FOREST RESOURCE IMPROVEMENT ASSOCIATION OF ALBERTA (FRIAA)

1999 FRIAA FISH AND STREAM INVENTORY PROGRAM ANNUAL REPORT & SUMMARY

For

Weldwood of Canada Ltd. (Hinton Division)

And

Foothills Model Forest

By

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January 2000

Weldwood

foothills model forest
a growing understanding

Summary

The overall goal of this FRIAA program undertaken by the Foothills Model Forest was to continue to increase the knowledge of the fish and fish habitat within the Weldwood Forest Management Area. In 1999, this program including five separate projects, each with different objectives. The first project was the continuation of the operational fish and stream inventory. This project was intended to obtain fish information for forest development planning and was focused on streams identified by Weldwood forest planning staff. During the 1999 field season, a total of 80 operational inventory sites were surveyed. The second project was watershed based monitoring. The objectives of this project were to determine basin-wide fish distributions within smaller watersheds in the FMA and to provide a means for long-term monitoring. During the 1999 field season, a total of 120 sites were surveyed within six monitoring watersheds. The third project was stream channel classification. The objectives of this project were to complete stream channel classification at a small number of sites in order to evaluate a selected methodology. In 1999, stream classification was completed at 44 sites. The fourth project was the Solomon Creek watershed study. The objectives of this study were to define fish distributions and to determine the importance of seasonal fish migration into Solomon Creek from the Athabasca River. In 1999, a fish trap was set up in lower Solomon Creek during September and October and the movement of 152 fish was documented. The final project was a review of existing information on lakes and ponds within the Weldwood Forest Management Area. This information is required to determine the need for and a possible strategy of a fish inventory within waterbodies in the Weldwood Forest Management Area. In 1999, a summary of the distribution of waterbodies based on size and type was completed and sources of existing fisheries information were identified.

Acknowledgements

In 1999, this Foothills Model Forest project was funded primarily by the Forest Resource Improvement Association of Alberta (FRIAA), through Weldwood of Canada (Hinton Division) and the Alberta Fish Habitat Development Program through the Alberta Conservation Association. Additional funding and support was received from the Foothills Model Forest and the Hinton Fish and Game Association.

Staff members from Weldwood of Canada (Hinton Division) including, Rick Bonar and Chris Sptyz, provided direction, review of project design and support. George Sterling of Alberta Environment, Fisheries Management Division in Edson also helped to refine overall goals, develop specific methodologies and troubleshoot during the field season.

The Alberta Conservation Association provided funding for a second crew to join the FRIAA crew. Paul Hvenegaard, of the Alberta Conservation Association, Peace River, arranged the loan of a fish trap for the Solomon Creek project to the Foothills Model Forest. Chris Davis and Sheldon Kowalchuk of the Alberta Conservation Association in Edson also supported the program.

Jasper National Park provided an alternate electrofisher and block-nets.

The field crew that undertook the inventories included Jason Cooper, Mike Blackburn, and Chantelle Bambrick. Cameron Davis served a field crew leader.

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1. Introduction

This year-end report describes activities that were completed in 1999 with resources provided by Forest Resource Improvement Association of Alberta (FRIAA) through Weldwood of Canada (Hinton Division). The year 1999 represents the fifth year that the Foothills Model Forest has undertaken fish inventory and research work with funds available from FRIAA.

As in 1998, the scope of the work undertaken in 1999 was expanded beyond from that of the previous year. Prior to 1998, the focus of the program was an operational inventory of small streams within the Forest Management Area (FMA) managed by Weldwood of Canada (Hinton Division). In 1998, the program was expanded to include a watershed-wide assessment of fish and fish habitat within several watersheds in the FMA. In 1999, the scope of the work completed with funding from the Forest Resource Improvement Association of Alberta (FRIAA) included:

a) Site based operational inventory

b) Watershed based monitoring

c) Stream channel classification

d) Solomon Creek study

e) Lakes and ponds existing information review

The objectives, methods, results, and discussion for each of these individual projects are described in this report.

In addition to funds provided through FRIAA, additional funds for 1999 were provided by the Alberta Conservation Association, Fisheries Habitat Development Program (FHDP). The FHDP funds ($40,000) were used to employ a second field crew during the 1999 sampling season. Partner agencies (Weldwood of Canada, Natural Resources Service, and Alberta Conservation Association) agreed that these crews and projects should be run as a single project where applicable. Because of this, those data presented in this report are not the results of the FRIAA project exclusively, but are the result of a combined effort between both FRIAA and FHDP.

This annual report is intended to serve as an interim report that summarizes the findings from the 1999 field season. More detailed analyses of those data collected in 1999 will be presented in other reports including the Solomon Creek Atlas and the Stream Classification Summary.

1.1 Operational Inventory

Knowledge of fish species distributions and habitats is important during forest planning. This information can be applied while developing both compartment operating plans and long-term forest management plans. The objective of the operational inventory project was to continue to increase the knowledge of fish and fish habitats at specific sites within individual streams that were in areas proposed for development in the near future. These sites were identified by Weldwood staff and were distributed across the Weldwood FMA.

1.2 Monitoring Project

In addition to the site-based operational inventory project, a watershed-based monitoring project was initiated that focused inventory work on small watersheds (4^{th} and 5^{th} order), rather than at individual sites across the landscape. Within these individual watersheds, efforts were made to determine extent of species distributions throughout the entire stream network. The information was intended to provide a means to monitor changes in fish abundance and distribution within individual watersheds over time. Knowledge of basin wide distributions will also be useful for future forest planning.

1.3 Stream Channel Classification

An understanding of general stream channel characteristics can assist a variety of biological and forestry management activities. Grouping sections of similar stream channel based on physical characteristics is a logical first step to evaluating sediment movement, channel disturbance, fish distribution, or determining stream crossing placement and design. The objective of this study was to conduct a preliminary evaluation of an existing channel classification methodology for applications within the Weldwood Forest Management Area. The method chosen for evaluation was "A Classification of Natural Rivers" developed by Rosgen (1994).

