SQUAMISH RIVER WATERSHED SOCIETY
Box 1791
Squamish, BC
V0N 3G0

Squamish Estuary Revegetation Marsh Replant and Tidal Channel Construction 2001/2002

Project # 01-LM-18

Prepared by:
Squamish River Watershed Society
Box 1791
Squamish, B.C.
V0N 3G0

Prepared for:
BC Hydro
Fish and Wildlife
Bridge Coastal Restoration Program
6911 Southpoint Drive E16
Burnaby, B.C.
V3N 4X8

Final Report completed January 2003

BC HYDRO
FISH & WILDLIFE
BRIDGE COASTAL RESTORATION PROGRAM

PART I - IDENTIFICATION

A. Proponent/Contractor Name Squamish River Watershed Society

B. Proponent/Contractor Address

PO Box 1791
Squamish, BC
V0N 3G0

(604) 898-9171 / (604) 898-9161
(Phone/Fax)
tobe@shaw.ca
(Email)

PART II - PROJECT DESCRIPTION

A. Project Number and Name 01-LM-18

B. Project Location

(Specific Stream/Watershed/etc. as applicable latitude and longitude, UTM and watershed code)

Squamish River Estuary, 92G/11;
NTS 5504250 N, 487600 E

C. Project Life October 1, 2001 *(Start Date* to March 31, 2002 *End Date)*

D. Project Funding $30,200.00

E. Report Prepared by Edith B. Tobe,
January 12th, 2003

BC HYDRO FISH & WILDLIFE
BRIDGE COASTAL RESTORATION PROGRAM

FINAL REPORT

Executive Summary

1. Introduction (includes background, statement of need, purpose and objectives)

In 1971 BC Rail dredged out a significant portion of the estuary and constructed a training dyke along the Squamish River in order to contain it along the western bank. The intention, at the time, was that BC Rail planned to construct a deep sea port for the storage of coal. The majority of the remaining dredgeate material (that did not go into the dyke production) was placed within the estuary filling an area approximately 250 m^2. In 1972, the Department of Fisheries and Oceans put a stop to BC Rails efforts. However, the legacy of the dyke construction and the stockpiling of the dredgeate material remained until the mid-1980's. At that time, Fisheries and Oceans Canada made an effort to place 2 culverts, which would connect the inner estuary to the Squamish River, which effectively had been restricted through the training dyke construction. In recent years, Fisheries and Oceans has installed several more culverts, up to 7 at present, and made an effort to reestablish channels and salmon spawning habitat within the inner estuary. As well, Fisheries and Oceans made efforts to remove the vast majority of the dredge spoils and reestablish the estuary to a productive state.

With the assistance of funding from the Habitat Restoration and Stewardship Program, the former Fisheries Renewal BC, and other internal DFO funding, and with the assistance and direction of the Squamish River Watershed Society, these projects were implemented over the years in a phased process. In the year 2000 the majority of the work was completed but there were several outstanding areas that needed attending to – including the ultimate removal of 90% of the original stock piled dredged material, the reconnection of the main channel that was constructed in the western estuary in the late 1990's and the final connection of some channels in the inner estuary by the WestBarr Log Sort.

Without these efforts the fisheries potential of this location would be all but lost, the area would be inhospitable to visit and would not be a welcome location for the locals to utilize as a nature viewing area, and the estuary would in no way provide the productive habitat that it had once provided.

The objectives of the work proposed for this fiscal year included the continued removal of much of the dredge material, the final grading of the estuary, the reconnection of two side channels, and the installation of an interpretive trail and signage. All of these objectives were met (however, due to vandalism, the signs have been stored at present until such time as there is better enforcement measures).

2. Study Area

Site Description

The site is on the east bank of the Squamish River approximately 8.0 km. downstream of the Squamish-Cheakamus confluence, in the area known as the central estuary.
Map reference Squamish. NTS 92G/11. 5504250mN: 487600mE.

