

**Project Title: Restoring Salmon Habitat in the Chilliwack/Vedder River Corridor:  
Peach, Street & Salwein Creeks**

**March 30, 2019**



**Canada**

Prepared for:  
Recreational Fisheries Conservation Partnership Program (16-HPAC-01266)  
Pacific Salmon Foundation (17F-026)

Prepared by:  
Natashia Cox and Rachel Drennan Fraser Valley Watersheds Coalition

## Executive Summary

The overall purpose of this project was to build on previous year's restoration, enhancement and monitoring efforts in the Vedder River floodplain to better understand and enhance existing habitats, support biodiversity values and plan for further multi-species approach for restoration and enhancement opportunities in the future.

This multi-year, watershed level restoration project is a collaborative effort to enhance, restore and promote shared conservation values in the Chilliwack-Vedder River Watershed. Specifically, this project has enhanced and restored salmon spawning, off-channel rearing and over-wintering habitat in the Chilliwack and Vedder River watershed located in the Fraser Valley, BC.

This watershed has high recreational fisheries value and is known for its year round world class fishing opportunities. However, lack of gravel recruitment in the upper reaches of the Chilliwack River limits spawning by chinook salmon, steelhead and other salmonid species in downstream areas. Development-related alterations of salmonid habitat, encroachment of non-native plant species into riparian areas and loss of floodplain functions following dyking have also occurred.

The results achieved from this years 2018 project workplan (April 1, 2018 to March 31, 2019) include:

- 960 linear meters (1,680m<sup>2</sup>) new instream habitat was constructed with 40 discrete pieces of large wood to enhance the complexity of the channel.
- 3,684 m<sup>2</sup> of riparian plantings with 10,870 individual plant species.
- Selective clearing and channel alignment to control against invasive plant species.
- Water quality and fish monitoring results that indicated that this new channel supports salmonids and provides high-value habitat.
- Student and volunteer engagement and hands-on project support.

Thanks to the momentum of on-the-ground restoration activities, the strength in partnerships and sponsorships, and overall importance of this project, further restoration efforts and long-term management plans are being developed to continue building upon the success and ensure long-term ecological integrity is maintained.

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## Introduction

Important spawning and rearing habitat for all species of salmon exists within the Chilliwack River Watershed. The purpose of this project was to increase viable off-channel habitats to support rearing, overwintering and spawning salmon, wildlife and overall biodiversity. 2018 restoration efforts targeted the Peach-Salwein extension channel. This project is part of a watershed-level restoration plan- meant to support viable salmon and fish habitats and populations through community engagement and collaboration.

Peach Creek- Salwein Extension Channel is an off-channel habitat designed to support increased salmon spawning within the lower Vedder River. An area that has been influenced by development, upstream natural geological instability, controlled flows through dykes and changes to the natural floodplain, resulting in the loss of historic off-channel systems.

## Rationale

Pursuing this project was timely as many community and partner organizations are also ready to support this project, building on the momentum and success that has been built over the last few years.

## Goals and Objectives

The vision for the Lower Vedder River floodplain is a resilient mosaic of forests, trails and river-systems that support wild Pacific salmon and create a place for the community to recreate and connect with nature.

The objectives of this project were to restore and enhance salmon habitat and collect data about species usage and aquatic conditions, with the specific goals listed below.

1. Construct new off-channel and spawning habitats along Peach –Salwein creek
2. Replant the new channels with native plant species.
3. Manage invasive plant species to support improved riparian resilience
4. Monitor for water quality and fish usage.
5. Engage the community about the importance of salmon habitats.

## Project Scope

This phase of the project is located within the Vedder River floodplain on the north side of the River between the Great Blue Heron Nature Reserve and just upstream of Hooge Rd Parking lot, in Chilliwack BC, Map 1.



Map 1. Overview of project scope and location, indicated by dashed red line. In relation to the Great Blue Heron Nature Reserve and Hooge Rd. Parking lot, Chilliwack BC.

