

**Clinton Creek,  
Fish Community Survey  
September, 2009**

**Prepared For  
Rachel Pugh  
Project Manager  
Assessment and Abandoned Mines Branch  
Energy, Mines and Resources  
Government of Yukon**

**PREPARED BY  
WHITE MOUNTAIN ENVIRONMENTAL CONSULTING  
PAUL SPARLING-  
P.O. Box 10140 Whitehorse,  
Yukon Y1A 7A1**

**November, 2009**

# TABLE OF CONTENTS

	Page
Introduction.....	1
1.0 Study area.....	1
2.0 Methods.....	2
3.0 Results.....	3
3.1 Site E1, Clinton Creek Downstream of the gabions.....	3
3.2 Site E2, Clinton Creek, Upstream of Wolverine Creek.....	3
3.3 Site E3, Wolverine Creek.....	4
3.4 Site E4, Clinton Creek upstream of Eagle Creek.....	5
3.5 Site E5, Porcupine Creek.....	5
3.6 Site R4, Eagle Creek.....	5
3.7 Site E6, Clinton Creek at town site Ford.....	6
3.8 Site R5, Mickey Creek.....	6
3.9 Site R7, Maiden Creek.....	7
3.10 Site R8, Marten Creek.....	7
4.0 Discussion.....	8
4.1 Fish Distribution and Fish Health.....	8
4.2 Evaluation of Reference Sites.....	9
4.3 Clinton Creek Overview.....	9
5.0 Appendix 1: Site Descriptions.....	11
5.1 Site E1 Clinton Creek, downstream of the gabion baskets.....	11
5.2 Site E2 Clinton Creek, upstream of Wolverine Creek.....	13
5.3 Site E3 Wolverine Creek upstream of its confluence with Clinton Creek.....	15
5.4 Site E4 Clinton Creek upstream of Eagle Creek.....	17
5.5 Site R4 Eagle Creek Upstream of Hanging Culvert.....	19
5.6 Site E6, Clinton Creek At Town Site Ford.....	22
5.7 Site R5, Mickey Creek.....	23
5.8 Site R7, Maiden Creek.....	25
5.9 Site R8, Marten Creek.....	26
6.0 Appendix 2: Excel data files (digital attachment)	

## List of Figures

Figure 1: Map of the study area (from Topo map 116B & 116C) showing sample locations used during 2009 fisheries investigations at Clinton Creek mine site.....	2
Figure 2: A comparison of slimy sculpin length weight relationships from all sites sampled during September, 2009 in the Clinton Creek area.....	10
Figure 3: Combined length distribution for slimy sculpin from all areas sampled during September, 2009 in the Clinton area.....	10
Figure 4: Clinton Creek at site E1 looking downstream from the gabions, September 8, 2009.....	12

Figure 5: Clinton Creek site E1 looking upstream at the gabions, September 8, 2009. The pool the technician is standing in represents the uppermost location on Clinton Creek that fish were found.....12

Figure 6: Clinton Creek Site E2, upstream of Wolverine and Porcupine Creeks, September 9, 2009. The gravel bars are remnants of a large beaver dam that crossed Clinton Creek and contained the flow from Porcupine Creek. The dam likely washed out in spring of '09.....14

Figure 7: Porcupine Creek was dammed by beavers during the summer of 2009 at the confluence with Clinton Creek. The dam shown in the photo is only a secondary dam below the main dam and not the main dam. The flowing water is Clinton Creek.....15

Figure8: Wolverine Creek immediately upstream of the road. Note the depositions of fines dropped out due to spring pooling upstream of the culverts. September 9, 2009.....17

Figure 9: Clinton Creek at site E4, immediately upstream of the confluence with Eagle Creek, Sept 8, 2009.....19

Figure 10: Eagle Creek immediately upstream of the culvert at the Clinton mine site access road, September 8, 2009.....21

Figure 11: Eagle Creek entering Clinton Creek through the suspended culvert. September 8, 2009.....21

Figure 12: Looking downstream at Site E6, Clinton Creek at the town site ford. The ford follows the riffle line upstream of the old bridge abutments. September 10, 2009.....23

Figure 13: Mickey Creek downstream of the culvert pool. September 11, 2009.....24

Figure 14: Maiden Creek, September 11, 2009.....26

Figure 15: Sampling on Marten Creek, September 11, 2009.....28

Figure 16: The largest corner pool on Marten Creek was at the edge of the placer mined area, September 11, 2009.....28

---

## **INTRODUCTION**

Data gaps in fisheries data at Clinton Creek Mine site were identified by Minnow Consulting (July 2009). The principle gaps were knowledge of the extent of fish utilization in some of the smaller tributaries to Clinton Creek; the affects those tributaries have on the primary productivity of Clinton Creek; and the affects on fish health. Based on these recommendations to further document fish utilization and fish health, field investigations were conducted in the Clinton Creek area during September of 2009.

The primary objective of this study was to build on base line fisheries data in order to provide a good indication of the magnitude and spatial extent of any mine-related influence on near-field areas. With the objective being met by sampling for fish at 5 previously established sites in and around the Clinton Creek mine site and establishing new reference areas away from the zone of influence in order to assist in identifying any substantive influence of mine exposure on the health of downstream fish populations.

Field investigations were conducted by White Mountain Environmental Consulting between September 7 and 13, 2009, under the authority of License # CL-09-42, issued by the Department of Fisheries and Oceans.

### **1.0 STUDY AREA**

Sites for sampling fish in the Clinton Creek area were set adjacent to the benthic and macro invertebrate sites established during August of 2009, at previously established sites and on tributaries to the Fortymile River. The sites sampled are as follows (see Figure 1);

- E1 – Clinton Creek downstream of gabion baskets/ upstream of Porcupine Creek
- E2 – Clinton Creek adjacent to Porcupine Creek/ upstream of Wolverine Creek
- E3 – Wolverine Creek upstream of hanging culvert
- E4 – Clinton Creek downstream of Wolverine Creek/ upstream of Eagle Creek
- E5 - Porcupine Creek upstream of Clinton Creek confluence
- E6- Clinton Creek at the town-site access road
- R4- Eagle Creek tributary to Clinton Creek,
- R5- Mickey Creek
- R7- Maiden Creek and
- R8- Marten Creek.

