The Mission Creek Stream Survey Report January 2000*

(*Incorporating data gathered between October 1998 and November 1999)

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For
The Waterfalls Creek Stream Rehabilitation Project

Project funded in part by Fisheries Renewal BC

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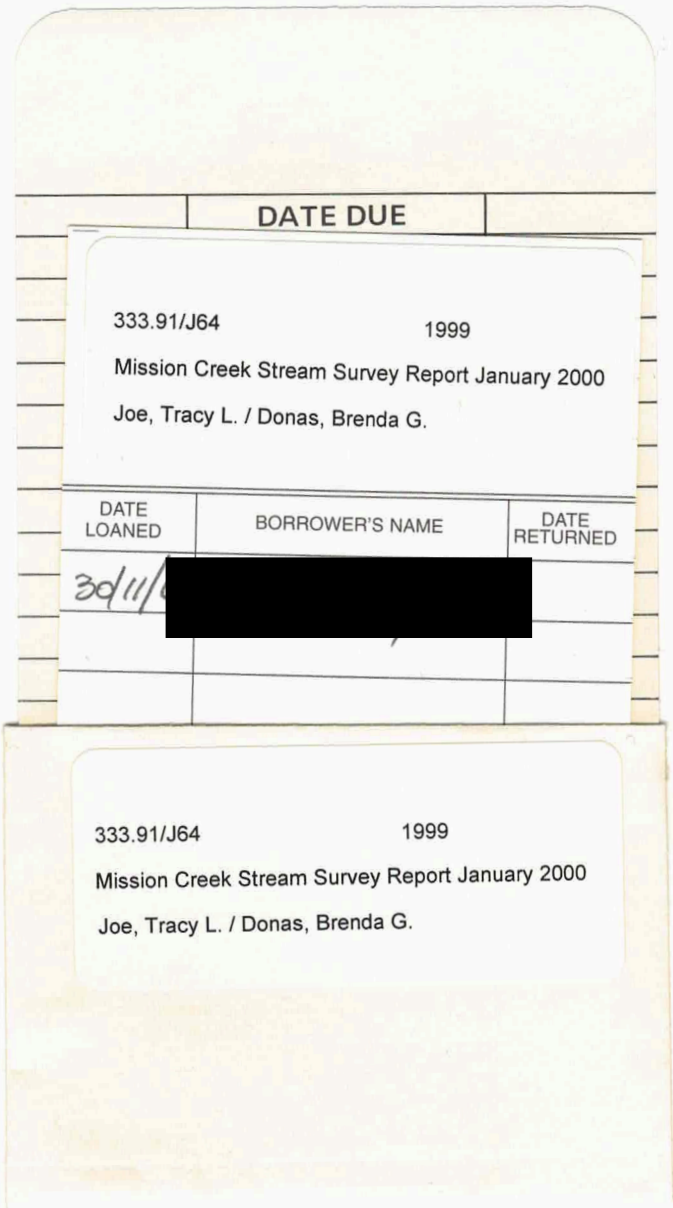


Introduction

1.1 Background Information

This project although entitled the Mission Creek Stream Survey, deals with Mission Creek, Station Creek and Waterfall Creek. The project was initiated by the Waterfall Creek Stream Rehabilitation Project led by Grieg Houlden and his grade seven class at the New Hazelton Elementary School.

The grade seven classes, under Mr. Houlden's supervision have participated in a coho egg incubation project, habitat surveys and public education and awareness events relating to Waterfall/Station/Mission Creeks. The students have conducted Streamkeepers activities such as aquatic insect monitoring, fry capture and identification and water quality sampling on Waterfall and Mission Creeks. The students of recent years have also been participating in a coho rehabilitation project on Mission and Waterfall Creeks. The coho rehabilitation project has been a joint initiative between Mr. Houlden's grade seven classes and the Chicago Creek Community Environmental Enhancement Society.

Mr. Houlden and his class became aware of a water diversion on Station Creek and due to their interest in the salmon resource, the class visited the site of the diversion. When the water diversion was visited by Mr. Houlden and his class, their observations caused them to become concerned about the amount of water being diverted away from the Station Creek side and they also became concerned about the issue of water withdrawl in general. Their observations led to a meeting and site inspection by DFO Community Programs staff and later to their interest in conducting a stream survey that would assist in determining impacts of the existing water diversion. When the Fisheries Renewal B.C. Program came into being, a conglomerate of community groups formed. That conglomerate is known as the Bulkley Morice Salmonid Preservation Group(BMSPG). The Waterfall Creek Stream Rehabilitation Project approached the BMSPG with a funding proposal to survey the stream systems of interest i.e. Mission, Station and Waterfall Creeks. The objective of the stream survey program was that the results could be used as baseline data. This baseline data would assist in providing information if and when water withdrawl is to be increased and/or if mitigative measures must be taken as a result of the water diversion causing loss of fish habitat.

1.2 Purpose and Methods

A stream survey provides information on stream hydrology. The information that is collected provides details on channel length, width, depths as well as information on components of fish habitat. The components of fish habitat that were recorded were presence/absence of woody debris, substrate type and size, substrate compaction, presence of cutbanks and information on riparian area and canopy cover.

This information provides a baseline for habitat rehabilitation work and coupled with the fish presence/absence data provides some direction on which areas of stream can be classified as sensitive habitat.

Stream Survey Method

The stream survey consisted of surveying three streams : Waterfall Creek, Station Creek and Mission Creek.

Waterfall Creek is defined as the stream that flows from the waterfall(impassable to upstream fish migration) in New Hazelton to the confluence with Station Creek which is approximately 1.889 kms. downstream from the falls. This stream flows through New Hazelton residential areas, alongside the CN Railway tracks, under Highway 16 (bridge), past a chipper mill and continues along the CN Railway tracks to the confluence with Station Creek. For purposes of this survey, Waterfall Creek has been referred to as Reach 4.

Station Creek is defined as the stream that flows from the water diversion westward along the base of Hagwilget mountain. The stream below the water diversion is steep at times but as the stream continues downstream, its flow becomes meandering through beaver swamp. The Station Creek portion has been referred to as Reach 3 in this report.

Mission Creek is defined as the stream that flows from the confluence of Waterfall and Station Creeks to the confluence with the Bulkley River. This section of stream has been referred to as Reach 1 and Reach 2 and includes some beaver pond areas that at the time of this survey were inaccessible to fish.

The stream survey commenced Oct. 22'nd, 1998 at the confluence of Mission Creek and the Bulkley River. A benchmark was established as the starting point for Reach 1 and the survey commenced upstream from that point. The surveyors were attempting to survey each Reach in terms of pool and riffle habitat units. However, many sections of these streams were often of one habitat type i.e. all riffle or all pool or all glide. In most cases the section units consisted of measuring long riffles or glides.

The stream survey was conducted as follows :

- Flagging tape was tied onto a tree limb to denote the start point of a section

- A hip chain or laser range finder was used to measure the length of the section
- Flagging tape was tied onto a tree limb to denote the end point of the section
- Where possible, three width transects were measured using either the hip chain or the laser range finder. Both bankfull and wetted width measurements were taken.
- Left bank, right bank and channel center depth measurements were taken across the width transects. These included both bankfull and wetted depths.
- Cobble diameter measurements were taken on 10 pieces of cobble chosen at random in most stream reaches and sections
- Cobble embeddedness was estimated for each piece of cobble sampled for diameter
- Canopy cover was estimated as percent of stream covered by riparian canopy
- Observations on width of riparian area were recorded
- Observations on woody debris presence were recorded
- Observations on cutbank presence were recorded
- Any pertinent comments regarding specific habitat "hot spots" were recorded eg. Cascades, beaver dams, impassable culverts etc…
- A hand level was used to determine the slope of the section(as per instructions in the Advanced Stream Habitat Survey Module in the Streamkeepers Manual).

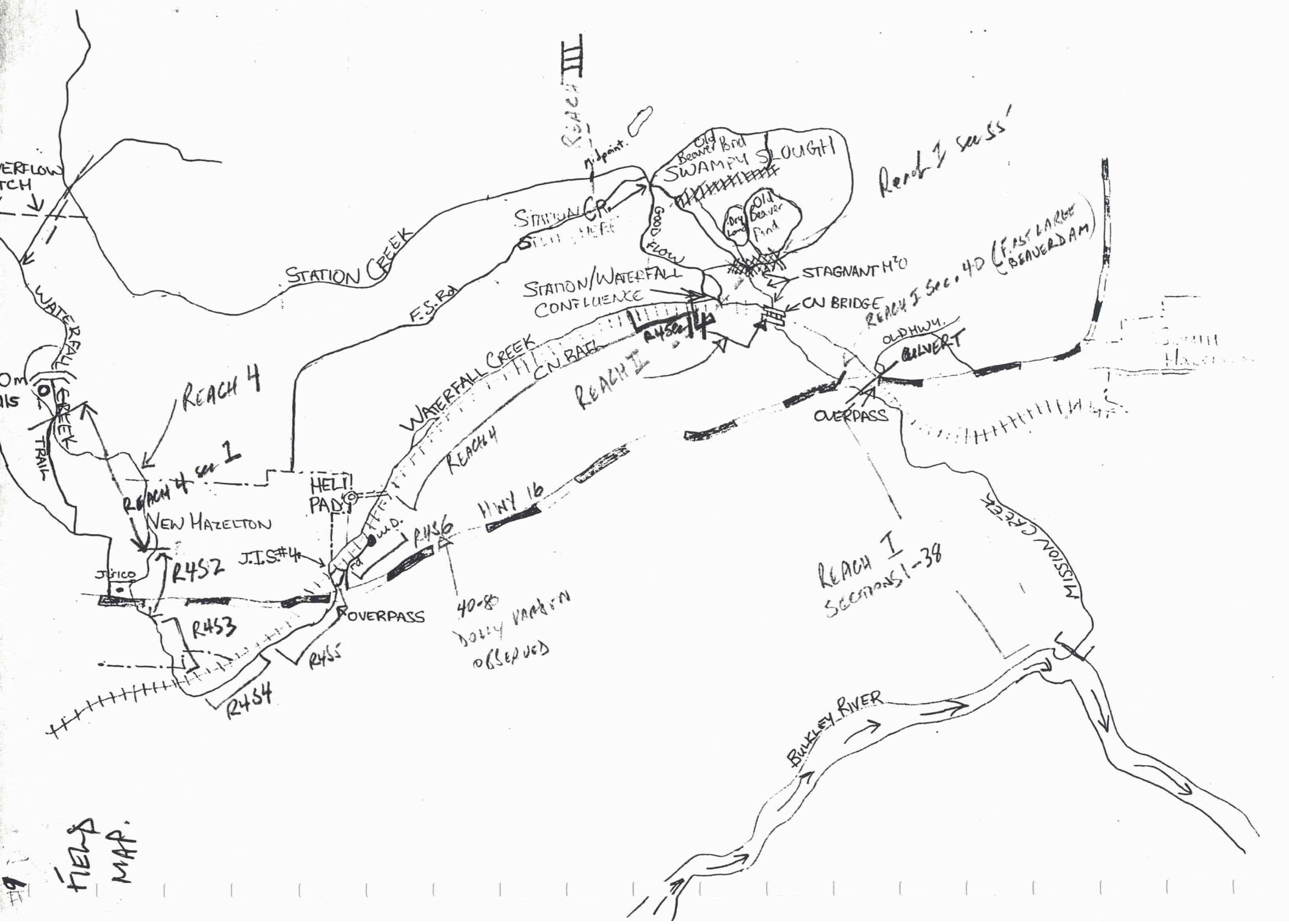
Some basic water quality data was collected using a LaMotte Kit for pH, turbidity, carbon dioxide and alkalinity and a Hach Kit was used to determine dissolved oxygen levels.

