Stave River Spawning Habitat Restoration Project
Final Report

Prepared by the
Fraser Valley Regional Watersheds Coalition

Submitted to the BC Hydro Bridge Coastal
Fish & Wildlife Restoration Program

BCRP Project # 07.SFN.01

March 20, 2008

Executive Summary

The spawning habitat within the lower Stave River supports the second greatest chum salmon population in the Fraser Basin, estimated at over 500,000 spawners per year. As a result of the redd-digging activities of all these salmon, combined with the substantial hydrological influence of the Ruskin Dam immediately upstream, this spawning habitat requires periodic rehabilitation every 10-20 years to retain its high habitat quality. The first major restoration project was conducted from 1990-1994. The next project was scheduled for 2006-2008. This report summarizes the results of the second year of this three-year project, conducted in 2007, with funding support from the BC Hydro Bridge Coastal Fish and Wildlife Restoration Program.

The 2007 project represented a collaborative effort involving the Fraser Valley Regional Watersheds Coalition, Fisheries and Oceans Canada, the Fraser Valley Regional District, BC Hydro, and the Kwantlen First Nation. Project objectives included:

1. Rehabilitation of 60,000 square meters of salmon spawning habitat within the lower Stave River,
2. stabilization of the left bank from erosion that is (a) threatening to destroy a Kwantlen First Nation archeological site, and (b) is contributing to fine sediment deposition into the spawning grounds;
3. Developing strong working relationships between project partners; and
4. Increasing awareness amongst the community about the value of the Stave River system.

Although water level conditions resulted in project delays, each of these objectives was successfully obtained for this phase of the project. Results are discussed. The third and final year of the project, expected for 2008, is currently pending funding support.

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1. Introduction

The lower Stave River, between the Ruskin Dam and the Fraser River, consists of numerous channels and gravel bars, with predominantly deciduous vegetation growing on the more established bars and river banks. Located within the traditional territory of the Kwantlen First Nation, the area contains numerous archaeological sites and artifacts of cultural and historical significance, many of which are threatened by the continual erosion of the river banks. The erosion of these banks has long been a concern of the Kwantlen First Nation, a concern identified during the past Water Use Planning process (2003).

This section of the river supports the second largest chum salmon population in the Fraser River watershed (after the Harrison River). Over 500,000 chum salmon and thousands of coho and Chinook salmon have been recorded spawning within these graveled channels. Because of the presence of the dam, the lower 3 km section of the Stave River provides the only remaining habitat for spawning salmon within this watershed.

The Ruskin Dam, located immediately upstream of this section, significantly influences the habitat and hydrology of the lower Stave River, by limiting gravel and wood recruitment, by altering the hydrology and erosion patterns, and by washing spawning gravels downstream during periodical large dam spillway releases. Combined with the lack of new gravel recruitment from upstream as a result of the dam, the degrading forces from over half a million salmon shifting the gravel bed during redd-digging actions further contributes to downstream gravel losses and shifts in gravel placement. Due to these combined influences, recurring restoration works are required on the lower Stave River every 10-20 years to avoid long-term diminished habitat capacity of these critical spawning grounds. The last major restoration efforts occurred in 1990 to 1994.

The next major restoration effort was scheduled to occur over a three-year period from 2006 to 2008. Fisheries and Oceans Canada (DFO), with BC Hydro, invested approximately $90,000 in 2006. In 2007, a partnership was formed with DFO, the Fraser Valley Regional Watersheds Coalition (FVRWC), BC Hydro, the Fraser Valley Regional District (FVRD) and the Kwantlen First Nation to continue these works. The third and final year of this project, scheduled for 2008, are pending funding approval.

This report summarizes the results of the second year of this project, conducted in 2007, with funding support from the BC Hydro Bridge Coastal Fish and Wildlife Restoration Program (BCRP).

2. Goals & Objectives

The two primary objectives of the 2007 works on the lower Stave River were to:

1. Rehabilitate ~60,000 square metres of salmon spawning habitat by recontouring and re-grading the gravel beds,

2. Stabilize the east (left) bank of the lower Stave River from erosion that is (a) threatening to destroy a Kwantlen First Nation archeological site, and (b) is contributing to fine sediment deposition into the spawning grounds.

