Toboggan Creek Groundwater Channel Monitoring Project
January – March 2001

By

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for

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1.0 Introduction

Toboggan Creek is a tributary of the Bulkley River whose headwaters originate at the Hudson Bay glacier. (Refer to Map 1). Toboggan Creek has high fish value and is the indicator stream for Upper Skeena River coho stocks. Due to its importance as an indicator stream, Toboggan Creek has been studied for coho hatchery smolt versus wild smolt production and survival levels. The creek has been a focus area for a water quality monitoring study, adult steelhead and coho assessment programs, a riparian assessment and has been a candidate for a "fish friendly" cattle crossing project. The confluence of Toboggan Creek with the Bulkley River is a popular recreational fishery for coho and in past years has been the only location for a catch and keep coho fishery on the Bulkley River.

There is a small hatchery located on Toboggan Creek approximately 0.5 kms downstream of the Evelyn Station Road crossing. This hatchery is part of the DFO Community Economic Development Program which was initiated in the mid 1980's. The hatchery produces a maximum of 70,000 coho smolts and 80,000 coho fry annually as well as a maximum of 85,000 chinook smolts annually.

Toboggan Creek has been impacted by several land use activities such as the CN Railway which runs parallel with the creek along much of its length. There are two railway crossings on Toboggan Creek and both crossings are downstream of Toboggan Lake but upstream of the Elliot Creek confluence.

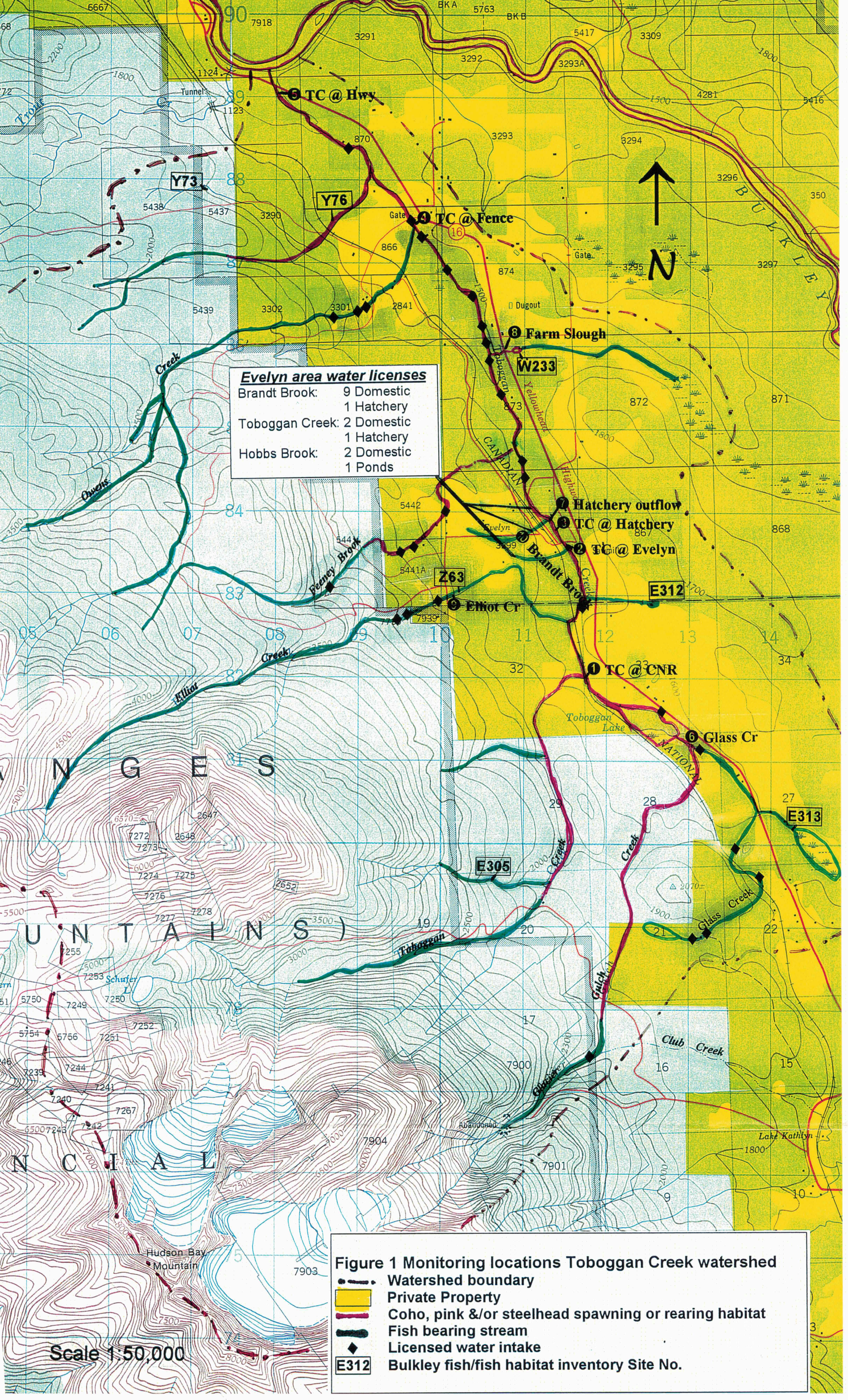
Highway #16 crosses Toboggan Creek just upstream of the confluence with the Bulkley River. This is a culvert crossing which is still passable to fish.