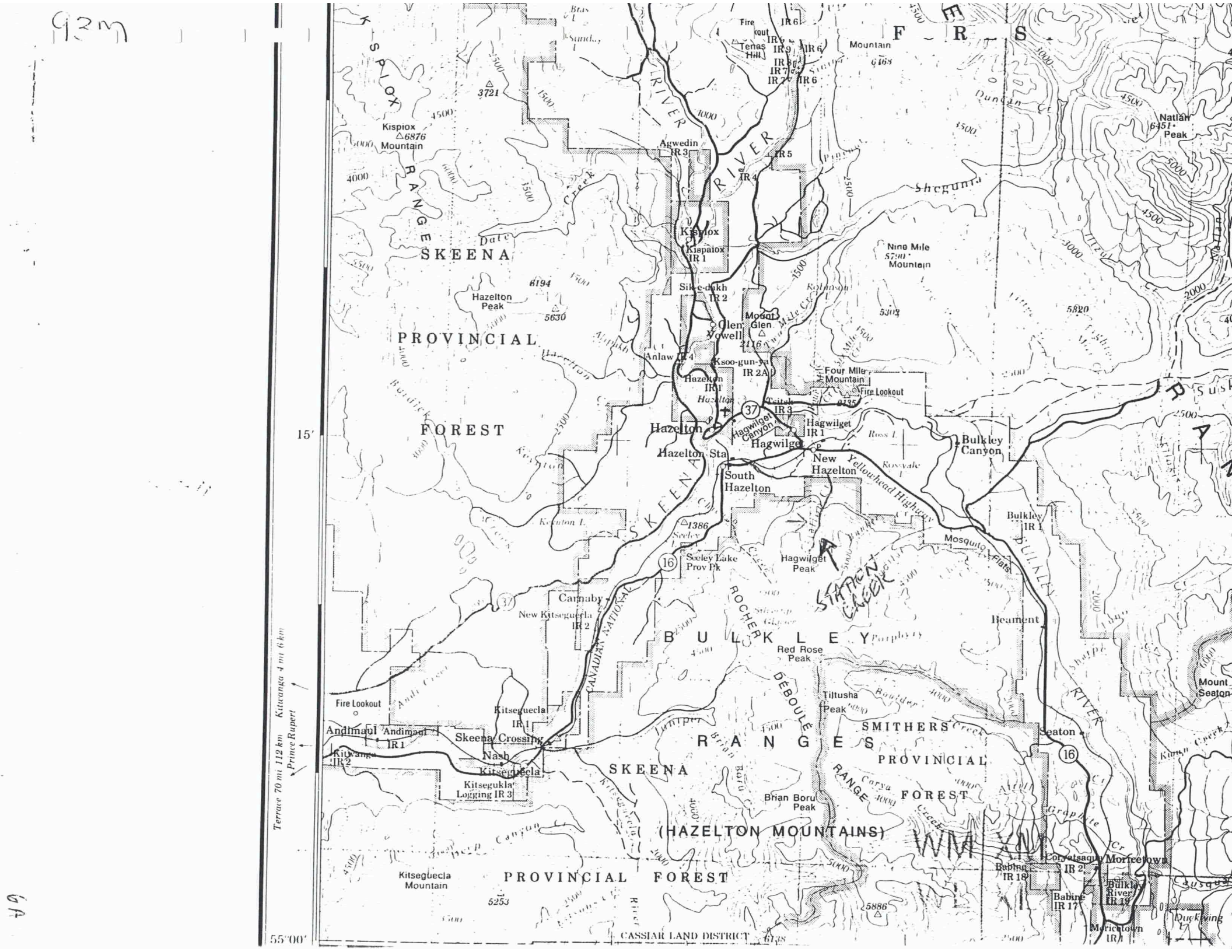
Observations were made on aquatic insect and fish presence.

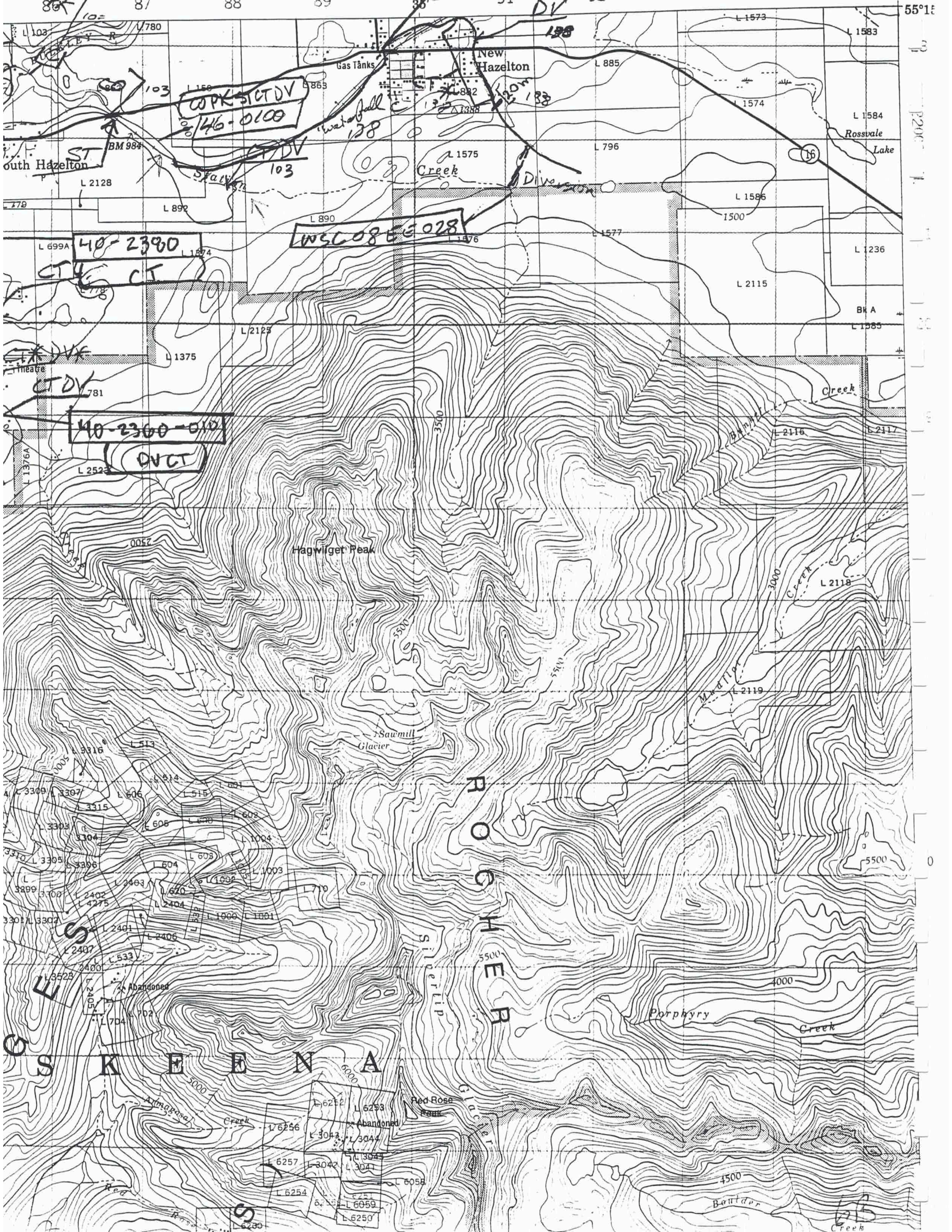
Stream Survey Data is attached in the following tables.

DATA TABLES FOR THE MISSION CREEK STREAM SURVEY NOVEMBER 1998 TO OCTOBER 1999

FIELD MAP FOR MISSION CREEK, STATION CREEK AND WATERFALL CREEK 1998/99

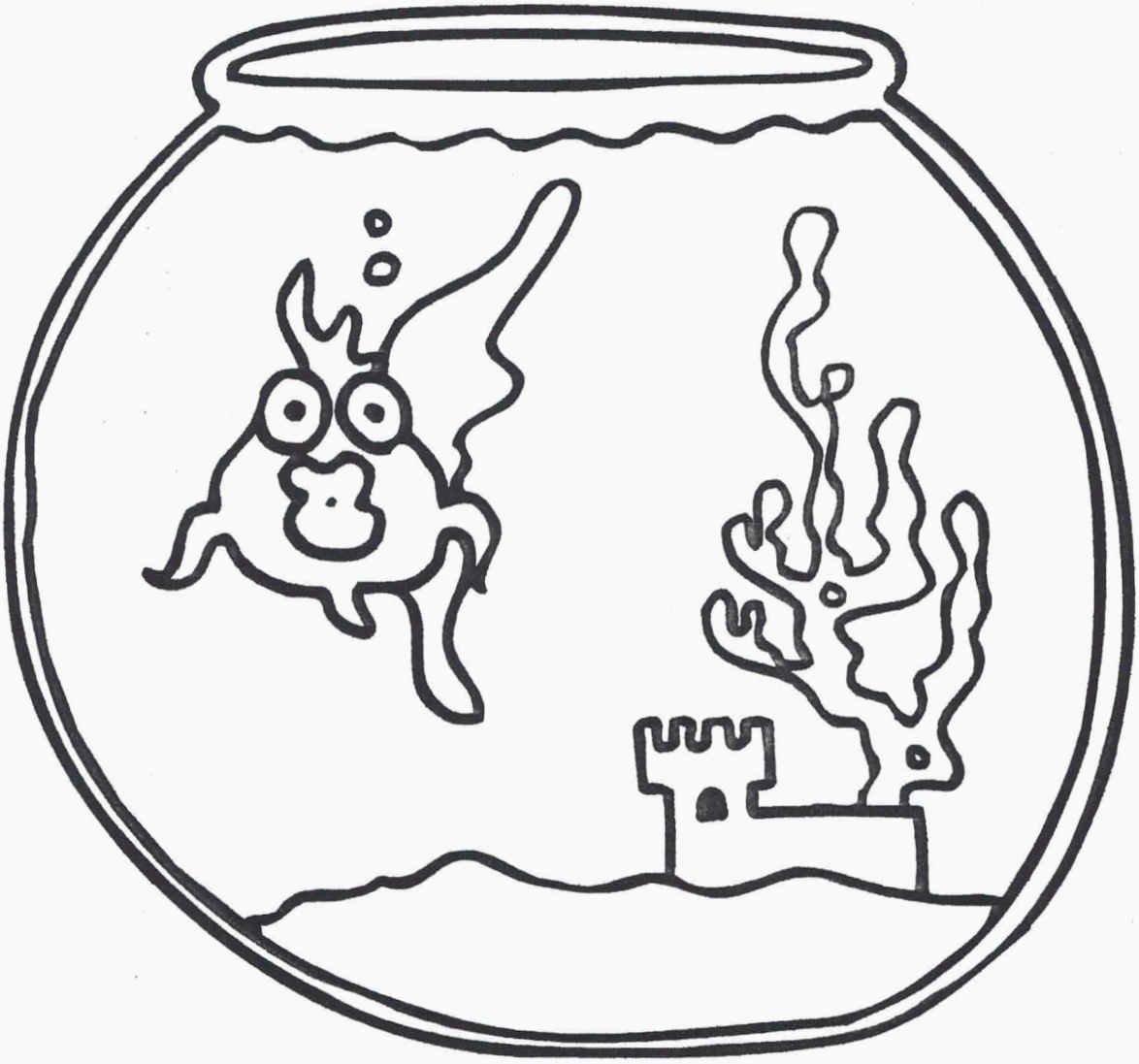

Reach III
n. point.
Old Beaver Bnd
SWAMPY SLOUGH
Reach I sec 5
STATION CREEK
STATION CR.
Dry Long
Old Beaver Pond
GOOD FLOW
STAGNANT H2O
STATION/WATERFALL CONFLUENCE
F.S. Rd
CN BRIDGE
REACH I Sec. 4D (FAST LARGE BEAVER DAM)
WATERFALL CREEK
CN RAIL
R45 sec 4
REACH I
OLD HWY.
CULVERT
OVERPASS
WATERFALL CREEK
TRAIL
REACH 4
REACH 4 sec 1
REACH 4
HELI PAD
NEW HAZELTON
J.I.S. #4
R456
HWY 16
R452
Jirico
R453
OVERPASS
40-80 DOLLY VARDEN OBSERVED
R455
R454
REACH I SECTIONS 1-38
MISSION CREEK
BULKLEY RIVER
FIELD MAP.


