EA3915

Reay Creek Fish and Fish Habitat Assessment 2018



Prepared for:

Town of Sidney
c/o Tim Tanton, Director of Development Services, Engineering, Parks and Public Works
2440 Sidney Avenue
Sidney, BC, V8L 1Y7

Prepared by:

Shane Johnson and Elmar Plate
LGL Limited
environmental research associates
9768 Second Street
Sidney, BC
V8L 3Y8

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LGL LIMITED
environmental research associates

EXCUTIVE SUMMARY AND RECOMMENDATIONS

Fish and fish habitat surveys were completed by LGL Limited in Reay Creek in May and June of 2018 and the diagnostic summary of results is shown in Table 1.

With regards to the importance of the Reay Creek Duck Pond (the Pond) for the entirety of Reay Creek salmonid rearing and spawning, results can be summarized as follows.
With regards to:

1. % pool, the majority of habitat with a ranking of "Good" is located downstream of the Pond and in the Pond itself;
2. pool frequency, the majority of habitat with a ranking of "Good" is located downstream of the Pond and in the Pond itself;
3. holding pools, the majority of habitat with a ranking of "Good" is located upstream of the Pond and in the Pond itself;
4. % of wood in pools, the only habitat ranked as "Good" is the Pond itself;
5. overhead cover, most of Reay Creek receives a "good" ranking with the exemption of the stretch newly established by the Victoria Airport Authority in Reach 6, upstream of the Pond;
6. spawning gravel quantity, the best reaches are located upstream and downstream of the Pond; and
7. gravel quality, the only reach with fair gravel quality is located upstream of the Pond.

Therefore, the Pond represents an important habitat as a holding pool, with a high percentage of wood in the Pond and its riparian zone. This assessment was supported by the fact that a high density of adult Cutthroat Trout was observed in the Pond and based on oral reports, Coho Salmon are using the Pond for holding on their spawning migration into upper Reay Creek. Therefore, the Pond should at least be preserved in its existing state or preferably be improved through the removal of the accumulated sediments to create even more holding habitat for adult salmonids and retain more water during summer low flows. To this end, a second hydrometric station downstream of the Pond should be installed to evaluate the Pond's water holding and release function.

Since spawning gravel quantity and quality was ranked as "Good" for reaches upstream of the Pond, the option for salmonids to pass the Pond dam in the upstream and downstream direction should be maintained or if possible be improved through the construction of a fish ladder. Thus, the full potential for salmonid spawning in Reay Creek can be maintained or improved.
As an alternative to the existing state, the Pond could be removed and replaced with approximately 225 m of pool-riffle sequences that will add spawning habitat to Reay Creek. The pool-riffle sequences will need to be augmented by Large-Woody-Debris (LWD) placements for cover and to create favourable hydraulic conditions for juvenile rearing. Spawning gravel would also need to be added to this section. In this scenario, likely the culvert leading into the Pond may need to be improved to prevent blockage for migrating fish.
In conclusion, leaving the Pond in place by replacing the existing dam with a dam that conforms to safety regulations including a fish ladder (and removal of sediment) would increase the

growth of salmonids in the Pond by 30-70% and provide suitable low water winter and summer rearing habitat, while the dam and Pond removal would create spawning habitat that would approximately produce an additional 60 Coho smolts leaving into the ocean. In addition, the Pond habitat appears to offer the right conditions for Cutthroat Trout to grow to maturity. For more detail on the discussion of this conclusion please refer to the "Discussions" chapter of this report.

In our opinion and independent of the fate of the Pond, the fish habitat in Reay Creek could benefit from the following:

- the addition of more LWD structures in several reaches;
- the removal of contaminated sediments in the Pond and pools throughout the creek;
- the addition of riparian vegetation on the banks of the creek in the stormwater retention pond area (upstream of Norseman Road) constructed by the Victoria Airport;
- the increase of ground water pumping into Reay Creek during the low-water and warm-water summer month (July-September).

Table 1. Diagnostic summary of salmonid habitat condition in the Reay Creek Watershed.

Reach Number	% Pools[1]		Pool Frequency[2]		Holding Pools[3]		% Wood in Pools[4]		% Boulder in Riffles[5]		% Overhead Cover[6]		Spawning Gravel Quantity[7]		Gravel Quality[8]	
	Value	Rating	Value	Rating	Value	Rating	Value	Rating	Value	Rating	Value	Rating	Value	Rating	Value	Rating
Reay Creek 0	0.0	Poor	n/a	n/a	0.0	Poor	n/a	n/a	n/a	n/a	0.0	Poor	0.0	Poor	0	Poor
Reay Creek 1	83.9	Good	5.3	Good	15.4	Good	0.0	Poor	n/a	n/a	30.8	Good	10.9	Fair	89	Poor
Reay Creek 2	58.9	Good	53.2	Poor	6.0	Good	0.0	Poor	n/a	n/a	31.0	Good	1.3	Poor	84	Poor
Reay Creek 3	7.3	Poor	64.9	Poor	0.0	Poor	0.0	Poor	n/a	n/a	69.5	Good	4.7	Poor	92	Poor
Reay Creek 4	54.3	Good	9.0	Good	14.4	Good	1.5	Poor	3.2	n/a	44.7	Good	22.1	Fair	69	Poor
Reay Creek 5 Duck Pond	100.0	Good	8.5	Good	3.9	Good	5.0	Fair	n/a	n/a	45.0	Good	0.2	Poor	98	Poor
Reay Creek 6	22.5	Poor	26.7	Poor	3.8	Good	0.0	Poor	0.0	n/a	10.7	Fair	39.2	Good	15	Fair
Reay Creek 7	20.2	Poor	52.5	Poor	3.4	Good	0.0	Poor	5.1	n/a	62.2	Good	3.5	Poor	85	Poor

[1] Value is percent pools (%P = total pool area / total wetted area). Poor < 30%, Fair <= 40%, Good > 40% (for gradients 2-5%).

[2] Value is number of bankfull widths per pool (PF = mean bankfull width / total number of pools). Good < 10, Fair <= 15, Poor > 15.

[3] Value is the number of pools per 1000 m for which the deep pool cover > 0 and maximum depth x % total instream cover >= 30. Poor < 1, Fair <= 2, Good > 2.

[4] Value is the mean percent wood cover in pools. Poor < 6%, Fair <= 20%, Good > 20%.

[5] Value is the percent boulder cover in riffles. Poor < 10%, Fair <= 30%, Good > 30%.

[6]Value is the percent overhead cover in pools. Poor < 10%, Fair <= 20%, Good > 20%.

[7] Value reflects the percentage of spawning gravel in all habitat areas of each reach. Poor < 10%, Fair <= 25%, Good >25%

[8] Value is the percent of substrate in <2 mm category (fines). Poor > 25%, Fair >15% and uncompacted, Good < =15% and uncompacted.

TABLE OF CONTENTS

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1 INTRODUCTION

1.1 Background

LGL Limited was retained by the Town of Sidney to conduct a fish and fish habitat assessment for all of Reay Creek with focus on the current and future importance of the Reay Creek "Duck Pond" (the Pond) and its dam (Figure 1). The current and historic public interest in Reay Creek is expressed the long history of community involvement and restoration efforts from 1982 on (Robinson and Sarrazin 2010). This interest triggered a Reay Creek restoration movement and it became apparent that the importance of the Pond for the rearing and spawning of salmonids in Reay Creek needed to be investigated based on commonly accepted habitat assessment standards.

This report summarises the results of the field surveys conducted in Reay Creek in May and June 2018 and recommendations based on field work and background literature (Appendix A) with focus on the current condition and suggested future actions with regards to the Reay Creek Pond and its dam.

1.2 Study Area

The Reay Creek watershed is located within the District of North Saanich and Town of Sidney. Reay Creek is approximately 1.80 km long, flows southeastward and drains into Bazan Bay, approximately 3 km south of the Town of Sidney town (Figure 1 and Figure 2). The Reay Creek Watershed is approximately 250 ha in area and is located primarily on property managed by the Victoria Airport Authority (VAA), urban residential subdivisions, as well as some surrounding open fields and forested lands. This watershed supports four fish species (Table 2) including coastal Cutthroat Trout (*Onchorhyncus clarki clarki*) and Coho Salmon (*Onchorhyncus kisutch*).

Reay Creek Pond is a part of the Reay Creek watershed located between Canora Road on the northeast end and reaching downstream in a south western direction for about 255 m to its dam (Figure 1). While the Pond was originally contained by an earthen dam to control water flow and depth for a duck farm, the dam was re-built in 1997 by the Town of Sidney to its currents state (SLR 2016).

Continuously acting as a settlement Pond for Upper Reay Creek, fines are accumulating in the Pond at a rate of approximately 0.33 cm/yr for an estimated total of 3,107 m^3 of fines (SLR 2016) that are now contained by the dam at the bottom of the Pond. Current water depths in the Pond are ranging from approximately 2 m at the dam to less than 0.5 m towards the inflow at Canora Road and at its fringes. The accumulated Pond sediment has cadmium, copper, lead and zinc concentrations that qualify it as a contaminated site under BC's Contaminated Site Regulations (CSR) for sensitive freshwater habitat but not for residential use.

1.3 Objectives

The assessment described in this report had the following objectives:

1. Review of the existing Reay Creek literature with special attention to fish and fish habitat in general and in particular the Reay Creek Pond;

2. Survey all the fish habitat of Reay Creek Fish including the Pond following the Johnston and Slaney 1996 Fish Habitat Assessment Procedure (FHAP);
3. Compare fish habitat quantity and quality upstream, downstream and in the "Duck Pond" to produce a relative estimate of salmonid spawning and rearing habitat; and
4. Suggest whether dam breaching or construction of a new dam with or without a fish ladder will be the best solution to enhance the local fish stocks.

2 METHODS

2.1 Assessment Methodology

Detailed fish habitat assessments in Reay Creek followed the methodologies and procedures described in the Fish Habitat Assessment Procedures Manual (FHAP), Watershed Restoration Technical Circular 8 (Johnston and Slaney 1996). FHAP is a multi-stepped approach to the qualitative assessment of fish habitat in forested and salmonid bearing streams. The FHAP procedure also identifies fish species at risk, generates a quantitative description and evaluates fish habitat conditions and identifies opportunities for effective fish habitat rehabilitation within a watershed (Johnston and Slaney 1996).
The characteristics and condition of fish habitat in the FHAP procedure are described by the following attributes:

- classification of habitat types – riffle, pool, glide and other;
- potential fish migration barriers;
- percentage of pools, residual pool depth, quality and quantity of adult holding pools;
- type and effectiveness of cover for juvenile summer rearing and adult escape cover during spawning;
- extent of and access to off-channel habitat; and
- quality and quantity of anadromous spawning habitat.

