

**CANADIAN FOREST PRODUCTS LTD AND  
'NAMGIS FIRST NATION**



---

**NIMPKISH RIVER RESTORATION  
2005 LEVEL 2 PRESCRIPTION REPORT  
FOR SEBALHALL RIVER**

March 2005

**ALBY Systems Ltd**

**nhc** northwest  
hydraulic  
consultants

# **NIMPKISH WATERSHED RESTORATION PROJECT**

## **2005 Level 2 Prescriptions For Sebalhall River**

submitted to

### **Land and Water British Columbia Inc.**

License Permit Officer  
Suite 501, 345 Wallace St.  
Nanaimo, BC V9R 5B6

on behalf of

### **'Nangis First Nation**

P.O. Box 210  
Alert Bay, B.C. V0N 1A0

and

### **CANADIAN FOREST PRODUCTS LTD**

Englewood Logging Division  
Woss, B.C. V0N 3P0

submitted by

### **northwest hydraulic consultants ltd.**

30 Gostick Place  
North Vancouver, B.C. V7M 3G2  
Phone: (604) 980-6011, Fax (604) 980-9264

and

### **ALBY Systems Ltd**

P.O. Box 71  
Alert Bay, B.C. V0N 1A0  
Phone: (250) 974-5855, Fax (250) 974-5855

March 2005

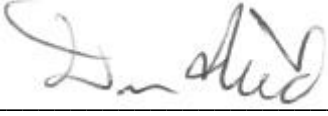
## ABSTRACT


A partnership of Canadian Forest Products Limited (Canfor) and the 'Namgis First Nation (the Nimpkish Resource Management Board) are restoring stream habitat in the Nimpkish River watershed. This program began in 1996 as part of Canfor's Forest Renewal BC (FRBC) agreement and continues with funding provided by the Forest Investment Account (FIA) from the Ministry of Forests. This report describes the stream and fish habitat restoration projects proposed for Sebalhall River in the Nimpkish Watershed.


The project sites included in this report are located in reach SE1 of Sebalhall River. They include:

- *Sebalhall River - Site SE1LWD1 – Bank Protection at 1000m to 1250m on Right Bank:* Typical LWD spurs constructed to prevent further erosion of bank and widening of channel.
- *Sebalhall River - Site SE1LWD2 – Bank Protection at 1290m to 1525m on Left Bank:* Lateral LWD structures constructed to slow future erosion of bank and widening of channel. Structures will add much needed cover to existing holding pools.

Nimpkish River is a 6<sup>th</sup> order stream with a total drainage area of approximately 2250km<sup>2</sup>. The watershed lies at the Northern end of Vancouver Island, British Columbia draining into Broughton Strait 10km South of Port McNeill. The watershed lies almost completely within Canfor's Tree Farm License (TFL) 37, Englewood Logging Division, and is part of the traditional territories of the 'Namgis First Nation. Yookwa Creek is a tributary to Sebalhall River in the Nimpkish River Watershed emptying into Sebalhall River at the outlet of Vernon Lake. In turn Sebalhall River joins Nimpkish River at Nimpkish Island ecological reserve located 18 km upstream from the town of Woss.

Report Prepared by   
Don Reid, R.P.Bio.  
northwest hydraulic consultants ltd

Report Prepared by   
Bruce Walsh, P.Eng  
northwest hydraulic consultants ltd

Report Prepared by   
Mike Berry, R.P.Bio.  
ALBY SYSTEMS ltd

## IMPORTANT

The present study has been conducted on the basis of available information, previous reports, and field inspections limited by the available time and budget. Numerical estimates provided herein represent attempts to satisfy the requirements of the study on the basis of available information and professional judgement, but in many cases they are subject to uncertainty.

This document is for the private information and benefit of the client for whom it was prepared and for the particular purpose for which it was developed. The contents of this document are not to be relied upon or used, in whole or in part, by or for the benefit of others without specific written authorization from **northwest hydraulic consultants ltd**.

**northwest hydraulic consultants ltd** and Alby Systems Ltd. and their respective officers, directors, employees, and agents assume no responsibility for the reliance upon this document or any of its contents by any parties other than our client.

**TABLE OF CONTENTS**

*LIST OF TABLES* ..... iii  
*LIST OF FIGURES* ..... iii

**1 INTRODUCTION**..... **1**

1.1 FIELD SURVEY AND PRESCRIPTIONS ..... 1  
1.2 SCHEDULE ..... 2  
1.3 ACCESS AND CONSTRUCTION..... 2  
1.4 ENVIRONMENTAL AND CONSTRUCTION SUPERVISION ..... 2  
1.5 MATERIALS ..... 2  
1.6 COSTS..... 2  
1.7 BIOLOGICAL BENEFITS ..... 2  
    1.7.1 Site SE1LWD1 ..... 3  
    1.7.2 Site SE1LWD2..... 3

