

# **Rebman Creek**

## **Evaluation of In-Stream Rehabilitation Structures**

### **Draft Report**

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## 1.0 INTRODUCTION

The Ministry of Environment, Lands and Parks (MELP), Ministry of Forests (MOF), and Weldwood of Canada Ltd., Quesnel Division (Weldwood), under the BC Watershed Restoration Program (WRP), selected the Willow River Watershed for rehabilitation of fish habitat impaired by logging and related activities. LGL (Ferguson and Bocking, 1998) applied a Level 1 Fish Habitat Assessment Procedure (FHAP) to selected reaches in the Willow River watershed in 1997. A sub-watershed, that of tributary Rebman Creek, was identified as having been heavily impacted and of high priority for restoration. In 1999, LGL and Northwest Hydraulic Consultants (Gaboury *et al.*, 1999) followed up with a Level 2 FHAP of Rebman Creek.

Restoration efforts were carried out in Rebman Creek on two occasions (LGL and Erosion Control, 1999):

- in 1998, riffles were constructed along Reach 4; and,
- in 1999, at a total of 19 sites in Reach 2 and Reach 4, riffle construction continued, pools were excavated upstream of the riffles, and LWD structures built to provide cover and scour at the excavated pools.

Under direction from MELP, Weldwood requested G3 Consulting Ltd. (G3) undertake a Site-Based Evaluation of 19 structures built in 1999, following the methodology developed by MELP (Parker, 2000). Results of this audit are reported below.

## 2.0 STUDY AREA & ACCESS

Rebman Creek is a tributary of the Willow River and its watershed has a total area of approximately 21 km<sup>2</sup> (Appendix 1, Figure 1). Rainbow trout (*Oncorhynchus mykiss*) is a dominant fish species in Rebman Creek and the target of restoration works.

The 19 restored sites along Reaches 2 and 4 were accessed by foot from the partially deactivated 900A road that parallels the north (right) bank of Rebman Creek. The access point for Sites 1 to 14 (Reach 2) is situated at approximately UTM 10.55452.5914833, and approximately UTM 10.568300.5914098 for sites 15 to 19 (Reach 4) (Appendix 1, Figure 2).

## 3.0 RESULTS

G3 visited each site during bankfull flow, October 23 and 24, 2000. The evaluation form used for these assessments is provided in Appendix 2.

### 3.1 Riffles

Riffles investigated appeared functional in high flow, as each was stable and passable by adult fish. Bank erosion was not evident. Only the riffle downstream of Site 13 was not well keyed into the right bank and a portion of flow went around the top of the riffle. It is recommended that this site be further monitored and boulders be added should erosion continue.

No definitive evaluation of functionality under low flow conditions could be made. Some riffles may be too wide and not adequately V-shaped to ensure sufficient water under low flow conditions.

### 3.2 LWD structures

LWD structures investigated appeared stable and firmly anchored. As such, detailed graphic comparisons of such parameters as percent of structures "removed", "shifted", and "in-place" to such attributes as "stream order" and "structure location" were not deemed necessary.

Most structures appeared to be functioning as intended (i.e. formation of primary pools [PP] and provision of cover [C]; LGL and Erosion Control, 1999). Residual pools varied from relatively deep (~0.8 m) to shallow (~0.15 m), and in many cases pools could not be assessed as being primary pools according to standard Fish Habitat Assessment Procedures (Johnston and Slaney, 1996).

At some sites only an estimate of the number of ballast boulders was possible given high water that increased the safety hazard, high turbidity (low water visibility), and presence of foam.

## 4.0 RECOMMENDATIONS

This audit was conducted during high flows, thereby limiting the ability to evaluate functionality of some structures. It is recommended that similar audits be performed under low flow conditions following at least one high flow event to enable riffle performance to be better assessed and residual pool depths to be more accurately measured.

Rehabilitation sites were well marked and documented with photographs. Clearly labelled flagging tape attached to branches indicated vantage points of photos. Unfortunately, UTM coordinates of sites were not provided in previous reports. As coordinates would facilitate later monitoring after markings have deteriorated, it is suggested that coordinates be recorded for future such projects.