In the 1930's to 1950's there was some mining (mineral deposits) activity in the headwaters of Glacier Gulch Creek. Ongoing impacts as a result of this mining activity have not been quantified to date.

Forestry activities have also impacted the Toboggan Creek watershed which is within the Bulkley T.S.A. There has been some clear-cut logging activity in the watershed.

Land clearing for agriculture has occurred along the entire length of Toboggan Creek. Local agriculture holdings include a variety of hobby farms, four beef cattle farms and two dairy farms. There is also some rural residential development along the creek.

The Toboggan Creek Groundwater Channel Monitoring Program originated with a local landowner, Robert Grebliunas.


5 TC @ Hwy
Y73
Y76
4 TC @ Fence
8 Farm Slough
W233
Evelyn area water licenses
Brandt Brook: 9 Domestic
1 Hatchery
Toboggan Creek: 2 Domestic
1 Hatchery
Hobbs Brook: 2 Domestic
1 Ponds
7 Hatchery outflow
3 TC @ Hatchery
2 TC @ Evelyn
Z63
9 Elliot Cr
E312
1 TC @ CNR
6 Glass Cr
E313
E305
Figure 1 Monitoring locations Toboggan Creek watershed
Watershed boundary
Private Property
Coho, pink &/or steelhead spawning or rearing habitat
Fish bearing stream
Licensed water intake
E312 Bulkley fish/fish habitat inventory Site No.
Scale 1:50,000

Robert was interested in creating some fish habitat on his property at a location where there had historically been a fish-bearing stream. Other neighbouring landowners had provided anecdotal information regarding a fish-bearing stream that used to flow through the Grebliunas property.

A quick foot survey was conducted and a remnant stream channel was located. The stream channel currently has some surface and some sub-surface water flow. Aerial photographs (1992 – Map 2) show what appears to be an old stream channel which originates in the northerly cutblock and enters Toboggan Creek upstream of the Grebliunas bridge crossing. At several locations along this old(remnant) stream channel, water is bubbling up from the remnant channel stream bed.

2.0 Objective

Two locations along the remnant stream channel were identified as potential monitoring locations. Site 1 appeared to be groundwater as it did not freeze. Site 2, which was about 30 metres downstream from Site 1 but still within the remnant stream channel was thought to have surface water influence.

These two sites were to be monitored for water temperature, dissolved oxygen levels and some pH and conductivity measurements were to be taken. The objective was to determine if the water source – specifically the Site 1 source, in the remnant stream channel was suitable for fish.