2.1.1 Photography

Photographs of selected habitat units and significant features were taken with a digital camera. Each picture was labelled with:

- chainage (distance from Lochside Road measured by hip-chain in m) of the habitat unit or feature;
- date; and
- description of the habitat unit or feature.

2.2 Detailed Habitat Assessment Methodology

Fish and fish habitat field assessments were conducted during May and June 2018. These surveys were conducted on foot and involved a crew of two people. Detailed fish-habitat surveys involved complete sampling of all habitat types within each reach.

2.2.1 Data Analysis and Interpretation

Detailed habitat assessment data for Reay Creek were analyzed to determine salmonid habitat condition and to identify potential physical habitat limitations to salmonid production. Habitat characteristics were compared to observed natural stream morphologies (Newbury and

Gaboury 1993) and bio-standards for undisturbed salmonid streams (Johnston and Slaney 1996) to detect habitats that are degraded or at risk, and which may be improved through rehabilitation. A summary of diagnostic values for salmonid habitat condition in Reay Creek was prepared based on bio-standards.

2.2.2 Diagnostic Value for Percent Pools and Pool Frequency

Ratings for percent pool habitat and pool frequency (spacing) were determined for each reach. A poor rating was given if percent pool was < 30%, a fair rating was given if ≤ 40%, and good rating was given if > 40%. Similarly, for pool frequency, a poor rating was given if the stream length equivalent to the number of bankfull widths between pools was > 15, a fair rating was given if ≤ 15, and good rating was given if < 10.

2.2.3 Diagnostic Value for Deep Pools (Holding Pools)

All pools with a depth greater than 0.85 m were defined as a "good" holding pool for adult fish. However, for shallower pools this ignores the importance of cover within the pool for creating good fish holding habitat. To account for the inter-relationship between pool depth and cover, the number of alternative adult holding pools that are ≤0.85 m deep was identified using the following criterion: an alternative holding pool was defined as a pool where the value composed of maximum depth times total percentage of overhead cover is > 30 (example: depth 0.5 m x 70% overhead cover = value of 35) and where total overhead cover can be composed of large woody debris (LWD), boulder, cutbank or overhanging vegetation. Maximum depth was measured during summer low flows. This diagnostic was developed to better reflect the interaction of cover and pool depth in providing suitable habitat to adult salmonids. In general, many pools that have a depth of less than 0.85 m but abundant cover (e.g., cutbanks) will present good habitat for adult holding.

The diagnostic value used to assess adequacy of adult holding pools within a reach was the total number of deep pools per 1000 m of stream within each reach. A rating of poor was given if the number of deep pools as defined above was < 1 per 1000 m of stream, a rating of fair was given for ≥ 1, but ≤ 2, and a rating of good was given if > 2.

2.2.4 Diagnostic Value for Spawning Gravel Quantity

Spawning gravel quantity was calculated as 100% of the stream wetted area with available gravels (2-64 mm), plus 20% of the stream wetted area with available cobbles (64-256 mm) times the wetted area of the reach. Gravel quantity was rated as poor if the spawning area represented <10% of the wetted total area, fair if it represented ≥ 10%, but ≤ 25%, and good if represented > 25%.

2.2.4 Diagnostic Value for Spawning Gravel Quality

Spawning gravel quality was ranked as good, fair or poor based on the degree of compaction and embeddedness (percent fines). Loose and clean substrates (fines < 15%) providing excellent spawning opportunity received a rating of good, while compact and embedded substrates (fines > 25%) received a ranking of poor. A fair ranking refers to moderately embedded and uncompacted gravel (15% < fines < 25%).

2.4 Fish Capture and Sampling

From June 5th to 7th 2018, LGL staff used baited minnow traps, pole seine, dip net and angling to capture fish in Reay Creek. On June 5th, 2018, 12 baited minnow traps were set at four different sites in the Reay Creek Pond. On June 6th, 2018, 16 baited minnow traps were set at six different sites in the Reay Creek Pond and upstream and downstream of Reay Creek Pond (Figure 2). On June 7th, 2018, LGL staff used a pole seine and a dip net at three different sites upstream and downstream of the Reay Creek Pond. Angling was also used to capture fish near the outlet of the Reay Creek Pond. The fork length (FL) was measured to the millimetre (mm) on all salmon and trout captured (except one).

2.5 Habitat Assessment Methodology

Following the overview assessment, detailed habitat assessments were carried out on Reay Creek mainstem, from the estuary to the headwaters. A visual inspection of the Pond was conducted during the surveys.

3 RESULTS

3.1 Watershed Characteristics

Reay Creek is a first order stream, with a mainstem length of approximately 1.80 km. The drainage area of the Reay Creek is approximately 250 ha. LGL staff surveyed Reay Creek from estuary in Bazan Bay to the headwaters, a culvert that drains storm water from the airport property (Figure 2).

3.2 Fish Habitat Condition

Detailed habitat condition results are presented in Table 1 and seven Appendices as follows:

- A diagnostic summary of salmonid habitat condition is presented in Table 1;
- Appendix B contains spreadsheets listing detailed habitat attributes in each reach surveyed;
- Appendix C is a summary of area surveyed and percentage of each primary habitat type present in each reach;
- Appendix D is a summary of cover attributes, detailed canopy and riparian stage descriptions for Reay Creek watershed;
- Appendix E is a summary of bed material and spawning attributes for surveyed reaches;
- Appendix F is a summary of LWD attributes for surveyed reaches;
- Appendix G contains all fish sampling data;
- Appendix H contains all of the FHAP photos.

3.3 Reay Creek Reaches

For consistency, LGL followed the reach breaks from Barraclough et al. 2005, adding a reach 0.

3.3.1 Reay Creek Reach 0 (Photos 1-2, Appendix H)

Reach 0 is tidally influenced and is part of the estuary and the survey was initiated at the downstream side of the Lochside Road culvert. Downstream of the culvert, Reay Creek drains

into Bazan Bay in a single channel, which is passable by anadromous salmon under low tide conditions. The creek and tidal flow is partially restricted by the concrete box culvert under Lochside Road.

A log jam was present on the downstream side of the culvert that could represent an obstacle to migrating salmon (Photo 2, Appendix H). Reach 0 was downstream of the FHAP survey border and no instream habitat measurements were taken.

3.3.2 Reay Creek Reach 1 (Photos 3-6, Appendix H)

Reach 1 was the next reach upstream of Reach 0 and a total of 65 m were surveyed. Mean bankfull width was 6.1 m with substrate predominately composed of fines. The instream habitat types were broken down into 0% riffle, 89% pool and 16% glide. Substrate composition was dominated by fines (89.1%) with some gravel (10.9%) and boulder (1.2%). This reach and is bordered by steep slopes to the north and south. In all habitat types, the primary components of instream cover were undercut banks and deep pools. Grasses and shrubs represented most of the vegetation with some deciduous/conifer trees on the benches of the slopes.

3.3.3 Reay Creek Reach 2 (Photos 7-10, Appendix H)

Reach 2, extends from the border of Reach 1 to the culvert under the Patricia Bay Highway (Hwy #17). A total of 167 m were surveyed. Mean bankfull width was 3.1 m with substrates predominately composed of fines (similar proportion of fines compared with Reach 1). The instream habitat was broken down into 59% pool and 27% glide. Substrate was composed of 1.3 % gravel and 84.3 % fines. In all habitat types, the primary components of instream cover were undercut banks, deep pools and boulders. The riparian vegetation was primarily composed of shrubs with some deciduous/conifer trees nearby. The right bank had some visible erosion due to high water and flow.

3.3.4 Reay Creek Reach 3 (Photos 11-15 and 17, Appendix H)

Reach 3, a total of 333 m was surveyed. This reach is located in Reay Creek Park, managed by the Town of Sidney and the District of North Saanich. The mean bankfull width was 2.6 m with substrate predominately composed of fines. The instream habitat was broken down into 7% pool and 90% glide. The substrate was composed of 4.6 % gravel, 0.4 % cobble and 92.3 % fines. In all habitat types, the primary components of instream cover were deep pools and instream vegetation.

3.3.5 Reay Creek Reach 4 (Photos 15-16 and 18-21, Appendix H)

For Reach 4, a total of 417 m was surveyed. Mean bankfull width was 3.3 m with predominately fines substrate. The instream habitat was composed of 18% riffle, 57% pool and 25% glide. The substrate was composed of 21.2 % gravel, 4.5 % cobble, 63.6 % fines and 1.2 % boulder. All typical components of instream cover were present in this reach including: deep pools, boulders, LWD/SWD, cutbanks and instream vegetation.

In this reach, several restoration projects were implemented. Spawning gravel was placed in a few locations, some of the banks were armoured and riffle/pool habitat structures were constructed.

3.3.6 Reay Creek Reach 5 (Photos 22-32, Appendix H)

Reach 5 is composed of the Reay Creek Pond and it extends approximately 2005 m to the Canora Road culvert. Mean bankfull width was approximately 30 m with substrate predominately composed of fines. The Pond was a pool habitat and represented the only habitat type in Reach 5. Fines were the only substrate present, with rip-rap forming the dam at the outlet. Most typical components of instream cover were present in this reach including: deep pools, boulders (at the dam), LWD/SWD and instream vegetation. A high abundance of instream vegetation was observed, providing good cover for fish and food for aquatic insects.

3.3.7 Reay Creek Reach 6 (Photos 33-41, Appendix H)

Reach 6, extends 250 m from the Conora Road culvert to the property fence of the Victoria International Airport. Mean bankfull width was 2.6 m with predominately gravel substrate. The instream habitat was broken down into 5% riffle, 23% pool and 62% glide. The substrate was composed of 31 % gravel, 26 % cobble, 42 % fines and 0.5 % boulder. In all habitat types, the primary components of instream cover were deep pools and instream vegetation. Downstream of the Norseman Road culvert Reay Creek had riffle/pool habitat with good overhanging vegetation. Upstream of Norseman Road culvert is the location of the 5,000m^3 stormwater detention pond constructed on VAA property in 2017. Neither overhanging vegetation on the left bank of Reay Creek nor instream cover in the creek were observed in this stretch (Photos 38-41, Appendix H).

3.3.8 Reay Creek Reach 7 (Photos 42-52, Appendix H)

Reach 4, a total of 277 m was surveyed. Mean bankfull width was 2.8 m with substrate predominately composed of fines. The instream habitat was broken down into 3 % riffle, 21 % pool and 75 % glide. The substrate was composed of 1.5 % gravel, 3.6 % cobble and 82.2 % fines. In all habitat types, the primary components of instream cover were instream vegetation, boulder and deep pools.

3.3.8 Riparian Condition

Results of the riparian condition, including canopy cover, are included in Appendix D. Reay Creek mainstem was predominately covered by shrubs with some mixed forest in the downstream reaches (2 and 6). All riparian stages of succession were present throughout the reaches ranging from non-vegetated to mature forest. A significant portion (148 m) of Reach 6 is non-vegetated due to agriculture and there is no canopy cover from the Norseman Road culver to the VAA property line fence due the recent creation of a stormwater detention pond.

