBS	Alnus crispa Salix sitchensis			APSECT OF PLOT: NW SITE SERIES:
SHORT SHRUBS	Rubus spectabilis Ribes bracteosum Ribes lacustre			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		40		
HERBS	Anaphalis margaritacea Epilobium angustifolium Athyrium filix-femina Tiarella trifoliata Oplopanax horridus Lysichiton americanum Gymnocarpium dryopteris Arucus dlocius Viola glabella			
TOTAL HERBS: % COVER:		5		
% COVER TOTAL VEGETATION:		40		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:	DATE:(Y/M/D/H/M): 96/08/28 OPENING 3L		BANK: Left PLOT #: 5	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: logged to edge of bank well vegetated side channel on edge of plot large woody deris lodged on sand bar between side channel and main channel
DOMINANT TREES				
MAIN CANOPY TREES	Tsuga mertensiana			SOIL DESCRIPTIONS: organic
SERAL TREES	Tsuga mertensiana Tsuga heterophylla Abies amabilis			SUBSTRATE (%):
TOTAL TREES: % COVER:		5		DECAYING WOOD: 20 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 80 WATER: 0
TALL SHRUBS	Alnus crispa Salix leucida			APSECT OF PLOT: N SITE SERIES:
SHORT SHRUBS	Ribes bracteosum Rubus spectabilis Vaccinium uliginosum			OTHER COMMENTS: white fur found stuck in branches along bank
TOTAL SHRUBS: % COVER:		60		
HERBS	Epilobium angustifolium Dryopteris expansa Gymnocarpium dryopteris Anaphalis margaritaceae Tiarella trifoliate			
TOTAL HERBS: % COVER:		15		
% COVER TOTAL VEGETATION:		80		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:	DATE:(Y/M/D/H/M): 96/08/28 OPENIN 3L		BANK: Left PLOT #: 6	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: logged to edge of bank grass on bank edge well vegetated moss at rear of plot
DOMINANT TREES				
MAIN CANOPY TREES	Abies amabilis Tsuga mertensiana			SOIL DESCRIPTIONS: organic
SERAL TREES	Tsuga heterophylla Abies amabilis			SUBSTRATE (%):
TOTAL TREES: % COVER:		20		DECAYING WOOD: 40 BEDROCK: 1 MINERAL SOIL: 0 ORGANIC MATTER: 59 WATER: 0
TALL SHRUBS	Alnus crispa			APSECT OF PLOT: W SITE SERIES:
SHORT SHRUBS	Rubus spectabilis Vaccinium membranaceum Rubus pedatus Ribes bracteosum Vaccinium uliginosum Ribes lacustre Oplopanax horridus Sambucus racemosa Menziesia ferruginea			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:				
HERBS	Epilobium angustifolium Dryopteris expansa Gymnocarpium dryopteris Tiarella trifoliata Streptopus roseus			
TOTAL HERBS: % COVER:		35		
% COVER TOTAL VEGETATION:		70		

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 1)

WATERCOURSE NAME:	Crawford
OPENING NAME:	3R
CREW:	Squamish
DATE(YMD):	96/08/28

STREAM SHADING				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Stream shading class	5	H	M	L
Biogeoclimatic zone*	2	others	ICH,CDF	BG,PP,IDF
Stream classification	3	S1	S2	S3,S4,S5,S6
Aspect of stream segment	5	NE-NW	NE-SE/NW-SW	SE-SW
TOTAL SCORE (max=25)	15			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	H			

*NOTE: biogeoclimatic zone should be doubled (i.e., 2, 6 or 10)

LARGE WOODY DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Layer 1A	5	>150	51-150	<50
Layer 1B	5	>100	50-100	<50
Layer 2	1	>200	75-200	<75
Layer 3	1	>400	200-400	<200
Layer 4	3	>600	300-600	<300
Stream classification*	10	S1	S5,S6	S2,S3,S4
TOTAL SCORE (max=35)	25			
OVERALL IMPACT (L=<17, M=17-23, H=24-28, VH>28	H			

* NOTE: stream class should be doubled (i.e., 2, 6 or 10)

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 2)

SMALL ORGANIC DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Relative effectiveness class	1	H,VH	M	L,VL
Change class*	2	Ci/Cn or Di/Dn	Cd and Di	Cd and Dd
Stream classification	3	S1	S2	S3,S4,S5,S6
TOTAL SCORE (max=20)	6			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: change class should be doubled (i.e., 2, 6 or 10)

SURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Surface filtering capacity	3	H	M	L
EITHER: RMA terrain stability class	6	1,2	3	4,5
OR: RMA slope class*	NA	<35%	36-70%	>70%
Upslope sediment sources	3	none	few	significant
TOTAL SCORE (max=20)	12			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	M			

* NOTE: either terrain stability class OR slope class should be doubled, but not both

SUBSURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Subsoil chemical filtering capacity class	5	H,VH	M	L,VL
Management area slope class	1	<35%	36-70%	>70%
Upslope chemical sources*	2	none	potentially	yes
TOTAL SCORE (max=20)	8			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	M			

* NOTE: upslope chemical sources should be doubled (i.e., 2, 6 or 10)

DATA SHEET 5: LARGE WOODY DEBRIS PLOT ASSESSMENT TABLE for 1/100 ha (10X10m plots)

WATERCOURSE: CRAWFORD		DATE (YMD): 08/29/96	SURVEYOR:		PAGE 1 OF 1
REACH #:		OPENING : 3R	SEGMENT		SEGMENT LENGTH:
PLOT #	LAYER 1A (>22 cm)	LAYER 1B (>12.5, <22 cm)	LAYER 2 (>7.5, <12.5 CM)	LAYER 3 (0-<7.5 cm)	LAYER 4 (O, height=<1.3M)
1	0	0	0	2	6
2	0	0	9	4	8
3	0	0	2	1	0
4	0	0	10	21	10
5	0	0	8	5	2
6	0	0	0	5	0
7	0	1	2	8	0
8					
9					
10					
TOTALS:	0	1	31	46	26
total # plots:	7	7	7	7	7

PRESENT LWD STOCKING:	0
FUTURE LWD STOCKING:	14
FUTURE LWD STOCKING:	443
FUTURE LWD STOCKING:	657
FUTURE LWD STOCKING:	371
TOTAL FUTURE LWD STOCKING:	1486

NOTES/COMMENTS:

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/29 OPENING: 3R		BANK: R PLOT #: 1	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: well vegetated logged to edge of stream
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: organic
SERAL TREES	Thuja plicata Tsuga mertensiana			
				SUBSTRATE (%):
TOTAL TREES: % COVER:		5		DECAYING WOOD: 25 BEDROCK: 10 MINERAL SOIL: 0 ORGANIC MATTER: 65 WATER: 0
TALL SHRUBS	Alnus crispa			APSECT OF PLOT: E SITE SERIES:
SHORT SHRUBS	Sorbus sitchensis Rubus pedata Menziesia ferruginea Vaccinium ovalifolium Rubus spectabilis Viburnum edule Oplopanax horridus Ribes bracteosum			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		25		
HERBS	Epilobium angustifolium Clintonia uniflora Cornus canadensis Anaphilis magaritacea Athyria felix femina Tiarella trifoliata Claytonia sibirica			
TOTAL HERBS: % COVER:		40		
% COVER TOTAL VEGETATION:		65		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/29 OPENING: 3R		BANK: R PLOT #: 2	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: not many seedlings lots of fireweed well vegetated
DOMINANT TREES	Abies amabilis			
MAIN CANOPY TREES	Abies amabilis Chamaecyparis nootkatensis			SOIL DESCRIPTIONS: organic
SERAL TREES	Abies amabilis			
				SUBSTRATE (%):
TOTAL TREES: % COVER:				DECAYING WOOD: 30 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 70 WATER: 0
TALL SHRUBS	Alnus crispa			APSECT OF PLOT: SE SITE SERIES:
SHORT SHRUBS	Rubus spectabilis Rubus pedatus Sambucus racemosa Vaccinium ovalifolium			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:				
HERBS	Epilobium angustifolium Gymnocarpium dryopteris Cornus canadensis Streptopus roseus Clintonia uniflora Athyrium filix-femina			
TOTAL HERBS: % COVER:				
% COVER TOTAL VEGETATION:				

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/29 OPENING: 3R		BANK: R PLOT #: 3	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: lots of fireweed logged to bank hardly any trees some grass
DOMINANT TREES	Abies amabilis			
MAIN CANOPY TREES	Abies amabilis			SOIL DESCRIPTIONS: organic
SERAL TREES	Chamaecyaris nootkatensis			SUBSTRATE (%):
TOTAL TREES: % COVER:		2		DECAYING WOOD: 20 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 80 WATER: 0
TALL SHRUBS	Alnus crispa			APSECT OF PLOT: E SITE SERIES:
SHORT SHRUBS	Rubus pedatus Rubus spectabilis Sambucus racemosa Vaccinium uliginosum Oplopanax horridus Vaccinium ovalifolium			OTHER COMMENTS: very hot
TOTAL SHRUBS: % COVER:		10		
HERBS	Epilobium angustifolium Athyrium filix-femina Cornus canadensis Anaphalis magaritacea Blechnum spicant			
TOTAL HERBS: % COVER:		70		
% COVER TOTAL VEGETATION:		80		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/29 OPENING 3R		BANK: R PLOT #: 4	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: very steep at stream bank logged to edge good variety of plants lots of trees
DOMINANT TREES	Abies amabilis Tsuga mertensiana			
MAIN CANOPY TREES	Abies amabilis Tsuga mertensiana			SOIL DESCRIPTIONS: organic
SERAL TREES	Abies amabilis Tsuga mertensiana Tsuga heterophylla Thuja plicata Chamaecyparis nootkatensis			SUBSTRATE (%):
TOTAL TREES: % COVER:		40		DECAYING WOOD: 30 BEDROCK: 3 MINERAL SOIL: 0 ORGANIC MATTER: 67 WATER: 0
TALL SHRUBS	Alnus crispa			APSECT OF PLOT: SE SITE SERIES:
SHORT SHRUBS	Vaccinium membranaceum Oplopanax horridus Vaccinum uliginosum Rubus spectabilis Ribes bracteosum			OTHER COMMENTS: Stellar jays
TOTAL SHRUBS: % COVER:		25		
HERBS	Epilobium angustifolium Cornus canadensis Tiarella trifoliata Athyrium filix-femina Gymnocarpium dryopteris Blechnum spicant			
TOTAL HERBS: % COVER:		10		
% COVER TOTAL VEGETATION:		75		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/29 OPENING 3R		BANK: R PLOT #: 5	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: lots of fireweed logged to bank well vegetated plot beside pool
DOMINANT TREES	Abies amabilis			
MAIN CANOPY TREES	Abies amabilis Tsuga mertensiana			SOIL DESCRIPTIONS: organic
SERAL TREES	Abies amabilis Tsuga heterophylla			SUBSTRATE (%):
TOTAL TREES: % COVER:		10		DECAYING WOOD: 30 BEDROCK: 3 MINERAL SOIL: 0 ORGANIC MATTER: 67 WATER: 0
TALL SHRUBS	Alnus crispa			APSECT OF PLOT: SE SITE SERIES:
SHORT SHRUBS	Rubus spectabilis Vaccinium uliginosum Rubus parviflorus Oplopanax horridus Sambucus racemosa			OTHER COMMENTS: Stellar jays
TOTAL SHRUBS: % COVER:		60		
HERBS	Epilobium angustifolium Cornus canadensis Athyrium filix-femina Dryopteris expansa Claytonia sibirica Tiarella trifoliata			
TOTAL HERBS: % COVER:		30		
% COVER TOTAL VEGETATION:		75		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/29 OPENING 3R		BANK: R PLOT #: 6	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: very large trib runs through the whole plot lots of willow plot is opposite dead tree going across stream, wet lots of mossand grass
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: wet, organic
SERAL TREES	Thuja plicata			
				SUBSTRATE (%):
TOTAL TREES: % COVER:		5		DECAYING WOOD: 0 BEDROCK: 30 MINERAL SOIL: 0 ORGANIC MATTER: 30 WATER: 40
TALL SHRUBS	Alnus crispa Salix sitchensis			APSECT OF PLOT: E SITE SERIES:
SHORT SHRUBS	Oplopanax horridus Ribes bracteosum Rubus parviflorum Rubus spectablilis			OTHER COMMENTS: Stellar jays in this opening and across the stream a plot was done almost directly across from this one on the left bank
TOTAL SHRUBS: % COVER:		70		
HERBS	Anaphilis magaritaceae Viola glabella Equisetum arvense Lactuca muralis Gallium triflorium			
TOTAL HERBS: % COVER:		30		
% COVER TOTAL VEGETATION:		75		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH # NA	DATE:(Y/M/D/H/M): 96/08/28 OPENIN 3R		BANK: R PLOT #: 7	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE:
DOMINANT TREES				
MAIN CANOPY TREES	Abies amabilis			SOIL DESCRIPTIONS:
SERAL TREES	Abies amabilis Tsuga heterophylla			SUBSTRATE (%):
TOTAL TREES: % COVER:		10		DECAYING WOOD: 5 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 95 WATER: 0
TALL SHRUBS	Alnus crispa			APSECT OF PLOT: E SITE SERIES:
SHORT SHRUBS	Rubus spectabilis Sambucus racemosa Vaccinium membranaceum Oplopanax horridus Vaccinium uliginosum			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		70		
HERBS	Anaphalis margaritaceae Epilobium angustifolium Tiarella trifoliata Gymnocarpium dryopteris Streptopus roseus Viola glabella Lactuca muralis Dryopteris expansa Veratrum viride Polystichum minutum Dicentra formosa			
TOTAL HERBS: % COVER:		15		
% COVER TOTAL VEGETATION:		75		

DATA SHEET 5: LARGE WOODY DEBRIS PLOT ASSESSMENT TABLE for 1/100 ha (10X10m plots)