**2 PRESCRIPTION SITES**..... **3**

SEBALHALL RIVER - SITE SE1LWD1 ..... 4  
SEBALHALL RIVER - SITE SE1LWD2 ..... 8

**3 REFERENCES** ..... **13**

**LIST OF TABLES**

- 1. Fish Timing Windows in Nimpkish Watershed
- 2. Summary of Materials Required for Construction
- 3. Estimated Construction Costs for Instream Projects

**LIST OF FIGURES**

- 1. Sebalhall River Location Figure
- 2. SE1LWD1 – Right Bank Protection at 1+000 to 1+250 m: Plan, Photographs and Typical Structure
- 3. SE1LWD2 – Left Bank Habitat Jams at 1+290 to 1+525 m: Plan, Section, and Typical Structure

## 1 INTRODUCTION

This report presents prescriptions for stream restoration sites on Sebalhall River in the Nimpkish River Watershed. The prescribed works are intended to stabilize eroding banks slow Sebalhall River widening. This work follows upstream work on Yookwa Creek that has been undertaken to limit coarse sediment production from this upstream source. The resident and anadromous fish populations in Sebalhall River have been negatively impacted by the increased supply of coarse sediment from Yookwa Creek, which has lead to dewatering of the Yookwa channel and infilling of holding pools and excessive channel widening downstream in Sebalhall River. The prescriptions are based on site reconnaissance, Overview and Level 1 Assessments, and field surveys.

This report is prepared in support of a Section 9 Approval for work in and around a stream, submitted by the 'Namgis First Nation. The prescriptions included in this report are for Type I and Type II projects, as defined by the FIA Activity Standards Document (FIA, 2003).

Type I projects are defined as:

“Treatments... (that) typically involve activities that alter the channel plan for only one habitat unit and less than 5 bankfull widths, producing a local effect on the streambed and banks. Examples include: large woody debris (LWD) placements and anchoring, boulder clusters, simple bank protection or stabilization”.

Type II projects are defined as:

“Treatments... (that) typically involve activities that alter the plan and profile of a stream over a reach length greater than 5 bankfull widths. This includes situations where treatments encroach in plan view more than 30% of the bankfull width, or in profile more than 50% of the bankfull depth. Examples include pool/riffle sequence construction, channel/gravel excavation, gravel placement, fishway and weir construction, berm and dike construction, and complex bank stabilization projects.”

### 1.1 FIELD SURVEY AND PRESCRIPTIONS

The work sites included in this report were selected for prescriptions in July 2005. They were surveyed in February 2005 following site visits. The location of the work sites are shown in Figure 1 and are as follows:

1. *Site SE1LWD1 - Bank Protection at 1000m to 1250m on Right Bank:* Typical LWD spurs constructed to prevent further erosion of bank and widening of channel.
2. *Site SE1LWD2 - Bank Protection at 1290m to 1525on Left Bank:* Lateral LWD structures constructed to slow future erosion of bank and widening of channel. Structures will add much needed cover to existing holding pools.

Construction layouts, profiles and cross sections can be found in the figures section of this report following the site descriptions, hydraulic analysis and construction plans in the main body of the report.

## 1.2 SCHEDULE

There is no current schedule to complete these projects. Instead these prescriptions have been developed for future use.

Instream projects would be completed within the fisheries construction window, extending from approximately July 15 to September 1, 2005 as shown in Tables 1a and 1b.

## 1.3 ACCESS AND CONSTRUCTION

Access for equipment and crew is discussed for each site in the following sections. Where possible, the access routes are highlighted on the prescription figures.

## 1.4 ENVIRONMENTAL AND CONSTRUCTION SUPERVISION

We propose to have an environmental monitor and a construction supervisor on-site during the construction of Type I and Type II projects or when large machinery is working.

The main environmental issues are the management of sediment during construction of instream structures and the proper handling of fuels. Any fuel at the site will be stored above the high water mark and any large containers will be enclosed by a berm in case of spills. All re-fuelling will occur away from the wetted portion of the stream using appropriate re-fuelling containers. All excavators or other equipment will be cleaned before entering the stream channel.

Specific plans to prevent or reduce the entry of sediment into the stream during construction are described for the individual projects. In all cases the bank protection works are expected to be constructed in flowing water.

## 1.5 MATERIALS

Table 2 summarises the materials (LWD and rock anchors) required for each of the sites.

## 1.6 COSTS

Approximate costs are provided in Table 3. The estimates are based on our experience in the Nimpkish Watershed and assume that there will be a cost of \$30/m<sup>3</sup> for x-grade logs and 7/m<sup>3</sup> for the development of rock anchors. In addition there will be those costs associated with transporting the materials to the sites. Delivery charges have been built into the heavy machinery estimates for each site. Due to the highly variable nature of instream work these values should be viewed as estimates only.