3.4 Fish Sampling and Capture (Photos 53-60, Appendix H)

In total, 1 Cutthroat trout, 1 Coho Salmon, 102 Stickleback and Sculpin were caught in minnow traps during two days (June 6-7, 2018) of sampling (Figure 2). During pole seining activities, a total of 7 Cutthroat trout, 4 Coho Salmon and 12 Stickleback were captured at three different sites (Figure 2). One adult Cutthroat trout was captured by angling from the dam while a total of five adult Cutthroat Trout were observed to follow the fishing lure from different directions but did not bite. The Cutthroat Trout following the lure appeared to be of different size and approached from different direction leading to the conclusion that different fish not the same fish approached the lure.

In addition to fish, several Signal Crayfish (*Pacifastacus leniusculus*) and Roughskin Newts (*Taricha granulosa*) were caught by hand when walking in Reay Creek.

All detailed fish sampling data is summarized in the tables in Appendix G.

4 DISCUSSION

It was the purpose of this study to assess the fish and fish habitat available throughout Reay Creek and to evaluate the importance of the "Duck Pond" in light of the fish habitat findings. Reay Creek is a highly urbanized watershed with a history of anthropogenic impacts such as river pollution, impoundment and development. Based on these impacts, flow regime as well as, fish habitat quality and quantity throughout the creek have been degraded leading to a loss of habitat and fish production. Recent enhancement initiatives such as habitat complexation as well as addition of spawning gravel and water augmentation from a well have reversed some of the declines in fish habitat quality and quantity and led to a rebound in Cutthroat Trout and Coho Salmon populations.

The watershed is now productive and provides habitat for Coho Salmon and Cutthroat Trout. Due to enhancement activities, Reach 3 to the lower portion of Reach 6 provide cover and habitat complexity although there is still a lack of adult and juvenile holding pools, quality spawning gravel, and LWD frequency and distribution.

In general, due to climate change watersheds in southern BC are experiencing longer and more severe droughts and in combination with habitat destruction are likely to experience reduced productivity due to declines in habitat quantity and quality (Nelitz et al. 2007).

The Duck Pond in its current state, offers otherwise non-existing deep pond holding habitat in Reay Creek and likely acts as a reservoir to maintain flows to Lower Reay Creek during low water periods in late summer. The Duck Pond also offers an opportunity to continue enhancement initiatives by maximizing the Town of Sidney's water licence for conservation (3700.44 m^3/ year) by removing accumulated Pond sediments to create even more deep pool holding habitat for adult salmonids and retain more water during summer base flows.

Should the Pond be maintained in its current state with a new dam conforming to the BC Dam Safety Regulations[1], a fish ladder should be added to allow for easy upstream and downstream dam passage especially in high-flow conditions in the fall when Coho Salmon typically ascend

[1] http://www.bclaws.ca/civix/document/id/complete/statreg/40_2016

their natal streams for spawning. The fish-ladder should be self-maintaining and function throughout a wide range of flows without intervention.

Should the Duck Pond dam be removed leading to the loss of the actual deep pool habitat being replaced by pool-riffle sequences with spawning habitat, the following suggestions should be considered:

- The culvert installed below Canora Road currently feeding water into the Duck Pond will need to be re-assessed in its functionality for fish migration once the Pond is removed and will likely become a hanging culvert and may need to be replaced by an open-bottom culvert if not properly backwatered on the downstream end;
- The approximate gradient of 0.5% and a bankfull width of approximately 3 m from the culvert at Canora Road to the bottom of the dam would lend itself to the construction of approximately ten pool-riffle sequences at five meander wavelengths (Newbury and Gaboury 1993) and would need to be followed by the addition of LWD structures to add habitat complexity and the addition of spawning gravel to promote salmonid spawning.

In the following paragraph, we will compare the productivity of the current Duck Pond with the productivity of a creek section that would replace the Pond with pool-riffle sequences including the addition of LWD and spawning gravel. In general, a large and deep holding pond has an ecological function different from a pool-riffle sequence. A large and tree-lined holding pond will provide cover, consistent water depth throughout the low-water summer and winter months combined with high primary and secondary productivity to produce nutrition in the form of terrestrial insect larvae, aquatic insects and small forage fish such as Three-Spine Stickleback. This is reflected in the finding that beaver ponds and low current side-channel habitat considerably increase summer (Leidholt-Bruner et al. 1992) and winter (Bustard and Narver 1975; Morley et al. 2005; Malison et al. 2015; Ogston et al. 2015) rearing habitat for Coho fry. In pond habitat, fines accumulate and cover up all suitable spawning gravel.

Pool-riffle sequences with LWD and gravel additions, provide opportunities for spawning of adult trout and salmon in the riffle sections and pool tail-outs and opportunities of holding for juvenile salmonids in the pool sections while productivity in the pools will be lower than in a pond environment. Therefore, on one hand, fish growth is expected to be 30-70% higher in the pool environment (Swales and Levings 1989) while opportunity for spawning is not existing. On the other hand, should the Pond be removed, the total amount of added spawning habitat based on ten additional pool-riffle sequences would be approximately 150 m^2, having the potential to produce approximately 60 additional Coho smolts that are out-migrating into the ocean based on the salmonid bio-standards described in Slaney and Zaldokas (1997).

In conclusion, leaving the Pond in place by replacing the existing dam with a dam safety regulation conforming dam including a fish ladder (and removal of sediment) would increase the growth of salmonids in the Pond by 30-70% and provide suitable low water winter and summer rearing habitat, while the dam and Pond removal would create spawning habitat that would approximately produce an additional 60 Coho smolts leaving into the ocean. In addition, the Pond habitat appears to offer the right conditions for Cutthroat Trout to grow to maturity.

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Slaney. P.A. and D. Zaldokas. 1997. Fish rehabilitation procedures. Watershed Restoration Technical Circular No. 9. Watershed Restoration Program. British Columbia Ministry of Environment, Lands and Parks, Vancouver, British Columbia: 313 pp.

Swales, S. and C.D. Levings. 1989. Role of off-channel ponds in the life cycle of Coho Salmon (Oncorhynchus kisutch) and other juvenile salmonids in the Coldwater River, British Columbia. Canadian Journal of Fisheries and Aquatic Sciences, 46 (2): 232-242.

SLR. 2016. Data gap analysis – Reay Creek Pond Canora Road between Northbrook Drive and Bowcott Place Sidney, BB. SLR Project No.: 201.02016.00001; Prepared for: Town of Sidney, 2440 Sidney Avenue, Sidney, BC V8L 1Y7. Prepared by: SLR Consulting (Canada) Ltd. 200 - 1620 West 8th Avenue, Vancouver, BC V6J 1V4: 279 pp. with appendices.

TABLES

Table 2. Fish species present in the Reay Creek Watershed.

Fish Species
Prickly Sculpin
Coho Salmon
Coastal Cutthroat Trout
Threespine Stickleback

Table 3. Life history stage classification and fork length criteria (Groot and Margolis 1991).

Fish Species	Life Stage	Fork Length Criteria
Prickle Sculpin	NA	NA
Coho Salmon	Fry	≤ 70 mm
	Parr/Smolt	> 70 mm
Coastal Cutthroat Trout	Fry	≤ 45 mm
	Parr	> 45 mm and ≤ 90 mm
	Smolt/Yearling	> 90 mm and ≤ 300 mm
	Adult	> 300 mm
Threespine Stickleback	NA	NA