Secondary objectives included:

3. Developing strong working relationships between project partners, and

4. Increasing awareness amongst the community about the value of the Stave River system.

3. Study Area

The project area was along the lower Stave River, between the Ruskin Dam and the confluence with the Fraser River, within the District of Mission (Figure 1). Most of the work occurred approximately 500 metres downstream of the dam, along the eastern-most channel of the main stem and along the east (left) bank.

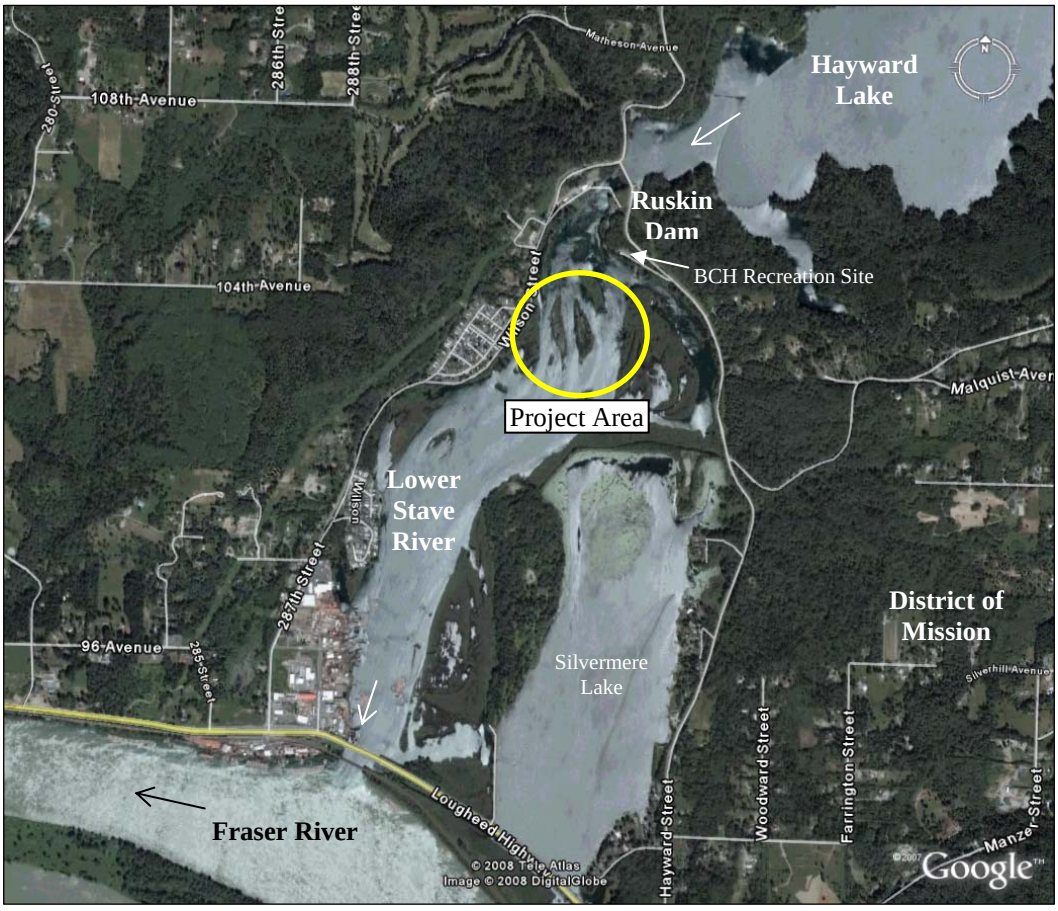

Figure 1. Project study area

4. Methods

Project planning was initiated in April 2007 (Figure 2) with a site meeting involving the FVRWC, DFO, BC Hydro, and the Kwantlen First Nation. The restoration strategies shown to be effective on the lower Stave River by Fisheries and Oceans and BC Hydro in 2006 involved the use of heavy construction equipment to move gravel from within the existing floodplain to areas where they are useful to spawning salmon and to where they provide a protective barrier against erosive water flows. The gravel bed of the river is then contoured such that any water released from the dam flows evenly across all of the spawning grounds. Due to the successful efforts in 2006, the same approach was planned for 2007.