1.4 Solomon Creek Study

A portion of the Solomon Creek watershed located within the Weldwood FMA has been identified for future forest development. This watershed has been the focus of several past and current fisheries investigations. In 1999, aquatic investigations undertaken by the FMF included:

a) description of upstream fish distribution including identification of upstream fish migration barriers

b) documenting fish migration movements into this watershed from the Athabasca River

The objective of the Solomon Creek study was to collect the above information for compilation into a comprehensive report to assist resource management activities in this basin. The information will be presented in a report titled "Solomon Creek Atlas," which will be ready for review before April 1, 2000.

1.5 Lakes and Ponds Existing Information Review

Within the province of Alberta, standards and guidelines have been established in order to protect streams and lakes during forest harvest (Alberta Environmental Protection 1994). The guidelines vary depending upon the recreational, waterfowl or sport fishing potential, as well as the size of the lake (Table 1).

Table 1. Summary of standards and guidelines for operating beside lakes (Alberta Environmental Protection 1994).

Watercourse Classification	Roads, Landings and Bared Areas	Watercourse Protective Buffers
Lakes with little or no recreation, waterfowl, or sport fishing potential.	Not permitted within 100 m of the high water mark without approval.	Lakes ≤ 16 ha in area: No buffer strip required.
		Lakes > 16 ha in area: 100 m buffer from high water line unless approved.
Lakes with recreation, waterfowl, or sport fishing potential.	Not permitted within 200 m of the high water mark without approval.	Lakes ≤ 4 ha in area: No buffer strip required.
		Lakes > 4 ha in area: 100 m buffer from high water line unless approved.

Although previous fisheries inventories have been conducted on waterbodies within the FMF, the findings have not been readily available for consideration during forest planning. Therefore, the objective of this review was to determine the state of existing fisheries knowledge regarding the lakes and ponds within the Weldwood FMA.

2. Methods

2.1 Operational Inventory

The fish inventory methods are consistent with those used in previous years and are described in

detail in the annual report for 1998 (Johnson and Spencer 1999). Methods specific to the 1999 inventory are described below.

2.1.1 Small Stream Inventory Sites

Staff from Weldwood of Canada (Hinton Division), identified high and low priority sites based on potential access development and forest harvesting plans.

The sampling season began on May 10, 1999 and ended on October 22, 1999. A two person crew, equipped with a four-wheel-drive truck and two all-terrain vehicles (ATV's) travelled to each site to complete the sampling.

2.1.2 River Electrofishing Inventory

Selected streams or rivers that were too wide or deep for the safe use of a backpack electrofisher were sampled using float electrofishing as a capture technique.

Staff from Weldwood of Canada (Hinton Division), identified high priority reaches within the large rivers. Sample site selection was based on proposed access development, forest harvest plans and existing information.

Sections of two different rivers were sampled during the 1999 field season. The Cardinal River was surveyed on September 2 and 3 while the McLeod River was surveyed on September 6 and 7.

2.1.3 Confirmation of Fish Absence

Within the Foothills Model Forest, use of streams by fish varies between seasons and years. In some small streams in the FMF, fish occur in low densities and only for a portion of the open water season and only during selected years. Therefore, although fish presence can often be confirmed on a single visit to a site, it is more difficult to establish fish absence.

Confirmation of fish absence has significant implications for road crossing design. If fish absence can be confirmed, fish passage is no longer a design criteria for the crossing. The present FMF protocol requires that a site be visited during two different seasons and two different years (three visits), before it can be designated as a fishless site. Therefore, it was important that several sites where no fish were captured during the 1998 field season were visited again during the 1999 field season. In the future, an analysis of habitat criteria from any confirmed fishless sites may be used to make a predictive model for designating fish presence or absence.

2.2 Monitoring Project

Whereas the operational inventory project focused on individual sites, the monitoring project used a watershed perspective. The selection of sample sites within each monitoring watershed was intended to cover a wide range of habitats and provide a means to evaluate changes in fish distribution and abundance in future years.

2.2.1 Selection of Monitoring Watersheds

In 1998, monitoring watersheds were Solomon Creek, Moon Creek, Tri-Creeks (Wampus, Deerlick, Eunice creeks) and MacKenzie Creek. All of these watersheds are located in the upper foothills and alpine natural sub-regions along the front ranges of the Rocky Mountains. In 1999, watersheds were selected to include the range of natural sub-regions within the Weldwood FMA. The 1999 monitoring watersheds included Anderson Creek, Fish Creek, Lynx Creek, Solomon Creek, Tri-Creeks and the upper Erith River (including Halpenny Creek). Fish Creek, Lynx Creek and the upper Erith River are located entirely within the upper and lower foothills natural sub-regions.

2.2.2 Selection of Sites within Monitoring Watersheds

A total of 120 sample visits were made to the six different monitoring watersheds.

2.3 Stream Channel Classification

During the week of September 20, 1999 field crews were trained in proper field techniques for gathering criteria used to conduct Stream Channel Classification (Level 2). These methods are clearly described in Field Guide for Stream Classification prepared by Rosgen and Lee (1998). The primary delineative criteria for the major stream types and the classification key for natural rivers (Rosgen and Lee 1998) are included in Appendix 2. Stream classification was completed at 44 sites between September 24 and October 22, 1999.

2.4 Solomon Creek Study

2.4.1 Fish Distribution and Identification of Fish Migration Barriers

Sampling was undertaken in order to define the extent of upstream fish distribution within known fish bearing streams in the Solomon Creek watershed. ATV's were used to access headwater

sites within the West Solomon Creek drainage. On September 28, 1999 a helicopter was used to access a single sample site in the headwaters of Solomon Creek.

During an overview helicopter flight of the Solomon Creek watershed on August 26, 1999 all potential natural fish migration barriers within the mainstem and fish-bearing tributaries were described. Potential barriers included bedrock chutes, waterfalls, and sections of de-watered channel. Barrier locations were recorded using a GPS. Barriers were photographed and documented.

2.4.2 Seasonal Fish Migration

A fish trap was installed in lower Solomon Creek in order to determine the importance of Solomon Creek as a spawning stream for bull trout and mountain whitefish from the Athabasca River. The trap was installed on the lower reach of Solomon Creek on August 24 and 25, 1999. The trap was operated from August 25 until October 8, 1999 when it was removed. The trap was obtained on loan from the Peace River office of the Alberta Conservation Association. The fence was configured to capture upstream and downstream migrating fish in separate traps.