NA = not applicable

FIGURES

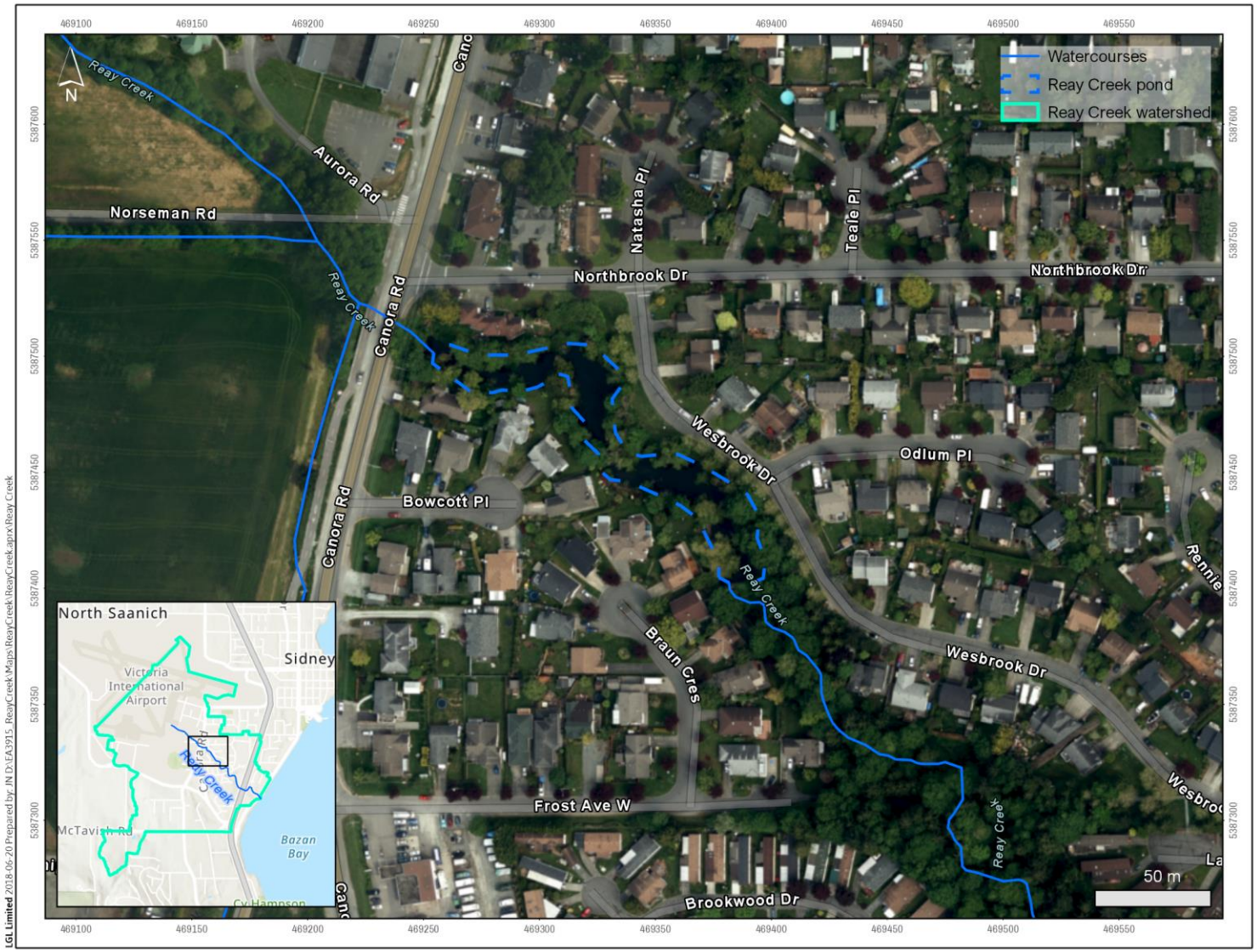

Figure 1. Reay Creek Duck Pond location

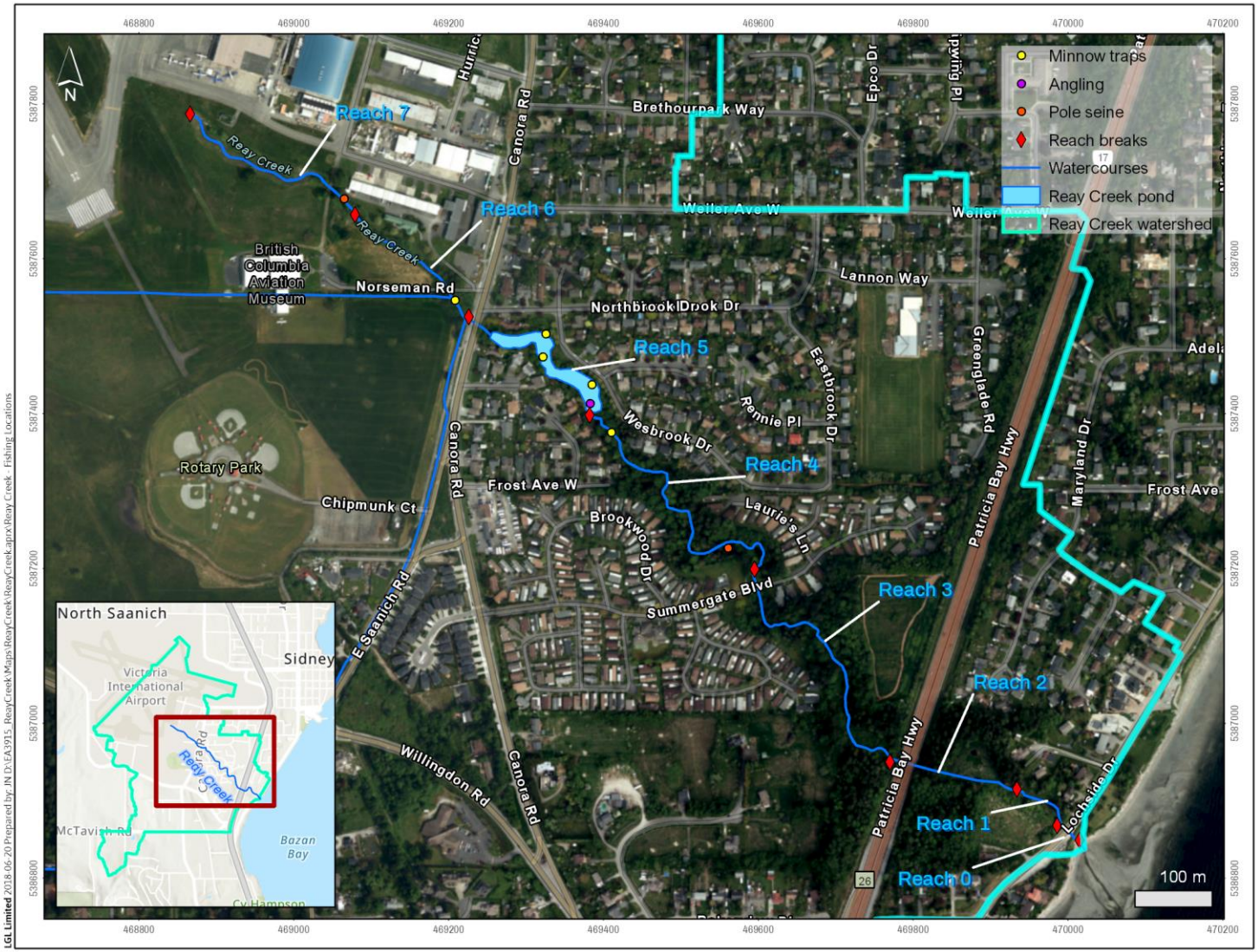

Figure 2. Reay Creek watershed with creek reach brakes, and fish sampling locations

Appendices

Appendix A

Literature Summary Table

Summary table for the Reay Creek literature that was reviewed for this report but not part of the literature cited.

Authors and Year	Title	Key Words or Abstract
Peninsula News Review, Steven Heywood. May 6, 2015 (newspaper article)	Reay Creek plan back on the table May 12.	• Victoria Airport Authority; • Consultation community meeting preparation; • Remediation of remediation planning by Town of Sidney; • Sediment contamination, dam construction • Reay Creek organization formed by citizens
Peninsula News Review, Steven Heywood. May 26, 2015 (newspaper article)	Rallying for Reay Creek	• Public rally in support of Reay Creek contamination • Clean-up of watercourse and pond funding by federal Ministry of Transportation • Local MP and MLA will speak at rally
Peninsula News Review, Our View – Editorial. April 17, 2015 (newspaper article)	Contaminated site for sore eyes	• Town of Sidney is taking lead role in Reay Creek clean-up based on citizens pressure
Town of Sidney Media Release, February 27, 2015	Town of Sidney to organize stakeholders to investigate options to clean-up Reay Creek	• Town of Sidney will organize a group of stakeholders, property owners and government agencies to investigate options and costs to clean up Reay Creek
Presentation given by Mike van der Linden, Town of Sidney	Reay Creek Pond	• Outline of clean-up approach and potential impacts to adjacent properties
Chad Davey, Kerr Wood Leidal. August 4, 2015. Technical Memorandum to James Bogusz, Victoria Airport Authority	Reay Creek Preliminary Stormwater Impact Assessment Technical Memorandum No. 2 – Erosion Assessment. Our File 2083.022 300	• Report on field investigation to determine the location and severity of the erosion along Reay Creek; and • Meetings with individual property owners along Reay Creek to discuss their concerns with respect to bank erosion along Reay Creek.

Victoria Airport Authority, September 22, 2013. Presentation	Reay Creek Remediation Project	The presentation describes: • The approach to and execution of works that leading to reduction in heavy metal and other pollutant concentrations in storm water runoff; • The incorporation of fish and riparian habitat features for potential fish habitat restoration in upper Reay Creek in the future; and • The provision of emergency storage to limit the impact of contaminant spills or other emergent events.
SLR. May 2015. (for Town of Sidney)	Reay Creek Pond Sediment Investigations Canora Road Between Northbrook Drive and Bowcott Place – SLR Project No.: 205.03696.00000	• The report summarizes results of the analysis of sediment samples from eight locations throughout Reay Creek.
Victoria Airport Authority, May 12, 2015. Presentation	Residents of Reay Creek	• The presentation outlines the Victoria Airport Authority's consultation process to address sediment contamination and bank erosion concerns with Reay Creek residents.

Appendix B
Reay Creek FHAP Measurements

Appendix B Physical data collected during the Reay Creek FHAP.

													Percent Bed Material (range in mm)				Spawning Gravel			Pools Only						Functional LWD Tally			Cover				Off-channel Habitat							
Sub Basin	Reach	Reach location (m) [1]	Habitat type [3]	Habitat category [4]	Habitat length (m)	Gradient (%)	Mean depth (m)	Bank height (m)	Bankfull width (m)	Wetted width (m)	Rearing Habitat Area (m^2) [5]	<2 mm	2-64 mm	64-256 mm	>256 mm	Type [6]	Quality [7]	Amount (m^2)	Maximum depth (m)	Crest depth (m)	Residual depth (m)	Control element [8]	Good holding pool? [9]	Total LWD tally	10 to 20 cm	20 to 50 cm	>50 cm	Woody debris	Boulder	Cutbank	Deep pool	Instream veg.	Total instream cover	Overhanging veg.	Type [10]	Access [11]	Length (m)	Channel Disturbances [12]	Barriers [13]	COMMENTS
Reay Creek	Reay Creek 0	0	O	1	31	0.5	0.09	1.55	0.1	2.2	68							0			0.00			0									0							Culvert at Lochside Drive
Reay Creek	Reay Creek 1	31	G	1	11	0.5	0.33	0.25	4.7	3.5	39	10	90			AR	M	35			0.00	CV		0									0	60						
Reay Creek	Reay Creek 1	42	P	1	41	0.2	0.20	0.60	8.0	7.0	287	100				N		0	0.50	0.36	0.14	GL	N	0						15	20		35	5						
Reay Creek	Reay Creek 1	83	G	1	8	0.2	0.22	0.50	3.9	3.1	24	70	30			AR	L	7			0.00			0						20			20	30						
Reay Creek	Reay Creek 1	91	P	1	5	0.2	0.90	0.60	8.0	7.5	39	99	1			N		0	1.15	0.30	0.85	GL	Y	0				20	20	15			55	30						
Reay Creek	Reay Creek 2	96	G	1	93	0.5	0.25	0.90	1.1	0.9	86	95	5			N		4			0.00			0						10			10	30				JM		SWD jam present in reach
Reay Creek	Reay Creek 2	189	P	1	32	0.2	0.50	0.70	7.2	6.0	190	100				N		0	1.13	0.11	1.02	GL	Y	0						2	25		27	30						
Reay Creek	Reay Creek 2	221	O	1	42	0.5	0.40	0.45	1.1	1.1	46					N		0			0.00			0									0	10						Culvert at Pat Bay Hwy
Reay Creek	Reay Creek 3	263	G	1	200	0.5	0.16	0.25	4.0	2.8	550	100				N		0			0.00			0								5	5	80						
Reay Creek	Reay Creek 3	463	P	1	4	0.2	0.23	1.20	2.2	2.1	9	95	5			R	L	0	0.27	0.11	0.16	GL	N	0						1	5		6	70						
Reay Creek	Reay Creek 3	467	G	1	76	0.5	0.09	0.3	1.8	1.43	109	69	30	1		AR	M	33			0.00			0						1			1	40						
Reay Creek	Reay Creek 3	543	P	1	13	0.2	0.35	0.4	3.7	3.4	44	95	1	4		AR	L	1	0.51	0.12	0.39	GL	N	0							5	1	6	40						
Reay Creek	Reay Creek 3	556	O	1	40	0.2	0.37	1.15	1.2	0.5	20					N		0			0.00			0									0							Culvert at Summergate Road
Reay Creek	Reay Creek 4	596	R	1	9	1.5	0.12	10.00	1.8	1.7	14		10	50	40	AR	H	3			0.00			0				10				5	15	10						
Reay Creek	Reay Creek 4	605	P	1	38	0.2	0.30	1.51	6.0	5.5	209	98	2			R	L	4	0.56	0.15	0.41	RI	N	1		1		1			5		6	30						
Reay Creek	Reay Creek 4	643	G	1	9	1.0	0.22	0.81	3.6	3.4	29	99	1			N		0			0.00			0						1			1	30						
Reay Creek	Reay Creek 4	651	R	1	4	2.0	0.07	0.52	2.3	1.9	8	4	80	15	1	AR	H	6			0.00			0									0	2						SWD jam present
Reay Creek	Reay Creek 4	655	P	1	23	0.2	0.25	1.13	2.5	2.1	48	89	10		1	R	L	5	0.41	0.10	0.31	RI	N	5	1	4		5.0			5		10	30						
Reay Creek	Reay Creek 4	678	G	1	24	1.0	0.28	0.55	2.4	2.1	49	5	79	5	1	AR	H	39			0.00			0					1				1	25						
Reay Creek	Reay Creek 4	702	R	1	2	2.0	0.03	0.74	3.5	2.9	6	59	30	10	1	AR	M	2			0.00			0					1				1	70						
Reay Creek	Reay Creek 4	704	P	1	14	0.2	26.00	1.00	3.9	2.7	38	95		5		AR	L	0	0.34	0.07	0.27		N	0					1				1	60						
Reay Creek	Reay Creek 4	718	R	1	2	1.0	0.01	1.10	3.3	2.9	4		90	10		AR	H	4			0.00			0									0	75						
Reay Creek	Reay Creek 4	720	P	1	17	0.5	0.27	1.08	4.0	3.1	52	94	1	5		A	L	1	0.36	0.11	0.25		N	0							1		1	70						
Reay Creek	Reay Creek 4	736	R	1	2	1.0	0.01	0.70	2.8	2.5	5		99	1		AR	H	4			0.00			0									0	80						
Reay Creek	Reay Creek 4	738	P	1	13	0.5	0.45	2.00	3.8	3.2	41	98			2	R	H	0	0.67	0.11	0.56	RI	N	2			2	5.0	1				6	60						
Reay Creek	Reay Creek 4	751	G	1	26	0.2	0.14	0.80	2.3	2.1	54	97	2	1		R	L	1			0.00			1	1			5.0					5	80						SWD jam present
Reay Creek	Reay Creek 4	777	R	1	5	2.0	0.04	1.50	2.7	2.0	9	1	95	3	1	AR	H	9			0.00			0									0	80						

