TLC The Land Conservancy

Horsefly River Riparian Restoration Project

Evaluation of restoration activities on the Horsefly River Riparian Conservation Area

Reports on three major projects

TLC Northern Region

Horsefly River Conservation Area

Submitted by

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EXECUTIVE SUMMARY

Wild salmon stocks are at risk throughout the Fraser River system. Habitat degradation due to past land use practices (ranching, agriculture, forestry, urban development, mining, road and rail construction) have seriously degraded, and in some instances destroyed spawning and rearing habitat. The Horsefly River, which is one of the most important and prolific sockeye salmon rivers in BC, is no exception. Habitat degradation from ranching (both in terms of haying to the rivers edge and having cattle impact riparian areas) is common throughout the Horsefly Valley. Due to these concerns The Land Conservancy of BC (TLC) has, over the last 8 years, purchased over 400 ha of flood plain habitat within the Horsefly River Valley. A large scale restoration project began immediately after the initial purchase in 1999 to rectify some of the above mentioned land use issues.

This project was designed to examine the efficacy of three major restoration efforts that were initiated between 1999 and 2007. This included the breach of a dyke that separated an oxbow lake from the main stem of the Horsefly River, a series of debris catchers that were installed along a 500 m length of the Horsefly, and the construction of a 550 m rearing channel.

DFO engineers examined the dyke breach that was completed in 2007. It was their opinion that the dyke was not at risk of further erosion and recommended further riparian planting at the toes of the dyke to further increase stability.

Each debris catcher was examined and a report was submitted to DFO. Upon review of this report it was recommended that each debris catcher be examined in situ and removed if necessary. Guidelines for the removal of the structures was provided. With assistance of DFO field staff we were able to systematically remove problematic portions of each debris catcher with minimal disturbance to both the riverbank and foreshore areas. Logs removed from the river channel were placed in areas not subject to flooding and, as a result, will function as coarse woody debris. In on instance we ‘planted’ a large log to function as bird habitat.

Fish were sampled in the rearing channel using unbaited minnow traps. Results of this sampling indicated that the channel provides habitat for a diverse fish community. It was also noted that juvenile Coho salmon were concentrated at the terminal end of the rearing channel, resulting in a potential trap for this species. Temperatures recorded in the rearing channel, and areas of low flow may represent barriers to the movement of these juveniles. Further work on this area of the Conservation Area is merited.

TABLE OF CONTENTS

Table of Figures

INTRODUCTION

Due to concerns regarding the health of sockeye salmon stocks in BC in general, and the Horsefly River in particular, The Land Conservancy of BC (TLC), along with a number of partners purchased 5 district lots (DL 2566, 2567, 9678, 9828, and 9176) of the Black Creek Ranch in 1999 for the purposes of salmon habitat enhancement. This initial area totalled nearly 330 ha along the Horsefly River. Between 2004 and 2007 TLC acquired an additional 75 ha of similar habitat (DL 9178 and Lot 1, Block B, DL 8979; Figure 1) with funds from the Donner Canada Foundation, the Ministry of Transportation and the Federal Department of Environment. Together, these holdings represent some of the best sockeye spawning habitat in the entire Horsefly River system. In addition, they also contain important spawning and rearing habitat for Coho salmon.

