Summary of Stream Restoration Activities at Sites 14 and 15 in the Kitwanga River South Sub-Basin to March, 1999

Prepared for the

Gitsegukla Band Council

by
Glenn Grieve, R.P. Bio.
BioLith Scientific Consultants Inc.
Terrace, B.C.

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Introduction

BioLith Scientific Consultants Inc. was contracted by the Gitsegukla Band Council to prepare a summary of Stream Restoration activities as per Schedule A of the Standards Agreement with the Ministry of Environment. The following summary is based on first hand information derived from BioLith's involvement and on the information provided by the Band.

As a result of a Level I Overview Assessment of the Kitwanga River watershed (Wild Stone 1995) and a subsequent Level I Detailed Field Assessment of the South Sub-Basin (Giesbrecht et al, 1998), restorative works in and around the streams were prescribed for a number of sites, including

- Prescription Site 14 on Tributary 15 of the Kitwanga River (Site 14; see Figures 1 and 2)
- Prescription Site 15 on Tributary 18 of the Kitwanga River (Site 15; see Figures 1 and 2).

This report summarizes the restorative works that were implemented by the Gitsegukla Band Council at those two sites in the 1998-1999 fiscal year.

Final Summation

Instream Work

Site 14

Site 14 was a 19 m long section of Tributary 15 in the Kitwanga River South Sub-Basin. It extended from the downstream end of the highway culvert to the stream's confluence with the Kitwanga River. It was characterized by a perched culvert that was likely a barrier to fish, overly steep and unstable banks cut through the fine and actively eroding sediments of an old road bed and a general lack of cover. The banks supported very little vegetation and there was no water in the stream

The site was less than 50 m in length and was considered a Type I project. The site was visited by a biologist and technician. The site was mapped with a tape measure, clinometer and a compass and labeled flagging was hung specifiying the treatment or structure required. The construction plan produced from this information (see Figure 2) prescribed

- digging the plunge pool under the culvert deeper,
- the construction of a small rock weir to increase the water depth of the pool,
- a second rock weir further downstream,
- a log placed across the channel and embedded into it and
- the upper third of the bank to be pulled back at the crest of the berms
- waste to be spoiled and seeded on the top of the bank.

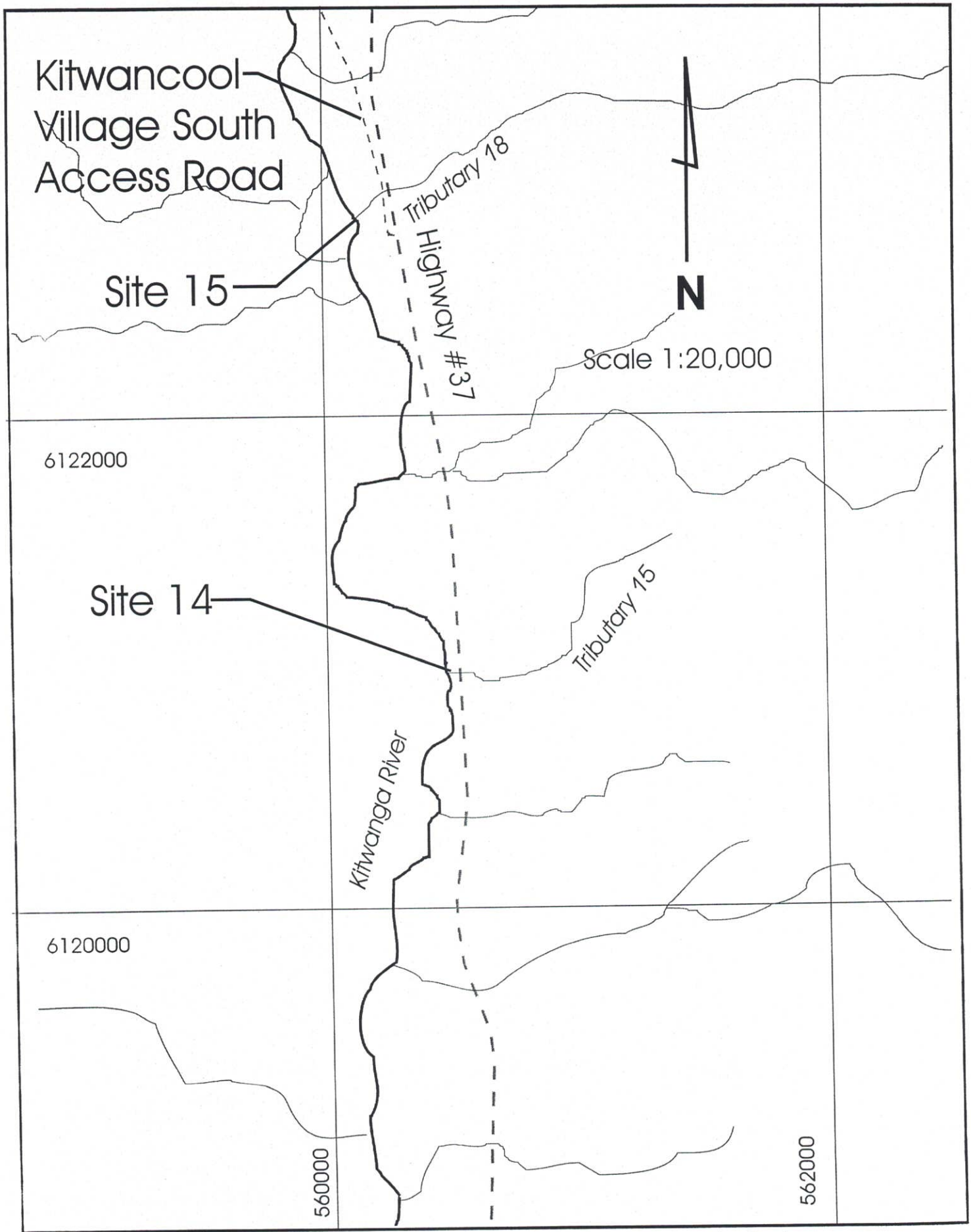


Figure 1. Map of the locations of Sites 14 and 15 in the Kitwanga River watershed.

Prior to construction, a site visit was scheduled for September 23, 1998 and local field and regional MoELP and DFO personnel were invited to attend this field trip one week in advance. The field trip was attended by Glenn Grieve, from BioLith Scientific Consultants (BioLith) and Pat Walsh, from the Department of Fisheries and Oceans (DFO). The construction plans were discussed in detail during this meeting. Verbal permission for the work was obtained from the Ministry of Transportation and Highways and from B.C. Tel.

Construction work was carried out under the supervision of the Gitsegukla Senior Fisheries Technician on October 15, 1998 with assistance from two labourers and an excavator operator (see Photo 1).

Photo 1. This composite photo looking north shows, from right to left and downstream, the perched culvert, the excavated plunge pool, a rock weir, another plunge pool and the northern pulled back bank.

After construction, the site was surveyed using a total station (see Appendix A). The locations of the restorative structures and modifications of the stream channel were determined and permanent photo reference points (photo points) were established. Some photographs were taken during construction. This information was used to produce an 'as-built' drawing of the site (see Figure 3).