Kispiox Mountain
Kispiox
Agwedin IR 3
Kispaiox IR 1
Sik-e-dakh IR 2
Hazelton Peak
Glen Vowell
Mount Glen
Anlaw IR 4
Ksoo-gun-ta IR 2A
Hazelton IR 1
Four Mile Mountain
Fire Lookout
Hagwilget IR 3
Hagwilget IR 1
Hagwilget Canyon
Hazelton
Hazelton Sta
New Hazelton
South Hazelton
Bulkley Canyon
Nine Mile Mountain
Natlan Peak
Bulkley IR 1
Mosquito Flats
Hagwilget Peak
Seeley Lake Prov Pk
Carnaby
New Kitseguecla IR 2
Beament
Red Rose Peak
Tiltusha Peak
Mount Seaton
Seaton
Fire Lookout
Kitseguecla IR 1
Andimaul
Andimaul IR 1
Skeena Crossing
Kitwanga IR 2
Nash
Kitseguecla
Kitsegukla Logging IR 3
Brian Boru Peak
Kitseguecla Mountain
Babine IR 18
Babine IR 17
Corya tsaguy IR 2
Moricetown
Moricetown IR 1
Bulkley River IR 19
Duckwing
Terrace 70 mi 112 km
Kitwanga 4 mi 6 km
Prince Rupert
CASSIAR LAND DISTRICT
15'
55°00'



55°15
New Hazelton
Gas Tanks
South Hazelton
BM 984
Creek
Diversion
Rossvale Lake
16
1500
L 1573
L 1583
L 885
L 1574
L 1584
L 796
L 1575
L 1586
L 1577
L 1236
L 2115
Bk A
L 1585
L 890
L 1576
L 892
L 2128
L 699A
L 1374
L 2125
L 1375
L 781
L 2523
L 1376A
L 863
L 882
L 103
L 780
WSC08EG028
40-2390
40-2360-010
46-0100
DVCT
CTDV
103
138
Hagwilget Peak
2500
3500
5500
3000
4000
4500
6000
Bunkel Creek
L 2116
L 2117
L 2118
L 2119
Mudflat
Sawmill Glacier
Silvertip
R O C H E R
S K E E N A
Porphyry Creek
Red Rose Peak
Abandoned
Glacier
Boulder Creek
Red Rose
L 6253
L 6252
L 6256
L 6257
L 6254
L 6058
L 6059
L 6250
L 3043
L 3044
L 3042
L 3041
L 3045
L 710
L 1000
L 1001
L 1002
L 1003
L 1004
L 513
L 514
L 515
L 601
L 602
L 604
L 605
L 606
L 533
L 702
L 704
L 2401
L 2402
L 2403
L 2404
L 2405
L 2406
L 2407
L 3316
L 3309
L 3307
L 3315
L 3303
L 3304
L 3305
L 3306
L 3523

STREAM SURVEY DATA



Stream	Station Cr										
Hydrolo	Data	REACH 3									
	Pool Ln.	Riffle Ln.	TTI Ln.	Bankfull	Wetted	bankfull	wetted	bankfull	wetted	bankfull	wetted
Section	Metres	Metres	Metres	width M	Width	LB depth	LB depth	CB depth	CB depth	RB depth	RB depth
1	8.3	4.5	12.8	3.6	3.2	0.6	0.28	0.37	0.19	0.38	0.175
				7.9	4.1	0.3	0.04	0.45	0.155	0.26	0.08
				3.2	3.2	0.6	0.29	0.48	0.155	0.48	0.15
Means				**4.9**	**3.5**	**0.50**	**0.20**	**0.43**	**0.17**	**0.37**	**0.14**
		4.5	4.5	6.4	3.3	0.6	0.15	0.46	0.09	0.52	0.09
				7	3.2	0.52	0.12	0.44	0.02	0.48	0.04
				4.1	3.2	0.61	0.25	0.4	0.07	0.51	0.03
Means			17.3	**5.83**	**3.23**	**0.58**	**0.17**	**0.43**	**0.06**	**0.50**	**0.05**
2	0	26.6	26.6	6.4	5.4	0.515	0.08	0.665	0.27	0.95	0.64
				6.5	4.4	0.85	0.28	0.875	0.29	0.755	0.145
				4.9	4	0.875	0.4	0.7	0.27	0.61	0.21
Means				**5.93**	**4.60**	**0.75**	**0.25**	**0.75**	**0.28**	**0.77**	**0.33**
3	0	26.4	26.4	7.1	6.6	1.22	0.56	0.375	0.41	0.53	0.12
				6.5	4.3	0.43	0.095	0.54	0.23	0.59	0.105
				5.2	5.2	0.435	0.12	0.53	0.21	0.6	0.305
Means				**6.27**	**5.37**	**0.70**	**0.26**	**0.48**	**0.28**	**0.57**	**0.18**
4	4	23.5	27.5	5.6	4.1	0.96	0.08	0.82	0.18	1.04	0.18
				5.7	4.6	0.775	0.22	0.88	0.02	0.86	0.25
				6.1	4.6	1.33	0.38	1.02	0.39	1.02	0.35
Means				**5.8**	**4.43**	**1.02**	0.23	**0.91**	**0.20**	**0.97**	**0.26**

Section	Pool Ln. Metres	Riffle Ln. Metres	TTI Ln. Metres	Bankfull width M	Wetted Width	bankfull LB depth	wetted LB depth	bankfull CB depth	wetted Cbdepth	bankful Rbdepth	wetted Rbdepth
5A	4	23.5	27.5	5.8	4.5	0.65	0.2	0.82	0.52	0.79	0.39
				5.7	4.6	0.74	0.23	1.16	0.8	1.18	0.81
				5.5	4.2	0.99	0.38	1.41	0.77	1.39	0.76
Means				**5.67**	**4.43**	**0.79**	**0.27**	**1.13**	**0.70**	**1.12**	**0.65**
5B	5.3	13.1	18.4	4.3	3.5	0.45	0.03	0.66	0.25	0.78	0.27
				4.5	3.8	0.45	0.15	0.52	0.2	0.62	0.25
				7.3	6.3	0.64	0.2	0.64	0.17	0.59	0.04
Means				**5.37**	**4.53**	**0.51**	**0.13**	**0.61**	**0.21**	**0.66**	**0.19**
6		54.4	54.4	8.4	6.4	0.33	0.13	0.11	0	0.36	0.03
				12.2	10.2	0.58	0.13	0.55	9	0.99	0.51
				3.9	3.4	0.5	0.15	0.48	0.14	0.24	0.055
Means				**8.17**	**6.67**	**0.47**	**0.14**	**0.38**	**3.05**	**0.53**	**0.20**
7		59.6	59.6	4.3	3.8	0.81	0.06	0.915	0.14	0.89	0.1
				5.2	4.4	0.645	0.105	0.88	0.4	0.615	0.11
				5	3	0.45	0.06	0.36	0.05	0.56	0.14
Means				**4.83**	**3.73**	**0.64**	**0.08**	**0.72**	**0.20**	**0.69**	**0.12**
8A		11.4	15.6	7.5	6.3	0.52	0.14	0.51	0.13	0.46	0.15
				6.5	4.7	0.61	0.13	0.41	0.71	0.69	0.69
				6.2	4.7	0.34	0.08	0.57	0.34	0.54	0.33
Means				**6.73**	**5.23**	**0.49**	**0.12**	**0.50**	**0.39**	**0.56**	**0.39**

REACH 3				Station Cr.							
	Pool Ln.	Riffle Ln.	TTI Ln.	Bankfull	Wetted	bankfull	wetted	bankfull	wetted	bankful	wetted
Section	Metres	Metres	Metres	width M	Width	LB depth	LB depth	CB depth	Cbdepth	Rbdepth	Rbdepth
8B	4.2		15.6	4.3	3.4	0.44	0.11	0.75	0.4	0.735	0.28
				4	3.4	0.61	0.12	0.92	0.45	0.765	0.3
				4.8	4.6	0.75	0.24	0.86	0.41	1.02	0.45
Means				**4.37**	**3.80**	**0.60**	**0.16**	**0.84**	**0.42**	**0.84**	**0.34**
9	0	77	77	3.7	3.2	0.73	0.13	0.805	0.25	0.86	0.33
				10.4	9.9	0.725	0.14	0.325	0.09	0.75	0.17
				8.7	7.7	0.495	0.11	0.5	0.25	0.47	0.105
Means				**7.60**	**6.93**	**0.65**	**0.13**	**0.54**	**0.20**	**0.69**	**0.20**
10	0	100	100	4.8	3.6	0.96	0.26	0.82	0.1	0.74	0.07
				27	25.6	0.94	0.28	0.41	0.05	0.59	0.3
				17.5	16.3	0.54	0.22	0.43	0.14	0.41	0.14
Means				**16.43**	**15.17**	**0.81**	**0.25**	**0.55**	**0.10**	**0.58**	**0.17**
11	0	107	107	17	9.1	0.74	0.32	0.75	0.06	1.16	0.1
				8.5	7.6	0.83	0.14	1.08	0.2	1.25	0.33
				11.1	5.8	0.62	0.13	0.78	0.17	0.82	0.03
Means				**12.20**	**7.50**	**0.73**	**0.20**	**0.87**	**0.14**	**1.08**	**0.15**
12		132.4	136.4	9.1	2.9	0.94	0.13	0.82	0.18	0.72	0.16
				6.2	4.2	0.735	0.08	0.715	0.125	0.855	0.33
				9.8	5.8	0.775	0.09	1.11	0.2	1.1	0.07
Means				**8.37**	**4.30**	**0.82**	**0.10**	**0.88**	**0.17**	**0.89**	**0.19**
	4			6.7	3.6	1.35	0.34	1.41	0.42	1.21	0.2
				6.6	3.1	1.7	0.6	1.71	0.61	1.48	0.375
				6.8	2.7	1.94	0.48	1.87	0.41	1.76	0.32
Means				**6.70**	**3.13**	**1.66**	**0.47**	**1.66**	**0.48**	**1.48**	**0.30**

REACH 3				Station Cr.							
	Pool Ln.	Riffle Ln.	TTI Ln.	Bankfull	Wetted	bankfull	wetted	bankfull	wetted	bankful	wetted
Section	Metres	Metres	Metres	width M	Width	LB depth	LB depth	CB depth	Cbdepth	Rbdepth	Rbdepth
13	0	160.4	160.4	6.3	3.6	0.82	0.09	1.06	0.205	1.11	0.81
				11.3	6.3	1.56	0.12	1.58	0.15	1.59	0.11
				8.4	3.1	2.04	0.22	2.06	0.21	2.2	0.25
Means				**8.67**	**4.33**	**1.47**	**0.14**	**1.57**	**0.19**	**1.63**	**0.39**
14	0	157.7	157.7	7.1	3.7	0.97	0.02	0.99	0.1	1.15	0.22
				7.8	3.8	1.72	0.35	1.46	0.22	0.625	0.105
				9.1	2.9	1.26	0.05	1.38	0.26	0.78	0.15
Means				**8.00**	**3.47**	**1.32**	**0.14**	**1.28**	**0.19**	**0.85**	**0.16**
15	3.2	149.3	152.5	8.3	3	1.13	0.09	1.52	0.24	1.48	0.16
				6.2	4.4	1.35	0.19	1.34	0.18	1.14	0.35
					2.6	0.975	0.07	1.18	0.12	1.39	0.345
Means				**7.25**	**3.33**	**1.15**	**0.12**	**1.35**	**0.18**	**1.34**	**0.29**
				4	3.2	1.35	0.37	1.24	0.12	1.54	0.23
				3.7	3.1	1.57	0.34	1.46	0.14	1.76	0.24
				3.9	2.4	1.17	0.2	1.3	0.27	1.45	0.49
Means				**3.87**	**2.90**	**1.36**	**0.30**	**1.33**	**0.18**	**1.58**	**0.32**
16	0	78.4	78.4	4.7	2.5	1.33	0.12	1.42	0.34	1.1	0.12
				7.4	3	1.48	0.06	1.76	0.31	1.55	0.1
				4.2	3.1	1.21	0.13	1	0.15	1.12	0.18
Means				**5.43**	**2.87**	**1.34**	**0.10**	**1.39**	**0.27**	**1.26**	**0.13**
END OF REACH 3											

