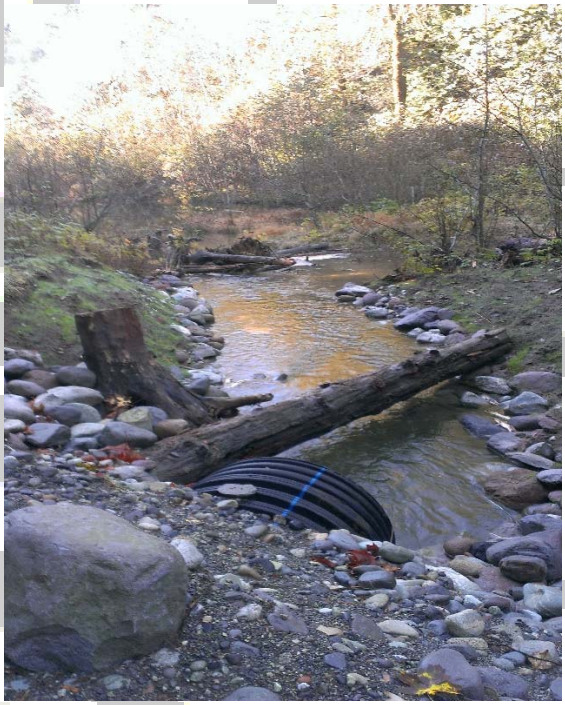
Cheakamus River IR 11 Floodplain Restoration Final Report

Project Number 13.CMS.01



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Executive Summary

The Cheakamus IR11 Floodplain Restoration Project is the culmination of over 30 years of partnership efforts between Fisheries Oceans Canada, North Vancouver Outdoor School, Squamish Nation, and the Squamish River Watershed Society in an attempt to re-establish ground water channels and spawning habitat within the diked off sections along the former Cheakamus River floodplain. This project is intended to expand upon previous habitat restoration projects in the Dave Marshall Salmon Reserve, adjacent to the Cheakamus River. The main purpose of the Project was to create spawning and rearing habitats to be utilized by Coho, Chinook, Pink, and Chum Salmon as well as Cutthroat and Steelhead Trout. The original floodplain habitats have become degraded over the decades due to changes in river flow, sediment budgets, and installation of flood protection works that resulted from the installation of the Daisy Lake Reservoir, transmission towers, and road access works that began in 1956.

New channel works were created in the Dave Marshall Reserve lands located on the property of the North Vancouver Outdoor School. The engineering and design works were provided by Fisheries and Oceans (DFO) staff who also assisted with construction supervision and technical support. Gravel for this project was provided by Squamish Nation that had been stockpiled earlier in the year as part of a gravel extraction project of the Cheakamus/Cheekye River and Mamquam River.

Large woody debris and large boulders were placed at various locations in the newly constructed channels to create refugia and overwintering habitat for juvenile salmonids. The project works commenced in early August and wrapped up the last week in October (with the last of the clear weather). As soon as the channel were opened Pink Salmon immediately began to populate every square metre of new habitat. Currently in November Chum and Coho Salmon can be seen spawning in these new channels.

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1.0 Introduction

The Squamish River Watershed Society has worked with BC Hydro over the years on numerous projects throughout the watershed and, in particular, in the Dave Marshall Salmon Reserve. At this time, the SRWS partnered with DFO, Squamish Nation, and the North Vancouver Outdoor School to develop a number of salmon habitat restoration projects to help reestablish spawning and rearing habitat that has become limited in the past half century. These new restoration works interconnect with the various channels and ponds that have been constructed outside of the flood control dikes to help reinvigorate the salmon stocks in the area.

The intent was to address the limiting factors that affected the area including the loss of habitat. Habitat has been lost through the construction of the Daisy Reservoir and the ensuing transmission lines and road ways. The diking of the Cheakamus River further restricted important fisheries habitat. Off-channel habitat is critically important for species such as Coho, Chinook, Pink, and Chum Salmon as well as Cutthroat and Steelhead Trout, and numerous other non-sport fish as well. The footprint impacts have altered fluvial processes, reduced downstream flows, restricted gravel recruitment and large woody debris movement, as well as isolating groundwater fed channels.

A second major impact has been the diversion of water at the Daisy Reservoir from the Cheakamus River through the penstocks into the Squamish River. This has resulted in a loss of nutrients from the watershed.

2.0 Goals and Objectives

The goals and objectives for this project included:

- Construction of over 1,500 square metres of rearing habitat for Coho salmon in the Dave Marshall Salmon Reserve spawning channels.
- Restore and expand a portion of Moody's Channel to re-establish stable salmon spawning habitat and create over 150 square metres of habitat for Chinook, Coho, Chum, and Pink salmon.