## 1.7 BIOLOGICAL BENEFITS

Lower Sebalhall River was, historically, a very important spawning area for Sockeye, Chinook, and Coho salmon, and Coastal Cutthroat Trout; the upper part of the reach near the outlet of

Vernon Lake was especially productive. Before the Sebalhall River channel became in-filled and widened through the deposition of large amounts of coarse sediment from Yookwa Creek (starting in the mid- 1970's), it was an extremely productive rearing area for Steelhead and Coho and Chinook salmon juveniles; the bed and banks were stable and this reach contained numerous stable pools with good rearing cover (NERP ('Namgis) Survey Reports, 1978-79). Since the late 1970's the channel has continued to widen and aggrade resulting in few stable adult holding or juvenile rearing pool habitats (nhc and ALBY, 2004).

## **1.7.1 Site SE1LWD1**

Continued erosion of the right bank at this site continues to contribute large amounts of coarse sediment to the lower part of the reach and, subsequently, to Upper Nimpkish River. Bank protection works at this site will, hopefully, reduce this coarse sediment input. The bank protection structures will increase pool scour along the toe of the bank and will provide both cover and calm water (back-eddies) for both adult and juvenile salmonids, especially during flood events; presently there is no cover or calm water refuge for holding adults or over-wintering juveniles at this site.

## **1.7.2 Site SE1LWD2**

The long lateral pool that runs along the eroding left bank at this site has little to no cover and flow velocities are extremely high during moderate to high river stages. The addition of the prescribed structures will provide much needed cover and areas of calmer water (back-eddies) that will benefit both holding adult and rearing/over-wintering juvenile salmonids. Sockeye fry will also benefit from the calmer water and back-eddies as they migrate upstream into Vernon Lake to rear. Bank protection works will reduce erosion of the fine bank materials and will provide stability until the second growth riparian vegetation becomes more established.

## **2 PRESCRIPTION SITES**

The following sections are meant as stand-alone prescriptions for individual sites on Sebalhall River.

## Nimkish River Watershed 2005 Level 2 Prescriptions

### SEBALHALL RIVER - SITE SE1LWD1

#### Type I Project – Bank Protection at 1000m to 1250m on Right Bank

- Location:** Eroding right bank approximately 1000m upstream from confluence with Nimkish River
- Access:** Access to the site is via a series of overgrown spurs on the left bank of Sebalhall River. Access to these spurs is off the Nimkish Mainline near the Sebalhall River bridge.
- 

#### 1. ISSUES AND OBJECTIVES

Lower Sebalhall River is a large, 5<sup>th</sup> order, lake outlet river located in the upper Nimkish Watershed on Northern Vancouver Island that drains a watershed area of 185 km<sup>2</sup>. The river drains Vernon Lake and flows for 1.5 km before joining upper Nimkish River above the Nimkish Island ecological reserve. Vernon Lake acts as an effective sediment trap between the active upper watershed and the lower river. Coarse sediment is supplied to the lower river through reworking of the river's bed and banks in the broad alluvial valley and from Yookwa Creek, which joins the river at the outlet of Vernon Lake. Historic logging on the Yookwa Creek fan has led to destabilization of the channel on the fan and the delivery of about 6,000 m<sup>3</sup>/year of coarse sediment to Sebalhall River (nhc, 1998).

Sebalhall River, downstream of Vernon Lake, flows through a broad alluvial plain before joining Nimkish River. Hillslopes are effectively buffered from the main river by the floodplain. At the upstream end of the reach, Yookwa Creek forces the river against the right valley wall, which is protected by riprap at the bridges and is composed of bedrock elsewhere. At the downstream end of the reach the river resembles an alluvial fan with several, now disconnected, distributary channels flowing across the floodplain to join the Nimkish River. One of these channels has been widened and deepened by DFO as a side channel project in 2000. A combination of floodplain logging and increased sediment supply from Yookwa Creek has led to extensive channel widening in the downstream section of the river and moderate widening in the upstream section.

Recently ALBY Systems Ltd. and nhc have assessed the restoration options in Lower Sebalhall River (nhc and ALBY, 2004). This report recommends that restoration of Lower Sebalhall River be confined to the upper 800 m until it can be determined if the coarse sediment supply from Yookwa Creek is reduced. Also, the report recommends restoration techniques that use LWD to stabilize the current channel alignment that will strengthen channel banks until the riparian forest regrows.

The objective of work at this site is to add strength to the right bank of Sebalhall River to slow the erosion and channel widening in the moderately widened upper section of the river. A series of LWD spurs constructed along the bank will protect the bank and have the added benefit of

providing cover for resident and anadromous fish species. Lower Sebalhall River is the highest priority watershed for restoration in the Nimpkish valley.

## 2. STREAM SURVEYS

A reconnaissance level survey was conducted at the site in July 2004. This survey included measurements of typical bank heights, bank and bank material type, streamside vegetation, and erosion length. Together with sequential aerial photo coverage of the site, this survey provides the basis for the prescription.

## 3. SITE DESCRIPTION

The eroding bank at 1+000 m to 1+250 m on Lower Sebalhall River is located on the right bank of the river 600 m below the Nimpkish Mainline bridge. The bank is located at the downstream end of the upper, moderately widened section of the river. At this point the river has widened to about 75 m, which is narrow compared to the 200 m wide section downstream. The bank is almost entirely composed of alluvial gravel and cobble, is one to two metres high, and 250 m long. The riparian forest is composed of a mixture of old growth, juvenile conifers, and mixed conifer-deciduous trees. Opposite the eroding bank a large, partly vegetated bar has formed. As the bar grows Sebalhall River is forced to the right, eroding more of the right bank.