3.0 Procedure

Site 1 was the site that was thought to be groundwater. A 91 cm. long piece of 8 cm diameter PVC pipe was installed by hand excavating a small hole. The pipe was sunk 60 cms. into the stream channel. Water level from bottom of excavation to water surface was measured as well as water temperature. Measurements were taken almost weekly with intermittent measurements of dissolved oxygen, pH and conductivity.

Site 2 had some surface flow of water. This site was also monitored almost weekly for water temperature and intermittently for dissolved oxygen, pH and conductivity. Atmospheric temperature and snow pack were also measured at time of monitoring.

Water temperature and atmospheric temperature were measured using a hand held pocket thermometer accurate to 0.1 degrees Celsius. The thermometer was held in the water or atmosphere until the temperature reading was unchanging.

Dissolved oxygen was measured using an Oxyguard Handy Probe dissolved oxygen meter which is accurate to 0.1 PPM. Conductivity and pH were measured using a Hanna HI 9812 pH – EC – TDS meter.

Water level was measured using a carpenter's measuring tape. The measuring tape was also used to record snow pack.

Monitoring commenced on January 5'th, 2001 and the last measurements were taken on March 21, 2001. This monitoring period represents traditionally low water level and low flow time of the year.

4.0 Results

All water quality monitoring measurements are presented in the following pages in both tabular and graph form. Measurements were taken at regular intervals i.e. almost weekly in both Sites 1 and 2. Water quality and water level measurements taken in the Toboggan Creek mainstem near the hatchery and in Toboggan Lake are also included in Table 1. The water quality measurements taken in Toboggan Creek and Toboggan Lake were taken as part of the 2000/2001 Overwintering Study. These measurements are presented for comparison purposes.

Site 1

Water level within the pipe remained constant at 60 cms. water depth. Despite sub zero atmospheric temperatures, the water temperature at Site 1 remained fairly warm (Refer to Water Temperature for Sites 1 and 2 and Toboggan Cr. Mainstem and Water Level for Site 1, Toboggan Cr. and Toboggan Lake).

Water temperature remained well above freezing except on Jan 22'nd where water temperature was recorded as 1.8 degrees C. While clearing the top of the pipe, some snow was dropped into the pipe which created some slush within the pipe. This may have led to the colder water temperature on that date.

Water was observed flowing over the ice at a site upstream of Site 1. No water quality measurements were taken at this location.

Site 2

Water level was not measured at Site 2 as this water appeared to be surface flow over the remnant streambed. Water temperature, atmospheric temperature, pH, dissolved oxygen, conductivity and snow pack are shown in tables and graph form under Water Quality Data for Site 2.

Water was observed flowing from Site 2 and downstream of Site 2. Some holes were dug through the ice and snow up to approximately 100 metres downstream from Site 2 and at several locations water was flowing over the streambed i.e. surface flow.

One location about 120 metres downstream of Site 2 was tested for water quality. At this location the water temperature was1.1 degrees C however the dissolved oxygen level was 1 PPM. The pH at this location was 6.6 and conductivity was 270 Microsiemens.

5.0 Discussion and Recommendations

Groundwater flow often provides a stable environment for both salmonid incubation and rearing by providing stable flow and water temperature regimes. (Bonnell 1991). Groundwater offers fish warmer water temperatures in winter and cooler water temperatures in summer. However, groundwater sources can be low in dissolved oxygen and this can negatively impact hatching salmon eggs.

Development of groundwater fed channels is a method that has been utilized throughout B.C. to augment both salmon and trout. Site selection involves looking for areas where there is groundwater near the surface and gravely soils. Although side channels with some intermittent flow are popular choices, relic channels with no flow have been successfully developed. (Mel Sheng, DFO Resource Restoration Biologist, personal communication).

In the Toboggan Creek Groundwater Channel Monitoring Program, two sites for monitoring were chosen. Site 1 appeared to have groundwater flow up to the remnant streambed surface and was located in a remnant stream channel which led into an old beaver dam complex. Site 2 appeared to be surface water flowing over the surface of the remnant stream channel. Site 1 flows downstream towards Site 2.