Appendix B Continued Physical data collected during the Reay Creek FHAP.

													Percent Bed Material (range in mm)				Spawning Gravel			Pools Only					Functional LWD Tally			Cover					Off-channel Habitat							
Sub Basin	Reach	Reach location (m) [1]	Habitat type [3]	Habitat category [4]	Habitat length (m)	Gradient (%)	Mean depth (m)	Bank height (m)	Bankfull width (m)	Wetted width (m)	Rearing Habitat Area (m^2) [5]	<2 mm	2-64 mm	64-256 mm	>256 mm	Type [6]	Quality [7]	Amount (m^2)	Maximum depth (m)	Crest depth (m)	Residual depth (m)	Control element [8]	Good holding pool? [9]	Total LWD tally	10 to 20 cm	20 to 50 cm	>50 cm	Woody debris	Boulder	Cutbank	Deep pool	Instream veg.	Total instream cover	Overhanging veg.	Type [10]	Access [11]	Length (m)	Channel Disturbances [12]	Barriers [13]	COMMENTS
Reay Creek	Reay Creek 4	782	P	1	7	0.2	0.18	1.10	3.8	3.3	22	89	10	1		AR	L	2	0.24	0.08	0.16	RI	N	0									0	60						
Reay Creek	Reay Creek 4	789	R	1	9	2.0	0.07	1.05	2.7	2.2	18	5	92	2	1	AR	H	17			0.00			0									0	75						
Reay Creek	Reay Creek 4	797	G	1	7	1.0	0.20	1.30	3.0	2.7	19	5	10	85		AR	M	5			0.00			0									0	70						
Reay Creek	Reay Creek 4	804	R	1	1	2.0	0.01	1.70	3.3	2.4	3		95	5		AR	H	3			0.00			0									0	80						
Reay Creek	Reay Creek 4	806	G	1	16	0.5	0.24	1.80	3.9	3.7	57	98	1	1		N		1			0.00			0									0	70						
Reay Creek	Reay Creek 4	821	P	1	8	0.2	0.38	2.30	5.5	3.5	27	95	5			AR	P	1	0.43	0.19	0.24	GL	N	3		2	1	10.0			10		20	70						
Reay Creek	Reay Creek 4	829	G	1	15	0.5	0.12	0.98	2.8	2.3	34	95	5			R	L	2			0.00			0									0	70						
Reay Creek	Reay Creek 4	844	R	1	13	1.5	0.04	1.18	4.1	3.1	40		90	5	5	AR	H	36			0.00			1	1			5.0	1	5			11	10						High abundance of CO and CTT; LB culvert
Reay Creek	Reay Creek 4	857	P	1	17	0.2	0.38	1.80	3.0	2.7	46	70	3	2	15	AR	M	2	0.46	0.13	0.33	RI	Y	1	1			1.0	10	5	30		46	40						
Reay Creek	Reay Creek 4	874	G	1	10	0.5	0.18	1.90	2.3	9.8	96	70	30			AR	M	29			0.00			0						5			5	75						
Reay Creek	Reay Creek 4	884	R	1	2	1.5	0.02	0.90	2.8	2.4	6	1	98	1		AR	H	6			0.00			0									0	70						
Reay Creek	Reay Creek 4	886	G	1	5	0.5	0.12	0.73	3.7	3.6	19	95	5			R	L	1			0.00			0						1			1	1						
Reay Creek	Reay Creek 4	892	R	1	6	1.5	0.13	0.89	3.3	2.9	16		99	1		AR	H	16			0.00			0						1			1	1						
Reay Creek	Reay Creek 4	897	P	1	11	0.2	0.30	0.38	4.8	4.7	50	95	3	2		R	L	2	0.53	0.10	0.43	RI	Y	0						1	20	15	36	5						
Reay Creek	Reay Creek 4	908	R	1	5	2.0	0.10	4.00	3.1	2.1	10	98		1	1	N		0			0.00			0								20	20	5						
Reay Creek	Reay Creek 4	913	P	1	3	0.5	0.30	4.50	3.0	2.7	9	98	1	1		N		0	0.41	0.08	0.33	RI	Y	0							20	15	35	20						
Reay Creek	Reay Creek 4	916	R	1	11	1.5	0.11	3.20	3.1	2.5	28	1		14	85	N		1			0.00			0					5			10	15	40						
Reay Creek	Reay Creek 4	927	P	1	20	0.5	0.33	0.80	3.1	2.7	54	15	82	2	1	AR	H	45	0.47	0.11	0.36			0					5		30	10	45	2						
Reay Creek	Reay Creek 4	947	R	1	2	2.0	0.08	0.92	1.2	0.8	2	100				N		0			0.00			0								30	30	30						
Reay Creek	Reay Creek 4	949	P	1	9	0.5	0.40	0.90	2.6	2.2	19	99	1			N		0	0.53	0.11	0.42	RI	Y	0								15	15	30						
Reay Creek	Reay Creek 4	958	R	1	7	1.5	0.39	0.55	4.1	0.5	3	99	1			N		0			0.00			0								20	20	60						
Reay Creek	Reay Creek 4	965	P	1	7	0.5	0.33	0.82	2.7	2.3	17	100				N		0	0.44	0.10	0.34	RI	Y	0							10	20	30	30						
Reay Creek	Reay Creek 4	972	R	1	5	1.5	0.04	0.40	7.5	7.1	32	10	80	5	5	AR	H	26			0.00			0								5	5	50						
Reay Creek	Reay Creek 4	977	P	1	21	0.5	0.51	0.39	3.4	3.3	70	90	4	1	5	AR	L	3	0.95	0.06	0.89	RI	Y	2		2		1.0	5	5	15	5	31	4						
Reay Creek	Reay Creek 4	998	R	1	15	3.0	0.10	1.50	2.0	1.9	28	5	25	40	30	AR	M	9			0.00			0					15			5	20	40						
Reay Creek	Reay Creek 5	1013	P	1	255	0.5	0.40	0.75	30.0	25.0	6375	98		1	1	N		13	2.00	0.10	1.90	O	Y	2		2		5.0			20	30	55	40				O		O	Duck Pond' with a dam present at outlet
Reay Creek	Reay Creek 6	1268	O	1	35	0.5	0.11		1.4	1.4	48					N		0			0.00			0									0						Culvert at Canora Road
Reay Creek	Reay Creek 6	1303	G	1	7	1.0	0.07	0.40	2.9	2.4	18	5	93	1	1	AR	M	16			0.00			0								2	2	75						
Reay Creek	Reay Creek 6	1310	P	1	8	0.5	0.32	0.43	2.8	2.5	20	1	99			AR	M	20	0.41	0.17	0.24	GL	N	0						5		5	10	60						

Appendix B Continued Physical data collected during the Reay Creek FHAP.