## Methods & Results

**Objective 1.** Restore and construct/ create new off-channel habitat at Peach Creek-Salwein Creek.

During the second year of the project, instream works concentrated on constructing new channels from Peach Creek downstream through McFaden pond and out to the Vedder River. The construction of phase 1 (completed in 2017 fisheries works window) was required in order to get the hydraulic flow sufficient to provide sustaining flows to the 1 km downstream portion of the project.

Prior to any construction works, the City of Chilliwack Operations department treated invasive Japanese knotweed (*Fallopia japonica*) within the channel alignment. This is important so that any known invasion was pre-treated away from water and thus, reduce any potential impact to the new system after construction works. To ensure public safety along the trails and dikes, safety flaggers were contracted to direct machinery and public during construction.

Lead by DFO Resource Restoration Unit, construction began in September 2018 to November 2018. Excavators and rock trucks were used to excavate 960 linear meters (1,680 m<sup>2</sup>) of new channel, place bank boulders, install 40 pieces of large wood throughout the channel and install the flanged control slotted intake. This upstream intake connects the increased flows from Peach Creek to the new channel. A total of 5 culverts were installed throughout the approximately 1 km project scope to allow movement of water through the new channel. The steel pipe that connected McFaden pond to the lower downstream end of the channel required on-site welding to seal and connect two pipe lengths.

As part of the design, channel works through Hooge Rd. parking lot had to maintain minimum distances away from the existing dike infrastructure, and consider the drainage requirements of the parking lot (so as to avoid lot run-off into the channel). The outlet channel required the movement of two memorial park benches. To move these (and return them after the outlet culvert was installed) required support from the City of Chilliwack.

After the channels were constructed, straw was blown on the exposed soils for erosion control measures. Figure 1, 2, Appendix A. As Built.



*Figure 1. Photo-documentation of the instream restoration works. A. Alignment roughed out and surveyed. B. Construction of channel alignment, with boulders along bank to protect fine substrate from sloughing. C. Construction along alignment near Hooge Rd parking lot. D. Contracted flagger-mobilizing machine down dike infrastructure, ensuring public safety. E. Installation of PVC pipe to support conveyance of water at Hooge Rd parking lot. F. City staff worker opens the control valve at upper end of Peach- connection channel Nov. 2018.*



*Figure 2. Photo-documentation of instream restoration. A. Installation of the steel connector pipe required to connect McFaden pond to the new Vedder River outlet channel. B. Outlet channel and PVC pipe. C. Straw spread along the project area after construction for erosion and sediment control measures.*

## Objective 2 Replant sections of the newly constructed channels

Riparian areas are important transition areas that connect the water with the land, and support a wide variety of plants and animals. Trees and shrubs that overhang streams can moderate the temperature through shading, benefiting fish and aquatic invertebrates, as well as preventing excess algae growth (Bannerman 1998). The roots of plants growing along stream banks provide structure, collect sediment and hold soil together.

The plants selected for this site are native species that tolerate seasonal drying during the summer months, herbivory from beaver and small mammals, and can survive a sandy, rocky substrate. Plants were placed according to their needs on high, medium or low bench areas. Planting densities were selected in order to allow for some inevitable plant death and prevent undesirable invasive species from colonizing the area.

Planting was completed in the fall of 2018 and winter of 2019, by the FVWC field team and community volunteers. A total of 10,870 individual native plant species were hand-dug into 3,648m<sup>2</sup> area to support the newly constructed channel, Table 1, Figure 3. Seeds from native herbaceous plant (species such as small camas (*Camassia quamash*), Nodding onion (*Allium cernuum*), Yarrow (*Achillea millefolium*), and Canadian goldenrod (*Solidago Canadensis*)) were spread along the banks of the channel in areas where the ground was compacted by machine and potted stock could not be installed. The seeds (approximately 100 grams) were mixed with a fine, wet sand and spread by hand over the area.