Comparisons of water temperature, water level, dissolved oxygen level, pH and conductivity are shown for Sites 1 and 2 and the Toboggan Creek mainstem and Toboggan Lake. The Site 1 temperatures are considerably warmer and the water at this site never froze. The water temperatures at Site 2 were much like the Toboggan Creek mainstem water temperatures indicating that the water at Site 2 was most likely surface water, not groundwater.

Groundwater can be low in dissolved oxygen. Two dissolved oxygen measurements were taken at Site 1 and both readings were within safe limits for fish i.e. over 8.5 PPM for hatching eggs.

One dissolved oxygen reading was taken at Site 2 and this reading was also within safe limits for fish.

The pH was measured at Site 1 on two occasions i.e. 6.9 on Jan 22'nd and 6.7 on February 9, 2001. Both pH readings are within safe limits for salmonids i.e. 6.5 to 8.5 pH units.

Two conductivity readings were taken at Site 1. Those conductivity readings fall within the range for Toboggan Creek as measured during the 1998 – 2000 Bulkely Overwintering Study (R. Saimoto and B. Donas 1999). Conductivity readings in Toboggan Creek typically range between 70 and 120 Microsiemens.

On February 9'th, water quality measurements were taken at a site downstream of Site 2. Although water temperature was 1.1 and pH was 6.6, the dissolved oxygen was at 1 PPM, well below the safe level for salmonids. The water also had an odor of hydrogen sulphide in this location and the streambed was not as gravely in texture, but rather had a fine organic layer.

Water quality parameters measured at Sites 1 and 2 fall within safe limits for fish. Water level within the pipe at Site 1 remained constant throughout the winter months. Typically groundwater level does remain constant i.e. there is minimal fluctuation in water level (Bonnell 1991). Given the warmer water temperatures and the constant water level at Site 1, this water source is most likely a groundwater source.

The water at Site 2, due to the temperature regime that mimicked the Toboggan Creek temperature regime, is most likely surface water. Water flow was observed at various points within the remnant channel indicating that there is year round flow, however the flow does go sub-surface.

On March 8, 2001, DFO Engineering staff visited the old stream channel and the two monitoring sites. A site walk was performed and the engineering staff recommended digging a test pit at Site 1 to determine water flow. The engineering staff recommended that the water from the excavated pit be steered down the old, remnant stream channel.

They felt confident that the groundwater influence along with any surface water now flowing sub-surface, would be more than sufficient for construction of a small pool at Site 1. Flow from the pool would create surface flow down the remnant channel and would empty into Toboggan Creek. The engineers suggested complexing the pool with root wads and then monitoring for fish use. (Ian Ross, Engineer and Sam McNeil, Engineering Technician – DFO, personal communication).

The remnant channel would be accessible to both juvenile and adult salmonids if more stable water flow and water level could be provided.