The proposed project involved restoring access to high marsh areas of the Cheakamus-Squamish River estuary that are no longer accessible to salmonid smolts and other fishes. Connecting tidal channels were excavated to develop new estuary habitat and to provide access to now isolated estuary channels. This work provided benefits to salmonid smolts and other fishes, which rely on this critical and limiting habitat.

3. Methods

A crew was hired to undertake the revegetation of the estuary, which included planting sedges, rushes, reeds, and other indigenous wetland species at this site.

A contractor (John Hunter and Sons) was hired to construct the spawning channels, rearrange the piles of dredgeate and reestablish the natural grade of the estuary in accordance with DFO engineering staff and providing assistance with the installation and placement of the signage.

Information regarding the project will be communicated using signs erected on the site.

The Squamish River Watershed Society informed the local community of the benefits of estuary restoration and provided updates at their regular meetings of the Squamish River Watershed Committee outlining the project and the contributions made by BC Hydro Bridge Coastal Restoration Program.

4. Results

The habitat development project consisted of reconnecting inactive portions of the Squamish Estuary to regular tidal flows. Tidal channels were developed that permitted juvenile salmonids access to areas of the estuary that were historically accessible but no longer provided good habitat due to past land development of the estuary. Under the terms of the "Squamish Estuary Plan" much of the central portion of the Squamish River estuary has been set aside for conservation purposes in perpetuity. Part of the allowable activities in the conservation area included restoring damaged estuary habitats.

Levy and Levings (1978) found that while all species of salmonids from the Squamish River watershed (including the Cheakamus River) used the

estuary to varying degrees it was chinook salmon juveniles which relied the most on estuary habitat for extended periods of time. Chinook salmon residing in the Cheakamus River is listed as high risk in the BCH Strategic Plan. The Squamish River Watershed Society has worked with Fisheries and Oceans over the past number of years to restore critical estuary habitats. Fisheries and Oceans Canada has offered to continue working with the Society during the design and development of the proposed estuary habitat project. Aside from expected benefits to salmonids, many other estuary and near shore fishes such as herring, are now benefiting from the completed works of this phase.

Limiting factors

The first limiting factor that was addressed was the loss of side channel and other rearing habitats important to species such as chinook salmon. Estuary channels provide excellent rearing habitat for chinook fry in their first and second years. C. Melville pers. comm. reports that over 95% of the chinook juveniles captured migrating out of the Cheakamus River in the spring of 2000 were first year fry. These chinook fry would require at least 3 months of rearing in habitats downstream of the Cheakamus River prior to their entry into saltwater. The Squamish River estuary and its tidal channels provide a significant amount of this critical chinook rearing habitat for the Cheakamus River chinook populations.

The second limiting factor to be addressed was probable decrease in chinook fry growth rate due to reduced water temperatures that result from flow diversion at Daisy Lake and the dominance of Rubble and Culliton Creek in defining summer temperatures in the lower Cheakamus River.

The third limiting factor was the reduced nutrient input to the lower Cheakamus River due to the Daisy Lake dam and the probable decease in chinook smolt rearing capacity as a result.

5. Discussion

Meeting Program Objectives

1. Former chinook fry rearing areas have been lost, primarily due to simplification of the Cheakamus River in the lower reaches due to dyke and bridge construction, diversion of flows out of the basin and loss of wood and gravel recruitment due to the effects of Daisy Lake. All these impacts are related to the footprint effects of the Cheakamus River power project. These footprint impacts such as altered fluvial processes, caused by reduced downstream flows, and reduced sediment budget have resulted in less downstream diversity such as side channels to the main river.

Loss of nutrients and decrease in spring and summer water temperatures due to the effects of the Daisy Lake reservoir has presumably reduced the

potential growth rates and productivity of chinook fry residing in the Cheakamus River. A large component of the chinook salmon fry produced from spawning grounds on the Cheakamus River leave the river soon after emergence and rear and feed in the mainstem Squamish and its estuary channels for some months prior to their migration into Howe Sound.

