Simms Creek Watershed
Habitat Assessment and Restoration Plan.

Prepared for

Greenways Land Trust
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Introduction

Simms Creek is an urban stream flowing through the City of Campbell River that supports salmon and trout. Over the years it has undergone logging, urbanization as well as preservation and restoration. The Greenways Land Trust Society (GLT) are interested in the health and recovery of the Simms Creek Watershed. The Urban Salmon Habitat Assessment (USHP) methodology was used to measure the habitat condition in representative reach areas through out the watershed. Volunteer stewards assisted in the survey and provided local knowledge. The report presents a ranked summary of fish and riparian habitat characteristics of reach segments of Simms Creek. The survey summarizes the current health of the stream, provides comparison to other streams on Vancouver Island and guidance on recovery and protection of the vital stream habitats.

Methods

The survey was a partnership of organization with Greenways Land Trust, local Stewards, and D.R. Clough Consulting (DRC). We brought all the required equipment except personal gear including chest waders, rain gear, lunch and water. The survey involved at least two people with three to four often involved.

Timing

The survey was conducted in September 21, 23, & 24, 2020. Weather was clear and dry. The stream reaches were at base low flow levels until the afternoon of September 23 when heavy rain marked the end of the summer low flow period.

Personnel

Involved local GLT volunteer stewards, landowners, staff and professionals. These people included;

- Program Manager Camille Andrews, coordination of survey, personnel, and assist in field data collection.
- GLT Volunteers: Bob Tonkin, Rick Buchanan and Michael Swanston. Conducted data collection on iPad, habitat and water quality measures, landowner contact.
- Dave Clough, RPBio. & Brad Remillard RPBio, Field data collection and training volunteers and report write up.

Equipment

The habitat survey included the following equipment;

- Chest Waders with non slip grips (non felt preferred)
- 2.0 m measuring staff (2)
- Field/viz vests for each participant, first aid kits, PFD for high water
- Retractable tape measures (2)
- Clinometer
- Flagging tape & markers
- Field Book, waterproof paper, pencils
- iPad © with Avenza Maps ©
- Field water quality–O2 meter, pH kit, conductivity/TDS/temp meter, thermometer.

USHP Survey Method

The Urban Salmon Habitat Program (USHP) survey[1] was utilized. This method of survey was developed in 1997 by the Ministry of Environment to accommodate the Urban Salmon Program that sponsored Vancouver Island stewardship groups. Since then the Urban Salmon Habitat methodology has been the used stewardship groups on Vancouver Island and the lower mainland. The survey methodology requires the watershed to be broken into reach or segments. A reach is a contiguous habitat section with similar riparian and gradient. Features such as migration barriers, road crossings and tributary entrance may also define a segment. Within the reach segment, the survey objective is a minimum of 10 habitat units or 100m lengths to get at least 10% of the reach surveyed, but more is better and done as time permits.
The survey started at the downstream area of a reach and walked in an upstream direction. Some reaches included large beaver ponds, where the perimeter was walked and the start and end of the ponds located with GPS.

The USHP survey method involves stream habitat, riparian as well as water quality assessment. The habitat and riparian data collection items and their definitions are shown in the USHP Field Survey Card (Figure 1). Fish habitat was measured using staffs, tapes, chains and clinometers. The sites were identified with a georeferenced place mark and a site photograph. The field data was recorded on an iPad © or iPhone © using a customized file (pdf schema) written by D.R. Clough Consulting. We used the application Avenza PDF © and a GIS enabled PDF map. The data was then exported off the devices as *.csv and *.kml files for use in the USHP program and Google Earth ©.

Water quality was measured in the field at representative reach segments. The Temperature, Oxygen, pH, Conductivity and Total Dissolved Solids were measured using field instruments (Oxyguard Meter, LaMotte Wide Range pH kit, LaMotte TDS and Conductivity meter). Flow was estimated by stage height (0-100% bankfull). This data was recorded on the iPad. The results were compared with Module 3 Water Quality Survey in “The Streamkeepers Handbook”[2].

[1] Michalski, T.A., G.E. Reid, G.E. Stewart, 1997. Urban Salmon Habitat Program ,Assessment And Mapping Procedures for Vancouver Island. Ministry of Environment, Lands and Parks, Fisheries Section. Nanaimo B.C.

[2] The Streamkeepers Handbook- A practical guide to stream and wetland care. 1995, SEP, DFO Vancouver B.C.

Fig. 1 USHP Survey Habitat And Riparian Data Card

Stream Name	*Fish C.*
Reach / pg. #	*R2/pg1*
Habitat Type (P/R)	*P*
Start (m)	*10 m*
End (m)	*20 m*
Wetted Width	*2 m*
Bankfull Width	*3 m*
Average Depth	*0.5 m*
% Bedrock	*20%*
% Boulders	*20%*
% Cobble	*30%*
% Gravel	*20%*
% Fines	*10%*
Instream Cover (type/%)	*C-10% B-2%*
% Crown Cover	*60%*
Gradient	*2%*
# LWD	*10*
A/E/O	*E-10m A-20m*
Off-Channel Habitat	*L/bank 20*2m*
Land Use (L/R)	*N/R*
Vegetation (L/R)	*CF/G*
Vegetation Depth (L/R)	*30+/2*
Riparian Slope (%)(L/R)	*10/15*
Stability (L/R)	*M/L*
Livestock Access (L/R)	*20m/0*
Photos	*1,2,3*
Comments	*1,2*

Habitat and Riparian Card Instructions

1. Measure <u>all</u> habitat parameters at the <u>beginning</u> of the reach and <u>every 200 meters</u>. Measure all parameters twice if the reach is less than 200 meters long;
2. Measure riparian parameters (black boxes) <u>every 100 meters</u>;
3. Measure the start, finish & wetted width for <u>pools only</u>; take data for all other shaded boxes along <u>entire stream length</u>.

Abbreviations and Definitions

A/E/O: Altered sites, Erosion sites, Obstructions

Bankfull Width: the horizontal distance from rooted terrestrial vegetation to rooted terrestrial vegetation.

Crown Cover: streamside vegetation at least 1 meter above water surface that provides shade over the habitat unit.

Gradient: slope of the stream, measured with a clinometer

Habitat Type: P=pool or R=riffle

Instream Cover: B=boulder C=undercut banks
LWD=large woody debris O=other
V=instream vegetation (includes algae)

Land Use: C=commercial I=industrial
EX=exposed L=lawns
FC=farms/cattle N=natural
FG=farms/grass R=roads or residential
GC=golf course

Livestock: note the length, in meters, of the site where any type of livestock have access to the stream.

LWD: deadwood >10cm in diameter and >2m. long and stable in the <u>wetted</u> channel

Obstructions: BD=beaver dam
CV=culvert X=log jam
D=dam EBB=other
F=falls

Off-Channel: includes ponds and lateral channels; note the bank side,[1] channel length and width

Riparian Slope: the slope of the bank above the high water mark to the far end of the riparian vegetation or break in slope; include distance if on floodplain

Stability: H=high; M=medium; L=low

Vegetation: Br=broadleaf forest Mix=mixed
Con=coniferous forest Sh=shrub
Gr=grasses

Wetted Width: the width of the water surface measured at right angles to the direction of flow

[1] NOTE: Bank side is determined when facing downstream

measure along stream length; note start and end for pools only

measure every 100 meters

Survey Area

The Simms Watershed consists of the mainstem and South Simms as the main channels (Figure 1). The survey reaches are shown below (Table 1) as well as in Figure 2. The mainstem included five survey reaches and South Simms included two. The Penfield Road, Sandowne Drive and Heritage Meadow Drive branches were inspected as representative tributaries. Figure 2 shows the reach segments.

All of the reach segments surveyed are within Salmon accessible habitat. Fish sampling was not done but observations of fish were noted during the survey.

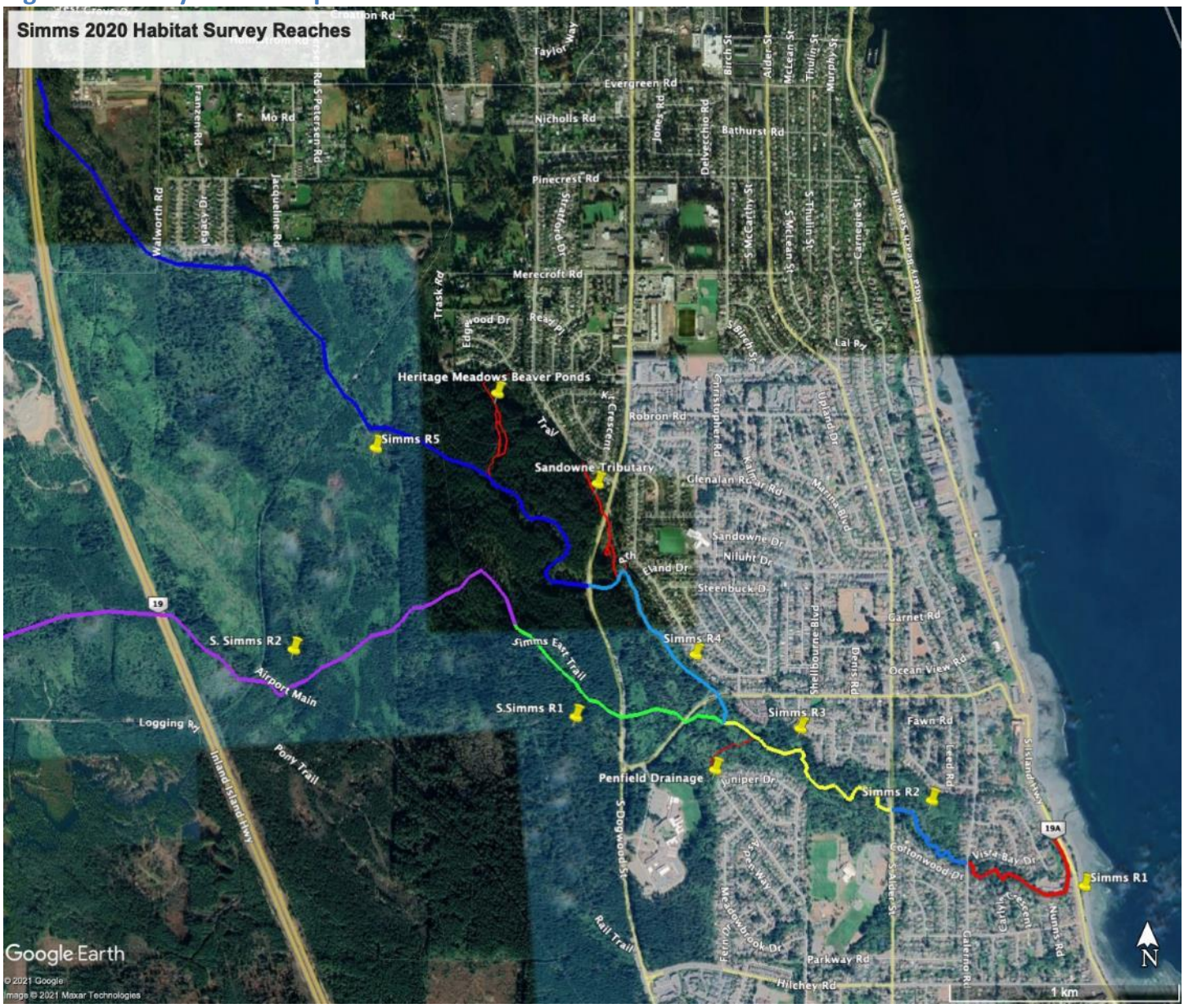
The survey objective was to measure the representative habitat in the main salmon and trout segments of the watershed. Each of the survey reaches would have 10 or more habitat units surveyed or at least 100m of stream length. The degree of effort was determined by timing and budget to the anticipated three days from September 21, 23 and 24 of 2020. Each day 2-3 reach segments were surveyed by the team. We started at the lowest reaches and worked upstream. The reach segments are described below and shown in Figure 3. The stream channels were segregated by reaches. Reaches were identified as contiguous habitat types based on confinement, gradient and riparian characteristics (Table 1).

Table 1 – Survey Reach Description

Reach	Length (m)	Description
Simms Reach 1	830	Ocean upstream to Galerno Road
Simms Reach 2	520	Galerno to Alder
Simms Reach 3	1,000	Alder to Rockland
Simms Reach 4	1,000	Springbok (Rockland to Dogwood)
Simms Reach 5	3,720	Upper Simms (Dogwood to Hwy 19)
South Simms R1	1100	Lower south fork (Dogwood Rd)
South Simms R2	2,650	Upper south fork (Argonaut Rd)

Figure 2: Simms Watershed Map (City of Campbell River)

Figure 3. Survey Reach Map



Results and Discussion –Habitat Survey

The fish habitat and riparian data was summarized for each survey reach following the USHP format. The field survey dates were September 21, 23 and 24, 2020. Simms mainstem reaches R1-R5 as well as South Simms R1 and R2 were surveyed. These reaches were surveyed using the full USHP assessment methodology. Tributaries and storm drain outfalls were inspected for Alterations, Erosion and Obstructions including the tributaries from Penfield Rd, Sandowne and Heritage Meadows Drive.

Water quality field equipment sampling (Temperature, Oxygen, pH, TDS and Conductivity) was conducted in Reach 1,3, 4 and South Simms R1. The results tables summarize 16 habitat and riparian parameters, the total of over 30 parameters are tabulated for each reach in the appendices. The complete field survey data collection is stored in a spreadsheet file provided to the Greenways Land Trust. The files attached to this document include;

- Excel © table of compiled USHP habitat data Reach 1-5 and S. Simms R1,2
- *.Kmz file of survey locations and photo points.

The data was collected at individual stream habitat units (pool or riffle). The data collection and assessment follows the B.C. Environment and DFO fish habitat assessment standards (Johnston & Slaney 1996[i]). The field data was transcribed into the USHP excel program, which uses macros to collate and rate the data to published habitat standards[3]. The reach habitat parameters were summarized, rated and scored using the macro enabled excel program created by the USHP. Scoring is based on the Fish Habitat Assessment Procedures (Johnston & Slaney 1996). This method converts the results into numbers thus offering a scoring system that can compare reaches or other streams (Table 2).

Table 2 – Example Diagnostics of Salmon Habitat Condition - LWD/Bankfull Channel Width

Parameter	Rating	Fish Habitat Result
<1	1	Good
1-2	3	Fair
>2	5	Poor

The USHP program summary scores each reach on (9) instream, (2) water quality and (5) riparian habitat parameters. Ratings are rounded to whole numbers. The results will show the lower the score, the better the habitat. The habitat/water quality summary and riparian summary rating scores can range from 11-55 and 5-25 for Good to Poor respectively. The data was scored according to the USHP methodology and presented in the results below for each survey reach.

A summary of the overall stream condition and comparison with other streams follows. Restoration opportunities are summarized in tables. The **Watershed Restoration Summary Table 20** identifies the topics for each reach:

- Riparian Habitat
- Spawning Habitat
- Rearing Habitat
- Obstructions
- Erosion
- Alterations
- Water Quality
- Education/Awareness

[3] Johnston ,N.T. & P.A. Slaney,1996. Fish Habitat Assessment Procedures. WRP Tech Circ.#8, MOELP & MOF

Reach 1 Results

Simms Reach 1 goes from the ocean under Highway 19 A upstream to Galerno Road. This reach is approximately 830m long. It has several driveway crossings and houses and apartments are located on both banks. This reach is salmon and trout accessible. The reach was surveyed Sep. 21, 2020 with the channel at low summer flow. Ten Pools and Ten Riffles were surveyed beginning at the Highway Culvert upstream over 480m of detailed USHP survey. The remaining reach area was walked up to the Galerno culvert to inspect Alterations, Erosion and Obstructions.