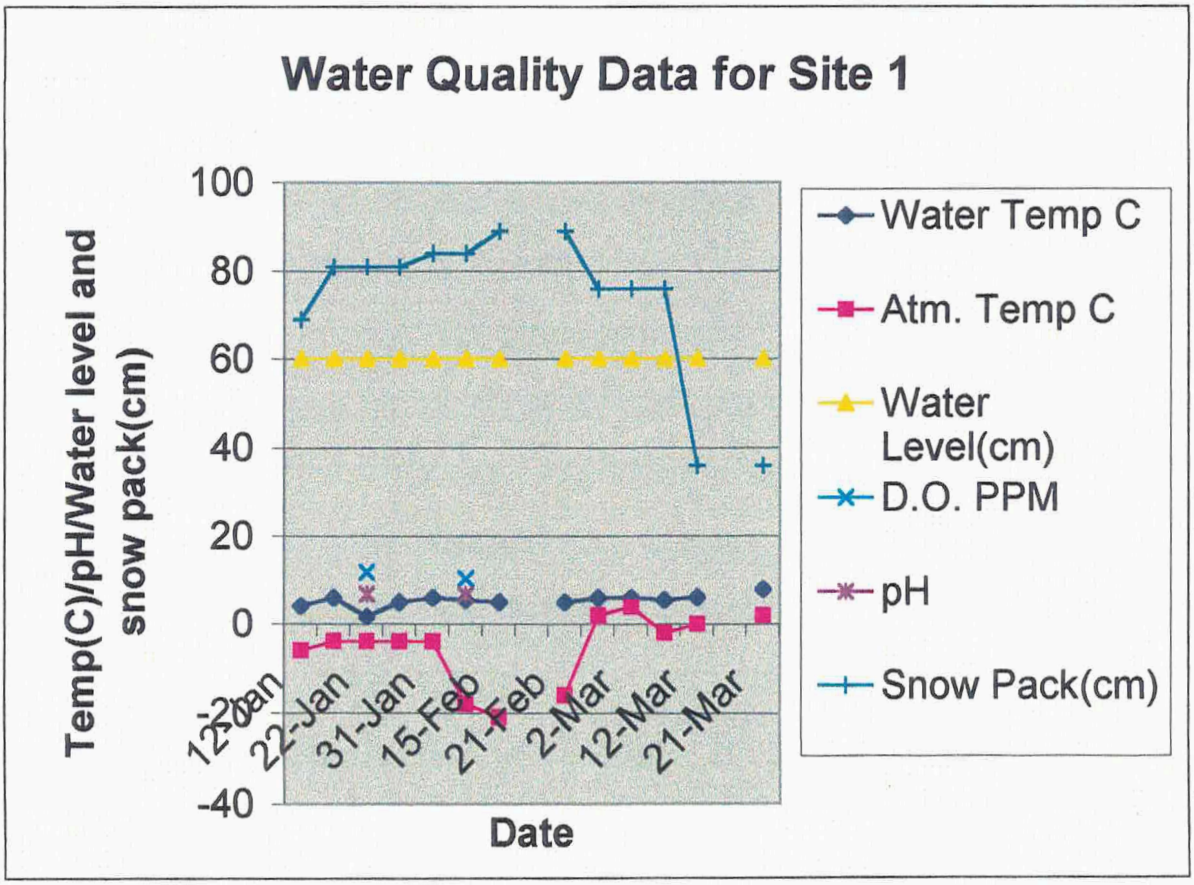
Recommendations

1. Site 1 is a good candidate for excavation into the groundwater table due to water quality parameters that are safe for fish and the gravely composition of the soils. A small pool, approximately 10m long by 10m wide by 1 to 1.5 metres deep could be excavated. Due to the gently sloping nature of the remnant stream channel and channel streambanks that are still intact, water should flow from the excavated pool down the remnant channel into Toboggan Creek. Total remnant channel length to the confluence with Toboggan Creek is approximately 400 metres. The remnant channel banks are in good condition and are well vegetated. There is some small woody debris in the remnant stream channel and there are cutbank areas as well. (Foot survey by Grebliunas and Donas). The channel is gently sloping into the confluence with Toboggan Creek and appears to be easily accessible to salmonids.
2. If Site 1 is excavated into a pool, pool should be monitored for water quality parameters (D.O., water temperature, pH, conductivity) and for flow exiting the pool. Ice thickness should also be monitored over the winter months.
3. If Site 1 is excavated into a pool, fish presence should be monitored from time of pool development and throughout the winter. If the pool is being utilized by salmonids, a downstream count would assist in quantifying the value of this project in terms of smolt output.

