Fraser Salmon & Watersheds Program

2011/12 FINAL REPORT

FSWP File Number*	07350-35 / FSWP 11 49 HWRS LR

* Please use the FSWP File Number provided in previous FSWP project correspondence.

1. Project Information

1.1. Project Title

Fraser Valley Stream Nutrient Enrichment

1.2. Proponent's Legal Name

British Columbia Conservation Foundation

1.3. Project Location

Fraser Valley

1.4. Contact for this report

Name: Kerry Baird	Phone: 604-576-1433	Email: kbaird@bccf.com

1.5 Funding Amount

Original Approved Grant Amount:	Total FSWP Expenditures:	Final Invoice Amount:	Final Non-FSWP leveraging, including cash and in-kind:
$18,000	$18,000	$5,400	$47,660.88

2. Project Summary

Please provide a single paragraph describing your project, its objectives, and the results. As this summary may be used in program communications, clearly state the issue(s) that were addressed and avoid overly technical descriptions. Maximum 300 words.

The loss of aquatic productivity has resulted from dam impoundment, riparian logging, and reduction in salmonid escapement. Salmonid species spend the largest portion of their adult life developing in salt water environments before returning to their natal freshwater streams to spawn and die. This life cycle provides an ecologically important process of delivering marine-derived nutrients to the freshwater aquatic and terrestrial ecosystems, providing links between ecosystems, playing an important role in maintaining ecosystem health, and having significant implications for conservation and biodiversity of freshwater flora and fauna.

The recent downturn in ocean productivity and survival has resulted in reduced salmon escapement. This loss of essential aquatic nutrients (nitrogen and phosphorous) in the form of salmon carcasses, has particular consequences on juvenile salmonid survival that rear for 1 to 4 years in freshwater ecosystems. Adequate levels of these limiting nutrients are needed by lower trophic-level organism, which then relay the nutrients up the food chain; periphyton (algae) growth increases, increasing insect growth and abundance, which are then fed

upon by juvenile fish. Their survival is strongly affected by the concentrations of these nutrients because faster growing or larger juveniles more successfully overwinter during major fall-winter flood events, thus increasing smolt production, marine survival and ultimately escapement.

To compensate for low freshwater productivity, BCCF fisheries technicians, with the assistance from various volunteer groups, added slow-release fertilizer to 6 nutrient-poor streams in the Fraser Valley. Bi-weekly monitoring of field parameters, water chemistry, and algal accumulation was performed throughout the summer growing season and juvenile fish assessment was performed in the fall. Results of the project showed there was an average increase of 212% in algal growth and fish that were 76.6% heavier in fertilizer reaches compared to unfertilized reaches.

OPTIONAL: **Please give a short statement (up to 100 words) of the most compelling activity or outcome from your project.**

Volunteer participation during the fertilizer application continues to grow each year with this year being a banner year. Volunteers on the Coquihalla and Silverhope systems drove from as far away as Kelowna to be part of putting the fertilizer in the rivers. The use of nutrient enrichment as a fisheries restoration tool is becoming better known and multiple stewardships groups have requested information to apply the techniques in their own local waters to improve freshwater productivity.

3. Final Project Results and Effectiveness

3.1 Please copy THE EXPECTED DELIVERABLES from your detailed proposal and insert into this table. Add additional rows as needed. Then describe the FINAL DELIVERABLES (the tangible end products resulting from this work) associated with each expected Deliverable.

If FINAL DELIVERABLES differ from the original EXPECTED DELIVERABLES, please describe why, and the implications for the project.

EXPECTED DELIVERABLES	FINAL DELIVERABLES
1. Apply Crystal Green® slow-release fertilizer to 6 priority streams in the Fraser Valley	5,130 kg of Crystal Green ® fertilizer and 2,120 kg of liquid fertilizer was applied to 6 Fraser Valley streams.
2. Perform water chemistry monitoring, stream discharge surveys and fertilizer release rate studies	Following fertilizer application, water and algae samples, discharge and temperature measurements, and fertilizer release rate observations were made throughout the summer growing season (July to September).
3. Compare algal accrual differences between control (unfertilized) and treatment (fertilized) sections	Bi-weekly algae samples were sent to the lab for analysis and the results compiled into charts. Sites downstream of the fertilizer (treated) on average showed a 212% increase in algae growth compared to control sites upstream (unfertilized).
4. Sample juvenile fish populations in the fall at control and treatment sites to identify increases in juvenile fish size by comparing length, weight and size-at-age data	Following the summer growing season, juvenile steelhead were collected from sites above the fertilizer and below and sampled to obtain lengths, weights and scales from a representative sample. Scale ageing to confirm comparison between 0+ aged fish showed fish collected from the fertilized sites were on average 17.7% longer and 76.6% heavier in fertilized sites compared to unfertilized sites.
5. Invite various volunteers including First Nation, local angling groups, stewardship groups and students in	Individuals from 14 different stewardship groups were involved in the various tasks of the project including