The combination of fluvial attack below the rooting layer and unconsolidated alluvial sediments make the bank easy to erode. This leads to a relatively high rate of retreat. Large trees eroded from the upper section of the bank (in the old growth section) lie along the bank, partly protecting it from further erosion. However, much of the bank lacks these large trees and as a result has no protection from future erosion. Adding to the severity of the site, material eroded from the bank adds to the bed material supply to downstream sections. Below the eroding bank the river has already widened to 200 m in places and any reduction in bed material supply would aid this extremely wide river reach.

## 4. HYDROLOGY AND HYDRAULICS

### *Channel Characteristics – Sebalhall River Reach SE1*

Drainage Area	
to head of reach .....	185 km <sup>2</sup>
Channel (top) width .....	75 m
Bankfull depth .....	2.0 m
Average bed slope (for reach) .....	0.004
Manning's n .....	0.03
Design Velocity .....	5 m/s
Design Discharge (50-year instantaneous).....	870 m <sup>3</sup> /s
Design Froude # .....	0.8
Stable Bed Material Size.....	200 mm

The design discharge was calculated from the drainage area and a Creager's C of 30 for a 50-year instantaneous flood. This C is based on a C value of 35 from the flood frequency analysis of the Water Survey of Canada gauge *Zeballos River near Zeballos (08HE006)* reduced to account for flood attenuation in Vernon Lake.

Channel characteristics are based on uniform flow calculations for the typical sections and reach slope. Depths at the design flood are above the banks and floodwaters are expected to flow over the floodplain to Nimpkish River along various channels. These calculations would tend to overestimate flow in the channel, as they do not account for flow loss, however the design velocity was increased slightly because of flow concentration along the bank.

## **5. RESTORATION PLAN**

The restoration plan consists of installing a series of typical LWD spurs along the bank for protection (Figure 2). The spurs will project 5 m or so from the bank and be placed at 4 x their projection distance apart. This gives a nominal spacing of 20 m or so to the spurs. This spacing will be shortened at the upstream and downstream end of the bank where the angle of attack is sharper. We recommend that the upper five and lower four spurs be placed 15 m apart or 3 x their projection length. As well, spurs at the upper end of the bank will be placed to incorporate natural LWD that occurs along the bank. Protection will start upstream of the main area of erosion.

All LWD spurs will be constructed from LWD pieces with a minimum diameter of 0.6 m and length of 8 m – longer, larger logs should be used where available. The structures should be attached to suitable streamside trees with cable and ballasted with rock anchors with a minimum diameter of 1.2m (5200 lb equivalent). Two 1.2m diameter boulders will be required for every log in the structure and one 1.2m boulder for every stump. Logs with rootwads attached should be used where available. Where no suitable streamside trees or stumps are available, an additional 1.2 m boulder should be used for each missing bank attachment.

## **6. CONSTRUCTION MATERIALS AND TECHNIQUES**

An excavator and hand crew will complete the work at this site. Material will be delivered to the site by a rock truck and self-loading log truck via the left bank abandoned spurs. From the end of the spur, the rock truck and log truck will have to pass through a short length of riparian forest before arriving on the left bank bar where it is only a short distance across the bar to the stockpile area. The excavator will manoeuvre the logs into position and place the rock anchors from the edge of the opposite bar. It will however, have to enter the wetted portion of the channel to reach the far bank in this large river. The hand crew will work with the excavator to cable the structure together and attach the anchors.

Table 2 summarises the materials required.

## **7. ENVIRONMENTAL MANAGEMENT**

It is expected that Sebalhall River will be flowing at this location during the construction period – the river is not known to dry. As a result, some fine sediment will be introduced when the excavator enters the river and places the logs and rocks. However, construction will cause minimal disturbance to the streambed and therefore the amount of fine sediment introduced will be small. Consequently, we do not anticipate the requirement for sediment control measures at this site. Care will be taken to minimise the disturbance to the bank vegetation. Where machines are required to drive across the partly vegetated portions of the left bank bar top, care will be taken to choose the shortest route and a single route will be consistently followed. An

# nhc / ALBY

environmental manager will be on-site at all times while machines are within the wetted portion of the channel.