WATERCOURSE: Crawford		DATE (YMD) 96/08/28	SURVEYOR:Mike		PAGE 1 OF 1
REACH #: NA		OPENING 4L	SEGMENT NA		SEGMENT LENGTH:178
PLOT #	LAYER 1A (>22 cm)	LAYER 1B (>12.5, <22 cm)	LAYER 2 (>7.5, <12.5 CM)	LAYER 3 (0-<7.5 cm)	LAYER 4 (O, height=<1.3M)
1	1	0	1	1	3
2	4	1	1	19	22
3	0	0	0	3	4
4					
5					
6					
7					
8					
9					
10					
TOTALS:	5	1	2	23	29
total # plots:	3	3	3	3	3

PRESENT LWD STOCKING:	167
FUTURE LWD STOCKING:	33
FUTURE LWD STOCKING:	67
FUTURE LWD STOCKING:	767
FUTURE LWD STOCKING:	967
TOTAL FUTURE LWD STOCKIN	1833

NOTES/COMMENTS:

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/22 OPENING: 4L		BANK: L PLOT #: 1	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES	Abies amabilis 1			GENERAL CONDITION OF RIPARIAN ZONE: lots of fireweed
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: organic
SERAL TREES	Tsuga heterophylla			
				SUBSTRATE (%):
TOTAL TREES: % COVER:				DECAYING WOOD: 20 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 90 WATER: 0
TALL SHRUBS	Alnus crispa			APSECT OF PLOT: NW SITE SERIES:
SHORT SHRUBS	Ribes bracteosum Rubus spectabilis Vaccinium uliginosum Sambucus racemosa			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		5		
HERBS	Epilobium angustifolium Gymnocarpium dryopteris Streptopus amplexifolius Oplopanax horridus Tiarella trifoliata Veratrum viride Viola glabella Athyrium filix-femina Equisetum arvense			
TOTAL HERBS: % COVER:		70		
% COVER TOTAL VEGETATION:		75		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/22 OPENING: 4L		BANK: L PLOT #: 2	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Tsuga heterophylla 4			GENERAL CONDITION OF RIPARIAN ZONE: patch of bare ground in center of plot narrow strip of veteran trees on edge
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: dry organic
SERAL TREES	Tsuga heterophylla Abies amabilis			SUBSTRATE (%):
TOTAL TREES: % COVER:		30		DECAYING WOOD: 15 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 85 WATER: 0
TALL SHRUBS				APSECT OF PLOT: NW SITE SERIES:
SHORT SHRUBS	Ribes bracteosum Rubus pedatus Rubus spectabilis Sambucus racemosa			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		20		
HERBS	Streptopus roseus Epilobium angustifolium Veratrum viride Gymnocarpium dryopteris Tiarella trifoliata Streptopus amplexifolius			
TOTAL HERBS: % COVER:		5		
% COVER TOTAL VEGETATION:		50		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH # NA	DATE:(Y/M/D/H/M): 96/08/22 OPENING: 4L		BANK: L PLOT #: 3	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: well vegetated, tall shrubs logged to edge
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: decaying wood/bedrock, moist, sand
SERAL TREES	Tsuga heterophylla			SUBSTRATE (%):
TOTAL TREES: % COVER:		1		DECAYING WOOD: 15 BEDROCK: 15 MINERAL SOIL: 5 ORGANIC MATTER: 45 WATER: 20
TALL SHRUBS	Alnus crispa Salix sitchensis			APSECT OF PLOT: W SITE SERIES:
SHORT SHRUBS	Vaccinium uliginosum Rubus spectabilis Ribes bracteosum Oplopanax horridus			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		60		
HERBS	Lysichiton americanum Viola glabella Epilobium angustifolium Athyrium filix-femina Gymnocarpium dryopteris Blechnum spicant Senecio triangularis Anaphalis margaritacea Saxifraga mertensiana Aruncus dioicus Streptopus roseus Parnassia fimbriata Prenanthes alata Veratrum viride Tiarella trifoliata Arnica sp.			
TOTAL HERBS: % COVER:		30		
% COVER TOTAL VEGETATION:		70		

DATA SHEET 5: LARGE WOODY DEBRIS PLOT ASSESSMENT TABLE for 1/100 ha (10X10m plots)

WATERCOURSE:Crawford		DATE (YMD)96/08/21	SURVEYOR:Rod		PAGE 1 OF 1
REACH #: NA		OPENING 5R	SEGMENT 5R		SEGMENT LENGTH:175
PLOT #	LAYER 1A (>22 cm)	LAYER 1B (>12.5, <22 cm)	LAYER 2 (>7.5, <12.5 CM)	LAYER 3 (0-<7.5 cm)	LAYER 4 (O, height=<1.3M)
1	2	0	0	1	17
2	0	1	1	1	65
3	0	0	20	0	61
4					
5					
6					
7					
8					
9					
10					
TOTALS:	2	1	21	2	143
total # plots:	3	3	3	3	3

PRESENT LWD STOCKING:	67
FUTURE LWD STOCKING:	33
FUTURE LWD STOCKING:	700
FUTURE LWD STOCKING:	67
FUTURE LWD STOCKING:	4767
TOTAL FUTURE LWD STOCKIN	5567

NOTES/COMMENTS:

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/21 OPENING: 5R		BANK: R PLOT #: 1	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: wet/boggy lots of willow (salix) moss and liverwort
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: organic, moist
SERAL TREES	Tsuga heterophylla			
				SUBSTRATE (%):
TOTAL TREES: % COVER:		5		DECAYING WOOD: 10 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 85 WATER: 5
TALL SHRUBS	Alnus crispa Salix sitchensis (30%)			APSECT OF PLOT: E SITE SERIES:
SHORT SHRUBS	Rubus spectabilis Rubus pedatus Ribes lacustre			OTHER COMMENTS: Standing dead trees on creek bank
TOTAL SHRUBS: % COVER:		40		
HERBS	Platanthera unalascensis Lysichiton americanum Equisetum arvense Gymnocarpium dryopteris Viola glabella Cornus canadensis Anaphalis margaritaceae Athyrium filix-femina Epilobium anagallidifolium Lactuca muralis Tiarella trifoliata Epilobium angustifolia Streptopur amplexifolius			
TOTAL HERBS: % COVER:		70		
% COVER TOTAL VEGETATION:		75		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford	DATE:(Y/M/D/H/M): 96/08/21	BANK: R	
REACH # NA	OPENING: 5R	PLOT #: 2	

VEGETATION STRATUM	SPECIES	qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Tsuga heterophylla	1			GENERAL CONDITION OF RIPARIAN ZONE: logged to edge of bank moist, grass growing in run-off channel lots of moss
DOMINANT TREES	Abies amabilis Tsuga heterophylla				
MAIN CANOPY TREES	none				SOIL DESCRIPTIONS: organic, moist
SERAL TREES	Tsuga heterophylla Abies amabilis Alnus crispa Thuja plicata				SUBSTRATE (%):
TOTAL TREES: % COVER:			20		DECAYING WOOD: 30 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 68 WATER: 3
TALL SHRUBS	Sorbus sitchensis Menziesia ferruginea				APSECT OF PLOT: E SITE SERIES:
SHORT SHRUBS	Rubus pedatus Vaccinium uliginosum Rubus spectabilis Ribes lacustre Oplopanax horridus				OTHER COMMENTS: grass whole deer skeleton
TOTAL SHRUBS: % COVER:			65		
HERBS	Streptopus roseus Veratrum viride Gymnocarpium dryopteris Tiarella trifoliata Epilobium angustifolium Dryopteris expansa Lysichiton americanum Platanthera unalascensis Mimulus lewisii Claytonia sibirica Cornus canadensis Athyrium filix-femina Saxifraga mertensiana Equietum arvense Clintonia uniflorum				
TOTAL HERBS: % COVER:			30		
% COVER TOTAL VEGETATION:			75		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/21 OPENING: 5R		BANK: R PLOT #: 3	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: sparse moss cover within plot well vegetated, lots of vaccinium and seedlings
DOMINANT TREES	Abies amabilis			
MAIN CANOPY TREES				SOIL DESCRIPTIONS: organic, moist
SERAL TREES	Tsuga heterophylla Abies amabilis Chamaecyparis nootkatensis			
TOTAL TREES: % COVER:		30		SUBSTRATE (%):
TALL SHRUBS				DECAYING WOOD: 20 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 80 WATER: 0
SHORT SHRUBS	Rubus spectabilis Vaccinium uliginosum Rubus pedatus Menziesia ferruginea			APSECT OF PLOT: N SITE SERIES:
TOTAL SHRUBS: % COVER:		60		OTHER COMMENTS: 4 veteran trees along bank logged to edge sparse alder (A. rubra) on edge of bank
HERBS	Gymnocarpium dryopteris Epilobium angustifolium Clintonia uniflora Streptopus amplexifolius Cornus canadensis			
TOTAL HERBS: % COVER:		30		
% COVER TOTAL VEGETATION:		70		

DATA SHEET 5: LARGE WOODY DEBRIS PLOT ASSESSMENT TABLE for 1/100 ha (10X10m plots)

WATERCOURSE: CRAWFORD		DATE (YMD): 08/29/96	SURVEYOR:		PAGE 1 OF 1
REACH #:		OPENING: 6R	SEGMENT		SEGMENT LENGTH:
PLOT #	LAYER 1A (>22 cm)	LAYER 1B (>12.5, <22 cm)	LAYER 2 (>7.5, <12.5 CM)	LAYER 3 (0-<7.5 cm)	LAYER 4 (O, height=<1.3M)
1	2	2	3	2	27
2	1	3	2	0	47
3	0	1	0	0	242
4	6	15	15	0	113
5					
6					
7					
8					
9					
10					
TOTALS:	9	21	20	2	429
total # plots:	4	4	4	4	4

PRESENT LWD STOCKING:	225
FUTURE LWD STOCKING:	525
FUTURE LWD STOCKING:	500
FUTURE LWD STOCKING:	50
FUTURE LWD STOCKING:	10725
TOTAL FUTURE LWD STOCKIN	11800

NOTES/COMMENTS:

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/21 OPENING 6R		BANK: R PLOT #: 0	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Chamaecyparis nootkaensis 1			GENERAL CONDITION OF RIPARIAN ZONE: moist, good cover, lots of moss logged to edge of stream
DOMINANT TREES				
MAIN CANOPY TREES	Alnus rubra			SOIL DESCRIPTIONS: organic, moist
SERAL TREES	Tsuga heterophylla Tsuga mertensiana Abies amabilis Chamaecyparus nootkatensis			SUBSTRATE (%):
TOTAL TREES: % COVER:		40		DECAYING WOOD: 20 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 65 WATER: 15
TALL SHRUBS	Viburnum edule Alnus crispa			APSECT OF PLOT: E SITE SERIES:
SHORT SHRUBS	Vaccinium uliginosum Rubus pedatus Rubus spectabilis Menziesia ferruginea			OTHER COMMENTS: large pile of logs above plot on edge of road
TOTAL SHRUBS: % COVER:		30		
HERBS	Cornus canadensis Equisetum arvense Gymnocarpium dryopteris Lysichiton americanum Tiarella trifoliata Anaphalis margaritacea Athyrium filix-femina Epilobium angustifolium Viola glabella Clintonia uniflorum Streptopus amplexifolius Saxifraga mertensiana Prenanthes alocta Veratrum viride Platanthera unalascensis			
TOTAL HERBS: % COVER:		20		
% COVER TOTAL VEGETATION:		75		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:	DATE:(Y/M/D/H/M): 96/08/21 OPENING: 6R		BANK: R PLOT #: 1	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES	Tsuga mertensiana Abies amabilis			GENERAL CONDITION OF RIPARIAN ZONE: healthy with shrubs Alnus rubra along outer edge of plot along bank moss covering debris within plot
DOMINANT TREES				
MAIN CANOPY TREES	Tsuga heterophylla			SOIL DESCRIPTIONS: moist, organic
SERAL TREES	Abies amabilis Tsuga heterophylla Chamaecyparis nootkatensis			SUBSTRATE (%):
TOTAL TREES: % COVER:		10		DECAYING WOOD: 20 BEDROCK: 0 MINERAL SOIL: 1 ORGANIC MATTER: 66 WATER: 15
TALL SHRUBS				APSECT OF PLOT: E SITE SERIES:
SHORT SHRUBS	Vaccinium membraneceum Rubus pedatus Rubus spectabilis			OTHER COMMENTS: tributary runs into plot bear droppings throughout plot opening seems to be a lot of birds in this opening veteran trees on outer edge alongside stream
TOTAL SHRUBS: % COVER:		70		
HERBS	Cornus canadensis Clintonia uniflora Tiarella trifoliata Streptopus roseus Menziesia ferruginea Epilobium angustifolium Gymnocarpium dryopteris			
TOTAL HERBS: % COVER:		15		
% COVER TOTAL VEGETATION:		80		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/20 OPENING: 6R		BANK: R PLOT #: 2	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Tsuga heterophylla			GENERAL CONDITION OF RIPARIAN ZONE: shrubs smaller than last plot, lots of small seedlings has moss cover
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: organic, moist
SERAL TREES	Abies amabilis Chamaecyparis nootkatensis Tsuga heterophylla			SUBSTRATE (%):
TOTAL TREES: % COVER:		20		DECAYING WOOD: 5 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 93 WATER: 2
TALL SHRUBS				ASPECT OF PLOT: E SITE SERIES:
SHORT SHRUBS	Vaccinium membraneceum Rubus pedatus Rubus spectabilis Lysichiton americanum Oplopanax horridus			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		35		
HERBS	Cornus canadensis Gymnocarpium dryopteris Tiarella trifoliata Streptopus roseus Clintonia uniflora Viola gallium Athyrium filix-femina Blechnum spicant			
TOTAL HERBS: % COVER:		15		
% COVER TOTAL VEGETATION:		65		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/20 OPENING: 6R		BANK: R PLOT #: 3	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES	Tsuga heterophylla			GENERAL CONDITION OF RIPARIAN ZONE: healthy, well-vegetated narrow strip of veteran trees on bank around 10m lots of moss on bank edge of plot
DOMINANT TREES	Tsuga heterophylla			
MAIN CANOPY TREES				SOIL DESCRIPTIONS: organic
SERAL TREES	Tsuga heterophylla Abies amabilis			SUBSTRATE (%):
TOTAL TREES: % COVER:		40		DECAYING WOOD: 15 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 85 WATER: 0
TALL SHRUBS	Oplopanax horridus			APSECT OF PLOT: E SITE SERIES:
SHORT SHRUBS	Vaccinium membraneceum Rubus spectabilis Rubus pedatus Rubus parviflorus			OTHER COMMENTS: bear droppings wet day
TOTAL SHRUBS: % COVER:		60		
HERBS	Cornus canadensis Clintonia uniflora Epilobium angustifolium Athyrium filix-femina Gymnocarpium dryopteris Tiarella trifoliata Streptopus roseus			
TOTAL HERBS: % COVER:		5		
% COVER TOTAL VEGETATION:		80		