2.1 Limiting Factors

1. The first limiting factor addressed was the loss of riverine side channel habitat that is critically important for spawning Chinook and Pink salmon and for rearing 0+ Chinook salmon. These areas are also important for Chum spawning and Coho rearing. The restoration sites are located on the historic active floodplain of the Cheakamus River that is now largely isolated from direct river flow by the BCH bridge and dike on the south bank of the Cheakamus River. Spawning surveys carried out in 1955 and 1957 confirm these areas supported important spawning populations of Pink, Chum and Coho salmon prior to hydroelectric development of the river (DFO, 1957, Ref. 1&2). D.B. Lister (2001) summarised the importance of these side-channel habitats for sustaining pink salmon populations in the Cheakamus River and suggested active restoration of these areas as the only practicable means of recovering these populations. Downstream trapping studies on the Cheakamus River in 2000 and 2001 attributed significant declines in

Chinook smolt abundance since 1966 with loss of channel complexity and loss of side-channel habitats (McCubbing and Melville, BCH reports in prep.).

2. The second limiting factor addressed was loss of nutrients due to the effects of the Daisy Lake Reservoir and diversion of nutrients out of the basin through the power tunnel to the Squamish River. This project increases the biomass of salmon produced by the lower Cheakamus River and thereby increase the amount of marine derived nutrients that enter the ecosystem each year.

All the works have been built upon previous investments by BC Hydro and others in the historic floodplain of the Cheakamus River. The constructed or restored habitats help to improve the functionality of these areas to better support present day salmon recovery efforts in this section of the Cheakamus River. This is consistent with priorities identified by the FWCP.

2.2 Value added benefits

The Dave Marshall Salmon Reserve is located at the North Vancouver Outdoor School which is recognized as one of the premier outdoor education facilities in Canada. All previous restoration projects have been designed to complement the educational programs developed by the NVOS. This area provides excellent nature viewing opportunities and supports high densities of bald eagles each winter which earns this site international recognition. NVOS, DFO, BC Hydro, Squamish River Watershed Society and Squamish Nation have long collaborated on improving environmental values in this area and these works will continue and strengthen that relationship.

In addition, the excavated material from the constructed channels has now provided a base for a new “fishing” road for the Squamish First Nation. This benefits the project by reducing costs of transporting excavated material off-site, while providing the Squamish First Nation with a value added cultural benefit.

3.0 Study Area

These salmon habitat restoration sites are located adjacent to the Cheakamus River within the area known as the Dave Marshall Salmon Reserve along Paradise Valley. The project focused on two off-channel habitats along the Cheakamus River and Moody’s Side Channel. Moody’s Side Channel was originally constructed for the benefit of Coho and Chum Salmon and originally was fed by upwelling groundwater. The upstream section originates from the NVOS Duck Pond and has been augmented by Cheakamus River water flows through the Eagle Point intake. Water from the intake flows through the Eagle Point Connector Channel, into the Canoe Pond, through the Bighouse Connector Channel and into the Moody’s System. It is from these waters that the newly constructed channels were connected across Squamish Nation owned lands at IR11 and re-enter into the Cheakamus River just upstream of the Cheekye River confluence.

The properties on which these works were undertaken were either owned by the NVOS or by Squamish Nation and crossed the BC Hydro Transmission line R/W. Maps covering the sites are Natural Resources Canada National Topographic System 92G/14 and Geo Data British Columbia Terrain Resource Information Management 92G.085 near UTM coordinates of 5519720m N by 488750m E BC Albers coordinates.

4.0 Methods

This project involved the use of a Cat 320 excavator and Cat 950 and 966 front end loader as well as a D250 Cat truck that was used to transport gravel from a distance of 1.5 km from the site. The channels were excavated with the Cat 320 unit and gravel, supplied by Squamish Nation, was moved by the D250 Cat truck. The Cat 950 and 966 front end loaders were used to place the gravel and position the culverts into place. LWD and boulders were placed using the Cat 320 excavator.

An intake box was fabricated and installed along the new channels. As well, two 5' culverts were placed along the new channel allowing road access over top of the channels.

The original project design and alignment was determined by several on-site walkabouts between DFO, SRWS, the NVOS and Squamish Nation well in advance of the works proceeding. A final survey of the site will be undertaken in early summer 2014 and as-built design drawings will be submitted to BC Hydro.

5.0 Results

This project involved undertaking works to improve existing fish habitats and create new habitats for the benefit of Chinook, Coho, Pink and Chum Salmon. The SRWS partnered with Fisheries and Oceans Canada, the North Vancouver Outdoor School and Squamish First Nation during all phases of the design and development of the proposed salmon habitat projects.

These habitat areas will now support pink and Chinook salmon and are also important for co-existing Coho and Chum Salmon. The original floodplain habitats were degraded due to changed river flow, sediment budgets and installation of flood protection works due to impacts of the Daisy Lake dam, transmission towers and access road construction in 1957.