REACH 2				**Mission Cr.**							
	Pool Ln.	**Riffle Ln.**	**TTI Ln.**	**Bankfull**	**Wetted**	**bankfull**	**wetted**	**bankfull**	**wetted**	**bankful**	**wetted**
Section	**Metres**	**Metres**	**Metres**	**width M**	**Width**	**LB depth**	**LB depth**	**CB depth**	**Cbdepth**	**Rbdepth**	**Rbdepth**
1		92.4	161	7.53	2.8	0.84	0.1	1.01	0.39	0.94	0.12
				5.4	2.2	0.83	0.11	1.2	0.34	0.89	0.14
				7.05	2.34	0.9	0.14	1.21	0.45	1.05	0.24
Means				**6.66**	**2.45**	**0.86**	**0.12**	**1.14**	**0.39**	**0.96**	**0.17**
	68.6			10	12.5	0.91	0.035	1.17	0.26	0.93	0.26
				8.8	7.36	1.12	0.025	1.21	0.07	1.1	0.05
Means				**9.4**	**9.93**	**1.015**	**0.03**	**1.19**	**0.165**	**1.015**	0.155
2		31.1	58.45	4.89	3.71	0.51	0.06	0.64	0.12	0.53	0.03
				5.82	1.1	0.41	0.03	0.57	0.09	0.45	0.02
				3.92	2.38	0.36	0.02	0.42	0.07	0.39	0.03
Means				**4.88**	**2.40**	**0.43**	**0.04**	**0.54**	**0.09**	**0.46**	**0.03**
	27.35			8.8	6.25	0.51	0.25	0.44	0.36	0.68	0.3
				7.35	5.1	0.84	0.4	0.79	0.26	0.68	0.17
				8.81	5.75	0.77	0.31	0.81	0.28	0.75	0.18
Means				**8.32**	**5.70**	**0.71**	**0.32**	**0.68**	**0.30**	**0.70**	**0.22**
End of Reach 2											

REACH 1				Mission Cr.							
	Pool Ln.	Riffle Ln.	TTI Ln.	Bankfull	Wetted	bankfull	wetted	bankfull	wetted	bankful	wetted
Section	Metres	Metres	Metres	width M	Width	LB depth	LB depth	CB depth	Cbdepth	Rbdepth	Rbdepth
32	0	25.5	25.5	12.3	3.7	1.025	0.14	0.991	0.15	0.89	0.08
33	0	49.7	49.7	9.3	5.8	0.68	0.19	0.76	0.12	0.835	0.06
34	0	43.9	43.9	6.4	4.1	0.854	0.117	0.941	0.117	1.004	0.125
35	26.3		26.3	3.7	2.9	0.635	0.11	0.75	0.3	0.57	0.1
36	0	23.9	23.9	6.1	4.2	0.608	0.07	0.774	0.205	0.71	0.09
37	3	28.9	31.9	6.2	4.2	0.685	0.049	0.818	0.178	0.699	0.05
38	4	14.3	18.3	11.5	6.5	0.71	0.15	1.13	0.14	1.02	0.18
39	0	16.2	16.2	14.4	5.2	0.807	0.2	0.665	0.1	0.92	0.11
40	0	19.2	19.2	12	8.6	0.576	0.13	1.047	0.632	0.592	0.146
41	0	26.8	26.8	8.4	4.3	0.86	0.1	0.88	0.2	0.7	0.06
42	0	21.6	21.6	5.3	3.4	0.732	0.114	0.855	0.217	0.809	0.22
43	0	18.7	18.7	5.8	3.9	0.557	0.103	0.708	0.21	0.705	0.14
44	0	26.2	26.2	5	3.3	0.846	0.18	0.979	0.3	0.851	0.165
45	0	33.6	33.6	5.4	3.8	0.807	0.083	0.911	0.215	0.724	0.065
46	0	17.7	17.7	5.2	3.3	0.934	0.1	1.087	0.79	0.86	0.55
47	0	29.5	29.5	7.1	5.1	0.806	0.177	0.842	0.188	0.764	0.098

REACH 1				Mission Cr.							
Section	Pool Ln. Metres	Riffle Ln. Metres	TTI Ln. Metres	Bankfull width M	Wetted Width	bankfull LB depth	wetted LB depth	bankfull CB depth	wetted Cbdepth	bankful Rbdepth	wetted Rbdepth
48	0	24.4	24.4	7	3.1	0.48	0.17	0.598	0.24	0.548	0.09
49	0	15.5	15.5	7.4	3.8	0.88	0.08	1.068	0.21	0.976	0.068
50	0	20.2	20.2	6.3	3.4	0.405	0.1	0.48	0.17	0.366	0.02
51	0	14.2	14.2	3.5	1.8	0.46	0.02	0.55	0.23	0.334	0.11
52	0	9.7	9.7	n/a	3.3	0.55	0.15	0.54	0.12	0.49	0.02
53	1.7		1.7	4.5	2.8	0.37	0.04	0.295	0.14	0.435	0.03
54	30.2	n/a	30.2	3.7	2.3	0.38	0.02	0.475	0.12	0.365	0.02
55	0	12.2	12.2	5	4.2	0.62	0.02	0.605	0.11	0.42	0.03
56	0	11.7	11.7	6.1	5.1	0.285	0.05	0.37	0.15	0.325	0.045
57	0	6	6	3.5	3.3	0.28	0.06	0.305	0.17	0.395	0.12
58	0	13.3	13.3	4.1	2.4	0.35	0.08	0.3	0.08	0.24	0.05
59	0	14.2	14.2	3.7	2.2	0.27	0.05	0.27	0.135	0.25	0.14
60	n/a	n/a	n/a	6.9	5.6	0.31	0.04	0.48	0.17	0.435	0.05
61	0	22.6	22.6	5	4	0.26	0.08	0.43	0.14	0.235	0.04
62	0	20.8	20.8	4.7	4.4	0.267	0.06	0.27	0.14	0.265	0.09

REACH 1				Mission Cr.							
	Pool Ln.	Riffle Ln.	TTI Ln.	Bankfull	Wetted	bankfull	wetted	bankfull	wetted	bankful	wetted
Section	Metres	Metres	Metres	width M	Width	LB depth	LB depth	CB depth	Cbdepth	Rbdepth	Rbdepth
63	0	12.7	12.7	5.9	5.3	0.2	0.03	0.22	0.12	0.255	0.16
64	0	21.9	21.9	4.8	3.6	0.27	0.03	0.3	0.1	0.36	0.15
65	0	17.3	17.3	3.8	2.8	0.27	0.04	0.465	0.2	0.24	0.03
66	0	15.6	15.6	3.6	2.2	0.38	0.03	0.61	0.25	0.62	0.23
67	0	20.4	20.4	4.2	3.6	0.25	0.09	0.365	0.19	0.35	0.04
68	0	12.7	12.7	8	2.8	0.18	0.06	0.16	0.03	20.4	n/a
69	0	20.8	20.8	4.5	3.5	0.49	0.04	0.6	0.14	0.535	0.04
70	0	8.2	8.2	3.9	3.5	0.39	0.19	0.435	0.24	0.35	0.07
71	0	24.4	24.4	6.1	5.4	0.44	0.04	0.485	0.11	0.375	0.07
72	0	16.4	16.4	4.1	3.6	0.53	0.1	0.4	0.13	0.43	0.26
73	0	9.2	9.2	5.3	2.5	0.52	0.03	0.69	0.24	0.49	0.05
74	0	7.4	7.4	5.1	4.8	0.305	0.03	0.55	0.24	0.47	0.09
75	0	20.7	20.7	5	4	0.43	0.05	0.62	0.3	0.4	0.09
76	0	13.8	13.8	4.5	3.8	0.39	0.08	0.51	0.11	0.38	0.09
77	0	14.8	14.8	4.8	3.8	0.31	0.05	0.44	0.15	0.52	0.16
78	0	12.1	12.1	4.4	3.7	0.29	0.05	0.56	0.24	0.43	0.06

REACH 1				Mission Cr.							
	Pool Ln.	Riffle Ln.	TTI Ln.	Bankfull	Wetted	bankfull	wetted	bankfull	wetted	bankful	wetted
Section	Metres	Metres	Metres	width M	Width	LB depth	LB depth	CB depth	Cbdepth	Rbdepth	Rbdepth
79	4	15.8	19.8	5	2.8	0.4	0.02	0.59	0.28	0.5	0.23
80	0	12.8	12.8	5.2	3.6	0.4	0.06	0.49	0.17	0.54	0.13
81	0	21.4	21.4	5.2	4.3	0.48	0.1	0.53	0.14	0.53	0.05
82	0	22.8	22.8	5.8	4.3	0.42	0.1	0.46	0.17	0.27	0.04
83	0	14.4	14.4	4.9	4	0.42	0.1	0.58	0.24	0.4	0.06
84	0	4.6	4.6	3.2	2.6	0.78	0.21	0.62	0.21	.93.	25
85	0	15.5	15.5	7.9	4.3	0.53	0.05	0.64	0.19	0.43	0.06
86	0	17.5	17.5	5.1	3.8	0.43	0.05	0.43	0.12	0.38	0.12
87	0	11.3	11.3	4	3.4	0.24	0.03	0.48	0.2	0.23	0.03
88	0	8.3	8.3	5.4	4.3	0.22	0.05	0.47	0.33	0.28	0.09
89	0	21.9	21.9	4.9	3.5	0.4	0.29	0.31	0.16	0.27	0.05
90	0	26.1	26.1	5.3	4	0.32	0.06	0.47	0.17	0.37	0.12
91	0	30	30	4.4	3.3	0.39	0.05	0.43	0.16	0.52	0.29
92	0	14.5	14.5	5.4	4.5	0.45	0.1	0.9	0.59	0.39	0.14
93	0	17.6	17.6	5.4	4.5	0.48	0.09	0.51	0.16	0.48	0.18
94	0	14.8	14.8	5.5	5	0.38	0.05	0.37	0.12	0.48	0.18

REACH 1				Mission Cr.							
	Pool Ln.	Riffle Ln.	TTI Ln.	Bankfull	Wetted	bankfull	wetted	bankfull	wetted	bankful	wetted
Section	Metres	Metres	Metres	width M	Width	LB depth	LB depth	CB depth	Cbdepth	Rbdepth	Rbdepth
95	0	10.5	10.5	5.1	4.6	0.4	0.09	0.32	0.04	0.45	0.05
96	0	14	14	7.3	5.3	0.41	0.07	0.41	0.1	0.33	0.03
97	0	24.8	24.8	3.8	3.3	0.33	0.03	0.56	0.27	0.56	0.27
98	0	18.3	18.3	3.6	2.5	0.5	0.17	0.42	0.06	0.52	0.03
99	0	12.9	12.9	5.2	4.4	0.34	0.07	0.51	0.16	0.36	0.03
100	0	11.6	11.6	3.6	3	0.3	0.03	0.25	0.1	0.35	0.11
101	0	18.6	18.6	5.4	3.8	0.3	0.03	0.61	0.33	0.52	0.26
102	0	9.1	9.1	5.8	2.7	0.38	0.05	0.42	0.2	0.32	0.12
103	0	24.6	24.6	3.7	3.3	0.34	0.06	0.45	0.16	0.35	0.03
104	0	30.1	30.1	5	4.5	0.33	0.15	0.33	0.16	0.26	0.03
105	0	17.5	17.5	4	3.5	0.38	0.2	0.27	0.1	0.35	0.09
106	Notes: Pool caused by a beaver dam 238 10m Mud bottom, no cobble										
107	0	17.8	17.8	7.6	3.7	0.41	0.22	0.56	0.26	0.55	0.1
108	0	28.6	28.6	7.4	2	0.23	0.04	0.35	0.16	0.34	0.15
109	0	10	10	6	2.8	0.27	0.1	0.31	0.22	0.19	0.06
110	0	17.7	17.7	3.9	3.5	0.37	0.1	0.37	0.09	0.38	0.06

REACH 1				Mission Cr.							
Section	Pool Ln. Metres	Riffle Ln. Metres	TTI Ln. Metres	Bankfull width M	Wetted Width	bankfull LB depth	wetted LB depth	bankfull CB depth	wetted Cbdepth	bankful Rbdepth	wetted Rbdepth
111	0	11.1	11.1	4.4	4	0.26	0.07	0.22	0.12	0.39	0.04
112	19.4	0	19.4	3.2	2.1	0.22	0.8	0.35	0.26	0.29	0.22
113	12.7	0	12.7	6.8	5.6	0.39	0.19	0.98	0.82	0.49	0.22
114	7	0	7	2.6	2.3	0.43	0.28	0.57	0.34	0.34	0.08
115	7.4	0	7.4	5	4.4	0.36	0.07	0.77	0.48	0.4	0.11
116	9.7	0	9.7	3.9	2.3	0.47	0.08	0.61	0.25	0.41	0.07
117	0	12.7	12.7	3.5	2.7	0.45	0.1	0.51	0.18	0.36	0.04
118	7.05	7.05	14.1	3.2	2.8	0.34	0.05	0.36	0.1	0.38	0.11
End of Reach 1											