DATA SHEET 5: LARGE WOODY DEBRIS PLOT ASSESSMENT TABLE for 1/100 ha (10X10m plots)

WATERCOURSE:Crawford		DATE (YMD)96/08/22	SURVEYOR:NA		PAGE 1 OF 1
REACH #:	NA	OPENING 7L	SEGMENT NA		SEGMENT LENGTH:364
PLOT #	LAYER 1A (>22 cm)	LAYER 1B (>12.5, <22 cm)	LAYER 2 (>7.5, <12.5 CM)	LAYER 3 (0-<7.5 cm)	LAYER 4 (O, height=<1.3M)
1	1	1	1	34	55
2	1	1	0	29	76
3	7	2	2	26	39
4	4	3	3	40	108
5	0	2	3	41	93
6	4	1	2	0	49
7					
8					
9					
10					
TOTALS:	17	10	11	170	420
total # plots:	6	6	6	6	6

PRESENT LWD STOCKING:	283
FUTURE LWD STOCKING:	167
FUTURE LWD STOCKING:	183
FUTURE LWD STOCKING:	2833
FUTURE LWD STOCKING:	7000
TOTAL FUTURE LWD STOCKIN	10183

NOTES/COMMENTS:

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:	DATE:(Y/M/D/H/M): 96/08/19 OPENING: 7L		BANK: L PLOT #: 1	
VEGETATION STRATUM	SPECIES	qty.	% COVER	DISTRIBUTION
VETERAN TREES	Abies amabilis	1		
DOMINANT TREES				
MAIN CANOPY TREES	Alnus rubra Chamaecyparis nootkatensis			
SERAL TREES				
TOTAL TREES: % COVER:			25	
TALL SHRUBS	Alnus crispa			
SHORT SHRUBS	Rubus spectabilis Salix leucida Sambucus racemosa Vaccinium uliginosum Oplopanax horridus			
TOTAL SHRUBS: % COVER:			25	
HERBS	Gymnocarpium dryopteris Streptopus amplexifolius Gallium triflorum Mimulus lewisii Tiarella trifoliata Senecio triangularis Veratrum viride Streptopus roseus Saxifraga mertensiana Athyrium filix-femina Viola glabella			
TOTAL HERBS: % COVER:				
% COVER TOTAL VEGETATION:				

OTHER ATTRIBUTES

GENERAL CONDITION OF RIPARIAN ZONE:
narrow strip of veteran trees
water in channel

SOIL DESCRIPTIONS:
organic, moist

SUBSTRATE (%):

DECAYING WOOD:	5
BEDROCK:	3
MINERAL SOIL:	0
ORGANIC MATTER:	90
WATER:	2

APSECT OF PLOT: SW
SITE SERIES:

OTHER COMMENTS:
cold/wet

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/19 OPENING: 7L		BANK: L PLOT #: 2	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES	Abies amabilis 1			GENERAL CONDITION OF RIPARIAN ZONE:
DOMINANT TREES				
MAIN CANOPY TREES	Alnus rubra			SOIL DESCRIPTIONS:
SERAL TREES				SUBSTRATE (%):
TOTAL TREES: % COVER:		10		DECAYING WOOD: BEDROCK: MINERAL SOIL: ORGANIC MATTER: WATER:
TALL SHRUBS	Salix scouleriana			APSECT OF PLOT: SITE SERIES:
SHORT SHRUBS	Rubus spectabilis Vaccinium uliginosum Ribes bracteosum Vaccinium membranaceum			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		40		
HERBS	Anaphalis margaritacea Streptopus roseus Tiarella trifoliata Gallium triflorum Athyrium filix-femina Gymnocarpium dryopteris Epilobium anagallifolium			
TOTAL HERBS: % COVER:		5		
% COVER TOTAL VEGETATION:		50		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/19 OPENING: 7L		BANK: L PLOT #: 3	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES	Abies amabilis			GENERAL CONDITION OF RIPARIAN ZONE: narrow patchy strip of veteran trees along edge of stream mostly vegetated
DOMINANT TREES				
MAIN CANOPY TREES	Alnus rubra Tsuga heterophylla			SOIL DESCRIPTIONS: organic
SERAL TREES	Tsuga heterophylla			SUBSTRATE (%):
TOTAL TREES: % COVER:		50		DECAYING WOOD: 20 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 80 WATER: 0
TALL SHRUBS				APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Ribes bracteosum Salix scouleriana Sambucus racemosa Ribes lacustre Rubus spectabilis Vaccinium uliginosum Rubus pedatus Oplopanax horridus			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		50		
HERBS	Anaphalis margaritacea Gallium triflorium Gymnocarpium dryopteris Tiarella trifoliata Athyrium filix-femina Lupinus arctica Viola glabella Streptopus roseus			
TOTAL HERBS: % COVER:		50		
% COVER TOTAL VEGETATION:		80		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:	DATE:(Y/M/D/H/M): 96/08/19 OPENING: 7L		BANK: L PLOT #: 4	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES	Abies amabilis 2 Tsuga heterophylla 2			GENERAL CONDITION OF RIPARIAN ZONE: narrow strip of veteran trees on edge plot on edge of ephemeral channel
DOMINANT TREES	Tsuga heterophylla			
MAIN CANOPY TREES	Alnus rubra			SOIL DESCRIPTIONS: organic soil, lots of debris
SERAL TREES	Tsuga heterophylla Chamaecyparis nootkatensis			SUBSTRATE (%):
TOTAL TREES: % COVER:		10		DECAYING WOOD: 50 BEDROCK: 5 MINERAL SOIL: 0 ORGANIC MATTER: 45 WATER: 0
TALL SHRUBS				APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Rubus spectabilis Rubus pedatus Vaccinium uliginosum Ribes lacustre			OTHER COMMENTS: highly impacted
TOTAL SHRUBS: % COVER:		20		
HERBS	Epilobium angustifolium Lupinus arctaris Orthilia secunda Tiarella trifoliata Prenanthes alata Arancus dioicus Hieracium albiflorum Viola glabella			
TOTAL HERBS: % COVER:				
% COVER TOTAL VEGETATION:				

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/19 OPENING: 7L		BANK: L PLOT #: 5	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: plot is on what looks like a high water run off area lots of gravel/sand, moss covered rocks, very flat area
DOMINANT TREES	Abies amabilis			
MAIN CANOPY TREES	Alnus rubra Chamaecyparis nootkatensis Abies amabilis			SOIL DESCRIPTIONS: sand/gravel
SERAL TREES	Abies amabilis Tsuga mertensiana Tsuga heterophylla			SUBSTRATE (%):
TOTAL TREES: % COVER:		40		DECAYING WOOD: 5 BEDROCK: 70 MINERAL SOIL: 10 ORGANIC MATTER: 15 WATER: 0
TALL SHRUBS				APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Rubus spectabilis Ribes bracteosum Ribes lacustre Rubus pedatus Vaccinium uliginosum			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		10		
HERBS	Anaphalis margaritacea Gymnocarpium dryopteris Lupinus arcticus Epilobium angustifolium Epilobium anagallidifolium Dicentra formosa Galifolium triflorum Epilobium angustifolium Saxifraga nelsoniana Senecio triangularis			
TOTAL HERBS: % COVER:		20		
% COVER TOTAL VEGETATION:		60		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:	DATE:(Y/M/D/H/M): 96/08/19 OPENING: 7L			BANK: L PLOT #: 6	
VEGETATION STRATUM	SPECIES	qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Tsuga heterophylla	5			GENERAL CONDITION OF RIPARIAN ZONE: highly impacted, plot on possible run-off channel/ gully narrow strip of veteran trees on edge
DOMINANT TREES	Chamaecyparis nootkatensis				
MAIN CANOPY TREES					SOIL DESCRIPTIONS: bare soil/sand, dead wood in gully area organic on edges of plot
SERAL TREES	Tsuga heterophylla Abies amabilis				SUBSTRATE (%):
TOTAL TREES: % COVER:			10		DECAYING WOOD: 30 BEDROCK: 50 MINERAL SOIL: 10 ORGANIC MATTER: 10 WATER: 0
TALL SHRUBS					APSECT OF PLOT: W SITE SERIES:
SHORT SHRUBS	Rubus pedatus Vaccinium uliginosum Rubus spectabilis Menziesia ferruginea Ribes lacustre				OTHER COMMENTS:
TOTAL SHRUBS: % COVER:			5		
HERBS	Epilobium angustifolium Tiarella trifoliata Lupinus arcticus Gymnocarpium dryopteris Athyrium filix-femina Epilobium anagallidifolium				
TOTAL HERBS: % COVER:			10		
% COVER TOTAL VEGETATION:			20		

DATA SHEET 5: LARGE WOODY DEBRIS PLOT ASSESSMENT TABLE for 1/100 ha (10X10m plots)

WATERCOURSE: Crawford		DATE (YMD)96/08/19	SURVEYOR:	Mike	PAGE _1__ OF 1
REACH #:	NA	OPENING 8L	SEGMENT	NA	SEGMENT LENGTH:267
PLOT #	LAYER 1A (>22 cm)	LAYER 1B (>12.5, <22 cm)	LAYER 2 (>7.5, <12.5 CM)	LAYER 3 (0-<7.5 cm)	LAYER 4 (O, height=<1.3M)
1	7	1	2	8	73
2	7	2	3	9	302
3	4	0	1	13	270*
4	1	2	3	10	118
5	3	1	1	5	83
6	11	3	3	21	137
7					
8					
9					
10					
TOTALS:	33	9	13	66	983
total # plots:	6	6	6	6	6

PRESENT LWD STOCKING:	550
FUTURE LWD STOCKING:	150
FUTURE LWD STOCKING:	217
FUTURE LWD STOCKING:	1100
FUTURE LWD STOCKING:	16383
TOTAL FUTURE LWD STOCKIN	17850

