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March 26, 2020
File No. 104486-01

Fraser Valley Watershed Coalition
#1-45950 Cheam Avenue
Chilliwack, BC V2P 1N6

Attention: Natasha Cox, Program Director

Re: William Phillips slough Restoration – Post Construction Report

1.0 INTRODUCTION

Under funding granted by Fisheries and Oceans Canada (DFO) through the Coastal Restoration Fund, Hemmera Envirochem Inc. (Hemmera), a wholly owned subsidiary of Ausenco Engineering Canada Inc. and the Sts'ailes First Nation (Sts'ailes) conducted fish habitat enhancement and restoration of William Phillips Slough and Nancy Phillips Slough (the "Project"). The project was completed as part of the Heart of the Fraser Collaborative Partnership led by the Fraser Valley Watershed Coalition to improve access to existing off-channel rearing and overwintering habitats.

The Ministry of Forests, Lands, and Natural Resource Operations and Rural Development issued a *Water Sustainability Act* - Subsection 11(1) and 11(2) Approval (2007223) for the Project on September 13, 2019. Construction of the Project commenced on October 11, 2019 and was substantially completed on November 8, 2019.

The enhancement and restoration activities completed for the Project are described in the Construction Plan / Environmental Management Plan (Hemmera 2019) and consist of the following:

- Excavation of new channel habitat upstream of existing channels;
- Excavation within the existing slough channels to lower the slough channel invert;
- Removal of existing access obstacles to fish movement (e.g., beaver dam, reed canary grass (*Phalaris arundinacea*));
- Excavation of pool habitats and embayments; and
- Instillation of rock weirs and large woody (LWD) debris structures.

These project elements were largely field-fitted to the local topography by the contractor with assistance and guidance from a Hemmera Environmental Monitor (EM) and a Hemmera Registered Professional Biologist (R.P.Bio.). This post-construction report was prepared by Hemmera and provides a summary of the work completed as part of the project, including photo documentation and as-built drawings.

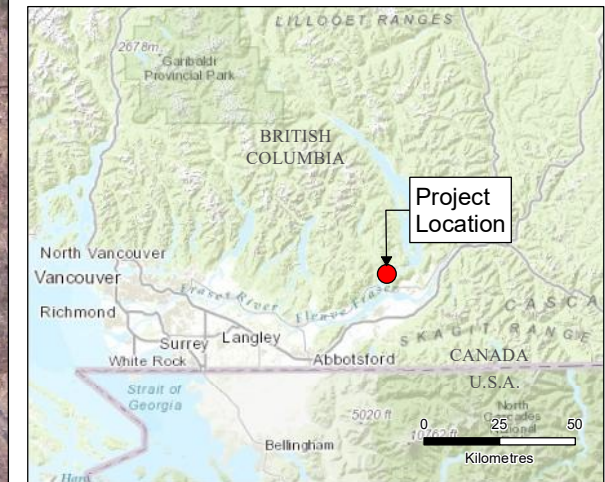
2.0 PROJECT DESCRIPTION

2.1 Pre-Construction Conditions

William Phillips and Nancy Phillips sloughs are part of an assortment of sloughs (“Harrison River sloughs”) located within the Harrison River floodplain and Chehalis River alluvial fan on the Chehalis Reserve #5 (**Figure 1**). The Harrison River sloughs represent key spawning areas for chum salmon (*Oncorhynchus keta*) and historically provided important coho salmon (*O. kisutch*) spawning, rearing and over-wintering habitat. Many of these sloughs currently have reduced capacity as a result of ingress of reed canary grass, presence of beaver dams, infill of the slough entrances and channels with sand and silt material, and overall lack of habitat complexity (J.O. Thomas and Associates and Chehalis Indian Band 1999, Welton and Pope 2014).

Past experience with slough restoration work and Traditional Ecological Knowledge (Kim Charlie, Burt Charlie personal communication) indicate groundwater and suitable spawning substrate are typically present approximately 2 m under the original ground elevation within the Harrison River floodplain, which provided confidence the proposed Project could be successfully constructed with minimal risk of dewatering and no requirement to import spawning gravels. These conditions provide extensive opportunities for creation, restoration and enhancement of high value habitat for chum and coho salmon.