This reach had an average channel width of 6.84m and a wetted width of 4.7m. The reach is very low with a gradient of 0.8%. The water temperature was 15C. No fish were observed in the channel during the survey but there were freshwater mussels in the gravel beds. The results are shown in the table below. Figure 4 shows the reach with the placemarks 2-37 from the survey with the iPad.

Table 1 - Reach 1 Habitat and Water Quality Summary Results

Habitat Parameter	Result	Ratings	Result
% Pool Area	54	3	Fair
Large Woody Debris/Bankfull Channel Width	0.2	5	Poor
% Cover in Pools	6.3	3	Fair
Average % Boulder Cover	3.8	5	Poor
Average % Fines	39	5	Poor
Average % Gravel	45	not rated	
% of Reach Eroded	12	5	Poor
Obstructions	3.0	3	Fair
% of Reach Altered	25	5	Poor
% Wetted Area	69	5	Poor
Dissolved Oxygen	7.6	1	Good
pH	6.8	1	Good
	Mean Score	3.7	Fair

Simms R1 Survey Area with Placemarks

Reach 1 Habitat Photos

1.) R1- Hwy 19A culvert with fishway on far side.

2.) Reach 1 riparian area, good shade but lacks conifers.

3.) Reach 1 Log Jam (Placemark 24).

4.)Carlisle Outfall erosion – Placemark 26

The Riparian features of Reach 1 are shown in the table below taken from the USHP summary tables.

Table 2 - Reach 1 Riparian Results

Riparian Ratings	Result	Ratings	Result
Land Use	94	2	Good
Riparian Slope	64	2	Good
Bank Stability	138	3	Fair
% Crown Cover	68	3	Fair
% of Reach Accessed	1	1	Good
Average Vegetation Depth	9	5	Poor
Mean Score		3	Fair

The USHP habitat survey results of Reach 1 for instream habitat and water quality (Table 1) were rated Fair. The USHP Riparian Rating for Reach 1 (table 2) resulted in a fair result as well.

The fish habitat characteristics that were good are;

- Good water quality
  The Oxygen level of 7.6 ppm and pH of 6.8 are good for the time of year.
  The oxygen saturation was 75% and the water temperature was 15C.
- The Riparian Land Use, Slope and Access impacts were good.
  The riparian area is made up of Park or residential areas. There is a short section of roadside as well. There are no industrial operations on the creek. There are few excessively steep banks. No access trails were observed that could have caused erosion or vegetation loss (except the bridges).

The fish habitat characteristics that were poor are;

- Large Woody Debris
  There were a total of 14 logs considered LWD in the 500m of channel. None of these logs were old growth Cedar and Fir. They were all second growth and much smaller diameter.
- Lack of instream Cover.
  The instream cover from logs, vegetation and boulders is very poor. This reach appears to have been dredged after it was logged and it has not regenerated the trees and other plants to provide this function. There are many wide-open pool areas that expose fish to high predation. Addition of cover structures is recommended.
- Poor spawning habitat.
  There was spawning gravel but it was high in sediment (39%) levels. The sediment sources require stream bank planting and storm water management improvements. Gravel placement is recommended in areas that are free of sediment.

- Boulders
  There is a lack of boulders in the riffles to offer aeration and habitat for invertebrates and fry. The native material was likely dredged and new recruitment is unlikely.
- Erosion
  Erosion was common along all the stream banks over 70m of the 480m length. The most common reason for bank erosion was flood scour on weak and poorly vegetated banks. Other causes were confined structures, and storm water outfalls.
- Alterations
  There was 120m of the reach with alterations such as bridge abutments, concrete, brick and rock armouring. These all displaced native vegetation and encroached on the channel.
- Poor Riparian Vegetation Depth.
  The riparian area was historically logged and cleared for residential developments. The remaining trees are lower down in the forest succession scale and many areas are thin. The average riparian depth was 9m. Under current Riparian Area bylaws, the riparian setback would be over 15m.

Reach 1 Discussion

A discussion of habitat condition of Reach 1 is presented below. The restoration opportunities are summarized in Table 20 at the end of this document. Reach 1 is the most altered reach of Simms Creek. It requires the most assistance at recovery.

Alteration – Armouring: There has been both dredging and armouring of banks throughout the reach. The armoured banks are made of bricks, concrete and stones that replace natural riparian habitat. The armour has significantly reduced the width of the stream and resulted in scour of the substrates and erosion. The undersized nature of the old crossings is likely a reflection of building to a pre-development storm surge. The scour height of the stream in constricted areas is over 2.0m. Property owners have responded with ever-higher armoured structures. It was evident the river has flooded the left bank near the Simms Garden apartment building and likely onto the parking lot area. There needs to be a public education program on the stream with landowner contacts to inform property owners on proper stream stewardship. A program of removing constrictive bank armour could begin at the low risk sites where native planting could be applied, such as river left bank along Simms Gardens.

Crossings: There are three road crossings and a footbridge over the stream. Located at 0m (Highway triple concrete culvert), 194 m (Bridge), 218m (Simms Gardens Apartments Bridge) and 231m (Footbridge/water line). All the stream crossing structures were less (4.5-4.9m) than the mean width of the reach (6.84m). All these structures are negatively impacting the channel with constriction and flooding. Upland areas are flooded and scoured, the bridge footings and deck are under great pressure from the flows. There is no spawning opportunity under the decks due to velocities. The low decks and culvert offer high potential for debris jams.

Highway Culvert: The highway culvert has three rectangular concrete culverts; two 2.2 wide by 1.8m tall and one that is 1.2m wide and 1.8m tall with a fish baffle floor. There is a concrete baffle to guide low flow to the fishway. The culverts are surcharging water velocities at high flow and limiting fish passage. It is likely a very difficult passage for adult Chum Salmon, less so for Coho or Cutthroat. The existing structure requires monitoring to ensure the narrow fishway culvert doesn't plug with debris. This structure likely delays salmon migration until conditions are perfect resulting in exposure to predators such as seals. Fish may wait for a high tide to get through as it is tidal.

There has been a rock crest installed in the tidal foreshore that helps fish stage for access through the pipes. The loss of gravel substrates at the culvert location was likely prime Chum spawning habitat. The existing culvert has likely diminished salmon access incrementally over time. This crossing needs to be replaced with a bridge in order to accommodate fish, flow and debris.

Log Jams: There is plenty of log debris in the river but it is mostly Red Alder and contributes very little to good instream cover. There were no large Red Cedar logs in the reach to provide proper functional LWD. We observed one beaver dam and two log jams (Placemark 24 & 27) next to the oxbow at Carlisle Crescent. These full spanning log jams offer cover for fish, but are unstable and create considerable overbank flow. They are made of shorter chunks of Alder that are resting on perhaps one or two longer stems. The jams are likely to break and flush out shortly. In 2020, Greenways Land Trust made an effort to remediate the jam by removing the chunks plugging flow. Log Jam inspection in this reach should be done after every large storm; this should be the responsibility of the City as their park is the biggest source of wood.

Spawning Gravel: The spawning gravel has either been dredged or washed out by the floods. There was only one clean deposit of gravel but it had been washed out by the Galerno culvert pool tailout and was rolling down the a clay glide to deposit in a sediment laden corner pool. Gravel placements in this reach require anchoring strategies.

Erosion – Erosion of the banks may also deny spawning success. There are numerous erosion sites, most are moderate in size (3-10m in length). In many of these locations an application of native plantings is recommended. In the shady sites, we recommend Red Osier Dogwood along wetted areas along with Salmonberry, Ninebark, Sitka Spruce and Red Cedar further up the bank.

There are erosion areas at the oxbow and along the armoured areas by the bridge crossings that are unlikely to respond to planting. These higher energy areas will require specific bioengineering prescriptions. These prescriptions may be engineered soil bags, gabions, log and rock spurs or other options depending on sites and budget.

Stormwater Runoff: The outfalls of these drains had eroding the banks and recent sediment deposits. The Carlisle Crescent storm drain pours over an exposed bank (Placemark 26). The 3m bank is eroding. A protective pipe should go all the down the bank followed by repair and native planting of the damaged areas. This appears to be a good site for an upland raingarden on the easement. This is a City outfall and staff should be involved.

Downstream on the opposite bank is the Vista Bay storm drain ditch entry (Placemark 19). This ditch route is lined with heavy sediment that spills into the creek. The drainage ditch needs to have the sediment removed and a sediment trap installed at a convenient location for maintenance.

Reach 2 Results

Reach 2 of Simms Mainstem is 520m long. We surveyed 231 m of reach. The reach began at the Galerno Culvert and ended at South Alder Street. It is a long series of pools broken only by beaver dams. This second reach is known rearing habitat for salmon and trout. The USHP survey September 21, 2020 was during low flow yet the entire reach was wetted. The channel width varied from 4.5 to 9.8m (average 6.9). The reach has an unconfined floodplain of 30 to 90m widths. This floodplain has numerous alternative channels that are activated by floods or beaver dam construction. The results are shown in the table below.

Table 3 - Reach 2 Habitat and Water Quality Summary Results

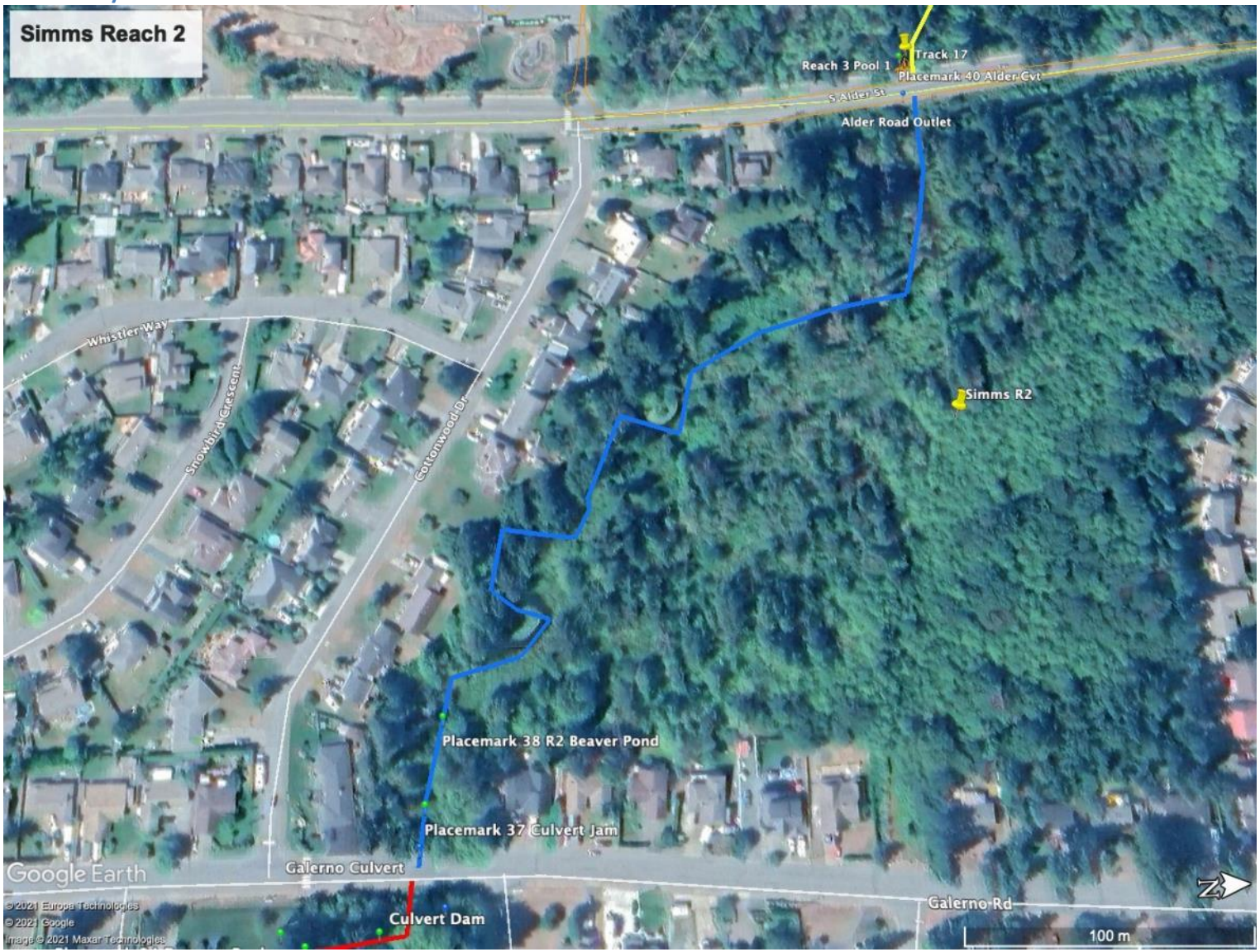
Habitat Parameter	Result	Ratings	Result
% Pool Area	100	1	Good
Large Woody Debris/Bankfull Channel Width	0.5	5	Poor
% Cover in Pools	11	3	Fair
Average % Boulder Cover	0	5	Poor
Average % Fines	85	5	Poor
Average % Gravel	10	not rated	
% of Reach Eroded	0	1	Good
Obstructions	4	4	Poor
% of Reach Altered	9	3	Fair
% Wetted Area	90	3	Fair
Dissolved Oxygen	Na		
pH	Na		
	Mean Score	3.1	Fair

The Riparian features of Reach 2 are shown in the table below taken from the USHP summary tables.

Table 4 - Reach 2 Riparian Results

Riparian Ratings	Result	Ratings	Result
Land Use	8	2	Good
Riparian Slope	6	2	Good
Bank Stability	14	4	Fair
% Crown Cover	60	3	Good
% of Reach Accessed	0	0	Fair
Average Vegetation Depth	50	3	Fair
Mean Score		2	Fair-Good

Simms Reach 2 Survey Area



Reach 2 Habitat Photos

1.) R2 Galerno culvert is surcharged in winter, shallow in summer.

2.) R2 Galerno culvert is easily plugged by Beaver or other debris

3.) R2 wide pools and wider floodplain throughout

4.) R2 pools/ponds extend up to South Alder Culverts.

Reach 2 Results cont.d…

Reach 2 USHP habitat scored an overall Fair result. The channel offers good fish rearing pools but very little spawning habitat. The fish habitat characteristics that were good are;

- High percentage of pool area.
  Pools were 6.9m wetted width and 0.5m deep. The entire reach was pool habitat
- Erosion
  The 30-90m wide floodplain reduces velocities and results in no scour erosion in the reach.

The fish habitat characteristics that were poor are;

- Spawning habitat.
  There is a lack of spawning gravel and high sediment (85%) levels. The spawning locations are flooded by beaver dams and the plugged Galerno Culvert.
- Lack of LWD Cover
  There is little LWD in Reach 2. It is compensated by 11% cover in undercuts and vegetation. Given the pond nature of this reach, LWD is generally not the dominant type of cover. Historically, there would have been old growth sized snags and their 3-5m high root plates laying in or along the pond to provide vertical structure for wildlife. These were taken in the first pass logging. The undercuts and vegetation cover is provided by other vegetation types; Red Osier Dogwood, Salmonberry, Willow species, Red Alder and Canary Reed Grass.
- High Fine Substrates
  The sediment sources are from historic or upstream sources as there is a general lack of erosion in this reach as noted above. Sediments were not so deep as to be infilling the pool habitat. The sediment depth was generally less than 0.1m and layered over a peat bottom.
- Obstructions
  Reach 2 fish entry through the Galerno Culvert is a barrier when flows are very high or low. The 3.0 m diameter is easily plugged by beaver dams or floating debris. This culvert does allow Coho and trout to pass but would be unlikely to pass. Chum salmon are weaker swimmers and will not pass. The culvert needs to be replaced to meet the DFO/BC Environment standards for fish passage.
- Riparian Vegetation.
  The riparian area was historically logged. It has regenerated to provide approximately 60% crown closure. There is a long thin line of second growth Douglas Fir on the south side, which provide important protection for the channel.