NOTES/COMMENTS:
* 83 are 1cm tall

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:	DATE:(Y/M/D/H/M): 96/08/19 OPENING 8L		BANK: L PLOT #: 1	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Abies amabilis 1 Tsuga heterophylla 5 Chamaecyparis nootkatensis 1			GENERAL CONDITION OF RIPARIAN ZONE: narrow strip of veteran trees plot on edge of waterfall
DOMINANT TREES				
MAIN CANOPY TREES	Tsuga heterophylla			SOIL DESCRIPTIONS: organic
SERAL TREES				SUBSTRATE (%):
TOTAL TREES: % COVER:		15		DECAYING WOOD: 60 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 40 WATER: 0
TALL SHRUBS				APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Menziesa ferruginea Vaccinium uliginosum Vaccinium membranaceum Gaultheria shallon Rubus pedatus Sorbus sitchensis			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		10		
HERBS	Clintonia uniflora Smilacina racemosa Blechnum spicant Streptopus amplexifolius			
TOTAL HERBS: % COVER:		3		
% COVER TOTAL VEGETATION:		20		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:	DATE:(Y/M/D/H/M): 96/08/19 OPENING: 8L		BANK: L PLOT #: 2	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES	Abies amabilis 2			GENERAL CONDITION OF RIPARIAN ZONE: narrow strip of veteran trees on edge not much ground cover
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: roting wood, organic debris
SERAL TREES	Abies amabilis Tsuga heterophylla			SUBSTRATE (%):
TOTAL TREES: % COVER:		10		DECAYING WOOD: 40 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 60 WATER: 0
TALL SHRUBS				APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Oplopanax horridus Vaccinium uliginosum Rubus pedatus Gaultheria shallon Rubus spectabilis			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		10		
HERBS	Streptopus roseus Athyrium filix-femina Blechnum spicant Tiarella trifoliata Viola sempervirens Viola glabella			
TOTAL HERBS: % COVER:		10		
% COVER TOTAL VEGETATION:		25		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/19 OPENING: 8L		BANK: L PLOT #: 3	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES	Tsuga heterophylla 3			GENERAL CONDITION OF RIPARIAN ZONE: small strip of veteran trees on edge very little ground cover some moss near bank
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: decaying wood, organic matter
SERAL TREES	Abies amabilis			SUBSTRATE (%):
TOTAL TREES: % COVER:		8		DECAYING WOOD: 15 BEDROCK: 5 MINERAL SOIL: 0 ORGANIC MATTER: 80 WATER: 0
TALL SHRUBS				APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Vaccinium membranaceum Vaccinium uliginosum Rubus spectabilis Rubus pedatus			OTHER COMMENTS: highly impacted, mostly bare soil
TOTAL SHRUBS: % COVER:		5		
HERBS	Juniperus communis Streptopus amplexifolius Tiarella trifoliata Athyrium filix-femina Streptopus roseus			
TOTAL HERBS: % COVER:		5		
% COVER TOTAL VEGETATION:		15		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:	DATE:(Y/M/D/H/M): 96/08/19 OPENING: 8L		BANK: L PLOT #: 4	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES	Tsuga heterophylla 2			GENERAL CONDITION OF RIPARIAN ZONE: small strip of veteran trees, bank eroded, veterans fallen across stream highly impacted, no ground cover very little moss
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: decaying wood, organic
SERAL TREES	Abies amabilis Chamaecyparis nootkatensis Tsuga heterophylla			SUBSTRATE (%):
TOTAL TREES: % COVER:		5		DECAYING WOOD: 25 BEDROCK: 3 MINERAL SOIL: 0 ORGANIC MATTER: 72 WATER: 0
TALL SHRUBS				APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Vaccinium uliginosum Rubus pedatus Vaccinium membranaceum Linnaea borealis Pachystima myrsinites			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		5		
HERBS	Epilobium angustifolium Streptopus roseus Juniperus communis			
TOTAL HERBS: % COVER:		3		
% COVER TOTAL VEGETATION:		10		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:		DATE:(Y/M/D/H/M): 96/08/19 OPENING: 8L		BANK: L PLOT #: 5	
VEGETATION STRATUM	SPECIES	qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Tsuga heterophylla	2			GENERAL CONDITION OF RIPARIAN ZONE: edge of bank eroded, veteran trees fallen in creek highly impacted, very little ground cover some moss
DOMINANT TREES					
MAIN CANOPY TREES					SOIL DESCRIPTIONS: rotting wood and debris, organic
SERAL TREES	Abies amabilis Tsuga heterophylla Chamaecyparis nootkatensis				SUBSTRATE (%):
TOTAL TREES: % COVER:			5		DECAYING WOOD: 20 BEDROCK: 2 MINERAL SOIL: 0 ORGANIC MATTER: 78 WATER: 0
TALL SHRUBS					APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Vaccinium membranaceum Rubus pedatus				OTHER COMMENTS: lots of bare soil exposed
TOTAL SHRUBS: % COVER:			2		
HERBS	Streptopus roseus				
TOTAL HERBS: % COVER:			1		
% COVER TOTAL VEGETATION:			5		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:	DATE:(Y/M/D/H/M): 96/08/19 OPENING: 8L		BANK: L PLOT #: 6	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Chamaecyparis nootkatensis 4 Tsuga heterophylla 3 Thuja plicata 3			GENERAL CONDITION OF RIPARIAN ZONE: 5m leave strip of veteran trees lots of moss cover no underbrush cover to speak of
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: decaying wood, organic
SERAL TREES	Tsuga heterophylla Abies amabilis Chamaecyparis nootkatensis			SUBSTRATE (%):
TOTAL TREES: % COVER:		25		DECAYING WOOD: 20 BEDROCK: 3 MINERAL SOIL: 0 ORGANIC MATTER: 77 WATER: 0
TALL SHRUBS				APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Vaccinium membranaceum Cornus canadensis Rubus pedatus Vaccinium uliginosum			OTHER COMMENTS: highly impacted
TOTAL SHRUBS: % COVER:		15		
HERBS	Streptopus roseus			
TOTAL HERBS: % COVER:		1		
% COVER TOTAL VEGETATION:		30		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/29 OPENING 3R		BANK: R PLOT #: 4	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: very steep at stream bank logged to edge good variety of plants lots of trees
DOMINANT TREES	Abies amabilis Tsuga mertensiana			
MAIN CANOPY TREES	Abies amabilis Tsuga mertensiana			SOIL DESCRIPTIONS: organic
SERAL TREES	Abies amabilis Tsuga mertensiana Tsuga heterophylla Thuja plicata Chamaecyparis nootkatensis			SUBSTRATE (%):
TOTAL TREES: % COVER:		40		DECAYING WOOD: 30 BEDROCK: 3 MINERAL SOIL: 0 ORGANIC MATTER: 67 WATER: 0
TALL SHRUBS	Alnus crispa			APSECT OF PLOT: SE SITE SERIES:
SHORT SHRUBS	Vaccinium membranaceum Oplopanax horridus Vaccinum uliginosum Rubus spectabilis Ribes bracteosum			OTHER COMMENTS: Stellar jays
TOTAL SHRUBS: % COVER:		25		
HERBS	Epilobium angustifolium Cornus canadensis Tiarella trifoliata Athyrium filix-femina Gymnocarpium dryopteris Blechnum spicant			
TOTAL HERBS: % COVER:		10		
% COVER TOTAL VEGETATION:		75		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/29 OPENING 3R		BANK: R PLOT #: 5	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: lots of fireweed logged to bank well vegetated plot beside pool
DOMINANT TREES	Abies amabilis			
MAIN CANOPY TREES	Abies amabilis Tsuga mertensiana			SOIL DESCRIPTIONS: organic
SERAL TREES	Abies amabilis Tsuga heterophylla			SUBSTRATE (%):
TOTAL TREES: % COVER:		10		DECAYING WOOD: 30 BEDROCK: 3 MINERAL SOIL: 0 ORGANIC MATTER: 67 WATER: 0
TALL SHRUBS	Alnus crispa			APSECT OF PLOT: SE SITE SERIES:
SHORT SHRUBS	Rubus spectabilis Vaccinium uliginosum Rubus parviflorus Oplopanax horridus Sambucus racemosa			OTHER COMMENTS: Stellar jays
TOTAL SHRUBS: % COVER:		60		
HERBS	Epilobium angustifolium Cornus canadensis Athyrium filix-femina Dryopteris expansa Claytonia sibirica Tiarella trifoliata			
TOTAL HERBS: % COVER:		30		
% COVER TOTAL VEGETATION:		75		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/29 OPENING 3R		BANK: R PLOT #: 6	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: very large trib runs through the whole plot lots of willow plot is opposite dead tree going across stream, wet lots of mossand grass
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: wet, organic
SERAL TREES	Thuja plicata			
				SUBSTRATE (%):
TOTAL TREES: % COVER:		5		DECAYING WOOD: 0 BEDROCK: 30 MINERAL SOIL: 0 ORGANIC MATTER: 30 WATER: 40
TALL SHRUBS	Alnus crispa Salix sitchensis			APSECT OF PLOT: E SITE SERIES:
SHORT SHRUBS	Oplopanax horridus Ribes bracteosum Rubus parviflorum Rubus spectablilis			OTHER COMMENTS: Stellar jays in this opening and across the stream a plot was done almost directly across from this one on the left bank
TOTAL SHRUBS: % COVER:		70		
HERBS	Anaphilis magaritaceae Viola glabella Equisetum arvense Lactuca muralis Gallium triflorium			
TOTAL HERBS: % COVER:		30		
% COVER TOTAL VEGETATION:		75		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH # NA	DATE:(Y/M/D/H/M): 96/08/28 OPENIN 3R		BANK: R PLOT #: 7	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE:
DOMINANT TREES				
MAIN CANOPY TREES	Abies amabilis			SOIL DESCRIPTIONS:
SERAL TREES	Abies amabilis Tsuga heterophylla			SUBSTRATE (%):
TOTAL TREES: % COVER:		10		DECAYING WOOD: 5 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 95 WATER: 0
TALL SHRUBS	Alnus crispa			APSECT OF PLOT: E SITE SERIES:
SHORT SHRUBS	Rubus spectabilis Sambucus racemosa Vaccinium membranaceum Oplopanax horridus Vaccinium uliginosum			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		70		
HERBS	Anaphalis margaritaceae Epilobium angustifolium Tiarella trifoliata Gymnocarpium dryopteris Streptopus roseus Viola glabella Lactuca muralis Dryopteris expansa Veratrum viride Polystichum minutum Dicentra formosa			
TOTAL HERBS: % COVER:		15		
% COVER TOTAL VEGETATION:		75		

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 1)

WATERCOURSE NAME:	Crawford
OPENING NAME:	4L
CREW:	Squamish
DATE(YMD):	96/08/22

STREAM SHADING				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Stream shading class	5	H	M	L
Biogeoclimatic zone*	2	others	ICH,CDF	BG,PP,IDF
Stream classification	3	S1	S2	S3,S4,S5,S6
Aspect of stream segment	3	NE-NW	NE-SE/NW-SW	SE-SW
TOTAL SCORE (max=25)	13			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	H			

* NOTE: bigeoclimatic zone should be doubled (i.e., 2, 6 or 10)

LARGE WOODY DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Layer 1A	1	>150	51-150	<50
Layer 1B	5	>100	50-100	<50
Layer 2	5	>200	75-200	<75
Layer 3	1	>400	200-400	<200
Layer 4	1	>600	300-600	<300
Stream classification*	10	S1	S5,S6	S2,S3,S4
TOTAL SCORE (max=35)	23			
OVERALL IMPACT (L=<17, M=17-23, H=24-28, VH>28	H			

* NOTE: stream class should be doubled (i.e., 2, 6 or 10)

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 2)

SMALL ORGANIC DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Relative effectiveness class	1	H,VH	M	L,VL
Change class*	2	Ci/Cn or Di/Dn	Cd and Di	Cd and Dd
Stream classification	3	S1	S2	S3,S4,S5,S6
TOTAL SCORE (max=20)	6			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: change class should be doubled (i.e., 2, 6 or 10)

SURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Surface filtering capacity	1	H	M	L
EITHER: RMA terrain stability class	2	1,2	3	4,5
OR: RMA slope class*	NA	<35%	36-70%	>70%
Upslope sediment sources	1	none	few	significant
TOTAL SCORE (max=20)	4			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: either terrain stability class OR slope class should be doubled, but not both

SUBSURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Subsoil chemical filtering capacity class	3	H,VH	M	L,VL
Management area slope class	1	<35%	36-70%	>70%
Upslope chemical sources*	2	none	potentially	yes
TOTAL SCORE (max=20)	5			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: upslope chemical sources should be doubled (i.e., 2, 6 or 10)

DATA SHEET 5: LARGE WOODY DEBRIS PLOT ASSESSMENT TABLE for 1/100 ha (10X10m plots)

WATERCOURSE: Crawford		DATE (YMD) 96/08/28	SURVEYOR:Mike		PAGE 1 OF 1
REACH #: NA		OPENING 4L	SEGMENT NA		SEGMENT LENGTH:178
PLOT #	LAYER 1A (>22 cm)	LAYER 1B (>12.5, <22 cm)	LAYER 2 (>7.5, <12.5 CM)	LAYER 3 (0-<7.5 cm)	LAYER 4 (O, height=<1.3M)
1	1	0	1	1	3
2	4	1	1	19	22
3	0	0	0	3	4
4					
5					
6					
7					
8					
9					
10					
TOTALS:	5	1	2	23	29
total # plots:	3	3	3	3	3

PRESENT LWD STOCKING:	167
FUTURE LWD STOCKING:	33
FUTURE LWD STOCKING:	67
FUTURE LWD STOCKING:	767
FUTURE LWD STOCKING:	967
TOTAL FUTURE LWD STOCKIN	1833

NOTES/COMMENTS:

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/22 OPENING: 4L		BANK: L PLOT #: 1	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES	Abies amabilis 1			GENERAL CONDITION OF RIPARIAN ZONE: lots of fireweed
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: organic
SERAL TREES	Tsuga heterophylla			
				SUBSTRATE (%):
TOTAL TREES: % COVER:				DECAYING WOOD: 20 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 90 WATER: 0
TALL SHRUBS	Alnus crispa			APSECT OF PLOT: NW SITE SERIES:
SHORT SHRUBS	Ribes bracteosum Rubus spectabilis Vaccinium uliginosum Sambucus racemosa			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		5		
HERBS	Epilobium angustifolium Gymnocarpium dryopteris Streptopus amplexifolius Oplopanax horridus Tiarella trifoliata Veratrum viride Viola glabella Athyrium filix-femina Equisetum arvense			
TOTAL HERBS: % COVER:		70		
% COVER TOTAL VEGETATION:		75		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/22 OPENING: 4L		BANK: L PLOT #: 2	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Tsuga heterophylla 4			GENERAL CONDITION OF RIPARIAN ZONE: patch of bare ground in center of plot narrow strip of veteran trees on edge
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: dry organic
SERAL TREES	Tsuga heterophylla Abies amabilis			SUBSTRATE (%):
TOTAL TREES: % COVER:		30		DECAYING WOOD: 15 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 85 WATER: 0
TALL SHRUBS				APSECT OF PLOT: NW SITE SERIES:
SHORT SHRUBS	Ribes bracteosum Rubus pedatus Rubus spectabilis Sambucus racemosa			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		20		
HERBS	Streptopus roseus Epilobium angustifolium Veratrum viride Gymnocarpium dryopteris Tiarella trifoliata Streptopus amplexifolius			
TOTAL HERBS: % COVER:		5		
% COVER TOTAL VEGETATION:		50		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH # NA	DATE:(Y/M/D/H/M): 96/08/22 OPENING: 4L		BANK: L PLOT #: 3	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: well vegetated, tall shrubs logged to edge
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: decaying wood/bedrock, moist, sand
SERAL TREES	Tsuga heterophylla			SUBSTRATE (%):
TOTAL TREES: % COVER:		1		DECAYING WOOD: 15 BEDROCK: 15 MINERAL SOIL: 5 ORGANIC MATTER: 45 WATER: 20
TALL SHRUBS	Alnus crispa Salix sitchensis			APSECT OF PLOT: W SITE SERIES:
SHORT SHRUBS	Vaccinium uliginosum Rubus spectabilis Ribes bracteosum Oplopanax horridus			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		60		
HERBS	Lysichiton americanum Viola glabella Epilobium angustifolium Athyrium filix-femina Gymnocarpium dryopteris Blechnum spicant Senecio triangularis Anaphalis margaritacea Saxifraga mertensiana Aruncus dioicus Streptopus roseus Parnassia fimbriata Prenanthes alata Veratrum viride Tiarella trifoliata Arnica sp.			
TOTAL HERBS: % COVER:		30		
% COVER TOTAL VEGETATION:		70		

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 1)