**Location and Pre-construction Condition of
Nancy and William Phillips Slough**



Legend

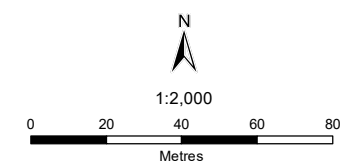
 Project Location

Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

- Contains information licensed under the Open Government Licence - Province of British Columbia
- Orthoimagery at 15 cm resolution.
- Inset Basemap: ESRI World Topographic Map



NAD 1983 UTM Zone 10N

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Figure 1

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 **Hemmera**
An Ausenco Company

Sts'ailes Fisheries

2.1.1 William Phillips Slough

Prior to restoration, William Phillips Slough consisted of a wetland that functioned as over-wintering/rearing habitat for juvenile salmonids (**Figure 1**). The wetland substrate was composed of soft organics with milfoil, reed canary grass, and slough grasses observed throughout the wetted area. The wetland was located upstream of a large beaver dam located approximately 50 m upstream from the Harrison River confluence. Fish access into the wetland habitat depended on beaver activity. At the time of pre-construction assessments there was an outflow channel past the dam that remained open and appear accessible by juvenile fish. Juvenile salmonids were observed in the wetland habitat on several occasions. An existing pond habitat, remnant of past gravel removal activities, was located approximately 80 m upstream of the original slough alignment. The pond was isolated and not connected to fish habitat.

2.1.2 Nancy Phillips Slough

Nancy Phillips Slough is located immediately adjacent to William Phillips Slough (**Figure 1**). Nancy Phillips Slough consisted of a wetted channel (with no flow) that was approximately 50 m long and largely infilled with grasses. The channel upstream had naturally infilled over time and become terrestrial habitat.

2.2 Construction Components

Construction of the project commenced on October 11, 2019 and was completed on November 8, 2019. A description of each project component is described in the following sections. As-built drawings (**Figure 2**) are attached. As previously noted, the project was field-fit, so exact excavation volumes are not available.

The project contractor was Maharg Contracting Ltd (Maharg), in partnership with Sts'ailes Development Corporation. Maharg utilized a Komat'su PC300-LL series excavator to undertake the bulk excavation activities and a Hitachi Zaxis 200 LC-E3 excavator for more delicate excavation work. Komat'su HM300 series rock trucks were used to move materials (e.g., root wads and riprap) to site and redistribute excavated material when required.

An EM from Hemmera was onsite daily to ensure environmental compliance and a R.P.Bio. conducted weekly site visits to assist in field-fit construction design. A Sts'ailes First Nation member, in the capacity of Archaeological Monitor¹, also conducted site-visits. A fish salvage crew completed site isolation and fish salvage activities in advance of instream work. Further discussion related to mitigation measures utilized to avoid or minimize adverse impacts on fish and fish habitat is provided in **Section 2.3**.

The habitats created and restored in both William Philips and Nancy Philips sloughs are discussed in **Sections 2.2.1** and **2.2.2** below.

2.2.1 William Phillips Slough

The two main construction components of William Phillips Slough were:

- 1) Excavation of a new channel to connect a pre-existing pond habitat to the wetland habitat (thereby providing fish access into the pond)
- 2) Removal of fine/organic sediment and vegetation that had infilled the wetland habitat. During excavation of the wetland, a low flow channel was created parallel to the right (south) bank to ensure connectivity at low water conditions. Additionally, LWD structures were installed throughout the new and existing habitats in embayments along the right bank to provide habitat complexity. Three rock weirs were constructed at strategic locations to increase the water level upstream of each weir and to concentrate flow. The downstream weir was installed across the existing beaver dam (**Figure 2**). A break down of construction activities is provided in **Table 1**.

Table 1 Construction Activities Completed in William Phillips Slough

| Project Activity | Approximate Dimensions | Activity Period |
|--|--|---|
| New channel excavation to connect existing pond habitat to wetland | Surface Area: 560 m ² Length: 80 m Average Width: 7 m Average Depth: 1.5 m | Excavated: 11/10/19 Opened to main: 22/10/19 |
| Remove organic substrate from wetland habitat and provide low flow channel | Surface Area: 1,600 m ² Length: 115 m Width: between 5 – 15 m Average Depth: 1 m *Low flow channel width: 1 m *Low flow channel depth: 1.5 m | 17/10/19 to 21/10/19 |
| Placement of LWD structures | Approximately 15 structures placed at approximately 20 m intervals | 23/10/19 to 24/10/19 |
| Construction of rock weirs | 3 weirs constructed at natural pinch points: <ul style="list-style-type: none"> • Outlet of pond habitat • Connection of new channel wetland • Across existing beaver dam at the downstream end of the site | 25/10/19 to 29/10/19 |