## Nimkish River Watershed 2005 Level 2 Prescriptions

### SEBALHALL RIVER - SITE SE1LWD2

#### Type I Project – Bank Protection at 1360m to 1600m on Right Bank

- Location:** Eroding left bank approximately 1300 m upstream from confluence with Nimkish River
- Access:** Access to the site is via a series of overgrown spurs on the left bank of Sebalhall River. Access to these spurs is off the Nimkish Mainline near the Sebalhall River bridge.
- 

#### 1. ISSUES AND OBJECTIVES

Lower Sebalhall River is a large, 5<sup>th</sup> order, lake outlet river located in the upper Nimkish Watershed on Northern Vancouver Island that drains a watershed area of 185 km<sup>2</sup>. The river drains Vernon Lake and flows for 1.5 km before joining upper Nimkish River above the Nimkish Island ecological reserve. Vernon Lake acts as an effective sediment trap between the active upper watershed and the lower river. Coarse sediment is supplied to the lower river through reworking of the river's bed and banks in the broad alluvial valley and from Yookwa Creek, which joins the river at the outlet of Vernon Lake. Historic logging on the Yookwa Creek fan has led to destabilization of the channel on the fan and the delivery of about 6,000 m<sup>3</sup>/year of coarse sediment to Sebalhall River (nhc, 1998).

Sebalhall River, downstream of Vernon Lake, flows through a broad alluvial plain before joining Nimkish River. Hillslopes are effectively buffered from the main river by the floodplain. At the upstream end of the reach, Yookwa Creek forces the river against the right valley wall, which is protected by riprap at the bridges and is composed of bedrock elsewhere. At the downstream end of the reach the river resembles an alluvial fan with several, now disconnected, distributary channels flowing across the floodplain to join the Nimkish River. One of these channels has been widened and deepened by DFO as a side channel project in 2000. A combination of floodplain logging and increased sediment supply from Yookwa Creek has led to extensive channel widening in the downstream section of the river and moderate widening in the upstream section.

Recently ALBY Systems Ltd. and nhc have assessed the restoration options in Lower Sebalhall River (nhc and ALBY, 2004). This report recommends that restoration of Lower Sebalhall River be confined to the upper 800 m until it can be determined if the coarse sediment supply from Yookwa Creek is reduced. Also, the report recommends restoration techniques that use LWD to stabilize the current channel alignment and that will strengthen channel banks until the riparian forest regrows.

The objective of work at this site is to add strength to the left bank of Sebalhall River to slow the erosion and channel widening in the moderately widened upper section of the river. A series of LWD jams placed at the outcropping points along the bank will add an increasing amount of strength to these areas as the river erodes and more of the structure enters the water. The jams

will have the added benefit of providing cover for resident and anadromous fish species – this too will increase with time. The proposed spurs are designed to increase in function as the bank continues to erode, leading to greater erosion protection and cover habitat with time. Lower Sebalhall River is the highest priority watershed for restoration in the Nimpkish valley.

## **2. STREAM SURVEYS**

A reconnaissance level survey was conducted at the site in July 2004 and February 2005. These surveys included measurements of typical bank heights, bank and bank material type, streamside vegetation, and erosion length. Together with sequential aerial photo coverage of the site, this survey provides the basis for the prescription.

## **3. SITE DESCRIPTION**

The eroding bank at 1+360 m to 1+600 m on Lower Sebalhall River is located on the left bank of the river 50 m below the Nimpkish Mainline bridge – it is quite visible from the bridge. The bank is located immediately downstream of the Yookwa Creek confluence in the moderately widened, upper section of the river. At this point the river has widened to about 75 m, which is narrow when compared to the 200 m wide section downstream. The bank is mainly composed of fine sediments such as sand and silt that give it a distinctive brown colour. These fine sediments are cohesive and as a result are fairly resistant to erosion. In contrast, there are layers of alluvial gravel and cobble interspersed with the finer sediments that are much more susceptible to erosion. The eroding bank is two to four metres high, and about 200 m long. The riparian forest is composed of a mixture of juvenile conifers and deciduous trees. Opposite the eroding bank a large, partly vegetated bar has formed. As the bar grows Sebalhall River is forced to the left, eroding more of the left bank.

The bank is made up of a series of erosional indentations separated by outcropping points. It is likely that the indentations correspond to areas of gravel lenses and therefore areas that are easier to erode. In contrast, the outcropping points tend to be areas of the bank that have a higher amount of fine sediment, are cohesive, and are therefore more resistant to erosion. It is these point areas that are experiencing greater stresses and deep pools are forming adjacent to them. At present much of the material eroded from this bank is silt and sand that is transported through lower reaches quickly by saltation or suspension. These materials do not contribute to the bed material load of the river and therefore do not contribute to the channel widening problems downstream. The trees eroded from the bank are small second growth conifers that do not add any protection to the bank when eroded.

## 4. HYDROLOGY AND HYDRAULICS

### *Channel Characteristics – Sebalhall River Reach SE1*

Drainage Area	
to head of reach .....	185 km <sup>2</sup>
Channel (top) width .....	75 m
Bankfull depth .....	2.0 m
Average bed slope (for reach) .....	0.004
Manning's n .....	0.03
Design Velocity .....	5 m/s
Design Discharge (50-year instantaneous).....	870 m <sup>3</sup> /s
Design Froude # .....	0.8
Stable Bed Material Size.....	200 mm

The design discharge was calculated from the drainage area and a Creager's C of 30 for a 50-year instantaneous flood. This C is based on a C value of 35 from the flood frequency analysis of the Water Survey of Canada gauge *Zeballos River near Zeballos (08HE006)* reduced to account for flood attenuation in Vernon Lake.