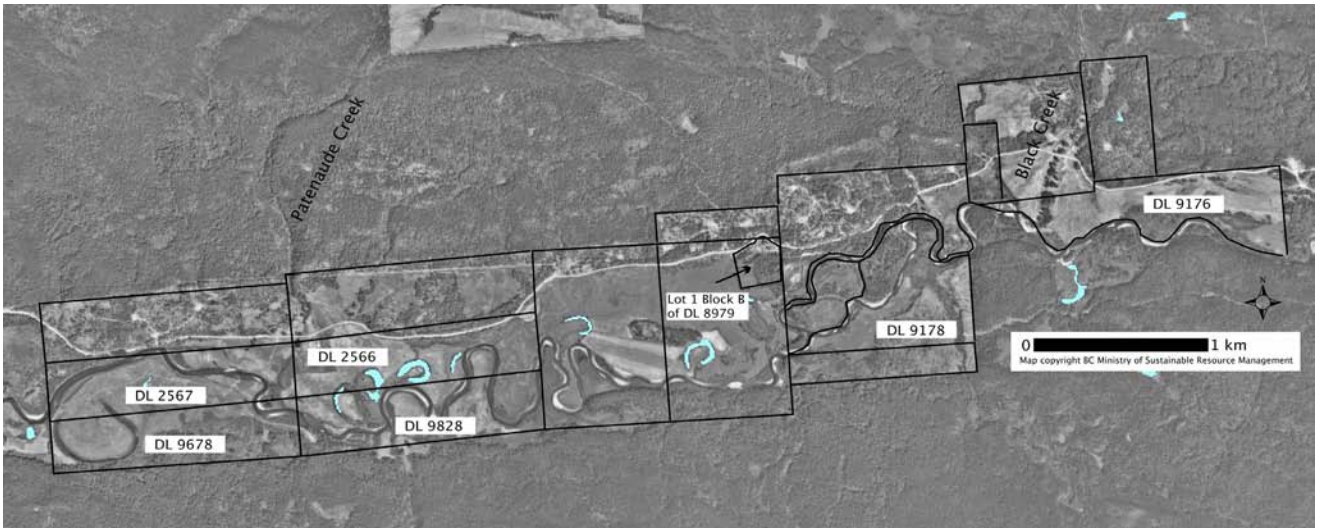

Figure 1. The District Lots that make up the HRRCA

From 1999 to 2003, a large scale restoration effort took place on the initial 330 ha acquisition. This involved a series of activities including: riparian planting, excavation of a 550 m rearing channel, machine pullbacks along sections of heavily eroded sections of riverbank, the installation of debris catchers, and the installation of wildlife trees. From 2004 to the present, restoration has been scaled back to include only the planting of riparian stock and the experimental use of horses and shade cloth to control reed canary grass, an invasive species. One major project that was conducted in 2007 was the removal of a portion of a containment dyke that separated an oxbow lake from the main stem of the Horsefly River.

OBJECTIVES

This project had three objectives:

1. To develop a comprehensive evaluation and monitoring program for restoration efforts in the Horsefly River Riparian Conservation Area;
2. To determine if the three major restoration construction projects are functioning as intended;
3. To refine a GIS mapping project that was started in 2007.

This report relates to objective 2.

RESULTS OF EFFORTS

The locations of the three projects covered in this report are located in Figure 2.

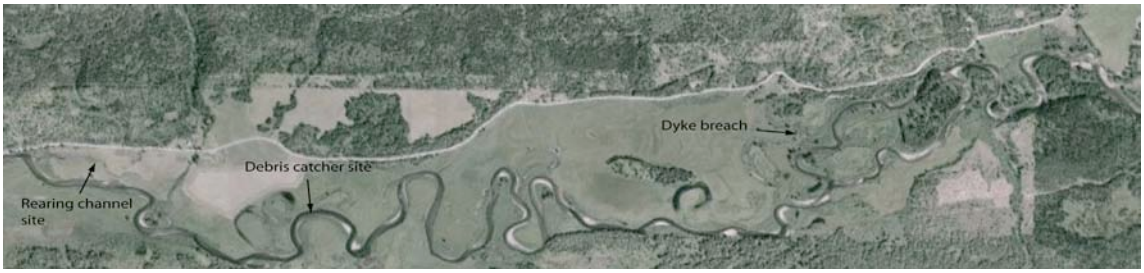

Figure 2. The Location of three projects in the HRRCA

Dyke Breach

A section of a containment dyke was removed in the fall of 2007. This involved the movement of a total of 350 m^3 of material: 200 m^3 of dyke material and 150 m^3 of road and river bed material. All of the excavated material was distributed along the existing road bed. Toes of the remaining dyke were sloped at approximately a 3:1 slope. Toes of the slope were re-vegetated with rescued plant material (alder, willow, dogwood, birch, and cottonwood seedlings). The toes of the dyke and the road bed were also seeded with a riparian grass mixture obtained from Premier Pacific Seeds.