WATERCOURSE NAME:	Crawford
OPENING NAME:	5R
CREW:	Squamish
DATE(YMD):	96/08/21

STREAM SHADING				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Stream shading class	3	H	M	L
Biogeoclimatic zone*	2	others	ICH,CDF	BG,PP,IDF
Stream classification	3	S1	S2	S3,S4,S5,S6
Aspect of stream segment	3	NE-NW	NE-SE/NW-SW	SE-SW
TOTAL SCORE (max=25)	11			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	M			

* NOTE: biogeoclimatic zone should be double (i.e., 2, 6 or 10)

LARGE WOODY DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Layer 1A	3	>150	51-150	<50
Layer 1B	5	>100	50-100	<50
Layer 2	1	>200	75-200	<75
Layer 3	5	>400	200-400	<200
Layer 4	1	>600	300-600	<300
Stream classification*	10	S1	S5,S6	S2,S3,S4
TOTAL SCORE (max=35)	25			
OVERALL IMPACT (L=<17, M=17-23, H=24-28, VH>28	H			

* NOTE: stream class should be doubled (i.e., 2, 6 or 10)

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 2)

SMALL ORGANIC DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Relative effectiveness class		H,VH	M	L,VL
Change class*	5	Ci/Cn or Di/Dn	Cd and Di	Cd and Dd
Stream classification	2	S1	S2	S3,S4,S5,S6
TOTAL SCORE (max=20)	3			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	10 M			

* NOTE: change class should be doubled (i.e., 2, 6 or 10)

SURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Surface filtering capacity	1	H	M	L
EITHER: RMA terrain stability class	2	1,2	3	4,5
OR: RMA slope class*	none	<35%	36-70%	>70%
Upslope sediment sources	1	none	few	significant
TOTAL SCORE (max=20)	4			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: either terrain stability class OR slope class should be doubled, but not both

SUBSURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Subsoil chemical filtering capacity class	3	H,VH	M	L,VL
Management area slope class	1	<35%	36-70%	>70%
Upslope chemical sources*	2	none	potentially	yes
TOTAL SCORE (max=20)	6			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: upslope chemical sources should be doubled (i.e., 2, 6 or 10)

DATA SHEET 5: LARGE WOODY DEBRIS PLOT ASSESSMENT TABLE for 1/100 ha (10X10m plots)

WATERCOURSE:Crawford		DATE (YMD)96/08/21	SURVEYOR:Rod		PAGE 1 OF 1
REACH #: NA		OPENING 5R	SEGMENT 5R		SEGMENT LENGTH:175
PLOT #	LAYER 1A (>22 cm)	LAYER 1B (>12.5, <22 cm)	LAYER 2 (>7.5, <12.5 CM)	LAYER 3 (0-<7.5 cm)	LAYER 4 (O, height=<1.3M)
1	2	0	0	1	17
2	0	1	1	1	65
3	0	0	20	0	61
4					
5					
6					
7					
8					
9					
10					
TOTALS:	2	1	21	2	143
total # plots:	3	3	3	3	3

PRESENT LWD STOCKING:	67
FUTURE LWD STOCKING:	33
FUTURE LWD STOCKING:	700
FUTURE LWD STOCKING:	67
FUTURE LWD STOCKING:	4767
TOTAL FUTURE LWD STOCKIN	5567

NOTES/COMMENTS:

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/21 OPENING: 5R		BANK: R PLOT #: 1	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: wet/boggy lots of willow (salix) moss and liverwort
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: organic, moist
SERAL TREES	Tsuga heterophylla			
				SUBSTRATE (%):
TOTAL TREES: % COVER:		5		DECAYING WOOD: 10 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 85 WATER: 5
TALL SHRUBS	Alnus crispa Salix sitchensis (30%)			APSECT OF PLOT: E SITE SERIES:
SHORT SHRUBS	Rubus spectabilis Rubus pedatus Ribes lacustre			OTHER COMMENTS: Standing dead trees on creek bank
TOTAL SHRUBS: % COVER:		40		
HERBS	Platanthera unalascensis Lysichiton americanum Equisetum arvense Gymnocarpium dryopteris Viola glabella Cornus canadensis Anaphalis margaritaceae Athyrium filix-femina Epilobium anagallidifolium Lactuca muralis Tiarella trifoliata Epilobium angustifolia Streptopur amplexifolius			
TOTAL HERBS: % COVER:		70		
% COVER TOTAL VEGETATION:		75		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford	DATE:(Y/M/D/H/M): 96/08/21	BANK: R	
REACH # NA	OPENING: 5R	PLOT #: 2	

VEGETATION STRATUM	SPECIES	qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Tsuga heterophylla	1			GENERAL CONDITION OF RIPARIAN ZONE: logged to edge of bank moist, grass growing in run-off channel lots of moss
DOMINANT TREES	Abies amabilis Tsuga heterophylla				
MAIN CANOPY TREES	none				SOIL DESCRIPTIONS: organic, moist
SERAL TREES	Tsuga heterophylla Abies amabilis Alnus crispa Thuja plicata				SUBSTRATE (%):
TOTAL TREES: % COVER:			20		DECAYING WOOD: 30 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 68 WATER: 3
TALL SHRUBS	Sorbus sitchensis Menziesia ferruginea				APSECT OF PLOT: E SITE SERIES:
SHORT SHRUBS	Rubus pedatus Vaccinium uliginosum Rubus spectabilis Ribes lacustre Oplopanax horridus				OTHER COMMENTS: grass whole deer skeleton
TOTAL SHRUBS: % COVER:			65		
HERBS	Streptopus roseus Veratrum viride Gymnocarpium dryopteris Tiarella trifoliata Epilobium angustifolium Dryopteris expansa Lysichiton americanum Platanthera unalascensis Mimulus lewisii Claytonia sibirica Cornus canadensis Athyrium filix-femina Saxifraga mertensiana Equietum arvense Clintonia uniflorum				
TOTAL HERBS: % COVER:			30		
% COVER TOTAL VEGETATION:			75		

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 1)

WATERCOURSE NAME:	Crawford
OPENING NAME:	6R
CREW:	Squamish
DATE(YMD):	96/08/20

STREAM SHADING				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Stream shading class	3	H	M	L
Biogeoclimatic zone*	2	others	ICH,CDF	BG,PP,IDF
Stream classification	3	S1	S2	S3,S4,S5,S6
Aspect of stream segment	5	NE-NW	NE-SE/NW-SW	SE-SW
TOTAL SCORE (max=25)	13			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	H			

* NOTE: biogeoclimatic zone should be double (i.e., 2, 6 or 10)

LARGE WOODY DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Layer 1A	1	>150	51-150	<50
Layer 1B	1	>100	50-100	<50
Layer 2	1	>200	75-200	<75
Layer 3	5	>400	200-400	<200
Layer 4	1	>600	300-600	<300
Stream classification*	10	S1	S5,S6	S2,S3,S4
TOTAL SCORE (max=35)	20			
OVERALL IMPACT (L=<17, M=17-23, H=24-28, VH>28	M			

* NOTE: stream class should be doubled (i.e., 2, 6 or 10)

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/21 OPENING: 5R		BANK: R PLOT #: 3	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: sparse moss cover within plot well vegetated, lots of vaccinium and seedlings
DOMINANT TREES	Abies amabilis			
MAIN CANOPY TREES				SOIL DESCRIPTIONS: organic, moist
SERAL TREES	Tsuga heterophylla Abies amabilis Chamaecyparis nootkatensis			
TOTAL TREES: % COVER:		30		SUBSTRATE (%):
TALL SHRUBS				DECAYING WOOD: 20 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 80 WATER: 0
SHORT SHRUBS	Rubus spectabilis Vaccinium uliginosum Rubus pedatus Menziesia ferruginea			APSECT OF PLOT: N SITE SERIES:
TOTAL SHRUBS: % COVER:		60		OTHER COMMENTS: 4 veteran trees along bank logged to edge sparse alder (A. rubra) on edge of bank
HERBS	Gymnocarpium dryopteris Epilobium angustifolium Clintonia uniflora Streptopus amplexifolius Cornus canadensis			
TOTAL HERBS: % COVER:		30		
% COVER TOTAL VEGETATION:		70		

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 2)

SMALL ORGANIC DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Relative effectiveness class	5	H,VH	M	L,VL
Change class*	2	Ci/Cn or Di/Dn	Cd and Di	Cd and Dd
Stream classification	3	S1	S2	S3,S4,S5,S6
TOTAL SCORE (max=20)	10			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	M			

* NOTE: change class should be doubled (i.e., 2, 6 or 10)

SURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Surface filtering capacity	1	H	M	L
EITHER: RMA terrain stability class	6	1,2	3	4,5
OR: RMA slope class*	NA	<35%	36-70%	>70%
Upslope sediment sources	3	none	few	significant
TOTAL SCORE (max=20)	10			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	M			

* NOTE: either terrain stability class OR slope class should be doubled, but not both

SUBSURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Subsoil chemical filtering capacity class	3	H,VH	M	L,VL
Management area slope class	1	<35%	36-70%	>70%
Upslope chemical sources*	2	none	potentially	yes
TOTAL SCORE (max=20)	6			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: upslope chemical sources should be doubled (i.e., 2, 6 or 10)

DATA SHEET 5: LARGE WOODY DEBRIS PLOT ASSESSMENT TABLE for 1/100 ha (10X10m plots)

WATERCOURSE: CRAWFORD		DATE (YMD): 08/29/96	SURVEYOR:		PAGE 1 OF 1
REACH #:		OPENING: 6R	SEGMENT		SEGMENT LENGTH:
PLOT #	LAYER 1A (>22 cm)	LAYER 1B (>12.5, <22 cm)	LAYER 2 (>7.5, <12.5 CM)	LAYER 3 (0-<7.5 cm)	LAYER 4 (O, height=<1.3M)
1	2	2	3	2	27
2	1	3	2	0	47
3	0	1	0	0	242
4	6	15	15	0	113
5					
6					
7					
8					
9					
10					
TOTALS:	9	21	20	2	429
total # plots:	4	4	4	4	4

PRESENT LWD STOCKING:	225
FUTURE LWD STOCKING:	525
FUTURE LWD STOCKING:	500
FUTURE LWD STOCKING:	50
FUTURE LWD STOCKING:	10725
TOTAL FUTURE LWD STOCKIN	11800

NOTES/COMMENTS:

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/21 OPENING 6R		BANK: R PLOT #: 0	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Chamaecyparis nootkaensis 1			GENERAL CONDITION OF RIPARIAN ZONE: moist, good cover, lots of moss logged to edge of stream
DOMINANT TREES				
MAIN CANOPY TREES	Alnus rubra			SOIL DESCRIPTIONS: organic, moist
SERAL TREES	Tsuga heterophylla Tsuga mertensiana Abies amabilis Chamaecyparus nootkatensis			SUBSTRATE (%):
TOTAL TREES: % COVER:		40		DECAYING WOOD: 20 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 65 WATER: 15
TALL SHRUBS	Viburnum edule Alnus crispa			APSECT OF PLOT: E SITE SERIES:
SHORT SHRUBS	Vaccinium uliginosum Rubus pedatus Rubus spectabilis Menziesia ferruginea			OTHER COMMENTS: large pile of logs above plot on edge of road
TOTAL SHRUBS: % COVER:		30		
HERBS	Cornus canadensis Equisetum arvense Gymnocarpium dryopteris Lysichiton americanum Tiarella trifoliata Anaphalis margaritacea Athyrium filix-femina Epilobium angustifolium Viola glabella Clintonia uniflorum Streptopus amplexifolius Saxifraga mertensiana Prenanthes alocta Veratrum viride Platanthera unalascensis			
TOTAL HERBS: % COVER:		20		
% COVER TOTAL VEGETATION:		75		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:	DATE:(Y/M/D/H/M): 96/08/21 OPENING: 6R		BANK: R PLOT #: 1	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES	Tsuga mertensiana Abies amabilis			GENERAL CONDITION OF RIPARIAN ZONE: healthy with shrubs Alnus rubra along outer edge of plot along bank moss covering debris within plot
DOMINANT TREES				
MAIN CANOPY TREES	Tsuga heterophylla			SOIL DESCRIPTIONS: moist, organic
SERAL TREES	Abies amabilis Tsuga heterophylla Chamaecyparis nootkatensis			SUBSTRATE (%):
TOTAL TREES: % COVER:		10		DECAYING WOOD: 20 BEDROCK: 0 MINERAL SOIL: 1 ORGANIC MATTER: 66 WATER: 15
TALL SHRUBS				APSECT OF PLOT: E SITE SERIES:
SHORT SHRUBS	Vaccinium membraneceum Rubus pedatus Rubus spectabilis			OTHER COMMENTS: tributary runs into plot bear droppings throughout plot opening seems to be a lot of birds in this opening veteran trees on outer edge alongside stream
TOTAL SHRUBS: % COVER:		70		
HERBS	Cornus canadensis Clintonia uniflora Tiarella trifoliata Streptopus roseus Menziesia ferruginea Epilobium angustifolium Gymnocarpium dryopteris			
TOTAL HERBS: % COVER:		15		
% COVER TOTAL VEGETATION:		80		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/20 OPENING: 6R		BANK: R PLOT #: 2	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Tsuga heterophylla			GENERAL CONDITION OF RIPARIAN ZONE: shrubs smaller than last plot, lots of small seedlings has moss cover
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: organic, moist
SERAL TREES	Abies amabilis Chamaecyparis nootkatensis Tsuga heterophylla			SUBSTRATE (%):
TOTAL TREES: % COVER:		20		DECAYING WOOD: 5 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 93 WATER: 2
TALL SHRUBS				ASPECT OF PLOT: E SITE SERIES:
SHORT SHRUBS	Vaccinium membraneceum Rubus pedatus Rubus spectabilis Lysichiton americanum Oplopanax horridus			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		35		
HERBS	Cornus canadensis Gymnocarpium dryopteris Tiarella trifoliata Streptopus roseus Clintonia uniflora Viola gallium Athyrium filix-femina Blechnum spicant			
TOTAL HERBS: % COVER:		15		
% COVER TOTAL VEGETATION:		65		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/20 OPENING: 6R		BANK: R PLOT #: 3	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES	Tsuga heterophylla			GENERAL CONDITION OF RIPARIAN ZONE: healthy, well-vegetated narrow strip of veteran trees on bank around 10m lots of moss on bank edge of plot
DOMINANT TREES	Tsuga heterophylla			
MAIN CANOPY TREES				SOIL DESCRIPTIONS: organic
SERAL TREES	Tsuga heterophylla Abies amabilis			SUBSTRATE (%):
TOTAL TREES: % COVER:		40		DECAYING WOOD: 15 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 85 WATER: 0
TALL SHRUBS	Oplopanax horridus			APSECT OF PLOT: E SITE SERIES:
SHORT SHRUBS	Vaccinium membraneceum Rubus spectabilis Rubus pedatus Rubus parviflorus			OTHER COMMENTS: bear droppings wet day
TOTAL SHRUBS: % COVER:		60		
HERBS	Cornus canadensis Clintonia uniflora Epilobium angustifolium Athyrium filix-femina Gymnocarpium dryopteris Tiarella trifoliata Streptopus roseus			
TOTAL HERBS: % COVER:		5		
% COVER TOTAL VEGETATION:		80		