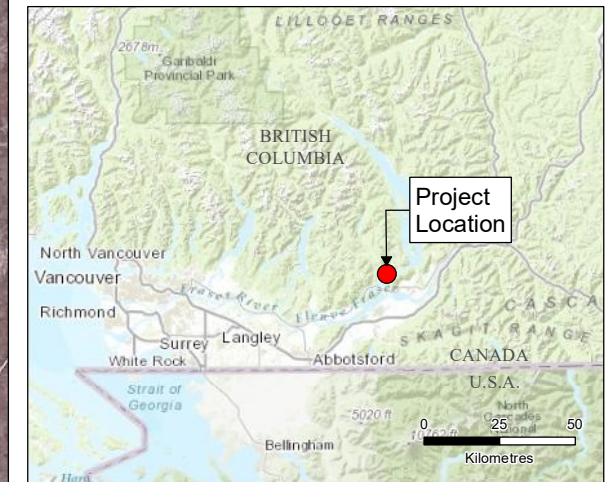
2.2.2 Nancy Philips Slough

Construction of Nancy Philips Slough consisted of excavating a new channel along the alignment of the historic slough channel which had infilled over time and had become terrestrial habitat. Two pool habitats were excavated within the channel: one at the upstream terminal end, and a second midway down the channel. Approximately 20 LWD structures were installed approximately every 20 m in embayments in the channel banks. Finally, three weirs were constructed at strategic locations to concentrate flow and to increase the water level upstream (reducing excavation volumes) (**Figure 2**). A break down of construction activities is provided in **Table 2**.

Table 2 Construction Activities Completed in Nancy Phillips Slough

| Project Activity | Approximate Dimensions | Activity Period |
|--|---|----------------------|
| New channel excavation (upper and lower reach) | Surface Area: 1,375 m ² Length: Up - 170 m, Low – 130 m Average Width: Up – 3.5 m, Low – 6 m Average Depth: 1.5 m | 29/10/19 to 08/11/19 |
| Excavation of mid-way pool | Surface Area: 100 m ² Length: 10 m Width 10 m Depth: 3 m | 05/11/19 |
| Excavation of terminal pool | Surface Area: 140 m ² Length: 20 m Width 7 m Depth: 3 m | 01/11/19 |
| Placement of LWD structures | Approximately 20 structures placed at approximately 20 m intervals | 29/10/19 to 08/11/19 |
| Construction of rock weirs | Three weirs: <ul style="list-style-type: none"> • Outlet of terminal pool • Downstream end of mid-way pool • Downstream end of excavated channel | 29/10/19 to 08/11/19 |

**William and Nancy Phillips Slough
As-built Drawing**



Legend

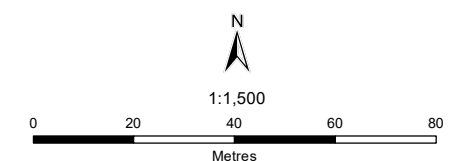
- Rock Weir
- Large Woody Debris
- Access Road
- Existing (Approximate Area: 1,946 m²)
- Enhance (Approximate Area: 726 m²)
- New (Approximate Total Area: 1,916 m²)
 - Nancy Phillips Slough Approximate Area: 1,486 m²
 - William Phillips Slough Approximate Area: 430 m²
- Riparian Planting (Approximate Area: 3,483 m²)
- New Riparian Area (Approximate Area: 7,615 m²)

Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

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- Inset Basemap: ESRI World Topographic Map



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2.3 Mitigation Measures and Contractor Compliance

William Phillips Slough had no hydraulic connection to the Harrison River at the time of construction due to low water levels. However, the slough was occupied by juvenile salmonids. Furthermore, the sloughs and surrounding areas have been used by the Sts'ailes people for more than 1,000 years and have a high likelihood of containing archaeological artifacts and items of cultural and historical significance. Nancy Phillips Slough was dry, and considered terrestrial habitat at the time of construction.

Given these sensitivities, the mitigation measures in the following sections were utilized during construction.

2.3.1 Environmental and Archaeological Monitoring

A qualified EM was present onsite daily for the duration of construction activities in and around fish habitat (i.e., from October 11, 2019 to November 8, 2019). No work was completed without direct approval from the EM.

To identify areas of high cultural or heritage sensitivity within the project area, archaeological surveys were conducted by the Sts'ailes prior to start of construction. A Sts'ailes Archaeological Monitor conducted site visits during construction to help ensure these areas of high sensitivity were preserved and to search the bedload spoil piles for artifacts.

2.3.2 Work Site Isolation and Fish Salvage

In case water levels increased during the construction period, an isolation net was installed on William Phillips Slough at a natural channel constriction immediately downstream of the beaver dam. The isolation net remained in place for the duration of construction on William Phillips Slough.