On June 16, 2009 I conducted a site visit with DFO field staff, including Patricia House, P. Eng., Sr. Project Engineer, Patrick Cochrane, Sr. Engineering Technician, Kamloops, Judy Hillaby, R.P. Bio., Restoration Biologist, Williams Lake to examine the dyke breach on DL 8979, There was a consensus on behalf of the field team that :

1. the amount of erosion noted at the toes of the dike was such that it was of no cause of concern,

2. the parent material of the dyke and the road bed (coarse gravel in both cases) is such that it was unlikely that erosion would be problematic in the future,

3. the flows observed at the time, although not peak flows, did not raise concerns with respect to the integrity of the toes of the dyke. When we discussed the issue of peak flows, the engineers on the team suggested that there was little cause for concern because of the two points above, and because that the velocity of the flows that would likely be encountered at peak flows would not likely to be high enough to be problematic (Figures 3-6).

The field team suggested that TLC continue monitoring of the dyke and to further efforts to re-vegetate the toe areas.

Figure 3 North toe of dyke breach

Figure 4. South toe of dyke breach

Figure 5. Looking south towards the Horsefly River

Figure 6. Looking north into oxbow

Rearing channel

On July 22, 2009 Judy Hillaby, Richard Case, Restoration Ecologist, and I set minnow traps at 5 locations along the rearing channel (Figure 7). Traps were retrieved by Judy Hillaby on the following morning. Judy Hillaby, a TLC volunteer and I conducted a follow-up visit on August 18th, 2009. Results from this limited sample revealed a number of interesting issues and are presented in Appendix 1.

First, there is a high fish species richness in the rearing channel. This includes 3 species of salmonids (Coho, Chinook, and rainbow trout fry) as well as 3 species of adult "coarse" fish (Longnose dace, Northern Pikeminnows, and Redside shiners), and several unidentified juvenile suckers. Second, there was a high abundance of Coho fry (175 fish) at the very upstream portion of the rearing channel. These fish appeared to be trapped in a small (~1 m^3) pool that is located where the run off from Patenaude Creek enters the rearing channel (Figure 8). The fry's forward movement is blocked at this point by a small (50 cm) headcut or waterfall.

The creation of this small head cut is the result of a series of events. Prior to TLC taking ownership of this section the Horsefly River flood plain, the area was cleared for the production of hay. Part of activity associated with the clearing of the flood plain was the straightening of Patenaude Creek. It can be seen from Figures 7 and 9 that the channel of this creek is unusually straight. When one walks along this section of Patenaude Creek it is quite apparent that the creek bed has been physically straightened. Since our taking possession of the property (and likely some time before this) the creek has started to

spill over its artificially created banks and is flowing over the flood plain on both sides of the creek. On the west side of Patenaude Creek the overflow has connected up with the end of the rearing channel that was constructed in 1999. This connection has created the head cut which now represents a barrier to the upstream movement of juvenile Coho that find themselves in the rearing channel (Figure 9).

Figure 7. Location of fish traps and areas of low flow in rearing channel

Figure 8. Small pool where Coho fry were caught

At the time that we first sampled the rearing channel, it was unclear to us as to whether the Coho that we sampled were in fact trapped at the head cut. Upon return on August 18, 2009 only 8 of the 175 fry were recaptured and then moved to Patenaude Creek. It uncertain whether these fish perished (e.g., were captured by predators), or whether they moved out of the system. Recent research on the movement of juvenile Coho salmon have illustrated that they do in fact move significant distances over the course of the season. However, these fry would have had to travel through areas of very low flow (Figure 7), through warm temperatures, and through a gauntlet of predators to reach the main stem of the Horsefly. Given that the Coho fry appeared to avoid those sections of the channel with water