													Percent Bed Material (range in mm)				Spawning Gravel			Pools Only					Functional LWD Tally			Cover				Off-channel Habitat							
Sub Basin	Reach	Reach location (m) [1]	Habitat type [3]	Habitat category [4]	Habitat length (m)	Gradient (%)	Mean depth (m)	Bank height (m)	Bankfull width (m)	Wetted width (m)	Rearing Habitat Area (m^2) [2] [5]	<2 mm	2-64 mm	64-256 mm	>256 mm	Type [6]	Quality [7]	Amount (m^2)	Maximum depth (m)	Crest depth (m)	Residual depth (m)	Control element [8]	Good holding pool? [9]	Total LWD tally	10 to 20 cm	20 to 50 cm	>50 cm	Woody debris	Boulder	Cutbank	Deep pool	Instream veg.	Total instream cover	Overhanging veg.	Type [10]	Access [11]	Length (m)	Channel Disturbances [12]	Barriers [13]	COMMENTS
Reay Creek	Reay Creek 6	1318	R	1	1	1.5	0.04	0.40	2.9	1.5	2	100				N		0			0.00			0								15	15	70						
Reay Creek	Reay Creek 6	1319	P	1	14	0.5	0.28	0.45	2.9	2.1	29	1	97	1	1	AR	H	28	0.50	0.12	0.38	RI	N	0				1		10		1	12	40						
Reay Creek	Reay Creek 6	1333	R	1	3	2.0	0.10	0.30	1.6	1.0	2	100				N		0			0.00			0								20	20	50						
Reay Creek	Reay Creek 6	1335	P	1	11	0.5	0.40	0.70	2.5	2.1	22	75		20	5	AR	M	1	0.57	0.16	0.41	RI	Y	0							5	5	10	40						
Reay Creek	Reay Creek 6	1346	R	1	4	2.0	0.04	0.55	2.8	0.6	2	100				N		0			0.00			0								5	5	40						
Reay Creek	Reay Creek 6	1350	O	1	15	0.5	0.28		0.2	0.2	3					N		0				O																CV	Norseman Road Culvert
Reay Creek	Reay Creek 6	1365	G	1	6	1.0	0.28	1.50	4.8	2.2	13	1	8	85	5	A	M	3			0.00			0				1					1						Sediment wall present
Reay Creek	Reay Creek 6	1371	P	1	8	0.5	0.50	1.55	5.5	4.5	36	3	7	90		A	M	9	1.25	0.30	0.95	O	N	0				1		20			21						Cover elements should be added
Reay Creek	Reay Creek 6	1379	G	1	94	1.0	0.10	0.80	3.2	2.4	225	20	30	50		AR	H	90			0.00			0									0						No cover present
Reay Creek	Reay Creek 6	1473	R	1	13	2.0	0.06	0.85	1.8	1.2	16	5	15	80		AR	M	5			0.00			0									0						No cover present
Reay Creek	Reay Creek 6	1486	G	1	27	1.0	0.03	0.75	2.0	1.3	35	5	25	70		AR	H	14			0.00			0									0						No cover present
Reay Creek	Reay Creek 6	1513	O	1	20	0.5	0.02		0.2	0.2	3					N		0			0.00			0									0						Culvert at VAA fence
Reay Creek	Reay Creek 7	1533	G	1	23	0.5	0.13	0.50	1.5	1.4	31	99			1	N		0			0.00			0				1				5	6	70						
Reay Creek	Reay Creek 7	1556	R	1	3	1.5	0.01	1.55	1.2	0.9	3	5	95			AR	M	2			0.00			0								1	1	5						
Reay Creek	Reay Creek 7	1559	G	1	9	0.5	0.14	0.72	2.3	1.9	17	95		5		N		0			0.00			0								2	2	50						
Reay Creek	Reay Creek 7	1568	R	1	7	1.5	0.10	3.00	2.8	1.9	12	10	10	20	50	AR	M	2			0.00			0				20					20	5					
Reay Creek	Reay Creek 7	1574	O	1	18	0.5	0.01	1.52	0.5	0.2	4					N		0			0.00			0									0						Culvert at VAA unnamed road
Reay Creek	Reay Creek 7	1592	P	1	15	0.2	0.23	0.92	5.8	5.5	80	100				N		0	0.43	0.22	0.21	CV	N	0								20	20	25						
Reay Creek	Reay Creek 7	1606	G	1	185	0.5	0.22	0.80	4.1	2.4	435	100				N		0			0.00			0								10	10	75						
Reay Creek	Reay Creek 7	1791	R	1	19	1.0	0.06	0.85	2.4	1.7	32		5	95		AR	M	8			0.00			0								10	10	70						
Reay Creek	Reay Creek 7	1810	P	1	14	0.5	0.40	1.00	4.4	4.0	55	10	10	50	30	AR	H	11	0.53	0.13	0.40	RI	Y	0				15		20		5	40	10						

[1] Reach location denotes the distance upstream from the lower reach break.

[2] Sampling fraction is used to expand habitat measurements to the entire reach (e.g. SF_p = 0.2 if only 1 in every 5th pool was sampled). (N/A for this project).

[3] Habitat types are: pool (P), riffle (R), glide (G), cascade (C), other (O).

[4] Habitat categories are: primary habitat type (1), side channel (2), tertiary scour pool (3).

[5] Habitat area is calculated for rearing salmonids as length multiplied by wetted width.

[6] Spawning gravel type codes are: suitable for anadromous salmon (A), suitable for resident trout and char (R), suitable for both salmon and trout (AR), not suitable (N).

[7] Spawning gravel quality codes are: low (L), moderate (M), high (H), none (N).

[8] Control element codes are: boulder (B), bedrock (R), wood (W), beaver dam (D), culvert (CV), riffle (RI), glide (G) and other (O).

[9] A pool is classified as a good adult holding pool (Y) if the product of the maximum depth times the total overhead cover is >= 30. Overhead cover is the sum of LWD, boulder, cutbank and overhanging vegetation.

[10] Off-channel habitat codes are: alcove (ALC), side channel (SC), slough (SL), pond (PD), wetland (WL), spring (SP), other (O).

[11] Off-channel access codes are: no access (N), high flow only (P), most flows (G).

[12] Disturbance indicator codes are: scour (SC), unvegetated bar (DW), sediment wedge (WG), middle-channel bars (MB), extensive riffle zone (LR), road crossing thru creek at riffle crest or pool tailout (RC), multiple channels (MC), eroding banks (EB), back-channels (BC), LWD parallel to bank (PD), LWD jams (JM), avulsion (AV), >50% silt content (E), other (O).

[13] Potential barrier codes are: none (N), log jam (X), falls > 2 m (F), culvert (CV), bridge (BR), beaver dam (BD), land slide or bank failure (LS), cascade or chute (C), other (O).

APPENDIX C

AREA SURVEYED AND PERCENTAGE OF EACH PRIMARY HABITAT TYPE IN REAY CREEK WATERSHED.

Appendix C Area surveyed and percentage of each primary habitat type in Reay Creek watershed.

Reach Number	Mean Bankfull Width (m)	Surveyed Length (m)	Surveyed Area (m^2)	Percent Habitat Type		
				Pool	Riffle	Glide
Reay Creek 0	0.1	31	68	0.0	0.0	0.0
Reay Creek 1	6.1	65	389	83.9	0.0	16.1
Reay Creek 2	3.1	167	322	58.9	0.0	26.8
Reay Creek 3	2.6	333	732	7.3	0.0	90.0
Reay Creek 4	3.3	417	1291	57.0	18.0	25.1
Reay Creek 5	30.0	255	6375	100.0	0.0	0.0
Reay Creek 6	2.6	250	470	22.6	4.8	61.7
Reay Creek 7	2.8	277	646	21.0	3.5	74.9

APPENDIX D

SUMMARY OF COVER ATTRIBUTES, DETAILED CANOPY AND RIPARIAN STAGE DESCFRIPTIONS FOR REAY CREEK WATERSHED.

Appendix D Summary of cover attributes, detailed canopy and riparian stage descriptions for Reay Creek watershed.

Sub		Reach	Habitat	Habitat	Canopy	Riparian	
Basin	Reach	Loc.[1]	Type[2]	Length[3]	Code[4]	Type[5]	Stage[6]
Reay Creek	Reay Creek 0	0	O	31	n/a	n/a	n/a
Reay Creek	Reay Creek 1	31	G	11	2	D	PS
Reay Creek	Reay Creek 1	42	P	41	2	S	SH
Reay Creek	Reay Creek 1	83	G	8	2	S	SH
Reay Creek	Reay Creek 1	91	P	5	2	S	SH
Reay Creek	Reay Creek 2	96	G	93	4	S	SH
Reay Creek	Reay Creek 2	189	P	32	4	D	YF
Reay Creek	Reay Creek 2	221	O	42	n/a	n/a	n/a
Reay Creek	Reay Creek 3	263	G	200	7	S	SH
Reay Creek	Reay Creek 3	463	P	4	4	S	SH
Reay Creek	Reay Creek 3	467	G	76	7	S	SH
Reay Creek	Reay Creek 3	543	P	13	4	S	SH
Reay Creek	Reay Creek 3	556	O	40	n/a	n/a	n/a
Reay Creek	Reay Creek 4	596	R	9	2	S	SH
Reay Creek	Reay Creek 4	605	P	38	4	S	SH
Reay Creek	Reay Creek 4	643	G	9	4	S	SH
Reay Creek	Reay Creek 4	651	R	4	2	S	SH
Reay Creek	Reay Creek 4	655	P	23	4	S	SH
Reay Creek	Reay Creek 4	678	G	24	4	S	SH
Reay Creek	Reay Creek 4	702	R	2	4	S	SH
Reay Creek	Reay Creek 4	704	P	14	4	S	SH
Reay Creek	Reay Creek 4	718	R	2	7	S	SH
Reay Creek	Reay Creek 4	720	P	17	4	S	SH
Reay Creek	Reay Creek 4	736	R	2	7	S	SH
Reay Creek	Reay Creek 4	738	P	13	4	S	SH
Reay Creek	Reay Creek 4	751	G	26	7	S	SH
Reay Creek	Reay Creek 4	777	R	5	7	S	SH
Reay Creek	Reay Creek 4	782	P	7	4	S	SH
Reay Creek	Reay Creek 4	789	R	9	7	S	SH
Reay Creek	Reay Creek 4	797	G	7	7	S	SH
Reay Creek	Reay Creek 4	804	R	1	7	S	SH
Reay Creek	Reay Creek 4	806	G	16	7	S	SH
Reay Creek	Reay Creek 4	821	P	8	7	S	SH
Reay Creek	Reay Creek 4	829	G	15	7	S	SH
Reay Creek	Reay Creek 4	844	R	13	2	C	MF
Reay Creek	Reay Creek 4	857	P	17	4	S	SH
Reay Creek	Reay Creek 4	874	G	10	7	S	SH
Reay Creek	Reay Creek 4	884	R	2	7	S	SH
Reay Creek	Reay Creek 4	886	G	5	0	S	SH
Reay Creek	Reay Creek 4	892	R	6	0	S	SH
Reay Creek	Reay Creek 4	897	P	11	0	S	SH
Reay Creek	Reay Creek 4	908	R	5	2	S	SH