REACH 4				Mission Cr.		Waterfalls	Cr. Reach				
	Pool Ln.	Riffle Ln.	TTI Ln.	Bankfull	Wetted	bankfull	wetted	bankfull	wetted	bankful	wetted
Section	Metres	Metres	Metres	width M	Width	LB depth	LB depth	CB depth	Cbdepth	Rbdepth	Rbdepth
1		421	421	2.4	1.9	0.28	0.11	0.31	0.13	0.255	0.08
				2.9	2.5	0.51	0.13	0.555	0.18	0.485	0.14
				2.1	1.6	0.27	0.09	0.35	0.13	0.3	0.11
Means				**2.47**	**2.00**	**0.35**	**0.11**	**0.41**	**0.15**	**0.35**	**0.11**
2		47.5	51.5	2.2	1.7	0.23	0.145	0.27	0.215	0.225	0.16
				2.1	1.8	0.19	0.13	0.265	0.18	0.21	0.15
				1.9	1.5	0.185	0.165	0.29	0.24	0.23	0.18
Means				**2.07**	**1.67**	**0.20**	**0.15**	**0.28**	**0.21**	**0.22**	**0.16**
	4			3.1	2.8	0.22	0.12	0.33	0.215	0.27	0.14
				3.9	3.5	0.27	0.17	0.36	0.23	0.29	0.15
				2.9	2.5	0.18	0.09	0.29	0.17	0.21	0.12
Means				**3.30**	**2.93**	**0.22**	**0.13**	**0.33**	**0.21**	**0.26**	**0.14**
3		55.6	59.4	2.4	2	0.55	0.24	0.54	0.25	0.51	0.23
				1.6	1.4	0.37	0.22	0.41	0.21	0.38	0.19
				2.1	1.6	0.38	0.26	0.35	0.23	0.32	0.21
Means				**2.03**	**1.67**	**0.43**	**0.24**	**0.43**	**0.23**	**0.40**	**0.21**
	3.8			3	2.3	1.01	0.33	0.94	0.3	0.96	0.31
				3.1	2.8	0.74	0.34	0.74	0.36	0.85	0.44
Means				**3.05**	**2.55**	**0.88**	**0.34**	**0.84**	**0.33**	**0.91**	**0.38**

REACH 4				Mission Cr.		Waterfalls	Cr.	Reach			
	Pool Ln.	Riffle Ln.	TTI Ln.	Bankfull	Wetted	bankfull	wetted	bankfull	wetted	bankful	wetted
Sec#	Metres	Metres	Metres	width M	Width	LB depth	LB depth	CB depth	Cbdepth	Rbdepth	Rbdepth
4		79.1	98.6	4.7	2.5	1.37	0.17	1.47	0.32	1.22	0.21
				3.8	2.75	0.85	0.24	1.02	0.48	0.94	0.17
				3.43	1.72	0.92	0.47	1.01	0.51	0.84	0.32
Means				**3.98**	**2.32**	**1.05**	**0.29**	**1.17**	**0.44**	**1.00**	**0.23**
	19.5			4.7	2.7	1.33	0.47	1.83	0.37	1.42	0.37
				4.2	1.92	1.32	0.72	1.24	0.62	0.98	0.31
				4.04	2.17	1.21	0.48	1.1	0.44	1.13	0.42
Means				**4.31**	**2.26**	**1.29**	**0.56**	**1.39**	**0.48**	**1.18**	**0.37**
5		62.6	74	2.1	1.7	0.61	0.37	0.67	0.41	0.78	0.34
				2.42	1.46	1.12	0.37	1.28	0.44	1.17	0.26
				3.14	2.6	0.81	0.32	1.08	0.56	0.97	0.44
Means				**2.55**	**1.92**	**0.85**	**0.35**	**1.01**	**0.47**	**0.97**	**0.35**
	11.4			2.8	2.4	0.67	0.2	1.01	0.57	0.92	0.48
				3.87	3.24	0.96	0.24	1.31	0.64	1.12	0.56
				3.2	1.73	1.1	0.22	1.22	0.44	1.42	0.17
				3.29	**2.46**	**0.91**	**0.22**	**1.18**	**0.55**	**1.15**	**0.40**
Means											
6		128	137	3.1	2.4	0.91	0.69	0.97	0.81	0.88	0.72
				4.7	3.2	0.58	0.42	0.68	0.51	0.61	0.48
				4.9	3	0.66	0.37	0.83	0.61	0.72	0.59
Means				**4.23**	**2.87**	**0.72**	**0.49**	**0.83**	**0.64**	**0.74**	**0.60**
	9			3.8	2.9	0.77	0.44	0.93	0.52	0.82	0.39
				5.7	4.1	0.85	0.46	0.98	0.6	0.9	0.53
				3.7	1.9	0.69	0.52	0.86	0.59	0.79	0.47
Means				**4.40**	**2.97**	**0.77**	**0.47**	**0.92**	**0.57**	**0.84**	**0.46**

REACH 4				Mission Cr.	Waterfalls	Cr.					
	Pool Ln.	Riffle Ln.	TTI Ln.	Bankfull	Wetted	bankfull	wetted	bankfull	wetted	bankful	wetted
Section	Metres	Metres	Metres	width M	Width	LB depth	LB depth	CB depth	Cbdepth	Rbdepth	Rbdepth
7	383 glide		424	3	2.6	0.24	0.165	0.335	0.18	0.27	0.13
				2.9	2.2	0.285	0.17	0.37	0.215	0.3	0.115
				2.9	2.7	0.195	0.09	0.25	0.16	0.21	0.115
Means				**2.93**	**2.50**	**0.24**	**0.14**	**0.32**	**0.19**	**0.26**	**0.12**
	12.6			4.7	3.5	0.635	0.51	0.695	0.57	0.62	0.41
				5.3	4.9	0.72	0.69	0.84	0.66	0.765	0.535
				4.9	4.1	0.705	0.565	0.75	0.51	0.69	0.44
Means				**4.97**	**4.17**	**0.69**	**0.59**	**0.76**	**0.58**	**0.69**	**0.46**
		28.4		2.5	2.1	0.17	0.04	0.235	0.13	0.195	0.09
				2.4	1.7	0.21	0.155	0.25	0.185	0.18	0.135
				2.2	1.5	0.135	0.09	0.19	0.135	0.175	0.105
Means				**2.37**	**1.77**	**0.17**	**0.10**	**0.23**	**0.15**	**0.18**	**0.11**
8		22.4	32.5	4.1	3.8	0.26	0.16	0.3	0.15	0.28	0.2
				4	3.9	0.265	0.18	0.27	0.18	0.265	0.18
				4.5	4.3	0.345	0.27	0.32	0.25	0.28	0.17
Means				**4.20**	**4.00**	**0.29**	**0.20**	**0.30**	**0.19**	**0.28**	**0.18**
	2.6			3.9	3.3	0.815	0.74	0.84	0.87	0.795	0.63
				4.1	3.6	0.71	0.67	0.825	0.74	0.68	0.56
				3.9	3.5	0.67	0.48	0.72	0.52	0.69	0.61
Means				**3.97**	**3.47**	**0.73**	**0.63**	**0.80**	**0.71**	**0.72**	**0.60**
	7.5			5.5	5	0.48	0.36	0.395	0.28	0.34	0.25
				5.6	5.2	0.55	0.44	0.435	0.3	0.38	0.27
				5.7	5.4	0.495	0.25	0.505	0.23	0.43	0.24
Means				**5.60**	**5.20**	**0.51**	**0.35**	**0.45**	**0.27**	**0.38**	**0.25**

REACH 4				Mission Cr.	Waterfalls	Cr.					
	Pool Ln.	Riffle Ln.	TTI Ln.	Bankfull	Wetted	bankfull	wetted	bankfull	wetted	bankful	wetted
Section	Metres	Metres	Metres	width M	Width	LB depth	LB depth	CB depth	Cbdepth	Rbdepth	Rbdepth
9		33.4	33.4	2.4	2.3	0.48	0.22	0.515	0.37	0.55	0.51
				2.5	2.2	0.29	0.27	0.335	0.22	0.28	0.15
				2.3	2.3	0.48	0.23	0.49	0.2	0.44	0.37
Means				**2.40**	**2.27**	**0.42**	**0.24**	**0.45**	**0.26**	**0.42**	**0.34**
10	95.3 glide		95.3	2.8	2.6	0.6	0.44	0.43	0.36	0.26	0.15
				2.8	2.4	0.29	0.2	0.28	0.34	0.24	0.34
				2.9	2.7	0.33	0.22	0.37	0.25	0.32	0.24
Means				**2.83**	**2.57**	**0.41**	**0.29**	**0.36**	**0.32**	**0.27**	**0.24**
11	131.5 glide		131.5	3	2.8	0.34	0.32	0.37	0.25	0.395	0.3
				3.1	2.7	0.37	0.24	0.38	0.27	0.43	0.33
				3	2.9	1.18	0.94	0.31	0.22	0.4	0.32
Means				**3.03**	**2.80**	**0.63**	**0.50**	**0.35**	**0.25**	**0.41**	**0.32**
12	68.8 glide		68.8	3.6	3	0.33	0.15	0.36	0.205	0.3	0.185
				3.3	3.1	0.32	0.245	0.37	0.225	0.33	0.18
				2.9	2.8	0.28	0.1	0.41	0.22	0.37	..24
Means				**3.27**	**2.97**	**0.31**	**0.17**	**0.38**	**0.22**	**0.33**	**0.18**
13	206		206	3.1	2.4	0.75	0.48	0.7	0.36	0.73	0.75
				2.4	1.9	0.8	0.47	0.78	0.48	0.84	0.52
				2.3	2	0.52	0.36	0.48	0.28	0.47	0.22
Means				**2.60**	**2.10**	**0.69**	**0.44**	**0.65**	**0.37**	**0.68**	**0.50**
14		44	56	3.4	2.6	0.65	0.35	0.62	0.33	0.61	0.3
				3.2	2.8	0.81	0.47	0.8	0.44	0.73	0.41
				3	2.4	0.61	0.35	0.54	0.32	0.62	0.36
Means				**3.20**	**2.60**	**0.69**	**0.39**	**0.65**	**0.36**	**0.65**	**0.36**

Slope Measurements : Mission Creek Stream Survey				
REACH 1		(M)		
Section	**TTI In. (M)**	**drop**	**Slope**	
REACH 1				
1	20.2	0.89	4.406%	
2	32.4	0.75	2.315%	
3	25.8	0.91	3.527%	
4	12.5	0.98	7.840%	
5	14.4	0.61	4.236%	
6	18	0.75	4.167%	
7	21.3	0.65	3.052%	
8	23.5	0.77	3.277%	
9	16.1	0.803	4.988%	
10	11.5	0.915	7.957%	
11	13.3	0.765	5.752%	
12	13.1	0.95	7.252%	
13	17.8	0.87	4.888%	
14	16.8	0.6	3.571%	
16	25.6	0.67	2.617%	
17	26.9	0.48	1.784%	
18	11.2	1.125	10.045%	
19	15.5	0.82	5.290%	
20	10.9	0.69	6.330%	

Reach 1	Percent		small			
SECTION	canopy cover	LWD>100mm	WD	cutbanks	Comments	
R1 sec23	0%	yes	yes	0		
R1 sec24	20%	yes	yes	yes		
R1sec25	20%			yes		
R1 sec26	0%	yes	yes	0		
R1sec27	0%	yes	yes	0		
R1sec28	25%	yes	yes	0		
R1sec29	25%	yes	yes	yes		
R1sec30	0%	yes	yes	yes		
R1sec31	0%	yes	no	0		
R1sec32	0%	no	yes	yes		
R1sec33	15%	no info		no		
R1sec34	0%	yes	yes	no		
R1sec35	0%	no	yes	yes		
R1sec36	50%	no	yes	no		
R1sec37	0%	yes	yes			
R1sec38	10%	yes	yes	no		
R1sec39	10%	yes	yes	entire left bank		
R1sec40	0%	yes	yes	0	Beaver dam	
R1sec41	30%	yes	yes	0		
R1sec42	30%	?	?	yes		
R1sec43	40%	no	yes	yes		
R1sec44	50%	no	no	yes		
R1sec45	30%	no	yes	yes		
R1sec46	40%	yes	yes	?		
R1sec47	0%	yes	yes	0		
R1sec48	40%	no	yes	no		
R1sec49	0%	no	no	0		
R1sec50	0%	n/a	n/a	0		
R1sec51	0%	no	yes	0		
R1sec52	10%	n/a	n/a	0	Beaver dam	
R1sec53	10%	no	yes	0		
R1sec54	0%	n/a	n/a	0		
R1sec55	50%	n/a	n/a	0		
R1sec56	n/a	n/a	n/a	0		
R1sec57	0%	no	yes	0		
R1sec58	0%	no	yes	n/a		
R1sec59	0%	no	yes	0		
R1sec60	10%	n/a	n/a	0		
R1sec61	50%	no	yes	0		
R1sec62	10%	n/a	n/a	0		
R1sec63	0%	n/a	n/a	n/a		
R1sec64	5%	no	no	0		
R1sec65	0%	n/a	n/a	yes		