Signs developed by Lisa Risvold, FMF Communications, were posted on site in order to educate the public regarding the operation of the trap.

During the first month when several fish were captured each day, a daily inspection of the trap was conducted. During the second month of operation, when fish movements were very limited, efforts were made to inspect the trap every second day.

The trap was located in an area frequently visited by younger residents from Brule and during the first week of operation, some minor vandalism occurred at the trap. In order to reduce vandalism, a resident from the town of Brule, 15 year-old Chase Bohning, was offered a volunteer position as the trap guardian. Chase accepted the volunteer position and made regular inspections of the site. He assisted with trap maintenance, fish capture and vandalism prevention.

Periodic electrofishing was undertaken to ensure that any bull trout that were holding upstream from the trap were enumerated.

Daily staff gauge readings of water levels were completed in two locations:

1. in Solomon Creek immediately downstream from the Brule Road bridge over Solomon Creek. In order to associate water level and stream flow, discharge measurements were completed on three different occasions that represented a range of flow conditions.

2. in Solomon Creek on the downstream side of the fence situated at the most downstream location. The water level at the lower fence was located in an area back-watered by the Athabasca River during high flows.

2.5 Lakes and Ponds Existing Information Review

The review included both a geographic analysis of all waterbodies within the Weldwood FMA and a review of the fisheries information available for these waterbodies.

In the geographic review, a descriptive table of all waterbodies within the Weldwood FMA was produced with outputs from ArcView 3.1 (ESRI 1999). To produce the table, a map was generated using current government of Alberta digital geographic data. The data used for this analysis were obtained from the provincial base features database on November 1999. The digital information on lakes and streams was titled "corrected single line hydrography." In addition to location of geographic features, the single line hydrography provided information for each waterbody in table format including:

a) area (m^2) and perimeter (m).

b) waterbody type (perennial boundary, intermittent boundary, reservoir).

This information was used to generate a table that grouped waterbodies based on size and type. Any lakes that were completely outside the boundary for the Weldwood FMA were excluded for this analysis.

The second component of this project included a preliminary review of the status, location and availability of previous lake inventory information. The review was completed in consultation with NRS staff from both the Hinton and Edson offices.

3. Results

3.1 Operational Inventory

3.1.1 Small Stream Inventory Sites

Weldwood staff identified a number sites where fish presence/absence information was required for forest development planning. A total 80 operational inventory sites were visited (Table 2). Fish were captured at 50% of the sites surveyed (Table 2).

Table 2. Summary of the number of sites completed and number of fish captured by site type during the 1999 field season.

Site Type	Number of sites	Number of fish
Operational Inventory	76	311
Operational / Erith monitoring	4	28
Total	**80**	**339**
"No fish captured" sites	40 (50%)	0

The sites were designated as first or second priority for inventory for the north and south regions of the FMA. Most of the first and a portion of the second priority sites within the north half of the FMA were inventoried. A portion of the first and second priority sites were completed in the south half of the FMA and some follow-up sampling is required to complete the existing list (Appendix 1).

A total of 10 different species of fish were captured during the operational inventory of small streams (Table 3). Rainbow trout were the most common fish captured, followed by brook trout and bull trout (Table 3).

Table 3. Summary of the number of fish captured by species during operational inventory of small streams.

Species	Number	Percentage of Total Catch
arctic grayling	1	0.3
brook trout	26	7.9
bull trout	13	4.0
burbot	9	2.7
cutthroat	5	1.5
finescale dace	3	0.9
mountain whitefish	8	2.4
rainbow trout	258	78.4
spoonhead sculpin	4	1.2
trout perch	2	0.6
Total	339	100.0

3.1.2 River Electrofishing Inventory

Sections of the McLeod River and the Cardinal River were surveyed using float electrofishing. A total of eight different species of fish were captured. (Table 4) Mountain whitefish, rainbow trout and bull trout were the most common fish captured (Table 4).

Table 4. Summary of the number of fish captured by species during float electrofishing of the McLeod and Cardinal rivers.

Species	Number	Percent
brook trout	17	1.9
bull trout	37	4.1
burbot	1	0.1
cutthroat trout	4	0.4
longnose sucker	14	1.6
mountain whitefish	775	86.1
rainbow trout	51	5.7
spoonhead sculpin	1	0.1
Total	900	100.0

3.1.3 Confirmation of Fish Absence

In order to confirm fish absence at a particular location, follow-up sampling was conducted at 30 sites where fish had not been captured during previous visits (Table 5). During the subsequent visits, fish were captured at two sites (Table 5).

Table 5. Summary of findings from follow-up sampling of "no fish captured' sites.

Site Type	Number of sites Surveyed	Number of "no fish captured" sites with fish captured on follow-up surveys	Number of fish captured on follow-up surveys
"No fish captured" on previous survey	30	2	Site 99013 = 17 Site 99180 = 1

3.2 Monitoring Project

3.2.1 Selection and Description of Monitoring Watersheds

A total of 120 visits were made to various sites in the six monitoring watersheds (Table 6). The number of surveys for most of the watersheds, other than Solomon Creek, varied between 19 and 28 (Table 6).

Table 6. Summary of sample site distribution within the six monitoring watersheds.

Watershed	Number of visits	Percent of Monitoring sites	Percent of total sites for 1999
Anderson Creek	28	23.33	12.23
Fish Creek	22	18.33	9.61
Lynx Creek	22	18.33	9.61
Solomon Creek	9	7.50	3.93
Tri-Creeks	19	15.83	8.30
Upper Erith River*	20	16.67	8.73
	120	100.00	52.40

* Four of these sites are also operational inventory

A review of the distribution of monitoring and inventory sites within the five Working Circles within the Weldwood FMA indicates that most of the work completed in 1999 occurred in the Embarras, McLeod and Athabasca Working Circles (Table 7). A total of nine of the sites were located outside of the FMA (Table 7).

Table 7. Summary of sample site distribution within the Weldwood Working Circles.

Working Circle	Number of Sites Surveyed	Number of fish Captured
Athabasca	46	367
Berland	15	48
Embarras	76	702
Marlboro	28	425
McLeod	55	2120
Outside FMA	9	205
Total	229	3867

Of the nine sites located outside of the Weldwood FMA, four were located in the Solomon Creek watershed (Forest Management Unit 4). The remaining five sites were located in Fish Creek and Hardisty Creek watersheds (Forest Management Unit 9).