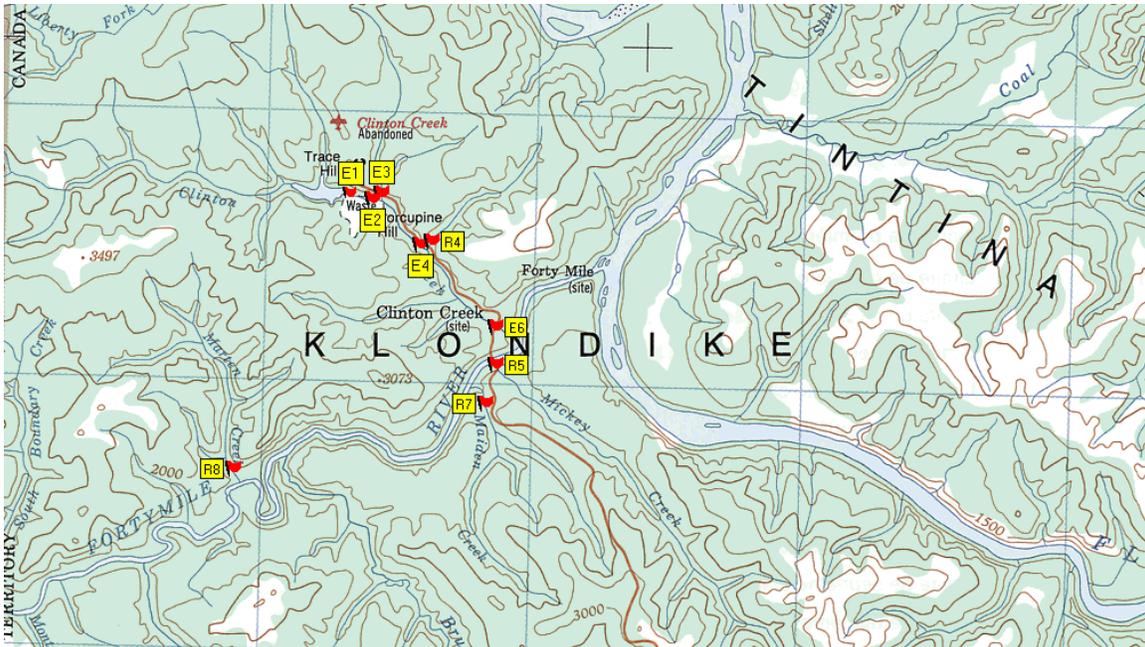


Figure 1: Map of the study area (from Topo map 116B & 116C) showing sample locations used during 2009 fisheries investigations at Clinton Creek mine site.

## 2.0 METHODS:

A total of four sites on Clinton Creek, three tributaries to Clinton Creek and three tributaries to the Forty Mile River were assessed between September 8 and 12, 2009.

Each site was assessed with similar fishing effort that included a variety of sampling techniques to ensure capture of all species present. The techniques applied were:  
 -minnow trapping with 10 traps per site baited with Yukon River salmon roe,  
 -electro fishing a maximum of 1,000 seconds over a reach up to 150 meters in length,  
 -and angling where appropriate to denote and record Arctic grayling.

All fish captured were identified by species, weighed and measured, inspected for any external lesions, tumors, other abnormalities or fin clips (all documented), and then released alive in the areas where they were caught.

Condition factor (K), a relative measure of fitness and robustness was calculated for adult and sub adult Arctic grayling using the following formula;

$$K = \frac{10^5 \times W_t}{L^3}$$

General fish habitat conditions were recorded and photographs representative of the site were taken. Habitat conditions were assessed through visual reconnaissance. Evaluations included assessments of creek width, depth, slope, velocity (floating object technique), bank stability, bottom substrates, available cover and adjacent vegetation. Residual pool depths were assessed by calculating the difference between the maximum pool depth and the out flow depth from the pool. Three pools at each site were assessed and an average depth was calculated. The flood pool depth was calculated at the same sites using the high water mark. Photographs representative of each site were taken.

### **3.0 RESULTS**

Fish habitats in the Clinton Creek area were modified by an extreme freshet during the spring of 2009 (pers. com. Earl Rolph, area resident trapper). Many of the existing beaver dams were washed out during the high flows leaving few obstructions to upstream fish movements during the spring and early summer of 2009. Juvenile chinook salmon (jcs) and Arctic grayling (all life stages) were well dispersed in the upstream reaches below Hudgeon Lake during this investigation. Fall weather conditions were building at the time of investigation and fish were not evenly distributed in Clinton Creek and it was thought that fish in Clinton Creek had started to move into winter habitat areas at the time.

All fish captured were examined for external abnormalities and the only fish found with an abnormality was an adult sculpin with a scab on its tail. Several other sculpin were captured in Clinton Creek that looked abnormally fat in the belly. Two of these sculpin were sacrificed to determine the cause, a large abdominal tape worm was found in each of these sculpins, tape worms such as these are not uncommon.

#### **3.1 Site E1, Clinton Creek downstream of the gabion structure**

This sample site includes the downstream end of the gabion baskets and the modified channel downstream of the gabions. This reach has had considerable anthropogenic modifications, from the initial waste rock slump to the construction of the gabion structure. The entirety of the sample reach falls within the zone of modification.

At the time of the investigation site E1 had an average wet width of 7.2m (the high water mark was indistinct and a bank full calculation was not possible although the modified channel width is 21.6m), the average depth was 0.4m and the average velocity was >1m/second. The gabion baskets and pools behind large boulders provide a significant amount of cover. A detailed listing of habitat conditions can be found in Appendix 1.

Angling effort consisted of 3 anglers for 15 minutes each, with a combined catch of 7 sub adult Arctic grayling and 4 more observed. The grayling were abundant in the largest pool at the downstream end of the gabion structure as well as in the small pools in the rapids below. All the captured grayling were considered sub-adults and ranged in length from 218 to 282mm, in weight from 105 to 155 grams and had an average condition factor (K) of 0.97.

A total of 9 minnow traps were set for an overnight period with an average soak time of 20 hours per trap. No fish were captured in any of the minnow traps.

A total of 766 seconds of electro-fishing time was expended for a total catch of 8 Arctic grayling sub-adults with a CPUE of 1.04 Arctic grayling/ 100 seconds. The grayling ranged in length from 186 to 264 mm and in weight from 72 to 233gm and had an average condition factor (K) value was 1.17.

#### **3.2 Site E2, Clinton Creek upstream of Wolverine Creek**

Habitats at site E2 have recently been modified by beaver activity. A large dam that held back Clinton Creek and Porcupine Creek in 2007, washed out, presumably in 2009. At the site of the old dam (approximately 50m upstream of Wolverine Creek) Clinton Creek now flows through a channel area with mid channel bars, cut banks, an attached large

pool near the outlet of Porcupine Creek the area provides good cover with a variety of flows and substrates. A new beaver dam has been constructed, however the new dam only contains the flows from Porcupine Creek and this dam has created a pool parallel to Clinton Creek.