Reach 1 SECTION	Percent canopy cover	LWD>100mm	small WD	cutbanks	Comments
R1sec66	10%	n/a	n/a	0	
R1sec67	0%	n/a	n/a	0	
R1sec68	0%	n/a	n/a	yes	
R1sec69	n/a	n/a	n/a	n/a	
R1sec70	0%	n/a	n/a	0	
R1sec71	10%	n/a	n/a	0	
R1sec72	40%	n/a	n/a	0	
R1sec73	100%	n/a	n/a	0	
R1sec74	0%	n/a	n/a	0	
R1sec75	50%	n/a	n/a	0	
R1sec76	0%	no	yes	0	
R1sec77	n/a	n/a	n/a	0	
R1sec78	n/a	n/a	n/a	0	
R1sec79	50%	yes	yes	yes	
R1sec80	n/a	n/a	n/a	n/a	
R1sec81	10%	n/a	n/a	0	
R1sec82	0%	no	no	0	
R1sec83	0%	n/a	n/a	0	
R1sec84	50%	n/a	n/a	0	
R1sec85	0%	n/a	n/a	0	
R1sec86	n/a	n/a	n/a	n/a	
R1sec87	0%	n/a	n/a	0	
R1sec88	n/a	n/a	n/a	n/a	
R1sec89	0%	no	no	0	
R1sec90	25%	n/a	n/a	0	
R1sec91	0%	n/a	n/a	0	
R1sec92	n/a	n/a	n/a	n/a	
R1sec93	0%	n/a	n/a	0	
R1sec94	50%	n/a	n/a	0	
R1sec95	0%	n/a	n/a	0	
R1sec96	0%	n/a	n/a	0	
R1sec97	n/a	no	no	no	
R1sec98	n/a	no	no	n/a	
R1sec99	0%	no	yes	0	
R1sec100	100%	n/a	n/a	0	
R1sec101	0%	n/a	n/a	n/a	
R1sec102	0%	n/a	n/a	n/a	
R1sec103	50%	n/a	n/a	0	
R1sec104	30%	n/a	n/a	0	
R1sec105	0%	n/a	n/a	0	
R1sec106	Beaver Dam 23m 8 10m mud bottom no cobble				

Reach 1	**Percent**		**small**			
SECTION	**canopy cover**	**LWD>100mm**	**WD**	**cutbanks**		
R1sec107	0%	n/a	n/a	0		
R1sec108	0%	n/a	n/a	0		
R1sec109	0%	no	yes			
R1sec110	65%	n/a	n/a	yes		
R1sec111	0%	no	yes	0		
R1sec112	50%	n/a	n/a	n/a		
R1sec113	0%	no	yes	n/a		
R1sec114	25%	yes	yes	n/a		
R1sec115	50%	no	yes	n/a		
R1sec116	50%	no	no	0		
R1sec117	0%	n/a	n/a	yes		
R1sec118	0%	no	no	0		
R2 sec 1	0%			21.8		
R2 sec 2	5%			0		
R4 SEC 1	90%	no	yes	yes		
R4 SEC 2	75%	no	yes	n/a		
R4 SEC 3	65%	no	yes	n/a		
R4 SEC 4	55%	yes	yes	n/a		
R4 SEC 5	5%	no	yes	yes		
R4 SEC 6	20%	no	yes	yes		
R4 SEC 5	5%	no	yes	n/a		
R4 SEC 6	75%	yes	yes	n/a		
R4 SEC 7	40%	no	yes	yes		
R4 SEC 8	20%	no	yes	yes		
R4 SEC 9	10%	no	yes	yes		
R4 SEC 10	15%	no	yes	yes		
R4 SEC 11	5%	no	yes	n/a		
R4 SEC 12	5%	no	yes	n/a		

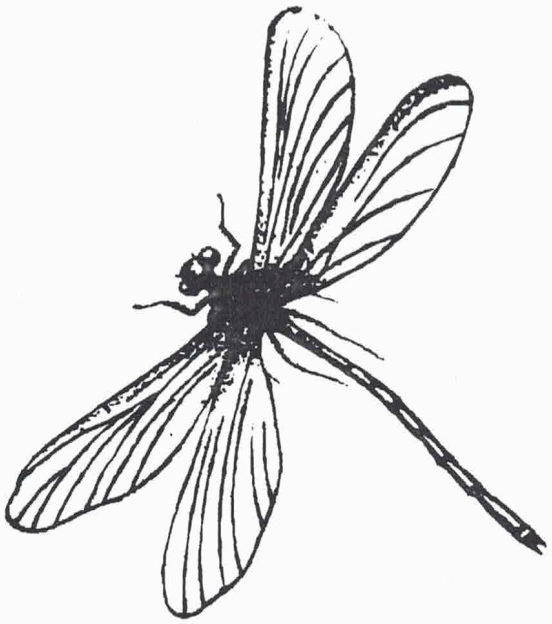
Reach 1

Section #	Median cobble cm	% Embed		Section #	Median cobble cm	% Embed
1	15	0%		50	13	2%
2	16	36%		60	15	7%
3	12	4%		65	13	1%
4				70	13	12%
5	12	9%		80	11	1%
6	11	9%		85	10	0%
7	11	9%		90	10	0%
8	13	9%		95	8	0%
9	12	0%		100	13	0%
10	11	3%		105	12	0%
11	12	9%		110	11	2%
12	20	9%		116	10	5%
13	14	5%		118	7	2%
14	30	18%				
15						
16	18	4%				
17	11	13%				
18	12	3%				
19	16	5%				
20	13	7%				
21	9	4%				
22	8	6%				
23	8	2%				
24	11	5%				
25	15	1%				
26	14	0%				
27	13	22%				
28	10	14%				
29	11	7%				
30	15	9%				
31	14	14%				
32	9	2%				
33	12	20%				
34	13	8%				
35	11	12%				
36	9	2%				
37	8	0%				
38	8	1%				
39	14	1%				
40	11	12%				
41	10	3%				
42	16	5%				
43	20	9%				
44	2	27%				
45	14	4%				
46	11	1%				
47	11	11%				

Mud Depth Sampling				
To determine if cobble was accessible.				
REACH 2				
Section #	**Sample #**		**Mud depth**	cms.
1	1		35	
	2		49	
	3		47	
	4		82	
	5		103	
	6		78	
	7		64	
	8		62	
	9		91	
	10		101	
2	1		27	
	2		38	
	3		41	
	4		21	
	5		61	
	6		79	
	7		31	
	8		54	
	9		63	
	10		37	

Cobble	Summary	Table
Reach 3		
	Median	%
Section #	cobble cm	Embed
1	20	17%
2	21	26%
3	21.5	53%
4	17	38%
5	23	28%
6	22	43%
7	16	34%
8	21	41%
9	20	43%
10	27	34%
11	37	45%
12	36	30%
13	31	48%
14	45	32%
15	49.5	34%
16	46	24%

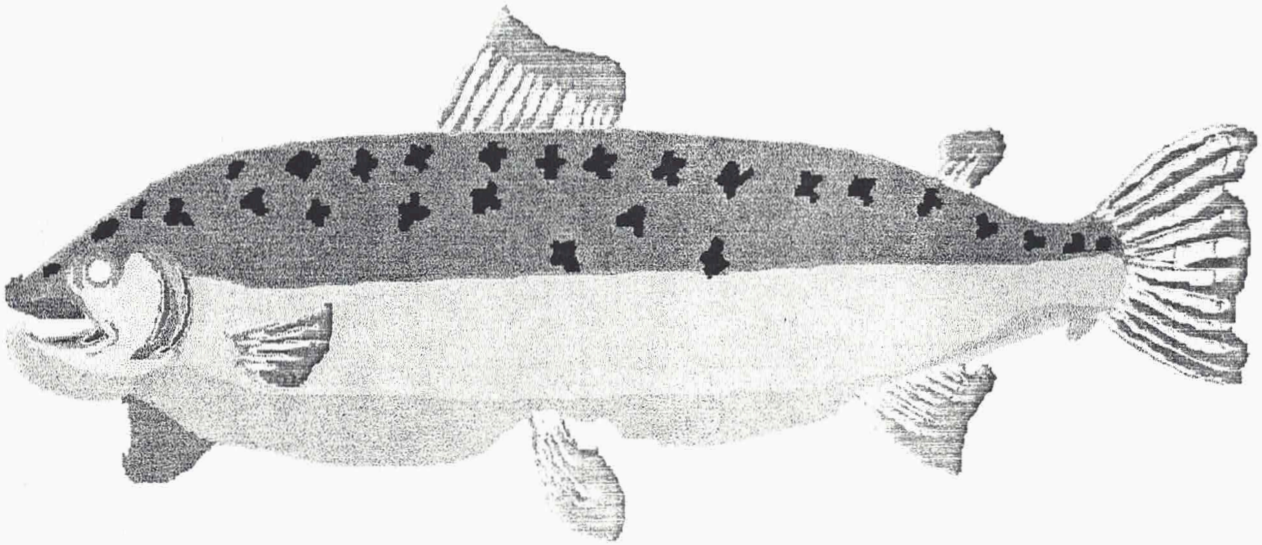
WATER QUALITY DATA



Mission Creek Stream Survey
Water Quality

Date	Section #	Air Temp Celsius	LaMotte Kit Readings Water temp Celsius	D.O. mg/l	pH	Ammonia mg/l	CO2 mg/l	Turbidity JTU's	Alkalinity mg/l	
May 19/99	15'th Ave.	9	6	10	7	0.2	3	10		
	Carr's	9	9	n/a	7	0.6	3	10	54	
May 19/99	Bulk Plant		7.5	10.8						
	Miss Cr.		9.4	11.4						
	at Mouth									
	StationCr.		7.2	10.8						
	at Mouth									
	Station Cr.		3.5	13						
	Pipe Flow									
	Water F Cr.		10.1	10.7						
	Foot Br.									
	Reach # 1									
Nov-98	Section 29			12	7	0	4	10	44	
	Section 33		4.5	11	7	0	3	10	44	
	Section 37		4.5	12	7	0	4	10	44	
	Section 42		4	11	7	0	4	10	44	
	Section 63		0	11	7	0.2	n/a	n/a	55	

FISH PRESENCE/ABSENCE DATA



Mission Creek Overwintering Study 1998/99
Fish Size Data

Mission Cr 1

Date Jan 29/99

Species	Wt(g)	Species	Wt.(g)
Dolly vard	9.7	Coho	
Dolly vard	10.9		
Dolly vard	11.6		
Dolly vard	12.7		
Dolly vard	14.4		
Dolly vard	14.8		
Dolly vard	16		
Dolly vard	16.6		
Dolly vard	17.3		
Dolly vard	18.3		
Dolly vard	18.7		
Dolly vard	18.8		
Dolly vard	20.3		
Dolly vard	20.8		
Dolly vard	21.3		
Dolly vard	22.6		
Dolly vard	24.7		
Dolly vard	32.2		
Dolly vard	40.5		
Dolly vard	49.2		
Means	20.6		

Date Feb 3/99

Species	Wt(g)	Species	Wt.(g)
Dolly vard	1.5	Coho	
Dolly vard	3.7		
Dolly vard	4.2		
Dolly vard	4.5		
Dolly vard	10.4		
Dolly vard	10.8		
Dolly vard	10.8		
Dolly vard	13.7		
Dolly vard	22.1		
Means	9.08		