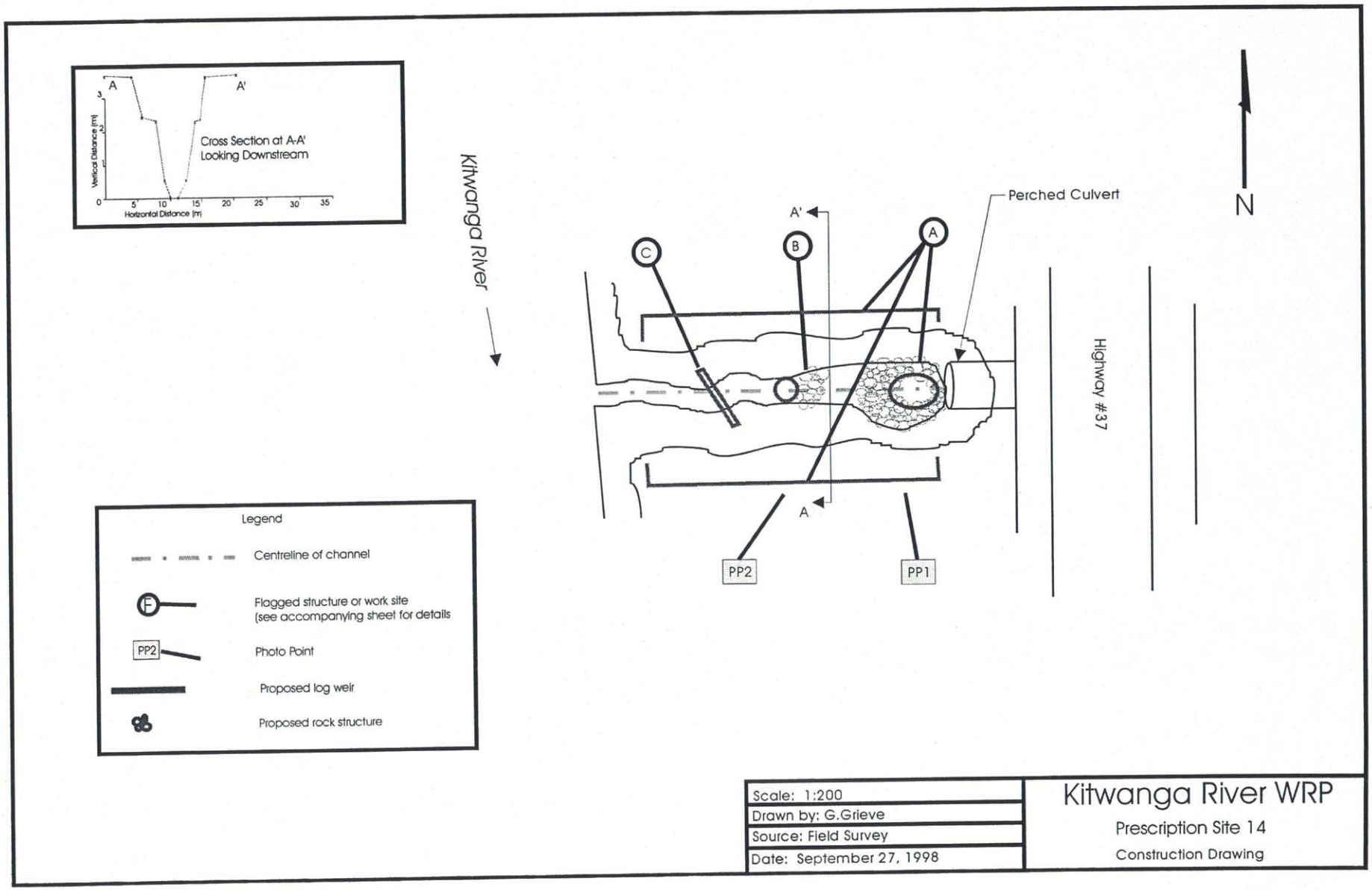


Figure 2. Construction drawing for Site 14, Kitwanga River.

Site 15

Prescription Site 15 was located on Tributary 18 of the Kitwanga River South Sub-Basin. The project involved the nearly 50 m section of stream below the southern access road into Gitanyow (Kitwancool) Village. The stream was characterized by a large, perched culvert under the access road that was a barrier to fish, some bank erosion on both sides of the stream, some channel instability in the lower section of the stream, a lack of woody debris, few deep pools and limited variety of habitat types (see Photo 2) .

Photo 2. Looking downstream from atop the perched culvert before construction.

This site was less than 50 m in length and was considered a Type I project. This site was visited by two biologists from BioLith and the Project Manager. The site was surveyed using a tape measure, clinometer and compass (see Appendix B) and labeled flagging was hung where restorative measures were prescribed. This information was used to produce a construction plan and drawing (see Figure 4). The plan prescribed

- placement of two channel spanning log weirs set into the stream bed,
- placement of complete trees with root wads and branches intact at two locations, and the redirection of the stream from its position near the northern eroding bank near the mouth to a position further south by a small trench hand dug into the raised mid-channel bar.

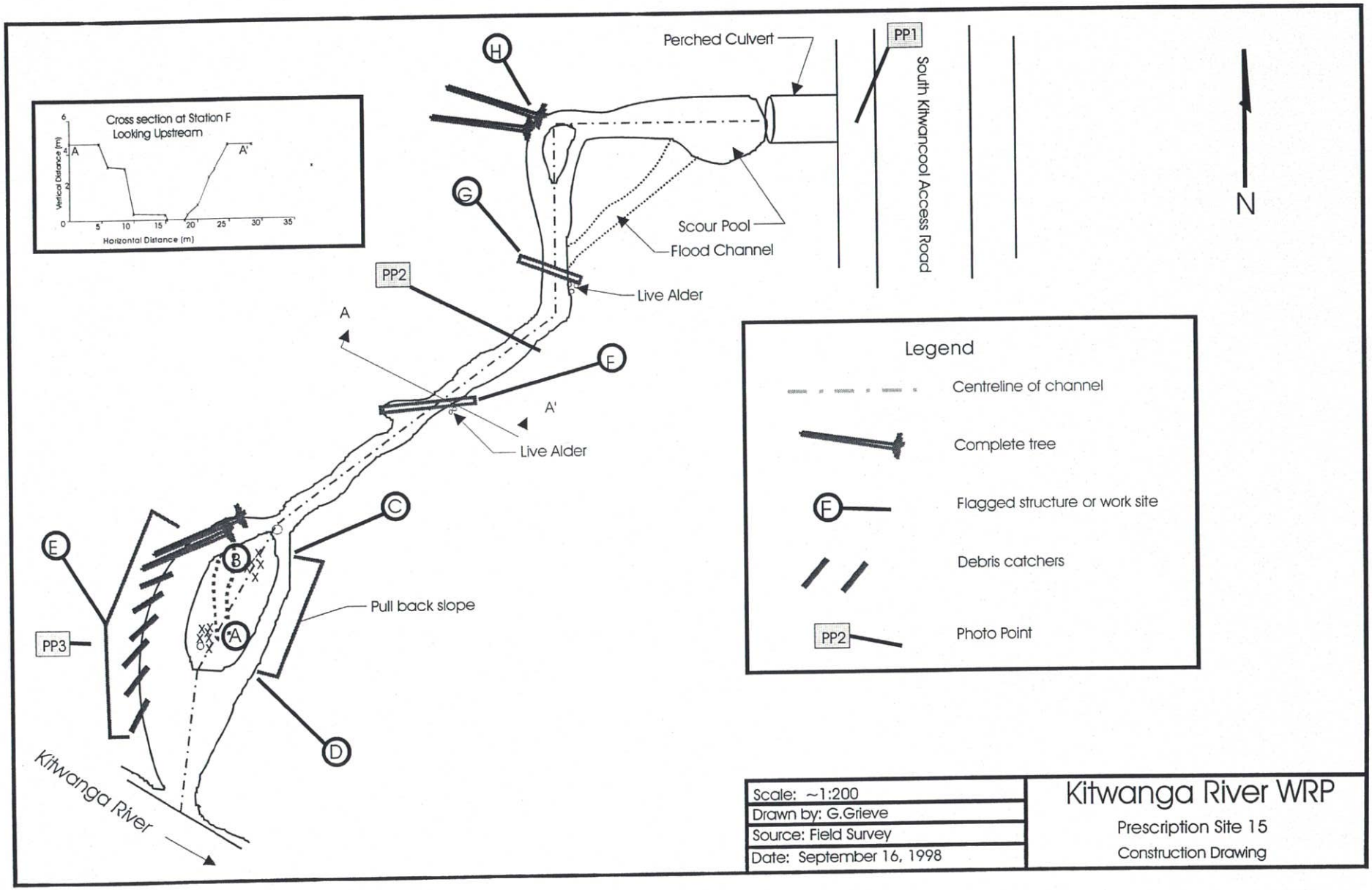


Figure 2. Pre-Construction plan for Site 15.

The Project Manager and the Technical Monitor visited the site prior to site design drawings, determined the site was suitable, and agreed to the date of the arranged site visit. Prior to construction, a site visit was scheduled for September 23, 1998 and local field, regional MoELP and DFO personnel were invited to attend this field trip one week in advance. This was attended by Glenn Grieve, from BioLith Scientific Consultants (BioLith) and Pat Walsh, from the Department of Fisheries and Oceans (DFO). The construction plans were discussed in detail during this meeting. The DFO representative suggested the inclusion of 'debris catchers', wooden pegs driven into the bank that point upstream. The purpose of these structures was to catch woody debris that would then help to protect the eroding northern bank from further erosion. This suggestion was incorporated into the construction plan (see Figure 4). The revised construction plans were sent to the concerned regulatory agencies and no comments were received prior to construction.

The construction plan was then implemented. Construction work was carried out under the supervision of BioLith's senior biologist and the Senior Fisheries Technician on October 14 and 15, 1998, with assistance from two labourers and an excavator operator (see Photos 3 and 4).

Photo 3. Looking downstream . The two technicians are standing on the LWD placed closest to the culvert.

Photo 4. Looking upstream toward the uppermost channel spanning LWD. This was amodification from the original plan.

After construction, the site was surveyed using a total station (see Appendix C). The locations of the restorative structures and modifications of the stream channel were determined and permanent photo points were established. A spike was driven into each end of each piece of LWD for use as reference points during the survey. A labeled metal tag was nailed to each piece in a position near the root wad so that it was not likely to be removed during movement of the LWD. The purpose of these tags was to uniquely identify each installed piece so that its origin could be determined if more than one piece moved downstream. Some photographs were taken of the installed structures. This information was used to produce an 'as-built' drawing of the site (see Figure 5).

Other Assessments

Jeff Lough and Darren Fillier, from the Ministry of Environment, Lands and Parks (MoELP), visited the site on November 12, after construction was complete. They have summarized their assessment of the work done at the site in the form of a letter dated March 8, 1999 (see attached copy).

In this letter they expressed concern regarding Site 14 with respect to the pull back of banks, inadequate seeding with grass, loss of low shrub and herb cover, inadequate step pool construction using insufficiently sized and improperly oriented materials and inadequate regulatory agency approvals.

With respect to Site 15, they suggested that, although the LWD was of high quality, branches and tops should be left attached. They further suggested that the LWD be anchored. Concerns were expressed over the stability of the debris catchers, possible end scouring around a channel spanning piece of LWD, riparian area degradation by machine use and the channel excavation.