At the time of investigation site E2 had an average wet width of 5.7m inside a channel of 11m. The average velocity was 0.5 m/sec, the average residual pool depth was 0.86 meters and the flood pool depth was 1.5 meters. A detailed listing of habitat conditions can be found in Appendix 1.

Angling effort consisted of 3 anglers for 15 minutes each; catch was 3 adult and 3 sub adult Arctic grayling and 1 jcs. Numerous juvenile fish were observed chasing the flies during angling. The captured grayling ranged in length from 104 to 382 mm, in weight from 50 to 399 gm and had an average condition factor (K) of 0.92.

A total of 10 minnow traps were set at site E2 with an average soak time of 21.5 hours per trap. A total of 41 jcs and 22 slimy sculpin were captured. The mean length of the sculpin was 89.4mm and the mean weight was 4.1 grams.

A total of 813 seconds of electro-fishing time was expended for a total catch of 136 slimy sculpin, 2 sub adult Arctic grayling and 4 jcs. This catch represents a CPUE of 0.49 jcs/100 secs, 16.73 slimy sculpin/100 secs and 0.25 Arctic grayling/100 secs.

### **3.3 Site E3, Wolverine Creek upstream of hanging culvert**

The mine site access road, which follows beside Clinton Creek, crosses Wolverine just above its confluence with Clinton Creek. The creek flows through 2 culverts (1m and 0.6m). The outflow from the culverts plunges > 1.5 meters and cascades the final few meters into Clinton Creek creating a complete barrier to fish passage. Above the culvert the creek has very limited fish habitat, very little cover with substrates consisting mostly of well washed fine gravel, likely derived from the mill site upstream. The creek likely could provide small seasonal habitats for rearing fish during summer months; however it is unlikely that the creek would provide over wintering habitat.

Upstream of the hanging culvert the creek is small and subject to flooding caused by the culvert. The 75m reach immediately upstream of the culverts has been flooded out on numerous occasions and has significant accumulations of fine materials (asbestos), the creek flows as a featureless glide in this reach. Small step riffles and pools caused by debris piles do occur in the wooded areas of the channel 75m upstream of the culvert.

At the time of the survey Wolverine Creek had an average wet width of 2.5m inside a channel of 5m with an average depth of 0.35 meters. The creek flows predominantly as a glide with several small riffles. A detailed description of habitat conditions can be found in Appendix 1.

Minnow traps were not set and angling effort was not exerted due to the small size of the creek.

A total of 435 seconds of electro-fishing time was expended in Wolverine Creek and no fish were captured or observed.

### **3.4 Site E4, Clinton Ck downstream of Wolverine Ck/ upstream of Eagle Ck**

This sample reach starts at the confluence of Eagle Creek with Clinton Creek and extends upstream for 200 meters. Habitats in this reach are stable, partially confined by bedrock and away from the mine site access road. The reach provides a variety of habitat types however had a limited amount of cover at the observed flow condition.

At the time of the investigation the reach had an average wet width of 6.4 meters inside a channel width of 7.7 meters, the average residual pool depth was 0.55 meters and the flood pool depth was 1.3 meters, the average velocity was 0.9 m/second. The reach was 60% glide with a small rapid at the upstream end of the reach, 3 small riffles and a pool from a past beaver dam. A detailed listing of habitat conditions can be found in Appendix 1.

Angling effort consisted of 3 anglers for 15 minutes each, no fish were captured and no fish were observed. Extra angling time downstream of the confluence with Eagle Creek also captured no fish. Visibility was excellent at the time.

A total of 10 minnow traps were set at site E4 with an average soak time of 28 hours per trap. A total of 4 slimy sculpin and 1 Arctic grayling were captured. The sculpin had a mean length of 68 mm and a mean weight of 1.3 grams.

A total of 868 seconds of electro-fishing time was expended for a total catch of 45 slimy sculpin (24 captured and 21 observed), with a CPUE of 5.2 slimy sculpin/ 100 secs shock time. The mean weight of captured sculpin was 1.8 grams and the mean length was 64.9 mm.

### **3.5 Site E5, Porcupine Creek upstream of Clinton Creek confluence**

Porcupine Creek flows into Clinton Creek approximately 75 meters upstream of Wolverine Creek. At the time of investigation the creek was blocked by a beaver dam that ran parallel to Clinton Creek with a resulting pond 25 meters in diameter. Upstream of the beaver pond the flows of Porcupine Creek run through the old mining area in a poorly defined channel that often runs subsurface making it difficult to calculate the volume of water in the creek. Fish habitats are very limited upstream of the beaver pond.

Angling effort consisting of 1 person fishing for 10 minutes captured no fish although adult and sub adult Arctic grayling were observed rising in the pond. Slimy sculpin were observed at the base of the dam adjacent to Clinton Creek. No other fishing effort was extended in this creek.

### **3.6 Site R4, Eagle Creek, upstream of hanging culvert**

Eagle Creek is crossed by the mine site access road within 25 meters of its confluence with Clinton Creek. The culvert has a plunge of 0.5 meters on the downstream side and was a complete barrier to fish passage at the observed flow. Upstream of the culvert Eagle Creek flows in a well defined channel that is totally confined. At the time of the investigation the average wet width was 1.5 meters inside a channel of 2.5 meters that had abrupt banks rising 1.5 to 2.5 meters. The average depth was only 10 cm and the

deepest water found was 0.45 meters. This creek has very limited if any fish habitat. The channel is scoured and obviously flows at higher levels. A detailed listing of habitat conditions can be found in Appendix 1.

Angling effort and minnow traps were not set in Eagle Creek due to the small size of the creek.

A total of 163 seconds of electro-fishing time was expended and no fish were captured. A span longer than 150 meters was covered during the electro-fishing.

### **3.7 Site E6, Clinton Creek at town site road Ford**

This site is located immediately upstream of the old Clinton Creek Town site road. At present the road crosses Clinton Creek as a ford, during the life of the mine there was a bridge at this location and the old abutments remain downstream of the present ford.

At the time of investigation the creek had an average wet width of 6.4 meters inside a channel of 10.2 meters. The average velocity was 0.5 m/sec., the average residual pool depth was 0.45 meters and the flood pool depth was 1.35 meters. This reach flows mainly as a wide glide with riffing at the ford and pooling upstream created by a new and partial beaver dam. The banks are well defined with a small bedrock out crop at the upper end with shifting bed load and bar development along the sides and at corners towards the ford. Good cover is provided by pools and deep cut bank areas. A detailed listing of habitat conditions can be found in Appendix 1.