Mission Creek Overwintering Study 1998/99
Fish Size Data

Mission Cr 1

Date Mar 25/99

Species	Wt(g)	LN(MM)	CC
Dolly vard	36.2	165	0.81
Dolly vard	25.1	137	0.98
Dolly vard	16	116	1.03
Dolly vard	17	126	0.85
Dolly vard	15.2	118	0.93
Dolly vard	20.4	130	0.93
Dolly vard	36.9	159	0.92
Dolly vard	29.3	147	0.92
Dolly vard	7.8	95	0.91
Dolly vard	60.8	195	0.82
Dolly vard	77.6	122	4.27
Dolly vard	26.3	145	0.86
Dolly vard	23.5	137	0.91
Dolly vard	42.8	172	0.84
Dolly vard	26.9	145	0.88
Dolly vard	12	110	0.90
Dolly vard	12.9	110	0.97
Dolly vard	10.6	101	1.03
Dolly vard	14.1	112	1.00
Dolly vard	14.4	117	0.90
Dolly vard	12.6	110	0.95
Dolly vard	11	105	0.95
Means	24.97	130.64	1.07

Mission Cr 1

Date Mar 30/99

Species	Wt(g)
Dolly vard	10.1
Dolly vard	11.3
Dolly vard	11.3
Dolly vard	11.4
Dolly vard	12.2
Dolly vard	14.6
Dolly vard	15.2
Dolly vard	15.7
Dolly vard	15.8
Dolly vard	16.1
Dolly vard	17.1
Dolly vard	17.3
Dolly vard	17.6
Dolly vard	19.1
Dolly vard	24.5
Dolly vard	24.7
Dolly vard	25.4
Dolly vard	25.5
Dolly vard	26.9
Dolly vard	32.3
Dolly vard	35.4
Dolly vard	46.8
Dolly vard	51.6
Dolly vard	60.6
Dolly vard	80.8
Means	25.57

Mission Creek Overwintering Study 1998/99
Fish Size Data

Mission Cr 2

Date Jan 29/99

Species	Wt(g)
Dolly vard	1.5
	4.1
	4.5
	7.8
	8.7
	9.3
	10.4
	11.1
	11.3
	11.3
	13
	20.3
	22.1
	32.7
	42.8
Means	14.06

Date Feb 3/99

Species	Wt(g)	Species	Wt(g)
Dolly vard	12.1	Dolly vard	13
Dolly vard	12.8	Dolly vard	17
Dolly vard	13.4	Dolly vard	19
Dolly vard	13.5	Dolly vard	19.7
Dolly vard	15.4	Dolly vard	20.7
Dolly vard	15.7	Dolly vard	22.5
Dolly vard	16.4	Dolly vard	28.7
Dolly vard	17.6	Means	24.65
Dolly vard	18.2		
Dolly vard	18.9		
Dolly vard	20.5		
Dolly vard	20.8		
Dolly vard	21.1		
Dolly vard	21.3		
Dolly vard	21.6		
Dolly vard	24.6		
Dolly vard	25		
Dolly vard	26.2		
Dolly vard	29.1		
Dolly vard	29.7		
Dolly vard	30.9		
Dolly vard	31.4		
Dolly vard	32		
Dolly vard	32.4		
Dolly vard	33		
Dolly vard	35.2		
Dolly vard	36.8		
Dolly vard	40.2		
Dolly vard	40.7		
Dolly vard	42		
Dolly vard	47.6		

Date Mar 25/99

Species	Wt(g)	LN(MM)	CC
Dolly vard	85.7	215	0.86
Dolly vard	80.8	216	0.80
Dolly vard	69.5	196	0.92
Dolly vard	73	200	0.91
Dolly vard	36	163	0.83
Dolly vard	77.2	221	0.72
Dolly vard	50.3	172	0.99
Dolly vard	23.2	138	0.88
Dolly vard	25.4	143	0.87
Dolly vard	36.6	162	0.86
Dolly vard	31.1	163	0.72
Dolly vard	23.3	142	0.81
Dolly vard	15.5	115	1.02
Dolly vard	15.7	121	0.89
Dolly vard	15	114	1.01
Dolly vard	18.2	125	0.93
Dolly vard	22	136	0.87
Dolly vard	2.3	57	1.24
Means	38.93	155.50	0.90

Date Mar 30/99

Species	Wt(g)	Species	Wt(g)
Dolly vard	11.7	Dolly vard	11.2
Dolly vard	12.3	Dolly vard	21.9
Dolly vard	13.1	Means	23.61
Dolly vard	13.8		
Dolly vard	15.2		
Dolly vard	16.8		
Dolly vard	22		
Dolly vard	54.8		
Dolly vard	66.9		

Mission Creek Overwintering Study 1998/99
Fish Size Data

Mission Cr. 3

Date Jan 29/99

Species	**Wt(g)**	**Species**	**Wt(g)**	**Species**	**Wt(g)**
Dolly vard	3.9	Dolly vard	1.7	Coho	13.1
Dolly vard	4	Dolly vard	2.7		
Dolly vard	4.1	Dolly vard	2.8		
Dolly vard	5.4	Dolly vard	2.9		
Dolly vard	5.7	Dolly vard	4		
Dolly vard	6.1	Dolly vard	6.1		
Dolly vard	7.7	Dolly vard	6.4		
Dolly vard	8.1	Dolly vard	6.6		
Dolly vard	8.2	Dolly vard	6.9		
Dolly vard	9.4	Dolly vard	7.4		
Dolly vard	9.5	Dolly vard	7.4		
Dolly vard	11.3	Dolly vard	8		
Dolly vard	19.2	Dolly vard	8.1		
Dolly vard	30	Dolly vard	10.2		
Dolly vard	30.2	Dolly vard	13.8		
Dolly vard	33.6	Dolly vard	17.1		
Means		Dolly vard	9.64	Coho	13.1

Date Feb 3/99

Species	**Wt(g)**
Dolly vard	2.1
	3.3
	3.3
	3.7
	4
	4.4
	8.2
	9.1
	10.7
	11.7
	11.8
Means	6.57

Mission Creek Overwintering Study 1998/99
Fish Size Data

Mission Cr. 3

Date Mar 25/99

Species	Wt(g)	LN(MM)	CC
Dolly vard	2.2	60	1.02
Dolly vard	8	92	1.03
Dolly vard	11.2	105	0.97
Dolly vard	2.3	61	1.01
Dolly vard	7	94	0.84
Dolly vard	15	117	0.94
Dolly vard	15.3	122	0.84
Dolly vard	12.9	113	0.89
Dolly vard	9.7	95	1.13
Dolly vard	16.7	120	0.97
Dolly vard	13.6	112	0.97
Means	10.4	99.2	1.0

Mission Cr. 3

Date Mar 30/99

Species	Wt(g)	Species	Wt(g)
Dolly vard	4.6	Dolly vard	2.4
Dolly vard	8.2	Dolly vard	6.8
Dolly vard	10.4	Dolly vard	7.4
Dolly vard	10.6	Dolly vard	7.7
Dolly vard	11.8	Dolly vard	8.1
Dolly vard	12.5	Dolly vard	8.2
Dolly vard	13	Dolly vard	9.5
Dolly vard	13.5	Dolly vard	9.9
Dolly vard	14.7	Dolly vard	10.4
Dolly vard	17.1	Dolly vard	11.5
Dolly vard	17.4	Dolly vard	11.9
Dolly vard	17.8	Dolly vard	11.9
Dolly vard	23.5	Dolly vard	12.9
Dolly vard	23.9	Dolly vard	14.9
Dolly vard	25.6	Dolly vard	26.7
Dolly vard	37.4	Dolly vard	37.9
Dolly vard	39.7		
Means		Dolly vard	15.15

Mission Creek Overwintering Study 1998/99
Fish Size Data

Mission Cr 4

Date	Jan 29/99
Species	**Wt(g)**
Dolly vard	1.9
Dolly vard	2
Dolly vard	2
Dolly vard	2.3
Dolly vard	2.4
Dolly vard	2.7
Dolly vard	2.9
Dolly vard	3
Dolly vard	3.1
Dolly vard	3.2
Dolly vard	3.6
Dolly vard	3.7
Dolly vard	3.7
Dolly vard	3.9
Dolly vard	4
Dolly vard	4.4
Dolly vard	8.8
Dolly vard	10.1
Means	3.76

Date	Feb 3/99
Species	**Wt(g)**
Dolly vard	1.8
Dolly vard	2.3
Dolly vard	2.3
Dolly vard	2.4
Dolly vard	2.8
Dolly vard	2.9
Dolly vard	2.9
Dolly vard	3.1
Dolly vard	3.2
Dolly vard	3.3
Dolly vard	3.7
Dolly vard	3.7
Dolly vard	3.7
Dolly vard	4.3
Dolly vard	4.8
Dolly vard	7.3
Dolly vard	11
Dolly vard	11.5
Means	4.28

Date	Mar 25/99		
Species	**Wt(g)**	**LN(MM)**	**CC**
Dolly vard	4.9	80	0.96
Dolly vard	2.4	64	0.92
Dolly vard	12	110	0.90
Dolly vard	7	92	0.90
Dolly vard	10.4	104	0.92
Dolly vard	3.4	69	1.03
Dolly vard	3.3	71	0.92
Dolly vard	7.5	97	0.82
Dolly vard	4.6	78	0.97
Dolly vard	2.6	63	1.04
Dolly vard	13.3	112	0.95
Dolly vard	10	104	0.89
Dolly vard	9	96	1.02
Dolly vard	3.5	73	0.90
Dolly vard	3.1	73	0.80
Dolly vard	3.8	73	0.98
Dolly vard	45.8	465	0.05
Dolly vard	41.1	176	0.75
Dolly vard	21.3	129	0.99
Dolly vard	3	63	1.20
Dolly vard	4.5	78	0.95
Dolly vard	5.4	78	1.14
Dolly vard	15.7	120	0.91
Dolly vard	16	124	0.84
Dolly vard	13.3	123	0.71
Dolly vard	5	83	0.87
Dolly vard	8.5	98	0.90
Means	10.39	107.26	0.90

Date	Mar 30/99
Species	**Wt(g)**
Dolly vard	1.8
Dolly vard	2.9
Dolly vard	3.4
Dolly vard	3.8
Dolly vard	10.6
Dolly vard	12.7
Mean	5.87

Results for Stream Habitat Survey

REACH 1

Reach 1 from sections 1 to 38 are downstream of the impassable culvert at the Highway #16 crossing. This portion of Mission Creek is almost exclusively riffle habitat. From Reach 1 section 1 to Reach 1 section 38 a total of 725.9 metres of riffle habitat and 49.6 metres of pool habitat. The largest pools in this area are just below the impassable culvert. Lack of pool habitat may very well be a limiting factor in terms of limited overwintering habitat. Wetted maximum pool depth during November 1998 ranged from 0.52 m. to 0.71m. The total number of pools from sections 1 to 38 was five pools. The smallest pool was 3 metres in length and the largest pool (downstream of the culvert) was 26.3 metres in length.

The distance between pools was as much as 200 metres in Reach 1 sections 1 to 38.

From section 1 to 38 the mean cobble size ranged from 2 cms. to 30 cms. in diameter. This is suitable for spawning gravel and coho and pink salmon were observed spawning throughout sections 3 to 38. Cobble is relatively clean with embeddedness ranging from 0% to 36%.

Riparian area and canopy cover are moderate in this section of stream as the riparian area is relatively intact. Presence of woody debris could be rated as moderate in this section of Reach 1.

The culvert at section 38 presents both a height and velocity barrier to upstream migrating salmon. In 1997, coho salmon were observed leaping at the culvert and were almost able to jump the height to get into the culvert flow, however, the velocity of the water pushed the fish backwards into the plunge pool. (Personal communication : Tim Lemky October 1997).

Reach 1 section 39 to 40 is riffle and the slope is steeper through this section. Just upstream of section 40 is a large beaver dam. This dam would be an impass to upstream migrating adults in low flow years.

Reach 1 section 41 to section 111 is listed as mostly riffle habitat. The remainder of Reach 1 is pool habitat.

REACH 2

Reach 2 is a short section of Mission Creek commencing at the CNR bridge at the stagnant section of Reach 1 which leads to the old beaver ponds. This section ends at the confluence of Station and Waterfall Creeks.

Reach 2 consists of 123.5 metres of riffle habitat and 96 metres of pool habitat.

This Reach is essentially devoid of riparian area and therefore canopy cover can be rated as none to poor. Reach 2 of Mission Creek is impacted by the CN Rail line. Cobble is mostly completely embedded in this area. Some mud depth sampling was done to determine if with some clean-up the cobble could be made available to fish. Mud depths in this reach varied from 21 cms. to 103 cms.