Mycorrhizae was added to the plantings to help reduce drought stress and jumpstart plant growth. The efficacy of commercial inoculants has advanced tremendously in recent years. The effects of mycorrhizal colonization are often noticeable in early growth, the plants may be taller, have more foliage and larger root systems (Quoreshi 2008). If water is scarce in the years right after planting mycorrhizae will help reduce drought stress on the native plants.

Resilience is being encouraged by ensuring a diverse species plant list. Due to climate change, we need to plan for species that are tolerant to drought conditions to encourage habitat complexity and health. By stacking plant functions, for example planting multiple colonizer species in case insects damage one species, or site conditions prevent growth of one species, we are creating greater resiliency at the site level. The species selected facilitate leaf litter drop and are important for wildlife use.

The riparian vegetation will have lasting benefits. Full results will take an estimated five to ten years for stock to mature before changes are observed. The benefits include providing shade to the channel, regulating water and soil temperature on a microhabitat level, and increasing bank stability, particularly where deep-rooted species were planted. By increasing riparian vegetation on site organic and detritus material will be added into the system which creates suitable habitat for riparian and aquatic invertebrates and makes the area less susceptible to invasive plant re-establishment. Insects falling from riparian vegetation into streams represent an important food source for drift-feeding fishes in headwater streams (Allan et al. 2003).



Figure 3 Replanting Area resulting in 3,648m<sup>2</sup>. Turquoise polygons show where potted stock and live stakes are mixed together. Green lines show dense cluster plantings of willow stakes to help shade the waterway and provide leaf litter.

Table 1. List of planted species

Latin Name	Common Name	Size	Quantity
<i>Pseudotsuga menziesii</i>	Douglas fir	5gal	30
<i>Thuja plicata</i>	Western red cedar	5gal	20
<i>Pinus contorta contorta</i>	Shore pine	5gal	20
<i>Acer Macrophyllum</i>	Big leaf maple	5gal	30
<i>Prunus virginiana</i>	Choke cherry	5gal	30
<i>Rhamnus purshiana</i>	Cascara	5gal	40
<i>Quercus garryana</i>	Garry oak	2gal	20
<i>Populus tremuloides</i>	Trembling aspen	1gal	30
<i>Rubus parviflorus</i>	Thimble berry	1gal	100
<i>Acer Circinatum</i>	Vine maple	2gal	30
<i>Acer glabrum</i>	Douglas maple	5gal	30
<i>Rosa woodsii</i>	Woods rose	1gal	100
<i>Amelanchier alnifolia</i>	Saskatoonberry	1gal	100
<i>Mahonia aquifolium</i>	Tall Oregon grape	1gal	20
<i>Sambucus cerulea</i>	Blue elderberry	1gal	20
<i>Ribes sanguineum</i>	Red flowering currant	2gal	150
<i>Philadelphus lewisii</i>	Mock orange	1gal	100
<i>Holodiscus discolor</i>	Ocean spray	1gal	100
<i>Salix sp.</i>	Willow	whip	6,800
<i>Populus trichocarpa</i>	Cottonwood	whip	3,000
<i>Alnus rubra</i>	Alder	whip	100
<b>Total plants</b>			<b>10,870</b>

**Objective 3:** Manage invasive plant species to support improved riparian resilience

With the support from the City of Chilliwack, foliar spray and stem-injection treatment for selective clearing along the channel alignment was completed prior to construction and post construction, post-planting efforts. Appendix B.

**Objective 4:** Monitor for water quality and fish usage.

As a measure to begin monitoring the project (Year 1 and 2) water quality and fish surveying stations were established and sampled. Water quality conditions supported all aquatic life stages and salmon species and trout species were observed using the newly constructed habitat, Appendix C.

### Objective 5: Engage the Community

An important measure of success was engaging the community on the importance of salmon habitat and waterways and providing meaningful opportunity for hands-on volunteerism. During the summer, local middle-school teachers were supported in establishing student-lead monitoring stations (locations where students will take photo-points, monitor the water quality and macroinvertebrates). During the fall, 70 student volunteers participated in tree and shrub planting, followed by an interactive educational tour of the project: learning about the role of native vegetation, identifying salmon spawning grounds and a close-up look at a chum salmon, Figure 4.