The new works have now expanded and restored restore fish habitat in and around the Lower Paradise Channel consisting of the following:

1. Lower Paradise (Moody's) Channel has now been backwatered to create a long riffle approximately 200 metres downstream of the Canoe Pond. This riffle is approximately 50m long and 3m wide and has been graded to provide 150 m² of spawning habitat for Chinook salmon, but it will also provide spawning habitat for Coho, Pink and Chum salmon.

2. The riffle was designed to a target elevation that enables a small intake to divert a minor flow into a constructed channel, which allows flow into an isolated backchannel on the historic floodplain of Cheakamus IR 11 land. The constructed and existing backchannel are approximately 440m in length and 5m in width, providing 2200 m² of high quality rearing habitat for Coho Salmon.
3. Two new watercourses were constructed to connect the backchannel to previously constructed habitats associated with Lower Paradise Channel. These watercourses provide a further 700 m² of spawning and rearing opportunities, primarily for Coho salmon.
4. Large wood debris and rock were placed at strategic locations to improve habitat function of the channels. The slope of the gravel bed in the newly constructed channels and the riffle were set to ensure all areas provide optimum conditions for spawning salmon.

   The importance of this habitat was demonstrated during the flood of record in 2003, when over 90% of the surviving pink salmon fry that migrated past the BC Hydro Water Use monitoring traps the next spring, were found to have originated in this restored side channel.

   Increased salmon returns to the relatively stable side-channel habitat now provide improved foraging opportunities for birds such as the Bald Eagle, Great Blue Heron and Belted Kingfisher. Additional marine derived nutrients from the salmon carcasses provide an important food and nutrient source for both aquatic and terrestrial animals and plants in the Cheakamus River.

6.0 Discussion

The Cheakamus IR 11 Project is a multi-year multiple phased project that involves the partnership of Squamish Nation, North Vancouver Outdoor School District #44, Fisheries and Oceans Canada, and the Squamish River Watershed Society. An important component of this project is also the support from BC Hydro and the Transmission Corporation. The overall objective is to provide off-channel habitat along the inner sections of the dyked portion of the Cheakamus River and restore the Coho populations to pre-reservoir construction numbers. This phase of the project helped to create over 2,200 square metres of high quality rearing habitat and over 700 square metres of spawning habitat for Coho Salmon. Hopefully the project will continue into Phase 2 and Phase 3 in the coming years to fully activate the entire inner channels and help to compensate for the dykes, dams, and other artificial obstructions that have been impacting populations over the past half century.

7.0 Recommendations

The only recommendation is to work towards continuing on with the next phases of this project to direct flows through the Notch Channel and ultimately to help re-water Evans Creek.

8.0 Acknowledgement

We would like to thank BC Hydro and the Fish and Wildlife Compensation Program for all of their help and assistance is funding and supporting this year's project.

We would also like to take this time to thank:

- Randall Lewis, and the support from Squamish Nation including the contribution of the gravel that was used to create spawning habitat for this project;
- North Vancouver Outdoor School;
- Steve Rochetta and other Ministry of Forests, Lands, and Natural Resource Operations staff;
- Matt Foy, Dave Nanson, Mike Landiak, Al Johnson and other Fisheries and Oceans Canada for all of their assistance; and
- John Hunter Company for their excellent work!

9.0 References

1. Department of Fisheries, Canada 1957. *A report on the fisheries problems related to the power development of the Cheakamus River system*. Vancouver B.C. 39p. + appendices.
2. Melville, M. and D. McCubbing. 2000. *Assessment of the 2000 Juvenile Salmon Migration from the Cheakamus River, using Rotary Screw Traps (draft)*. Prepared for BC Hydro, Burnaby. 36 p. + appendices
3. Northwest Hydraulic Consultants. 2001. *Analysis of channel morphology and sediment transport characteristics of the Cheakamus River*. Prepared for BC Hydro, Burnaby. 40p. + appendices.