Angling effort consisted of 3 anglers for 15 minutes each, no fish were captured and only 2 sub adult grayling were observed.

A total of 10 minnow traps were set at site C Ck Ford with an average soak time of 17 hours per trap. A total of 3 jcs, 5 slimy sculpin and 2 Arctic grayling were captured. The mean length of the sculpins was 62.2 mm and the mean weight was 1.4 grams.

A total of 1,052 seconds of electro-fishing time was expended for a total catch of 88 adult slimy sculpin representing a CPUE of 2.95 slimy sculpin/ 100 seconds of shock time. Of the sculpin recorded electro-fishing, 41 sculpin were sampled, they had a mean length of 60.3 mm and a mean weight of 1.3 grams.

### **3.8 Site R5, Mickey Creek**

Mickey Creek was sampled immediately downstream of the road that accesses the bridge to Clinton Creek. The 3m culvert has a large plunge pool, however does not represent a complete barrier to fish passage. The pool creates some of the best fish habitats on Mickey Creek. Evidence that parts of this reach were placer mined in the distant past was noticed and the bottom substrates are very active and non compacted; however the site is not completely altered, was stable and has revegetated.

At the time of the investigation Mickey Creek had an average wet width of 4.1 meters inside a channel of 6.5 meters. The average velocity was 0.7 m/sec., the average residual pool depth was 0.5 meters and the flood pool depth was 1.2 meters. The channel was stable and offered a variety of small fish habitats. The best cover was

provided by pools, notably the large pool at the culvert but also a few smaller pools downstream. Cover and available habitats diminish away from the culvert. A detailed listing of habitat conditions can be found in Appendix 1.

Angling effort consisted of 3 anglers for 15 minutes each, over a 350 meter long reach, a single sub adult grayling was angled, 2 adult, 5 sub adult and approximately 30 juvenile grayling were observed.

A total of 10 minnow traps were set at Mickey Creek with an average soak time of 19.6 hours per trap. A total of 23 jcs, 2 slimy sculpin and 1 Arctic grayling were captured. The mean weight of the sculpins was 3.35 grams and the mean length was 77 mm.

A total of 567 seconds of electro-fishing time was expended for a total catch of 1 juvenile Arctic grayling and 6 slimy sculpin representing a CPUE for slimy sculpin of 1.23/ 100 secs shock time. The mean weight of the sculpin captured was 3.0 grams and the mean length was 76.5 mm.

### **3.9 Site R7, Maiden Creek**

Maiden Creek was sampled downstream of a recently active placer mine (not active in 2009) at a location more than a kilometer from the Forty Mile River. The site may have had historic mining decades ago. The fish habitats were limited due the small size of the creek but were stable in the fast flowing creek.

At the time of investigation the creek had an average wet width of 3.4 meters inside a channel 5.3 meters wide. The average velocity was 0.8 m/sec, the average residual pool depth was 0.45 meters and the average flood pool depth was 1.7 meters. Most of the sample reach was a riffle with occasional small pools. Cover was provided by large organic debris caused features. A detailed listing of habitat conditions can be found in Appendix 1.

Angling effort consisted of 3 anglers for 15 minutes each, over a 350 meter long reach; no fish were captured or observed.

A total of 10 minnow traps were set on Maiden Creek with an average soak time of 18 hours per trap. A single Arctic grayling was the only fish captured.

A total of 685 seconds of electro-fishing time was expended on Maiden Creek and no fish were captured or observed.

### **3.10 Site R8, Marten Creek**

Marten Creek was sampled a short distance (300 m) from the Forty Mile River at the site of an active placer mine. The site sampled had been historically mined, decades ago and active mining had/was occurring upstream during 2009. At the time of sampling the water was turbid with residual placer debris. The channel was stable, flanked by a vertical bedrock wall for 40 meters on the right bank and had abundant cover of organic debris, pools and turbidity.

At the time of investigation the creek had an average wet width of 6.2 meters inside a channel 7.9 meters wide. The average velocity was 1 m/sec, with an average residual

pool depth of 0.5 meters and an average flood pool depth of 1.2 meters. The creek flowed mostly as a rapid interspersed with runs and corner pools. A detailed listing of habitat conditions can be found in Appendix 1.

Angling effort consisted of 3 anglers for 15 minutes each, no fish were captured or observed.

A total of 10 minnow traps were set on Marten Creek, however due to site access constraints the traps were only in for a soak time of 2 hours each. The traps were set away from the area used for electro fishing. A single slimy sculpin was the only fish captured. The sculpin was 58 mm and weighed 1.4 grams,

A total of 716 seconds of electro-fishing time was expended with virtually no visibility into the water due to placer derived turbidity. The total catch recorded was 3 juvenile Arctic grayling and 19 adult slimy sculpin, representing a CPUE of 3.07 slimy sculpin/ 100 seconds shock time. The mean length of the sculpins sampled was 67 mm and the mean weight was 1.8 grams.

## **4.0 DISCUSSION**

### **4.1 Fish Distribution and Fish Health**

Fish distribution within the study area and the individual creeks was not even during this investigation. Ambient water temperatures were decreasing and fish appeared to have had moved into areas near over wintering sites. The highest densities of fish found were near the confluences of Porcupine and Wolverine Creeks on Clinton Creek. This area also had the warmest water temperatures of all sample sites and has several key factors that may make it suitable winter habitat; specifically that the flows of Clinton Creek will be attenuated by Hudgeon Lake and by the beaver pond on Porcupine Creek. At the time of investigation sculpin had moved into the shallow seep water coming out of the beaver dam on Porcupine Creek at the edge of Clinton Creek. An additional electro-fishing effort was extended between E1 and E2 at the access road ford crossing of Clinton Creek. This site had considerable numbers of fish, similar to E2 including the three species, grayling, sculpin and jcs.

Arctic grayling captured immediately below the gabion structures were more robust than those a short distance downstream at site E2. The condition factor (k) of grayling captured at the gabions (E1) was 1.17 and at E2 was 0.92.

Sculpin captured at E2 were slightly more robust than fish captured at either E6 or E4 (Figure 2), although older fish at E4 were heavier than at the other sites. Sculpin from Mickey Creek were more robust than those from Clinton Creek.