*Figure 4. FVWC technician leading a school group and sharing about the importance of salmon habitat on the Vedder River.*

## Next Steps and Recommendations

- Continue restoration and enhancement efforts within the north and south bank of the river, finding opportunities to reconstruct channels and wetlands to improve salmon habitat and enhance biodiversity and functional floodplain values; to also support climate change impacts to water resources (Verschelling, Perk, & Middelkoop, 2018).
- Continue to monitor and manage against invasive species (specifically Japanese knotweed)
- Continue to monitor fish usage and aquatic water quality conditions.
- Consider opportunities to support greater soil building accumulation methods to support the riparian and aquatic bench plantings.

## List of Appendices

- A. As Built Diagram
- B. Selective Clearing Treatment Report
- C. Water Quality and Fish Monitoring Report

## Acknowledgements

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- Recreational Fisheries Conservation Partnership Program
- Pacific Salmon Foundation
- Wally Hall Jr. Memorial Steelhead Fishing Derby donations
- TD Friends of the Environment

Thank you to our partners and team

- City of Chilliwack
- DFO Resource Restoration Unit
- Fraser Valley Regional District
- University of the Fraser Valley

Special thanks to: Dave Nanson, Al Jonsson, Jonathan Bulcock, Michael Crowe, Michelle Bouchard, Tara Friesen, David Blair, Darrell Lindhout, Alisdair Chapple, Elizabeth Rankin, Frank Van Nynatten Alan Penner (Mount Slesse School), Wally Hall Sr., Paul Dulong, Dave Barnes, Masheed Salehomoum, Mandip Kharod .