Reach 2 Discussion

Reach 2 is a long series of deep ponds in a wide floodplain. It offers excellent rearing habitat for fish as the pools are average of 6.9 m wide and over 0.5m deep with some over 1.5 m deep. There were no riffles or shallow areas for spawning and unlikely there ever were. This reach was always likely a wetland area based on older airphotos and the adjacent tree community. The reach was inspected at the road culverts as access through the reach was limited by private property and deep pools. We did not see any storm outfalls that may exist along Cottonwood, and they should be inspected. During the September survey, the water quality was measured downstream in Reach 1 and found to be good. The stream is oriented flowing from west to east and is vulnerable to south sun exposure if the canopy was altered. Historically all the trees were logged off in this reach. They have regenerated in a mix of deciduous and coniferous trees that now provide adequate shade to

mitigate sun exposure. Water temperature 200m below the reach was 15 C, which is comfortably cool (less than 19 is good in summer).

The culvert at Galerno is a significant concern. It is a 3m round pipe with a beaver dam barrier at the top end and a drop off the pipe at the bottom end. It is undersized and poorly placed. The culverts that feed it upstream are much larger and better placed. This pipe is potential barrier to fish, a source of scour downstream and a source of flooding upstream.

Reach 3 Results

Simms Creek Reach 3 is a 1.0 km long reach that begins at South Alder St. going upstream surrounded by Willow Point Park to the confluence of South Simms Creek just below Rockland Road. The USHP survey covered 212m and covered six pools and nine riffles heading upstream from the Alder St culverts. The main culvert at S. Alder is a 3.7m wide arch culvert. It has a residual depth of 0.45m. The culvert appears fish passable at all flows. A second culvert approximately 1.2m diameter pipe is partially submerged on the south side. The average channel width was 6.7m and wetted was 3.3m. The channel flowed on an average low gradient of 0.73% and resulted in longer pools (15.6m average) than riffles (12.0m). The water quality was measured at the trail edge in the mid reach. The results are shown in the table below.

Table 5 - Reach 3 Habitat and Water Quality Summary Results

Habitat Parameter	Result	Ratings	Result
% Pool Area	70	1	Good
Large Woody Debris/Bankfull Channel Width	0.5	5	Poor
% Cover in Pools	5	5	Fair
Average % Boulder Cover	1	5	Poor
Average % Fines	34	5	Poor
Average % Gravel	42	not rated	
% of Reach Eroded	5	3	Good
Obstructions	0	0	Good
% of Reach Altered	0	1	Good
% Wetted Area	48	5	Fair
Dissolved Oxygen	7.6	1	Good
pH	6.8	1	Good
	Mean Score	2.9	Fair

The Riparian features of Reach 3 are shown in the table below taken from the USHP summary tables.

Table 6 - Reach 3 Riparian Results

Riparian Ratings	Result	Ratings	Result
Land Use	30	1	Good
Riparian Slope	32	1	Good
Bank Stability	102	3	Fair
% Crown Cover	65	3	Good
% of Reach Accessed	12	3	Fair
Average Vegetation Depth	47	3	Fair
Mean Score	Mean Score	1	Good

Reach 3 Survey Area

Reach 3 Habitat Photos

1.) R3 – S. Alder culvert is embedded Arch – passable

2.) R3 –Pool 1 in Reach 3 fair veg. cover despite no LWD

3.) R3 –Riffle 2 alongside Willows Park.

4.) Pool 10 with typical Riparian of mostly deciduous with some conifer.

Reach 3 results contd…

Simms Reach 3 habitat and water quality results indicate a Fair result. The fish habitat characteristics that were good are Pool area, lack of alterations and water quality;

- High percentage of Pool area.
  The reach had 70% pool area. It has wide pools that offer year round rearing habitat. The mean depth of the pools was 0.43m.
- No Alterations
  The Park designated area has reduced the potential for alterations such as bank armouring. Armouring was only found at culverts under the community trail which is 10 -30 m from Simms.
- Good Water Quality
  The Oxygen level was 7.6 ppm and 75% saturation in 15C water temperature. The pH of 6.8 was close to neutral. The high oxygen levels and relatively low temperatures reflect the good shade of the park area.
- Riparian
  Reach 3 Riparian characteristics were good. It is a protected area with no disturbance since the historic logging approximately 60 to 80 years ago. This reach has a riparian zone width of 44m on right and 50m depth on left. Logging altered the plant community. The low land plant community is dominated by Red Osier Dogwood, Pacific Crabapple, Red Alder and Willow species. The higher banks are a broader mix: Red Alder, Broadleaf Maple, Cottonwood, Douglas Fir, Sitka Spruce, Red Cedar and Grand Fir. The understory shrubbery consists of Red Osier Dogwood, Willow Species, Salmonberry, Pacific Ninebark, Oceanspray, Snow Berry and Swordfern. There is much opportunity to infill planting at trailside areas.

The Reach 3 fish habitat characteristics that were poor are;

- Cover
  There is a lack of LWD in the entire reach. It was historically logged. Fortunately grass and shrubbery are doing a fair job in sheltering the edges of the deep pools. Importing LWD would be difficult and not recommended. Anchoring and preserving blowdown will be the most effective way to maintain LWD function. This requires commitment by the City Parks to not cut up the trees that fall but preserve them for nature. Boulders
  There are few boulders in the reach, which limits habitat, especially for trout and invertebrates. The lack of boulders in this reach may be because they were never there; this reach used to be a peat substrate wetland that was drained in elevation for roads and development. There are a few trail side riffle/glides where boulders could be transported on a trail to within 5-10 m of the stream.
- Sediments – Stormwater and Trail Erosion
  The sediment sources that resulted in 34% fines are from stormwater and adjacent erosion sources. There are stormwater ditch lines from Juniper and Penfield Road Subdivisions (Placemark 67 & 111). They are filled with fine sediments and discharge this material into Simms Creek. The ditches require sediment sumps at the pipe end that would require the city to maintain. Creating Rain Gardens and bioswales in the public easement areas of the storm pipe are would help.

Trail erosion along Willows Park side of Simms Creek is very evident. Unsanctioned trails along the reach have trampled down native plants and exposed banks to erosion. These sites could be very easily blocked using stumps or logs. Coarse wood debris (CWD) using imported or blowdown trees can be placed to block access to erosion areas. Signage and fencing can be useful options. The protected areas should then be replanted and may require soil and mulch in compacted areas.

Reach 3 Discussion

Reach 3 is a regenerating stream riparian area heavily altered by historic logging;. It appears to have been drained to accommodate the desired elevation of the road culverts and adjacent residential developments. Dropping the water level has resulted in riffles with spawning gravel between connecting pools. It offers fish spawning habitat in these gravel riffles, but the reach is more important to fish as a pool/wetland rearing area. The survey indicated there was adequate spawning gravel and cover in this reach. There is a concern about sedimentation from stormwater and erosion. Trail damage to streamside plants and erosion from the many unofficial routes is a high impact.

Beavers are in Reach 3 and are restoring it to wetland characteristics. The pools offer increased rearing area for fish as well as habitat for a higher diversity of wildlife. Beavers are needed to accomplish the recovery. But the may plug the S. Alder culverts and create fish barriers and flooding routinely. This is not the fault of Beavers but a poor road design. It is obvious a large portion of wetland was filled in to accommodate the road and culvert installation. If the crossing was a bridge like at Dogwood Street, it would not plug or ever be a flood problem. A bridge would also benefit wildlife passage by permitting Deer, Bear and Beavers from walking on the road.

- Work with City on bridge replacement plan for the S. Alder Culvert.
- Monitor the beaver activity and identify den and feeding areas
- Install beaver protection around tree areas in enhancement areas
- Plant beaver preferred plant species (Willow, Red Osier, Alder, Cottonwood) in wetland areas
- The Juniper/Penfield stormwater drainages were observed to be unfiltered. The addition of sediment traps is recommended.

Reach 3 is entirely within a City Park. Park designated property can offer a level of protection not available in other reaches. Currently the Park has recreational use (disk park and trail, bike areas within the riparian area of Simms Creek. There are tributaries and small wetlands entirely unprotected from recreational impacts.

- It is important for City Parks to have a mandate and plan to protect the natural areas.
- Many areas need protection of stream riparian area from encroachment (trail deactivation, signage, fencing, planting).
- Identify and protect important amphibian habitat in drainages and wetlands from encroachment (trail deactivation, CWD buffers, planting, signage, migration corridors)
- Invasive plant management is needed (identify areas, remove, replacement planting)
- Native plant protection/restoration plan (stop tree damage, soil scarring, trampling, clearing/ plant for succession and park health – more fir and cedar, more native shrubbery).
- Natural areas enhancement plan for protection or creation of wildlife trees (standing or down cavity/den habitat) and utilize coarse woody debris (CWD) and large woody debris (LWD) as habitat.

Reach 4 Results

Simms Reach 4 is located above the south fork confluence, through the Rockland Road culverts and up to the Dogwood Bridge. This reach is a pool/wetland complex segmented by beaver dams. As with reach 2, a modified USHP survey was done around the pools. We walked the entire perimeter assessing the riparian plant community, drainages, alterations, obstructions and erosion. The lengths and widths were taken in the field as well as using the Google Earth © measuring tools and iPad gps tracks and placemarks.

This reach is approximately 1.0 km long. It begins in a narrow channelized section (6.8m channel, 4.5m wetted) approximately 100m long through the Rockland Road culvert. The Rockland Road culvert is a 4.2m wide flat bottom plated culvert with approximately 0.5m residual depth. It appears easily fish passable. There are no signs of recent beaver dams in this location. The culvert has an outlet sump and adjacent storm water pond that are both filled with sandy sediment to depths from 0.3 to 1.0m deep.

Above the Rockland Road Culvert the reach is in a more natural state of pool/wetland with beaver dams. It is alongside Springbok Road ending at South Dogwood Street. There is a paved trail between the Springbok Road housing area and the wetland. The unconfined wetland area is 30 - 85 m wide. In September, the wetted areas were a mixture of open water 5 - 40m wide and emergent vegetation in other areas. There were two full spanning beaver dams approximately 40- 60m wide. The wetted edge goes to the base of the paved public trail along Springbok.

There were two drainages entering across the Springbok Trail at the top end of Reach 4. The Sandowne Trail tributary is a small fish accessible channel. It has a recently constructed footbridge and trail surface. The Elan Road storm drainage enters at the public access easement. It has a storm water pond and discharges along the paved trail. It had recently overtopped and washed out the trail material into the wetland.
Crossing the new footbridge upstream leads to the Dogwood Road bridge and end of the reach. The bridge area of reach 4 has a short confined stream segment that is impacted by foot and wheeled erosion along the banks and across the stream.

The river right bank of Reach 4 is entirely forested second growth between Rockland and Dogwood Roads. There is a small foot trail and no indications of encroachment, erosion or drainages. The right bank of Reach 4 has no development for an average depth of 150m. It is likely the least encroached and healthiest riparian area of Simms Creek.

Water quality was measured at the Rockland Culverts at the end of Reach 4. Habitat results are shown in the table below.

Table 7 - Reach 4 Habitat Summary Results

Habitat Parameter	Result	Ratings	Result
% Pool Area	90	1	Good
Large Woody Debris/Bankfull Channel Width	0.0	5	Poor
% Cover in Pools	11	3	Fair
Average % Boulder Cover	0	5	Poor
Average % Fines	100	5	Poor
Average % Gravel	5	not rated	

% of Reach Eroded	0	1	Good
Obstructions	0	0	Good
% of Reach Altered	0	1	Good
% Wetted Area	80	1	Good
Dissolved Oxygen	8.2	1	Good
pH	6.8	1	Good
	Mean Score	2.2	Fair

The Riparian features of Reach 4 are shown in the table below taken from the USHP summary tables.

Table 8 - Reach 4 Riparian Results

Riparian Ratings	**Result**	**Ratings**	**Result**
Land Use	8	2	Fair
Riparian Slope	10	1	Good
Bank Stability	4	1	Fair
% Crown Cover	70	3	Fair
% of Reach Accessed	2	2	Fair
Average Vegetation Depth	80	2	Fair
Mean Score		2.1	Fair

Reach 4 – Survey Area

Reach 4 Habitat Photos

1.) R4 - Rockland 4.2m flat bottom culvert.

2.) R4 Typical 30-80m wide wetland

3.) R4 –Beaver dams cross the wetland (60m)

4.) R4 South (right) bank riparian forest is 150m deep.

Reach 4 Discussion

Reach 4 is a beaver pond wetland. It is in good condition except for erosion issues related to storm water and riparian impacts from encroachment.

- Erosion- Storm water
  The reach drains the fully paved and developed Springbok and McPhedran neighborhoods. There is a storm water drainage at the Eland /Springbok Trail entrance (Placemark 82). The drainage pipe dumps into a 5m by 5m by 1.0 m (wet) settling pond. The pond discharge is eroding and overflowing resulting in washouts along the trail that deposit directly into the creek. It may also permit fish access to enter the ditch line. Repair is recommended this summer. Empty the pond of accumulated sediments at that time.

  The Sandowne Trail bridge to Dogwood bridge area has heavy erosion resulting in loss of streamside plants and degraded stream banks. Mitigate with coarse woody debris, fencing, signage and planting (soil and mulch may be required). There are rocks under the Dogwood bridge that may be used as bank erosion protection and stream stepping stones. The crossings need to be either blocked or bridged.

  The Dogwood Bridge drainage gutters are plugged and leaking road runoff directly off the bridge into the creek. The drainage system needs maintenance and then a review for opportunity to mitigate the runoff further (possibly bioswales/sumps).

  The Rockland Road storm drainage collection pond is full of road sand. It is overflowing into Simms Creek. This needs to be cleaned out. The sand filled sump immediately below the culvert should be considered to be cleaned as well.

- Riparian Condition
  The riparian condition of the south east bank is excellent. There is a regenerating second growth forest on a gently rising slope that extends an average of 150m deep.

  The Springbok trail side (north west) is much poorer condition. It has a thin riparian strip 5 to 25m wide along a paved trail that is against residential house fence line. There are heavy impacts to the riparian area; adjacent property owners and trail users have been dumping lawn clippings and garbage into this vulnerable riparian area. They are killing the trees and degrading water quality.
    1.) Remove the garden waste and garbage along trail.
    2.) Infill plant the damaged areas with plants (Shrubs, Fir, Cedar), consider Crabapple and Wild Rose close to the trail to prevent further encroachment.
    3.) Fence sensitive areas and place signage.
    4.) Consider installing an elevated boardwalk viewing area into the wetland at a natural opening to mitigate for the opportunistic access that has been occurring.