This audit provided an opportunity to field-test the new audit methodology by Parker (2000), and some modifications may be warranted. In particular, the Assessment Form provided (Appendix 2) was inconsistent with the procedural text and it is therefore recommended that forms and text be adjusted accordingly. It is also recommended that additional information be identified as necessary for collection (as outlined below):

1. Column "Structure Location": stream bank (i.e., left or right bank) should be noted with which structures were associated to facilitate future site identification;
2. Column "Keyed into Bank (y or n)": as some of the LWD may be keyed into the bank in multi-log structures and some may not, it is recommended that the number of keyed-in LWD pieces per structure be recorded. In this audit a "y" indicates that at least one piece of LWD was keyed into the bank;
3. Column "# LWD (<2m & 15 cm)": the heading should read "# LWD >2 m long & >15 cm diameter" (Johnston and Slaney, 1996);
4. Column "Associated Scour": the form provides a choice of codes (H, M, L) to describe the extent of the scour, whereas text methodology refers to type of scour pool (Primary, Tertiary, or No). In this audit, both indicators were noted; and
5. the data form should request assessment date, auditor initials, UTM coordinates, and photo documentation records.

## 5.0 LITERATURE SOURCES

- Johnston, N.T., and P.A. Slaney. 1996. Fish Habitat Assessment Procedures. Watershed Restoration Technical Circular No. 8. MELP and MOF. Victoria; 97 pp.
- Ferguson, J., and R. Bocking. 1998. Willow River Level 1 fish habitat assessment and rehabilitation opportunities. Prepared for Weldwood of Canada Ltd., Quesnel. LGL Limited Environmental Research Associates, Sidney, BC.
- Gaboury, M., B. Bocking, and K. Rood. 1999. Willow River Watershed Restoration Program. Fish habitat prescriptions for Rebman Creek. Prepared for Weldwood of Canada Ltd., Quesnel. LGL Limited Environmental Research Associates, Sidney, BC and Northwest Hydraulic Consultants Ltd., North Vancouver, BC. 13 pp. + app.
- LGL Limited Environmental Research Associates and Erosion Control Inc. 1999. Willow River Watershed Restoration Program. Stream rehabilitation 1999, as-built report for Rebman Creek. Prepared for MELP, Williams Lake. Sidney, BC (LGL) and Quesnel, BC (ECI); 3 pp. + app.
- Parker, M.A. 2000. Cariboo Region in stream structures evaluation, durability and habitat. MELP. Williams Lake; 8 pp. + app.