Because the project required low water levels within the lower Stave River to conduct the in-stream works, the project was scheduled for August 21 to September 7, during which time the project was granted conditional approval by the Comptroller of Water Rights to reduce water flows from Ruskin Dam. This period was chosen because of: (1) the low likelihood of heavy precipitation events in the Stave River system, (2) typical Fraser River water levels being sufficiently low during the late summer so as not to raise water levels within the lower Stave River, (3) limited presence of salmon in the river, and (4) favourable tidal conditions in the Fraser River that significantly influence water levels in the lower Stave River. The approval for the variance in tailwater elevations was conditional upon inflows into the Stave River watershed and other potential system requirements.

Figure 2. Site meetings and project planning (April 2007)

The restoration project design was led by Fisheries and Oceans Canada, which designed the previous restoration works that had functioned at a high level since the 1990's. DFO also functioned as Site Manager during project construction. The Fraser Valley Regional Watersheds Coalition served as Project Manager and helped to coordinate the overall project. BC Hydro provided logistical support pertaining to site operations and site safety, and the Kwantlen First Nation was involved in project planning and in providing guidance for archaeological protection. Table 1 further outlines the project partners' roles and responsibilities on the project.

Table 1. Project partners and associated roles/responsibilities

Agency/Organization	Project Tasks
Fraser Valley Regional Watersheds Coalition (with support from Fraser Valley Regional District)	• Project Management • Coordinate planning and site meetings • Hire contractors • Acquire approval for water withdrawal • Reporting/invoicing • Community awareness (press releases, project signage, FVRWC communications and public meetings)
Fisheries and Oceans Canada	• Project planning • Site/Construction Management • Project design • Engineering and biology expertise • Project monitoring
BC Hydro	• Project planning • Coordination and logistical support of BC Hydro operations and safety • Biologist support
Kwantlen First Nation	• Project planning • Archaeological expertise • Project (construction) assistance

5. Results

Due to high water levels in the Fraser River throughout the month of August, the project was delayed for over two weeks until water levels receded sufficiently to allow in-stream works to be safely conducted in the project area. Consequently, project surveying to determine stream bed and gravel bar elevations, and final project design, was not able to commence until September 7. Project construction (Figure 3) began on September 10 and proceeded until September 19.

Figure 3. Project construction (September 2007)

Unfortunately, due to the original project delay resulting from high Fraser River water levels, project construction was limited both in the number of hours per day and the number of days because of shorter daylight available and uncooperative tidal periods, as well as the presence of salmon beginning to return to the system to spawn. This resulted in the project coming in significantly under budget due to the reduced machine time used on the project.

Despite the limited machine time available, the project resulted in very significant benefits to the lower Stave River, both in terms of improved spawning habitat as well as bank protection and stability. These results, demonstrated by the accompanying sketch (Figure 4) and locational map (Figure 5), include:

(1) Substantial shoreline protection (~175 m) along the eastern bank using on-site gravel, to help protect the bank from further erosion resulting in siltation of spawning beds and risking damage to important cultural and archaeological sites and artifacts;

(2) Recontouring of streambed gravel to create 150 m long spawning riffle and 120 m long spawning channel in the eastern channel;

(3) ~150 m long spawning bench, also in the eastern channel;

(4) Three deep water trenches perpendicular to stream flows in the central channel, creating refuge pits for steelhead and other salmonids during h flows.