Simms Reach 5 Results

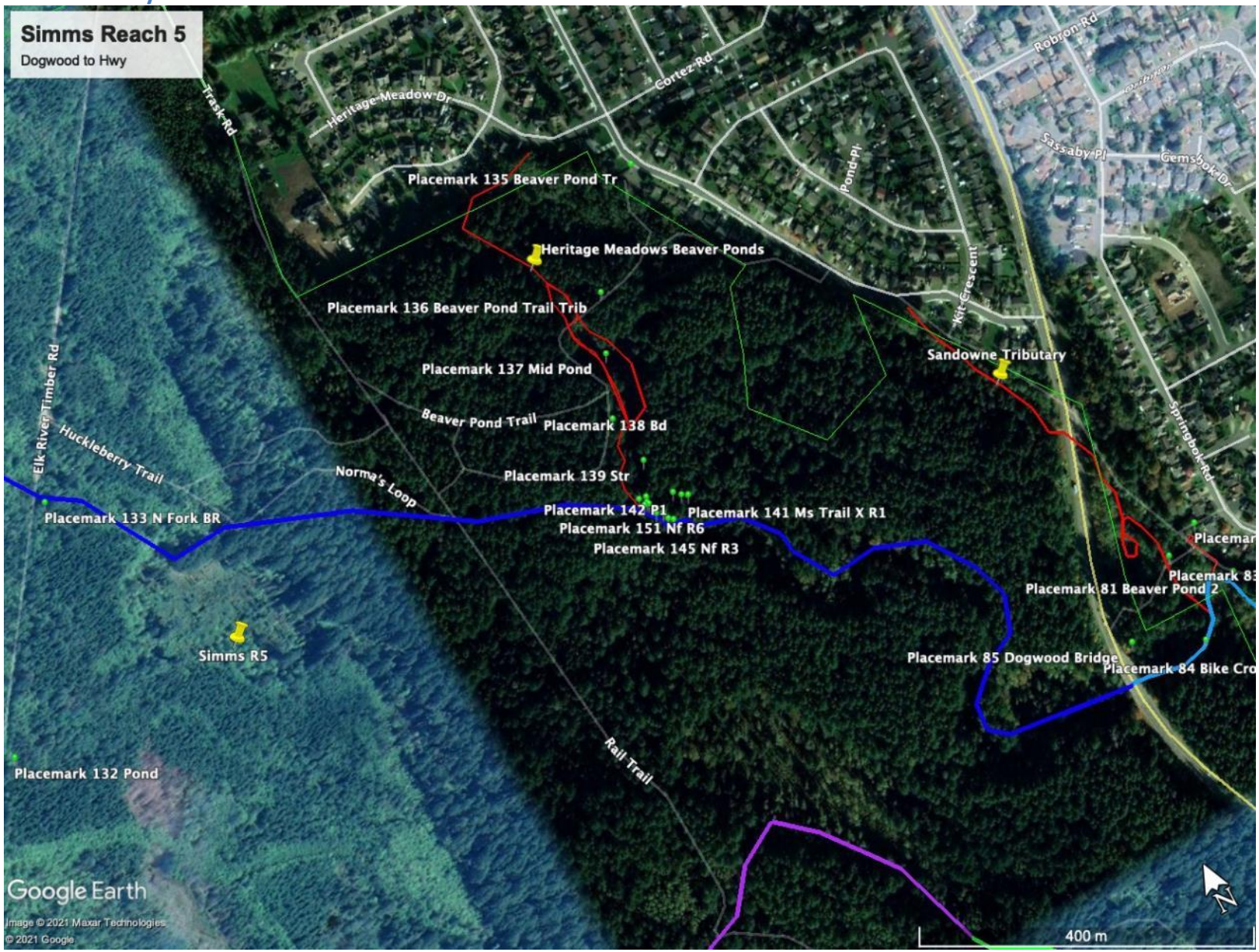
Reach 5 is the uppermost segment of the mainstem (North branch) of Simms Creek. It goes from Dogwood to the Highway 19 ditch line. The reach is 3.72 km long. The reach encompasses the Beaver Woodlands Forest reserve area. This is a protected area from logging but trails and crossings on the creek abound. The reach has trails on both sides, at least one ford crossing and a bridge on the ERT Road. It was surveyed in the mid section where Heritage Meadows wetland tributary enters the mainstem of Reach 5. The site was accessed off the McPhedran Road trail. The mean channel width was 5.4m with a 3.9m wetted width. The mean gradient was 1.7% and mean pool depth of 0.27m. The stream was flowing slightly above base flow due to an overnight rain.

The results are shown in the table below.

Table 9 - Reach 5 Habitat and Water Quality Summary Results

Habitat Parameter	Result	Ratings	Result
% Pool Area	38	5	Poor
Large Woody Debris/Bankfull Channel Width	0.1	5	Poor
% Cover in Pools	4	5	Poor
Average % Boulder Cover	3	5	Poor
Average % Fines	38	5	Poor
Average % Gravel	24	not rated	
% of Reach Eroded	15	5	Poor
Obstructions	0	0	Good
% of Reach Altered	0	1	Good
% Wetted Area	72	3	Fair
Dissolved Oxygen	Na		
pH	Na		
	Mean Score	4	Poor

Simms Reach 5 Survey Area



Reach 5 Habitat Photos

1.) R5 Pool 1 – note lack of cover, sediment..

2.) R5 Riffle 1 habitat in better shape with gravel and cobble.

3.) R5- Pool 3 with only log in reach

4.) R5- Riffle 6 with sedimented substrates

The Riparian features of Reach 5 are shown in the table below taken from the USHP summary tables.

Table 10 - Reach 5 Riparian Results

Riparian Ratings	Result	Ratings	Result
Land Use	24	1	Good
Riparian Slope	24	1	Good
Bank Stability	108	5	Poor
% Crown Cover	83	1	Good
% of Reach Accessed	76	5	Poor
Average Vegetation Depth	450	1	Good
Mean Score		2	Good

Simms Reach 5 Discussion

The reach is encircled in second growth forest. The habitat survey results reflect the historic logging that took place 60-80 years ago.
The habitat characteristics that were Poor included

- Lack of Pool Area – there was only 38% pool area in the reach survey. Inspections at other locations indicated this reach is confined. Only one beaver pond was observed and it was located at the very top of the reach above the ERT road. The lack of pools is directly related to lack of LWD as a result of removal or wash out after historic logging. The were no LWD scour structures.
- Lack of Cover in Pools – the reach had no Boulder or LWD cover. The second growth trees had not developed a large undercut root system yet. Adding LWD is going to be difficult due to access, conifer brush mats offer low cost interim cover.
- High % Fines - The current source of bank erosion is from park trails and crossings. There is a ford crossing and exposed banks. This crossing site is at the midway point of the trail and gets a lot of use. A foot bridge crossing is recommended as it appears the many access points would circumvent barriers.
- Storm water – Both the Highway 19 area and Legacy Drive area drain development runoff to Simms Creek. Further inspection is required to confirm the runoff from these areas is being treated and protected from Simms Creek.

The habitat characteristics that are Good include

- Lack of Alterations – there is only the ford crossing, otherwise the stream has a regenerating second growth forest that is unaltered on both banks.
- Riparian Land Use, Slope, Crown Cover and Depth – good due to the protected forest with 400m on the left bank and a 2.0 km deep forest on the right. The upper portion of the reach has a subdivision at Legacy Drive that was not part of the USHP survey. The setback appears to be 30m on the development side.

Overall this reach is recovering due to the protected nature of the forest. The ongoing impacts are park users creating unchecked erosion from creek access. A bridge is recommended at the Heritage Meadows Tributary confluence with the mainstem. In addition many areas of the trail near the streamside require minor maintenance to control encroachment and erosion.

South Simms Reach 1 Results

South Simms Reach 1 confluence with Simms mainstem is just below the Willows Park foot trail (6m Footbridge), then goes upstream through Rockland (2 x 3.2m arch culverts) and Dogwood Road (approx. 20m Bridge) to end in the Beaver woodlands reserve. It is 1.1 km long. We surveyed 107m length and captured five pools and riffles. The survey site is in the forest 100m above Dogwood Street off the Simms east trail. Water quality date is shown in South Simms Reach 2. This reach had an average channel width of 5.6m and a wetted width of 2.5 m. The average reach gradient was 1.2 %. The water temperature was 15 C. The results are shown in the table below.

Table 11 – South Simms R1 Habitat and Water Quality Summary Results

Habitat Parameter	Result	Ratings	Result
% Pool Area	75	1	Good
Large Woody Debris/Bankfull Channel Width	0.5	5	Poor
% Cover in Pools	10	3	Fair
Average % Boulder Cover	0	5	Poor
Average % Fines	50	5	Poor
Average % Gravel	50	not rated	
% of Reach Eroded	14	5	Poor
Obstructions	0	0	Good
% of Reach Altered	0	1	Good
% Wetted Area	44	5	Poor
	Mean Score	3.3	Fair

The Riparian features of South Simms Reach 1are shown in the table below taken from the USHP summary tables.

Table 12 – S. Simms R1 Riparian Results

Riparian Ratings	Result	Ratings	Result
Land Use	20	1	Good
Riparian Slope	20	1	Good
Bank Stability	66	3	Fair
% Crown Cover	86	1	Good
% of Reach Accessed	5	1	Good
Average Vegetation Depth	378	1	Good
Mean Score		1.3	Good

South Simms Reach 1 Discussion

S. Simms Reach 1 was historically logged 60 to 80 years ago. It is now protected in a preserve area with a regenerating conifer forest (Douglas Fir is the dominant tree species). The channel is generally confined riffle/pool relationship with no large wetlands or beaver activity on the main channel. A wetland fed tributary enters at the top end of this reach. The fish habitat characteristics in South Simms R1 that were poor are;

- Lack of Cover – the reach scored poor in LWD and Boulder cover. The legacy effects of logging are the reasons. The material was removed and the remaining burned or washed

out. Replacement LWD is being made by the forest. Interim LWD installations may be considered but would take further consideration to the cost and benefit. Accessing the site with heavy equipment would be difficult. The cover habitat can be compensated in less invasive methods (Brush bundles and boulder placement/planting).

- Erosion/Fines – The stream banks were 1.0 m high and many un-vegetated edges were eroding. The substrates were high in fines (50%). Legacy effects of logging cause this erosion and sediment. There is concern runoff erosion is influenced by Highway 19 and Campbell River Airport exposed headwater areas. The erosion locations in the survey area offer restoration strategies of planting the banks with shade tolerant species.
- Lack of Wetted Area – This upper reach of Simms Creek suffers from reduced wetted area but there was connected flow during the survey between pools over the small gravel riffles. Pool depth was an average of 0.33m in summer. Reach 2 upstream dries.

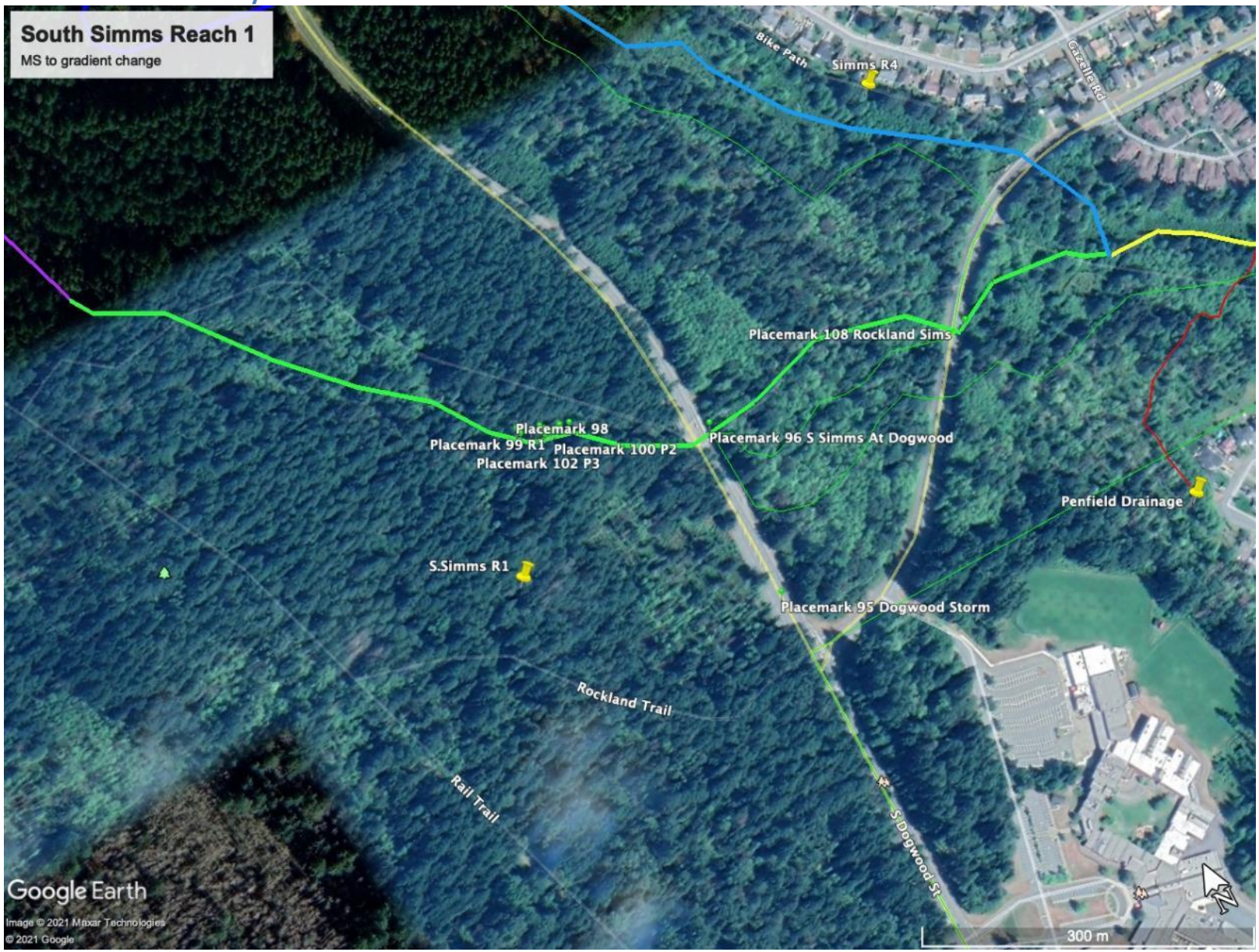
The reach characteristics that were good in South Simms Reach 1 were:

- Encroachment/Alteration - The trail areas near the survey areas (Dogwood/ERT) were set back from the stream and did not include any crossings or encroachment issues (the entire trail network was not inspected).
- Barriers/Obstruction – the reach goes under two bridges and the culverts at Rockland. All were unobstructed and offer fish passage. These structures are much larger than the Culverts downstream in Reach 1 and 2 of Simms. There is a small (0.5m ht) seasonal beaver dam built under the Willows trail bridge. This dam will wash out or overtop easily. It floods a pool/wetland area (50m) upstream.
- Spawning Habitat - The substrates included 50% gravel. The reach offers the largest area of spawning habitat in Simms Creek.
- Riparian Area – This reach had the best ratings in the entire watershed for riparian characteristics. Most of the reach is undisturbed forest area on either side of the reach for over 500m.

South Simms Reach 1 offers spawning habitat reach for Coho salmon. It has gravel riffles that appear sufficient except for concerns about fines in the substrate. An inspection of Reach 2 above at the ERT indicates it is a source of erosion. Bank repair may find more opportunities in the upper reach than this one.

Downstream at the Willows trail bridge is an alteration that should be repaired. There are three manmade boulder crests in the channel under the bridge. They are washed out and creating erosion around the outer banks. The site has 4% gradient, which is fish passable without help. The beaver used the top of the upper rock crest for its dam foundation. The crests should be removed at low flow in summer and repositioned perhaps as rock spurs and boulder groups. They are small enough to be moved by hand or with a pry bar. Upstream is a wide floodplain that indicates Reach 1 was altered by dredging and its exit under the footbridge has confined the historic wetted entrance. The upland pool area floods the trail and the Penfield Road drainage was also dug to collect this overflow.

South Simms Reach 1 Survey Area



S. Simms R1 Habitat Photos

1.) SS R1 – Willows Park trail bridge at confluence – note beaver dam

2.) R1 – Twin 3.2m Arch culverts at Rockland Crossing

3.) SSR1 – Riffle 1 above Dogwood – good spawning gravel content

4.) SSR1 – Pools lack instream cover LWD/Roots

South Simms R2

South Simms Reach 2 is 2.65 km long and ends on the airport lands above Highway 19. It begins above reach 1 in the Beaver Woodlands. The stream survey site was above and below the ERT Road bridge. A habitat survey of five pools and five riffles was done over 131.5m. The habitat characteristics are shown in the table below.

Table 13 – S. Simms R2 Habitat and Water Quality Summary Results

Habitat Parameter	Result	Ratings	Result
% Pool Area	24	5	Poor
Large Woody Debris/Bankfull Channel Width	0.1	5	Poor
% Cover in Pools	7	3	Fair
Average % Boulder Cover	2	5	Poor
Average % Fines	20	3	Fair
Average % Gravel	35	not rated	
% of Reach Eroded	14	5	Poor
Obstructions	0	0	Good
% of Reach Altered	0	1	Good
% Wetted Area	38	5	Poor
Dissolved Oxygen	8.20	1	Good
pH	6.80	1	Good
	Mean Score	3	Fair

The Riparian features are shown in the table below taken from the USHP summary tables.