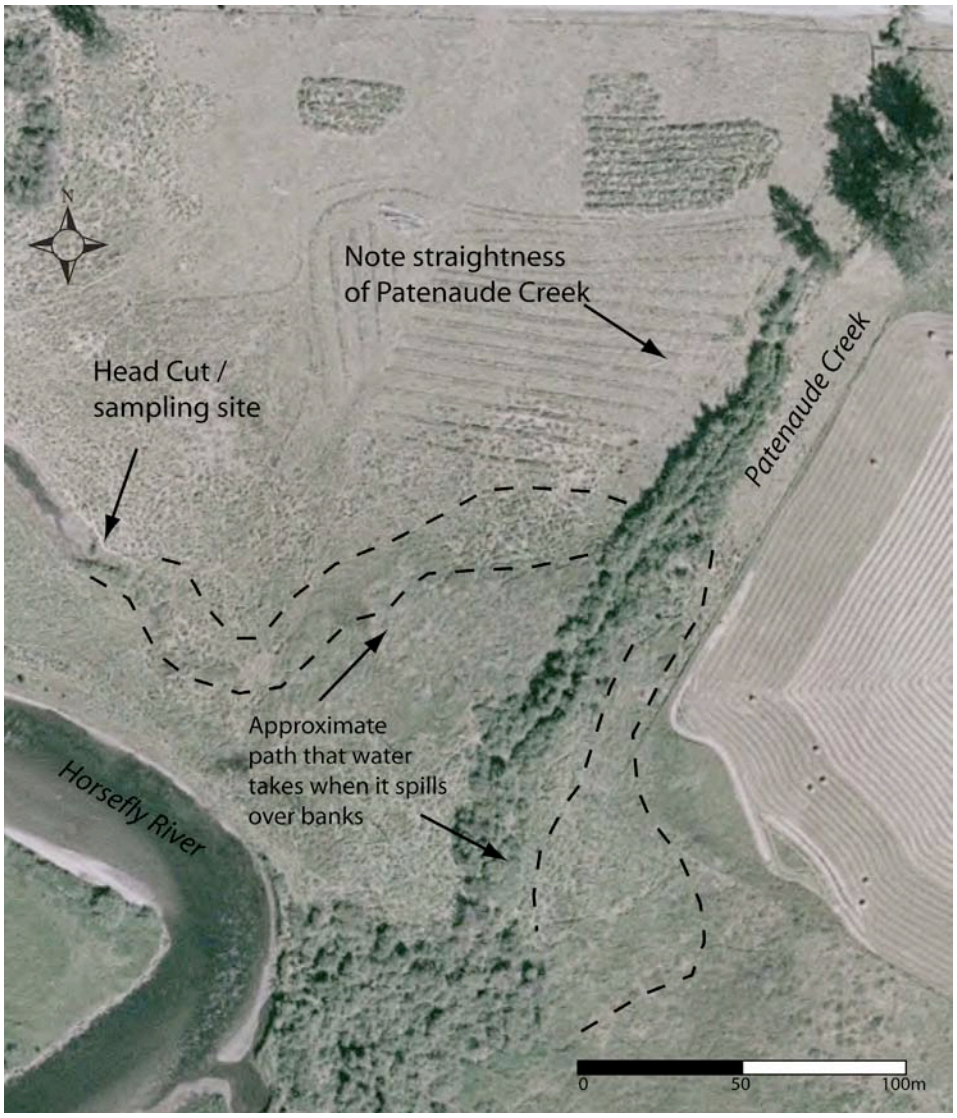

Figure 9. Dynamics of Patenaude Creek

temperatures over 18°C (Appendix 1), it is assumed that they did in fact perish at the head cut area. From this preliminary study, it appears as though the rearing channel may be functioning as a fish trap, whereby juvenile Coho are moving from the main stem of the Horsefly, up the rearing channel and having their passage blocked at the head cut. If this is in fact the case, it is cause for concern. Coho salmon occur in very low numbers throughout the Fraser River system. Spawning returns in the Horsefly River system only number in the thousands, Consequently, loss of fry in these numbers in the rearing channel on a repeated basis could represent a biologically significant loss to the Horsefly River Coho stocks.