The freshwater rearing corridor for Cheakamus River chinook juveniles begins in the Cheakamus River canyon and extends downstream along the Cheakamus-Squamish River corridor and ends in the Squamish River estuary where Cheakamus River chinook reside prior to their entry to Howe Sound.

By improving Cheakamus River chinook fry and smolt access to and use of the warm, nutrient rich waters of the Squamish River estuary their overall productivity and survival will be expected to increase. The development of estuary habitat would compensate for some of the chinook productivity losses in the Cheakamus River such loss of critical rearing habitat and decreased water quality that result from footprint impacts from the hydro development.

Rearing side channels lost on the Cheakamus River would be restored lower down in the watershed at the estuary where water temperatures and nutrient levels are higher. Cheakamus River chinook fry would not only have more critical rearing habitat available to them but they would enjoy higher quality rearing conditions and higher growth rates. To mitigate the entire footprint impacts on chinook salmon within the Cheakamus River itself will not be practical. Restoration of the estuary can provide immediate benefits to the Cheakamus River chinook salmon.

2. Added value benefits included the informational signs placed in estuary for interested members of the public. The Squamish River Estuary Society has developed a brochure on trails and ecological and historic values within the Squamish River estuary. This project will complement those initiatives. The general public currently has excellent access to this area for nature viewing. Promotion of Eco-tourism opportunities is being pursued within the business community of Squamish as a key economic strategy for the community and these works complement and adds to the value of the estuary to provide those opportunities.

Achievement of Objectives

- Production of 5000 m^2 of tidal channel rearing habitat.
- Replanting of marsh vegetation in the newly constructed habitat areas.
- Installation informational signs that will enhance awareness of the ecological value of estuaries (some of which have had to be temporarily stored due to an increase in vandalism this year).
- Providing an educational experience for members of the public that take advantage of the trails provided by the Squamish River Estuary Society.

This project was a joint partnership and provided much involvement from various sectors. The crew was hired from Squamish Nation and volunteers were provided through the Capilano College Outdoor Leadership Awareness program.

This area is being used more and more by the public and as the dredge spoils are removed and the area reestablished as estuary, there is an increased respect and ownership that is being given to this location. The work being done is ongoing and as funds are made available channels and habitat will be continue to be established. In the mean time volunteer efforts will continue to improve the vegetation, trails, and interpretive signage.

6. Recommendations

Risks and Benefits

There are no foreseeable risks involved with this project. The inner estuary is within a dedicated conservation area. Previous restoration projects similar to the proposed works, have been endorsed by SEEAC, the Squamish Estuary Environmental Assessment Committee, a local environmental review group made of all levels of government that have mandates within the estuary. The marsh areas targeted for restoration are in protected, low energy environments and the likelihood of developed habitat functioning for decades is high.
The Squamish River estuary has been previously identified as an area with exceptional value to many bird species who use these habitats both on a seasonal and year round basis (Trethewey, 1985). The inner estuary has been found to produce much of the near shore detritus material that feeds the near shore amphipod populations that in turn provide forage for many of the fish found in the outer estuary and upper Howe Sound (Goodman and Vroom, 1972). The proposed habitat work will add to the diversity of wildlife habitat in the estuary and enhance the nutrient cycling potential between the inner and outer estuary environments.

As such, the area within the estuary should continue to be restored to it's natural state and the rearing and spawning channels should continue to be monitored to ensure that they are meeting the expected potential to permit increased habitat for the salmonids. The revegetation efforts should continue until there is a solid establishment of natural regeneration within the estuary of sedges, rushes, and reeds.