Table 14- S. Simms R2 Riparian Results

Riparian Ratings	Result	Ratings	Result
Land Use	18	1	Good
Riparian Slope	16	1	Good
Bank Stability	56	4	Poor
% Crown Cover	82	1	Good
% of Reach Accessed	1	1	Good
Average Vegetation Depth	500	1	Good
	Mean Score	1.4	Good

The results of the S. Simms R2 habitat and water quality survey show a Fair result. The habitat in this reach is protected by a forest reserve but it was logged. The result is that the trees are young and the stream banks are somewhat disturbed. It has seasonal flow and shallow pools in summer on a gravel bed channel. The reach is poor in fish rearing habitat and fair in fish spawning habitat. Successful fish in this reach likely migrate downstream to reach 1 where the habitat is wetter and deeper.

Overall the Sims South R2 USHP survey found the following Poor attributes;

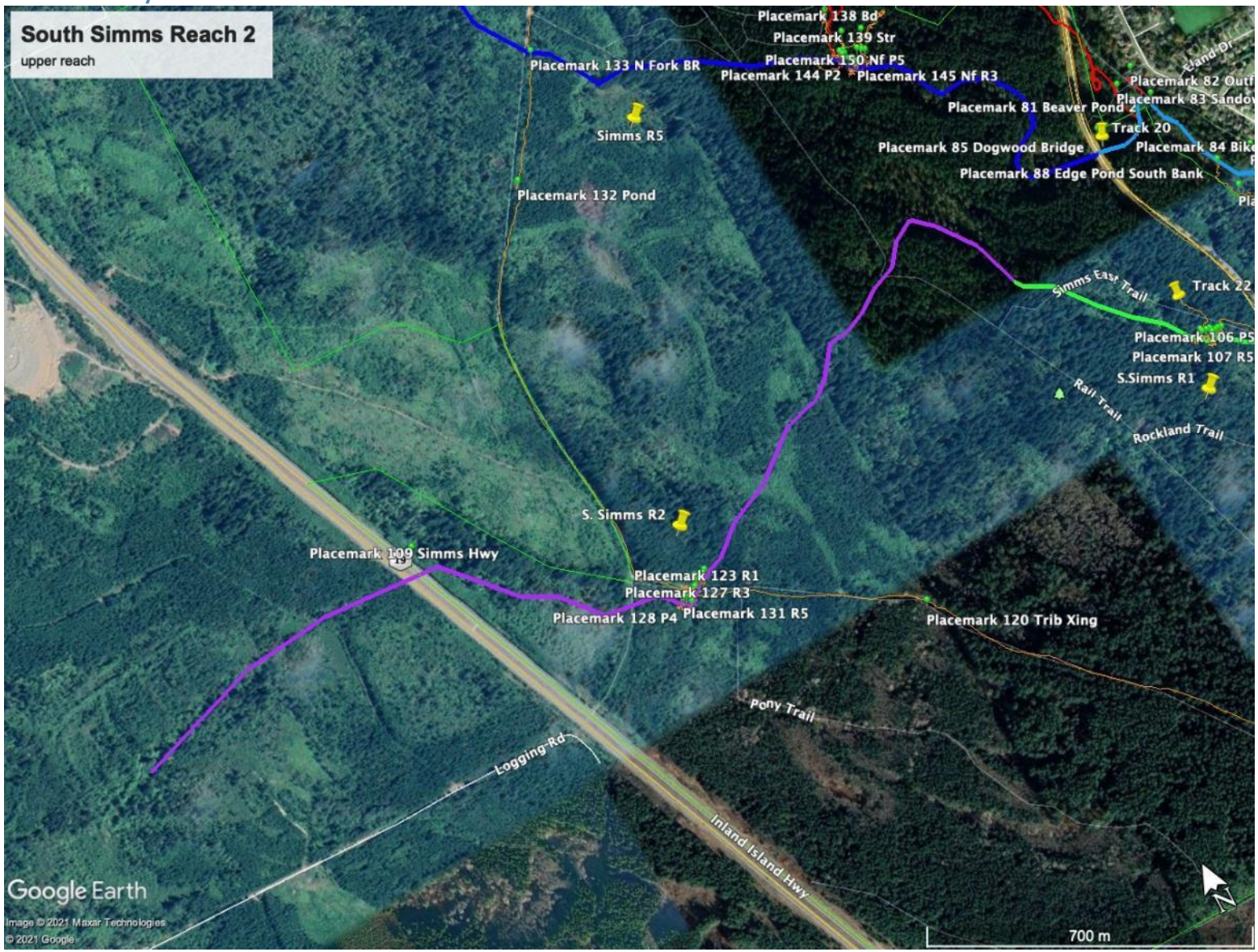
- Pool Area- this reach has seasonal flow with small perennial pools.
- LWD – the reach lacks LWD due to historic logging effects. The lack of LWD results in the shallow pools. Adding LWD in this reach will be challenging due to the steep eroding banks.
- Cover – Lack of cover in the pools was very obvious. Cover habitat was taken in historic logging. The survey was done in late summer and the pools had virtually no visible fish. Predators due to the lack of cover had likely eaten them. Brush bundles could be applied here to provide fry cover.
- Erosion – The banks were eroding with sediment and gravels in bends. The conditions had been worse but the regenerating shrubbery has taken hold of most areas. These sites are recovering but could be helped along by specific plant/bioengineering treatments.

The South Sims R2 Good habitat attributes were;

- Spawning Habitat – 38% gravel in this reach area. Lots of spawning gravel. Also least fine sediments of survey. Gravel is a poorly anchored in steep sections due to lack of LWD.
- Water Quality – Good water quality with high oxygen (8.2 ppm/82% sat) and low temperatures (15 C) with normal pH (6.8).
- Riparian - This reach has an excellent regenerating forest canopy that scored overall Good on every riparian characteristic except Bank Stability. The forest is primarily a Douglas Fir dominant stand with some Red Cedar, Red Alder as well as understory shrubbery. The riparian species diversity and condition is good. In a forest area of this size and history, there may be areas that do require planting or silvicultural treatments for enhancement. A silvicultural assessment is required of the Beaver Woodlands by an RPF to assess the stand age and structure condition and long term management and protection

This reach is in a protected forest area. It suffers from drying in summer. There is bank erosion from high water surges. The upland drainage alterations (Highway/Airport) are likely causes. The reach has plenty of gravel. It lacks deep pools and LWD cover. It offers spawning habitat but very little summer rearing area.

S. Simms Reach 2 Survey Area



S. Simms R2 Habitat Photos

1.)Pool 2 with the only undercut we found in reach.

2.) Riffle 2 – under ERT bridge – shallow passable.

3.). Pools 3 (Stn 126) typical shallow poor cover

4.) Riffle 3 (Site 127) offers good spawning gravel

Discussion

Survey Efficiency and Limitations

The level 2 habitat survey of Simms Creek covered seven reaches as well as tributaries and drainages over out of a total length of 10.3 km. We did not survey all the tributaries. The survey was limited in time and budget to the main channels. We surveyed 1261 m of the stream for an overall 12% of Simms Watershed. The lower salmon bearing waters (R1, R2, R3) were USHP surveyed 57%, 44% and 21% respectively. The survey effort was biased to the reaches of highest salmon value and impacts. We also walked R1 to R4 entirely and most of the upper segments to determine alteration, erosion or obstructions (AEO). We found the lowest reaches to be the most impacted and needing restoration plans.

The survey was completed with the assistance of the Greenways Land Trust and local Streamkeepers (Camille Andrews, Bob Tonkin, Rick Buchanan and Michael Swanston). Their local knowledge was invaluable and helpful for the survey access locations. There were three field days in late September. There were no injuries to report despite some challenging wading and walking areas. Prior to the survey, the group arranged for access through the gates in the Beaver Woodlands allowing field time to be dedicated to collecting data.

Simms Creek Habitat Comparison

Reach Comparison

The interpretation of the USHP survey was compared in the reach summary tables presented in the Results above. The summary tables identified a numeric score for Good (1), Fair (3) and Poor (5). Converting the values into a numeric score permits reaches to be compared amongst each other or over time. The table below shows a comparison of the reach condition by habitat scores of the Simms Watershed. The scores in the table below do not include water quality as it wasn't taken in every reach.

Table 15 – Simms Reach Habitat and Riparian Comparison

Reach	Habitat	Result	Riparian	Result
Reach 1	4.3	Poor	3	Fair
Reach 2	3.4	Fair	2	Good
Reach 3	3.1	Fair	2	Good
Reach 4	na		na	
Reach 5	3.8		2	Good
SS R1	3.1	Fair	1	Good
SS R2	3.4	Fair	1	Good
Mean Score	**3.4**	**Fair**	**1.3**	**Good**

Based on overall reach scores in Table 15; the instream habitat and riparian results of 3.4 and 1.3 respectively. Reach 1 was poorest in both categories. South Simms reaches scored the best overall.

Vancouver Island Habitat Comparison

The USHP survey of Simms Creek can be compared with other streams on Vancouver Island that were surveyed using the same methods. Table 16 below compares Simms Creek to other surveyed streams on Vancouver Island;

Table 16 - Fish Habitat Deficiency (x) Comparison of Simms Creek and Vancouver Island Streams [4]

Watershed	Percent Pool Area (<55%)	Large Woody Debris (<2)	Percent In-stream Cover (<20%)	Percent Fines (10-20%)	Percent Wetted Area (<90%)	Critical Flow (<10% MAD)	Impervious Surface (>10%)
Simms Creek (2020)		**X**	**X**	**X**	**X**		**X**
Simms Creek (1999)	X	X	No data	No Data	X	No Data	X
Bings Creek		**X**	**X**	**X**	**X**		
Ayum Creek	X				X	X	X
Beach Creek		X		X	X	X	
Bear Creek		X	X	No Data	X	X	X
Fairways Creek		X	X	No Data	X	No Data	
Kingfisher Creek	X	X	X	X	X	No Data	
Little Oyster R.		X	X	No Data	X	X	
Little River		X		X	X	X	
Nile Creek		X	X	No Data	X		
Piercy Creek	X	X	X	X	X	No Data	X
Scales Creek	X	X		X	X	No Data	No Data
Thatcher Creek		X	X	X	No Data	No Data	
Woodhus Creek	X	X	X	No Data	X	X	
Woods Creek		X		X	X	No Data	

***An X entry represents a rating poorer than the proposed cutoff for acceptable habitat quality.**

The Table 16 comparison shows Simms Creek is deficient is similarly afflicted with urban impacts as the comparison watersheds. Of interest is the 1999 data for Simms Creek indicates the % Pool Area has increased to beyond the 55% threshold. This is entirely to the credit of beavers increasing the pool area in Reach 2, 3 and 4. An example of the benefit of these animals.

Simms Watershed Restoration Plans

The field survey in September resulted in many ideas for restoration. As we measured habitat, we also considered the restoration plans for a site. The Simms Watershed Restoration Table (Table 17) below itemizes and prioritizes the restoration strategies from the habitat impacts of each Reach. The main restoration activities identified were:

- Cover Habitat – LWD, Brush Bundles, Boulders
- Spawning Habitat – Gravel and rock crest additions
- Obstructions – culverts, log jams, beaver dams
- Erosion – bank erosion and sediment sources from roads and ditches (Raingardens, sumps)
- Alterations – rock, brick & concrete walls
- Water Quality – basic monitoring in field, lab samples broad spectrum, data loggers

[4] Reid et al. 1999

- Education/Awareness – information distribution, signage and land owner contact
- Riparian Habitat – planting, CWD, bank bioengineering

Table 17 has a priority ranking for the restoration activity. The ranking of high, medium or low is based on a combination of factors; the ecological hazard and the benefit (cost, access, partnerships) of doing the activity.

Restoration Prescriptions

Permits

Work instream that could result in disturbance to fish or their habitat is done under a water act permit. Generally riparian planting and surface garbage clean up does not require a permit. This permit is available online through Frontcounter B.C. http://www.frontcounterbc.gov.bc.ca. Fish habitat restoration permits are submitted as *notifications* and signed off by Fisheries and Oceans, City of Campbell River or other government. The restoration design is taken from the data provided in the habitat survey (i.e. location, channel width).

Designs

Stream habitat restoration requires designs to plan the work and submit for permit. Table 17 identifies the restoration prescription. The table describes the type of restoration to be applied to the site. The designs for the sites are based on standard practices developed and published for stream restoration projects. The B.C. Watershed Restoration Program provides a standard reference for stream restoration techniques in "Fish Habitat Rehabilitation Procedures"[5]. This manual is often referred for acceptable restoration practices including rock log and gravel placements in streams.

The Pacific Streamkeepers Federation Streamkeepers Handbook is another very useful guide for restoration and monitoring examples such as;

- Module 3 – Water Quality Survey
- Module 6 – Stream Clean up
- Module 7 – Streamside Planting

Conclusion

The Urban Salmon Habitat Survey of the Simms Creek watershed serves as a reference for both monitoring and restoring the watershed. The survey of fish habitat with reference locations offers repeatable surveys critical to understanding the current and future stream health. The USHP survey also provides the data on the functional components used for recovery of the watershed. This information is the basis for restoration planning. The USHP provides specific data on the length width and character of the instream and riparian area.

While Simms Creek is a relatively healthy urban stream. Mainly due to the vast park are in the upper reaches. It supports year round Coho Salmon and Cutthroat trout fish populations, which were observed during the survey. It scored Fair scores in most instream categories and Good in most riparian categories. But the survey highlighted how vulnerable the watershed is from some key impacts that can be corrected over time.

Simms Creek Watershed is impacted mostly in the lower urban reaches.

- The most impacted habitat is in Reach 1;
    - It has the poorest riparian condition, fewest conifers,
    - It has the poorest spawning habitat due to floods and sediment
    - Reach 1 has debris jams, garbage and hardened banks

[5] Slaney, P.A. and D. Zaldokas, 1997. Fish Habitat Rehabilitation Procedures, Watershed Restoration Program, MOELP, UBC , Vancouver BC.

- Culverts in all reaches are impacting fish access;
    - Chum salmon may be limited by the Highway 19A culvert.
    - Culverts are undersized and are smallest further downstream in the watershed.
    - All City culverts except Hwy 19 should be replaced with bridges to maintain water flow, fish passage and avoid beaver plugging.
- Urban runoff in Reach 1,3 and 4 is creating erosion, sedimentation and needs maintenance of channels with rebuilt channels, clean out of drainage sumps and installation of bioswales/raingardens
- Beaver ponds in the mid reaches (i.e. Reach 2,3,4) offer a huge wetted rearing area for fish as well as significant wildlife use.
- The upper reaches (Reach 5, S. Simms R1 and R2) offer plenty of spawning gravel as long as spawners can get upstream through the culverts and fry are able to migrate downstream to the lower reaches to rear.
- Willow Point Park recreational use is significantly encroaching on the riparian area of Simms as well as impacting smaller drainages contributing to amphibian habitat and water quality protection. It needs an environmental plan.
- The Beaver Woodlands and City Parks require management of access trails that are impacting riparian plants, erosion and spawning habitat. There need to be foot bridges on the Heritage Trail to eliminate significant erosion.
- The Beaver woodlands are a high value ecological area that requires a silvicultural management plan to enhance and protect its values for the future.
  .

Watershed based planning is key to protection of the waterways, fish and wildlife values. A good plan equally protects homes and infrastructure. Higher level guidance is available for communities from the B.C./DFO Develop With Care Guidebook and Waterbucket.ca. Establishing these principles in the OCP of local government is vital to protecting the Creek.