A total of 12 different species of fish were captured at the 120 backpack monitoring sites (Table 8). Rainbow trout, mountain whitefish and brook trout were the most common fish captured (Table 8).

Table 8. Summary of fish captured at the 120 backpack monitoring sites.

Species	Number	Percent
arctic grayling	2	0.1
brook trout	248	9.4
bull trout	143	5.4
burbot	44	1.7
longnose dace	2	0.1
longnose sucker	21	0.8
mountain whitefish	88	3.3
pearl dace	2	0.1
rainbow trout	2066	78.3
spoonhead sculpin	17	0.6
trout perch	3	0.1
white sucker	2	0.1
Total	2638	100.0

3.3 Stream Channel Classification

Stream channel classification was undertaken at a total of 44 sites. The field measurements, stream type and representative photographs from each of these sites are presented in Appendix 2.

3.4 Solomon Creek Study

The findings from this study will be presented in the Solomon Creek Atlas report. Selected findings of potential importance to forest management are discussed in the following sections.

3.4.1 Fish Distribution and Identification of Fish Migration Barriers

During backpack electrofishing, bull trout populations were identified in two separate areas within the Solomon Creek watershed. The first population inhabits West Solomon Creek basin, including the lower reaches of Sheba Creek. A large portion of the West Solomon Creek basin is located within the Athabasca 4 compartment, which is currently undergoing forest development planning. The second population is located within the mainstem of Solomon Creek in the most northern portion of the watershed. This population inhabits an area outside the Athabasca 4 compartment, but inside the Weldwood FMA. Although natural migration barriers were located within the watershed, they do not serve to physically isolate either of these two populations from downstream areas of the watershed.

3.4.2 Seasonal Fish Migration from the Athabasca River

A total of 152 fish from six different species were captured using various methods at the study site (Table 9). A total of 60 of the fish that were captured were tagged using uniquely numbered floy tags from Edson Fish and Wildlife. The high number of recaptures of tagged longnose sucker and rainbow trout indicate that the individuals sampled were likely inhabiting the stream in the vicinity of the trap and not undergoing migration at the time of the study.

Table 9. Summary of number of fish captured by species and capture method at the lower Solomon Creek study site.

Fish Species	Number of individual fish captured by various methods *				
	Trapped Downstream	Trapped Upstream	Electrofished	Angled	Total Capture
Brook trout	4		15		19
Bull trout	3		5 (6,1)		8 (9,1)
Burbot	2				2
Longnose sucker		2 (3,1)	0 (1,1)		2 (4,2)
Mountain whitefish	86		33		119
Rainbow trout	1 (3,2)		0 (1,1)	1	2 (5,3)
Total Capture	96 (98,2)	2 (3,1)	53 (56,3)	1	152 (158,6)

*(total catch, number of recaptures)

Mountain whitefish formed the majority of the catch in the downstream movement trap, with incidental numbers of bull trout and rainbow trout also captured between August 27 and October 28 (Figure 1). Most mountain whitefish migrated out of Solomon Creek and into the Athabasca River between September 4 and 18, 1999 (Figure 1).