Sites 14 and 15 were also visited during late September of 1998 before construction, by Jeff Lough and Darren Fillier from the MoELP, and Glenn Harkleroad, a Fisheries Biologist working with the U.S. Forest Service. In a summary of his observations (see attached copy), Mr. Harkleroad suggested that Site 14 was a low priority site, that the fish habitat in this stream was of limited value and that placement of wood in the stream would not likely improve it. Regarding Site 15, Mr. Harkleroad suggested this was a good site for experimenting with anchoring techniques and directing the flow away from the southern bank using log structures.

Modifications to Original Plans

Site 14: There were no significant deviations from the construction plans during implementation.

Site 15:

- A complete tree with root wad and branches intact was used at Structure Site G instead of the prescribed log. This was done to utilize an extra complete tree that was on hand rather than cutting the root wad off. Complete trees are more stable than simple logs.
- The prescribed pullback of the southern bank near the mouth was not implemented, as it became obvious during construction that the degree of damage to the riparian area or channel that would result from the excavator's encroachment would not warrant the gain to habitat from the pullback.
- Since more LWD pieces were available than were required by the prescription, the extra trees were piled on top of the two LWD clusters prescribed in order to increase the stability of these structures.
- Extra LWD pieces that resulted from some trimming of trees that were too long, were placed in the interstitial spaces of the LWD clusters and the upper cluster was linked to the upper weir to provide triangular strength.

Preliminary Monitoring Plan

The efficacy of the restorative treatments implemented can only be assessed through quantitative comparisons of parameters measured before and then after construction. The two most significant parameters to measure are changes to fish populations and changes to fish habitat. Only limited data on each of these characteristics is available from the Level I FHAP assessment, as that process involved sampling of representative parts of a much larger portion of the watershed. A reasonably valid assessment of efficacy will require a more intensive program of measurements. In particular, each of the construction sites should be the subject of an intensive topographic survey of the stream's channel to determine its characteristics over time, along with an intensive fishing program to determine changes in the fish population over time.

Fish Habitat

The physical characteristics of samples of the stream, and the pre-construction and post-construction surveys provide some 'before' data. The as-built survey data is valid as 'before' data because there had not been any habitat-altering floods between the time of construction and the as-built survey. It is recommended that the stream channel should be the subject of an intensive topographic survey, using a total station, to quantify the shape of the channel before the spring freshet produces the first significant alterations. A photographic record of the sites should also be compiled over time using the photo points that were established during construction.

Fish

Fish data too is limited to that provided by sampling of the stream during the Level I field assessment. The sites should be fished intensively to determine species composition, micro-distribution, and relative abundance. Relative abundance could best be determined through a mark-recapture program at each site. This work should be done before the spring freshet to get as much 'before' data as is possible.

Similarly intense repetitions of the methods used should be implemented each year, beginning after the spring freshet in 1999, and continuing for at least four years, in order to produce reasonably valid assessments of the efficacy of the treatments.

Recommendations

The design and placement of LWD was considered appropriate for this low energy site. LWD pieces with root wads and branches were bound together and oriented such that they should resist movement. Bundling together and placing some on top of others was adopted to increase their stability by increasing their above-flood-water mass, so that they were less likely to float, and thereby avoid the necessity of less natural anchoring means. The potential to experiment with this anchoring and placement method presented little risk at this site and was considered an excellent opportunity if monitored appropriately.

It is recommended that, if significant movement is observed during future monitoring, the LWD installed at Site 15 should be anchored to imported boulders >65 cm in their b axis, using steel cable >1.5 cm in diameter epoxied into 15 cm deep holes drilled into the rock using the Hilti Epoxy system. Such boulders may be available along the west Kitwancool Lake FSR.

References

Fillier, D. and J. Lough. 1999. Letter to Bill Fell. A copy is attached to this report as Appendix D.

Giesbrecht, S., G. Grieve and M. Prins. 1998. Level I detailed assessment of fish and fish habitat in the south Kitwanga River and its tributaries. Report for the Gitsegukla Band Council, available at the Regional Library, Ministry of Environment, 3726 Alfred Ave., Smithers, B.C.

Gilchrist, A. 1998. Kitwanga River and Kitseguecla River Watershed Restoration Program: Hydrological and channel stability assessments of specific impact sites. Prepared for the Gitsegukla Band Council.

Harkleroad, G.R. 1998. British Columbia Stream Restoration Project Review Report, 1998. A copy is attached to this report as Appendix E.

Wildstone Resources Ltd. 1995. Level I Assessment of the Kitwanga River Watershed. Prepared for Skeena Cellulose Inc. Available in the library, Ministry of Environment, 3726 Alfred Ave., Smithers, B.C., V0J 2N0

Appendix A. Pre-Construction Survey Data for Site 14

Site 14 Pre-Construction Survey Data

This site is ~ 19 m long from the culvert lip to the mainstem Kitwanga

The thalweg has <1 m sinuosity.

The channel is incised ~ 2 m below an old road grade in fine material.

The channel is ~ 2 m at Wb

X-Section @ 5 m below culvert, starting from s side

0	3.6
5	3.5
7	2.4
8	2.2
9	0.4
10	0
12	0
13	0.4
14	2.2
15	2.4
16	3.5
21	3.6

Appendix B. 'As-Built' Survey Data for Site 14

Total Station Survey of 'As-Built' Site 14, Reach 1, Trib 15, South Kitwanga River

BioLith Scientific Consultants Inc.

250-635-5378 Temp 9

WX cool overcast

Date of Survey: Nov.2 1998

Crew

Pentax PCS 325-W Barom Pres: 986

All measurements taken from BM#48.

Measurements to Large Woody Debris pieces taken with respect to nails driven into each end of the log.

Measurements to photo points taken to the top of the reference post or metal pipe.

Missing shot numbers indicate no data recorded.

Shot #	Description	HD	HA			Decimal	VD	RH	HI			
			Degr	Minu	Sec	Degrees				x	y	z
0	BM48 & SP									0.000	0.000	0.000
1	Photo Poin	15.16	143	20	45	143.346	-0.82	1.676	1.66	9.050	-12.162	-0.840
2	Photo Poin	16.82	169	51	50	169.864	-0.24	1.676	1.66	2.960	-16.557	-0.260
3	Pool 1 Refe	13.63	129	11	50	129.197	-3.13	1.676	1.66	10.563	-8.614	-3.150
4	Pool 2 Refe	11.54	138	38	20	138.639	-3.41	1.676	1.66	7.626	-8.661	-3.430
5	Culvert Lip	14.18	116	46	35	116.776	-2.60	1.674	1.66	12.660	-6.388	-2.618
6	Thalweg (	13.83	117	51	35	117.86	-3.57	1.676	1.66	12.227	-6.463	-3.590
7	TH 2	13.17	121	46	25	121.774	-4.03	1.676	1.66	11.196	-6.935	-4.050
8	TH 3	12.28	125	41	30	125.692	-3.55	1.674	1.66	9.973	-7.164	-3.568
9	TH 4	11.09	133	2	30	133.042	-3.92	1.674	1.66	8.105	-7.569	-3.938
10	TH 5	9.88	134	9	30	134.158	-4.31	1.674	1.66	7.088	-6.883	-4.328
11	TH 6	8.8	141	41	20	141.689	-3.69	1.76	1.66	5.455	-6.905	-3.794
12	TH 7	8.56	147	25	30	147.425	-3.80	1.76	1.66	4.609	-7.213	-3.904
13	TH 8	8.59	159	38	0	159.633	-3.83	1.76	1.66	2.990	-8.053	-3.934
14	TH 9	8.58	159	42	25	159.707	-3.83	1.76	1.66	2.976	-8.047	-3.934
15	TH 10	10.13	177	38	50	177.647	-4.41	1.76	1.66	0.416	-10.121	-4.514
16	TH 11	10.02	185	28	40	185.478	-4.57	1.76	1.66	-0.957	-9.974	-4.674
17	TH 12	9.81	192	3	55	192.065	-4.58	1.76	1.66	-2.051	-9.593	-4.684
18	TH 13	11.07	209	37	0	209.617	-4.86	1.76	1.66	-5.471	-9.624	-4.964
19	TH 14	11.68	216	56	15	216.938	-4.94	1.76	1.66	-7.019	-9.336	-5.044
20	TH 15	17.49	229	45	0	229.75	-5.46	1.76	1.66	-13.349	-11.301	-5.564