There is little to no woody debris in this area of the creek.

REACH 3

Reach 3 is defined as Station Creek and this reach commences at the confluence of Station and Waterfall Creeks.

Station Creek at the confluence with Waterfall Creek has a very muddy bottom. Cobble embeddedness ranges from 17% to 53%. Cobble diameter ranged from 16 cms. to 49.5 cms. in diameter.

Flow was moderate at the time of the survey and several Dolly varden were observed holding in a small pool at the mouth of Station Creek.

Station Creek (Reach 3) from sections 1 to 16 is mostly meandering and slough-like. Although most sections are listed as riffle they can be described as glides. Flow throughout Reach 3 could be described as poor to none with flow going sub-surface in places. The stream bottom for most of Reach 3 to section 16 can be described as muddy with little to no visible cobble.

The riparian area consists of mostly small shrubs and grasses with few to no trees. Canopy cover is poor to none.

Presence of woody debris can be rated as poor to none.

Station Creek was not fully surveyed from the confluence to the water diversion.

REACH 4

This reach encompasses the Waterfall Creek portion of the survey. Waterfall Creek is an urban stream that is impacted by residential development (roads, Highway #16, sewage outfall), CN Railway, a bulk oil plant and a chipper mill. There is an impassable falls on Waterfall Creek however adult coho salmon have been observed just downstream of the waterfall plunge pool. There is an old weir just downstream of the falls which is a barrier to both adult and juvenile salmonids reaching the waterfall plunge pool.

Waterfall Creek consists of productive habitat with water quality parameters that fall within levels that are safe for fish. Water quality sampling results are presented in the data section of the report.

The most productive habitat occurs within those sections of stream that flow through New Hazelton, B.C.

Sporadic aquatic insect surveys have been conducted. The majority of aquatic insects found were stonefly, caddis fly and mayfly larva which indicate good water quality i.e. water quality that is sufficient to support salmonids.

Gee minnow trapping was conducted and fish are present from the confluence with Station Creek to upstream of the first Highway #16 crossing(culvert). Some overwintering fish presence/absence data was collected during the 1998/99 winter season. Refer to Fish Presence/Absence Data Tables for fish presence/absence data.

Reach 4 section 1 is that portion of the stream downstream of the waterfall. This portion of stream has a relatively steep slope i.e. greater than 2% and consists of riffle habitat. The cobble in this section is suitable for spawning. (Coho spawners observed in this section of stream in October 1998 and 1999. Personal communication : Tim Lemky, Chicago Creek Community Environmental Enhancement Society).

Reach 4 sections 2 and 3 consist of pool and riffle units although these pools are most likely not deep enough to be high quality overwintering habitat. Pool depths at time of this survey ranged from 0.35 m. to 0.91 metres. The overwintering data collected in the 1998/99 winter showed ice thickness of up to 30 cms. Sections 2 and 3 are utilized by coho salmon for spawning.

Sections 1 through 3 have a relatively good riparian area with moderate to good canopy cover. There is woody debris present in those sections as well. Overall, in Reach 4, canopy cover ranged from 5% to 90% and instream small woody debris is present in most sections.

The substrate is relatively clean and cobble presence can be described as moderate to good. Cobble embeddedness can be described as low.

Reach 4 sections 4, 5 and 6 run along the CN Railway line through New Hazelton, B.C. Although listed as riffle habitat on the data tables, this habitat should be classified as glide. The substrate is mostly muddy bottom with little exposed cobble. The riparian area can be described as moderate to good on the south side of the CN Rail line. The riparian area on the opposite side of the CN Rail line is non-existent. Any vegetation growing along that side (north side) of the CN Rail line is removed on a regular basis. There is also moderate to high beaver activity along sections 4,5 and 6. The CN Rail maintenance crews regularly remove beaver dams to protect the Rail line bed.

Water levels and flows are moderate to good in sections 4, 5 and 6. The presence of beaver dams during the overwintering period is extremely important as the deeper water created by the beaver dams represents important overwintering habitat for both Dolly varden and Coho salmon.

There is also a slough like area within section 5 that is utilized by Coho salmon juveniles for rearing throughout the year. (This specific area was not surveyed). This area is just upstream of the oil/gas bulk plant. In this particular area in the spring of 1994 and 1995, some Gee minnow trapping occurred. Cutthroat trout and steelhead/rainbow trout juveniles were captured. The 1996 to 1999 trapping in that area showed no cutthroat or steelhead/rainbow trout juveniles. However, Coho salmon juveniles and various age classes of Dolly varden were captured.

The section of stream that flows just upstream of the chipper mill, parallel to the helicopter landing pad is also quite productive. This section of stream downstream of the double culverts (under the driveway crossing to the helicopter pad) consists of a deep pool on the downstream side of the culverts. Dolly varden juveniles were captured in this section of creek. There are also cobbles present that would be suitable for spawning. The level of cobble embeddedness can be described as low. The riparian area in this short section of stream can be described as moderate to good and the canopy cover can be described as moderate.

The section of stream past the chipper mill and along the CN Rail line, from section 7 to the confluence with Station Creek can be described as mostly glide habitat. The stream bottom is extremely muddy with little to no cobble visible. The riparian area on both sides of the stream can be described as poor. Canopy cover is also poor. There is some woody debris present as well as some cutbanks. Although the habitat in this area appears to be unproductive, Dolly varden were observed throughout sections 7 to 14. (Personal communication : Cory Koenig – stream survey technician).

During the overwintering sampling conducted in the winter of 1998/99, sampling to determine if fish were Dolly varden or bull trout was conducted. Several fish were anesthetized and the full analysis was conducted to determine species. The method of identification used was as per Gordon Haus' method. After several fish were sampled and determined to be Dolly varden, only branchiostegial rays were counted. These counts were well within the range for Dolly varden on all fish sampled.

Fish Presence/Absence

Sporadic Gee minnow trapping occurs each spring and each fall as part of the Salmonids in the Classroom Program which is sponsored by Fisheries and Oceans Canada. Juvenile trapping usually occurs in Waterfall Creek in the vicinity of the oil/gas bulk plant. (This plant is no longer operating and reclamation of the bulk plant site has not been completed). The species that are usually captured are Dolly varden and Coho salmon juveniles. Although there is an impassable culvert on this system, returning coho adults are captured below the impass and trucked to the Waterfall Creek reach. Some of the coho fry that are captured are therefore progeny of those adults that have spawned naturally in the creek and some of the fry are a result of hatchery releases. In some years the Chicago Creek Hatchery has surplus fry which are released in the early fall to Waterfall Creek. In the fall of 1999, approximatley 7,000 coho fry were released to sites from Waterfall Creek at the first Highway #16 crossing to Mission Creek upstream of the

impassable culvert. In 1996 approximately 4000 fry were released to the same areas as the 1999 release.

Rainbow/steelhead trout have been captured in Waterfall Creek from upstream of the first Highway #16 crossing to the bulk plant site. In 1994 and 1995, rainbow/steelhead juveniles made up approximately 20% of the total catch. Since 1996, very few rainbow/steelhead juveniles have been captured.

Exclusively Dolly varden have been captured below the chipper mill in Waterfall Creek. These fish are of varying age classes i.e. from juvenile to adult.

In Mission Creek, downstream of the impassable culvert, Coho, rainbow/steelhead and Dolly varden juveniles have been captured.

Pink and Coho salmon adults have been observed in Mission Cr. below the impassable culvert as have Steelhead adults.

The section of Waterfall Creek that flows alongside the CN Rail line in New Hazelton has high densities of Dolly varden. That section of stream appears to be important overwintering habitat.

Recommendations

Waterfall Creek

The Waterfall Creek section of this survey (Reach 4) appears to have high fish value. The portion of stream that flows along the CN Rail line through New Hazelton is important overwintering area for Dolly varden. Downstream of this section, the portion of Waterfall Cr. near the old oil/gas bulk plant, is valuable habitat for coho juveniles.

Spawning adults utilize Waterfall Creek downstream of the waterfall. Although this section is too steep for juvenile coho rearing, the odd rainbow/steelhead juvenile has been captured in this section.

Waterfall Creek from the waterfall to the chipper mill should be considered as important fish habitat. The following recommendations should be considered prior to any streamside or in-stream disturbance:

- Riparian area removal should be prohibited in this section. Canopy cover is extremely important to both juvenile and adult fish. Riparian area provides shade, terrestrial insects as food for juveniles and recruitment of woody debris.
- Due to the importance of Waterfall Cr. for salmon spawning, silts/fines should be prevented from entering the stream. Land Development Guidelines should be followed closely in the case of residential, light industrial and industrial development.

- Salmonids require high quality water. Storm sewer installations should not drain directly into the stream and effluent storage areas should be constructed as per the Land Development Guidelines. Sewage treatment effluent should be maintained at appropriate levels.
- Salmonids require adequate flows and water levels. Minimum flow and water level requirements should be developed to ensure adequate levels. These parameters should be defined prior to any further water withdrawl or diversion from Waterfall Creek. Flows and water levels should be maintained such that they are fairly stable. Large fluctuations in water flow and level can displace rearing juveniles.
- Minimum standards for stream flow and water level should consider overwintering requirements by both juvenile and adult fish that may be present in the system.
- The appropriate management of beaver dams is important to ensure that good quality overwintering habitat remains. CN Rail line should develop a beaver dam control management plan. Such a plan would define the times of the year that beaver dam control is appropriate and specific fish friendly methods of beaver dam control.

Station Creek

A large proportion of the Station Creek flow has been diverted for domestic use by the District of New Hazelton. At times very little water overtops the weir on the Station Creek side. The habitat in Station Creek is currently of poor quality for fish and due to low flow levels, is mostly inaccessible to fish. Recommendations for Station Creek are as follows :

- Maintain overflow to the Station Creek side in such a way that fish are not attracted into Station Creek. There is high potential for fish to become stranded in Station Creek in the event that water flow increases at the confluence. Water level may increase to allow fish access, but once water flow and level drop, fish will become stranded.

Mission Creek

The old beaver swamp/pond areas on Mission Creek appear to be inaccessible to fish for the majority of the year. There are small areas upstream of the impassable culverts that may support juveniles during certain times of the year, however, there appears to be minimal overwintering habitat i.e. mostly riffle, few pools.

The portion of Mission Creek downstream of the culvert is valuable spawning habitat and also contains some juvenile rearing areas.

Due to the presence of the culvert and its impact on the stream i.e . stream hydrology is constantly changing. This culvert is supposed to be replaced within the next ten years. (Personal communciation : Ralph Turner, Ministry of Transportation and Highways). Until the culvert is replaced with a structure that allows fish passage, the Ministry of Transportation and Highways is bound by D.F.O. Inspector's Order to maintain fish

passage. This Inspector's Order is obeyed by transporting upstream migrating Coho salmon upstream of the culvert. The following recommendations should be considered :

- Coho adults will spawn naturally when moved upstream of the impassable culvert. At present approximately half of the adult returning to Mission Creek are transported upstream of the culvert and about half spawn naturally downstream of the impassable culvert. This natural coho production must be taken into account in the definition of minimum flows and water levels for the Waterfall Creek/Station Creek/Mission Crek system.
- Coho are extremely sensitive to environmental change and therefore are good indicators of watershed health.
- Any development downstream of the culvert must be planned in a way that fish habitat is maintained.
- Until the present culvert is replaced, any habitat rehabilitation downstream of the culvert should be deferred.

Other Recommendations

A **Water Use Plan** should be developed for the Waterfall Creek/Station Creek/Mission Creek system. The water use plan could include the following :

- Water withdrawl amounts, schedules and procedures(monitoring etc…)
- Definition of minimum flow and water level requirements of fish populations
- Schedule of minimum flow and water level requirements for fish i.e. spring, summer, fall and winter minimum flow and water level requirements. This would include monitoring methods.
- Procedures for ensuring domestic needs are met without destruction of fish habitat
- Procedures for monitoring those water quality parameters important to fish(dissolved oxygen, temperature)

Closing Remarks

This report has provided actual stream survey data with some interpretation of that data. The purpose of this survey was to provide some baseline data that could be used to define where fish habitat exists and assist in determing how to conserve and protect that habitat. This survey will also assist in any habitat rehabilitation efforts.

The survey has been conducted by local community members who want to ensure the future of their fisheries resource.