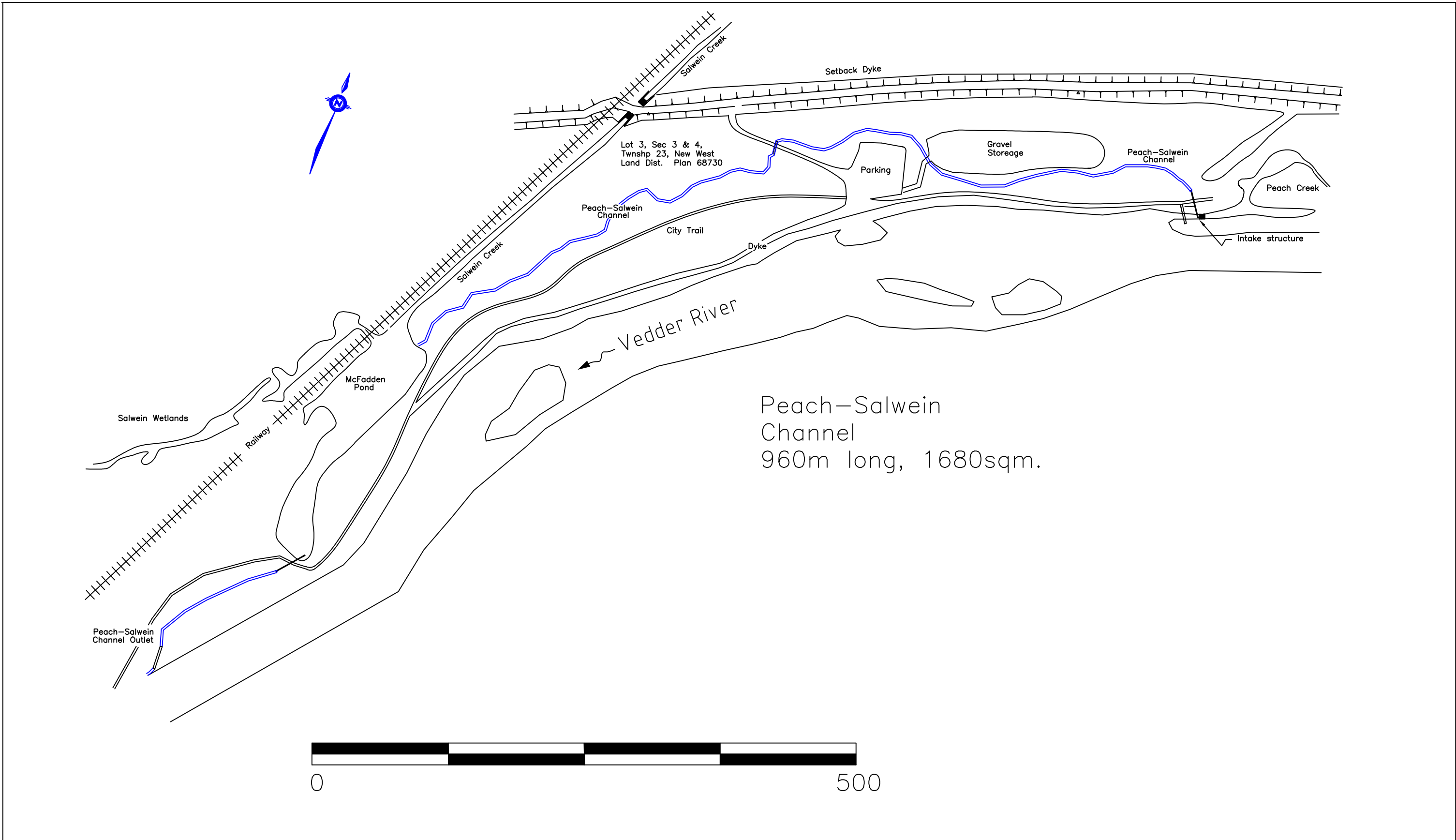


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DWG. NO.	REFERENCE	DRAWINGS
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NOTES
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**FISHERIES CANADA  
HABITAT ENHANCEMENT BRANCH  
RESOURCE RESTORATION UNIT**

NO.	DATE	REVISIONS
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DESIGNED	LFARRU
DRAWN	JB
CHECKED	
RECOMMENDED	
APPROVED	
APPROVED	

Fraser Valley  
Watersheds Coalition  
Peach-Salwein Channel  
As Built

SCALE	As Shown
DATE	17.04.19
DRAWING NUMBER	
REVISION	



CITY OF  
**CHILLIWACK**

Natashia Cox  
Project Manager  
#1-45950 Cheam Avenue  
Chilliwack BC V2P 1N6

December 7, 2018

File No: 5280-01  
Engineering

Dear Mrs. Cox:

**Re: Japanese Knotweed Management along the Peach Creek Extension Project**

The Fraser Valley Watersheds Coalition (FVWC) has retained the services of the City of Chilliwack to proactively manage Japanese Knotweed (JK) in line with the 2018 Peach Creek channel extension project and adjacent riparian areas. Management of the invasive plants before work commences is paramount in order to prevent their spread to new locations through the movement of soil and equipment.

Further to the flagging and initial treatment in 2017, the JK sites were gps'ed and uploaded to the City's GIS program in 2018 (see enclosed map). The locations were also treated by foliar application and stem injection by the City's contractor in 2018. Further, City staff also met with FVWC and DFO staff to review the locations, setbacks, and protocols regarding JK before channel excavation commenced. This onsite assessment resulted in the mutually beneficial realignment of a small portion of the channel to avoid contact with a JK patch.

The City gratefully acknowledges the partnership and funding provided by the FVWC which will allow for scheduled repeat treatments in spring and fall until eradication is reached.

Please reach me directly if you would like to discuss the project further.