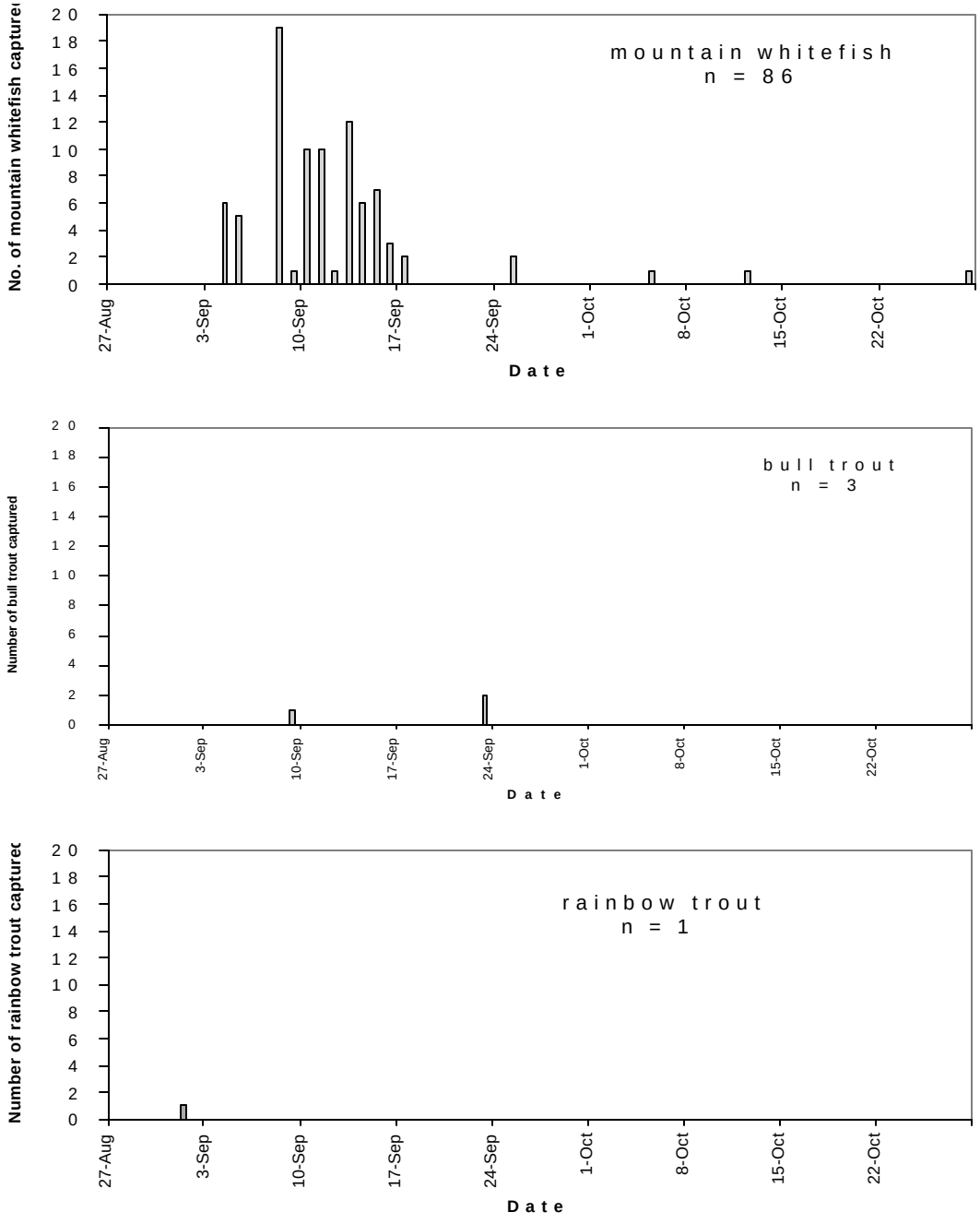

Figure 1. Downstream movement of mountain whitefish, bull trout and rainbow trout in Solomon Creek near the mouth from August 27 to October 28, 1999.

In a study of mountain whitefish in the nearby McLeod River, the majority of fish sampled greater than or equal to 234 mm were mature (Walker et. al. 1996). Based on this size differentiation, the group of mountain whitefish that were moving downstream included both juveniles and adults (Figure 2). Although the histogram shows very few fish less than 160 mm in length, this is likely because the trap cannot effectively contain small fish (<150 mm). Smaller mountain whitefish were observed swimming within the trap, but because of their size, they were able to escape. Juvenile mountain whitefish were also captured during electrofishing.

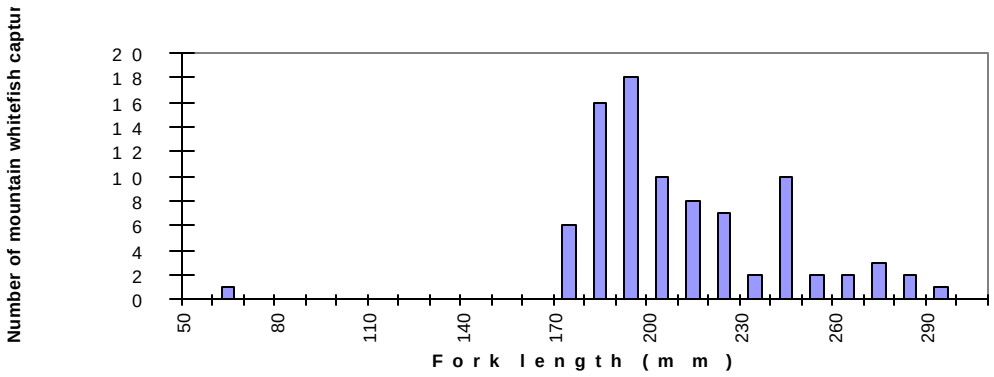

Figure 2. Size distribution of mountain whitefish captured in during downstream migration in lower Solomon Creek.

Bull trout have a variety of life history patterns based on migratory behavior (McCart 1997). Growth and size at maturity vary amoung these life history patterns (McCart 1990). Two distinct types of bull trout that may inhabit the Solomon Creek include the fluvial (migratory) bull trout and resident (non-migratory) bull trout. Fluvial bull trout migrate from large rivers to spawn and rear in smaller tributary streams, while resident bull trout inhabit smaller tributary streams for their entire life cycle (McCart 1997). Mature bull trout from fluvial populations in the Muskeg, Berland and McLeod River basins range in size from 275 – 550 mm for males and 350 – 494 mm for females. Fish from resident populations mature at smaller sizes and few fish grow to exceed 300 mm (Reiman and McIntyre 1993). Males from small headwater streams in the Athabasca River watershed mature between 200 and 300 mm (Hunt et.al. 1997). Therefore for the purposes of this report, juvenile bull trout were considered to be any fish less than 200 mm. Based on size class, the bull trout that were moving downstream may have been juvenile migratory fish and likely did not move into Solomon Creek for spawning purposes (Figure 3).

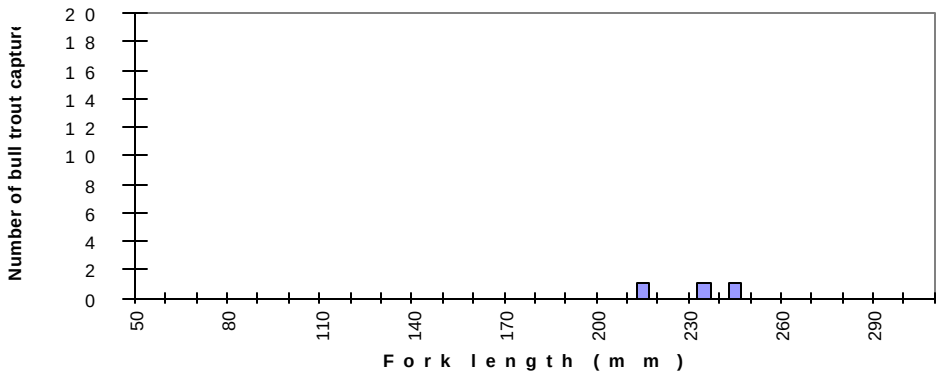

Figure 3. Size distribution of bull trout captured during downstream migration in lower Solomon Creek.

3.5 Lakes and Ponds Existing Information Review

A total of 636 unique lakes were identified within the Weldwood FMA (Table 10). Of these lakes, 81% were 4 ha or less in area (Table 10), and therefore protective buffer strips are not required around their perimeter (Alberta Environmental Protection 1994). Fifteen percent of the lakes were between 4 ha and 16 ha (Table 10), and may be afforded protective buffers depending upon the fish, waterfowl and recreation resources (Table 10). A total of 4% of the lakes exceeded 16 ha in area (Table 10) and the guidelines require 100 m protective buffers (Alberta Environmental Protection 1994).