Toboggan Creek Groundwater Channel Monitoring Project : January to March 2001

Water Quality Data for Site 1

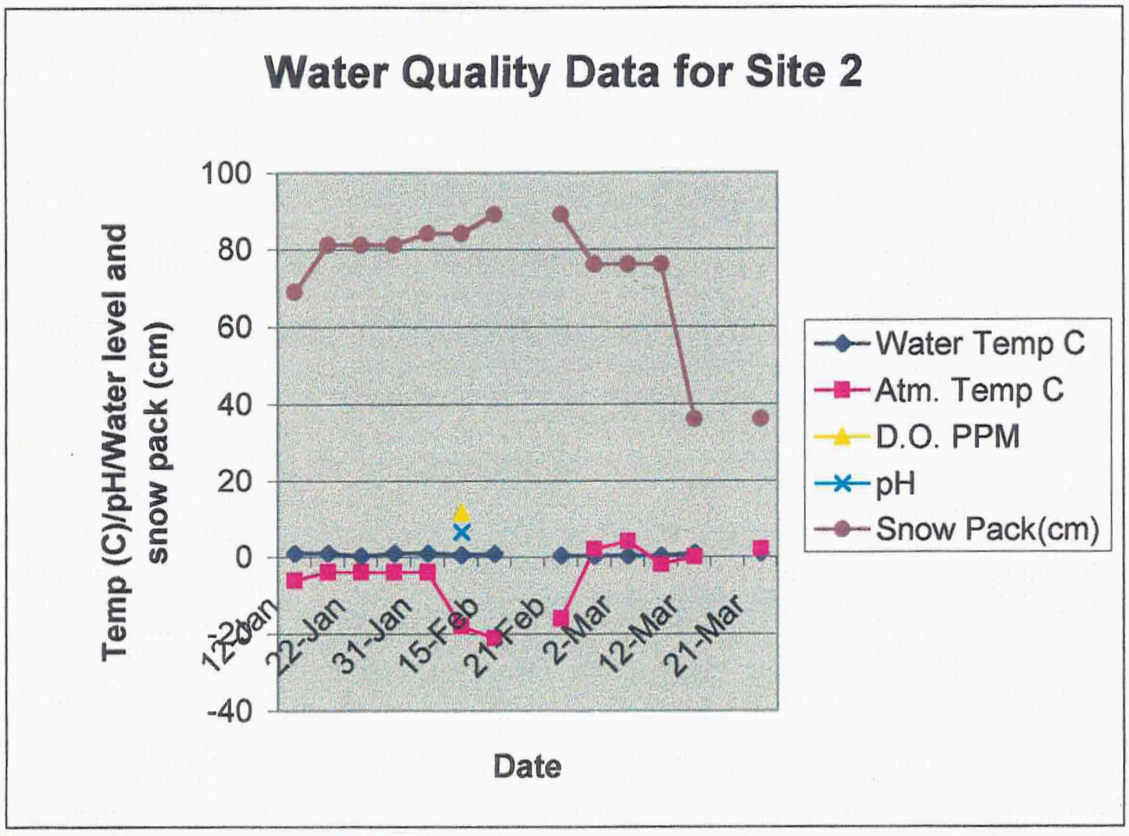
Date	Water Temp C	Atm. Temp C	Water Level(cm)	D.O. PPM	pH	Snow Pack(cm)	Conduct. Msiemens
12-Jan	4.2	-6	60			69	
18-Jan	6	-4	60			81	
22-Jan	1.8	-4	60	11.9	6.9	81	170
25-Jan	5	-4	60			81	
31-Jan	6	-4	60			84	
9-Feb	5.5	-18	60	10.4	6.7	84	70
15-Feb	5	-21	60			89	
19-Feb							
21-Feb	5	-16	60			89	
28-Feb	6	2	60			76	
2-Mar	6	4	60			76	
7-Mar	5.5	-2	60			76	
12-Mar	6.2	0	60			36	
19-Mar							
21-Mar	8	2	60			36	