Appendices

I. Financial Statements

See attached

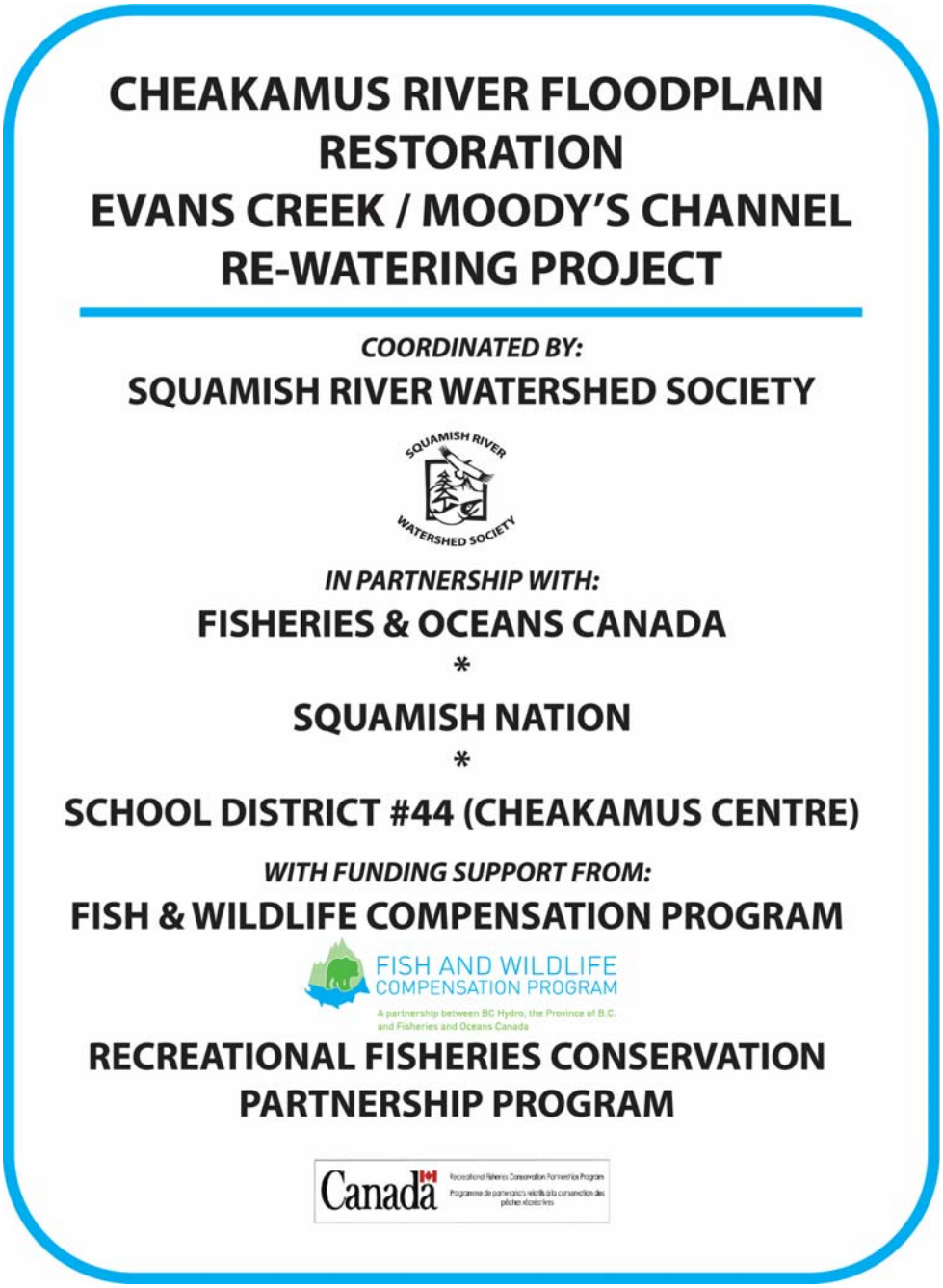
II. Performance Measures and Outcomes

See attached

III. Confirmation of FWCP Recognition

Signage is being installed alongside the project (see photos below in Section IV) and a short summary of the project is being included in the Squamish River Watershed Society website (www.squamishwatershed.com).

Image of signage:



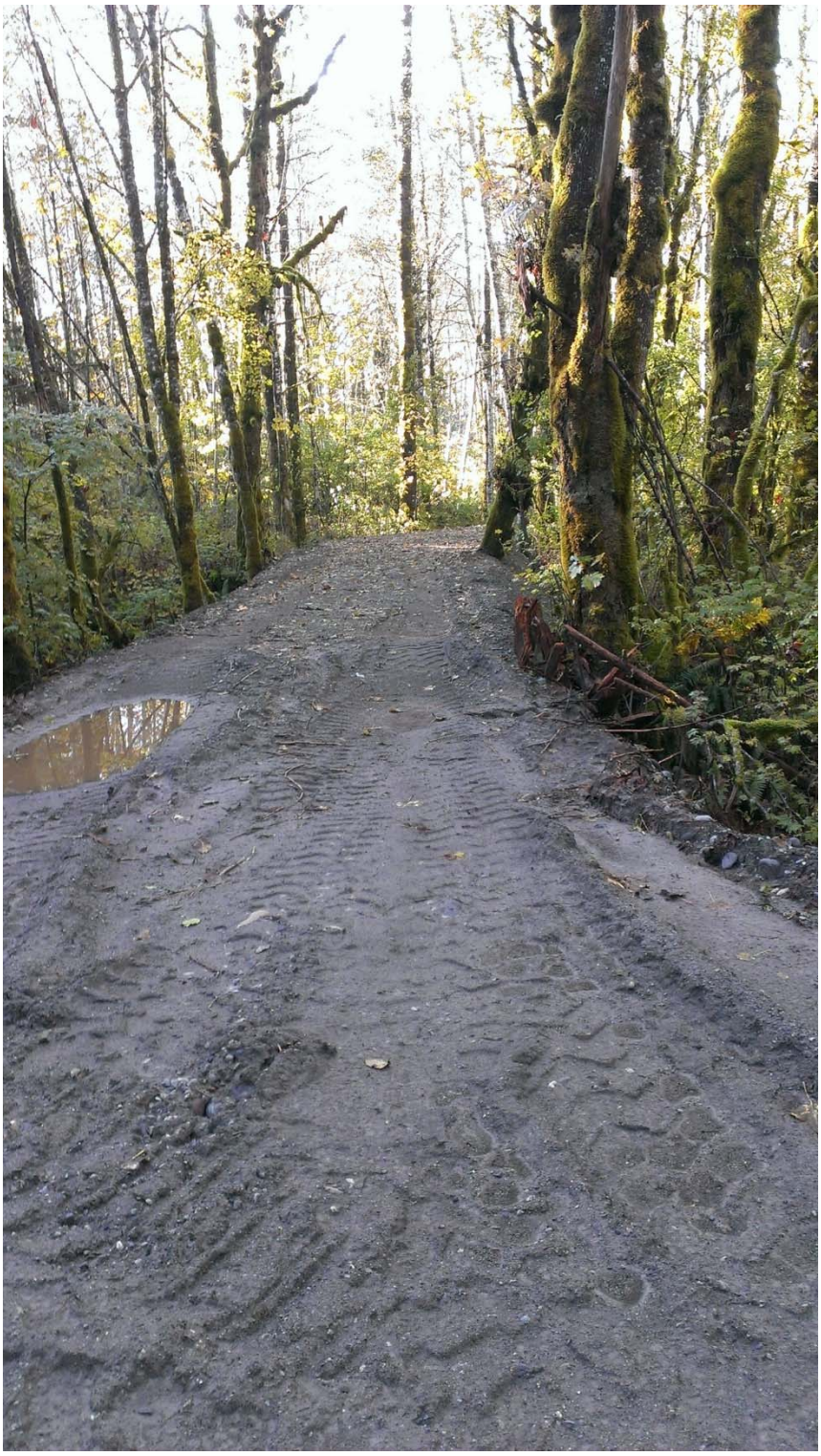
IV. Photos

October 3, 2013

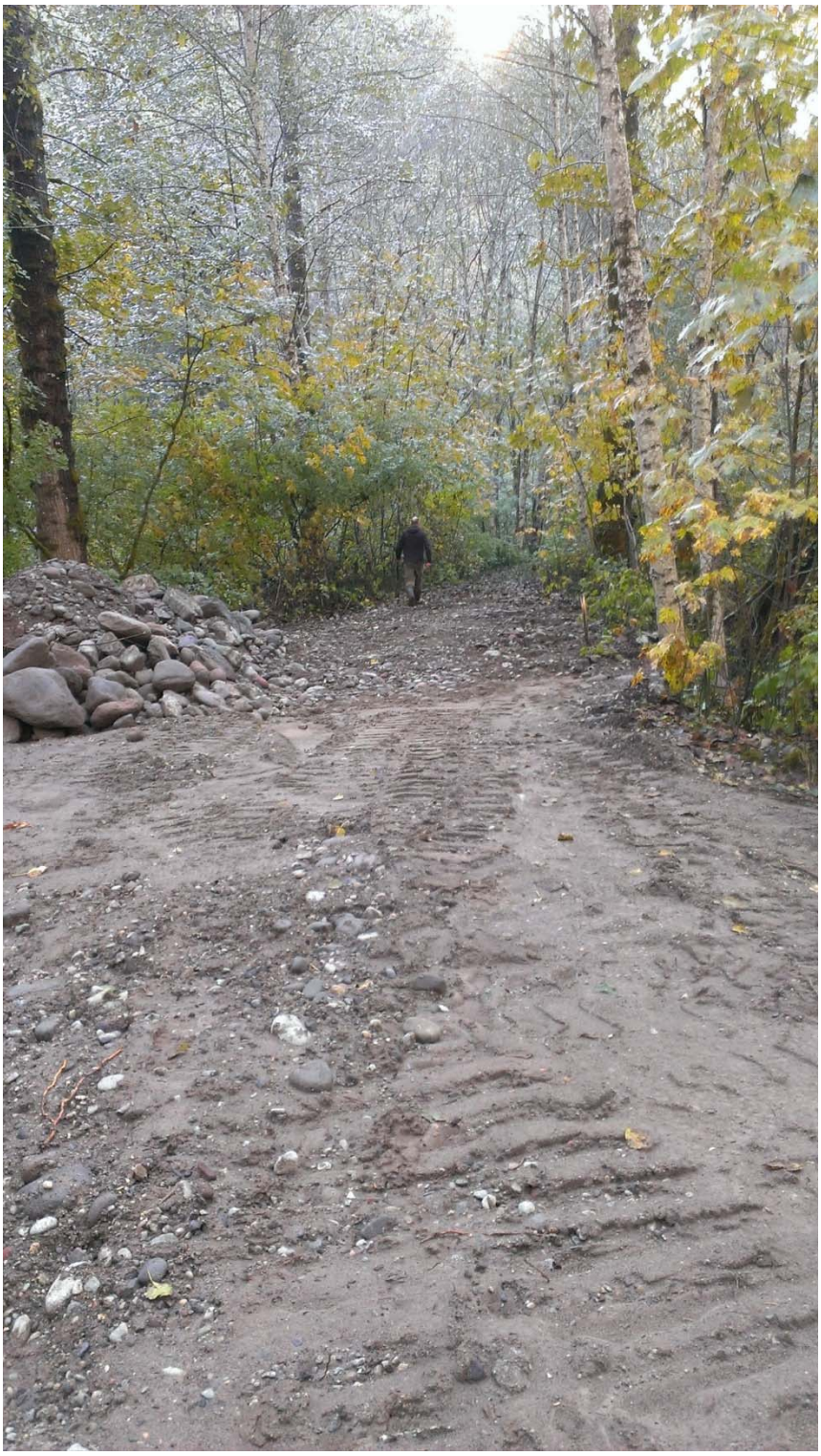
Facing downstream along newly constructed channel – note armoured embankments