Table 10. Summary of waterbody characteristics by type and size

Waterbody Area	Perennial (# of lakes)	Intermittent (# of lakes)	Reservoir (# of lakes)	Total (# of lakes)
≤ 4 ha	185	323	5	513 (81 %)
> 4 ha ≤ 16 ha	72	26	0	98 (15 %)
> 16 ha	19	6	0	25 (4%)
Total Number	276 (43%)	355 (56%)	5 (1%)	636

The second part of the information review included discussions with the NRS staff at the both the Hinton and Edson offices. In 1994, Rudy Hawryluk, Fisheries Biologist with the Hinton NRS, was involved in a review of all lakes that support bull trout within Alberta's Fish Management Area Four (Hunt et. al. 1997). Weldwood's FMA is located entirely within this fisheries management area. Of the more than 400 lakes reviewed in Area 4, approximately 120 were found to support naturally reproducing or stocked fish populations (Hunt et.al. 1997). Bull trout have

been reported in 17 of these lakes (Hunt et. al. 1997). Of these 17 bull trout lakes, 11 are located within the boundaries of the Foothills Model Forest and one of these lakes is located within the Weldwood FMA (Table 11).

Table 11. Bull trout lakes and their locations within the Foothills Model Forest.

Name of Lake	Legal Land Description (unnamed lakes only)	Jurisdiction within the Foothills Model Forest			
		Weldwood FMA	Willmore Wilderness Area	Jasper National Park	Forest Management Unit
Busby					FMU E4
Flapjack		x			
Lac des Roche					FMU E4
Mystery					FMW E4
Ptarmigan				x	
Rock					FMU E4
Ruby					FMU E11
Unnamed (Clear)	(23-55-12-6)		x		
Unnamed (Marie)	(7-52-6-6)		x		
Unnamed (Saracen)	(8-43-20-5)				FMU E11
Unnamed (Bell's)	(4 of 26-55-6-6)		x		

At the time of writing, additional information on the 120 fish bearing lakes, including lake stocking records, were on file at the NRS regional office in Edson and staff were in the process of inputting the information into a GIS (Sterling pers. comm. 2000). This information should be available prior to the 2000 field season.

4. Discussion

4.1 Operational Inventory

A total of 50% of the operational inventory sites surveyed were designated as “no fish captured” sites. Although several of these sites may be found to support fish on future visits, the majority will likely be classified as fishless sites. In order to improve the use of the limited field resources, it may be worthwhile to develop a predictive model for identifying streams that have a very low probability of supporting fish. During the summer, field staff found that before they visited a site they were often able to make an accurate prediction on whether or not fish would be captured at a

particular site. The prediction was based on general knowledge of site location and also considered site physical factors including upstream drainage area, stream order and proximity to muskeg topography. This anecdotal information indicates that it may be worthwhile to attempt to develop a mathematical model for identifying sites that have a very low probability of supporting fish. This would enable future surveyors to focus their limited resources on streams that have a higher probability of supporting fish.

4.2 Monitoring Project

Completing thorough inventories of the smaller watersheds within the Weldwood FMA provides two valuable benefits. First, more can be learned about watershed-wide fish distribution within individual basins. This knowledge may be useful for forest planning and also for understanding individual species distributions across the landscape. Secondly, this information can provide a means to monitor changes in species distributions over time.

4.3 Stream Channel Classification

Stream channel classification is often the first step into more detailed investigations. The utility of a particular classification system may become apparent once the findings of the investigation are used to answer some basic questions. We are recommending two changes to the Classification of Natural Rivers methodology (Rosgen 1994), in order to improve interpretation for fish and forestry applications.

First, the methodology of the Classification of Natural Rivers (Rosgen 1994) and the classification of Watercourse Classification described in the Alberta Timber Harvest Planning and operational Ground Rules (Alberta Lands and Forest Services 1994), should be merged in order to meet a wider range of needs. The Classification of Natural Rivers provides a methodology that is very useful for describing the permanent streams on the landscape in a high level of detail. The classification system has proved useful for sediment delivery studies, as well as biological investigations in western North America. However, this system can not be used on watercourses that lack well defined channels and floodplains, such as ephemeral and intermittent streams. On a watershed scale, the blue lines that represent ephemeral and intermittent streams may represent a significant proportion of the total length of watercourses and these streams must be classified in order to comply with the Alberta Timber Harvest Planning and Operational Ground Rules. Therefore, during the exercise of stream classification, it may be prudent to complete the provincial Watercourse Classification concurrently with the Classification of Natural Rivers.

The second suggested change to the current application is to shift from a site based application to a watershed based classification. During a watershed classification, based on map and air photo interpretation, the stream network is divided into segments with similar characteristics, called stream reaches. Information collected at any individual site can then be applied to all areas within the given stream reach.

These two changes will be applied during the production of the Solomon Creek watershed atlas.

4.4 Solomon Creek Study

4.4.1 Fish Distribution and Identification of Fish Migration Barriers

Some follow-up sampling within the West Solomon Creek basin is recommended in order to confirm upstream fish distribution. In Sheba Creek, the lowest kilometre of this stream has a very high abundance of juvenile fish. However, fish were absent upstream from the 1 km mark. This absence beyond the 1 km mark cannot be explained by presence of a fish migration barrier. Therefore re-sampling in the upstream reaches is recommended during the 2000 field season to confirm fish absence.

4.4.2 Seasonal Fish Migration from the Athabasca River

This study indicates that in 1999, Solomon Creek was not an important spawning stream for bull trout from the Athabasca River. In addition, although several mature mountain whitefish were captured in the stream, the wide size distribution of mountain whitefish indicates that mountain whitefish may be using Solomon Creek for purposes other than spawning. During the summer glacial run-off period, the Athabasca River is typically high and very turbid. During the fall, as glacial runoff decreases, water clarity also improves. In comparison, baseflow conditions occur in Solomon Creek following the spring and early summer snow-melt period. Therefore, for the summer months, Solomon Creek may offer improved feeding conditions for mountain whitefish. During the fall, as mountain whitefish begin to move towards over-wintering areas, the improved water clarity in the Athabasca River may offer improved feeding conditions.

4.5 Lakes and Ponds Existing Information Review

The objective of this review was to identify the need for fish inventories within lakes and ponds in the Weldwood FMA. Additional information should be forthcoming before the upcoming field season. In order to ensure that Weldwood has the information to comply with the current

provincial operating ground rules and to promote the efficient use of limited field resources, future surveys should focus on lakes:

1. without previous inventory information.
2. located in areas proposed for forest development.
3. with areas between 4 and 16 ha.