various aspects of the project including fertilizer application, monitoring and fish sampling	fertilizer bagging, application, monitoring and fish sampling accounting for 70 man days of labour.
6. Compile a report to share the project results with all interested parties	The results from this project will be uploaded to BCCF's website, given to federal and provincial fisheries managers, and made available to interested parties, stakeholders and stewardship groups through avenues such as presentations that are routinely given by BCCF to streamkeeper groups.

3.2 Please evaluate the EFFECTIVENESS of your project in achieving Project Objectives, using the specific measures of success identified in your proposal. Please include any notable successes or challenges.

1. **Measure of Success:** Lab results (5-day turnaround) will show no increase in nutrients (ortho-phosphorous and total dissolved phosphorous) downstream of fertilizer application site; increased algae growth fully utilizes the increased nutrient additions.
   - **Project Effectiveness:** Lab results were received in timely fashion, there was only marginal phosphorous increases in the water samples at the Coquihalla and Statlu systems at sites downstream of the fertilizer.

2. **Measure of Success:** Increased algal growth on periphyton plates in the treated reaches (vs. control).
   - **Project Effectiveness:** There was significant increases in algal growth at all fertilized sites even when except for Foley Creek. Even including Foley, the increase in algal growth averaged over all the fertilized sites was 212% greater than the average over the unfertilized sites.

3. **Measure of Success:** Statistically-significant increased mean weights of steelhead fry (age 0+) in treated reaches (vs. control).
   - **Project Effectiveness:** On average, steelhead fry (aged 0+) were 76.7% heavier in fertilized sites than in the unfertilized sites, 1.76*g* vs. 1.0*g* respectively.

4. **Measure of Success:** High involvement from individuals from varying backgrounds.
   - **Project Effectiveness:** 70 man days of volunteer labour from 14 different groups (details provided in Appendix).

5. **Measure of Success:** Use of the results from this project used to inform fisheries managers and span new enrichment projects.
   - **Project Effectiveness:** The results will be provided to federal and provincial fisheries managers as there is a significant amount of good information that can be used to shape the future of stream nutrient enrichment and shows the effectiveness in improving freshwater productivity. The results of this years' project have been sought by several organizations. BCCF staff will present the results at a meeting on March 20, 2011 with Metro Vancouver as they have expressed considerable interest in applying the methodology and techniques at the Seymour, Lynn and Capilano rivers. The Fraser Valley Watershed Coalition has asked BCCF staff to present the results at a meeting in June. In addition, the Steelhead Society of BC and the Kingfishers' Rod and Gun Club, whose members contributed significant volunteer hours to this project, have expressed interest in having BCCF speak at their annual AGMs to discuss the project and results.

Challenges:

The snow pack this year was uncharacteristically high and the mild weather pushed the start of the freshet back by several weeks. The intent was to apply the fertilizer after the peak of the spring run-off as the water levels began to subside. This is desired for a number of reasons including safety of those putting the fertilizer into the water and to keep the fertilizer bags from being washed away but also to maximize the effects of the fertilizer. If the freshet occurs early in the year, the fertilizer can be added earlier and then the summer growing season is

typically long, say early- to mid-June into September. This increases the amount of time that nutrients can be relayed up the food chain in the freshwater ecosystem and have the greatest benefit to fish growth. This year, the high waters persisted in most systems until early July, thus the growing season was prominently reduced (mid-July to September). As a result, the associated fish gains were also reduced in comparison with years that rivers were treated much earlier.

Though the fish growth in fertilized reaches this year may not have been as significant as in years with a longer summer growing season, the application of the fertilizer this year might have been equally as important. With a short growing season, juvenile fish would have a greater reliance of this nutrient pulse to ensure adequate growth to be able to withstand and survive the critical overwintering period.