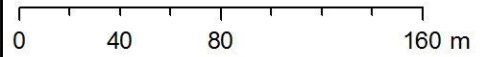
Sincerely,

Steve Clegg, Dip. T

Environmental Services Specialist



Scale: 1:3,000



Data accuracy not guaranteed

March 26, 2019

## Peach Creek Fish and Water Quality Monitoring Memo



Fisheries and Oceans Canada / Pêches et Océans Canada

Prepared for: DFO's Recreational Fisheries Conservation Partnership Program  
Pacific Salmon Foundation

Field monitoring completed by Winter Moon, Michael Gaultier, Bridgette Knowlan  
Report Prepared by Natasha Cox & Rachel Drennan, Fraser Valley Watersheds Coalition

## 1. Introduction and Monitoring Parameters

Monitoring was completed by FVWC Field Operations Manager and Field Crew to assess water quality conditions and juvenile fish usage to help inform designs and communications, future restoration and enhancement and actions needed. The variables included in the monitoring plan were:

- **Dissolved Oxygen** – dissolved oxygen (DO)-(mg/L and %) is measured using a YSI hand meter. *Rationale:* DO is a key habitat parameter for fish and amphibian species, and indicates aquatic system health. Dissolved oxygen levels will in part determine whether fish trapping will occur based on the British Columbia Ministry of Environment.
- **Temperature** – Water temperature (degrees Celsius) is recorded at each sampling site during water quality measurements. *Rationale:* Water temperature is a critical factor for many aquatic animal species during varying life stages. It can influence fish survival and amphibian breeding cycles. Mature vegetation moderates water temperature, and we expect that temperature fluctuations would be mitigated once vegetation matures. Temperature levels will in part determine whether fish trapping will occur.
- **Turbidity** – Turbidity is measured using with a Triton turbidity wedge at each sampling point. In cases where turbidity is lower than the range of the instrument turbidity will be recorded as ‘none visible’ or ‘some visible’. *Rationale:* The suspended /dissolved substances in a water column can impact the ability of aquatic species and salmon to survive and reproduce at certain thresholds and can have varying effects including suspended fallout covering spawning grounds/redds, reduce predation/increase predation among others. It can also impact the macrophytic habitat. It will be measured in NTU’s and will help to determine background trends.
- **Specific Conductivity** - is a measure of how effectively water conducts electricity, which varies with its ion concentration. It rises with salinity, water hardness, nutrient loading and other forms of pollution. It is valuable as an indicator of productivity and of pollution; however, the cause of high readings cannot be determined without additional testing. Specific conductivity is able detect high levels of a very wide range of substances.
- **pH** – is a measure of the concentration of hydrogen ions in water. It is a negative log scale, with a neutral value of 7. Each unit decrease in pH (e.g. from 7 to 6) indicates a tenfold increase in hydrogen ion concentration. *Rationale:* pH is an important water chemistry parameter. Changes in pH can indicate contaminated water, or changes to the waterway. Levels outside the range of 6.5-9 are unsuitable for most aquatic life. Levels close to neutral are most productive.
- **Fish Use** - Fish are trapped using standard G-traps (2 per site) in accordance to DFO and MOE permits and standards. Baited traps will were set for approximately 22 hours at ten standard locations. Fish were identified to species and counted. These results will provide an indication of overall habitat diversity and use.

## 2. Monitoring Results

### 2.1 Peach Creek

A total of nine monitoring locations were established along Peach Creek. Monitoring locations were identified along a newly restored channel of Peach Creek, and monitoring began in the winter of 2019. Map 1, Table 1. The average water quality conditions at each monitoring station are shown in Table 2. Of note, the water quality conditions met the minimum requirements set out by the BC Ministry of Water, Land and Air Protection for temperature and Dissolved oxygen. The fish surveying results are shown in Table 3.