Other waterbodies may be considered for inventory, however they would likely be a lower priority.

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Appendix 1. List of incomplete sample sites from South FMA.

Weldwood Site ID	Working Circle	Compartment	Priority	Easting	Northing	Comments
21	Embarras	11	1	508324	5889802	no access
27	Embarras	11	1	512493	5886499	no access
20	Embarras	11	2	506577	5890975	
96	Embarras	12	1	507573	5889668	no access
114	Embarras	12	1	495743	5890888	intermittent stream
84	Embarras	12	2	505951	5881112	found dead BKTR under ice
85	Embarras	12	2	507577	5882496	intermittent stream
86	Embarras	12	2	507746	5882196	
87	Embarras	12	2	509859	5882327	intermittent stream
89	Embarras	12	2	507577	5884410	
90	Embarras	12	2	506658	5884875	
94	Embarras	12	2	506489	5887098	
97	Embarras	12	2	501887	5893180	intermittent stream
99	Embarras	12	2	499796	5892712	
101	Embarras	12	2	503190	5890888	
102	Embarras	12	2	501883	5889228	
103	Embarras	12	2	502460	5888749	
104	Embarras	12	2	503011	5888329	
105	Embarras	12	2	503247	5888123	
107	Embarras	12	2	503224	5887868	
109	Embarras	12	2	503943	588217	
110	Embarras	12	2	503408	5888719	
111	Embarras	12	2	500849	5889258	
112	Embarras	12	2	498586	5890075	
113	Embarras	12	2	497987	5890528	fish downstream (96139)
119	Embarras	12	2	500381	5886557	
121	Embarras	12	2	500609	5886366	
122	Embarras	12	2	501156	5885913	
123	Embarras	12	2	501523	5885598	
124	Embarras	12	2	501827	5885253	
125	Embarras	12	2	502003	5885160	
126	Embarras	12	2	502194	5885029	
127	Embarras	12	2	502471	5884939	
128	Embarras	12	2	502040	5886111	
12	Embarras	14	2	504905	5872704	intermittent stream
82	Embarras	18	1	509526	5848230	fish upstream (97104)
133	Embarras	18	1	507003	5851600	intermittent stream
134	Embarras	18	1	pond	pond	gill netted, large pond, winter O_2 test
50	Embarras	20	2	490843	5876429	
51	Embarras	20	2	491076	5877375	
54	Embarras	20	2	492144	5880829	
55	Embarras	20	2	489610	5881245	
59	Embarras	20	2	496773	5877375	

Weldwood Site ID	Working Circle	Compartment	Priority	Easting	Northing	Comments
60	Embarras	20	2	495909	5876450	
41	Embarras	21	1	486782	5875925	fish downstream (98069,98230)
42	Embarras	21	2	489840	5870080	same as 98090
43	Embarras	21	2	490248	5871645	same as 98091
34	Embarras	22	1	503660	5867445	
73	Embarras	22	1	505472	5869144	
35	Embarras	22	2	497748	5869002	
36	Embarras	22	2	498120	5868795	
37	Embarras	22	2	499333	5867968	
69	Embarras	22	2	508238	5859623	
71	Embarras	22	2	505304	5865946	fish downstream (96098)
72	Embarras	22	2	506935	5868351	fish upstream (96098)
74	Embarras	22	2	500013	5867317	
75	Embarras	22	2	501826	5863076	
76	Embarras	22	2	498186	5864180	
66	McLeod	8	1	457718	5901235	no access
65	McLeod	8	2	457155	5901459	
67	McLeod	8	2	458310	5900958	

Appendix 2. Excerpts from the field guide for stream classification

(Rosgen and Lee 1998).

Appendix 3. Description and photographs of streams classified during the 1999 field season.

Site ID	Stream Name	Easting Northing	Survey Date	Bankfull Width (m) **Wbkf**	Floodprone Area (m) **Wfpa**	Mean Slope (%)	Entrenchment Ratio (**Wfpa / Wbkf**)	Width / Depth Ratio (**Wbkf/dbkf**)	Channel Sinuosity	Channel Materials D50 mm	Crew	Stream Type	Best site photo
99178	Anderson Ck	474862 5907907	24-Sep-99	4.40	7.80	1.5	1.77	10.39	Moderate	Gravel	Cooper Mcleary	B4c	99178-1
99180	Unnamed Ck	435365 5957368	27-Sep-99	6.50	39.00	0.3	6.00	6.77	Moderate	Fines	Blackburn Cooper	E5	99180-2
99181	Unnamed Ck	426277 5950259	27-Sep-99	1.90	100.00	0.5	52.63	1.62	High	Fines	Cooper Blackburn	E6	99181
99182	Unnamed Ck	500283 5965897	28-Sep-99	3.60	21.30	1.0	5.92	7.15	Moderate	Cobble	Cooper Fourny Davis	C3	99182-1
99183	Lynx Ck	500196 5965829	28-Sep-99	5.80	36.20	1.0	6.24	6.52	Moderate	Cobble	Davis Fourny Cooper	C3	99183-1
99184	Solomon Ck	432193 5920576	28-Sep-99	11.90	14.30	1.8	1.20	9.39	Low	Boulder	Blackburn McCleary	G2	99184-1
99185	Unnamed Ck	454381 5944124	27-Sep-99	2.80	19.20	1.5	6.86	3.46	Moderate		McCleary Davis	E3	99185-1
99186	Unnamed Ck	453551 5943716	29-Sep-99	1.50	14.80	2.0	9.87	2.59	Moderate	Gravel	Davis Fourny	C4	99186-1
99187	Unnamed Ck	446377 5933518	29-Sep-99	1.70	10.80	1.5	6.35	3.72	Moderate	Cobble	Davis Fourny	C3	99187-1
99188	Unnamed Ck	509281 5956319	29-Sep-99	0.80	4.40	4.2	5.50	2.76	Moderate	Cobble	Blackburn Cooper	B5c	99188
99189	Lynx Ck	500158 5960531	29-Sep-99	2.50	13.00	2.7	5.20	4.41	Moderate	Cobble	Cooper Blackburn	C3b	no photo
99190	Embarras River	507253 5905704	30-Sep-99								Davis Fourny	E6	99190-2