3.4 If applicable, please describe project outcomes that relate to one or more of the following strategic approaches (Section 2.1 of RFP; section 8 of detailed proposal template), and include specific examples.

Engagement of First Nations. Please specify who, and in what capacity.	
Active partnerships with one or more organizations.	Partnership funding from the Habitat Conservation Trust Foundation and Living Rivers: Georgia Basin. In-kind support from the BC Ministry of Forests, Lands and Natural Resource Operations, Freshwater Fisheries Society of BC, and Fisheries and Oceans Canada. Volunteer contributions from several organizations including stewardship and angling groups. BCCF has been working with Ostara Nutrient Recovery Technologies to find the grain size that is most suited to the project.
Engagement and participation of diverse and under-represented groups.	
Relationship building, as a foundation for sustainable, enduring activities.	
Capacity building, including mentorship models, leadership training and skills development.	This project supports stewardship groups in repeating and/or undertaking new stream enrichment initiatives based on an easily replicated project methodology and available technical guidance from BCCF.
Recognition and support of champions and their initiatives.	Crystal Green® is recovered from wastewater using technique recently developed at UBC. BCCF and the BC MoE were the first to use it and continue to refine the methodology for future uses, such as MetroVancouver's interest in using a locally-developed technology, and a locally produced product (fertilizer is being produce on a pilot-scale at Annacis Island) to improve local waters (Seymour, Lynn and Capilano rivers).
Opportunities to influence policy and decision making,	

3.5 Please describe how the benefits of this project will be sustained and/or be built upon into the future. What are the planned next steps, or recommendations for further work, if applicable?

This stream nutrient project was designed to help offset poor ocean productivity, survival and reduced escapement. Though the project has seen benefits in each year (increased algal growth and increase juvenile steelhead fish growth), it was only initially intended to run for a 5-year time period after which the program would be evaluated following a year or two of monitoring without adding fertilizer to see if there are residual effects of the fertilizer or if the rivers immediately return to pre-treated conditions. With this project being the fifth year, the program will go through a critical evaluation before potentially redefining, reshaping or redirecting the future of stream enrichment as a valuable fisheries restoration tool.

3.6. What are the top three lessons learned from this project that could be useful to communicate to others doing similar work in the Basin?

1. Timing: Getting the fertilizer into the rivers immediately following the peak of the runoff maximizes the gains in periphyton and fish growth.

2. Size of the Crystal Green® fertilizer prills: The larger the fertilizer prills, the more consistent and complete the fertilizer dissolves. In initial experimenting with a much smaller prill, the burlap bags filled with fertilizer did not always dissolve evenly or completely, requiring increase man-time to physically enter the water to manipulate the bags and breaks up the left over chunks of fertilizer. In 2008 and 2009, the prill size used was 150 SGN, in 2010 it was 240 and this year it was 350 SGN. After about 6 weeks the fertilizer in the bags was nearly all dissolved; this was consistently observed in all systems.

3. Vandalism: Sample sites where periphyton plates (used to collect algae samples) are placed, should be located in areas that are not frequented by river users. Over the years it was evident where people would tend to congregate and periphyton plates would routinely be removed from the water (potential with good intentions) or found smashed to pieces. While the value of these plates is not very much, it is the lost information that you cannot put a value on. Place more than one periphyton plate at a site in the event that one goes missing, there is a backup.

3.7 REQUIRED: Attach all DOCUMENTATION of Final Deliverables, and LIST attachments in Section 8. These may include technical reports, maps, photos, evidence of communications, lists of meeting participants, etc.

4. Outreach and Communications

Please describe how you have communicated project activities and results within local and basin-wide communities, across organizations and/or to decision makers.

Please list and attach copies of (or links to) any communications materials from these efforts that you have not previously submitted.

Results from this project have not been communicated yet but we will pursue avenues such as sending the report to fisheries managers, uploading the report on BCCF's website and presenting the project at stewardship and club meetings.

Volunteers were contacted either directly based on their involvement in past projects or by providing a project information package and request to the directors of on organization for distribution to their members. An information package and request for volunteer assistance was included on two fishing forum websites and a hunting website and several individuals read the postings and participated in some aspect of the project.