# **APPENDICES**

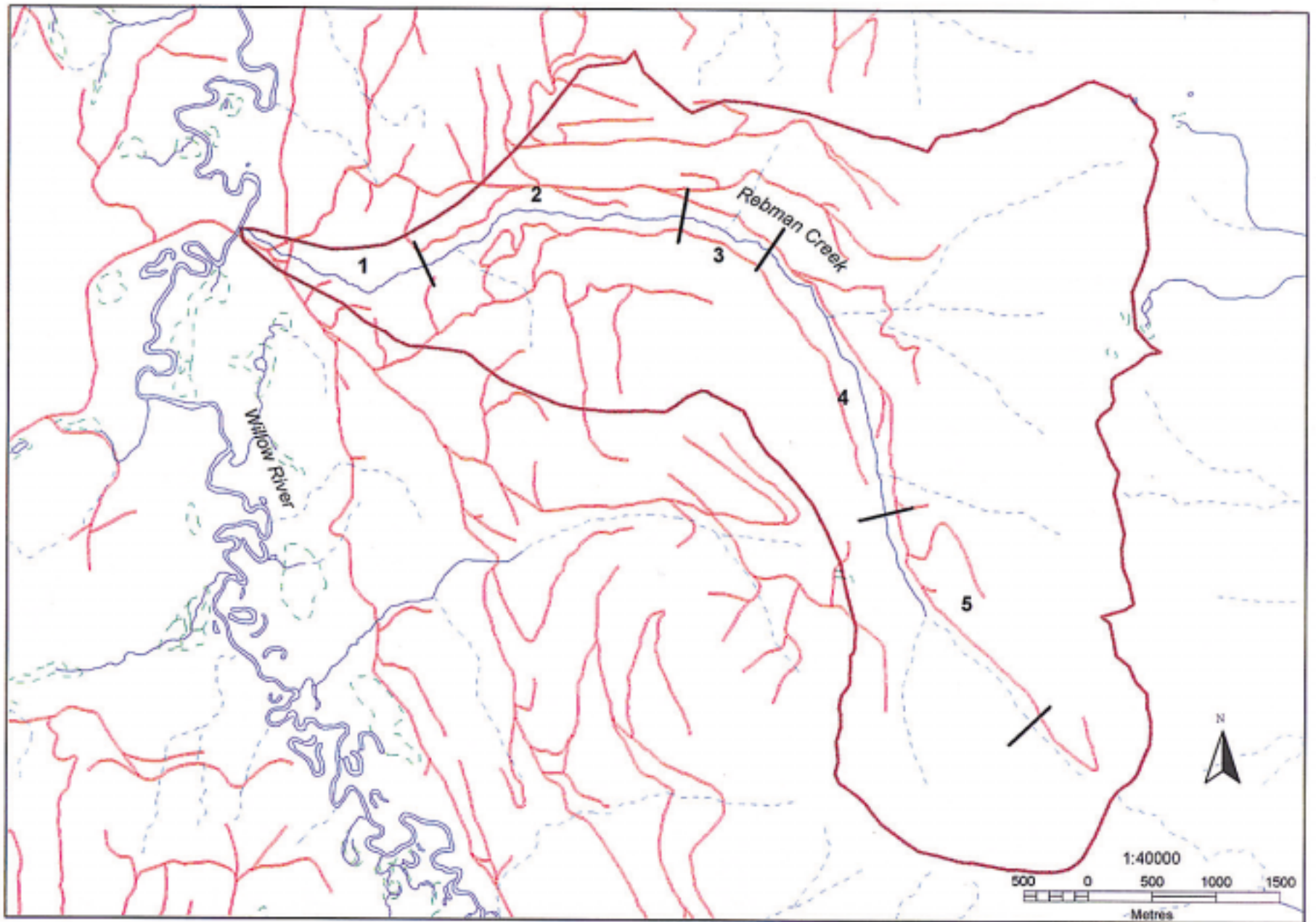
Appendix 1 – Figures

Appendix 2 – Assessment Form

Appendix 3 – Photo Plates

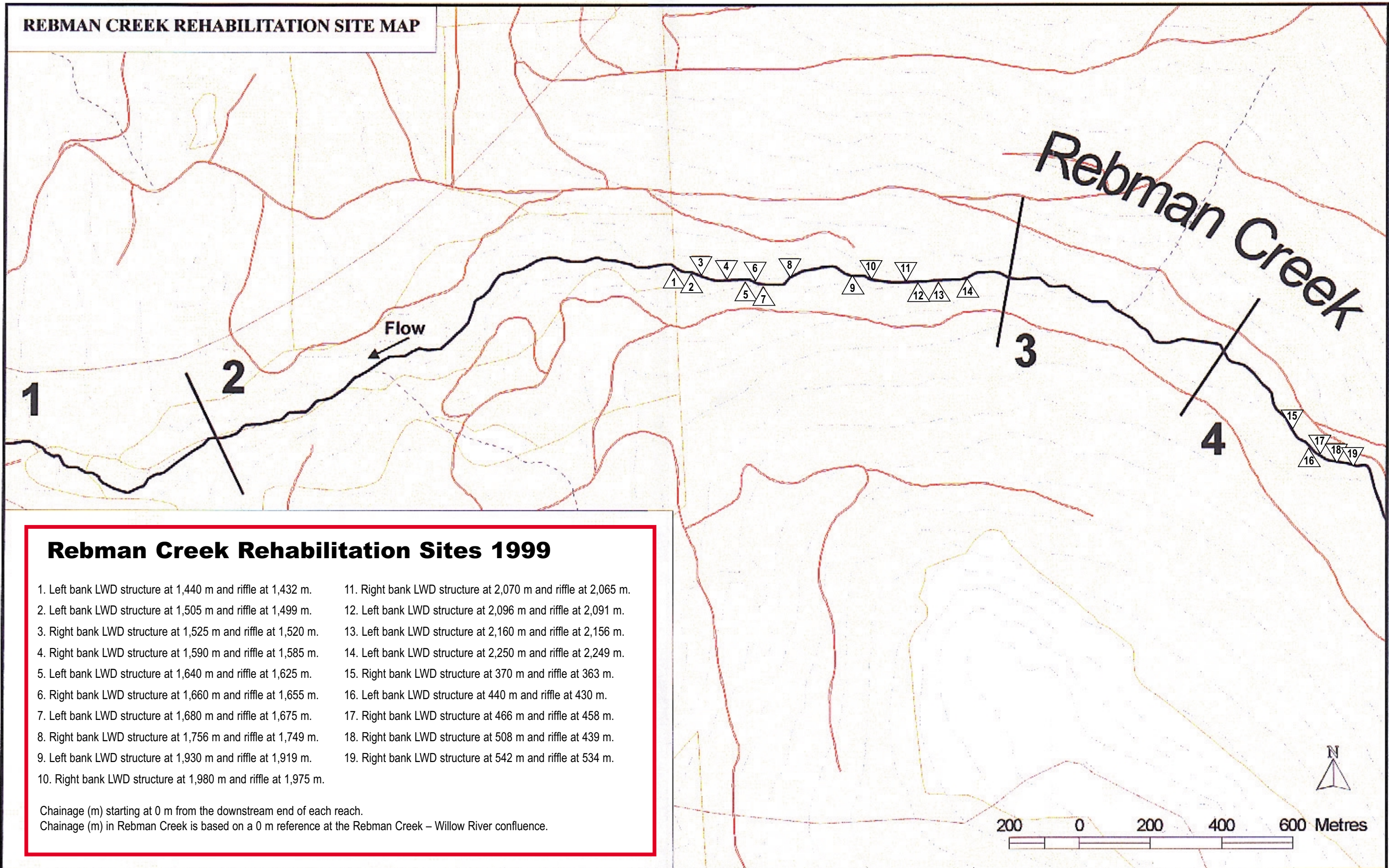
# **Appendix 1**

## **Figures**



**Figure 1:** Level 2 FHAP Reaches in Rebman Creek (Gaboury *et al.*, 1999).





**Figure 2: Rebman Creek Rehabilitation Sites, 1999 (LGL and Erosion Control, 1999).**

# **Appendix 2**

## **Assessment Form**

**TABLE 1**  
**Rebman Creek – Site Based Evaluation**

System	Stream Order	Site Identifier	Months Since Installation	Structure Location	Structure Size	Structure Type	Ballasted/Anchored	# of boulders/Ballast	Keyed into bank	# LWD (>2m & 15 cm)	Total LWD	Stability	Intended Function	Intended Functionality	Current Function	Associated Erosion	Associated Scour	Habitat Unit	Residual Pool (m)	Notes
Rebman Creek	3	1	13	E (LB)	H	AWD	Y	~ 2	Y	3	3	I	PP/C	S	C	L	P (L)	P	0.3	Shallow pool (does not qualify as primary habitat unit) UTM 10.566553.5914594
	3	2	13	E (LB)	H	MWD	Y	6	Y	4	5	I	PP/C	S	IN	L	P (H)	P	0.5	2 existing LWD, 2 LWD added
	3	3	13	E (RB)	H	AWD	Y	4	Y	2	2	I	PP/C	I	BS, C, CN	M	P (L)	P	0.15	RB eroding between logs, sedimentation inside AWD
	3	4	13	E (RB)	H	AWD	Y	~ 4	Y	2	3	I	PP/C	S	IN	L	P (H)	P	0.6	LWD submerged, one sill log d/s of structure may be newly deposited (not in as-built photo)