Toboggan Creek Groundwater Channel Monitoring Project : January to March 2001

Water Quality Data for Site 2

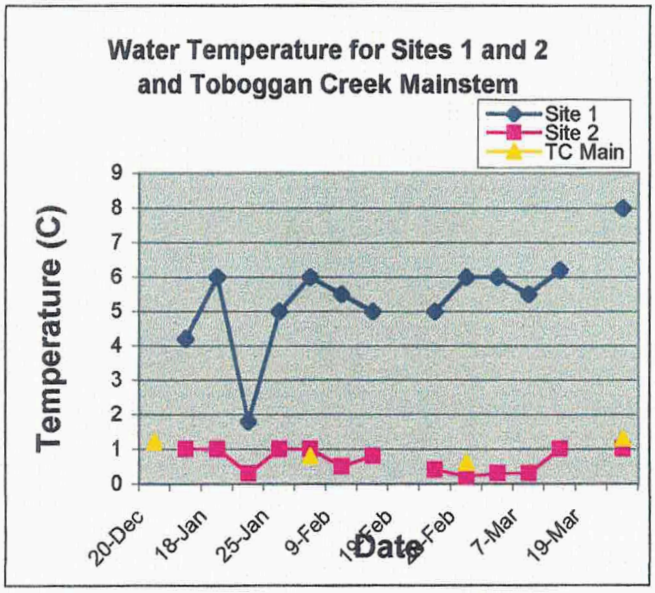
Date	Water Temp C	Atm. Temp C	D.O. PPM	pH	Snow Pack(cm)	Conduct. Msiemens
12-Jan	1	-6			69	
18-Jan	1	-4			81	
22-Jan	0.3	-4			81	
25-Jan	1	-4			81	
31-Jan	1	-4			84	
9-Feb	0.5	-18	11.6	6.6	84	270
15-Feb	0.8	-21			89	
19-Feb						
21-Feb	0.4	-16			89	
28-Feb	0.2	2			76	
2-Mar	0.3	4			76	
7-Mar	0.3	-2			76	
12-Mar	1	0			36	
19-Mar						
21-Mar	1	2			36	



Toboggan Creek Groundwater Channel Monitoring Project : January to March 2001

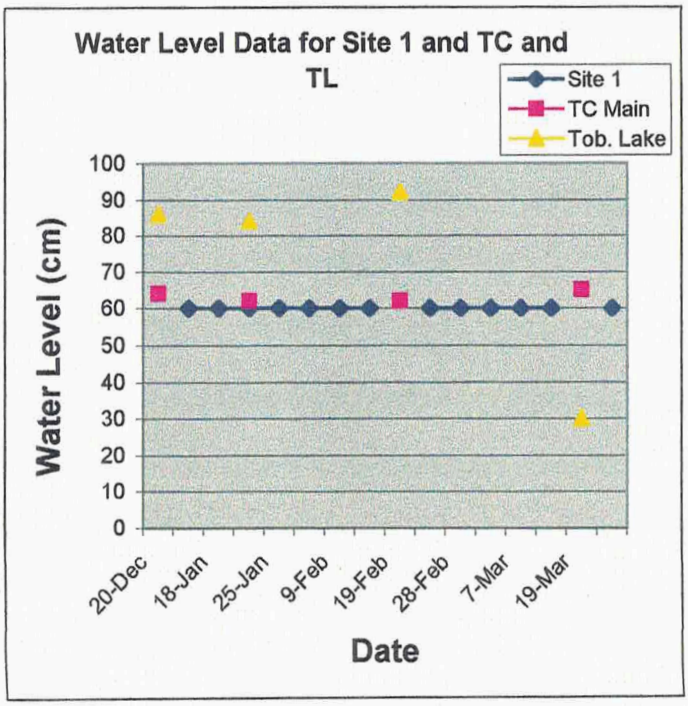
Water Temperature for Sites 1 and 2 and Toboggan Cr. Mainstem

Date	Site 1	Site 2	TC Main
20-Dec			1.2
12-Jan	4.2	1	
18-Jan	6	1	
22-Jan	1.8	0.3	
25-Jan	5	1	
31-Jan	6	1	0.8
9-Feb	5.5	0.5	
15-Feb	5	0.8	
19-Feb			
21-Feb	5	0.4	
28-Feb	6	0.2	0.6
2-Mar	6	0.3	
7-Mar	5.5	0.3	
12-Mar	6.2	1	
19-Mar			
21-Mar	8	1	1.3