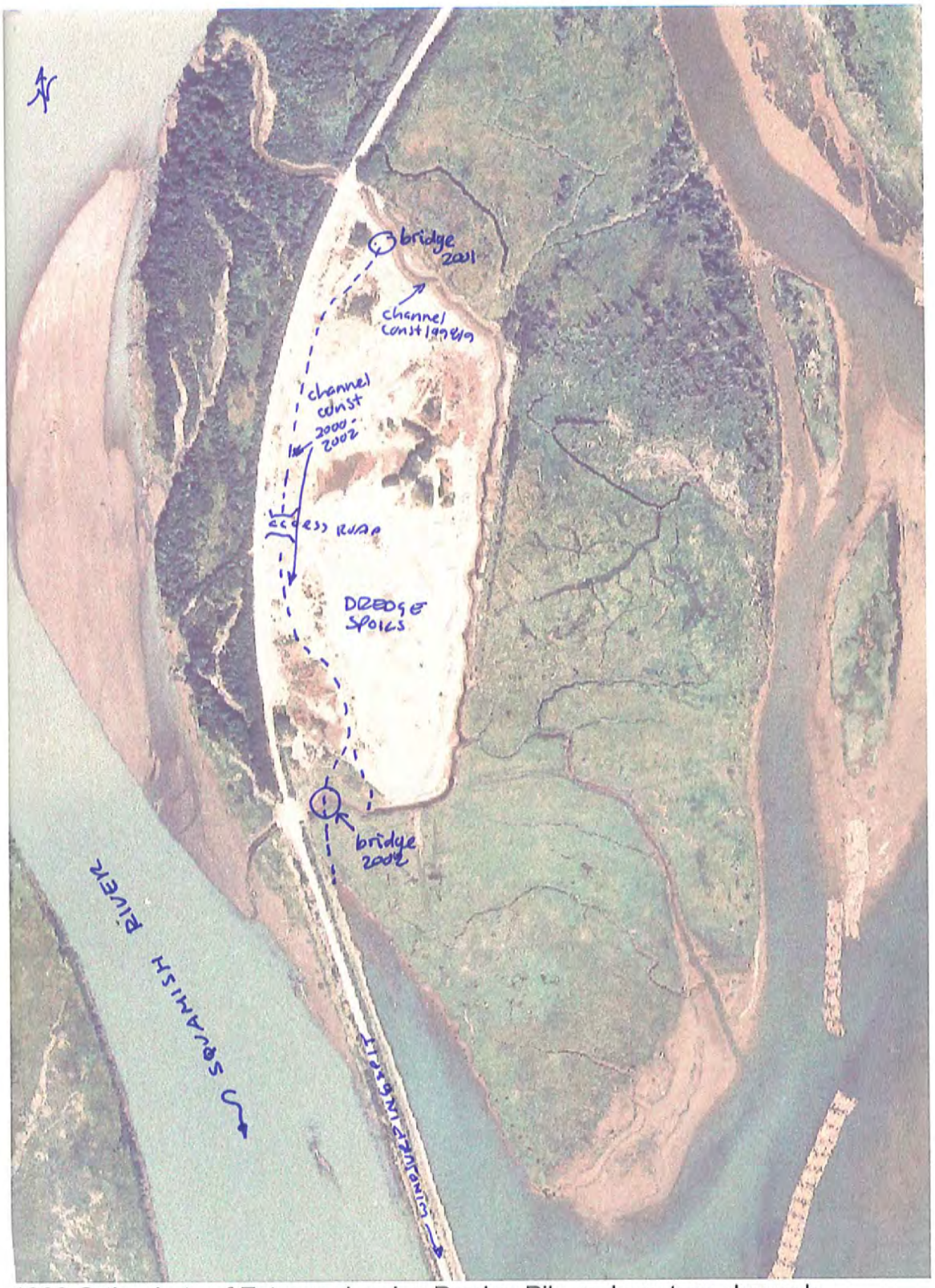
7. Acknowledgements (include the financial support of BC Hydro Bridge Coastal Fish and Wildlife Restoration Program)