	3	5	13	E (LB)	H	MWD	Y	10	Y	4	4	I	PP/C	S	C	L	P (L)	P	0.3	Though pool shallow, structure sorts gravel well
	3	6	13	E (RB)	H	AWD	Y	4	Y	2	2	I	PP/C	S	IN	M	P (H)	P	0.8	Erosion between logs on RB
	3	7	13	E (LB)	H	AWD	Y	4	Y	3	3	I	PP/C	S	IN	L	P (H)	P	0.6	Cable on u/s log loose and log not held by ballast rock; structure may have shifted
	3	8	13	E (RB)	H	MWD	Y	7	Y	4	4	I	PP/C	S	IN	L	P (H)	P	0.5	UTM 10.56800.5914641
	3	9	13	E (LB)	H	AWD	Y	4	Y	2	2	I	PP/C	S	IN	L	P (M)	P	0.4	UTM 10.567009.5914557
	3	10	13	E (RB)	H	MWD	Y	10	Y	5	6	I	PP/C	S	C	L	P (L)	P	0.3	shallow pool
	3	11	13	E (RB)	H	AWD	Y	~ 3	Y	3	3	I	PP/C	S	IN	L	P (H)	P	0.7	
	3	12	13	E (LB)	H	AWD	Y	~ 2	Y	2	4	I	PP/C	S	IN	L	P (H)	P	0.9	
	3	13	13	E (LB)	H	AWD	Y	4	Y	3	3	I	PP/C	S	IN	L	P (H)	P	0.6	some flow around top of riffle (RB): riffle not well keyed in to the RB
	3	14	13	E (LB)	H	MWD	Y	12	Y	5	5	I	PP/C	S	C	L	P (L)	P	0.3	Log jam d/s of riffle backwatering riffle, UTM 10.567343.5914505
	3	15	13	E (RB)	H	AWD	Y	4	Y	2	2	I	PP/C	S	C	L	P (L)	P	0.3	shallow pool, UTM 10.568301.5914034
	3	16	13	E (LB)	H	MDW	Y	12	Y	6	6	I	PP/C	S	IN	L	P (H)	P	0.5	
	3	17	13	E (RB)	H	AWD	Y	~ 3	Y	3	3	I	PP/C	S	IN	L	P (H)	P	0.7	
	3	18	13	E (RB)	H	AWD	Y	4	Y	3	3	I	PP/C	S	IN	L	P (H)	P	0.6	
	3	19	13	E (RB)	H	MWD	Y	~ 8	Y	5	5	I	PP/C	S	IN	L	P (H)	P	0.6	structure totally submerged, BO hard to see!, UTM 10.568408.5913996