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 1)

WATERCOURSE NAME:	Crawford
OPENING NAME:	7L
CREW:	Squamish
DATE(YMD):	96/08/19

STREAM SHADING				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Stream shading class	1	H	M	L
Biogeoclimatic zone*	2	others	ICH,CDF	BG,PP,IDF
Stream classification	3	S1	S2	S3,S4,S5,S6
Aspect of stream segment	3	NE-NW	NE-SE/NW-SW	SE-SW
TOTAL SCORE (max=25)	9			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	M			

* NOTE: biogeoclimatic zone should be double (i.e., 2, 6 or 10)

LARGE WOODY DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Layer 1A	1	>150	51-150	<50
Layer 1B	1	>100	50-100	<50
Layer 2	3	>200	75-200	<75
Layer 3	1	>400	200-400	<200
Layer 4	1	>600	300-600	<300
Stream classification*	10	S1	S5,S6	S2,S3,S4
TOTAL SCORE (max=35)	17			
OVERALL IMPACT (L=<17, M=17-23, H=24-28, VH>28	M			

* NOTE: stream class should be doubled (i.e., 2, 6 or 10)

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 2)

SMALL ORGANIC DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Relative effectiveness class	3	H,VH	M	L,VL
Change class*	2	Ci/Cn or Di/Dn	Cd and Di	Cd and Dd
Stream classification	3	S1	S2	S3,S4,S5,S6
TOTAL SCORE (max=20)	8			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	M			

* NOTE: change class should be doubled (i.e., 2, 6 or 10)

SURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Surface filtering capacity	3	H	M	L
EITHER: RMA terrain stability class	2	1,2	3	4,5
OR: RMA slope class*	NA	<35%	36-70%	>70%
Upslope sediment sources	1	none	few	significant
TOTAL SCORE (max=20)	6			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: either terrain stability class OR slope class should be doubled, but not both

SUBSURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Subsoil chemical filtering capacity class	5	H,VH	M	L,VL
Management area slope class	1	<35%	36-70%	>70%
Upslope chemical sources*	2	none	potentially	yes
TOTAL SCORE (max=20)	8			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	M			

* NOTE: upslope chemical sources should be doubled (i.e., 2, 6 or 10)

DATA SHEET 5: LARGE WOODY DEBRIS PLOT ASSESSMENT TABLE for 1/100 ha (10X10m plots)

WATERCOURSE:Crawford		DATE (YMD)96/08/22	SURVEYOR:NA		PAGE 1 OF 1
REACH #:	NA	OPENING 7L	SEGMENT NA		SEGMENT LENGTH:364
PLOT #	LAYER 1A (>22 cm)	LAYER 1B (>12.5, <22 cm)	LAYER 2 (>7.5, <12.5 CM)	LAYER 3 (0-<7.5 cm)	LAYER 4 (O, height=<1.3M)
1	1	1	1	34	55
2	1	1	0	29	76
3	7	2	2	26	39
4	4	3	3	40	108
5	0	2	3	41	93
6	4	1	2	0	49
7					
8					
9					
10					
TOTALS:	17	10	11	170	420
total # plots:	6	6	6	6	6

PRESENT LWD STOCKING:	283
FUTURE LWD STOCKING:	167
FUTURE LWD STOCKING:	183
FUTURE LWD STOCKING:	2833
FUTURE LWD STOCKING:	7000
TOTAL FUTURE LWD STOCKIN	10183

NOTES/COMMENTS:

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:	DATE:(Y/M/D/H/M): 96/08/19 OPENING: 7L		BANK: L PLOT #: 1	
VEGETATION STRATUM	SPECIES	qty.	% COVER	DISTRIBUTION
VETERAN TREES	Abies amabilis	1		
DOMINANT TREES				
MAIN CANOPY TREES	Alnus rubra Chamaecyparis nootkatensis			
SERAL TREES				
TOTAL TREES: % COVER:			25	
TALL SHRUBS	Alnus crispa			
SHORT SHRUBS	Rubus spectabilis Salix leucida Sambucus racemosa Vaccinium uliginosum Oplopanax horridus			
TOTAL SHRUBS: % COVER:			25	
HERBS	Gymnocarpium dryopteris Streptopus amplexifolius Gallium triflorum Mimulus lewisii Tiarella trifoliata Senecio triangularis Veratrum viride Streptopus roseus Saxifraga mertensiana Athyrium filix-femina Viola glabella			
TOTAL HERBS: % COVER:				
% COVER TOTAL VEGETATION:				

OTHER ATTRIBUTES

GENERAL CONDITION OF RIPARIAN ZONE:
narrow strip of veteran trees
water in channel

SOIL DESCRIPTIONS:
organic, moist

SUBSTRATE (%):

DECAYING WOOD:	5
BEDROCK:	3
MINERAL SOIL:	0
ORGANIC MATTER:	90
WATER:	2

APSECT OF PLOT: SW
SITE SERIES:

OTHER COMMENTS:
cold/wet

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/19 OPENING: 7L		BANK: L PLOT #: 2	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES	Abies amabilis 1			GENERAL CONDITION OF RIPARIAN ZONE:
DOMINANT TREES				
MAIN CANOPY TREES	Alnus rubra			SOIL DESCRIPTIONS:
SERAL TREES				SUBSTRATE (%):
TOTAL TREES: % COVER:		10		DECAYING WOOD: BEDROCK: MINERAL SOIL: ORGANIC MATTER: WATER:
TALL SHRUBS	Salix scouleriana			APSECT OF PLOT: SITE SERIES:
SHORT SHRUBS	Rubus spectabilis Vaccinium uliginosum Ribes bracteosum Vaccinium membranaceum			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		40		
HERBS	Anaphalis margaritacea Streptopus roseus Tiarella trifoliata Gallium triflorum Athyrium filix-femina Gymnocarpium dryopteris Epilobium anagallifolium			
TOTAL HERBS: % COVER:		5		
% COVER TOTAL VEGETATION:		50		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/19 OPENING: 7L		BANK: L PLOT #: 3	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES	Abies amabilis			GENERAL CONDITION OF RIPARIAN ZONE: narrow patchy strip of veteran trees along edge of stream mostly vegetated
DOMINANT TREES				
MAIN CANOPY TREES	Alnus rubra Tsuga heterophylla			SOIL DESCRIPTIONS: organic
SERAL TREES	Tsuga heterophylla			SUBSTRATE (%):
TOTAL TREES: % COVER:		50		DECAYING WOOD: 20 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 80 WATER: 0
TALL SHRUBS				APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Ribes bracteosum Salix scouleriana Sambucus racemosa Ribes lacustre Rubus spectabilis Vaccinium uliginosum Rubus pedatus Oplopanax horridus			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		50		
HERBS	Anaphalis margaritacea Gallium triflorium Gymnocarpium dryopteris Tiarella trifoliata Athyrium filix-femina Lupinus arctica Viola glabella Streptopus roseus			
TOTAL HERBS: % COVER:		50		
% COVER TOTAL VEGETATION:		80		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:	DATE:(Y/M/D/H/M): 96/08/19 OPENING: 7L		BANK: L PLOT #: 4	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES	Abies amabilis 2 Tsuga heterophylla 2			GENERAL CONDITION OF RIPARIAN ZONE: narrow strip of veteran trees on edge plot on edge of ephemeral channel
DOMINANT TREES	Tsuga heterophylla			
MAIN CANOPY TREES	Alnus rubra			SOIL DESCRIPTIONS: organic soil, lots of debris
SERAL TREES	Tsuga heterophylla Chamaecyparis nootkatensis			SUBSTRATE (%):
TOTAL TREES: % COVER:		10		DECAYING WOOD: 50 BEDROCK: 5 MINERAL SOIL: 0 ORGANIC MATTER: 45 WATER: 0
TALL SHRUBS				APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Rubus spectabilis Rubus pedatus Vaccinium uliginosum Ribes lacustre			OTHER COMMENTS: highly impacted
TOTAL SHRUBS: % COVER:		20		
HERBS	Epilobium angustifolium Lupinus arctaris Orthilia secunda Tiarella trifoliata Prenanthes alata Arancus dioicus Hieracium albiflorum Viola glabella			
TOTAL HERBS: % COVER:				
% COVER TOTAL VEGETATION:				

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/19 OPENING: 7L		BANK: L PLOT #: 5	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES				GENERAL CONDITION OF RIPARIAN ZONE: plot is on what looks like a high water run off area lots of gravel/sand, moss covered rocks, very flat area
DOMINANT TREES	Abies amabilis			
MAIN CANOPY TREES	Alnus rubra Chamaecyparis nootkatensis Abies amabilis			SOIL DESCRIPTIONS: sand/gravel
SERAL TREES	Abies amabilis Tsuga mertensiana Tsuga heterophylla			SUBSTRATE (%):
TOTAL TREES: % COVER:		40		DECAYING WOOD: 5 BEDROCK: 70 MINERAL SOIL: 10 ORGANIC MATTER: 15 WATER: 0
TALL SHRUBS				APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Rubus spectabilis Ribes bracteosum Ribes lacustre Rubus pedatus Vaccinium uliginosum			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		10		
HERBS	Anaphalis margaritacea Gymnocarpium dryopteris Lupinus arcticus Epilobium angustifolium Epilobium anagallidifolium Dicentra formosa Galifolium triflorum Epilobium angustifolium Saxifraga nelsoniana Senecio triangularis			
TOTAL HERBS: % COVER:		20		
% COVER TOTAL VEGETATION:		60		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:	DATE:(Y/M/D/H/M): 96/08/19 OPENING: 7L			BANK: L PLOT #: 6	
VEGETATION STRATUM	SPECIES	qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Tsuga heterophylla	5			GENERAL CONDITION OF RIPARIAN ZONE: highly impacted, plot on possible run-off channel/ gully narrow strip of veteran trees on edge
DOMINANT TREES	Chamaecyparis nootkatensis				
MAIN CANOPY TREES					SOIL DESCRIPTIONS: bare soil/sand, dead wood in gully area organic on edges of plot
SERAL TREES	Tsuga heterophylla Abies amabilis				SUBSTRATE (%):
TOTAL TREES: % COVER:			10		DECAYING WOOD: 30 BEDROCK: 50 MINERAL SOIL: 10 ORGANIC MATTER: 10 WATER: 0
TALL SHRUBS					APSECT OF PLOT: W SITE SERIES:
SHORT SHRUBS	Rubus pedatus Vaccinium uliginosum Rubus spectabilis Menziesia ferruginea Ribes lacustre				OTHER COMMENTS:
TOTAL SHRUBS: % COVER:			5		
HERBS	Epilobium angustifolium Tiarella trifoliata Lupinus arcticus Gymnocarpium dryopteris Athyrium filix-femina Epilobium anagallidifolium				
TOTAL HERBS: % COVER:			10		
% COVER TOTAL VEGETATION:			20		

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 1)

WATERCOURSE NAME:	Crawford
OPENING NAME:	TRIBL
CREW:	Squamish
DATE(YMD):	96/08/19

STREAM SHADING				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Stream shading class	1	H	M	L
Biogeoclimatic zone*	2	others	ICH,CDF	BG,PP,IDF
Stream classification	5	S1	S2	S3,S4,S5,S6
Aspect of stream segment	5	NE-NW	NE-SE/NW-SW	SE-SW
TOTAL SCORE (max=25)	13			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	H			

* NOTE: biogeoclimatic zone should be double (i.e., 2, 6 or 10)

LARGE WOODY DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Layer 1A	1	>150	51-150	<50
Layer 1B	1	>100	50-100	<50
Layer 2	1	>200	75-200	<75
Layer 3	1	>400	200-400	<200
Layer 4	1	>600	300-600	<300
Stream classification*	10	S1	S5,S6	S2,S3,S4
TOTAL SCORE (max=35)	15			
OVERALL IMPACT (L=<17, M=17-23, H=24-28, VH>28	L			

* NOTE: stream class should be doubled (i.e., 2, 6 or 10)

DATA SHEET 3: CALCULATION OF OVERALL IMPACT SCORES (PAGE 2)

SMALL ORGANIC DEBRIS				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Relative effectiveness class	5	H,VH	M	L,VL
Change class*	6	Ci/Cn or Di/Dn	Cd and Di	Cd and Dd
Stream classification	5	S1	S2	S3,S4,S5,S6
TOTAL SCORE (max=20)	15			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	H			

* NOTE: change class should be doubled (i.e., 2, 6 or 10)

SURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Surface filtering capacity	3	H	M	L
EITHER: RMA terrain stability class	2	1,2	3	4,5
OR: RMA slope class*	NA	<35%	36-70%	>70%
Upslope sediment sources	1	none	few	significant
TOTAL SCORE (max=20)	6			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	L			

* NOTE: either terrain stability class OR slope class should be doubled, but not both

SUBSURFACE FILTERING CAPACITY				
VARIABLE	CLASS SCORE	IMPACT CLASS		
		LOW (1)	MEDIUM (3)	HIGH (5)
Subsoil chemical filtering capacity class	5	H,VH	M	L,VL
Management area slope class	1	<35%	36-70%	>70%
Upslope chemical sources*	2	none	potentially	yes
TOTAL SCORE (max=20)	8			
OVERALL IMPACT (L=<8, M=8-12, H=13-16, VH>16	M			

* NOTE: upslope chemical sources should be doubled (i.e., 2, 6 or 10)

DATA SHEET 5: LARGE WOODY DEBRIS PLOT ASSESSMENT TABLE for 1/100 ha (10X10m plots)

WATERCOURSE: Crawford		DATE (YMD)96/08/19	SURVEYOR:	Mike	PAGE _1__ OF 1
REACH #:	NA	OPENING 8L	SEGMENT	NA	SEGMENT LENGTH:267
PLOT #	LAYER 1A (>22 cm)	LAYER 1B (>12.5, <22 cm)	LAYER 2 (>7.5, <12.5 CM)	LAYER 3 (0-<7.5 cm)	LAYER 4 (O, height=<1.3M)
1	7	1	2	8	73
2	7	2	3	9	302
3	4	0	1	13	270*
4	1	2	3	10	118
5	3	1	1	5	83
6	11	3	3	21	137
7					
8					
9					
10					
TOTALS:	33	9	13	66	983
total # plots:	6	6	6	6	6

PRESENT LWD STOCKING:	550
FUTURE LWD STOCKING:	150
FUTURE LWD STOCKING:	217
FUTURE LWD STOCKING:	1100
FUTURE LWD STOCKING:	16383
TOTAL FUTURE LWD STOCKIN	17850

NOTES/COMMENTS:
* 83 are 1cm tall

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:	DATE:(Y/M/D/H/M): 96/08/19 OPENING 8L		BANK: L PLOT #: 1	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Abies amabilis 1 Tsuga heterophylla 5 Chamaecyparis nootkatensis 1			GENERAL CONDITION OF RIPARIAN ZONE: narrow strip of veteran trees plot on edge of waterfall
DOMINANT TREES				
MAIN CANOPY TREES	Tsuga heterophylla			SOIL DESCRIPTIONS: organic
SERAL TREES				SUBSTRATE (%):
TOTAL TREES: % COVER:		15		DECAYING WOOD: 60 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 40 WATER: 0
TALL SHRUBS				APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Menziesa ferruginea Vaccinium uliginosum Vaccinium membranaceum Gaultheria shallon Rubus pedatus Sorbus sitchensis			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		10		
HERBS	Clintonia uniflora Smilacina racemosa Blechnum spicant Streptopus amplexifolius			
TOTAL HERBS: % COVER:		3		
% COVER TOTAL VEGETATION:		20		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:	DATE:(Y/M/D/H/M): 96/08/19 OPENING 8L		BANK: L PLOT #: 1	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Abies amabilis 1 Tsuga heterophylla 5 Chamaecyparis nootkatensis 1			GENERAL CONDITION OF RIPARIAN ZONE: narrow strip of veteran trees plot on edge of waterfall
DOMINANT TREES				
MAIN CANOPY TREES	Tsuga heterophylla			SOIL DESCRIPTIONS: organic
SERAL TREES				SUBSTRATE (%):
TOTAL TREES: % COVER:		15		DECAYING WOOD: 60 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 40 WATER: 0
TALL SHRUBS				APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Menziesa ferruginea Vaccinium uliginosum Vaccinium membranaceum Gaultheria shallon Rubus pedatus Sorbus sitchensis			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		10		
HERBS	Clintonia uniflora Smilacina racemosa Blechnum spicant Streptopus amplexifolius			
TOTAL HERBS: % COVER:		3		
% COVER TOTAL VEGETATION:		20		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:	DATE:(Y/M/D/H/M): 96/08/19 OPENING: 8L		BANK: L PLOT #: 2	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES	Abies amabilis 2			GENERAL CONDITION OF RIPARIAN ZONE: narrow strip of veteran trees on edge not much ground cover
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: roting wood, organic debris
SERAL TREES	Abies amabilis Tsuga heterophylla			SUBSTRATE (%):
TOTAL TREES: % COVER:		10		DECAYING WOOD: 40 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 60 WATER: 0
TALL SHRUBS				APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Oplopanax horridus Vaccinium uliginosum Rubus pedatus Gaultheria shallon Rubus spectabilis			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		10		
HERBS	Streptopus roseus Athyrium filix-femina Blechnum spicant Tiarella trifoliata Viola sempervirens Viola glabella			
TOTAL HERBS: % COVER:		10		
% COVER TOTAL VEGETATION:		25		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/19 OPENING: 8L		BANK: L PLOT #: 3	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES	Tsuga heterophylla 3			GENERAL CONDITION OF RIPARIAN ZONE: small strip of veteran trees on edge very little ground cover some moss near bank
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: decaying wood, organic matter
SERAL TREES	Abies amabilis			SUBSTRATE (%):
TOTAL TREES: % COVER:		8		DECAYING WOOD: 15 BEDROCK: 5 MINERAL SOIL: 0 ORGANIC MATTER: 80 WATER: 0
TALL SHRUBS				APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Vaccinium membranaceum Vaccinium uliginosum Rubus spectabilis Rubus pedatus			OTHER COMMENTS: highly impacted, mostly bare soil
TOTAL SHRUBS: % COVER:		5		
HERBS	Juniperus communis Streptopus amplexifolius Tiarella trifoliata Athyrium filix-femina Streptopus roseus			
TOTAL HERBS: % COVER:		5		
% COVER TOTAL VEGETATION:		15		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:	DATE:(Y/M/D/H/M): 96/08/19 OPENING: 8L		BANK: L PLOT #: 4	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES	Tsuga heterophylla 2			GENERAL CONDITION OF RIPARIAN ZONE: small strip of veteran trees, bank eroded, veterans fallen across stream highly impacted, no ground cover very little moss
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: decaying wood, organic
SERAL TREES	Abies amabilis Chamaecyparis nootkatensis Tsuga heterophylla			SUBSTRATE (%):
TOTAL TREES: % COVER:		5		DECAYING WOOD: 25 BEDROCK: 3 MINERAL SOIL: 0 ORGANIC MATTER: 72 WATER: 0
TALL SHRUBS				APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Vaccinium uliginosum Rubus pedatus Vaccinium membranaceum Linnaea borealis Pachystima myrsinites			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		5		
HERBS	Epilobium angustifolium Streptopus roseus Juniperus communis			
TOTAL HERBS: % COVER:		3		
% COVER TOTAL VEGETATION:		10		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:		DATE:(Y/M/D/H/M): 96/08/19 OPENING: 8L		BANK: L PLOT #: 5	
VEGETATION STRATUM	SPECIES	qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Tsuga heterophylla	2			GENERAL CONDITION OF RIPARIAN ZONE: edge of bank eroded, veteran trees fallen in creek highly impacted, very little ground cover some moss
DOMINANT TREES					
MAIN CANOPY TREES					SOIL DESCRIPTIONS: rotting wood and debris, organic
SERAL TREES	Abies amabilis Tsuga heterophylla Chamaecyparis nootkatensis				SUBSTRATE (%):
TOTAL TREES: % COVER:			5		DECAYING WOOD: 20 BEDROCK: 2 MINERAL SOIL: 0 ORGANIC MATTER: 78 WATER: 0
TALL SHRUBS					APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Vaccinium membranaceum Rubus pedatus				OTHER COMMENTS: lots of bare soil exposed
TOTAL SHRUBS: % COVER:			2		
HERBS	Streptopus roseus				
TOTAL HERBS: % COVER:			1		
% COVER TOTAL VEGETATION:			5		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:	DATE:(Y/M/D/H/M): 96/08/19 OPENING: 8L		BANK: L PLOT #: 6	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Chamaecyparis nootkatensis 4 Tsuga heterophylla 3 Thuja plicata 3			GENERAL CONDITION OF RIPARIAN ZONE: 5m leave strip of veteran trees lots of moss cover no underbrush cover to speak of
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: decaying wood, organic
SERAL TREES	Tsuga heterophylla Abies amabilis Chamaecyparis nootkatensis			SUBSTRATE (%):
TOTAL TREES: % COVER:		25		DECAYING WOOD: 20 BEDROCK: 3 MINERAL SOIL: 0 ORGANIC MATTER: 77 WATER: 0
TALL SHRUBS				APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Vaccinium membranaceum Cornus canadensis Rubus pedatus Vaccinium uliginosum			OTHER COMMENTS: highly impacted
TOTAL SHRUBS: % COVER:		15		
HERBS	Streptopus roseus			
TOTAL HERBS: % COVER:		1		
% COVER TOTAL VEGETATION:		30		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:	DATE:(Y/M/D/H/M): 96/08/19 OPENING: 8L		BANK: L PLOT #: 2	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES	Abies amabilis 2			GENERAL CONDITION OF RIPARIAN ZONE: narrow strip of veteran trees on edge not much ground cover
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: roting wood, organic debris
SERAL TREES	Abies amabilis Tsuga heterophylla			SUBSTRATE (%):
TOTAL TREES: % COVER:		10		DECAYING WOOD: 40 BEDROCK: 0 MINERAL SOIL: 0 ORGANIC MATTER: 60 WATER: 0
TALL SHRUBS				APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Oplopanax horridus Vaccinium uliginosum Rubus pedatus Gaultheria shallon Rubus spectabilis			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		10		
HERBS	Streptopus roseus Athyrium filix-femina Blechnum spicant Tiarella trifoliata Viola sempervirens Viola glabella			
TOTAL HERBS: % COVER:		10		
% COVER TOTAL VEGETATION:		25		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #: NA	DATE:(Y/M/D/H/M): 96/08/19 OPENING: 8L		BANK: L PLOT #: 3	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES	Tsuga heterophylla 3			GENERAL CONDITION OF RIPARIAN ZONE: small strip of veteran trees on edge very little ground cover some moss near bank
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: decaying wood, organic matter
SERAL TREES	Abies amabilis			SUBSTRATE (%):
TOTAL TREES: % COVER:		8		DECAYING WOOD: 15 BEDROCK: 5 MINERAL SOIL: 0 ORGANIC MATTER: 80 WATER: 0
TALL SHRUBS				APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Vaccinium membranaceum Vaccinium uliginosum Rubus spectabilis Rubus pedatus			OTHER COMMENTS: highly impacted, mostly bare soil
TOTAL SHRUBS: % COVER:		5		
HERBS	Juniperus communis Streptopus amplexifolius Tiarella trifoliata Athyrium filix-femina Streptopus roseus			
TOTAL HERBS: % COVER:		5		
% COVER TOTAL VEGETATION:		15		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:	DATE:(Y/M/D/H/M): 96/08/19 OPENING: 8L		BANK: L PLOT #: 4	
VEGETATION STRATUM	SPECIES	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
	qty.			
VETERAN TREES	Tsuga heterophylla 2			GENERAL CONDITION OF RIPARIAN ZONE: small strip of veteran trees, bank eroded, veterans fallen across stream highly impacted, no ground cover very little moss
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: decaying wood, organic
SERAL TREES	Abies amabilis Chamaecyparis nootkatensis Tsuga heterophylla			SUBSTRATE (%):
TOTAL TREES: % COVER:		5		DECAYING WOOD: 25 BEDROCK: 3 MINERAL SOIL: 0 ORGANIC MATTER: 72 WATER: 0
TALL SHRUBS				APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Vaccinium uliginosum Rubus pedatus Vaccinium membranaceum Linnaea borealis Pachystima myrsinites			OTHER COMMENTS:
TOTAL SHRUBS: % COVER:		5		
HERBS	Epilobium angustifolium Streptopus roseus Juniperus communis			
TOTAL HERBS: % COVER:		3		
% COVER TOTAL VEGETATION:		10		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:		DATE:(Y/M/D/H/M): 96/08/19 OPENING: 8L		BANK: L PLOT #: 5	
VEGETATION STRATUM	SPECIES	qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Tsuga heterophylla	2			GENERAL CONDITION OF RIPARIAN ZONE: edge of bank eroded, veteran trees fallen in creek highly impacted, very little ground cover some moss
DOMINANT TREES					
MAIN CANOPY TREES					SOIL DESCRIPTIONS: rotting wood and debris, organic
SERAL TREES	Abies amabilis Tsuga heterophylla Chamaecyparis nootkatensis				SUBSTRATE (%):
TOTAL TREES: % COVER:			5		DECAYING WOOD: 20 BEDROCK: 2 MINERAL SOIL: 0 ORGANIC MATTER: 78 WATER: 0
TALL SHRUBS					APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Vaccinium membranaceum Rubus pedatus				OTHER COMMENTS: lots of bare soil exposed
TOTAL SHRUBS: % COVER:			2		
HERBS	Streptopus roseus				
TOTAL HERBS: % COVER:			1		
% COVER TOTAL VEGETATION:			5		