Channel characteristics are based on uniform flow calculations for the typical sections and reach slope. Depths at the design flood are above the banks and floodwaters are expected to flow over the floodplain to Nimpkish River along various channels. These calculations would tend to overestimate flow in the channel, as they do not account for flow loss, however the design velocity was increased slightly because of flow concentration along the bank. The bank at the site is likely overtopped during moderate flood events.

## 5. RESTORATION PLAN

The restoration plan consists of installing a series of LWD jams along the bank to add protection to the point areas (areas of greatest attack) while providing much needed overhead cover to the deep pools (Figure 3). Due to the bank height, lack of attachment points on the bank, and size of the river it is not practical to construct LWD jams that would protect the entire bank. Also, erosion of the bank is not contributing to downstream problems and therefore is not a high priority for protection. Instead the jams will be constructed to provide some protection to the top of the bank now while allowing the base of the bank to continue to erode (see typical section Figure 3). As the bank erodes more of the structure will enter the water – this will provide an increasing degree of protection. We expect that some balance will develop where the added strength from the LWD jams and natural strength of the bank will be sufficient to oppose future erosion.

These LWD jams are not intended to stop future erosion at the site; instead they will slow erosion by adding strength to the point areas. The jams will project 2 m or so from the bank, cover about 15 m of bank length, and have most of their mass on the bank to prevent shifting. The bank lacks suitable attachment points (large trees or stumps) and therefore lateral stability of the structure is entirely dependent on the ballast incorporated into the structure. Placing more of the structure on the bank than in the water will add lateral stability.

The LWD jams will be constructed from LWD pieces with a minimum diameter of 0.6 m and length of 8 m – longer, larger logs should be used where available. The structures should be attached to suitable streamside trees with cable and ballasted with rock anchors with a minimum diameter of 1.2m (5200 lb equivalent). Two 1.2m diameter boulders will be required for every log in the structure and one 1.2m boulder for every stump. Anchors will be set down into the floodplain as deadman anchors where possible. Logs with rootwads attached should be used where available.

*The LWD jams will have the following features:*

- All LWD structures will be constructed with logs having a minimum diameter of 0.6m. Use logs with rootwads attached where possible. Two 1.2m diameter boulders will be required for every log in the structures and one 1.2m boulder for every stump.
- The LWD jams will have a typical projection width from the bank of 2m leaving about 6m of the structure on the bank.
- Two LWD jams will be constructed at each of the points at 1+360 m and 1+495 m. The LWD jams will be spaced 6 m apart or 3 x their projection width. Only one LWD jam will be constructed at the 1+560 m point.
- No suitable trees or stumps are located on the bank so lateral stability of the structures is dependent on the ballast and portion of the jam on the bank. The structures should be constructed around existing small trees on the bank so that as these grow they will add stability.
- As erosion progresses a greater portion of the structures will enter the water providing more protection with time.
- A large benefit of the structures is their cover in the pools.

## **6. CONSTRUCTION MATERIALS AND TECHNIQUES**

An excavator and hand crew will complete the work at this site. Material will be delivered to the site by a rock truck and self-loading log truck to the end of the abandoned spurs or to the nearby mainline (Figure 3). The excavator will ferry the materials from these staging areas to the construction site via tote roads built through the riparian forest. The excavator will then place the logs, stumps, and the rock anchors while working from the top of the bank. It is not possible to build the structures from the edge of the opposite bar because of the pool depth, size of the channel, and height of the bank. The hand crew will work with the excavator to cable the structure together and attach the anchors.

Table 2 summarises the materials required.

## **7. ENVIRONMENTAL MANAGEMENT**

It is expected that Sebalhall River will be flowing at this location during the construction period – the river is not known to dry. As a result, some fine sediment will be introduced when the excavator places the logs and rocks along the edge of the bank. However, most of the construction will proceed on the top of the bank and will cause minimal disturbance to the

streambed and bank and therefore only small amount of fine sediment will be introduced. Consequently, we do not anticipate the requirement for sediment control measures at this site.

There will be some unavoidable disturbance to the bank vegetation both during delivery of the materials to the site and during construction. Where machines are required to drive through the left bank riparian forest, care will be taken to choose the shortest route and a single route will be consistently followed (see Figure 3 for possible route). The environmental manager will flag an appropriate route through the trees. Any trees removed from the riparian zone will be used in the construction. An environmental manager will be on-site at all times while machines are working at the site.