Water Level (cm) for Site 1 , Toboggan Cr. Mainstem and Toboggan Lake

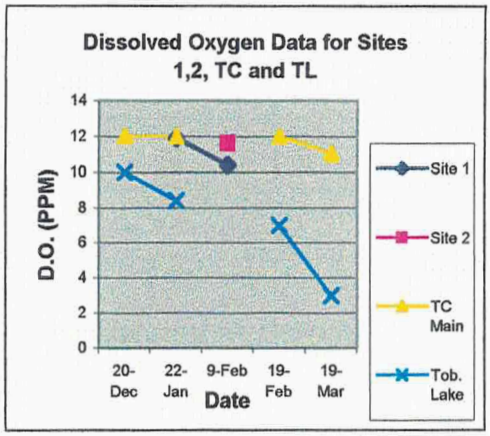
Date	Site 1	TC Main	Tob. Lake
20-Dec		64	86
12-Jan	60		
18-Jan	60		
22-Jan	60	62	84
25-Jan	60		
31-Jan	60		
9-Feb	60		
15-Feb	60		
19-Feb		62	92
21-Feb	60		
28-Feb	60		
2-Mar	60		
7-Mar	60		
12-Mar	60		
19-Mar		65	30
21-Mar	60		



Toboggan Creek Groundwater Channel Monitoring Project : January to March 2001

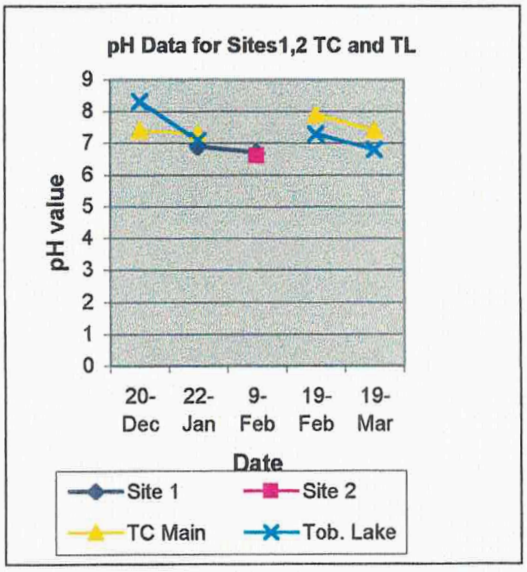
Dissolved Oxygen Data for Sites 1 and 2, Toboggan Cr. Mainstem and Toboggan Lake

Date	Site 1	Site 2	TC Main	Tob. Lake
20-Dec			12	10
22-Jan	11.9		12	8.4
9-Feb	10.4	11.6		
19-Feb			12	7
19-Mar			11	3



pH Data for Sites 1 and 2, Toboggan Cr. Mainstem and Toboggan Lake

Date	Site 1	Site 2	TC Main	Tob. Lake
20-Dec			7.4	8.3
22-Jan	6.9		7.3	7.1
9-Feb	6.7	6.6		
19-Feb			7.9	7.3
19-Mar			7.4	6.8



Conductivity Data for Sites 1 and 2, Toboggan Cr. Mainstem and Toboggan Lake

Date	Site 1	Site 2	TC Main	Tob. Lake
20-Dec			70	70
22-Jan	170		80	100
9-Feb	70	270		
19-Feb				
19-Mar				

References

Bonnel, R.G. 1991. Construction, Operation and Evaluation of Groundwater-Fed Side Channels for Chum Salmon in British Columbia. American Fisheries Society Symposium 10 : 109-124, 1991

Donas, B. and Remington, D. 1999. Water quality in the Toboggan Creek watershed 1996-1998: are land use activities affecting water quality and salmonid health?

Toboggan Creek watershed in 1992
Air Photo Mosaic
(Flight lines: 30BCB 92086, 92087, 92090, 92091 and 92135)