Facing upstream from road/train/top of dike; note newly installed steel pipe intake

Facing downstream from same location as above photo; note large river rock placement on banks

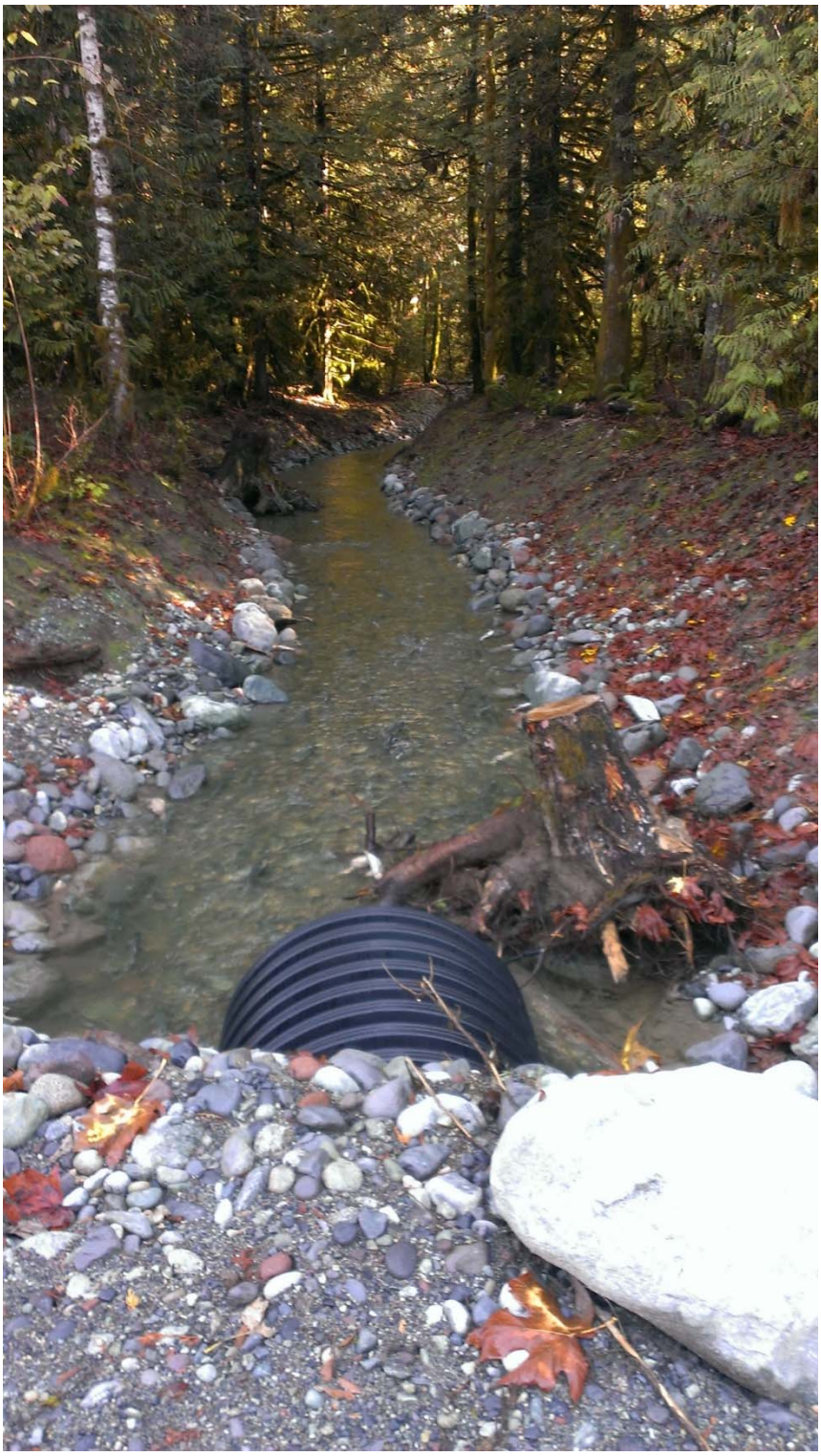


Resurfaced road/dike



Walking along the dike towards the southern end of the project

Looking at the existing Moody's Channel with pink salmon swimming