Based on these findings it will be important to further this monitoring situation in order to ascertain: a) do Coho fry remain trapped in the upper reaches of this structure, b) how is the rearing channel used by other species in different times of the year, and how might this affect the survival of Coho fry and, c) if this is a trap for Coho, what could/should be done to rectify this situation? This could involve some of the following efforts: trapping and moving fish on an annual basis, excavating shallow spots to facilitate movement out of the rearing channel, re-directing Patenaude Creek into the rearing channel. Some of these solutions are potentially very invasive and expensive propositions (not to mention controversial) that will require further study and broad consultation with the Department of Fisheries and Oceans, the Provincial Ministry of the Environment (original architects of the rearing channel), and fisheries

researchers from UNBC.

It should also be noted that the restoration work in this area of the Conservation Area has been extremely effective. Willows that were planted along the rearing channel have become well established along most of the rearing channel (Figures 10 and 11).

Figure 10 Rearing channel under construction in 1999

Figure 11 A section of the rearing channel in 2009

Debris Catchers

Throughout the HRRCA, areas were cleared of native vegetation for the production of hay. This has resulted in numerous areas where river the banks have become steep and are and slowly eroding into the main stem of the Horsefly River. As part of early restoration efforts, the Ministry of Environment isolated one 500 m meander of the river where banks where near vertical and sloughing was evident. Restoration efforts here involved the pulling back of the banks and the construction of 28 log structures that were designed to capture floating material to create habitat for fish and to push the flow of the Horsefly away from the eroding bank. This building project was accompanied by an aggressive planting project that saw thousands of willow stakes planted in new newly re-sloped banks.

As early as 2001 individual debris catchers were starting to fail. A report conducted by North West Hydralics at the time recommended that the structures as built were inappropriate for this river and that their presence would increase rather than decrease erosion. At the time, they recommended that the structures be dismantled and re-built in a completely different configuration. Nothing was done with these structures and as a result they continued to unravel.

Judy Hillaby, DFO restoration biologist, Richard Case, restoration ecologist and I visited the debris catcher site on July 23, 2009. During this visit, we collected data on the status of each debris catcher in terms of the location of each of the pins that hold the catcher in place, the logs used to capture and hold debris, and the nature and stability of the bank in the vicinity of each structure. The results of this reconnaissance work indicated that:

a) most of the debris catchers had failed,
b) the majority of the bank had reverted back to being vertical,
c) erosion was continuing around the remaining pins of the debris structures,
d) there was one very large raft of large logs cabled together
e) present rafts of logs cabled together represented a potential threat to downstream property
f) the creation of further rafts of logs cabled together was probable due to continued erosion around the remaining debris catchers.
g) there was extensive growth of willows along the top of the bank

These findings closely paralleled the predictions outlined by North West Hydraulics in 2001.

The above findings were summarized and presented in a document that was then distributed to the DFO engineering team and to the Ministry of Environment (Appendix 2). Upon review of this document it was decided that it would be appropriate to remove some of the debris catchers, and parts thereof, that pose current and potential future risks. This would be done using an excavator from the top of the bank as well as a 2-3 person crew on the ground. Each structure was to be assessed and if necessary dismantled with the objective of reducing bank erosion and human and downstream property hazards. The excavator would only be used to remove logs from the river as opposed to digging out existing infrastructure. A site visit was conducted on December 23, 2009 with Judy Hilaby and Patrick Cochrane, Sr. Engineering Technician, Kamloops to assess the feasibility of removing some of the structures during the winter season. At that time Mr. Cochrane decided that any activity on site would have to be delayed until later in the season with the ice and snow had retreated.