# **Appendix 3**

## **Photo Plates**



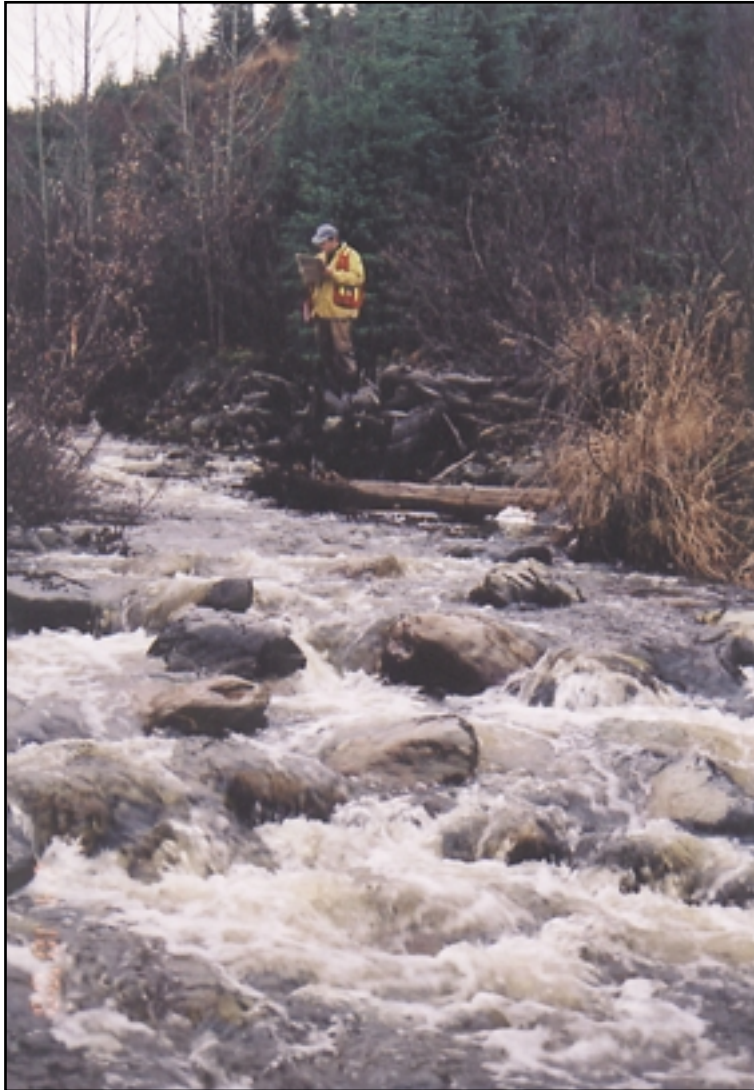
**Photo 1:** Rebman Creek Site 1: left bank LWD structure, Reach 2 at ~1,440 m.