Sculpin from the older age classes were well represented at most sample stations, a lack of 40 to 55 mm length sculpins may indicate a low recruitment in the 3 year old length classes (Figure 3).

Visually, all the fish captured in Clinton Creek appeared healthy and no external abnormalities were noticed.

## **4.2 Evaluation of Reference Sites**

Both Eagle Creek and Wolverine Creek, tributaries to Clinton Creek have limited amounts of fish habitat, are close to being ephemeral in nature and are blocked to upstream fish migrations by hanging culverts at their outlets to Clinton Creek. Neither of these creeks provides opportunity as reference areas for fish utilization.

The three tributaries to the Forty Mile River investigated for potential as reference sites have all been modified to some extent by placer mining in the past or at present.

Mickey Creek has been used in the past as a reference creek, has easy access and does have similar fish habitats to Clinton Creek. The most significant difference being the aspects, Clinton Creek faces south and Mickey Creek faces north.

Maiden Creek was sampled at the only location with easy enough access to make it practical, unfortunately this site has been extensively modified by placer mining in the last few years and does not have very productive fish habitat. This site should not be considered as a reference location in future investigations.

Marten Creek flows parallel to Clinton Creek in the next drainage basin to the west and both creeks face south. Marten Creek has excellent fish habitats and has flows similar in size to those of Clinton Creek near the mine site. Marten Creek has had and continues to have placer mining activity making it difficult to compare with Clinton Creek. This site should be considered during future investigations although it would be mandatory to contact the placer miner to discuss the location and timing of his mining activities before sampling at this site. Marten Creek was accessed on the placer miners road, strictly a four wheel drive access.

## **4.3 Clinton Creek Overview**

At present Clinton Creek appears to have a vibrant, stable and healthy fish population relative to other creeks of its size in the Yukon drainage and Clinton Creek has been recognized as an important rearing habitat for juvenile salmon. The relative importance of Clinton Creek to the surrounding ecosystem in terms of importance as fish habitat is difficult to accurately gauge without extensive scientific evaluation, however it should not be underestimated.

The whole of the Forty Mile River basin has been an important placer mining area since the late 1800's and most if not all of the tributaries have been impacted by placer activity. Many of the shallow gravel bars on the Forty Mile itself have likewise been impacted. This makes it impossible to accurately assess the pre-impact fisheries of the area but at present the Forty Mile is a known natal river to chinook salmon however with lower densities of adult salmon than many other large tributaries to the Yukon River.

Placer mining has the effect of (temporarily) altering fish species composition of small tributaries. Clinton Creek appears to have had less recent placer activity than the other tributaries investigated during this study and as such may mean that Clinton Creek plays a very important role as a rearing habitat for juvenile salmon. The role of the main stem of the Forty Mile in terms of juvenile salmon rearing has never been defined.

The dominant threat to fisheries in the Clinton Creek basin arises from the unstable waste rock that slumped in the 1970's creating Hudgeon Lake. A failure in the slump

would have dire consequences to the fish community downstream. At present Hudgeon Lake attenuates the flows of Clinton Creek, creating stable winter flows and less variation in thermal regimes, possibly enhancing the fishery potential of Clinton Creek. The constructed gabion channel has created a barrier to upstream fish migration.

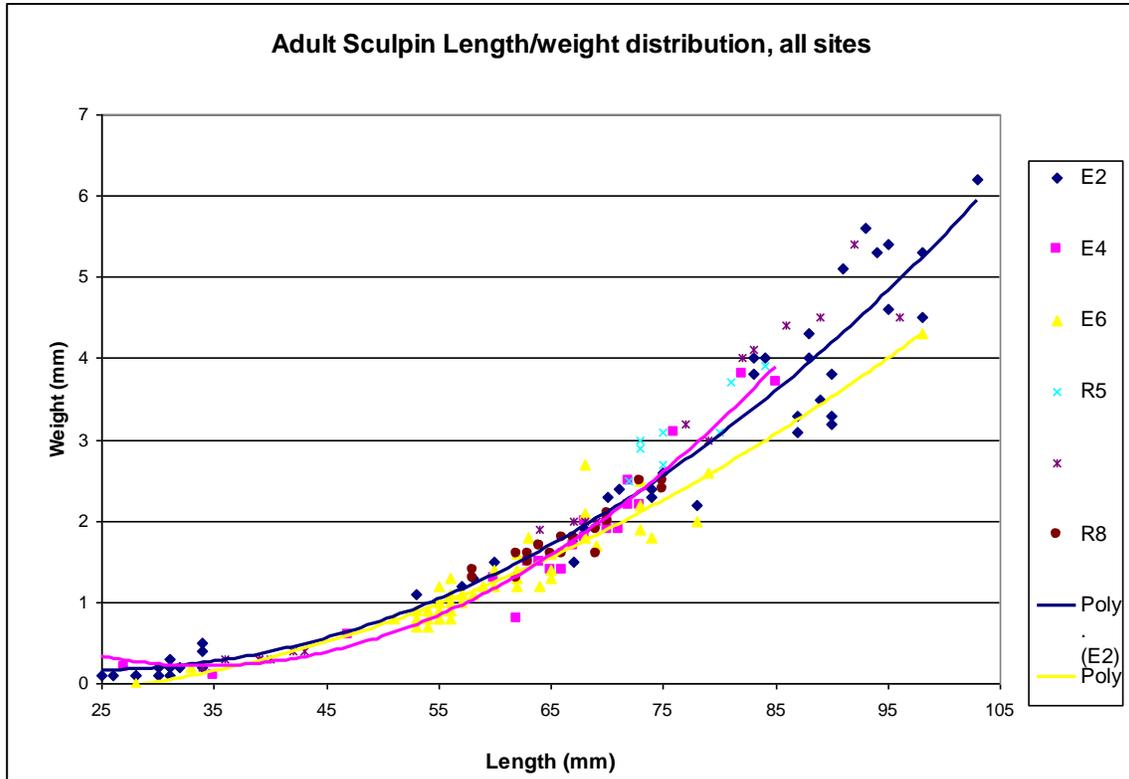


Figure 2: A comparison of slimy sculpin length weight relationships from all sites sampled during September, 2009 in the Clinton Creek area.