The focus of restoration on Simms Creek should not start with this list; it should start with forming partnerships with the local government and land owners. The priority of activities in the restoration plan is not necessarily the order in which they should be done. Restoration is best done with willing land owners and partners. Bringing in the property owners and local residents as active participants is vital to long term success. Greenways Land Trust knows this and is active in the community with programs locally that have addressed riparian planting, footbridge and trail construction, and assessments of water ways. Past work by Streamkeepers needs to be recognized and credited as well. There was much streamside planting, gravel placement, fish trap counting, past habitat surveys going back to the mid 1990s'. These people have been doing great work. we could see the gravel, LWD and plantings during the survey. It was very helpful in understanding what has worked the best (planting).

Restoration should start small with monitoring to avoid big failures, which early in the process would defeat the effort. Small failures are learning opportunities and permit adjustments. In 2021 we would hope the following items get started;

1.) Water quality monitoring at all main reaches, routine at low flow, first flush, with data loggers established similar to RDN DWWP Program
2.) Garbage removal and debris in Reach 1
3.) Stormwater drainage maintenance by the City at Elan/Springbok drain, Dogwood Bridge gutters, Rockland sumps.

There is much more in the restoration table to choose from. Any activities should be documented for later monitoring and assessment. A proper record of Simms Creek restoration has not been collected. In reviewing this project there were many past restoration projects that were not well

recorded to location and their measures. It is hoped with the technology available that future records can be kept in a format that can be referenced. Publishing projects through the BC Government Ecological Catalogues (ECOCAT) or reporting the work to pacific Streamkeepers Federation (PSKF) are two options that have been useful to date. The City or regional government may have an archive available.

In closing, I would like to hope that this report is helpful in continuing the good effort of the many past stewards in the Simms Watershed. I hope the restoration and protection is successful and the watershed continues to provide a home for wildlife and a treasured environmental area to the community.

Submitted by

David R. Clough, RPBio

Table 17 - Simms Watershed Reach Restoration Sites -2020.

Reach	Issue	Location	Prescription	Priority
Reach 1	Riparian Restoration Human removal (and beavers). Thin riparian (9-12m) Entire length. Prioritize on public property and willing property owners on eroding areas.	1) Highway - pool1 & 2 2.) Simms Garden Apartments – Pool 6/7 3.) Reach 1 remainder	1.) Left bank pool 1 & 2. Brush dominated, clear and add conifer plots (Red Cedar, Doug Fir, Sitka Spruce) . 2.) Infill plant a 2m riparian area along apartment block (Red Osier, willows, Ninebark and other shrubbery suitable to property owners and shady wet site. 3.) Other Reach 1 openings (and erosion sites- also incorporate invasive plant removal (Himalayan Balsam at placemark 30)	**H**
R1	Riparian lack of Coarse Woody Debris (CWD)	Both sides in upper reach less flooded areas.	Lack of Coarse Woody Debris is a problem for amphibians and birds in the riparian zone. Removal of log jams should include CWD placement in flood secure areas i.e. placemark 24 jam. Also CWD placement through danger tree removal; cut long and leave on ground	L
R1	Spawning Gravel Lack of gravel recruitment Gravel washed out by floods, confined structures.	Roadways and driveways for ease of access - old trap Site, Galerno Culvert outlet	Past gravel placements have washed out. There is a shortage of clean stable gravel. Gravel must be anchored by selecting pool tail-outs or adding rock crests.. The easiest access lower site by the old fish counting fence (Placemark 6) could receive larger chum sized gravel while upper areas mixed more for Coho and Trout. Placements require site prescriptions based on channel area, access, gravel sizes and anchoring method. The Galerno Road outfall is a natural location for Coho to spawn as the culvert holds them up. Gravel must be locked in place with a rock crest in the pool tail-out. The pool outlet crest should be widened and raised to bring the elevation up to the floor of the culvert to improve access through the hung pipe. There is also river left bank remediation required to address the shotgun effect of water erosion from the undersized culvert.	M M
R1	Boulder Habitat	Riffles	Every riffle from the old fish trap (80m) upstream to Galerno (830m) is deficient in Boulder habitat for aeration and invertebrate/fry habitat. Addition of boulders is recommended in the easiest to access riffle/glide sites. This can be done by hand. Each site does need a specific prescription of how many and what size and position of rocks.	M-H

R1	Cover Habitat Lack of Cover, dredged channel, virtually no stable LWD or rooted banks	Pools in Reach 1	Brush mat cover habitat can be hand placed along pool edges. The method involves bundling Red Cedar or Douglas Fir branches or small trees to create brush mats. Anchor with cable to permanent structures pins or duckbills ©. This is a low risk technique to compensate where LWD placement cannot be applied. Structures last 5-10 years and can be done by volunteers with little risk, low cost and usually easy permit approval.	H
R1	Obstructions	Highway 19A Culvert	Fish access and habitat compromised by triple culverts. Plan for replacement with a clear span bridge and remediate channel substrates.	H
R1	Obstructions	Simms Garden Bridge	Potential debris jam site due to constriction, 4.9m wide plan for wider replacement	M
R1	Obstructions	Driveway Bridge	1784 hwy19A – private wood bridge 4.5m wide plan for wider replacement	M
R1	Obstructions	Beaver dams	See LWD above about log jams. Beaver Dams The beaver dam in lower reach 1 will wash over permitting adult salmon passage. It is not a fish barrier and results in a larger shaded pool for fry in summer. There is no flooding issue in this area. Beavers are best managed by cutting off food supplies so they move on. This reach due to nearby riparian encroachment by housing, limits the beaver' ability to spread the flood plain resulting in potential conflict.	L
R1	Obstructions	Log Jams	Placemark 24 and 27 are full spanning log Jams. They are located adjacent Carlyle Crescent at approximately 500 and 550m upstream. Remediate Jams to improve fish passage, reduce erosion and loose debris that could plug at crossings below. Mark and leave large structural cedar or fir logs. Remove only anthropogenic introduced debris; lumber, cut log chunks and garbage.	M
R1	LWD Fish Habitat	At or near log Jams	The LWD in log jams may be repositioned and anchored under more detailed plans and permits. This may require machinery access to bury the logs or install anchor rocks. The non-machinery option would be using winches then using Duckbills © or other anchors. All LWD placements are risky in this reach due to the storm surge and infrastructure downstream. Any work will require a permit and professional oversight.	M-L

R1	Erosion	Carlisle Street Storm outfall	The outfall eroding the stream bank. Extend pipe down to grade. Then repair bank and replant. City should be contacted. Consider a raingarden on easement to intercept and settle first flush.	H
R1	Erosion	Vista Bay Storm Outfall	The Vista Bay storm drain ditch entry (Placemark 19). This ditch route is lined with heavy sediment that spills into the creek. The drainage ditch needs to have the sediment removed and a sediment trap installed at a convenient location for maintenance.	H
R1	Erosion	Throughout i.e. Placemarks 2,16,20 26, 32	Bioengineering (wattles and stakes) and other native planting are recommended along the creek in the abundant erosion locations. Geotechnical applications such as fibre mats and logs are suggested at the steeper harder sites. Bank erosion protection with LWD and rock placement has opportunities but there is no obvious access for machinery	M-H
R1	Alterations – Bank Armour	Near bridge crossings (Placemark 13)	1-4m high armoured walls of concrete and stone. These would not now be permitted structures and impact the stream by increasing flow. Mitigation requires river engineering solutions.	
R1	Water Quality There was adequate oxygen (7.6ppm) and cool temperature (15C) levels during the survey	Water quality monitoring program	Routine (annual seasonal) Water Quality monitoring of each reach in is highly recommended. Set up a summer period and first flush monitoring program with stewards. Set up data loggers that collect water quality data such as temperature pH, Turbidity, Oxygen and flow. Collect laboratory water samples at least once at low flow,	**H**
R1	Garbage	Through out	Bikes and garden debris – requires an annual sweep .	M
R1	Education/Partnerships	Through out	Land owner contact program, Stream signage at every public site.	L
Reach 2	**Issue**	**Location**	**Prescription**	**Priority**
R2	Riparian Restoration	South Side	Infill planting along the Douglas Fir grove in the backyards of properties along Cottonwood Drive.	M
R2	Obstructions	Galerno Culvert	Culvert is non conforming, creating drainage and fish passage Contact the City, investigate a replacement plan; bridge is preferred , large arch acceptable. Work with city on a funding plan and pursue grants. Ensure a fish habitat restoration plan for the past impacts is addressed (repair substrates, native plants and cover)	H

R2	Obstructions - Beaver Dams	Through out	This is a wide historic wetland area, the beaver dams overtop and permit fish passage when migrating and create pool habitat when rearing. There is no biological reason to alter the beaver dams. The Galerno Culvert if plugged by beavers will block salmon passage. The culvert needs to be replaced with a wide natural bottom to eliminate the problem. Removal of beaver dams at this site is likely to be ongoing with disruption to wetland elevations and rearing habitat until fixed.	L H
R2	Water Quality	No concerns from survey	Water Quality Monitoring program is highly recommended as a first priority item.	H
R2	Education/Partnerships	Cottonwood Rd	Land owner contact and environmental audit of backyard practices; such as compost location, streamside native plant condition and drainages.	H
Reach 3	**Issue**	**Location**	**Prescription**	**Priority**
R 3	Riparian Restoration	Placemarks 38, 56-66, 71.	Trail erosion on stream side areas. Infill planting of to replace damaged plants, add soil, mulch, CWD, fences and/or signs to protect the sites.	H
R3	Spawning Gravel	Well distributed throughout	Plenty of gravel although it is dirty from storm water and erosion. Monitor usage.	L
R3	Cover Habitat	Throughout	Lacks LWD but has good cover from grass, shrubbery and associated roots as well as beaver dams increasing depth to over 1.0 m. There are local areas such as near trail sites where brush mats cover could serve fish and block access	L
R3	Obstructions – Road Crossings	S. Alder Culvert	The 3.7m arch and 1.5m round culvert are larger than the Galerno culvert but are undersized compared to upstream crossings and vulnerable to beaver dams and flooding. The wetland was filled for the road and culvert. This crossing needs to be a bridge in its future replacement. Priority is low unless beavers start plugging culvert then high.	L
R3	Obstructions - Beaver dams	throughout	No concerns. The S. Alder Culvert had a dam on either side but nothing in it. There were several small (0.5m) dams through out creating deep pool habit. Multiple overflow routes exist, there are no salmon access issues. Coho appear to easily access and were	L

			observed in October 2017 at Rockland in the first freshet events of that year.	
R3	Water Quality	No concerns from survey	Water Quality Monitoring program is highly recommended as a first priority item. Our survey equipment does not measure turbidity or toxins (i.e. Metals & PAH's) which are common street runoff products.	H
R3	Erosion/water quality – Stormwater	Penfield and Juniper Storm water	These storm circuits have no rain gardens or sumps at their outlet. Partner with the City and look into easy and cheap sumps but also creation of rain gardens on public easements	M
R3	Erosion –Trails and recreational trampling	Placemarks 38, 56-66, 71. Streamside areas as well as drainage/frog pond in disk park	Noted above in riparian planting. Opportunistic trails need deactivating and signage. Blocking trails with fences or CWD (using imported or blowdown/ danger trees) would be double benefit to eliminating erosion and adding habitat. CWD (Coarse wood debris) should be large logs or stumps placed above floodplain.	H
Reach 4	**Issue**	**Location**	**Prescription**	**Priority**
R 4	Riparian Restoration – river left bank	Along Springbok Trail	Shallow north west side requires removal of garden waste & garbage, infill planting along the trail erosion areas, fencing, signage and directed and controlled viewing areas of the wetland.	H
R4	Trail erosion	Sandowne Trail to Dogwood Street	The short length of trail from new foot bridge to Dogwood St has a wide erosion area of no plants and worn down stream bank. Add structures to limit impacts; start with existing CWD and rocks, plant trees/shrubs, add fencing and consider foot bridge at bike crossing over Simms or block it off.	
R4	Erosion - Stormwater	Rockland Rd Culvert	The Rockland Road storm drainage collection pond is full of road sand. It is overflowing into Simms Creek. This needs to be cleaned out. The channel immediately below the culvert should be considered to be cleaned as well.	
R4	Erosion – Stormwater	Springbok at Elan trail	There is a storm water drainage at the Eland /Springbok Trail entrance (Placemark 82). The drainage pipe dumps into a 5m by 5m by 1.0 m wet settling pond. The pond discharge is poorly controlled and the drainage is eroding and overflowing resulting in erosion along the trail that deposits directly into reach 4. The matter appears to be remedied with repair of the ditch and culvert to appropriate capacity. This repair needs the City attention. During the repair, the trail culvert should be relocated to eliminate the possibility of fish entering the storm ditch line.	H

R4	Erosion – water quality	Dogwood Bridge	Dogwood Bridge has plugged rain gutters leaking onto stream slope that needs maintenance and possible bioswales or erosion proof drainage route. Directly under bridge is bare soil stream bank from lack of sunlight and heavy use. Add step stones across creek, passive walkways with rocks. Plant sunny edges with Swordfern in protected polygons.	M
R4	Water Quality	No concerns from survey	Water Quality Monitoring program is highly recommended as a first priority item.	**H**
Reach 5	**Issue**	**Location**	**Prescription**	**Priority**
R 5	Erosion	Creek crossing on Simms mainstem	Add foot bridge crossing to eliminate erosion at a 10m wide band of bare bank. Fence the bridge approaches.	**M-H**
R5	Erosion	Streamside trails	Many small encroachment/erosion trail sources; block with fence, logs, plants or signage	M
R5	Lack of Pool Cover	Pools	All surveyed lack cover, consider conifer sapling/brush bundles as they are low cost and easy to install in a remote area. Long term waiting for LWD development from riparian forest.	M
R5	Water Quality	No concerns	Continue water quality monitoring of the reach with interest directed at Hwy 19 and Subdivision areas.	H
South Simms R1	**Issue**	**Location**	**Prescription**	**Priority**
SS R1	Spawning Gravel	Entire area	This reach offers the best spawning habitat for Coho. Gravel addition not required as it has a supply from Reach 2.	L
SS R1	Cover Habitat - LWD	Entire reach	Impacts from logging removed cover LWD. Addition of LWD is limited due to poor access, avoid disturbing the forest.	L
SS R1	Cover Habitat – Boulders and Brush Bundles	Above Dogwood Rd	Brush bundles and Boulder placement by hand minimizes forest impacts to offer increased cover	M
SS R1	Erosion	Willows Trail bridge	Rock Crest Repair- remove rock crests, make into wide rock spurs, use remainder as boulder habitat. This work can be	M-H

			done by hand in summer to reduce bank erosion and improve flow and fish passage.	
SS R1	Erosion	Above Dogwood	Small Bank erosion sites along survey area – planting and staking (Red Osier), small boulder spur placements for erosion protection	M
S. Simms Reach 2	**Issue**	**Location**	**Prescription**	**Priority**
S.S R2	Erosion	Near ERT crossing area (Sites 122,129)	Eroding bank segments- plants or cuttings (Red Osier) may be applied to hasten recovery	L
SS R2	Cover Habitat	Entire reach	Add cover – Brush Bundles least risk over LWD. Place on edges of pools. Boulders not recommended, too steep and flashy.	L
SSR2	Forest Stand Condition Assessment	Beaver Woodlands Reserve	Silvicultural assessment of stand condition for long term management planning; - historic impact (i.e. replanting, thinning, invasives), - wildlife habitat (cavity trees, CWD, den and nest trees) - public use area (Trail routes, road maintenance) - fire protection (Access routes, fire breaks, signage) - climate change (Species selection, management of die off)	H

Simms Reach Restoration Photos

Reach 1

R1 – Site 10 Riffle 3 has gravel, could use Boulders

R1 – garbage is common near bridges (Site 12)

R1 – Invasive plants (Placemark 33)

R1 – Salmonberry dominated area in need of conifer plantings (Site 30)

Reach 2 Restoration Photos

R2 - Beaver dam blocking exit of Galerno Culvert

R2 – March flow (moderate flow) at culvert entrance

R2 – Culvert lacks embedded depth

R2 – Galerno Culvert entrance at low flow.