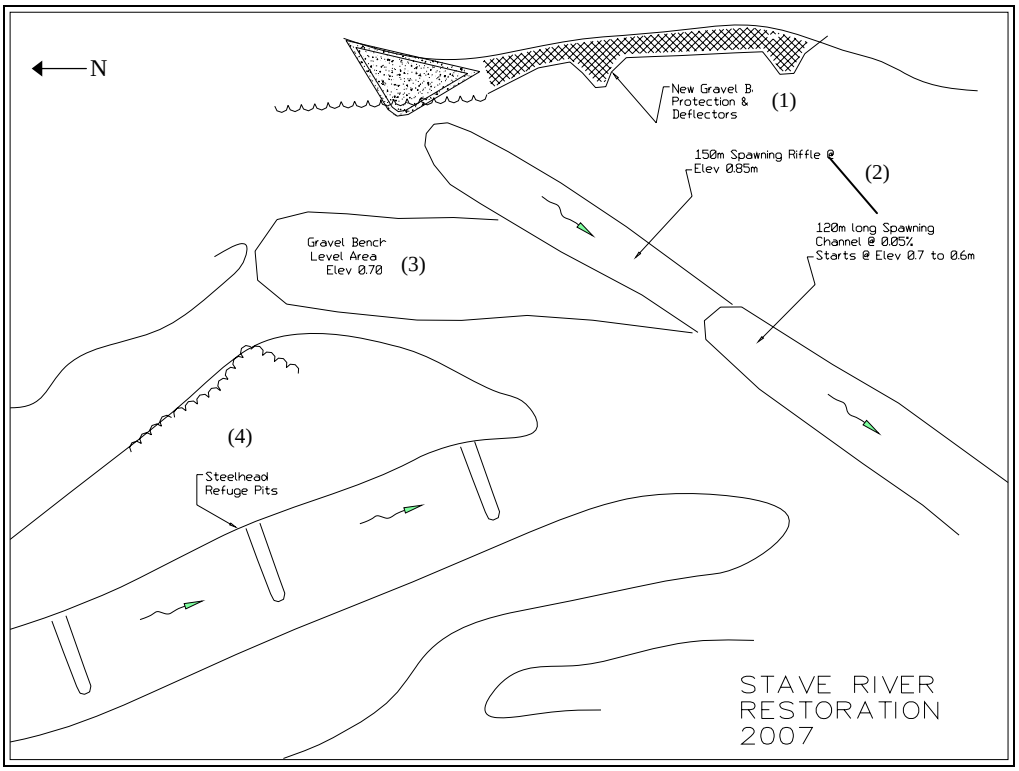

Figure 4. Project results schematic overview (courtesy DFO)

Figure 5. Final project results and locational map of (1) bank protection, (2) re-contoured spawning riffle/channel, (3) gravel bench, and (4) new steelhead refuge pits

Figure 6 shows photos of the east (left) bank before and after the project, showing the bank protection provided to these previously-eroding sites as a result of the project. The gravel used to stabilize the bank was taken from elsewhere on the site while recontouring the streambed to allow for improved spawning habitat conditions.

Figure 6. Photos of the eroding (east) bank comparing pre- and post-project conditions

6. Discussion

The project, the second phase of a proposed three-year project, was successfully completed on-time (albeit delayed) and under budget, achieving each of the four project objectives (Table 2). Given the importance of the system particularly for chum habitat, rehabilitating the spawning habitat within the river was the primary objective of the project. Also of major significance was to stabilize the eroding streambank that was contributing to siltation of spawning grounds and risking the destruction of an important cultural and archaeological site. Both of these objectives were successfully obtained.

The secondary objectives, the strengthening of partnerships between the agencies and organizations involved, and the raising community awareness, were also obtained, albeit more difficult to quantitatively evaluate.

Table 2. Project evaluation

Objective	Evaluation
(1) Rehabilitate ~60,000 square meters of salmon spawning habitat	Significant areas of the eastern channel of the lower Stave River were re-contoured for improved spawning habitat conditions within the system. ***Conclusion: Successful***
(2) Stabilize the east bank from further erosion	Gravel from the streambed was pushed towards the eastern bank, protecting the shoreline from further erosion and protecting the cultural and archaeological value of the site. ***Conclusion: Successful***
(3) Develop strong working relationships between project partners	Communication between project partners throughout planning and construction phases helped contribute to the project success and completion. The project is a prime example of the value of partnerships, with strong support coming from multiple agencies and organizations to help achieve project results. ***Conclusion: Successful (but difficult to assess)***
(4) Increase awareness amongst the community about the value of the Stave River system	A number of newspaper articles about the project, as well as project signage and answering questions by inquisitive visitors during the project, helped to inform the public about what was being done and why. In addition, the project was highlighted in FVRWC correspondence and was presented at the FVRWC Annual General Meeting in November 2007. ***Conclusion: Successful (but difficult to assess)***

Although substantial results were still obtained that will provide long-term benefit to the spawning habitat and bank stability of the area, the project demonstrated some of the challenges inherent with working within the lower Stave River. First, the project location is immediately downstream of the Ruskin Dam, a 105.6 MW facility that is relied upon to provide electricity services to customers within the Lower Mainland. Consequently, holding back water in the reservoir, which was needed to allow the in-stream works to be conducted for this project, means reduced power generation for the facility. The ability to safely hold back water within the reservoir is also dependent on water level conditions within the reservoir. As a result, the project was, by necessity, greatly weather-dependent. Weather did not greatly impact this project however – it remained sunny and dry throughout most of the project duration. Partially due to the warm weather however, there was a concern by BC Hydro regarding the release of water from the dam at the conclusion of each day's in-stream construction works. The area is a popular recreation site and numerous fishermen were taking advantage of the nice weather and the low water levels to access previously submerged or difficult-to-access gravel bars in the mid channel. This posed a concern to BC Hydro that these people do not become stranded when the water is re-released. This issue was resolved, apparently, with the use of an air horn by BC Hydro staff standing on the top of the dam giving a number of short blasts causing people below to make their way to safety before the water level rose too high.