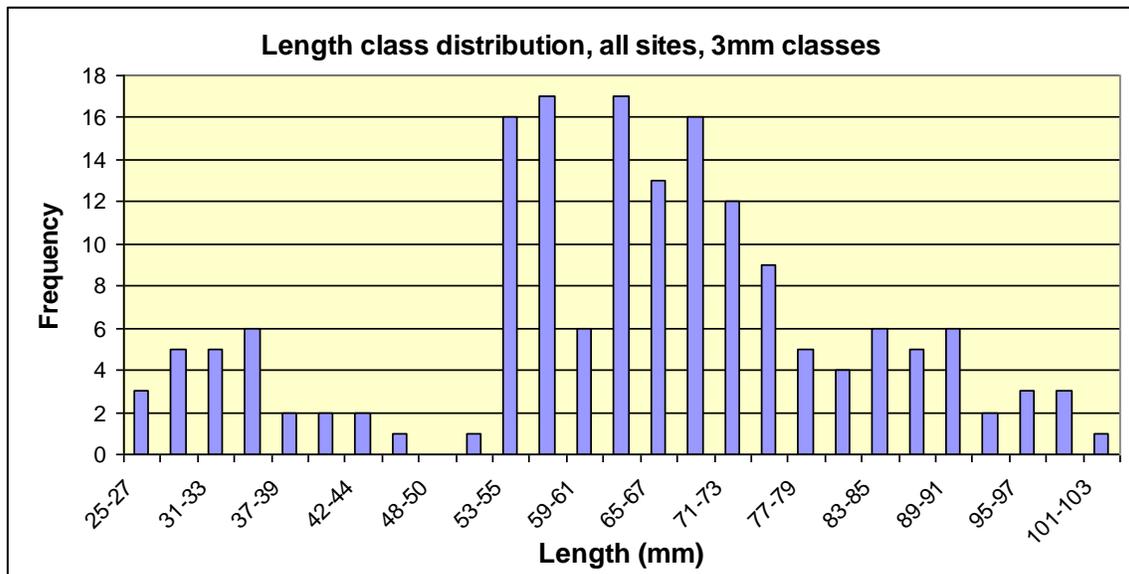


Figure 3: Combined length distribution for slimy sculpin from all areas sampled during September, 2009 in the Clinton area.

## 5.0 APPENDIX 1: Site Descriptions

### 5.1 SITE-E1 Clinton Creek, downstream of the gabion baskets

PARAMETER		UTM 0513080E/7147380N
<b>Site</b>	Survey Date (dd/mm/yr)	Sept. 8, 2009
	Site Elevation (ft)	1416'
	Aspect	East
	Site Survey Length (m)	140 m
<b>Channel</b>	Ave. Channel Width (m)	21.6m
	Ave. Wetted Width (m)	7.2m
	Ave. Bankfull Channel Depth (m)	No high water mark
	Ave. Residual Pool Depth (m)	0.47m
	Ave. Velocity	>1 m/sec
	Gradient (%)	4%
<b>Cover</b>	Cover Abundance	Trace
	Dominant Cover Type	Boulders
	Subdominant Cover Type	pools
	Other Cover Types Present	0
	% Crown Closure	0
	Left Bank Shape	Abrupt
	Texture	Bedrock
	Riparian Vegetation	Sparse willow
	Riparian Stage	immature
	Right Bank Shape	Abrupt
	Texture	Waste rock
	Riparian Vegetation	0
	Riparian Stage	n/a
	Instream Vegetation	algae
<b>Morphology</b>	Dominant Bed Material	Boulders
	Subdominant Bed Material	Cobbles
	D95 (cm)	80cm
	D (cm)	18cm
	Morphology	Gabions and step pools/ rapids
	Pattern	straight
	Islands	None
	Bars	none
	Confinement	100%

**WATER QUALITY:**

Date	pH	Temp (C)	Air temp (C)	Cond (uS/cm)	Visual color
Sept. 8, 09	8.33	11.9°	21°	470	Deep tannin stain



Figure 4: Clinton Creek at site E1 looking downstream from the gabions, September 8, 2009.



Figure 5: Clinton Creek site E1 looking upstream at the gabions, September 8. 2009. The pool the technician is standing in represents the uppermost location on Clinton Creek that fish were found.

## Site E2

### 5.2 Clinton Creek, upstream of Wolverine Creek

PARAMETER		UTM 0514181E/ 7147077N
<b>Site</b>	Survey Date (dd/mm/yr)	September 8, 2009
	Site Elevation (ft)	1,223'
	Aspect	East
	Site Survey Length (m)	185 m
	Ave. Channel Width (m)	11.0m
	Ave. Wetted Width (m)	5.7m
	Ave. Bankfull Pool Depth (m)	1.5m
	Ave. Residual Pool Depth (m)	0.86m
	Ave. Velocity	0.5 m/sec
	Gradient (%)	1.5%
<b>Cover</b>	Cover Abundance	30%
	Dominant Cover Type	Pools
	Subdominant Cover Type	Cut banks
	Other Cover Types Present	Willow root wads
	% Crown Closure	0
	Left Bank Shape	Abrupt to open
	Texture	Fine with LOD
	Riparian Vegetation	Alder/ willow
	Riparian Stage	immature
	Right Bank Shape	Abrupt to open
	Texture	Fine with LOD
	Riparian Vegetation	Alder willow some young spruce
	Riparian Stage	Immature
Instream Vegetation	none	
<b>Morphology</b>	Dominant Bed Material	Cobble
	Subdominant Bed Material	Gravel
	D95 (cm)	24cm
	D (cm)	14cm (flat x 2 cm)
	Morphology	Riffle pool/ functioning gravel
	Pattern	Modified by beavers
	Islands	Occasional
	Bars	Mid channel and side
	Confinement	none

**WATER QUALITY:**

Date	pH	Temp (C)	Air temp (C)	Cond (uS/cm)	Visual color
Sept 8, 09	8.23	12.1°	19.3°	550	Light tannin stain



Figure 6: Clinton Creek Site E2, upstream of Wolverine and Porcupine Creeks, September 9, 2009. The gravel bars are remnants of a large beaver dam that crossed Clinton Creek and contained the flow from Porcupine Creek. The dam likely washed out in spring of '09.



Figure 7: Porcupine Creek was dammed by beavers during the summer of 2009 at the confluence with Clinton Creek. The dam shown in the photo is only a secondary dam below the main dam and not the main dam. The flowing water is Clinton Creek.