21	Wetted Wi	14.5	118	46	5	118.768	-3.27	1.75	1.66	12.710	-6.978	-3.364
22	WW RL 2	14.62	122	50	25	122.84	-3.34	1.75	1.66	12.284	-7.928	-3.434
23	WW RL 3	13.88	127	18	20	127.306	-3.31	1.75	1.66	11.040	-8.412	-3.404
24	WW RL 4	13.07	128	29	40	128.494	-3.26	1.75	1.66	10.229	-8.135	-3.354
25	WW RL 5	12.26	125	58	25	125.974	-3.23	1.75	1.66	9.922	-7.202	-3.324
26	WW RL 6	11.6	133	17	20	133.289	-3.61	1.75	1.66	8.444	-7.954	-3.704
27	WW RL 7	10.41	141	22	55	141.382	-3.64	1.75	1.66	6.497	-8.134	-3.734
28	WW RL 8	9.24	142	2	30	142.042	-3.69	1.75	1.66	5.683	-7.285	-3.784
29	WW RL 9	9.05	150	25	45	150.429	-3.79	1.75	1.66	4.466	-7.871	-3.884
30	WW RL 10	9.4	156	51	45	156.863	-3.75	1.75	1.66	3.694	-8.644	-3.844
31	WW RL 11	8.94	160	4	10	160.069	-4.10	1.75	1.66	3.047	-8.405	-4.194
32	WW RL 12	10.28	175	21	25	175.357	-4.17	1.75	1.66	0.832	-10.246	-4.264
33	WW RL 13	10.35	183	40	25	183.674	-4.35	1.656	1.66	-0.663	-10.329	-4.350
34	WW RL 14	10.74	196	14	40	196.244	-4.49	1.656	1.66	-3.004	-10.311	-4.490
35	WW RL 15	11.67	207	47	5	207.785	-4.75	1.656	1.66	-5.440	-10.325	-4.750
36	WW RL 16	11.45	212	31	40	212.528	-4.79	1.656	1.66	-6.157	-9.654	-4.790
37	WW RL 17	15.91	226	17	10	226.286	-5.29	1.656	1.66	-11.500	-10.995	-5.290
38	WW RL 18	17.28	227	3	35	227.06	-5.36	1.656	1.66	-12.650	-11.772	-5.360
39	WW 19 R/F	16.31	231	37	40	231.628	-5.25	1.652	1.66	-12.787	-10.125	-5.246
40	WW RR 20	10.86	219	39	30	219.658	-4.86	1.652	1.66	-6.931	-8.361	-4.856
41	WW RR 21	10.41	211	45	30	211.758	-4.76	1.652	1.66	-5.479	-8.851	-4.756
42	WW RR 22	10.23	206	43	35	206.726	-4.72	1.652	1.66	-4.601	-9.137	-4.716
43	WW RR 23	9.19	182	52	15	182.871	-4.36	1.652	1.66	-0.460	-9.178	-4.356
44	WW RR 24	8.2	164	16	35	164.276	-4.05	1.652	1.66	2.222	-7.893	-4.046
45	WW RR 25	7.51	156	23	0	156.383	-3.84	1.652	1.66	3.009	-6.881	-3.836
46	WW RR 26	7.5	148	10	55	148.182	-3.86	1.652	1.66	3.954	-6.373	-3.856
47	WW RR 27	8.29	145	23	55	145.399	-3.76	1.652	1.66	4.708	-6.824	-3.756
48	WW RR 28	8.42	138	6	50	138.114	-3.64	1.652	1.66	5.622	-6.268	-3.636
49	WW RR 29	9.04	129	7	30	129.125	-3.66	1.652	1.66	7.013	-5.704	-3.656
50	WW RR 30	9.66	128	7	50	128.131	-3.63	1.652	1.66	7.599	-5.965	-3.626
51	WW RR 31	11.29	128	29	40	128.494	-3.48	1.652	1.66	8.836	-7.027	-3.476
52	WW RR 32	11.93	125	24	5	125.401	-3.27	1.652	1.66	9.724	-6.911	-3.266
53	WW RR 33	11.46	118	39	25	118.657	-3.31	1.652	1.66	10.056	-5.496	-3.306
54	WW RR 34	12.65	114	42	15	114.704	-3.28	1.652	1.66	11.492	-5.287	-3.276
55	WW RR 35	13.78	114	32	5	114.535	-3.30	1.652	1.66	12.536	-5.722	-3.296
56	CROSS SE	36.6	161	15	45	161.263	-0.05	1.652	1.66	11.757	-34.660	-0.046
57	C/S 2	29.16	160	7	55	160.132	0.81	1.652	1.66	9.910	-27.424	0.814

58	C/S 3	20.8	158	33	30	158.558	0.11	1.652	1.66	7.604	-19.360	0.114
59	C/S 4	15.47	159	21	5	159.351	-0.38	1.652	1.66	5.455	-14.476	-0.376
60	C/S 5	10.58	156	55	35	156.926	-3.55	1.652	1.66	4.146	-9.734	-3.546
61	C/S 6	9.17	153	38	15	153.638	-3.79	1.652	1.66	4.072	-8.216	-3.786
62	C/S 7	7.5	152	22	40	152.378	-3.53	1.652	1.66	3.477	-6.645	-3.526
63	C/S 8	2.03	94	1	5	94.0181	0.10	1.652	1.66	2.025	-0.142	0.104
64	C/S 9	7.2	352	24	55	352.415	0.00	1.652	1.66	-0.950	7.137	0.004
65	C/S 10	19.96	347	40	20	347.672	-1.26	1.652	1.66	-4.262	19.500	-1.256
66	lwd U/S TA	9.69	156	18	0	156.3	-3.68	1.652	1.66	3.895	-8.873	-3.676
67	LWD D/S	7.9	161	38	20	161.639	-3.78	1.652	1.66	2.489	-7.498	-3.776
68	CHANNEL	18.22	194	40	50	194.681	-0.73	1.652	1.66	-4.617	-17.625	-0.726
69	cb #2	15.31	152	6	30	152.108	-0.40	1.652	1.66	7.162	-13.531	-0.396
70	CB #3	14.95	140	12	45	140.213	-0.93	1.652	1.66	9.567	-11.488	-0.926
71	cb #4	16.49	127	38	5	127.635	-1.30	1.652	1.66	13.059	-10.069	-1.296
72	#5 Top of (	15.35	112	16	5	112.268	-1.03	1.652	1.66	14.205	-5.817	-1.026
73	channel br	11.71	106	2	45	106.046	-1.44	1.652	1.66	11.254	-3.237	-1.436
74	CB r/r #2	10.22	110	9	30	110.158	-1.73	1.652	1.66	9.594	-3.522	-1.726
75	CB R/R #3	8.53	102	20	10	102.336	-1.29	1.652	1.66	8.333	-1.822	-1.286
76	CB r/R #4	6.57	83	20	40	83.3444	-0.05	1.652	1.66	6.526	0.761	-0.046
77	CB R/R #5	2.99	240	14	5	240.235	-0.35	1.652	1.66	-2.596	-1.484	-0.346
78	cb R/R #6	6.31	269	0	50	269.014	-0.61	1.652	1.66	-6.309	-0.109	-0.606
79	POOL #1-1	13.98	118	28	40	118.478	-3.77	1.656	1.66	12.288	-6.666	-3.770
80	POOL #1-2	13.16	120	35	55	120.599	-4.11	1.656	1.66	11.328	-6.699	-4.110
81	POOL #1-3	12.79	123	40	50	123.681	-3.76	1.656	1.66	10.643	-7.093	-3.760
82	POOL #1-4	12.53	120	3	0	120.05	-3.72	1.656	1.66	10.846	-6.274	-3.720
83	POOL #1-5	13.92	124	25	45	124.429	-3.74	1.656	1.66	11.482	-7.870	-3.740
84	POOL #2 D	9.96	133	52	55	133.882	-4.32	1.656	1.66	7.179	-6.904	-4.320

Appendix C. Pre-Construction Survey Data for Site 15

Survey of Kitwanga Prescription Site 15 using clinometer, compass and tape.														
Shot	Comment	SD	% Slope	HD	HA			VD	Pole H	HI	X=eas	Y=nortl	Z	
Number				m	deg	s	Dec Brg	m	m	m	m	m	m	
									Earl	Glenn				
POC is a metal tag facing east, nailed to a 20 cm DBH cottonwood											X	Y	Z	
located on the north bank above the cree's mouth. Reference point is at base of tree.														
POC	Description										x	y	z	
1	to mouth of cr.	15.8	-19	15.62	168		168.00	-2.35	1.70	1.70	3.25	-15.28	-2.35	
2	s bank at mou	16.6	-10	16.55	152		152.00	-1.30	1.70	1.70	7.77	-14.61	-1.30	
3	on n	8.5	-20	8.40	176		176.00	-1.33	1.70	1.70	0.59	-8.37	-1.33	
	moved to sta 1 (mouth)													
4		7.75	4	7.75	8		8.00	0.24	1.70	1.70	4.33	-7.61	0.24	
5		19.6	4	19.59	9		9.00	0.62	1.70	1.70	6.31	4.07	0.62	
	moved to sta 4													
6		15.4	2.5	15.40	64		64.00	0.30	1.70	1.70	18.17	-0.86	0.30	
7		9.2	2.5	9.20	73		73.00	0.18	1.70	1.70	13.12	-4.92	0.18	
8		4.9	10	4.88	314		314.00	0.38	1.70	1.70	0.81	-4.22	0.38	
9		12.9	27	12.61	314		314.00	2.72	1.70	1.70	-4.75	1.15	2.72	
10		18	20	17.78	314		314.00	2.82	1.70	1.70	-8.46	4.74	2.82	
11		13	20	12.84	344		344.00	2.03	1.70	1.70	0.79	4.73	2.03	
12		13.3	20	13.14	4		4.00	2.08	1.70	1.70	5.24	5.49	2.08	
13		12.6	11	12.55	18		18.00	1.09	1.70	1.70	8.21	4.33	1.09	
14	e side of old r	13.2	8	13.17	29		29.00	0.83	1.70	1.70	10.71	3.91	0.83	
15	at stump in ch	9.2	5	9.19	30		30.00	0.36	1.70	1.70	8.92	0.35	0.36	
16		8.9	14	8.85	51		51.00	0.98	1.70	1.70	11.20	-2.05	0.98	
17		2.1	44	1.98	144		144.00	0.71	1.70	1.70	5.49	-9.21	0.71	
18		10.3	12	10.25	144		144.00	0.97	1.70	1.70	10.35	-15.91	0.97	
19		12.1	28	11.81	142		142.00	2.64	1.70	1.70	11.60	-16.92	2.64	
	moved to sta 15 at stump													
20		9.4	1	9.40	72		72.00	0.07	1.70	1.70	17.86	3.25	0.07	
21	on bank above	9.7	11	9.66	78		78.00	0.84	1.70	1.70	18.38	2.36	0.84	
22		18.5	3	18.49	54		54.00	0.44	1.70	1.70	23.89	11.22	0.44	
	moved to sta 22													
23	junction	5.9	2.5	5.90	357		357.00	0.12	1.70	1.70	23.58	17.11	0.12	
24		10.1	5	10.09	360		360.00	0.40	1.70	1.70	23.89	21.31	0.40	
25		4.9	6	4.89	316		316.00	0.23	1.70	1.70	20.49	14.74	0.23	