Newly installed PVC Culvert at northern end of project site (on SD#44 school property)

Facing downstream towards the south from same location as photo above. Note LWD placement and large river rock boulders along slopes

March 25, 2014

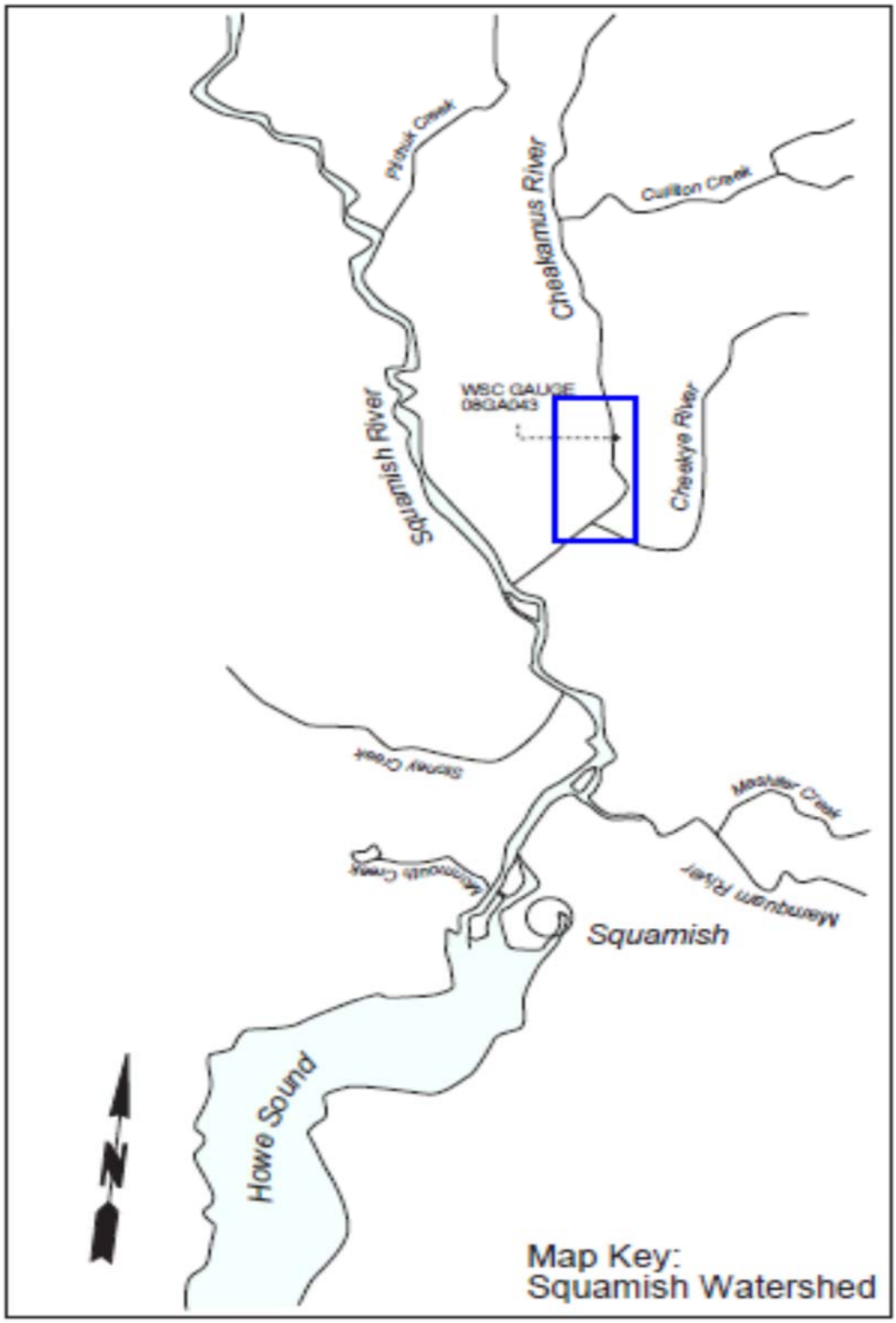
Facing downstream along newly constructed and newly graveled Coho Channel