With funds from the BC Ministry of Transportation, a crew of 5 met at the debris catcher site on March 6, 2010 to dismantle the debris catchers. This included an excavator operator, a professional chain saw operator, Richard Case, restoration ecologist, Judy Hillaby from DFO and myself. Each debris catcher was examined and all but 3 were dismantled. This involved the removal of any logs from the river that were cabled together and/or were cabled to the foreshore. We left debris in the river that we felt posed no risk to down stream habitat. Logs that were removed from the river were placed on high points of the bank that are not subject to flooding and cables were removed from them. In two areas we actively transported logs to upland areas in the vicinity of the debris catchers. We also “planted” one particularly long log as a snag (Figures 12-16). Because the ground was still frozen and because of the expertise of the excavator operator, minimal disturbance to the river bed and to the foreshore was noted. Permanent monitoring sites will be established to monitor bank movement and stability in areas were debris catchers were both left and removed.

Figure 12 and 13. Removing debris catchers along the main stem of the Horsefly

Figure 14. Transporting of logs to higher ground

Figure 15. Planting of new snag

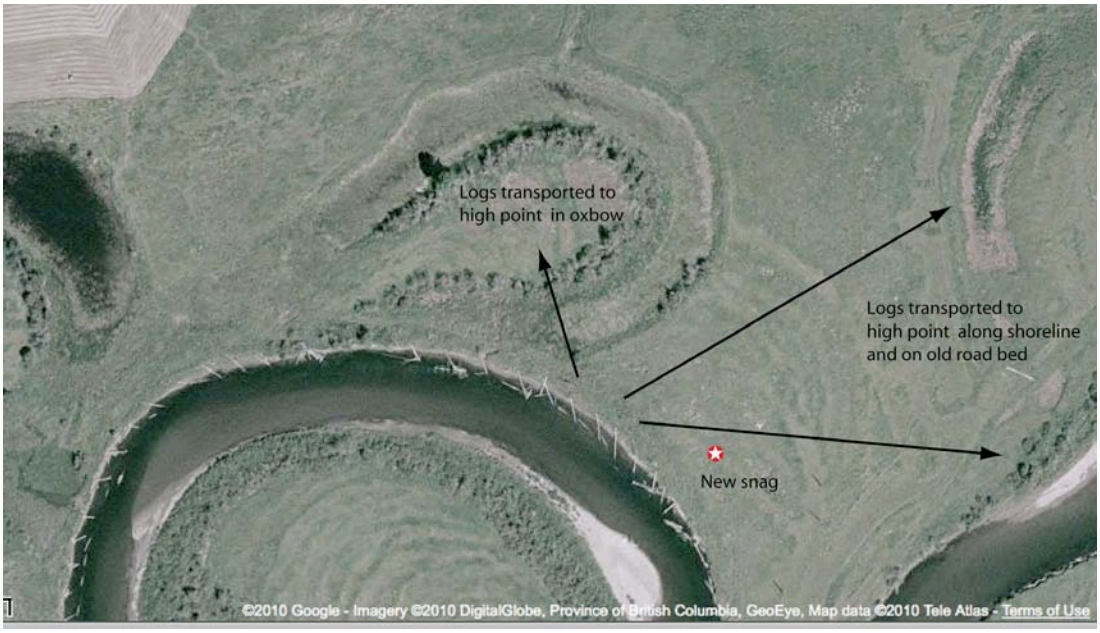

Figure 16. Location of where logs were transported and where snag was planted

CONCLUSIONS AND RECOMMENDATIONS

Results from this season's field work have resulted in a greater understanding of how three major projects are "behaving". We will continue to monitor all three projects into the future. We have plans this spring to plant additional plants at the toes of the dyke where the breach occurred in 2007. We will carefully monitor debris catcher site to determine if the removal of the problematic structures has resulted in any additional changes in the stability of the shore line. We will also re-sample of the fish in the rearing channel, hopefully with the assistance of fisheries researchers in the valley. We will also be consulting further with DFO, MOE and UNBC to determine if further work is required at this site.

Fisheries and Oceans / Pêches et Océans

MEMORANDUM NOTE DE SERVICE

To / À: File

From / De: Judy Hillaby

Security Classification - Classification de sécurité **UNCLASSIFIED**
Our file - Notre référence
Your File - Votre référence
Date **July 29, 2009**

Subject / Object: **HRRCA BACKCHANNEL FISH UTILISATION**

This memo is to report on the recent fish capture exercise that was conducted on this backchannel area a few days ago, by myself, B.Booth and R. Case.