26		14.4	6	14.38	315		315.00	0.68	1.70	1.70	13.71	21.39	0.68
27	top of bank	18.9	19	18.69	318		318.00	2.81	1.70	1.70	11.38	25.11	2.81
28	5m back	24	15	23.83	318		318.00	2.82	1.70	1.70	7.94	28.93	2.82
29	s bank at mou	1.2	22	1.18	141		141.00	0.21	1.70	1.70	24.63	10.30	0.21
30		3.3	25	3.24	144		144.00	0.64	1.70	1.70	25.79	8.60	0.64
31		7.1	30	6.90	144		144.00	1.66	1.70	1.70	27.94	5.63	1.66
32		12	18	11.88	139		139.00	1.69	1.70	1.70	31.68	2.25	1.69
33		11.2	2	11.20	90		90.00	0.18	1.70	1.70	35.08	11.22	0.18
34		9.9	2	9.90	106		106.00	0.16	1.70	1.70	33.40	8.49	0.16
35		10.2	32	9.88	58		58.00	2.54	1.70	1.70	32.26	16.46	2.54
36		17.2	38	16.44	58		58.00	5.06	1.70	1.70	37.83	19.93	5.06

Appendix D. As-Built Survey Data for Site 15

Total Station Survey of 'As-Built' Site 15, Reach 1, Trib 18, South Kitwanga River

BioLith Scientific Consultants Inc.

250-635-5378 Temp 8

Crew EW/GG

Pentax PCS 325-W Barom Press. 981

All measurements taken from BM#56.

Measurements to Large Woody Debris pieces taken with respect to nails driven into each end of the log. Debris catcher measurements were taken with respect to one nail driven into the highest point on the piece.

Measurements to photo points taken to the top of the reference post or metal pipe.

Missing shot numbers indicate no data recorded.

First S First SP tag #55

Shot #		HD	Degr	Minu	Secc	Dec. Deg.	VD	RH	HI	x	y	z	Description
										0.000	0.000	0.000	BM55
1	to tag # 54	29.74	217	8	35	217.143	-2.38	1.52	1.55	-17.957	-23.707	-2.346	to tag # 54
2	edge of hig	31.6	227	42	45	227.713	-1.52	1.52	1.55	-23.377	-21.262	-1.486	edge of highest bank on N
3	edge of hig	23.01	235	20	25	235.340	-1.35	1.52	1.55	-18.927	-13.086	-1.316	edge of highest bank on N
4	edge of hig	15.82	251	1	35	251.026	-0.71	1.66	1.55	-14.960	-5.144	-0.822	edge of highest bank on N
5	edge of hig	6.59	252	52	20	252.872	-0.46	1.66	1.55	-6.298	-1.941	-0.572	edge of highest bank on N
6	edge of hig	2.09	282	37	55	282.632	0.13	1.66	1.55	-2.039	0.457	0.018	edge of highest bank on N
7	edge of hig	3.23	195	30	50	195.514	-1.01	1.66	1.55	-0.864	-3.112	-1.122	edge of highest bank on N
8	edge of hig	3.6	131	53	5	131.885	-0.76	1.66	1.55	2.680	-2.403	-0.872	edge of highest bank on N
9	edge of hig	10.75	93	59	50	93.997	-0.07	1.66	1.55	10.724	-0.749	-0.180	edge of highest bank on N
10	w.edge N s	11.47	114	7	40	114.128	-3.35	1.66	1.55	10.468	-4.689	-3.460	w.edge N side
11	w.edge N s	8.57	127	34	45	127.579	-3.36	1.66	1.55	6.792	-5.226	-3.467	w.edge N side
12	w.edge N s	6.01	148	50	5	148.835	-3.49	1.65	1.55	3.110	-5.143	-3.594	w.edge N side
13	Outside of	8.47	188	17	50	188.297	-3.83	1.65	1.55	-1.222	-8.381	-3.933	Outside of first bend
14	alder clump	11.55	185	17	55	185.299	-4.12	1.65	1.55	-1.067	-11.501	-4.223	alder clump
15	w.edge N s	18.22	187	44	45	187.746	-4.18	1.65	1.55	-2.456	-18.054	-4.283	w.edge N side
16	w.edge N s	21.77	191	2	55	191.049	-4.15	1.65	1.55	-4.172	-21.366	-4.253	w.edge N side
17	w.edge N s	25.4	199	50	50	199.847	-4.29	1.65	1.55	-8.624	-23.891	-4.393	w.edge N side
18	S end of w	24.87	185	25	20	185.422	-4.21	1.65	1.55	-2.350	-24.759	-4.310	S end of weir log working u/s
19	w. edge S	22.1	182	6	55	182.115	-4.2	1.6	1.55	-0.816	-22.085	-4.246	w. edge S. side
20	w. edge S	19.94	179	14	35	179.243	-4.14	1.64	1.55	0.263	-19.938	-4.234	w. edge S. side

21	w. edge S	17.45	176	7	45	176.129	-4.15	1.64	1.55	1.178	-17.410	-4.236	w. edge S. side		
22	w. edge S	13.81	174	39	5	174.651	-4	1.64	1.55	1.287	-13.750	-4.086	w. edge S. side		
23	w. edge S	10.65	168	1	10	168.019	-3.7	1.63	1.55	2.211	-10.418	-3.780	w. edge S. side		
24	w. edge S	10	141	28	25	141.474	-3.41	1.63	1.55	6.229	-7.823	-3.488	w. edge S. side		
25	w. edge S	13.66	135	36	40	135.611	-3.35	1.63	1.55	9.556	-9.762	-3.427	w. edge S. side		
26	w. edge S	14.19	121	37	20	121.622	-3.4	1.63	1.55	12.083	-7.440	-3.475	w. edge S. side		
27	top of culve	13.87	111	46	10	111.769	0.84	1.62	1.55	12.881	-5.144	0.766	top of culvert		
28	bottom of c	13.71	112	17	40	112.294	-0.43	2.51	1.55	12.685	-5.201	-1.388	bottom of culvert 2 m in from edge		
29	top of phot	16.95	116	13	10	116.219	2.13	1.52	1.55	15.206	-7.489	2.162	top of photo point 1		
30	thalweg fro	9.53	135	39	45	135.663	-3.74	1.52	1.55	6.660	-6.816	-3.707	thalweg from culvert plunge pool tail out d/s		
31	thalweg	7.98	155	5	55	155.099	-3.8	1.52	1.55	3.360	-7.238	-3.767	thalweg		
32	thalweg	10.68	175	8	15	175.138	-4.19	1.52	1.55	0.905	-10.642	-4.157	thalweg		
33	u/s of log 1	14.72	180	12	35	180.210	-4.25	1.52	1.55	-0.054	-14.720	-4.217	u/s of log 1 in thalweg		
34	top of phot	24.19	181	49	25	181.824	-2.09	1.52	1.55	-0.770	-24.178	-2.056	top of photo point 2		
35		23.28	187	55	5	187.918	-4.45	1.52	1.55	-3.207	-23.058	-4.416			
36	middle of lo	24.79	191	9	40	191.161	-4.4	1.52	1.55	-4.799	-24.321	-4.366	middle of log 5		
37	S end of lo	25.01	185	41	55	185.699	-4.1	1.52	1.55	-2.483	-24.886	-4.066	S end of log 5		
38	N end of lo	25.1	198	36	20	198.606	-4.07	1.52	1.55	-8.008	-23.788	-4.036	N end of log 5		
39	N end of tr	14.23	205	3	25	205.057	-3.35	1.52	1.55	-6.027	-12.891	-3.316	N end of tree 4		
40	S end of tr	15.39	176	18	30	176.308	-3.43	1.52	1.55	0.991	-15.358	-3.396	S end of tree 4		
41	rootwad en	6.98	188	32	45	188.546	-3.02	1.52	1.55	-1.037	-6.903	-2.986	rootwad end of S most log of group of 3-tree #3		
42	middle log-	6.05	175	38	25	175.640	-3.08	1.52	1.55	0.460	-6.032	-3.046	middle log-tree #2		
43	N log-tree #	5.36	170	22	40	170.378	-2.54	1.66	1.55	0.896	-5.285	-2.648	N log-tree #1		
44	single debr	5.98	149	17	0	149.283	-2.84	1.66	1.55	3.055	-5.141	-2.947	single debris catcher		
45	S log-tree #	19.44	238	7	35	238.126	-2.3	1.66	1.55	-16.509	-10.265	-2.406	S log-tree #3		
46	N log-tree #	17.91	242	30	10	242.503	-2.22	1.66	1.55	-15.887	-8.269	-2.326	N log-tree #1		
47	Middle log-	14.45	237	55	25	237.924	-2.86	1.66	1.55	-12.244	-7.674	-2.966	Middle log-tree #2		
48	N end of cr	11.79	241	56	25	241.940	-2.3	1.66	1.55	-10.404	-5.546	-2.406	N end of crossed log		
49		11.72	205	4	5	205.068	-3.21	1.65	1.55	-4.966	-10.616	-3.310			
50	cross secti	21.64	148	2	25	148.040	-1.63	1.58	1.55	11.455	-18.360	-1.664	cross section from S to N		
51	cross secti	20.47	152	7	50	152.131	-2.29	1.58	1.55	9.569	-18.096	-2.323	cross section from S to N		
52	cross secti	19.19	155	59	50	155.997	-3.12	1.58	1.55	7.806	-17.531	-3.153	cross section from S to N		
54	cross secti	15.65	174	37	45	174.629	-4.17	1.57	1.55	1.465	-15.581	-4.192	cross section from S to N		
55	cross secti	14.07	199	10	5	199.168	-3.67	1.57	1.55	-4.620	-13.290	-3.692	cross section from S to N		
56	cross secti	15.99	227	56	25	227.940	-3.35	1.57	1.55	-11.872	-10.712	-3.372	cross section from S to N		
57	cross secti	18.66	237	51	35	237.860	-3.04	1.57	1.55	-15.800	-9.927	-3.062	cross section from S to N		
58	cross secti	20.4	242	12	50	242.214	-0.93	1.57	1.55	-18.048	-9.510	-0.950	cross section from S to N		