Reach 3 Restoration Photos

Reach 3 – Placemark 71 – planting site adjacent trail/creek

Reach 3 – Placemark 56 bank erosion

Reach 3 – Juniper outfall needs sediment traps (site 67)

Reach 3 – Penfield Road storm drainage needs sediment traps (site 119)

Reach 4 Restoration Photos

R4 – Rockland Storm Sump and culvert filled w sediment

R4 – Garden waste buried 1m deep into riparian off trail (Site 77,78,79)

R4 – Stormwater overflow/erosion across trail (Site 82)

R4 – Bike/Foot trail near Dogwood has erosion & plant loss (Site 84)

Reach 5 Restoration Photos

R5 –Erosion at crossing(Site 141) needs bridge

R5 – Perennial Pools lack Cover (Pool 4)

R5 – ERT Crossing – OK but seasonal flow, small perennial pools

R5) Heritage Trail tributary need bridge to avoid beaver conflict

South Simms Reach 1 Restoration Photos

SS R1 – Willow Trail rock crests are in need of repair

SSR1 – Rockland Rock crests failed as well

SSR1 – Pool 1 eroding banks (Placemark 98)

SSR1 – Riffle 3 lacks boulders to aerate and anchor gravel

South Simms Reach 2 Restoration Photos

1.) Pool1 (Site 122) old logging crossing, has bank erosion

2.) Pool 4 (Site 128) lacks depth

3.) Hwy 19 at top end of SSR2- seasonally dry

4.) Hwy 8m Arch culvert accommodates wildlife passage

Appendix 1 – Simms Reach 1 Habitat Data

Stream Name: Simms | Watershed Code: 1234 | Date: Sep.20/20 | Reach Name: Simms R1 | Field Crew: BRR,DRC,CA | Total Length: 869 | Discharge Depth #1 | Velocity T1 | Site Length

Water Quality Information

Dissolved Oxygen: 7.60 | pH: 6.80 | Total Dissolved Solids: 66.00 | Temp C: 15.00 | Chainage at Beginning of Reach: 0.00 | Discharge Depth #2 | T2

Velocity (m/s): . | Average Depth (at flow site) | Wetted Width (at flow site) | Discharge (m3/s) | Chainage at End of Reach: 480.00 | Discharge Depth #3 | T3

Habitat Information (All Pool and Cross Section Data) — Reach1 from Ocean upstream to Galerno Rd

Habitat Type	Start chainage	Finish Chainage	Unit Length	Wetted Width	Pool Area	Wetted Reach Area	%Pool Area	Mean Depth (m)	Gradient %	Bankfull Width(m)	Avg. Wetted Area %	Substrate Percent Bed	Bld	Cob	Grv	Fine	Instream Cover % Bold	LWD	Cutbk	Veg	Other	Crown Cover	Large Woody Debris No.	LWD/CW	Erosion Sites (length)	Altered Stream Sites (length)	Obstructions (number)	Land Use Right	Left	Vegetation Type Right	Left	Riparian Slope Right	Left	Stability Right	Left	Vegetation Depth Right	Left	Livestock Access Right	Left	Photos	Comments
Riffle	0.0	4.4		4.50	0.0	19.8			2.0	6.80			10	5	70	15	5	0	0			60	0		0	4	1	C	C	Mix	Mix	35	40	Med	Med	3	6				
Pool	4.4	17.9	13.5	5.20	70.2	70.2		0.45	0.0	7.90			10	10	10	70	10	0	0			85	0		5	0	0	C	Nat	Mix	Mix	10	25	High	Med	5	30				
Riffle	17.9	29.0		3.70	0.0	41.1			2.0	7.00			0	0	70	30	0	0	0			75	0		0	5	0	C	Nat	Mix	Mix	10	25	Low	Low	10	30				
Pool	29.0	49.0	20.0	4.90	98.0	98.0		0.40	0.0	8.70			5	5	10	80	5	0	0			60	0		10	10	1	C	Nat	Mix	Mix	15	50	Low	Low	12	30				
Pool	49.0	80.0	31.0	5.90	182.9	182.9		0.90	0.0	13.00			0	5	5	90	20	0	0			75	0		0	0	0	C	Nat	Mix	Mix	20	25	Med	Med	7	30				
Pool	80.0	124.0	44.0	5.50	242.0	242.0		0.60	0.0	5.50			0	0	0	##	10	0	10			60	9		0	10	0	C	Nat	Sh	Mix	40	40	Med	Med	7	30				
Pool	124.0	160.0	36.0	5.90	212.4	212.4		0.45	0.0	7.00			10	10	60	20	5	0	0			60	0		0	20	0	C	C	Mix	Mix	40	40	High	High	8	20				old site
Riffle	160.0	194.0		3.70	0.0	125.8			1.0	7.20			0	10	80	10	0	0	0			65	0		0	17	0	C	R	Mix	Mix	10	10	Med	Med	9	6				
Pool	194.0	200.0	6.0	4.00	24.0	24.0		0.40	0.0	4.50			10	20	20	60	0	0	0			100	1		0	6	0	C	Nat	Mix	Mix	10	10	Med	Med	9	6				bridge
Riffle	200.0	218.0		3.30	0.0	59.4			2.0	5.40			10	10	70	10	5	0	0			60	1		0	3	0	C	C	Mix	Mix	35	40	Med	Med	5	5				bridge
Pool	218.0	231.0	13.0	3.90	50.7	50.7		0.25	0.0	4.90			15	25	50	10	10	0	0			60	1		0	13	0	R	R	Mix	Mix	40	40	Med	Med	3	0				rip rap bank
Riffle	231.0	264.0		4.30	0.0	141.9			1.0	4.90			5	20	60	15	0	0	0			60	0		0	20	0	0	0	Mix	Gr	40	25	High	High	2	2				yard
Riffle	264.0	293.0		3.70	0.0	107.3		0.10	2.0	6.60			0	15	50	35	0	0	0			75	0		9	10	0	RS	RS	Gr	Gr	45	10	Low	Low	8	4				more yard
Pool	293.0	318.0	25.0	4.30	107.5	107.5		0.45	0.0	7.40			0	10	50	40	0	0	10			60	0		25	0	0	RS	R	Sh	Sh	45	10	Low	Low	10	2				
Riffle	318.0	358.0		5.10	0.0	204.0			2.0	6.90			5	15	50	30	0	10	0			65	1		10	0	0	Nat	Nat	Mix	Mix	45	10	Med	Med	10	2				
Riffle	358.0	396.0		6.00	0.0	228.0			1.0	6.90			0	15	50	35	0	5	0			65	0		5	0	0	Nat	Nat	Mix	Mix	90	10	Med	Med	8	2				logged bank
Pool	396.0	423.0	27.0	5.20	140.4	140.4		0.30	1.0	6.10			5	15	50	30	0	0	10			70	1		5	0	0	R	R	Mix	Mix	70	10	Low	Low	7	2				outfall
Riffle	423.0	437.0			0.0	0.0			1.5	7.20			0	15	50	35	0	0	0			70	0		0	0	0	Nat	Nat	Mix	Mix	70	10	Med	Med	7	2				
Pool	437.0	454.0	17.0	5.50	93.5	93.5		0.35	0.0	7.00			0	10	60	30	0	0	5			70	0		0	0	0	Nat	Nat	Mix	Mix	70	15	Low	Low	5	15				
Riffle	454.0	480.0		5.10	0.0	132.6			2.0	5.90			20	10	30	40	5	0	0			70	0		3	3	1	Nat	Nat	Mix	Mix	15	25	Low	Low	5	15	1			
Reach Totals and Averages		480.0	232.5	4.7	1221.6	2266.1	54	0.42	0.88	6.84	69.0		5	11	45	39	4	1	2			68	14	0	15	25	3	51	43			42	22	68	70	7	12	0.2	0.0		

Appendix 2 – Reach 2 Habitat Data

Stream Name: Simms R2 | Watershed Code: 12344 | Date: sep 21/20 | Reach Name: Simms R2 | Field Crew: DRC.BRR,CA | Discharge Depth #1 | Velocity T1 | Site Length

Water Quality Information

Dissolved Oxygen: . | pH | Total Dissolved Solids | Temp C | Chainage at Beginning of Reach: 0.00 | Discharge Depth #2 | T2

Velocity (m/s): . | Average Depth (at flow site) | Wetted Width (at flow site) | Discharge (m3/s) | Chainage at End of Reach: 231.00 | Discharge Depth #3 | T3

Habitat Information (All Pool and Cross Section Data) — Reach 2 - from Galerno upstream to Alder rd

Habitat Type	Start chainage	Finish Chainage	Unit Length	Wetted Width	Pool Area	Wetted Reach Area	%Pool Area	Mean Depth (m)	Gradient %	Bankfull Width(m)	Avg. Wetted Area %	Substrate Percent Bed	Bld	Cob	Grv	Fine	Instream Cover % Bold	LWD	Cutbk	Veg	Other	Crown Cover	Large Woody Debris No.	LWD/CW	Erosion Sites (length)	Altered Stream Sites (length)	Obstructions (number)	Off-Channel Habitat (length)	Off-Channel Ha	Off-Chann	Land Use Right	Left	Vegetation Type Right	Left	Riparian Slope Right	Left	Stability Right	Left	Vegetation Depth Right	Left	Livestock Access Right	Left	Photos	Comments
Pool	0.00	42.00	42.00	3.70	155.40			0.40	0.00	6.60		0	5	5	30	60	0	0	10	5		60.00	9			20	2				Nat	Nat	Mix	Mix	25	5	High	High	50	50				
Pool	42.00	78.00	36.00	7.90	284.40			0.60	0.00	4.50		0	0	10	10	80	0	0	5	5		60.00	6								Nat	Nat	Mix	Mix	25	5	High	High	50	50				B Dam
Pool	78.00	144.00	66.00	7.10	468.60			0.55	0.00	6.80		0	0	0	0	100			5	5		60.00	0								Nat	Nat	0	0			0	0						B Dam
Pool	144.00	231.00	87.00	6.10	530.70			0.45	0.00	9.80		0	0	0	0	100			5	5		60.00	1				2				Nat	Nat	Mix	Mix	25	5	Low	Low						B Dam split
																														0	0	0	0			0	0						
																														0	0	0	0			0	0						
Reach Totals and Averages		231.00	231.00	6.20	1439.10	1432.20	####	0.50	0.00	6.93	89.53	0	1	4	10	85	0	0	6	5		60.00	16	0.48	0	9	4	0			4	4			3	3	7	7	50.00	50.00	0	0		

Appendix 3 – Reach 3 Habitat Data

Water Quality Information — Field Crew: BRR,DRC,CA — T1 — Site Length

Dissolved Oxygen	7.60	pH	6.80	Total Dissolved Solids	66.00	Temp C	15.00	Chainage at Beginning of Reach	0.00	Discharge Depth #2	T2
Velocity (m/s)	.	Average Depth (at flow site)		Wetted Width (at flow site)		Discharge (m3/s)		Chainage at End of Reach	212.00	Discharge Depth #3	T3

Habitat Information (All Pool and Cross Section Data) — Reach 3 - From Alder upstream to Rockland

Habitat Type	Start chainage	Finish Chainage	Unit Length	Wetted Width	Pool Area	Wetted Reach Area	%Pool Area	Mean Depth (m)	Gradient %	Bankfull Width(m)	Avg. Wetted Are	Substrate Percent Bed	Bld	Cob	Grv	Fine	Instream Cover % Bold	LWD	Cutbk	Veg	Other	Crown Cover	Large Woody Debris No.	LWD / CW	Erosion Sites (lengt	Altered Stream	Obstructions (number)	Off-Channel	Off-Ch	Land Use Right	Land Use Left	Vegetation Type Right	Vegetation Type Left	Riparian Slope Right	Riparian Slope Left	Stability Right	Stability Left	Vegetation Depth Right	Vegetation Depth Left	Livestock Access Right	Livestock Access Left	Comments
Riffle	0.00	20.00		3.30	0.00	66.00			2.00	6.60		10	5	50	35		5	0	0			75.00	1		0		0			Nat	Nat	Mix	Mix	25	5	Med	Med	50	70			
Pool	20.00	31.00	11.00	4.30	47.30	47.30		0.30	0.00	10.00		5	10	30	55		5	5	0			75.00	2		0		0			Nat	Nat	Mix	Mix	25	5	Med	Med	10	70		10	
Riffle	32.00	55.00		2.70	0.00	62.10			2.00	5.50		0	5	90	5		0	5	0			70.00	3		0		0			Nat	Nat	Mix	Mix	25	5	Med	Med	8	50			
Pool	54.00	68.00	14.00	4.50	63.00	63.00		0.50	0.00	8.70		0	0	0	0		0	0	0			70.00	2		6		0			Nat	Nat	Mix	Mix	25	5	Med	Med	12	50			
Pool	68.00	95.00	27.00	3.30	89.10	89.10		0.50	0.00	5.90		0	0	0	100		0	0	5			60.00	1		0		0			Nat	Nat	Mix	Mix	25	5	Med	Med	12	50			
Riffle	95.00	98.00		3.70	0.00	11.10			1.00	10.00		0	0	90	10		0	15	0			70.00	2		0		0			Nat	Nat	Mix	Mix	20	5	Med	Low	25	50			
Pool	98.00	110.00	12.00	4.30	51.60	51.60		0.40	0.00	7.20		0	10	50	40		0	0	0			70.00	1		0		0			Nat	Nat	Mix	Mix	20	5	Med	Med	40	50			
Riffle	110.00	112.00		2.20	0.00	4.40			1.00	4.30		0	0	100	0		0	0	0			60.00	0		0		0			Nat	Nat	Mix	Mix	20	5	Med	Low	45	50			floodplain
Pool	112.00	139.00	27.00	3.70	99.90	99.90		0.40	0.00	7.20		0	10	30	60		0	0	10			60.00	0		0		0			Nat	Nat	Mix	Mix	25	5	Med	Med	45	50			
Pool	139.00	158.00	19.00	2.70	51.30	51.30		0.50	1.00	4.30		0	0	10	90		0	20	0			60.00	3		0		0			Nat	Nat	Mix	Mix	25	5	Med	Med	50	50			
Riffle	158.00	171.00		3.30	0.00	42.90			0.00	4.50		0	0	0	0		0	0	0			60.00	0		0		0			Nat	Nat	Mix	Mix	25	5	Med	Med	60	50			
Pool	172.00	182.00	10.00	2.70	27.00	27.00		0.40	0.00	2.70		0	0	20	80		0	0	0			60.00	0		0		0			Nat	Nat	Mix	Mix	25	5	Med	Med	65	50			
Pool	182.00	197.00	15.00	3.10	46.50	46.50		0.30	1.00	4.90		0	0	0	0		0	0	0			60.00	0		5		0			Nat	Nat	Mix	Mix	25	5	Med	Low	75	40			
Riffle	197.00	206.00		2.70	0.00	24.30			2.00	6.80		0	10	70	20		0	0	0			60.00	0		0		0			Nat	Nat	Mix	Mix	25	5	Med	Med	80	40			
Pool	206.00	212.00	6.00	2.20	13.20	13.20		0.60	1.00	12.00		0	0	90	10		0	5	0			60.00	2		0		0			Nat	Nat	Mix	Mix	25	5	Med	Med	85	40			
																													0	0	0	0	25	5	Med	Med					
Reach Totals and Averages		212.0	141.0	3.25	489	700	70	0.43	0.73	6.71	48		1	3	42	34	1	3	1			65	17	0.54	5	0	0	0		15	15			16	16	48	54	44	51	0	5	