Map 1. Monitoring Locations Peach creek

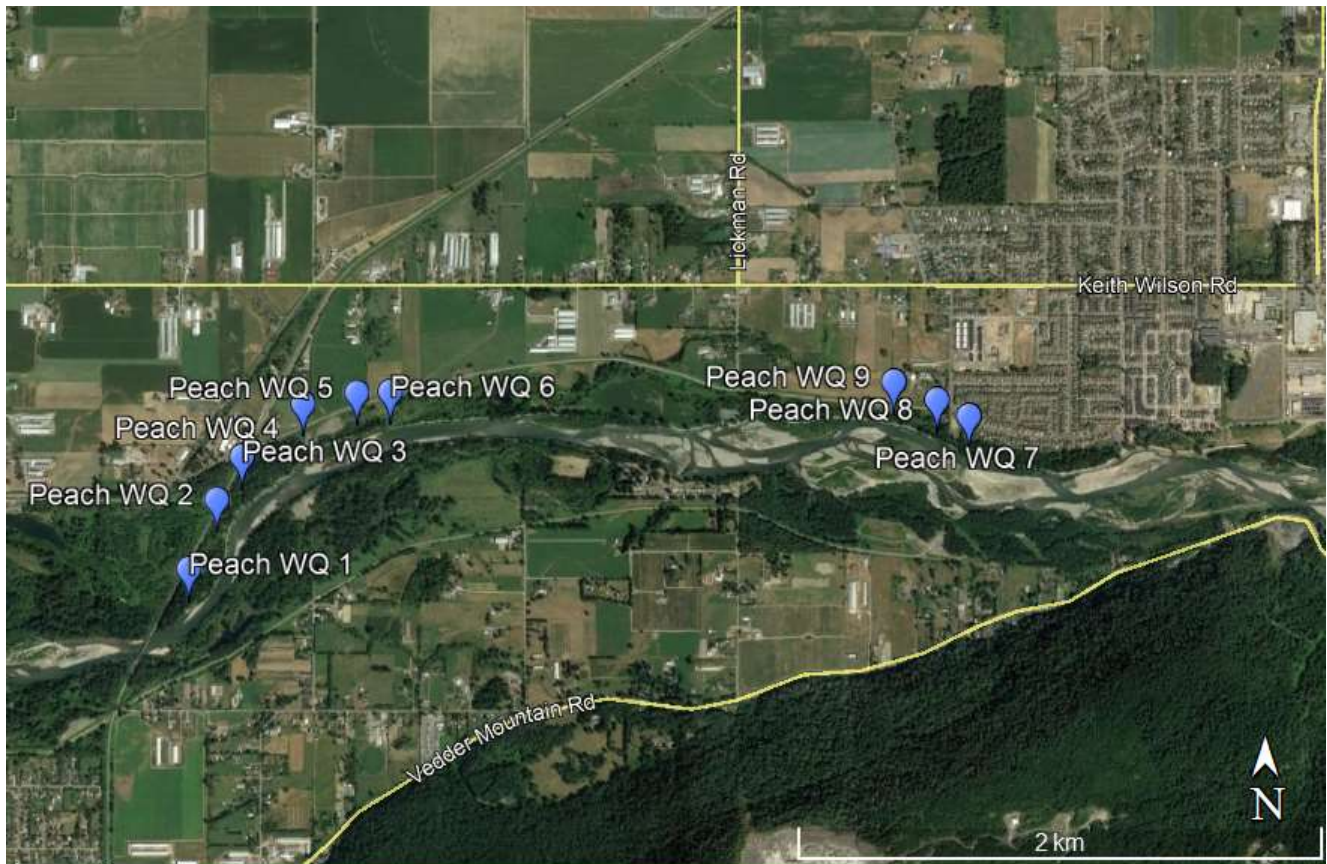


Table 1. Monitoring Locations Peach Creek

Site	Station	Type	GPS UTMS Easting	Northing
Peach Creek	1	Water Quality & Fish	10 U 570414.78 m E	5438246.39 m N
	2	Water Quality & Fish	10 U 570518.68 m E	5438511.30 m N
	3	Water Quality & Fish	10 U 570612.05 m E	5438676.51 m N
	4	Water Quality & Fish	10 U 570841.69 m E	5438879.39 m N
	5	Water Quality & Fish	10 U 571045.78 m E	5438923.43 m N
	6	Water Quality & Fish	10 U 571172.83 m E	5438929.50 m N
	7	Water Quality & Fish	10 U 573375.62 m E	5438865.59 m N
	8	Water Quality & Fish	10 U 573253.56 m E	5438925.33 m N
	9	Water Quality & Fish	10 U 573088.60 m E	5438992.50 m N