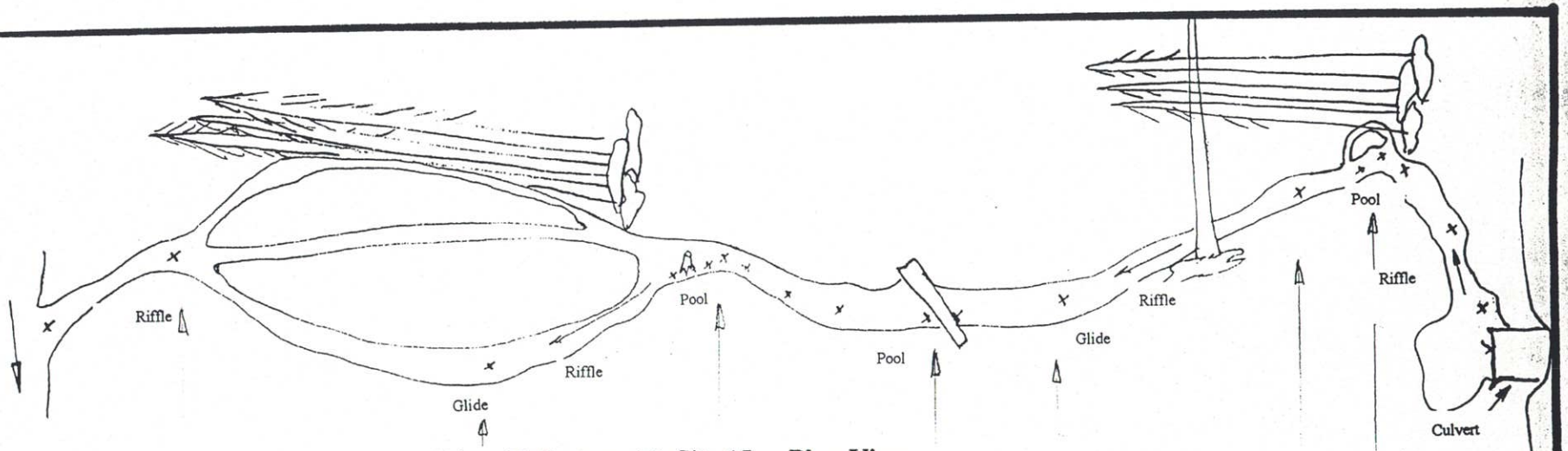
59	cross secti	26.04	254	49	10	254.819	-1.03	1	1.55	-25.131	-6.819	-0.480	cross section from S to N		
60	channel bo	7.21	157	42	30	157.708	-3.1	2.16	1.55	2.735	-6.671	-3.712	channel bottom near bundled trees		
61	channel bo	8.38	173	48	15	173.804	-3.2	2.16	1.55	0.904	-8.331	-3.806	channel bottom near bundled trees		
62	channel bo	7.89	185	8	0	185.133	-3.37	2.15	1.55	-0.706	-7.858	-3.973	channel bottom near bundled trees		
63	channel bo	8.51	198	18	5	198.301	-3.03	2.15	1.55	-2.672	-8.080	-3.630	channel bottom near bundled trees		
64	channel bo	14.47	176	13	5	176.218	-3.6	2.15	1.55	0.954	-14.438	-4.200	channel bottom u/s tree #4 rootwad end		
65	channel bo	13.38	168	31	45	168.529	-3.47	2.02	1.55	2.661	-13.113	-3.943	channel bottom u/s log 1 rootwad end		
66	channel bo	16.98	177	47	50	177.797	-3.7	2.02	1.55	0.653	-16.967	-4.170	channel bottom u/s log 1 rootwad end		
67	channel bo	16.45	177	35	40	177.594	-3.81	2.02	1.55	0.690	-16.436	-4.280	channel bottom u/s log 1 rootwad end		
68	channel bo	15.86	179	53	20	179.889	-3.82	2.02	1.55	0.031	-15.860	-4.286	channel bottom u/s log 1 rootwad end		
69	channel bo	23.64	187	15	15	187.254	-4.11	1.95	1.55	-2.985	-23.451	-4.510	channel bottom log #5		
70	channel bo	24.61	190	22	10	190.369	-4.06	1.95	1.55	-4.430	-24.208	-4.460	channel bottom log 2		
71	channel bo	24.47	194	1	10	194.019	-4.09	1.95	1.55	-5.928	-23.741	-4.490	channel bottom log 2		
72	channel bo	26.85	193	42	45	193.713	-4.13	1.95	1.55	-6.365	-26.085	-4.530	channel bottom log 2		
73	N end log #	26.48	197	46	35	197.776	-4.1	1.95	1.55	-8.084	-25.216	-4.500	N end log #5		
74		26.31	190	3	15	190.054	-4.23	1.93	1.55	-4.593	-25.906	-4.611			
75	SW edge o	32.96	135	27	15	135.454	2.26	1.93	1.55	23.121	-23.490	1.884	SW edge of pavement		
76	S centerlin	35.05	130	44	10	130.736	2.37	1.93	1.55	26.558	-22.873	1.994	S centerline of road		
77	N centrelin	26.61	50	34	35	50.576	3.14	1.92	1.55	20.555	16.899	2.768	N centreline of road		
78	W edge of	23.62	46	16	10	46.269	3.03	1.92	1.55	17.068	16.328	2.658	W edge of pavement		
80	Backshot fi	29.8	37	8	35	37.143	2.57	1.6	1.36	0.036	0.047	-0.016	Backshot from BM 54 to BM 55		
81	C/L from lo	11.65	99	24	15	99.404	-1.98	1.6	1.36	-6.464	-25.611	-4.566	C/L from log #5		
82	C/L	8.67	116	8	15	116.138	-2.19	1.6	1.36	-10.174	-27.526	-4.776	C/L		
83	C/L at u/s e	6.21	135	57	0	135.950	-2.48	1.6	1.36	-13.639	-28.170	-5.066	C/L at u/s edge of stump		
84	C/L of S dis	9.96	151	4	45	151.079	-2.54	1.6	1.36	-13.140	-32.425	-5.126	C/L of S distributary		
85	C/L of S dis	13.45	174	0	30	174.008	-2.64	1.6	1.36	-16.553	-37.084	-5.226	C/L of S distributary		
86	C/L of S dis	17.56	193	5	45	193.096	-2.81	1.6	1.36	-21.936	-40.810	-5.396	C/L of S distributary		
87	C/L conflue	20.1	202	25	15	202.421	-2.99	1.6	1.36	-25.623	-42.288	-5.576	C/L confluence		
88	confluence	26.73	200	37	45	200.629	-3.33	1.6	1.36	-27.374	-48.723	-5.916	confluence w/ Kitwanga R		
89	C/L of N dis	19.5	205	19	20	205.322	-3.1	1.6	1.36	-26.297	-41.333	-5.686	C/L of N distributary @ confluence of S dist.		
90	C/L of N dis	10.97	215	31	25	215.524	-2.7	1.6	1.36	-24.331	-32.635	-5.286	C/L of N distrubutary		
91	C/L of N dis	6.95	219	49	5	219.818	-2.5	1.6	1.36	-22.407	-29.045	-5.086	C/L of N distrubutary		
92	C/L of N dis	3.4	171	39	40	171.661	-2.3	1.6	1.36	-17.464	-27.071	-4.886	C/L of N distrubutary		
93	u/s end of d	4.98	155	17	20	155.289	-2.29	1.6	1.36	-15.875	-28.231	-4.876	u/s end of dug channel C/L		
94	u/s end of d	15.99	192	49	0	192.817	-2.75	1.6	1.36	-21.504	-39.299	-5.336	u/s end of dug channel C/L		
95	bole of S lo	15.55	221	34	55	221.582	-1.88	1.6	1.36	-28.277	-35.339	-4.466	bole of S log-tree #7		
96	DC most w	11.2	227	37	20	227.622	-1.42	1.6	1.36	-26.231	-31.256	-4.006	DC most westerly # 1		