Another challenge inherent with trying to perform in-stream works on the project site is the fact that the lower Stave River is greatly influenced by the water level of the Fraser River and by the tidal conditions of the Fraser River. This was a particular problem with our project because of seasonally high water levels in the Fraser River, necessitating an almost three-week project delay to allow for water levels both in the Fraser River and the lower Stave River, to recede sufficiently. This late starting time further complicated project progress, partially due to the greater risk of weather preventing water hold-back behind the dam, but also because now tidal conditions were not favourable for prolonged in-stream works to be conducted. High tide was approximately in mid-day, meaning that water levels within the project area were generally too high during much of the daylight hours. Consequently, the project was greatly under budget and not as much in-stream work was able to be achieved had conditions been different.

7. Conclusions and Recommendations

Although the project window was limited due to a number of unforeseen conditions, substantial results were still obtained as a result of the project. Of most importance to the lower Stave River system, spawning habitat was rehabilitated by recontouring the stream bed and the east bank was stabilized from further erosion. This remains only the second year of a three-year project however, so further rehabilitation efforts are still needed on the system to complete the project. Given the continual influence of the Ruskin Dam on the lower Stave River, these rehabilitation efforts need to be repeatedly supported in order to maintain the high salmon populations that the river currently supports.

The proposed 2008 works will continue to enhance spawning habitat within the river, with an additional 30,000 square meters of in-stream spawning habitat located upstream of the 2007 project area planned to be restored. Also, as with the 2007 works, a secondary objective will be to provide streambank stability to another eroding site potentially threatening an important Kwantlen First Nation archaeological site. A third objective of the work is to improve public access to the left bank of the Stave River adjacent to the BC Hydro recreation site. This area is popular for a number of recreational activities, and the current footbridge from the recreation site was not designed to withstand the high volume of pedestrian traffic it currently experiences. Replacing the footbridge with a more stable aluminum structure will ensure long-term stability and enjoyment of the facility. It is hoped that the BC Hydro Bridge Coastal Fish & Wildlife Restoration Program will continue to support these much needed works.

8. Acknowledgements

Financial contributions for this project were received from:

- BC Hydro Bridge Coastal Fish and Wildlife Restoration Program

Financial and in-kind support for this project was gratefully received from:

- Fisheries and Oceans Canada
- Fraser Valley Regional District
- Kwantlen First Nation
- BC Hydro

9. References

BC Hydro, 2003. Stave River Water Use Plan (Stave Falls and Ruskin Projects), Revised for Acceptance by the Comptroller of Water Rights. December 15, 2003. Available: http://www.bchydro.com/rx_files/environment/environment30835.pdf (3/19/2008).

Appendix I: Financial Statement of Project Expenditures

Project Number: 07.SFN.01

Financial Statement Form

	BUDGET		ACTUAL	
	BCRP	**Other**	**BCRP**	**Other**
INCOME				
Total Income by Source				
Bridge Coastal Restoration Program (BCRP)	$97,700.00		$48,896.58	
Fisheries and Oceans Canada (DFO)		$101,500		$97,500
Fraser Valley Regional District (FVRD)		$13,735		$13,735
Kwantlen First Nation		$2,500.00		$2,500.00
BC Hydro		$4,600.00		$4,600.00
Volunteers		$800.00		
Sub-Total Income:	***$97,700.00***	***$123,135.00***	***$48,896.58***	***$118,335.00***
Grand Total Income (BCRP + other)		**$220,835.00**		**$167,231.58**
EXPENSES				
Project Labour				
Project Manager	- $8,500.00	- $1,100.00 [a]	- $8,500.00	- $1,100.00 [a]
Senior Biologist Design and Construction (DFO)		- $12,000.00 [b]		- $12,000.00 [b]
Senior Engineer Design and Direction (DFO)		- $7,000.00 [b]		- $7,000.00 [b]
Aboriginal Heritage Consultant		- $2,500.00 [c]		- $2,500.00 [c]
Engineering Support (DFO)		- $8,000.00 [b]		- $8,000.00 [b]
Construction/Site Supervision (DFO)		- $12,000.00 [b]		- $8,000.00 [b]
Project Labour (Assistant)	- $3,000.00	- $3,000.00 [c]	- $2,673.75	
BCH Biologists and Engineer		- $4,600.00 [d]		- $4,600.00 [d]
Project Volunteers		- $800.00		
Total Project Labour:	*- $11,500.00*	*- $51,000.00*	*- $11,173.75.00*	*- $43,200.00*