A fish salvage was conducted in William Philips Slough wetland habitat prior to the start of construction. Approximately 40 minnow traps were deployed within the main channel and checked over a period of several days. Additionally, during dewatering, the EM used a dip-net to salvage any remaining fish observed. The salvaged fish primarily consisted of juvenile coho salmon (*Oncorhynchus kisutch*), threespine stickleback (*Gasterosteus aculeatus*), and northern pikeminnow (*Ptychocheilus oregonensis*). Additionally, three northwestern salamanders were captured. Fish and amphibians were released downstream of the isolation net at the confluence of William Philips Slough and the Harrison River. Fish salvage results are summarised in **Table 3**.

Table 3 William Philips Slough Fish Salvage Results

| Fish Species Captured | | Total Number Captured |
|------------------------|----------------------------------|-----------------------|
| Common Name | Scientific Name | |
| Coho salmon (juvenile) | <i>Oncorhynchus kisutch</i> | 138 |
| Threespine stickleback | <i>Gasterosteus aculeatus</i> | 115 |
| Northern pikeminnow | <i>Ptychocheilus oregonensis</i> | 37 |
| Peamouth sucker | <i>Mylocheilus caurinus</i> | 22 |
| Prickly sculpin | <i>Cottus asper</i> | 14 |
| Pumpkinseed | <i>Lepomis gibbosus</i> | 2 |

Work site isolation and fish salvage was not required for Nancy Philips Slough as the site was dry at the time of construction.

2.3.3 Material Spoiling

The construction footprint was limited, where possible, to minimize disturbance to vegetation and reduce the exposure of erodible materials. Topsoil material was stripped from all excavation areas first to avoid washing the organic material into the new channel during side-casting activities. Materials were selectively spoiled based on the material type and location.

Along both slough alignments, organic materials removed from the channel were primarily spoiled along the right bank of the channels. In these areas, spoil was selectively side-cast to preserve the root zones of large trees and efforts were made to avoid areas with high riparian integrity. Some spoil material was relocated via rock truck and used to improve the site access roads for the Sts'ailes Fisheries crew. Where possible, woody debris removed from the Nancy Phillips Slough channel alignment was retained for placement into the slough or along the banks following excavation.

Groundwater inflow to the slough channels prevented the instream excavation activities from being conducted in the dry. Where possible, wet organic and fluvial materials excavated from the channel fork were stockpiled ahead of the excavator to dewater before being side-cast along the banks. This technique reduced the volume of runoff water and sediment mobilization into the new channel fork and increased slope stability.

2.3.4 Erosion and Sediment Control

Soil material was temporarily placed in the outflow gap in the existing beaver dam on William Phillips Slough to prevent discharge of sediment-laden water from the site during construction. Additionally, a silt curtain was installed downstream of the beaver dam to prevent potential sediment release into the Harrison River. A 6-inch water pump was employed during excavation to further reduce the water level within the wetland and remove turbid water. Water was discharged into an adjacent vegetated area.

Nancy Philips Slough was terrestrial habitat at the time of construction. Prior to excavation, an earth berm was built across the channel immediately upstream of the existing wetted channel to retain water released during new channel excavation. A silt curtain was also installed downstream of the work area within the existing channel to prevent sediment release to the Harrison River.

2.3.5 Hazardous Materials / Waste

Hazardous materials and waste were properly stored and a spill kit was kept onsite at all times. All Maharg employees had spill response training and knew the locations of spill kit materials. Absorbent pads were kept with the pumps at all times.

Machinery was kept clean and in good working order. All fuelling was completed >30 m away from any waterbody. Excavators had environmentally-friendly hydraulic fluid and the operators worked slowly and carefully in and around vegetation to reduce the possibility of snagging and rupturing a hydraulic line. Excavators working in the water moved slowly to avoid water contacting greased articulation points on their machines.

2.3.6 Contractor Compliance

The Environmental Monitor was onsite daily for the duration of construction and during that time the contractor complied with all of the Environmental Monitor’s requests.

2.3.7 Site Restoration

Side-cast spoil material was shaped to mimic the natural contour of the stream bank. Upon completion of the Project, areas of exposed soil in and around the sloughs were covered with a layer of scattered straw. Planting of native species in areas of disturbed riparian vegetation will be undertaken in 2020 according to the Hemmera Restoration Plan for Nancy and Williams Phillips Slough.

Site access roads were groomed and left in-place as requested by the Sts’ailes Fisheries crew.

3.0 NEW AND ENHANCED FISH HABITAT

3.1 Area of Habitat Enhancement or Created

In total, the Project generated approximately 2,642 m² of instream habitat, comprised of 1,916 m² of new habitat and 726 m² of enhanced habitat. The aquatic habitats were complexed with rock weirs, anchored LWD complexes, and numerous pieces of unanchored LWD and SWD to create scour, refugia and increase habitat complexity. The Project also created 7,616 m² of new riparian habitat by its proximity to new instream fish habitat.