### Site E3

#### 5.3 Wolverine Creek upstream of its confluence with Clinton Creek

PARAMETER		UTM 0514181E/ 7147077
<b>Site</b>	Survey Date (dd/mm/yr)	September 9, 2009
	Site Elevation (ft)	1230'
	Aspect	West
	Site Survey Length (m)	150m
<b>Channel</b>	Ave. Channel Width (m)	5.0m
	Ave. Wetted Width (m)	2.5m
	Ave. Bankfull Channel Depth (m)	Non-measurable
	Ave. Residual Pool Depth (m)	No pools
	% Pool/ Riffle/ Run	10 Pool/ 10 Riffle/ 80 Glide
	Ave. Velocity	<1m/sec
	Gradient (%)	1%
<b>Cover</b>	Cover Abundance	Trace
	Dominant Cover Type	LOD

	Subdominant Cover Type Other Cover Types Present % Crown Closure Left Bank Shape Texture Riparian Vegetation Riparian Stage Right Bank Shape Texture Riparian Vegetation Riparian Stage Instream Vegetation	None None 100% after 50m from road Gentle Sand Willow with spruce and birch Immature Gentle Sand Willow with spruce and birch Immature none
<b>Morphology</b>	Dominant Bed Material Subdominant Bed Material D95 (cm) D (cm) Morphology Pattern Islands Bars Confinement	Gravel cobble 6cm 6cm Riffle straight None None None

**WATER QUALITY:**

Date	pH	Temp (C)	Air temp (C)	Cond (uS/cm)	Visual color
Sept 9, 09	8.66	7.8°	17°	780	Light yellow tannin



Figure 8: Wolverine Creek immediately upstream of the road. Note the depositions of fines dropped out due to spring pooling upstream of the culverts. September 9, 2009.

## Site E4

### 5.4 Clinton Creek upstream of Eagle Creek

PARAMETER		UTM 0515939E/ 7145284N
<b>Site</b>	Survey Date (dd/mm/yr)	September 8, 2009
	Site Elevation (ft)	1159'
	Aspect	South East
	Site Survey Length (m)	200m
<b>Channel</b>	Ave. Channel Width (m)	7.7m
	Ave. Wetted Width (m)	6.4m
	Ave. Flood Pool Depth (m)	1.3m
	Ave. Residual Pool Depth (m)	0.55m
	% Pool, Riffle, Run	10 pool/20 riffle/ 60 glide/ 10 rapid
	Ave. Velocity	0.85 m/sec
Gradient (%)		1.5%
<b>Cover</b>	Cover Abundance	15%
	Dominant Cover Type	Boulders
	Subdominant Cover Type	Cut bank

	Other Cover Types Present % Crown Closure Left Bank Shape Texture Riparian Vegetation Riparian Stage Right Bank Shape Texture Riparian Vegetation Riparian Stage Instream Vegetation	Small pools 0 Sloped Fine Shrubs Mature Sloped Fine Shrubs Mature None
<b>Morphology</b>	Dominant Bed Material Subdominant Bed Material D95 (cm) D (cm) Morphology Pattern Islands Bars Confinement	Cobble Gravel 26cm 9cm Step pool/riffle glide Straight None None Partially entrenched

**WATER QUALITY:**

Date	pH	Temp (C)	Air Temp (C)	Cond (uS/cm)	Visual color
Sept.8, 09	8.14	8.5°	20°	860	Light tannin stain



Figure 9: Clinton Creek at site E4, 100 meters upstream of the confluence with Eagle Creek, Sept 8, 2009

## Site: R4 Eagle Creek

### 5.5 Upstream of Hanging Culvert

PARAMETER		UTM 0515939E/ 7145284N
<b>Site</b>	Survey Date (dd/mm/yr)	September 8, 2009
	Site Elevation (ft)	1171'
	Aspect	South East
	Site Survey Length (m)	200m
<b>Channel</b>	Ave. Channel Width (m)	2.5m
	Ave. Wetted Width (m)	1.5m
	Ave. Flood Pool Depth (m)	n/a
	Ave. Residual Pool Depth (m)	n/a
	% Pool/ Riffle/ Run	10 pool/ 70 glide/ 20 riffle
	Ave. Velocity	>0.5 m/sec

	Gradient (%)	>2%
	% pool/ riffle / run/ rapid	10 small pool/ 70 run/ 20 riffle
<b>Cover</b>	Cover Abundance	Trace
	Dominant Cover Type	Large woody debris
	Subdominant Cover Type	Small woody debris
	Other Cover Types Present	None
	% Crown Closure	60%
	Left Bank Shape	Vertical to 1.5 m
	Texture	Vegetated
	Riparian Vegetation	Sedges/willow/alder/ spruce
	Riparian Stage	Mature
	Right Bank Shape	Vertical to 1.5 m
	Texture	Vegetated
	Riparian Vegetation	Sedges/willow/alder/ spruce
	Riparian Stage	Mature
Instream Vegetation	none	
<b>Morphology</b>	Dominant Bed Material	Cobble
	Subdominant Bed Material	Gravel
	D95 (cm)	15cm
	D (cm)	12cm
	Morphology	riffle
	Pattern	Straight
	Islands	None
	Bars	None
	Confinement	entrenched

**WATER QUALITY:**

<b>Date</b>	<b>pH</b>	<b>Temp (C)</b>	<b>Air Temp (C)</b>	<b>Cond (uS/cm)</b>	<b>Visual color</b>
Sept. 9,09	8.52	4.5	15	510	Gin clear



Figure 10: Eagle Creek immediately upstream of the culvert at the Clinton mine site access road, September 8, 2009.



Figure 11: Eagle Creek entering Clinton Creek through the suspended culvert. September 8, 2009.

**SITE: E6**

**5.6 Clinton Creek At Town Site Ford**

<b>PARAMETER</b>		<b>UTM 0518539E/ 7142465N</b>
<b>Site</b>	Survey Date (dd/mm/yr)	September 10, 2009
	Site Elevation (ft)	1103'
	Site Survey Length (m)	300m
<b>Channel</b>	Ave. Channel Width (m)	10.15m
	Ave. Wetted Width (m)	6.39m
	Ave. Flood Pool Depth (m)	1.35
	Ave. Residual Pool Depth (m)	0.45
	% pool/ riffle/ run	10 pool/ 30 riffle/ 60 glide
	Ave. Velocity	0.5 m/sec
	Gradient (%)	1.5%
<b>Cover</b>	Cover Abundance	10%
	Dominant Cover Type	Loose cobbles
	Subdominant Cover Type	Undercut banks
	Other Cover Types Present	Debris piles
	% Crown Closure	5%
	Left Bank Shape	Flat
	Texture	Fine
	Riparian Vegetation	Willow/ alder with occ. Mat spruce
	Riparian Stage	mature
	Right Bank Shape	Vertical
	Texture	Fine with embedded sticks
	Riparian Vegetation	Willow/ alder with occ. Mat spruce
	Riparian Stage	Mature
Instream Vegetation	None	
<b>Morphology</b>	Dominant Bed Material	Gravel
	Subdominant Bed Material	Sand
	D95 (cm)	18cm
	D (cm)	12cm
	Morphology	Riffle pool/ functioning gravel
	Pattern	Gentle meanders
	Islands	None
	Bars	Point bars opposite riffles
	Confinement	Confined on R and open on L

**WATER QUALITY:**

Date	pH	Temp (C)	Air temp (C)	Cond (uS/cm)	Visual color
Sept 10, 09	8.15	8.7°	15°	830	Clear- light tannin



Figure 12: Looking downstream at Site E6, Clinton Creek at the town site ford. The ford follows the riffle line upstream of the old bridge abutments. September 10, 2009.