Appendix 4 – Reach 4 Habitat Data – not USHP surveyed see results

Appendix 5 – Reach 5 Habitat Data

Stream Name: N Simms | Watershed Code: 1234 | Date: Sep 23/20 | Reach Name: SimmsR5 | Discharge Depth #1 | Velocity T1 | Site Length

Field Crew: DRC GLT

Water Quality Information

Dissolved Oxygen: . | pH | Total Dissolved Solids | Temp C | Chainage at Beginning of Reach: 0.00 | Discharge Depth #2 | T2

Velocity (m/s): . | Average Depth (at flow site) | Wetted Width (at flow site) | Discharge (m3/s) | Chainage at End of Reach: 99.00 | Discharge Depth #3 | T3

Habitat Information (All Pool and Cross Section Data)

Reach - North Simms to Hwy

Habitat Type	Start chainage	Finish Chainage	Unit Length	Wetted Width	Pool Area	Wetted Reach Area	%Pool Area	Mean Depth (m)	Gradient %	Bankfull Width(m)	Avg. Wetted Area %	Substrate Percent Bed	Bld	Cob	Grv	Fine	Instream Cover % Bold	LWD	Cutbk	Veg	Other
Riffle	0.00	22.00		4.30	0.00				3.00	7.30		0	25	10	20	45	5	0	0	0	0
Pool	22.00	27.50	5.50	4.00	22.00			0.25	0.00	7.30		0	10	10	20	60	0	0	0	0	0
Riffle	27.50	40.50		4.30	0.00				5.00	5.30		0	50	20	20	10	10	0	0	0	0
Pool	40.50	51.50	11.00	4.00	44.00			0.30	0.00	5.30		0	10	10	40	40	5	0	0	0	0
Riffle	51.50	60.50		3.80	0.00				3.00	4.50		0	50	20	30	0	5	0	0	0	0
Pool	60.50	65.50	5.00	4.10	20.50			0.25	0.00	5.70		0	20	10	10	60	0	5	0	0	0
Riffle	65.50	79.50		3.80	0.00				4.00	4.50		0	40	20	30	10	5	0	0	0	0
Pool	79.50	84.50	5.00	4.80	24.00			0.20	0.00	5.30		0	25	25	10	40	0	0	0	0	0
Riffle	84.50	85.50		3.80	0.00				3.00	5.30		0	0	0	80	20	0	0	0	0	0
Pool	85.50	90.50	5.00	2.90	14.50			0.30	0.00	4.30		0	10	10	10	70	5	0	0	0	0
Riffle	90.50	93.50		3.50	0.00				2.00	5.00		0	40	20	10	30	0	0	0	5	0
Pool	93.50	99.00	5.50	3.80	20.90			0.30	0.00	5.30		0	10	10	10	70	0	5	0	0	0
Reach Totals and Averages		99.00	37.00	3.93	145.90	388.6	37.5	0.27	1.7	5.43	72	0	24	14	24	38	3	1	0	0	0

Habitat Type	Crown Cover	Large Woody Debris No.	LWD/CW	Erosion Sites (length)	Altered Stream Sites	Obstructions (number)	Off-Channel Habitat	Off-Cha	Off-Channel Ha	Land Use Right	Land Use Left	Vegetation Type Right	Vegetation Type Left	Riparian Slope Right	Riparian Slope Left	Stability Right	Stability Left	Vegetation Depth Right	Vegetation Depth Left	Livestock Access Right	Livestock Access Left		Comments
Riffle	80.00	0		10						Nat	Nat	Con	Con	30	40	Low	Low	500	400				old Bridge site
Pool	80.00	0		5						Nat	Nat	Con	Con	30	40	Med	Low	500	400		5		trail erosion
Riffle	80.00	0		0						Nat	Nat	Con	Con	30	40	Low	Low	500	400				old Bridge site
Pool	80.00	0		0						Nat	Nat	Con	Con	30	40	Med	Low	500	400		5		trail erosion
Riffle	85.00	0		0						Nat	Nat	Con	Con	30	40	Low	Low	500	400				old Bridge site
Pool	85.00	1		0						Nat	Nat	Con	Con	40	10	Med	Low	500	400		5		trail erosion
Riffle	85.00	0		0						Nat	Nat	Con	Con	40	10	Low	Low	500	400				old Bridge site
Pool	85.00	0		0						Nat	Nat	Con	Con	40	10	Med	Low	500	400		5		trail erosion
Riffle	85.00	0		0						Nat	Nat	Con	Con	30	10	Low	Low	500	400				old Bridge site
Pool	85.00	0		0						Nat	Nat	Con	Con	30	10	Med	Low	500	400		5		trail erosion
Riffle	80.00	0		0						Nat	Nat	Con	Con	20	10	Low	Low	500	400				old Bridge site
Pool	80.00	1		0						Nat	Nat	Con	Con	10	10	Med	Low	500	400		5		trail erosion
										0	0	0	0			0	0						
Reach Totals and Averages	82.50	2	0.11	15	0	0	0			12	12			12	12	48	60	500	400	0	30		

Appendix 6 – South Simms R1 Habitat Data

Stream Name	S Simms	Watershed Code	1234	Date	sep 23,20	Reach Name	SSims R1	Discharge Depth #1	Velocity T1	Site Length
Water Quality Information					Field Crew		DRC GLT			
Dissolved Oxygen	.	pH		Total Dissolved Solids		Temp C	at Beginning of Reach	0.00	Discharge Depth #2	T2
Velocity (m/s)	.	Average Depth (at flow site)		Wetted Width (at flow site)		Discharge (m3/s)	Chainage at End of Reach	107.00	Discharge Depth #3	T3

Habitat Information (All Pool and Cross Section Data)

Habitat Type	Start chainage	Finish Chainage	Unit Length	Wetted Width	Pool Area	Wetted Reach Area	%Pool Area	Mean Depth (m)	Gradient %	Bankfull Width(m)	Avg. Wetted Area %
Pool	0.00	20.00	20.00	3.00	60.00			0.30	1.00	4.90	
Riffle	20.00	40.00		2.00	0.00			0.10	3.00	5.30	
Pool	40.00	54.00	14.00	2.50	35.00			0.25	0.00	4.30	
Riffle	54.00	61.00		1.50	0.00			0.00	3.00	5.50	
Pool	61.00	72.00	11.00	3.50	38.50			0.40	0.00	6.10	
Riffle	72.00	76.00		2.20	0.00			0.10	1.00	5.50	
Pool	76.00	92.00	16.00	2.70	43.20			0.25	0.00	5.50	
Riffle	92.00	102.00		1.20				0.10	1.00	5.00	
Pool	102.00	106.00	4.00	5.50	22.00			0.30	0.00	7.50	
Riffle	106.00	107.00		0.60				0.10	3.00	6.10	
Reach Totals and Averages		107.00	65.00	2.47	198.70	264.29	75.18	0.19	1.20	5.57	44

Habitat Type	Substrate Percent Bed	Bld	Cob	Grv	Fine	Instream Cover % Bold	LWD	Cutbk	Veg	Other	Crown Cover	Large Woody Debris No.	LWD /CW	Erosion Sites (length)	Altered Stream Site	Obstruction	Land Use Right	Left	Vegetation Type Right	Left	Riparian Slope Right	Left	Stability Right	Left	Vegetation Depth Right	Left	Livestock Access Right	Left	Comments
Pool	0	5	0	0	95	0	0	0	5		80.00	1		5			Nat	Nat	Mix	Mix	30	30	Med	w	500	150	1	1	Dogwood
Riffle	0	0	0	90	10	0	0	0	0		85.0	0		3			Nat	Nat	Mix	Mix	30	30	Low	d	150	150			
Pool	0	0	0	10	90	0	5	0	0		85.0	1		2			Nat	Nat	Mix	Mix	30	30	Low	d	150	150			
Riffle	0	0	0	90	10	0	0	0	0		85.0	0		3			Nat	Nat	Mix	Mix	30	30	Med	d	150	150			
Pool	0	0	0	30	70	0	10	0	0		85.0	1		0			Nat	Nat	Mix	Mix	30	30	Med	d	500	500			
Riffle	0	0	0	70	30	0	0	0	0		85.0	0		0			Nat	Nat	Mix	Mix	30	30	Med	d	500	500			
Pool	0	0	0	10	90	0	0	0	0		85.0	0		0			Nat	Nat	Mix	Mix	30	30	Med	d	500	500			
Riffle	0	0	0	90	10	0	5	0	0		95.0	1		0			Nat	Nat	Mix	Mix	30	30	Med	d	500	500			
Pool	0	0	0	10	90	0	70	0	0		85.0	6		2			Nat	Nat	Mix	Mix	30	30	Med	d	500	500			
Riffle	0	0	0	100	0	0	0	0	0		85.0	0		0			Nat	Nat	Mix	Mix	30	30	Med	d	500	500			
																	0	0	0	0			0	0					
Reach Totals and Averages	0	1	0	50	50	0	9	0	1		85.5	10	0.52	14	0	0	10	10			10	10	34	32	395	360	1	1	

Appendix 7 – S. Simms R2 Habitat Data

Stream Name	S Simms ERT	Watershed Code	1234	Date	Sep 23/20	Reach Name	SSimms R2			Discharge Depth #1		Velocity T1	Site Length
Water Quality Information					Field Crew	DRCGLT							
Dissolved Oxygen	8.20	pH	6.80	Total Dissolved Solids	50.00	Temp C	15.00	Chainage at Beginning of Reach	0.00	Discharge Depth #2		T2	
Velocity (m/s)	.	Average Depth (at flow site)		Wetted Width (at flow site)		Discharge (m3/s)		Chainage at End of Reach	131.50	Discharge Depth #3		T3	

Habitat Information (All Pool and Cross Section Data)

Habitat Type	Start chainage	Finish Chainage	Unit Length	Wetted Width	Pool Area	Wetted Reach Area	%Pool Area	Mean Depth (m)	Gradient %	Bankfull Width(m)	Avg. Wetted Area %	Substrate Percent Bed	Bld	Cob	Grv	Fine	Instream Cover % Bold	LWD	Cutbk	Veg	Other
Pool	0.00	5.00	5.00	2.20	11.00			0.60	0.00	5.80		0	20	0	20	60	0	0	20		
Riffle	5.00	17.00		3.00	0.00				10.00	10.00		0	50	30	20	0	5	0	0		
Pool	17.00	22.00	5.00	1.50	7.50			0.20	0.00	5.00			20	5	25	50	0	0	10		
Riffle	22.00	50.00		1.80	0.00				5.00	5.40		0	50	10	40	0	5	0	0		
Pool	50.00	64.00	14.00	2.00	28.00			0.30	0.00	8.60			20	30	30	20	0	10	0		
Riffle	64.00	86.00		2.00	0.00				6.00	4.00		0	30	30	40	0	5	0	0		
Pool	86.00	88.50	2.50	2.00	5.00			0.25	0.00	3.80			10	20	40	30	0	0	10		
Riffle	88.50	111.50		1.40	0.00				6.00	4.30			10	10	70	10	0	0	0		
Pool	111.50	115.50	4.00	3.50	14.00			0.30	0.00	3.50		0	25	25	25	25	0	0	0		
Riffle	115.50	145.50		1.00	0.00				6.00	3.20		0	50	10	40	0	5	0	0		
0																					
Reach Totals and Averages		131.50	30.50	2.04	65.50	268.26	24.42	0.33	3.30	5.36	###	0	29	17	35	20	2	1	4		

Habitat Type	Crown Cover	Large Woody Debris No.	LWD/ CW	Erosion Sites (length)	Altered Stream Sites (length)	Obstructions (number)	Off-Channel Habitat	Off-Channel Ha	Off-Channel Ha	Land Use Right	Left	Vegetation Type Right	Left	Riparian Slope Right	Left	Stability Right	Left	Vegetation Depth Right	Left	Livestock Access Right	Left	Photo	Comments
Pool	90.00	1		3						Nat	Nat	Br	Con	30	40	Med	Low	500	500				at ERT Xing
Riffle	90.00	0								Nat	Nat	Br	Con	30	40	Med	Med	500	500				
Pool	90.00	0								Nat	Nat	0	0			Med	High						
Riffle	75.00	0								Nat	Nat	Mix	Con			0	0	500	500				
Pool	75.00	1								0	0	0	0			Med	Med						
Riffle	80.00	0								Nat	Nat	Mix	Mix	10	10	Med	Med	500	500				
Pool	80.00	1								Nat	Nat	Mix	Mix	40	10	Med	Med	500	500				
Riffle	80.00	0		15						Nat	Nat	Mix	Mix	40	10	Low	Med	500	500				
Pool	80.00	0								Nat	Nat	Mix	Mix	45	20	Med	Med	500	500				
Riffle	80.00	0								Nat	Nat	Mix	Mix	15	15	Med	Med	500	500				
										0	0	0	0			0	0						
0										0	0	0	0			0	0						
										0	0	0	0			0	0						
Reach Totals and Averages	82.00	3	0.12	14	0	0	0			9	9			9	7	29	27	500	500	0	0		

Appendix 9 – Simms Watershed USHP Habitat Assessment Scores

Habitat and Water Quality Reaches 1-5, South Simms R1 R2.

Stream Name	Simms			Watershed Code	1234								
Habitat Parameter	**Simms R1**	**Ratings**	**Simms R2**	**Ratings**	**Simms R3**	**Ratings**	**Simms R5**	**Ratings**	**SSimms R2**	**Ratings**	**SSims R1**	**Ratings**	**Total**
% Pool Area	54	3	100	1	70	1	38	5	24	5	75	1	**16**
Large Woody Debris/Bankfull Channel Width	0.2	5	0.5	5	0.5	5	0.1	5	0.1	5	0.5	5	**30**
% Cover in Pools	6.3	3	11	3	5	5	4	5	7	3	10	3	**22**
Average% Boulder Cover	3.8	5	0	5	1	5	3	5	2	5	0	5	**30**
Average % Fines	39	5	85	5	34	5	38	5	20	3	50	5	**28**
Average % Gravel	45	not rated	10	not rated	42	not rated	24	not rated	35	not rated	50	not rated	**--**
% of Reach Eroded	15	5	0	1	5	3	15	5	14	5	14	5	**24**
Obstructions	3.0	3	4	4	0	0	0	0	0	0	0	0	**7**
% of Reach Altered	25	5	9	3	0	1	0	1	0	1	0	1	**12**
% Wetted Area	69	5	90	3	48	5	72	3	38	5	44	5	**26**
Dissolved Oxygen	7.6	1	.		7.6	1	.	1	8.20	1	.	1	**5**
pH	6.8	1			6.8	1		5	6.80	1		5	**13**
Totals		**41**		**30**		**32**		**40**		**34**		**36**	**213**
Off-Channel Habitat as % of Reach	0	5	0	5	0	5	0	5	0	5	0	5	**30**
Survey Lengths	480	not rated	231	not rated	212	not rated	99	not rated	132	not rated	107	not rated	**1261**

Riparian Ratings Reaches 1-5, South Simms R1 R2

Riparian Ratings													
Reach	**Simms R1**	**Ave. Ratings**	**Simms R2**	**Ave. Ratings**	**Simms R3**	**Ave. Ratings**	**Simms R5**	**Ave. Ratings**	**SSimms R2**	**Ave. Ratings**	**SSims R1**	**Ave. Ratings**	**Total**
Land Use	94	2	8	2	30	1	24	1	18	1	20	1	**8**
Riparian Slope	64	2	6	2	32	1	24	1	16	1	20	1	**7**
Bank Stability	138	3	14	4	102	3	108	5	56	4	66	3	**22**
% Crown Cover	68	3	60	3	65	3	83	1	82	1	86	1	**12**
% of Reach Accessed by Livestock	1	1	0	0	12	3	76	5	0	0	5	1	**10**
Average Vegetation Depth	9	5	50	3	47	3	450	1	500	1	378	1	**14**
Totals		**16**		**13**		**14**		**14**		**8**		**8**	**73**