## 3 REFERENCES

- FIA, 2003. Forest Investment Account Activity Standards Document, Aquatic Restoration and Rehabilitation Projects. British Columbia Ministry of Forests, 26 pp.
- Ministry of Environment, Lands and Parks. April 1998. Watershed Restoration Program. Habitat Restoration Prescription Guidebook - Vancouver Island Region 1.
- Ministry of Water, Land and Air Protection. November 2001. Timing Windows and Measures for the Conservation of Fish, Fish Habitat and Water Quality for the Port McNeill Forest District. Habitat Protection Program.
- Northwest Hydraulic Consultants Ltd. and Alby Systems Ltd. July 1998. Upper Nimpkish Watershed. Coarse Sediment Supply (Final Report). Canadian Forest Products Ltd.
- Northwest Hydraulic Consultants Ltd. and Alby Systems Ltd. January 2000. Nimpkish River Watershed Restoration Project. Overview Assessment of Fish Habitat and Hydrology. Canadian Forest Products Ltd.
- Northwest Hydraulic Consultants Ltd. and Alby Systems Ltd. June 2003. Nimpkish River Restoration – 2003. 2003 Level 2 Prescriptions for Yookwa Creek. Canadian Forest Products Ltd. and ‘Namgis First Nation.
- Northwest Hydraulic Consultants Ltd. and Alby Systems Ltd. October 2004. Sebalhall River Restoration Options. Nimpkish River Restoration. Canadian Forest Products Ltd. and ‘Namgis First Nation.
- Northwest Hydraulic Consultants Ltd. and Alby Systems Ltd. January 2005. Nimpkish River Restoration. Yookwa Creek Inspection – Effects of November 2004 Flood. Letter to Canadian Forest Products Ltd.

# TABLES

**Table 1a: Instream Work Timing Windows by Species - Vancouver Isl**

Species		Timing Window
Common Name	Latin Name	
Chinook salmon	Oncorhynchus tshawytscha	July 15 - September 15
Coho salmon	Oncorhynchus kisutch	June 15 - September 15
Pink salmon	Oncorhynchus gorbuscha	May 1 - August 1
Chum salmon	Oncorhynchus keta	May 15 - September 15
Sockeye salmon	Oncorhynchus nerka	June 1 - September 15
Kokanee	Oncorhynchus nerka	June 1 - September 15
Steelhead	Oncorhynchus mykiss	June 15 - September 15
Resident rainbow trout	Oncorhynchus mykiss	July 15 - September 15
Resident cutthroat trout	Oncorhynchus clarki	July 15 - September 15
Resident Dolly Varden	Salvelinus malma	June 1 - September 1

**Table 1b: Instream Work Timing Windows by Stream**

Stream	Known or Suspected Fish Use	Timing Window
Sebalhall River	SK, CO, CH, ST, RB, CT, DV	July 15 - September 1

Species Key:

SK - Sockeye salmon

CH - Chinook salmon

PK - Pink salmon

KO - Kokanee

ST - Steelhead

CT - Cutthroat Trout

CO - Coho salmon

RB - Rainbow Trout

DV - Dolly Varden Char

Notes:

1 - From MWLAP 2001.

**TABLE 2: Summary of Materials Required for Construction**

Project Sites	Structure Type	Number of Struct.	LWD					Anchors			Biological Objective	Physical Objective	Comments
			Type	No.	Diameter (m)	Length (m)	Source (m)	diameter (m)	no. per struct.	total no.			
<b>Sebalhall River</b>													
SE1LWD1; Right Bank at 1+000 to 1+250 m	LWD spur	14	log	2	0.6-0.8	8	truck to site	1.2 (5200 lb equivalent)	2 per log	4	Slow channel widening and shallowing; reduce downstream transport of coarse sediment	Protect eroding bank	More ballast required if no suitably sized trees exist on bank
			stump	1	1.0-1.5	-	truck to site	1.2 (5200 lb equivalent)	1 per stump	1			
	<b>Total at Site</b>	<b>14</b>	<b>log stump</b>	<b>28</b>	<b>14</b>					<b>70</b>			
SE1LWD2; Left Bank at 1+360 to 1+600 m	LWD Jam	5	log	11	0.6-0.8	8	truck to site	1.2 (5200 lb equivalent)	2 per log	22	Add cover to holding pools at the head of the reach	Add some protection of eroding banks to slow (not stop) erosion	Bank lacks appropriate attachment points so most of structure placed on the bank to prevent shifting.
			stump	5	1.0-1.5	-	truck to site	1.2 (5200 lb equivalent)	1 per stump	5			
	<b>Total at Site</b>	<b>5</b>	<b>log stump</b>	<b>55</b>	<b>25</b>					<b>135</b>			

**Table 3: Estimated Construction Costs for Instream Projects**

Project Sites	Construction Costs								Labour Tasks	Misc. Materials Required	Comments
	Materials		Labour (\$)	Contracted Machines		Misc. Equipment Charges (\$)	Project Supervision (\$)	Total (\$)			
	Misc. (\$)	Logs and Boulder Anchors <sup>1</sup> (\$)		Heavy Machinery (\$)	Helicopter <sup>2</sup> (\$)						
<b>Sebalhall River</b>											
SE1LWD1	\$2,000	1900	\$14,000	\$18,000	\$0	\$1,200	\$8,200	<b>\$49,800</b>	Cable structure together and attach anchor boulders	Cables and clamps	Assume delivery of material along LB access road and across bar; a further \$22,000 in helicopter charges will be required to fly material to the site
SE1LWD2	\$4,000	3700	\$28,000	\$37,500	\$0	\$1,200	\$9,600	<b>\$92,400</b>	Cable structure together and attach anchor boulders	Cables and clamps	Assume delivery of material along LB access road; a further \$41,000 in helicopter charges will be required to fly material to the site

Notes:

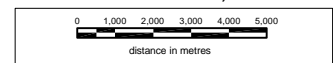
1 - Assumes \$30/m<sup>3</sup> for logs and \$7/m<sup>3</sup> for developing boulder anchors. Contracted machinery costs to deliver materials is included in the heavy machinery estimates.