Objective:

To determine midsummer fish utilization in the backchannel.

Method:

Fifteen unbaited minnow traps were placed in 5 locations approximately 100m apart, beginning at the upstream end of the backchannel, at its confluence with Patenaude Creek. The traps were set between 15:30 and 16:30 on July 22nd, and picked up between 10:00 and 11:00 on July 23rd, 2009.

All fish captured were identified to species and life stage, and then released in situ. Given that the weather was clear, hot and sunny throughout the exercise, water depth and temperature were also measured when the traps were retrieved.

Figure 1. HRRCA Backchannel, showing minnow trap sites.

Results:

Table 1. Summary of minnow trap results, July 23, 2009.

Temperature (degrees Celsius)	Location	Species	Number Caught
13.0	1	Coho fry	176
		Chnook fry	15
		Northern whitefish fry	2
		Rainbow trout fingerlings	2
16.5	2	Coho fry	1
17.0	3	Coho fry	1
		Sucker juveniles	6
		Longnose dace adults	3
19.5	4	Sucker juveniles	1
		Northern Pikeminnow adults	6
		Redside shiner adults	1
21.5	5	Northern Pikeminnow adults	2

Discussion:

The salmonids have avoided those sections of the channel with water temperatures over 18^{o}C, and become concentrated in the upper channel at 13^{o}C. The other species exhibit more warm-water tolerance, consistent with what we know of their biology. Overall, the channel is exhibiting considerable biodiversity among its fish populations.

Recommendation:

Continue monitoring the channel to ensure salmon egress when appropriate.

Yours truly,

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Prince George, BC

Summary of field observations at the debris catchers on the Horsefly River Riparian Conservation Area, 2009

The following is a summary of observations of a field trip conducted on July 22, 2009 on the Horsefly River Riparian Conservation Area conducted by Barry Booth of TLC and Judy Hillaby from DFO. The field trip was intended to provide an initial sketch of the condition of the debris catchers installed on TLC lands. This summary is by no means complete. Distance and height measurements are approximate.

Barry Booth
TLC Northern Region Manager

Status of individual debris catchers

1. No functioning pins, five logs cabled together here
2. No functioning pins, deflector embedded in river botton
3. No functioning pins, all debris upstream deposited here
4. No functioning pins, deflector in water
5. No functioning pins, deflector on bank
6. Upslope pin on shore, actively being scoured at base
7. Upslope pin at waters edge, actively being scoured at base
8. Upslope pin at waters edge, actively being scoured at base
9. Upslope pin at waters edge, actively being scoured at base
10. No functioning pins, debris catcher in water
11. Upslope pin 3.5 m from shore, bank vertical here .7m
12. No functioning pins, deflector in water
13. Upslope pin on river's edge, downslope pin in channel
14. Upslope pin 5 m from river's edge, downslope pin 1.5 m from river's edge
15. Upslope pin 7 m from river's edge, downslope pin 3 m from river's edge
16. Upslope pin 4.5 m from river's edge, downslope pin 1.5 m from river's edge
17. Both pins in place, deflector has floated up over top of pins and is on shore
18. Upslope pin 3 m from river's edge, downslope missing, bank vertical here - 2m
19. All material gone from here
20. Upslope pin on river's edge, downslope missing
21. All material gone from here
22. Both pins gone, deflector on shore
23. Both pins gone, deflector in water
24. Upslope pin 1.5 m from shore, downstream pin gone, debris catcher in water
25. Upstream pin on river's edge, downstearm pin gone, debris catcher in water
26. Both pins gone, deflector in water

Aggregation of debris at location 1.

Vertical bank between locations 1 and 2.

Debris at location 3.

Debris at location 3, from downstream.

Debris at location 3, note logs cabled together at downstream end of debris pile.

One of few places were debris catchers are still functioning, note slope of bank and regeneration of willows - at location 14-16.