Randall Lewis Squamish Nation
Harold Beardmore P.Eng., Fisheries and Oceans
BC WLAP Habitat Officer, Squamish, Steve Rochetta
Jas Michalski, Environmental Co-ordinator, District of Squamish,
Bridge Coastal Fish and Wildlife Restoration Program
Squamish Estuary Conservation Society

Squamish River Estuary Project				
2001/2002				
	HRSEP	**FsRBC**	**BC Hydro**	**Project Totals**
Wages				
Project Coordinator (Edith Tobe)	6,800.00	4,000.00	2,000.00	12,800.00
Labour	2,240.00	9,343.00	3,200.00	14,783.00
Sub-Total:	**9,040.00**	**13,343.00**	**5,200.00**	**27,583.00**
Transportation / Equipment				
Heavy Equipment Rental	48,000.00	15,000.00	23,000.00	86,000.00
Plant Stock / Site Supplies	2,020.00	-	-	2,020.00
Safety	500.00	-	-	500.00
Transportation	1,000.00	-	-	1,000.00
Trucking	4,000.00	-	-	4,000.00
Culvert	5,000.00	-	-	5,000.00
Bridge Deck	-	4,657.00	-	4,657.00
Sub-Total:	**60,520.00**	**19,657.00**	**23,000.00**	**103,177.00**
Other Project Costs				
Film	100.00	-	-	100.00
Processing	120.00	-	-	120.00
Education Sign	400.00	3,000.00	-	3,400.00
Liability Insurance / Advertising	1,500.00	-	-	1,500.00
Sub-Total:	**2,120.00**	**3,000.00**	**-**	**5,120.00**
Office / Overhead				
Office rental, supplies	200.00	-	-	200.00
Storage & Crew support	1,000.00	-	-	1,000.00
Financial / Admin Fees	2,500.00	-	2,000.00	4,500.00
Sub-Total:	**3,700.00**	**-**	**2,000.00**	**5,700.00**
TOTAL	**$ 75,380.00**	**$ 36,000.00**	**$ 30,200.00**	**$ 141,580.00**

wrm 12/01/03

BC HYDRO
FISH & WILDLIFE
BRIDGE COASTAL RESTORATION PROGRAM



1999 Orthophoto of Estuary showing Dredge Pile and western channels

BC HYDRO
FISH & WILDLIFE
BRIDGE COASTAL RESTORATION PROGRAM

The following are some photos of the site illustrating the channel works and sedge revegetation.

North access bridge across channel (access road/Training Dyke and parking area can be seen in the background – channel from River access can be seen to the right)

Facing West – side channel (constructed in 2001/2002) with access bridge (access to berm/trail)

BC HYDRO
FISH & WILDLIFE
BRIDGE COASTAL RESTORATION PROGRAM

Facing South – view of channel from bridge deck

Facing East – sedge replant (small clumps visible on graded estuary flats berm/trail on right)

BC HYDRO
FISH & WILDLIFE
BRIDGE COASTAL RESTORATION PROGRAM

Facing East – sedge replant on graded estuary flats (berm/trail on right)

Facing North - people walking along the berm/trail

BC HYDRO
FISH & WILDLIFE
BRIDGE COASTAL RESTORATION PROGRAM

Facing North – view of dredge spoils and southern portion of berm/trail in the foreground

Facing North - a closer view of the dredge spoils with crew member

BC HYDRO
FISH & WILDLIFE
BRIDGE COASTAL RESTORATION PROGRAM

Facing South – view of south bridge (constructed in April 2003) with access to berm/trail to left

Facing East – view of south bridge and side channels with berm/trail meandering in middle

BC HYDRO
FISH & WILDLIFE
BRIDGE COASTAL RESTORATION PROGRAM

Facing North – happy trails along the berm/trail (trees and shrubs (as flagged) planted November 2003)

Facing North – berm/trail and dredge spoil pile in the background