Table 2. Water Quality Conditions at each Peach Creek Monitoring Station and Across Project Site Feb 19 2019

Site-Station	Temp (°C)	DO (%)	DO (mg/L)	Turb	pH	Depth (m)	cond (µS/cm)	sal (ppm)
Peach 1	3.2	108.9	14.55	21	8.61	0.25	101	49
Peach 2	2.8	107.8	14.57	21	8.17	0.55	104	52
Peach 3	3.1	108	14.46	21	7.91	0.31	95	52
Peach 4	3.5	108	14.34	21	7.66	0.36	98	49
Peach 5	3.4	106	14.12	21	7.59	0.54	96	48
Peach 6	3.3	107	14.18	21	7.46	0.66	74	47
Peach 7	2.7	101.75	13.75	21	7.48	0.38	108	54
Peach 8	3.2	103.5	13.85	21	7.48	0.34	103	52
Peach 9	4.8	102.3	13.14	21	7.33	0.52	95	46

<sup>A</sup> Red highlighted indicates DO levels below 5.0mg/L

<sup>B</sup> Orange highlighted indicates Temperature levels above 15° Celsius

<sup>1</sup> British Columbia. Ministry of Water, Land and Air Protection. *Water Quality Guidelines for Dissolved Oxygen Overview Report* Environmental Protection Division.

Table 3. Fish species Peach Creek Feb 20 2019

Station	Total Fish Caught	CO	RB	CAS	TSB
Peach 1	4	1	3	0	0
Peach 2	10	5	0	0	5
Peach 3	0	0	0	0	0
Peach 4	1	1	0	0	0
Peach 5	1	1	0	0	0
Peach 6	31	30	0	1	0
Peach 7	4	4	0	0	0
Peach 8	11	11	0	0	0
Peach 9	8	4	0	0	4
<b>Totals</b>	<b>70</b>	<b>57</b>	<b>3</b>	<b>1</b>	<b>9</b>

\*CO =Coho salmon, **RB**= Rainbow trout, **CAS**= Prickly sculpin, **TSB**= Three spine stickleback.

\*One Northwestern salamander was also caught.

### Fish Monitoring Peach Creek

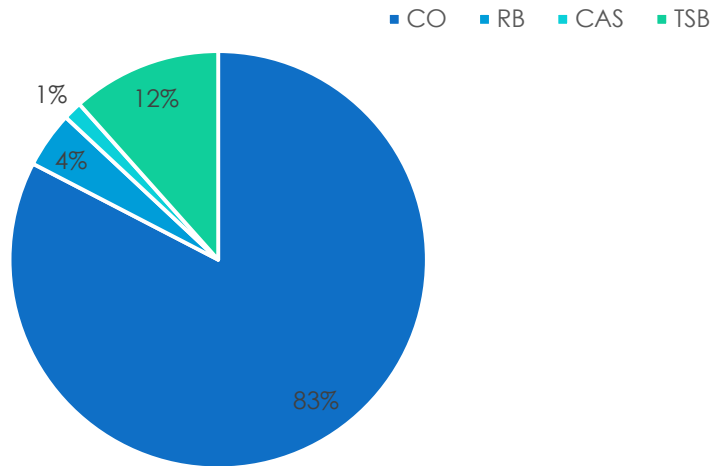


Figure 1. Fish Monitoring by Species - Caught at Peach Creek Feb 20 2019. 83% of fish caught were Coho salmon. 4% of fish caught were Rainbow trout.

### 3. References

British Columbia. Ministry of Water, Land and Air Protection. *Water Quality Guidelines for Dissolved Oxygen Overview Report* Environmental Protection Division. Web. March 7, 2017.  
<http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/dissolvedoxygen-or.pdf>

British Columbia. Ministry of Water, Land and Air Protection. *Water Quality Guidelines for Temperature Overview Report* Environmental Protection Division. Web. March 7, 2017.  
<http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/temperature-or.pdf>

### 4. List of Attachments

- Attachment A: Raw WQ and Fish Monitoring Data