[a] Fraser Valley Regional District Contribution (in-kind)
[b] Fisheries and Oceans Canada Contribution (cash and in-kind)
[c] Kwantlen First Nation Contribution (in-kind)
[d] BC Hydro Contribution (in-kind)

Materials & Equipment				
Heavy Hydraulic Excavators	- $36,000.00	- $18,000.00 [b]	- $8,124.20	- $18,000.00 [b]
Volvo Articulated Trucks	- $30,000.00	- $30,000.00 [b]	- $20,253.63	- $30,000.00 [b]
Bulldozer	- $10,000.00	- $6,000.00 [b]	- $5,645.00	- $6,000.00 [b]
Equipment Rental	- $2,500.00	- $2,500.00 [b]		- $2,500.00 [b]
Mobilization/Demobilization	- $2,000.00	- $2,000.00 [b]	- $2,500.00	- $2,000.00 [b]
Plants	- $1,500.00	- $975.00 [b]		
Accommodation	- $1,000.00			- $1,000.00 [b]
Travel (gas, vehicle lease/maint.)	- $900.00	- $4,560.00 [a,b]	- $900.00	
Signage	- $2,000.00			
Total Materials & Equip	*- $85,900.00*	*- $64,035.00*	*- $37,422.83*	*- $59,500.00*
Administration				
Office space/computers		- $4,800.00 [a]		- $4,800.00 [a]
Telephone	- $300.00	- $300.00 [a]	- $300.00	- $300.00 [a]
Office Supplies (printer, etc.)		- $300.00 [a]		- $300.00 [a]
Printing/Photocopying		- $200.00 [a]		- $200.00 [a]
Courier/Postage		- $100.00 [a]		- $100.00 [a]
Software		- $500.00 [a]		- $500.00 [a]
Camera		- $400.00 [a]		- $400.00 [a]
Insurance		- $500.00 [a]		- $500.00 [a]
Employee payroll and benefit administration		- $1,000.00 [a]		- $1,000.00 [a]
Total Admin Costs	*- $300.00*	*- $8,100.00*	*- $300.00*	*- $8,100.00*
Sub-Total Expenses:	***- $97,700.00***	***- $123,135.00***	***- $48,896.58***	***- $110,800.00***
Grand Total Expenses (BCRP + other)		**- $220,835.00**		**- $159,696.58**
BALANCE (Grand Total Income – Grand Total Expenses)		**0**		**$7,535.00**

Appendix II: Performance Measures

Project Number: 07.SFN.01

Performance Measures – Target Outcomes													
Project Type	Primary habitat benefit targeted of project	Primary Target Species	Habitat (m2)										
			Estuarine	In-stream Habitat – Mainstream	In-stream Habitat – Tributary	Riparian	Reservoir Shoreline Complexes	Riverine	Lowland Deciduous	Lowland Coniferous	Upland	Wetland
Impact Mitigation												
Fish passage technologies	Area of habitat made available to target species											
Drawdown zone revegetation/stabilization	Area turned into productive habitat											
Wildlife migration improvement	Area of habitat made available to target species											
Prevention of drowning of nests, nestlings	Area of wetland habitat created outside expected flood level (1:10 year)											
Habitat Conservation												
Habitat conserved – general	Functional habitat conserved/replaced through acquisition and management											
	Functional habitat conserved by other measures (e.g. riprapping)	**(various)**							**300**			
Designated rare/special habitat (subset)	Rare/special habitat protected											
Maintain or Restore Habitat forming process												
Artificial gravel recruitment	Area of stream habitat improved by gravel placement	**Chum salmon**		**60,000**								
Artificial wood debris recruitment	Area of stream habitat improved by LWD placement											
Small-scale complexing in existing habitats	Area increase in functional habitat through complexing											
Prescribed burns or other upland habitat enhancement	Functional area of habitat improved											
Habitat Development												
New habitat created	Functional area created	**Steelhead**		**500**								

Appendix III: Confirmation of BCRP Recognition

A: Newspaper recognition:

Mission City Record, Sept 13 2007:

Crews enhancing Stave River salmon habitat

By Jason Roessle
Mission Record

Stave River salmon are getting a helping bucket from the Fraser Valley Regional District (FVRD).