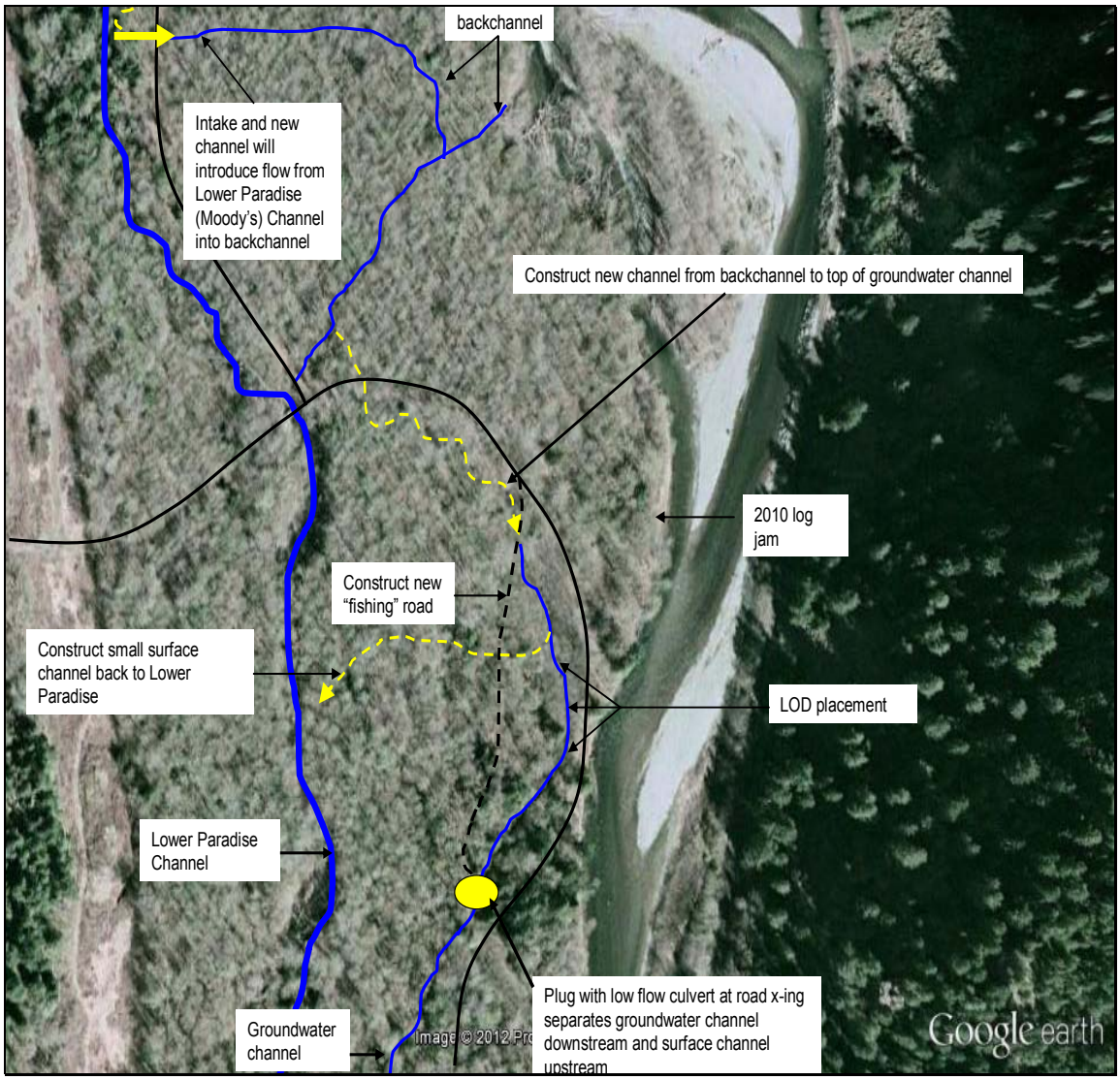
Duck Pond Intake (installed March 24, 2014)

Intake pipe (facing downstream along newly constructed intake channel – note armour and spawning riffle further downstream)

New channel (primary rearing habitat and overwintering for Coho fry) parallel to Moody's Channel on north side of Flood Dyke

V. Map of Site


Pilfold Creek
Cheakamus River
Cuillon Creek
WSC GAUGE
08GA043
Squamish River
Cheekye River
Stawamus Creek
Mashiter Creek
Mamquam River
Squamish
Howe Sound
N
Map Key:
Squamish Watershed


backchannel
Intake and new channel will introduce flow from Lower Paradise (Moody's) Channel into backchannel
Construct new channel from backchannel to top of groundwater channel
2010 log jam
Construct new "fishing" road
Construct small surface channel back to Lower Paradise
LOD placement
Lower Paradise Channel
Plug with low flow culvert at road x-ing separates groundwater channel downstream and surface channel upstream
Groundwater channel
Google earth