97	bole of N lo	7.69	209	21	50	209.364	-1.91	1.6	1.36	-21.728	-30.409	-4.496	bole of N log-tree #6		
98	DC # 2	8.02	223	11	45	223.196	-1.7	1.6	1.36	-23.447	-29.554	-4.286	DC # 2		
99	DC # 3	6.26	223	0	20	223.006	-1.67	1.6	1.36	-22.227	-28.285	-4.256	DC # 3		
100	DC # 4	3.24	213	11	55	213.199	-1.43	1.6	1.36	-19.731	-26.418	-4.016	DC # 4		
101	rootwad en	3.1	145	49	20	145.822	-1.53	1.6	1.36	-16.216	-26.272	-4.116	rootwad end of N log-tree #6		
102	rootwad en	3.77	148	31	35	148.526	-1.56	1.6	1.36	-15.989	-26.922	-4.146	rootwad end of S log-tree #7		
103	S Bank	10.33	120	28	45	120.479	-1.94	1.6	1.36	-9.054	-28.947	-4.526	S Bank		
104	S Bank	8.68	136	40	25	136.674	-2.33	1.6	1.36	-12.001	-30.021	-4.916	S Bank		
105	S Bank	11.72	157	49	0	157.817	-2.55	1.6	1.36	-13.532	-34.559	-5.136	S Bank		
106	S Bank	15.9	182	45	0	182.750	-2.63	1.6	1.36	-18.720	-39.589	-5.216	S Bank		
107	S bank poi	20.9	201	21	45	201.363	-2.95	1.6	1.36	-25.570	-43.171	-5.536	S bank point		
108	N Bank poi	25.37	203	43	5	203.718	-3.09	1.6	1.36	-28.162	-46.934	-5.676	N Bank point		
109	N Bank by	9.16	222	57	50	222.964	-2.54	1.6	1.36	-24.200	-30.410	-5.126	N Bank by DC #2		
110	N Bank by	3.32	203	42	20	203.706	-2.31	1.6	1.36	-19.292	-26.747	-4.896	N Bank by DC #3		
111	N Bank ups	4.74	119	12	30	119.208	-2.13	1.6	1.36	-13.820	-26.020	-4.716	N Bank upstream of rootwads		
112	channel sh	5.23	134	15	40	134.261	-2.33	1.6	1.36	-14.211	-27.357	-4.916	channel shape out from rootwads		
113	S edge of c	5.65	151	6	30	151.108	-2.2	1.6	1.36	-15.227	-28.654	-4.786	S edge of dug channel E		
114	S edge of D	13.59	188	17	55	188.299	-2.56	1.6	1.36	-19.918	-37.155	-5.146	S edge of DC W		
115	N edge of D	13.24	193	6	25	193.107	-2.56	1.6	1.36	-20.959	-36.602	-5.146	N edge of DC W		
116	N edge of D	4.15	157	3	40	157.061	-2.2	1.6	1.36	-16.340	-27.529	-4.786	N edge of DC E		
117	Photo Poin	10.32	240	42	45	240.713	-2.08	1.6	1.36	-26.958	-28.755	-4.666	Photo Point 3		

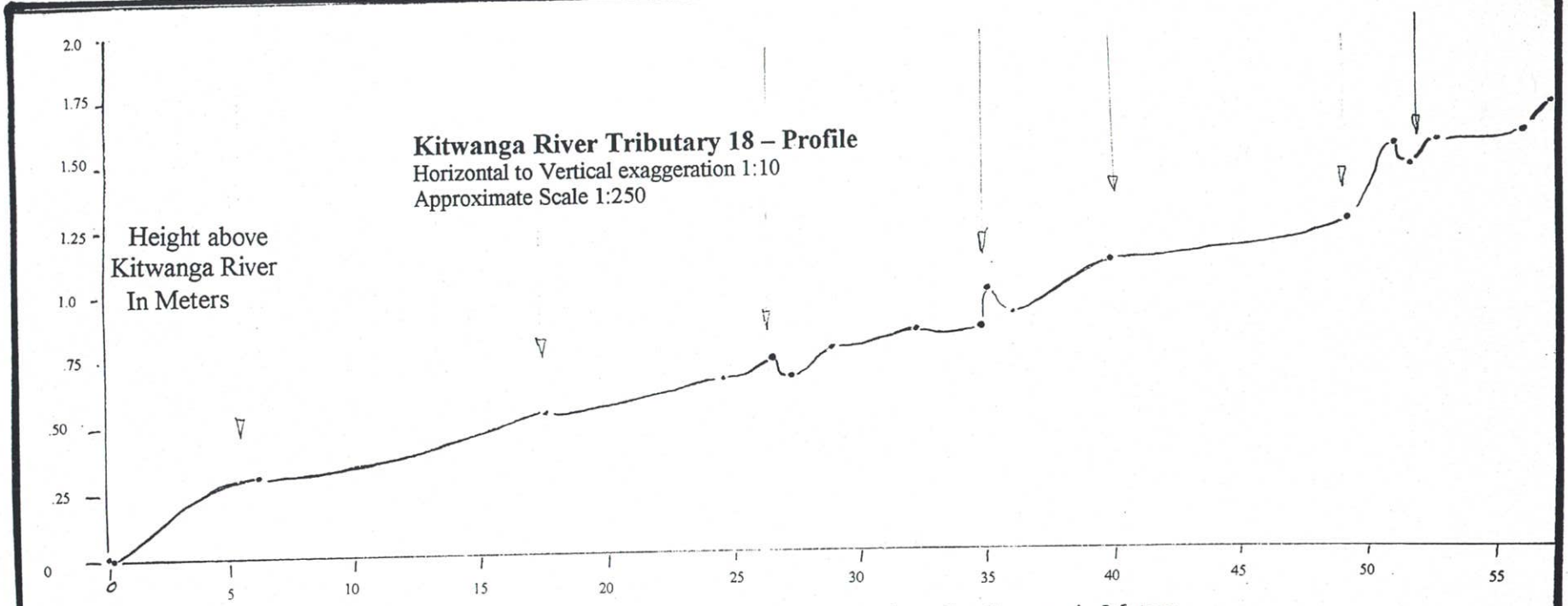
Appendix E. Fillier and Lough Letter

Appendix F. Harkleroad Report

Appendix G. Centreline Survey, March, 1999



Kitwanga River Tributary 18, Site 15 - Plan View
Scale approximate 1:250
Drawn by B. Fell



Kitwanga River Tributary 18 – Profile
Horizontal to Vertical exaggeration 1:10
Approximate Scale 1:250

BRITISH COLUMBIA

March 8, 1999

BCE File: 36780-30/Kitseguecla WRP
36780-30/Kitwanga WRP
Your File: Annual Agmt. 0000128
Activity 101462
Activity 12395

Bill Fell, Cedarvale Resources Ltd.
WRP Coordinator
Gitseguecla Band Council
36 Cascade Avenue
South Hazelton, BC V0J 2R0

Dear Bill Fell:

As stated in the letter dated 02/16/99, a technical review of instream rehabilitation work in the Kitwanga and Kitseguecla Watershed Restoration Program (WRP) projects were pending draft report submissions (not received to date). We are providing these preliminary comments in lieu of the draft report submissions. The purpose of this letter is to facilitate an estimate of percentage of work completed in the Kitseguecla and Kitwanga watersheds stream rehabilitation (SR) activities for 1998/99.

Site visits to the Kitseguecla and Kitwanga stream rehabilitation activity areas were conducted on November 12, 1998. In attendance for these field visits were both Jeff Lough and Darren Fillier. We delayed our comments until draft document changes for prescription alteration approval requests, "As-Builts" with supporting documentation, and Compendium Report submissions were submitted for our review.

Both Kitseguecla and Kitwanga Standard Agreements for WRP SR activity, and respective Schedule "A"s, outlined a pertinent course of action in dealing with substantive prescription changes. Specifically, Section 4.1 of the Aquatic Habitat Rehabilitation (Works) Schedule "A" delineates that changes to the prescription, stemming from a pre-work review, were to be incorporated, in writing, into the design and then submitted to the Technical Monitor for approval. This clearly did not occur.

Ministry of Environment, Lands and Parks

Environment and Lands
Skeena Region

Mail Address: Kispiox Forest District, Bag 5000, Smithers, BC V0J 2N0

Location Address: 2210, Highway 62 W, Hazelton, BC

Telephone: (250) 842-7615
Facsimile: (250) 842-7676

Activity Number 12395 - SR - Restoration Prescription Implementation for Prescription Sites 14 and 15 Kitwanga River South Sub-Basin

Site 14 - Our first concern with this project is in regard to the pull back of the banks. This activity was not initially prescribed nor approved for work at the site. The pull back that was undertaken is of concern given its proximity to the highway and, specifically, within the road right of way. Was the Ministry of Highways consulted regarding this change?