Appendix D continued

Sub Basin	Reach	Reach Loc.[1]	Habitat Type[2]	Habitat Length[3]	Canopy Code[4]	Riparian Type[5]	Riparian Stage[6]
Reay Creek	Reay Creek 4	913	P	3	2	S	SH
Reay Creek	Reay Creek 4	916	R	11	0	S	SH
Reay Creek	Reay Creek 4	927	P	20	2	S	SH
Reay Creek	Reay Creek 4	947	R	2	2	S	SH
Reay Creek	Reay Creek 4	949	P	9	4	S	SH
Reay Creek	Reay Creek 4	958	R	7	4	S	SH
Reay Creek	Reay Creek 4	965	P	7	2	S	SH
Reay Creek	Reay Creek 4	972	R	5	4	S	SH
Reay Creek	Reay Creek 4	977	P	21	7	S	SH
Reay Creek	Reay Creek 4	998	R	15	4	S	SH
Reay Creek	Reay Creek 5	1013	P	255	4	D	YF
Reay Creek	Reay Creek 6	1268	O	35	n/a	n/a	n/a
Reay Creek	Reay Creek 6	1303	G	7	7	S	SH
Reay Creek	Reay Creek 6	1310	P	8	4	S	SH
Reay Creek	Reay Creek 6	1318	R	1	7	S	SH
Reay Creek	Reay Creek 6	1319	P	14	4	S	SH
Reay Creek	Reay Creek 6	1333	R	3	4	S	SH
Reay Creek	Reay Creek 6	1335	P	11	4	S	SH
Reay Creek	Reay Creek 6	1346	R	4	4	S	SH
Reay Creek	Reay Creek 6	1350	G	6	0	D	YF
Reay Creek	Reay Creek 6	1356	P	8	0	D	YF
Reay Creek	Reay Creek 6	1364	G	94	0	D	PS
Reay Creek	Reay Creek 6	1458	R	13	0	D	PS
Reay Creek	Reay Creek 6	1471	G	27	0	D	PS
Reay Creek	Reay Creek 6	1498	O	20	n/a	n/a	n/a
Reay Creek	Reay Creek 7	1518	G	23	7	S	SH
Reay Creek	Reay Creek 7	1541	R	3	2	S	SH
Reay Creek	Reay Creek 7	1544	G	9	4	S	SH
Reay Creek	Reay Creek 7	1553	R	7	2	S	SH
Reay Creek	Reay Creek 7	1559	O	18	n/a	n/a	n/a
Reay Creek	Reay Creek 7	1577	P	15	4	D	PS
Reay Creek	Reay Creek 7	1591	G	185	7	S	SH
Reay Creek	Reay Creek 7	1776	R	4	7	S	SH
Reay Creek	Reay Creek 7	1781	P	14	2	S	SH

[1] Reach location (in meters); denotes the distance upstream from the lower reach break.

[2] Habitat types are: pool (P), riffle (R), glide (G), cascade (C) and other (O).

[3] Habitat length is the length (m) of the habitat unit being assessed.

[4] Canopy code for Reay Creek is: 0 = 0-20%; 2 = 21-40%;
4 = 41-70%; 7 = 71-90%; 4 = 71-90%; 9 = > 90%;

[5] Riparian type denotes the dominant type within 20 m of the stream: D=deciduous,
C=coniferous, M=mixed, N = largely bare, S =shrub / herb and G = grasslands / bog.

[6] Riparian stage of the dominanat vegetation: IN = non vegetated, SH = shrub / herb,
PS = pole sapling, YF = young forest and MF = mature forest.

APPENDIX E

SUMMARY OF BED MATERIAL AND SPAWNING ATTRIBUTES FOR STUDY AREA REACHES

Appendix E Summary of bed material and spawning attributes for Reay Creek watershed.

Reach Number	Bed Material Composition (%)					Spawning Quantity (m^2)		Spawning Quality[3]
	<2 mm	2-64 mm	64-256 mm	>256 mm	Bedrock	Minimum[1]	Maximum[2]	
Reay Creek 0	0.0	0.0	0.0	0.0	0.0	0	0	Poor
Reay Creek 1	89.1	10.9	0.0	0.0	0.0	0	42	Poor
Reay Creek 2	84.3	1.3	0.0	0.0	0.0	0	4	Poor
Reay Creek 3	92.3	4.6	0.4	0.0	0.0	0	34	Poor
Reay Creek 4	69.3	21.2	4.5	4.2	0.0	0	286	Poor
Reay Creek 5	98.0	0.0	1.0	1.0	0.0	0	13	Poor
Reay Creek 6	15.6	31.0	42.0	0.5	0.0	0	185	Fair
Reay Creek 7	88.2	1.5	5.9	3.6	0.0	0	17	Poor

[1] Value estimated from actual measurements of all reaches.

[2] Value = (%gravels (2-64 mm) + 20 % cobbles (64-256 mm))*length*wetted width (surveyed area only).

[3] Poor is fines (<2 mm) >25%, Fair if fines >15% and uncompacted, Good if fines < =15% and uncompacted.

APPENDIX F

Summary of large woody debris (LWD) attributes for study area reaches.

Appendix F Summary of large woody debris (LWD) attributes for study area reaches.

Reach Number	Habitat Unit	Surveyed Length (m)	Mean Bankfull Width (m)	Number of Functional LWD [1]				Total All LWD	Recommended Number of LWD Pieces [2]		
				<20 cm	20-50 cm	>50 cm	Total		10m x 0.35m pieces	10m x 0.5m pieces	10m x 0.75m pieces
Reay Creek 0	All	31	0.1	0	0	0	0	0	n/a	n/a	n/a
Reay Creek 1	All	65	6.1	0	0	0	0	0	54	27	12
Reay Creek 2	All	167	3.1	0	0	0	0	0	139	68	30
Reay Creek 3	All	333	2.6	0	0	0	0	0	278	136	60
Reay Creek 4	All	417	3.3	4	9	3	16	16	347	170	75
Reay Creek 5	All	255	30.0	0	2	0	2	2	106	52	23
Reay Creek 6	All	250	2.6	0	0	0	0	0	209	102	45
Reay Creek 7	All	277	2.8	0	0	0	0	0	231	113	50

[1] To be termed functional, a piece of LWD must be providing cover, a control element for a pool or modifying channel morphology.

[2] Modified from Cederholm et al. (1997) such that recommended volume of LWD per 100 m of stream is 80 m^3 for streams with less than or equal to 10 m bankfull width and 40 m^3 for streams with greater than 10 m bankfull width.

APPENDIX G
FISH CAPTURE DATA

Appendix G Minnow Trapping Catch and Effort

Set/Trap#	Start Date	Set Start Time (hh:mm)	End Date	Set End Time (hh:mm)	Soak time (hours)	Location (UTM)	Catch (# fish)				Comments
							Cutthroat	Coho	Stickleback	Sculpin	
1	5-Jun	11:07	6-Jun	10:50	23:43	10 U 469326 E; 5387503 N	0	0	3	0	North east side of the duck pond
2	5-Jun	11:07	6-Jun	10:50	23:43	10 U 469326 E; 5387503 N	0	0	0	0	North east side of the duck pond
3	5-Jun	11:07	6-Jun	10:50	23:43	10 U 469326 E; 5387503 N	0	0	6	0	North east side of the duck pond
4	5-Jun	11:20	6-Jun	11:04	23:44	10 U 469385 E; 5387437 N	0	0	15	0	Near Odlum Place side of the duck pond
5	5-Jun	11:20	6-Jun	11:07	23:47	10 U 469385 E; 5387437 N	0	0	0	0	Near Odlum Place side of the duck pond
6	5-Jun	11:20	6-Jun	11:09	23:49	10 U 469385 E; 5387437 N	0	0	4	0	Near Odlum Place side of the duck pond
7	5-Jun	11:45	6-Jun	11:25	23:40	10 U 469383 E; 5387413 N	0	0	0	0	At the dam of the duck pond
8	5-Jun	11:45	6-Jun	11:30	23:45	10 U 469383 E; 5387413 N	0	0	4	0	At the dam of the duck pond
9	5-Jun	11:45	6-Jun	11:32	23:47	10 U 469383 E; 5387413 N	0	0	0	0	At the dam of the duck pond
10	5-Jun	11:45	6-Jun	11:25	23:40	10 U 469383 E; 5387413 N	0	0	1	0	At the dam of the duck pond
11	5-Jun	12:35	6-Jun	13:28	24:53	10 U 469322 E; 5387473 N	0	0	13	0	Westside of the duck pond near Bowcott Place
12	5-Jun	11:45	6-Jun	13:32	25:47	10 U 469322 E; 5387473 N	0	0	7	0	Westside of the duck pond near Bowcott Place
1	6-Jun	11:58	7-Jun	10:40	22:42	10 U 469410 E; 5387376 N	0	0	0	0	Dowstream of dam; Water temp. = 15.0°C
2	6-Jun	11:53	7-Jun	10:38	22:45	10 U 469410 E; 5387376 N	0	0	3	0	Dowstream of dam
3	6-Jun	13:05	7-Jun	11:20	22:15	10 U 469208 E; 5387546 N	0	0	5	0	Upstream of Canora Road
4	6-Jun	13:05	7-Jun	11:17	22:12	10 U 469208 E; 5387546 N	0	0	9	0	Upstream of Canora Road
5	6-Jun	13:15	7-Jun	11:17	22:02	10 U 469208 E; 5387546 N	0	0	6	0	Upstream of Canora Road
6	6-Jun	11:52	7-Jun	10:39	22:47	10 U 469410 E; 5387376 N	0	0	2	1	Dowstream of dam
7	6-Jun	11:15	7-Jun	9:52	22:37	10 U 469385 E; 5387437 N	0	0	3	0	One damselfly and one mayfly were captured
8	6-Jun	11:42	7-Jun	10:12	22:30	10 U 469383 E; 5387413 N	0	0	0	0	Upstream of dam
9	6-Jun	11:38	7-Jun	10:22	22:44	10 U 469383 E; 5387413 N	0	0	0	0	Upstream of dam
10	6-Jun	11:35	7-Jun	10:20	22:45	10 U 469383 E; 5387413 N	0	0	0	0	Upstream of dam
11	6-Jun	11:32	7-Jun	10:17	22:45	10 U 469383 E; 5387413 N	0	0	0	0	Upstream of dam
12	6-Jun	13:28	7-Jun	11:01	21:33	10 U 469322 E; 5387473 N	0	0	13	0	Westside of the duck pond near Bowcott Place
13	6-Jun	13:32	7-Jun	11:03	21:31	10 U 469322 E; 5387473 N	0	0	7	0	Westside of the duck pond near Bowcott Place
14	6-Jun	14:05	7-Jun	12:47	22:42	10 U 469065 E; 5387677 N	0	0	1	0	Near Frost Road Crayfish caught
15	6-Jun	14:05	7-Jun	12:47	22:42	10 U 469065 E; 5387677 N	1	1	0	0	Near Frost Road
						Total	1	1	102	1	

CTT = Coastal Cutthroat, CO = Coho Salmon, CAS = Prickly sculpin, STB = stickleback

Appendix G Pole seining and angling catch an effort

Set	Date	Location (UTM)	Catch (# fish)				Comments
			Cutthroat	Coho	Stickleback	Sculpin	
Pole seine	7-Jun	10 U 469065 E; 5387677 N	3	3	0	0	Near Frost Road; Crayfish caught
Pole seine	7-Jun	10 U 469208 E; 5387546 N	0	0	11	0	Upstream of Canora Road culvert
Angling	7-Jun	10 U 469387 E; 5387403 N	1	0	0	0	5 differ Cutthroat strikes
Pole siene	7-Jun	10 U 469561 E; 5387226 N	3	0	1	0	Upstream of Summergate Village
		Total	7	3	12	0	