People and machines are currently working in the lower Stave, approximately 200 metres downstream from the Ruskin Dam, labouring to enhance salmon habitat, according to FVRD Watershed Planner Lance Lilley.

"There is a desire there to create more habitat," he noted. "We'll be trimming gravel from the upper bars, and using it to recontour the river."

The project began Monday and is expected to run until Sept. 21, pending suitable weather and tidal conditions. There will not be any material trucked in to the work site; everything used will be from the immediate environment.

"Beginning in 1990, the Stave River has been a priority for habitat restoration to improve conditions for salmon and trout," noted Matt Foy, fisheries biologist with the Department of Fisheries and Oceans. "From a few thousand salmon spawners in the 1940s and 1950s, the Stave River today enjoys spawning salmon returns of over 500,000 fish in some years. The restoration of the Stave River salmon runs is one of the modern success stories here in the Lower Fraser Valley."

The current project is expected to add to the success of past restoration efforts, including those achieved last year at the site.

The project, which is funded by the BC Hydro Bridge Coastal Fish and Wildlife Restoration Program, will involve recontouring sections within the river to create more spawning habitat, and stabilizing the streambank to prevent further erosion and siltation.

This is part of a collaborative effort involving the Fraser Valley Regional Watersheds Coalition, the Department of Fisheries and Oceans, the Fraser Valley Regional District, and Kwantlen First Nation.

The location is a popular spot for local fishermen, but they are urged to avoid the area for the next couple of weeks due to safety concerns while heavy machines are operating.

For more information about the project, please contact Lance Lilley at 604-702-5006.

Maple Ridge Times, Sept 11 2007:

Maple Ridge•PittMeadows
times

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Chamber of Commerce
- Chamber of Commerce Serving Maple Ridge and

Stave work

The Times
Published: Tuesday, September 11, 2007

Those living, working, or visiting Ruskin over the next couple of weeks may notice a number of people and machines working within the lower Stave River, approximately 200 metres downstream of the Ruskin Dam. This is part of a collaborative effort involving the Fraser Valley Regional Watersheds Coalition, the Department of Fisheries and Oceans, the Fraser Valley Regional District, Kwantlen First Nation, and BC Hydro to restore and enhance fish habitat below the dam.

"Beginning in 1990, the Stave River has been a priority for habitat restoration to improve conditions for salmon and trout," notes Matt Foy, Fisheries Biologist with the Department of Fisheries and Oceans. "From a few thousand salmon spawners in the 1940's and 1950's, the Stave River today enjoys spawning salmon returns of over 500,000 fish in some years. The restoration of the Stave River salmon runs is one of the modern success stories here in the Lower Fraser Valley." The current project is expected to add to the success of past restoration efforts, including those achieved last year at the site.

The project, which is funded by the BC Hydro Bridge Coastal Fish and Wildlife Restoration Program, will involve recontouring sections within the river to create more spawning habitat, and stabilizing the streambank to prevent further erosion and siltation. Work is expected to continue until Sept. 21, pending suitable weather and tidal conditions.

Email to a friend
Printer friendly

For more information about the project, contact Lance Lilley, Watershed Planner for the Fraser Valley Regional Watersheds Coalition, at 702-5006.

B: Project Signage:

At each public access point (one on left bank, one on right bank), temporary signs (shown below) were provided on site during project construction.

WORK IN PROGRESS

- CAUTION -

Heavy Machinery in use
DO NOT ENTER

In-stream construction to improve fish habitat and provide stream bank stability in the Lower Stave River is scheduled to occur from September 10 to September 21, 2007. Information inquiries can be directed to the Site Supervisor @ 604-803-2785.

Project partners include

- BC Hydro Fish & Wildlife Bridge Coastal Restoration Program
- Department of Fisheries and Oceans Canada
- Fraser Valley Regional Watersheds Coalition
- Fraser Valley Regional District
- Kwantlen First Nation
- BC Hydro