PLOT VEGETATION DESCRIPTION FORM

STREAM: Crawford REACH #:	DATE:(Y/M/D/H/M): 96/08/19 OPENING: 8L		BANK: L PLOT #: 6	
VEGETATION STRATUM	SPECIES qty.	% COVER	DISTRIBUTION	OTHER ATTRIBUTES
VETERAN TREES	Chamaecyparis nootkatensis 4 Tsuga heterophylla 3 Thuja plicata 3			GENERAL CONDITION OF RIPARIAN ZONE: 5m leave strip of veteran trees lots of moss cover no underbrush cover to speak of
DOMINANT TREES				
MAIN CANOPY TREES				SOIL DESCRIPTIONS: decaying wood, organic
SERAL TREES	Tsuga heterophylla Abies amabilis Chamaecyparis nootkatensis			SUBSTRATE (%):
TOTAL TREES: % COVER:		25		DECAYING WOOD: 20 BEDROCK: 3 MINERAL SOIL: 0 ORGANIC MATTER: 77 WATER: 0
TALL SHRUBS				APSECT OF PLOT: SW SITE SERIES:
SHORT SHRUBS	Vaccinium membranaceum Cornus canadensis Rubus pedatus Vaccinium uliginosum			OTHER COMMENTS: highly impacted
TOTAL SHRUBS: % COVER:		15		
HERBS	Streptopus roseus			
TOTAL HERBS: % COVER:		1		
% COVER TOTAL VEGETATION:		30		


DAISY LAKE
DAM
ABANDONED PIT
ABANDONED PIT
DAM
Shadow Lake
BALDY
Deadmans Creek
BCRM
99
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TRIM 092g094 Scale 1:50.000

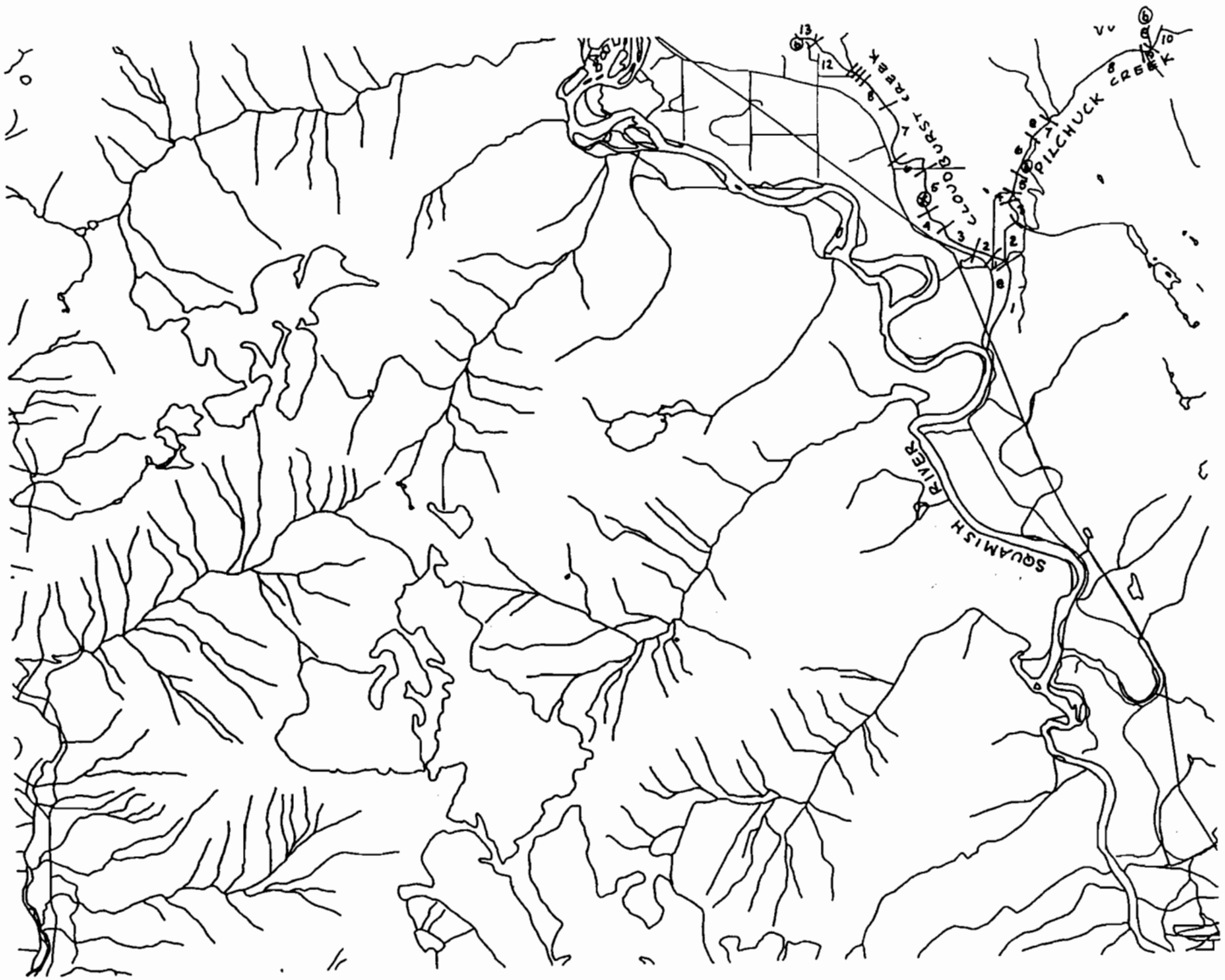
92G4

Chance Creek

LEGEND

1	reach break
e	electrofishing site
a	angling site
b	barrier
lj	log jam
x	beaver dam
w1	water sample site
op1	riparian opening

DRAFT



TRIM 092g084 Scale 1:50,000

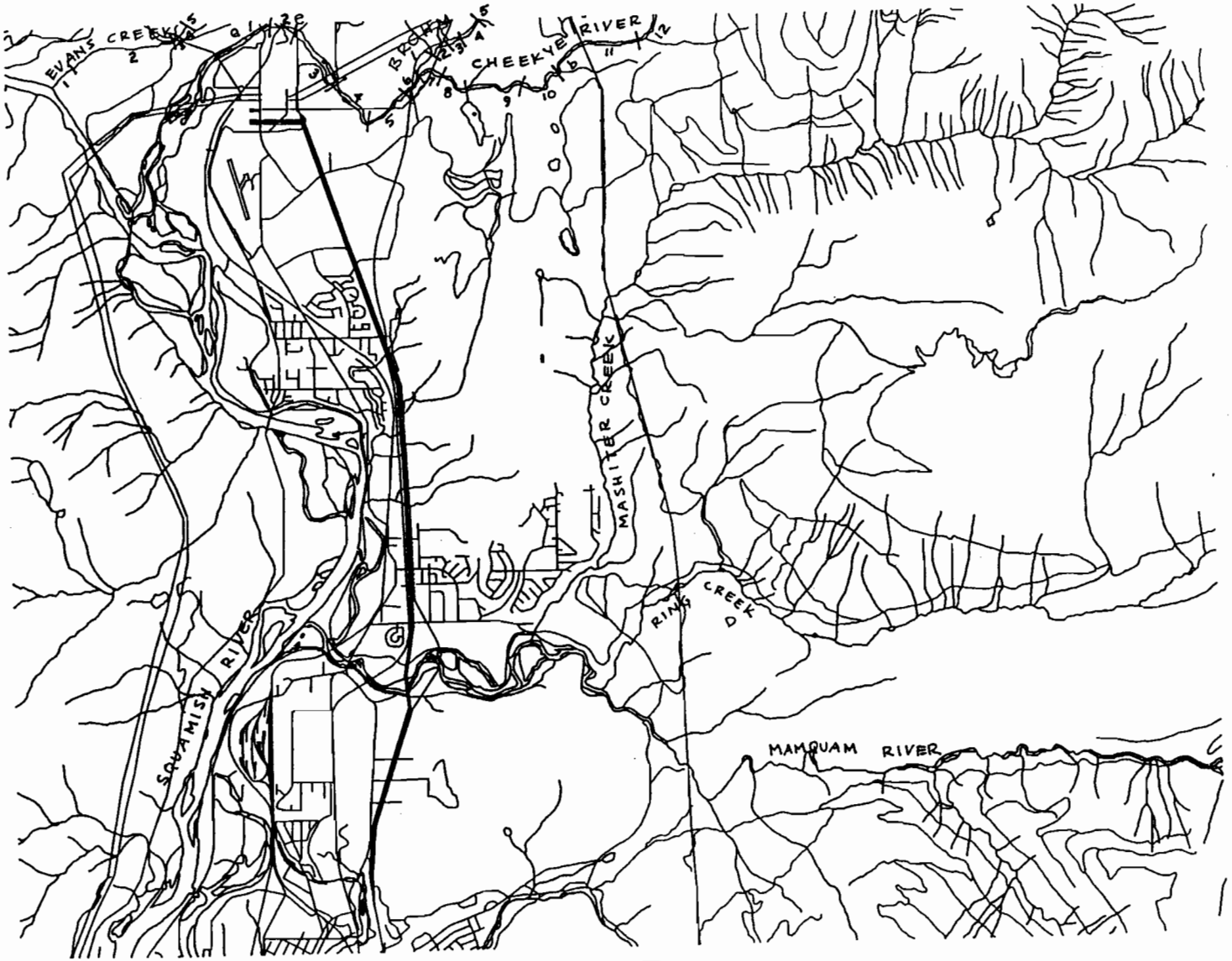
92414

Pilchuck Creek
Cloudburst Creek

LEGEND

1	reach break
e	electrofishing site
a	angling site
b	barrier
lj	log jam
x	beaver dam
w1	water sample site
op1	riparian opening

DRAFT



TRIM 092g075 Scale 1:50,000

Evans Creek
Brohm River
Cheekye River

LEGEND

1	reach break
e	electrofishing site
a	angling site
b	barrier
lj	log jam
x	beaver dam
w1	water sample site
op1	riparian opening

DRAFT



TRIM 092g085 Scale 1:50,000

92G14

Evans Creek
Brohm River
Cheekye River

LEGEND

1	reach break
e	electrofishing site
a	angling site
b	barrier
lj	log jam
x	beaver dam
w1	water sample site
op1	riparian opening

DRAFT



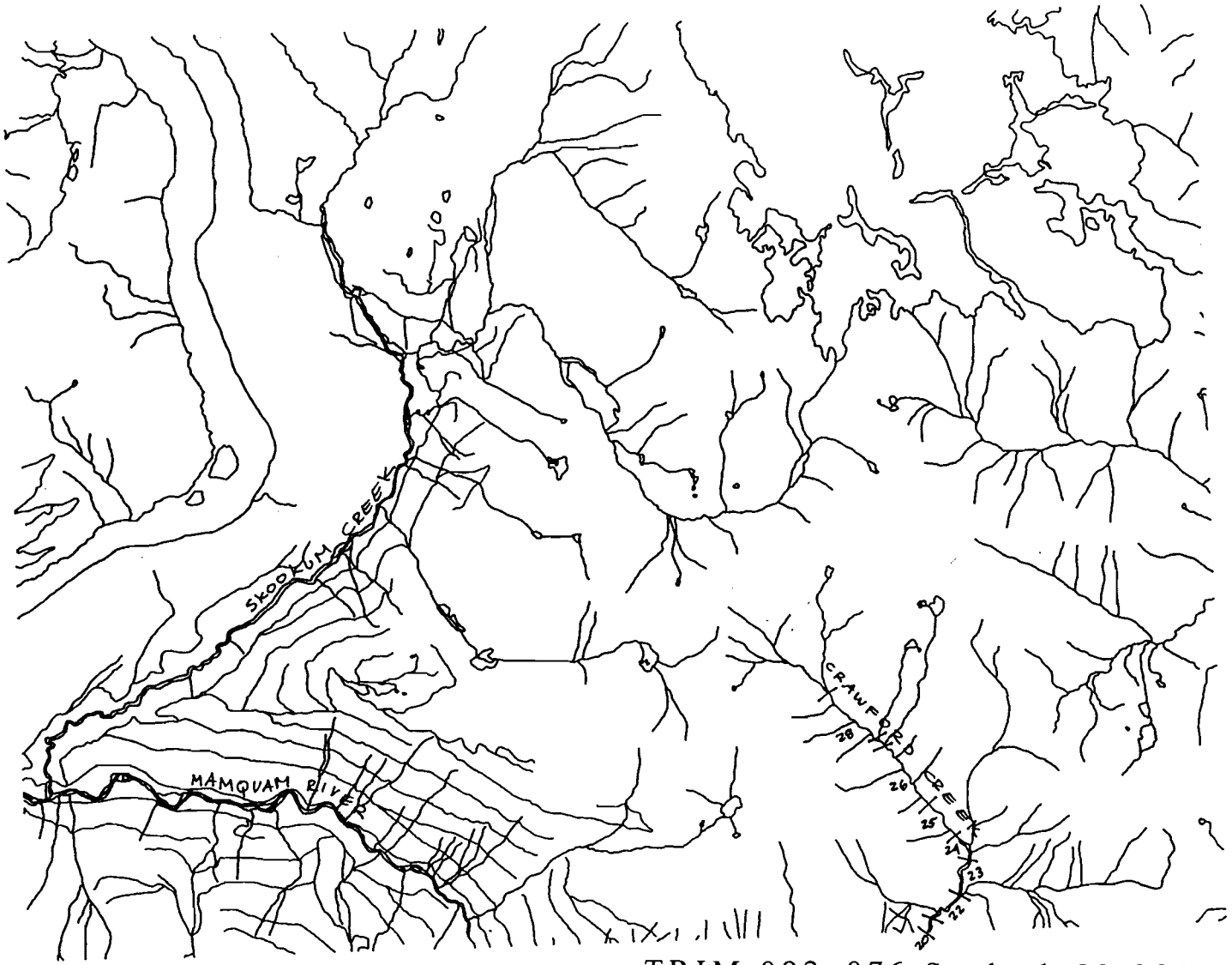
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92G10

Crawford Creek

LEGEND

1	reach break
e	electrofishing site
a	angling site
b	barrier
lj	log jam
x	beaver dam
w1	water sample site
op1	riparian opening



TRIM 092g076 Scale 1:50,000

92G10

Crawford Creek

LEGEND

1	reach break
e	electrofishing site
a	angling site
b	barrier
lj	log jam
x	beaver dam
w1	water sample site
op1	riparian opening