Appendix G Bio sampling Coho

Fish #	Date (m/d)	Species	FL (mm)	Location (UTM)	Comments
1	7-Jun	CO	38	10 U 469065 E; 5387677 N	Pole seine
2	7-Jun	CO	39	10 U 469065 E; 5387677 N	Pole seine
3	7-Jun	CO	34	10 U 469065 E; 5387677 N	Pole seine
4	7-Jun	CO	42	10 U 469065 E; 5387677 N	Minnow trap

FL = Fork Length, CO = Coho Salmon

Coho	
	FL (mm)
Mean	38
Stdev	3
Min	34
Max	42
Count	4

Appendix G Bio Sampling Cutthroat Trout

Fish #	Date (m/d)	Species	FL (mm)	Location (UTM)	Comments
1	7-Jun	CTT	54	10 U 469065 E; 5387677 N	Pole seine
2	7-Jun	CTT	52	10 U 469065 E; 5387677 N	Pole seine
3	7-Jun	CTT	47	10 U 469065 E; 5387677 N	Pole seine
4	7-Jun	CTT	190	10 U 469387 E; 5387403 N	Angling; approximate FL
5	7-Jun	CTT	65	10 U 469065 E; 5387677 N	Minnow trap
6	7-Jun	CTT	48	10 U 469561 E; 5387226 N	Pole seine
7	7-Jun	CTT	40	10 U 469561 E; 5387226 N	Pole seine
8	7-Jun	CTT	41	10 U 469561 E; 5387226 N	Pole seine

FL = Fork Length, CTT = Coastal Cutthroat

Cutthroat	
	FL (mm)
Mean	67
Stdev	47
Min	40
Max	190
Count	8

APPENDIX H

REAY CREEK FHAP PHOTOGRAPHY

Appendix H Reay Creek Photography.

Photo 1. Reach-0: Looking downstream at Reay Creek draining into Bazan Bay (May 11, 2018).

Photo 2. Reach-0: Looking upstream at Reay Creek flowing out of the Lochside Drive culvert (May 11, 2018).

Photo 3. Reach-1 (0+042): Looking upstream at Reay Creek saltmarsh/pool habitat (May 11, 2018).

Photo 4. Reach-1 (0+042): Looking downstream at Reay Creek saltmarsh/pool habitat (May 11, 2018).

Photo 5. Reach-1 (0+042): Looking upstream at a glide habitat (May 11, 2018).

Photo 6. Reach-1 (0+042): Looking from leftbank at the substrate in the upstream portion of the glide habitat (May 11, 2018).

Photo 7. Reach-2 (0+105): Looking upstream at a glide habitat (May 14, 2018).

Photo 8. Reach-2 (0+189): Looking upstream at a pool habitat (May 14, 2018).

Photo 9. Reach-2 (0+221): Looking downstream at a pool habitat (May 14, 2018).

Photo 10. Reach-2 (0+221): Looking upstream at the Patricia Bay Highway culvert (May 14, 2018).

Photo 11. Reach-3 (0+263): Looking downstream at the Patricia Bay Highway culvert (May 14, 2018).

Photo 12. Reach-3 (0+263): Looking upstream from the Patricia Bay Highway culvert at a glide habitat (May 14, 2018).

Photo 13. Reach-3 (10 U 469690 E; 5387011 N): Looking upstream at rightbank tributary (May 14, 2018).

Photo 14. Reach-3 (0+463): Looking upstream at a pool habitat (May 14, 2018).

Photo 15. Reach-4 (0+596): Looking downstream at the Summergate Road culvert (May 14, 2018).

Photo 16. Reach-4 (0+596): Looking upstream at a riffle habitat from the Summergate Road culvert (May 14, 2018).

Photo 17. Reach-3 (0+655): Looking downstream at a pool habitat (May 14, 2018).

Photo 18. Reach-4 (0+702): Looking downstream at an enhanced riffle habitat (June 5, 2018).

Photo 19. Reach-4 (0+751): Looking upstream at a glide habitat with a log jam (June 5, 2018).

Photo 20. Reach-4 (0+844): Looking downstream at enhanced riffle habitat with LWD (June 5, 2018).

Photo 21. Reach-4 (0+844): Looking upstream at created riffle habitat at the outlet of the Pond (June 5, 2018).

Photo 22. Reach-5 (10 U 469326 E; 5387503 N): Looking south at the Pond and minnow trap from north east side of the Pond (June 5, 2018).

Photo 23. Reach-5 (10 U 469385 E; 5387437 N): Looking west at the Pond and minnow trap from the east side of the Pond (June 5, 2018).

Photo 24. Reach-5 (10 U 469385 E; 5387437 N): Looking north west at the Pond and minnow trap (pink twine) from the Pond dam (June 5, 2018).

Photo 25. Reach-5 (10 U 469385 E; 5387437 N): Looking north (upstream) at the Pond and minnow traps (pink twine) from the Pond dam (June 5, 2018).

Photo 26. Reach-5 (10 U 469322 E; 5387473 N): Looking east at the Pond and minnow trap from the west side of the Pond (June 5, 2018).

Photo 27. Reach-5 (10 U 469322 E; 5387473 N): Looking south (downstream) at the Pond from the west side of the Pond (June 5, 2018).

Photo 28. Reach-5 (10 U 469322 E; 5387473 N): Looking north east at the Pond from the west side of the Pond (June 5, 2018).

Photo 29. Reach-5 (10 U 469385 E; 5387437 N): Looking west at the Pond dam (May 11, 2018).

Photo 30. Reach-5 (10 U 469385 E; 5387437 N): Looking west at overflow spillway of the Pond dam (May 11, 2018).

Photo 31. Reach-5 (10 U 469385 E; 5387437 N): Looking downstream at overflow spillway of the Pond dam (May 11, 2018).

Photo 32. Reach-5 (10 U 469385 E; 5387437 N): Looking downstream at spillway of the Pond dam (May 11, 2018).

Photo 33. Reach-6 (1+302): Looking downstream at rightbank spring at the upstream side of Canora Road (June 5, 2018).

Photo 34. Reach-6 (1+310): Looking upstream at pool habitat and staff gauge (0.23 m @ 14:14; June 5, 2018).

Photo 35. Reach-6 (1+350): Looking downstream at glide habitat at the upstream side of Norseman Road (May 11, 2018).

Photo 36. Reach-6 (1+350): Looking upstream at glide habitat and stormwater detention pond wall (May 11, 2018).

Photo 37. Reach-6 (1+379): Looking downstream at pool habitat and stormwater detention pond wall (May 11, 2018).

Photo 38. Reach-6 (1+379): Looking upstream at glide habitat (May 11, 2018).

Photo 39. Reach-6 (1+473): Looking downstream at glide habitat (May 11, 2018).

Photo 40. Reach-6 (1+473): Looking downstream at riffle habitat (May 11, 2018).

Photo 41. Reach-6 (1+473): Looking upstream at glide habitat and culvert at VAA property boundary (May 11, 2018).

Photo 42. Reach-7 (1+533): Looking downstream at culvert at VAA property boundary (June 6, 2018).

Photo 43. Reach-7 (1+533): Looking upstream at glide habitat (June 6, 2018).

Photo 44. Reach-7 (1+574): Looking upstream at riffle habitat and a culvert under an unnamed road on VAA property (June 6, 2018).

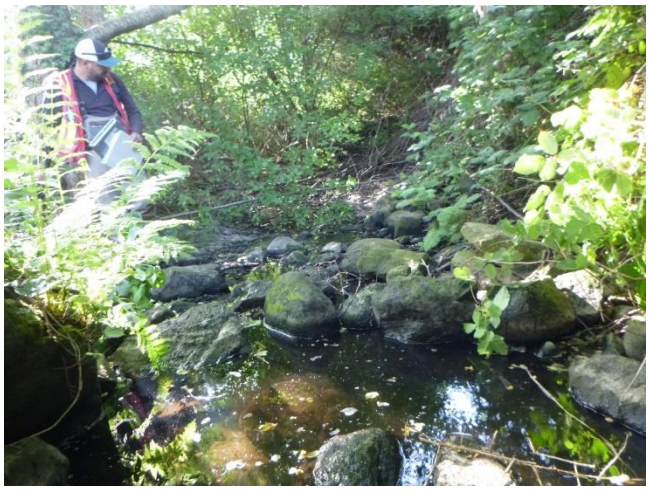

Photo 45. Reach-7 (1+574): Looking downstream at riffle habitat from culvert under an unnamed road on VAA property (June 6, 2018).

Photo 46. Reach-7 (1+592): Looking upstream at pool habitat from culvert under an unnamed road on VAA property (June 6, 2018).

Photo 47. Reach-7 (1+606): Looking upstream at glide habitat (June 6, 2018).

Photo 48. Reach-7 (1+791): Looking downstream at glide habitat (June 6, 2018).

Photo 49. Reach-7 (1+791): Looking upstream at pool habitat (June 6, 2018).

Photo 50. Reach-7 (1+791): Looking upstream at overflow culvert (June 6, 2018).

Photo 51. Reach-7 (1+810): Looking upstream at the edge VAA tarmac culvert and end of Reay Creek(June 6, 2018).

Photo 52. Reach-7 (1+810): Looking downstream at pool habitat from the edge VAA tarmac culvert and end of Reay Creek (June 6, 2018).

Photo 53. Threespine stickleback displaying spawning colours (June 6, 2018).

Photo 54. Prickly Sculpin (June 6, 2018).

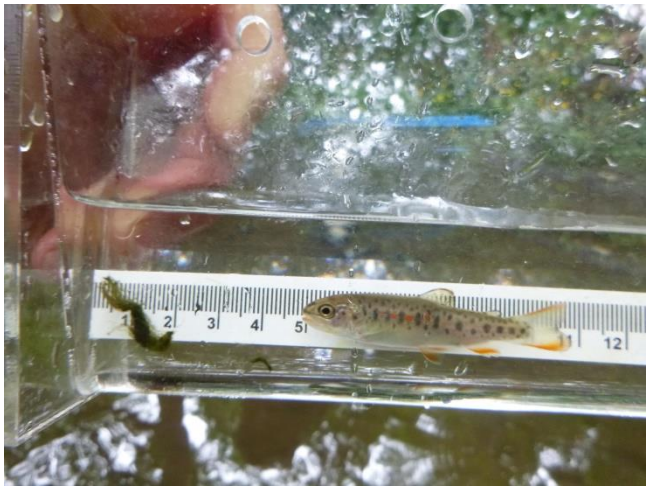

Photo 55. Coastal Cutthroat trout parr (June 7, 2018).

Photo 56. Coho Salmon fry (June 7, 2018).

Photo 57. Coastal Cutthroat trout adult (June 7, 2018).

Photo 58. Coastal Cutthroat trout adult (June 7, 2018).

Photo 59. Rough skinned newt (June 7, 2018).

Photo 60. Crayfish (June 4, 2018).