Prescription implementation was to be as per the BioLith's 1997-98 report as delineated within the Water Act Regulations Section 9 Letter of Notification. Such prescription alteration and associated pull back to the suggested angle of repose must have been submitted for consideration by the Technical Monitor, or designate, prior to any work commencing at this site. Adherence with Section 4.1 of the Schedule "A" for Site 14 is paramount. Deviation from the prescription must follow the process as outlined within the Standard Agreement and the respective Schedule(s). Regardless of holding a Letter of Notification for specific in stream "timing windows" for work to be undertaken, the prescription alteration must be submitted for review and incorporation into a revised Letter of Notification. Clearly work should not have commenced without fulfilling all these requirements and, as such, violates Section 4.2 of the Schedule "A" and that is unacceptable to the Ministry.

Construction of the step pool system at Site 14 does not appear to be adequate to meet the goal of better facilitating fish access through the culvert. We are also concerned about the size and orientation of the materials used to construct the weirs (their long term stability is questionable). Close monitoring of this site at various flow levels, and associated modifications, will be required to fulfil the goal of creating long term fish access through the culvert.

Finally, the loss of the riparian low shrub and herb cover at Site 14 associated with the work undertaken last fall has increased surface erosion and will continue to deliver sediment into the Kitwanga River until inevitable revegitation takes place. On that note, the grass seeding that was planted seemed sporadic. In addition this surface erosion will not be mitigated by the silt fence given that its' installation was done incorrectly. This will require correction if not already done so. Again monitoring of this aspect of the project will be conducted this Spring after snowmelt.

Given the problems outlined above, no quality certificate will be issued until the site is monitored and appropriate changes are completed this Spring.

Site 15 - The Recipient provided a good source of Large Woody Debris (LWD) by species and by size. Root wad presence was good but it would be advantageous, in future, to leave branches and tops attached to the LWD pieces to increase their stability. If the objective of using rope to tie the structures together was to increase their stability, then we suggest rock anchoring would help better achieve your objective.

Sincerely,

Darren J. Fillier, RPF, RPBio.
Forest Ecosystem Specialist
Kispiox Forest District

Jeff Lough
WRP Fisheries Specialist
Skeena Region, MELP

DJF& JL/djf & jl

attachments

cc: Doug Johnston, WRP Coordinator, Skeena Region, MELP
Dionys deLeeuw, Senior Habitat Protection Biologist, Skeena Region, MELP
Brian Fuhr, Habitat Protection Section Head, Skeena Region, MELP
Bob Purdon, Skeena-Bulkley Region, Forest Renewal BC
Bert Mast, Skeena-Bulkley Region, Forest Renewal BC
Eero Karanka, Habitat Biologist, Department of Fisheries and Oceans, Smithers, BC
Darlene Morgan, Gitsegukla Band Council

Appendix E. Harkleroad Letter.

DARREN FILLIER
Rec'd Nov. 12/98
D. Fillier

British Columbia Stream Restoration
Project Review Report
1998

USFS Contact: Glenn R. Harkleroad, Fisheries Biologist

BC Contact: Jeff Lough, Fisheries Specialist

This report will be divided into two parts. The first part will be a review of the projects Jeff and I, as well as other Ministry personnel, reviewed while I was visiting in British Columbia the week of September 21 – 25, 1998. The second part of this report will be an overview of potential monitoring activities that could be used to evaluate instream restoration activities.

Photos of sites that were reviewed in the field have been forwarded to Jeff Lough.

Project Reviews

River System: Kitwonga Stream system: Tea Creek

Site review by: Jeff Lough, Darren Fillier, and Glenn Harkleroad

Project Background: This project consisted of 10 to 12 channel spanning weirs created by cement "lock-blocks" below a 1.5 meter culvert. The "lock-blocks" were placed to raise the level of the streambed with the intent of helping pass fish through the upstream highway culvert. The "lock-blocks" had been placed and re-enforced by rock riprap ranging in size from 15 to 60 cm. The "lock-block" weirs were placed approximately 4 to 5 meters apart and were placed perpendicular to the stream channel. The local highway authority had completed this work.

Stream Conditions: The stream passed through a 1.5 meter culvert below highway 16. The structures began immediately below the culvert and continued down stream approximately 30 meter. The stream was bordered on the right by a small access road. When this road was constructed the road cut/base material had been sidecast into the floodprone and bankfull stream channel. Most of the immediate stream side vegetation in the local area had been removed during highway and access road construction. Some vegetative recovery had occurred.

Restoration Design Concerns: While reviewing this site a number of project design concerns surfaced. These concerns included the following:

1) "Lock-block" weirs appeared to be placed too close together. The plunge created by the upstream weirs may have a scouring effect on weirs immediately downstream resulting in design failure.
2) The perpendicular placement of the weirs may result in channel widening, thereby increasing the localized channel width to depth ratio. This may eventually result in bank erosion and "end cutting" around the weir structures.

One other item that was discussed at this site was the alteration of road design to reduce channel diversion potential associated with culvert plugging. As the road is currently designed, if the culvert plugs, water will be diverted out the left side of the channel, down the road and will eventually cross the road approximately 25 meters from the stream channel (Figure 1). This would result in the loss of road fill and the potential to deliver road fill associated sediment to Tea Creek. Altering the road grade in the vicinity of the culvert could mitigate this concern. The creation of a dip above the culvert, would allow water and debris to pass over the road and directly back onto Tea Creek in the event the culvert became plugged. This would minimize potential sediment delivery to Tea Creek as well as reduce road repair cost since only the fill immediately above the culvert would have the potential to be lost. If this fill was made of primarily of large rock with a driving surface cap, fine sediment delivery and repair cost could be kept to a minimum.

River System: Kitwonga **Stream system: un-named tributary #1** (Kitwonga Pres. site #15.)

Site review by: Jeff Lough, Darren Fillier, and Glenn Harkleroad

Project Background: This project site was an approximate 90 to 100 meter length of stream below a highway culvert that fed directly into the Kitwonga River. This area had been identified for large wood placement in order to improve juvenile salmonid rearing habitat. This relatively small project would also serve as a trial run project for a new contractor.

The proposed wood placement locations had been flagged and consisted primarily of placing single logs in more or less and alternating pattern down the length of the channel. The logs would be anchored to streamside trees with cable. Boulders and rootwads currently present within the stream would also be used to help stabilize the placed wood.

Project Comments: While in the field at this site we talked about a number of different design options. The first of these options was to consider experimenting with log anchoring techniques. The option of cable anchoring some logs, while just using channel features and streamside trees to stabilize other logs was discussed. If this is done during the project implementation, this project could serve as an area to compare the effectiveness of both techniques.

We also discussed specific project designs for the lower 20 to 25 meters of the stream channel. Figure 2 displays the project design that was discussed for this location in the field. The idea was to direct the water toward the right side of the channel with the idea of reducing the bank cutting / mass wasting which was occurring along the left bank. There would be some bank cutting expected along the right bank, but it would be expected to be fairly minor and well within the range of natural channel adjustment. The placement of a log complex along the left bank was recommended to further discourage cutting along this bank. The use of log complexes, instead of just single logs, was suggested to more closely mimic natural wood accumulation within the channel.

Recommendations: While at this site, we also discussed some potential monitoring items. These included photo points, topographic surveys of the channel, and sketching desired post-project channel conditions. Since this project would be completed by a relatively inexperienced contractor, I would recommend having him take photo points and having him sketch what he envisions the post-project channel will look like.

River System: Kitwonga **Stream system: un-named tributary #2** (Kitwanga Pres. Site #14)

Site review by: Jeff Lough, Darren Fillier, and Glenn Harkleroad

Project Background: This project was similar to the project proposed for un-named tributary #1 in that it was an approximate 30 to 35 meter length of stream below a highway culvert which fed directly into the Kitwonga River. This area had been identified for large wood placement in order to improve juvenile salmonid rearing habitat. This relatively small project would also serve as a trial run project for a new contractor. However the stream channel in this area was much higher gradient and lacked the channel diversity seen in the first tributary.

This project also involved trying to create a series of step pools for trying to raise the streambed, in order to pass fish through the highway culvert. Channel conditions and available habitat above the culvert were unknown.

Project Comments: The stream channel below the culvert was relatively steep and appeared to provide little fish habitat. Placing wood in this channel would be expected to have low chance of success for meeting the goal of increasing fish habitat. This is because the natural condition of this channel does not lend itself to providing good spawning or rearing habitat.

Passage at the culvert should be delayed until fish habitat values above the culvert are determined. Without this information, it is possible that time and money could be spent providing fish access to an area with very little habitat value.

Recommendations: I would recommend determining if there are other higher priority areas where work could be done. Initial field review of this project would suggest that it would be low priority.

River System: Kispiox **Stream system: un-named tributary #1** (Dale c/c).

Site review by: Jeff Lough, Darren Fillier, and Glenn Harkleroad

Project Background: This project consisted of two rows of "lock blocks" which were placed in a small tributary of the Kispiox River with the intent of raising the streambed level below two culverts. This was done in order to help facilitate fish passage through the culverts. We were reviewing this project because the design used was not authorized by Ministry fisheries personnel and was going to be changed.

The "lock block" weirs were placed approximately 6 to 7 meters apart and were arranged perpendicular to the stream flow. There were concerns that this design would increase the stream channel width to depth ratio and result in end cutting around the weirs. Excessive fine sediment deposition had already begun above the upper weir. This was resulting in the filling of the jump pool necessary for fish passage through the culverts. There was also a concern that the weirs were too placed close together and that the scour created by the upper weir would undermine the lower one.

While reviewing the project we also discovered that the inlets of both culverts were blocked by a log that had backed up sediment. making fish passage difficult during most flows..