2 - See notes for budgeting helicopter use. Projects may be able to be completed without the use of helicopters.

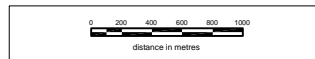
# FIGURES



Scale: 1:150,000



Scale: 1:50,000



NIMPKISH RESTORATION 2005

Sebalhall River Restoration Sites  
Location Figure

northwest hydraulic consultants

NHCV figure 1

Figure 1

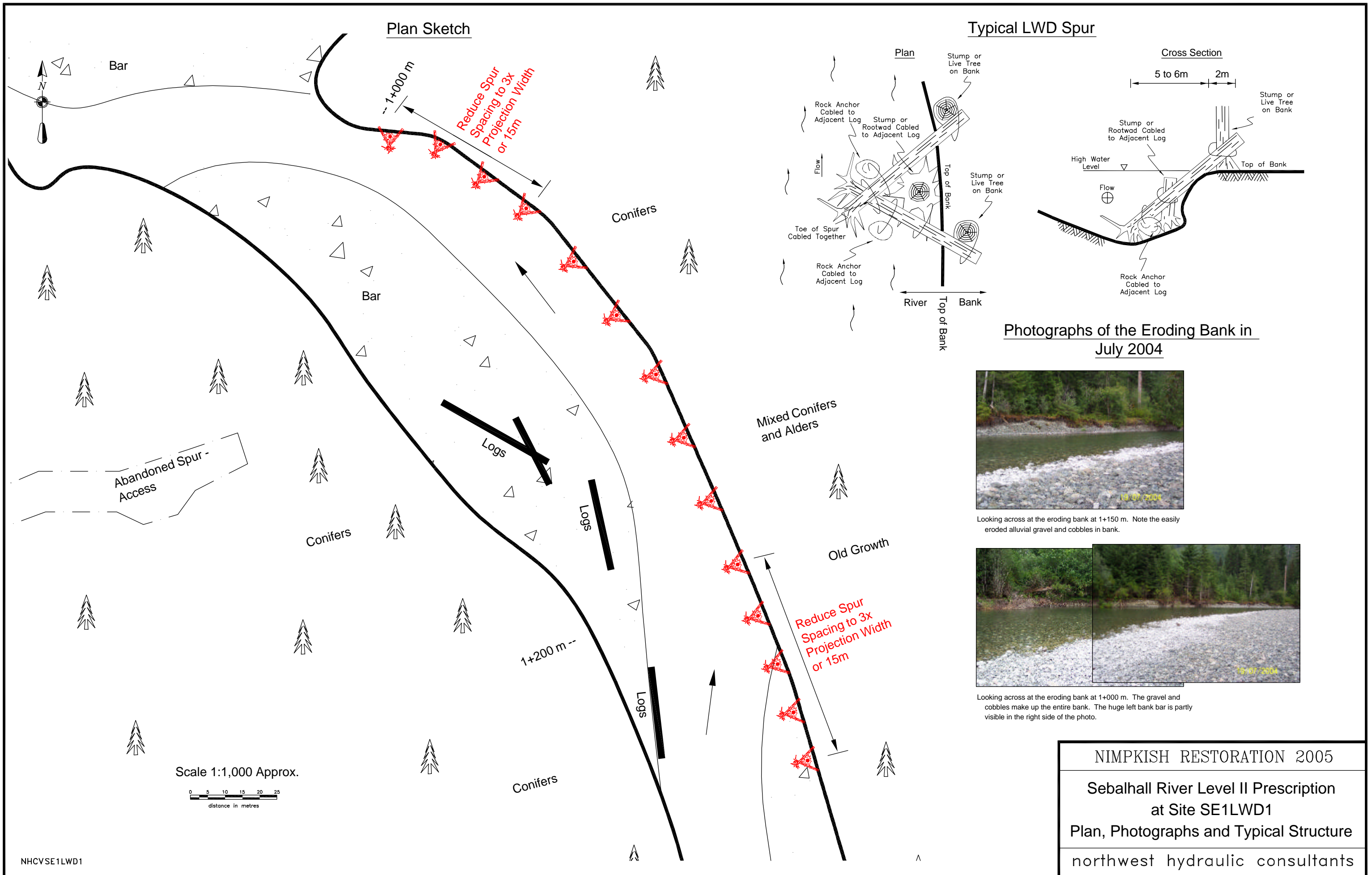


Figure 2