**Site R5**  
**5.7 Mickey Creek**

PARAMETER		UTM 0518822E/ 7140723N
<b>Site</b>	Survey Date (dd/mm/yr)	September 10, 2009
	Site Elevation (ft)	1030'
	Site Survey Length (m)	300m
<b>Channel</b>	Ave. Channel Width (m)	6.52m
	Ave. Wetted Width (m)	4.10m
	Ave. Flood Pool Depth (m)	1.19m
	Ave. Residual Pool Depth (m)	0.49m
	% Pool/ Riffle/ Run	10 pool/ 10 glide/ 80 riffle
	Ave. Velocity	0.5 m/sec
	Gradient (%)	2%
<b>Cover</b>	Cover Abundance	10%
	Dominant Cover Type	Undercut banks
	Subdominant Cover Type	Plunge pool
	Other Cover Types Present	Woody debris

	% Crown Closure	80%
	Left Bank Shape	Abrupt rise of 1 m
	Texture	Fine
	Riparian Vegetation	Willow/ alder/ poplar/ spruce
	Riparian Stage	Mature
	Right Bank Shape	Abrupt rise 2 m
	Texture	Coarse
	Riparian Vegetation	Willow/ alder/ poplar/ spruce
	Riparian Stage	Mature
	Instream Vegetation	None
<b>Morphology</b>	Dominant Bed Material	Cobble
	Subdominant Bed Material	Gravel
	D95 (cm)	18cm
	D (cm)	15cm
	Morphology	Riffle pool/ functioning gravel
	Pattern	Meandering
	Islands	Occasional
	Bars	Occasional point bar
Confinement	Mostly confined	

**WATER QUALITY:**

Date	pH	Temp (C)	Air temp (C)	Cond (uS/cm)	Visual color
Sept 10,09	8.01	5.1°	14.5°	310	Gin clear



Figure 13: Mickey Creek downstream of the culvert pool. September 11, 2009.

## Site R7

### 5.8 Maiden Creek

PARAMETER		UTM 0518333E/ 7139251N
<b>Site</b>	Survey Date (dd/mm/yr) Site Elevation (ft) Site Survey Length (m)	September 11, 2009 1095' 300m
<b>Channel</b>	Ave. Channel Width (m) Ave. Wetted Width (m) Ave. Flood Pool Depth (m) Ave. Residual Pool Depth (m) % pool, riffle, glide Ave. Velocity Gradient (%)	5.25m 3.40m 1.67m 0.47m <10 pool/ 10 glide/ 80 riffle 0.35 m/sec 2%
<b>Cover</b>	Cover Abundance Dominant Cover Type Subdominant Cover Type Other Cover Types Present % Crown Closure Left Bank Shape Texture Riparian Vegetation Riparian Stage Right Bank Shape Texture Riparian Vegetation Riparian Stage Instream Vegetation	30% Lg. woody debris Undercut banks Small plunge pools 30% Abrupt rise 2 to 3m Fines with woody debris Alder / willow/ spruce mature Abrupt rise 2 to 3m Fines with woody debris Alder / willow/ spruce mature None
<b>Morphology</b>	Dominant Bed Material Subdominant Bed Material D95 (cm) D (cm) Morphology Pattern Islands Bars	Cobble Gravel 28cm 14cm Step pool/ riffle pool Meandering None Occasional d/s of logs

Confinement	confined
-------------	----------

**WATER QUALITY:**

Date	pH	Temp (C)	Air Temp (C)	Cond (uS/cm)	Visual color
Sept 11, 09	7.90	4.2°	12°	320	Light tannin



Figure 14: Maiden Creek, September 11, 2009.

**Site R8**

**5.9 Marten Creek.**

PARAMETER		UTM: 0509095, 7136575 (WP87)
<b>Site</b>	Survey Date (dd/mm/yr)	11/9/09
	Site Elevation (ft)	1072'
	Aspect	South
	Site Survey Length (m)	230
<b>Channel</b>	Ave. Channel Width (m)	7.9
	Ave. Wetted Width (m)	6.2
	Ave. Bankfull Channel Depth (m)	18.6

	Ave. Residual Pool Depth (m)	Not sure which figures to take
	% pool/ riffle/ glide	5 sm. Pool/ 30 run/ 65 rapid
	Ave. Velocity	1.1 m/sec
	Gradient (%)	1%
<b>Cover</b>	Cover Abundance	80%
	Dominant Cover Type	Turbidity
	Subdominant Cover Type	LWD
	Other Cover Types Present	Abundant in-stream LOD
	% Crown Closure	10%
	Left Bank Shape	Abrupt (mined)
	Texture	Fine
	Riparian Vegetation	Birch, spruce, alder
	Riparian Stage	Mature
	Right Bank Shape	Abrupt (mined)
	Texture	Some bed rock
	Riparian Vegetation	Birch, spruce, alder
	Riparian Stage	Mature
	Instream Vegetation	none
<b>Morphology</b>	Dominant Bed Material	Cobble
	Subdominant Bed Material	Gravel
	D95 (cm)	28
	D (cm)	18
	Morphology	Rapid 10%, 5% pool, 30% run, 55% glide
	Pattern	Irregular wandering/straight
	Islands	none
	Bars	Side and point
	Confinement	Totally confined
	Stream flow	Moderate to low. Mined, mostly straight. Mostly riffle with some rapid caused by log jams.

**WATER QUALITY:**

Date	pH	Temp (C)	Air Temp (C)	Cond (uS/cm)	Visual color
Sept 11, 09	8.01	5.2	15		Tannin stain with high silt load



Figure 15: Sampling on Marten Creek, September 11, 2009



Figure 16: The largest corner pool on Marten Creek was at the edge of the placer mined area, September 11, 2009.