**Photo 2:** Rebman Creek Site 1: view upstream toward constructed riffle, Reach 2 at ~1,432 m.



**Photo 3:** Rebman Creek Site 2: left bank LWD structure, Reach 2 at ~1,505 m.



**Photo 4:** Rebman Creek Site 2: view upstream toward constructed riffle, Reach 2 at ~1,499 m.



**Photo 5:** Rebman Creek Site 3: view upstream toward LWD structure, Reach 2 at ~1,525 m.



**Photo 6:** Rebman Creek Site 3: view upstream toward constructed riffle, Reach 2 at ~1,520 m.





**Photo 7:** Rebman Creek Site 4: view toward left bank LWD structure, Reach 2 at ~1,590 m.



**Photo 8:** Rebman Creek Site 4: view upstream toward constructed riffle, Reach 2 at 1590 m.



**Photo 9:** Rebman Creek Site 5: view downstream toward LWD structure, Reach 2 at ~1,640 m.



**Photo 10:** Rebman Creek Site 5: view upstream toward constructed riffle, Reach 2 at ~1,625 m.



**Photo 11:** Rebman Creek Site 6: view upstream toward LWD structure, Reach 2 at ~1,660 m.



**Photo 12:** Rebman Creek Site 6: view upstream toward constructed riffle and LWD structure, Reach 2 at ~1,655 m.



**Photo 13:** Rebman Creek Site 7: left bank LWD structure, Reach 2 at ~1,680 m.



**Photo 14:** Rebman Creek Site 7: view upstream toward constructed riffle, Reach 2 at ~1,675 m.



**Photo 15:** Rebman Creek Site 8: view upstream toward LWD structure, Reach 2 at ~1,756 m.



**Photo 16:** Rebman Creek Site 8: view upstream toward constructed riffle, Reach 2 at ~1,749 m.



**Photo 17:** Rebman Creek Site 9: view upstream toward LWD structure, Reach 2 at ~1,930 m.



**Photo 18:** Rebman Creek Site 9: view upstream toward constructed riffle, Reach 2 at ~1,920 m.



**Photo 19:** Rebman Creek Site 10: view downstream toward LWD structure, Reach 2 at ~1,980 m.



**Photo 20:** Rebman Creek Site 10: view upstream toward constructed riffle, Reach 2 at ~1,975 m.





**Photo 21:** Rebman Creek Site 11: view upstream toward LWD structure, Reach 2 at ~2,070 m.



**Photo 22:** Rebman Creek Site 11: view upstream toward constructed riffle, Reach 2 at ~2,065 m.



**Photo 23:** Rebman Creek Site 12: left bank LWD structure, Reach 2 at ~2,096 m.



**Photo 24:** Rebman Creek Site 12: view upstream toward constructed riffle, Reach 2 at ~2,091 m.



**Photo 25:** Rebman Creek Site 13: left bank LWD structure, Reach 2 at ~2,160 m.



**Photo 26:** Rebman Creek Site 13: view upstream toward constructed riffle, Reach 2 at ~2,156 m.



**Photo 27:** Rebman Creek Site 14: view upstream toward LWD structure, Reach 2 at ~2,250 m.



**Photo 28:** Rebman Creek Site 15: view downstream toward LWD structure, Reach 4 at ~370 m.



**Photo 29:** Rebman Creek Site 16 (downstream part): view upstream toward constructed riffle, Reach 4 at ~430 m.



**Photo 30:** Rebman Creek Site 16 (downstream part): view upstream toward LWD structure, Reach 4 at ~440 m.



**Photo 31:** Rebman Creek Site 16 (upstream part): view upstream toward LWD structure, Reach 4 at ~445 m.



**Photo 32:** Rebman Creek Site 17: view upstream toward LWD structure, Reach 4 at ~466 m.



**Photo 33:** Rebman Creek Site 18: view upstream toward LWD structure, Reach 4 at ~508 m.



**Photo 34:** Rebman Creek Site 19: view upstream toward LWD structure, Reach 4 at ~542 m.