Total areas of new and enhanced fish habitat created by the Project are summarized in **Table 4**, below.

Table 4 Habitat Created by the Project

| Fish Habitat Component | Aquatic Habitat | | New Riparian Habitat | Riparian Area to be planted |
|---|--------------------|----------------------|----------------------|-----------------------------|
| | Enhanced | Created | | |
| William Philips Slough New Channel/Access to Pool Habitat* * existing pool was previously inaccessible so is considered new fish habitat | 726 m ² | 430 m ² | 776 m ² | 1,336 m ² |
| Nancy Philips Slough | - | 1,486 m ² | 6,840 m ² | 2,148 m ² |
| Total | 726 m ² | 1,916 m ² | 7,616 m ² | 3,483 m ² |

3.2 Riparian Planting

Riparian planting was planned to be executed during site construction but was not undertaken due to timing constraints. Candidate locations for riparian planting have been identified on the as-built figures for each slough and are outlined in **Table 4**. These proposed planting areas generally overlap with habitat disturbed by machine operation.

A Riparian Restoration Plan for William and Nancy Phillips sloughs will be provided under separate cover.

3.3 Post Construction Habitat Function

Post-construction monitoring of habitat function was not conducted immediately after construction due to the timing of project completion and the salmon spawning window. The silt curtain was not removed from the outlet of Nancy Philips Slough to avoid disturbing the adult salmon were observed spawning immediately downstream of it and also the eggs in the gravel. The silt curtain will be removed in spring 2020 when disturbance to salmon embryos and alevins is expected to be minimal.

Juvenile salmonids were observed utilizing the new channel in William Phillips Slough shortly after removing isolation barriers at the end of construction. Formal post-construction monitoring will be conducted in the spring of 2020. A few juvenile salmonids were also observed in the lower reach of Nancy Phillips Slough during the as-build survey.

4.0 CLOSURE

We have appreciated the opportunity of working with you on this project and trust that this report is satisfactory to your requirements. Please feel free to contact the undersigned regarding any questions or further information that you may require.

Report prepared by:
Hemmera Envirochem Inc.

Report prepared by:
Hemmera Envirochem Inc.



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Report reviewed by:
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Trevor Welton, R.P.Bio.
Vice President BC/YK

5.0 REFERENCES

Hemmera. 2019. Construction Plan / Environmental Management Plan, William and Nancy Philips Slough Restoration Project. Prepared for Sts'ailes First Nation. Burnaby, BC.

Hemmera. 2020. Nancy Williams and William Phillips Slough Restoration Plan,

J.O. Thomas and Associates, and Chehalis Indian Band. 1999. Harrison Sloughs Habitat and Fisheries Needs Assessment Program.

Welton, T., and R. Pope. 2014. Tretheway Creek Hydropower Project Fish Habitat Offsetting Plan. Prepared by Dillon Consulting Ltd. for Innergex, Richmond, BC.

APPENDIX A

Photo Log

William Phillips Slough



Photo 1 October 11, 2019 – Beginning of excavation of channel at Williams Phillips Slough.



Photo 2 October 15, 2019 – Pumps used for dewatering of the work area at William Phillips Slough.



Photo 3 October 17, 2019 – Swamp mats laid out for machine access on William Phillips Slough.



Photo 4 October 18, 2019 – Dewatering of work area at William Phillips Slough.



Photo 5 October 18, 2019 – Coho fry captured during fish salvage at William Phillips Slough.



Photo 6 October 21, 2019 – Channel excavation at William Phillips Slough.



Photo 7 October 24, 2019 - Marhag equipment installing a rock weir on William Phillips Slough.



Photo 8 October 25, 2019 – Silt curtain at downstream extent of the William Phillips Slough to isolate work area.



Photo 9 October 28, 2019 – LWD installed at William Phillips Slough



Photo 10 November 7, 2019 – West view of the downstream rock weir at William Phillips Slough.

Nancy Phillips Slough



Photo 11 October 28, 2019 - Marhag construction beginning slough excavation at Nancy Phillips Slough.



Photo 12 November 7, 2019 - Marhag construction placing LWD in Nancy Phillips Slough.



Photo 13 November 7, 2019 - North view of construction channel near the north end of Nancy Phillips Slough.



Photo 14 November 7, 2019 - View of earth berm and silt current used to isolate the construction area at Nancy Williams Slough.



Photo 15 November 8, 2019 – View of silt current at confluence of the Nancy Phillips Slough that leads to the Harrison River.