Site ID	Stream Name	Easting Northing	Survey Date	Bankfull Width (m) **Wbkf**	Floodprone Area (m) **Wfpa**	Mean Slope (%)	Entrenchment Ratio (**Wfpa / Wbkf**)	Width / Depth Ratio (**Wbkf/dbkf**)	Channel Sinuosity	Channel Materials D50 mm	Crew	Stream Type	Best site photo
99191	Unnamed Ck	479428 5906155	30-Sep-99	2.30	17.20	0.7	7.48	3.69	Moderate	Gravel	Davis Fourny	E4	99191-2
99193	Anderson Ck	470702 5906999	30-Sep-99	4.20	10.10	1.8	2.40	8.13	Moderate	Cobble	Cooper Blackburn	B3c	99193-5
99194	Unnamed Ck	472289 5908506	30-Sep-99	1.40	16.70	0.7	11.93	1.69	Moderate	Cobble	Blackburn Cooper	E3	99194-2
99195	Halpenny Ck	515750 5886353	01-Oct-99	5.40	18.20	0.7	3.37	6.67	Moderate	Gravel	Cooper Davis Blackburn	C4c	99195-1
99196	Bacon Ck	513164 5886914	02-Oct-99	5.10	8.50	2.5	1.67	9.05	Low	Gravel	Blackburn Cooper	A4	99196-1
99197	Erith River	509035 5892030	02-Oct-99	8.10	8.60	0.3	1.06	8.68	Moderate		Cooper Blackburn	G5c	99197-1
99198	Unnamed Ck	480622 5963479	03-Oct-99	1.10	3.10	2.5	2.82	2.70	Moderate	Fines	Davis Cooper Blackburn	E6	no photo
99199	Unnamed Ck	482115 5948823	03-Oct-99	1.00	2.10	0.5	2.10	3.33	Low	Fines	Davis Blackburn Cooper	E6	no photo
99200	Unnamed Ck	501006 5887300	04-Oct-99						Moderate		Cooper Blackburn	E6	99200
99201	Unnamed Ck	499696 5887139	04-Oct-99	0.90	2.60	4.3	2.89	2.29		Fines	Blackburn Cooper	E5b	99201-1
99202	Unnamed Ck	505359 5861298	05-Oct-99	1.10	36.20	1.0	32.91	1.92	Low	Fines	Davis Bambrick	E6	99202-1
99203	Grave Ck	505392 5859369	05-Oct-99	31.00	103.00	2.0	3.32	24.47	Low	Cobble	Davis Bambrick	C3	99203-2
99204	Embarras River	500501 5887721	05-Oct-99	4.80	7.80	0.5	1.63	8.23	Moderate	Cobble	Cooper Blackburn	G3c	99204-2

Site ID	Stream Name	Easting Northing	Survey Date	Bankfull Width (m) **Wbkf**	Floodprone Area (m) **Wfpa**	Mean Slope (%)	Entrenchment Ratio (**Wfpa / Wbkf**)	Width / Depth Ratio (**Wbkf/dbkf**)	Channel Sinuosity	Channel Materials D50 mm	Crew	Stream Type	Best site photo
99205	Unnamed Ck	500554 5887678	05-Oct-99	1.10	3.20	2.8	2.91	2.36	Moderate	Gravel	Cooper Blackburn	E4b	99205
99206	Fish Ck	456757 5926491	06-Oct-99	1.75	16.90	1.0	9.66	3.48	High	Fines	Davis Bambrick	E6	99206
99208	Mitchell Ck	512551 5907573	06-Oct-99	7.70	12.90	0.3	1.68	16.38	Moderate	Boulder	Blackburn Cooper	B2c	99208-3
99209	Thistle Ck	504253 5849147	13-Oct-99	26.40	59.10	1.5	2.24	36.00	Moderate	Cobble	Cooper Bambrick	B3c	99209-2
99210	Unnamed Ck	507373 5851932	13-Oct-99	3.10	5.00	1.7	1.61	4.87	Moderate	Gravel	Cooper Bambrick	G4c	99210-1
99213	Unnamed Ck	510914 5881216	14-Oct-99	1.20	2.60	1.0	2.17	2.93	Moderate	Fines	Cooper Bambrick	C6	99213
99214	Unnamed Ck	507329 5872522	15-Oct-99	1.10	10.70	0.7	9.73	2.50	Moderate	Gravel	Cooper Bambrick	C4c-	99214-1
99215	Unnamed Ck	507602 5876383	15-Oct-99								Davis Blackburn	E6	99215
99216	Unnamed Ck	508915 5875303	15-Oct-99								Blackburn Davis	E6	no photo
99217	Unnamed Ck	504602 5873932	18-Oct-99							Fines	Cooper Davis	E6	99217
99218	Unnamed Ck	504793 5874296	18-Oct-99								Davis Cooper	E6	99218-2
99219	Unnamed Ck	502845 5865651	18-Oct-99							Cobble	Blackburn Bambrick	E3	99219-1
99220	Unnamed Ck	501894 5893176	19-Oct-99	3.20	7.80	1.2	2.44	6.67	Moderate	Cobble	Cooper Davis	E3	99220-2
99221	Seabolt Ck	458528 5901456	19-Oct-99	4.10	6.90	2.3	1.68	9.92	Low	Cobble	Blackburn Bambrick	B3	99221-1

Site ID	Stream Name	Easting Northing	Survey Date	Bankfull Width (m) **Wbkf**	Floodprone Area (m) **Wfpa**	Mean Slope (%)	Entrenchment Ratio (**Wfpa / Wbkf**)	Width / Depth Ratio (**Wbkf/dbkf**)	Channel Sinuosity	Channel Materials D50 mm	Crew	Stream Type	Best site photo
99223	Embarras River	503530 5882277	20-Oct-99							Cobble	Blackburn Bambrick	E3	99223-2
99224	Unnamed Ck	503816 5882508	20-Oct-99							Cobble	Blackburn Bambrick	B3	99224-1
99225	Unnamed Ck	494854 5878118	21-Oct-99							Cobble	Blackburn Bambrick	E3	99225-2
99226	Unnamed Ck	495151 5877824	21-Oct-99	0.80	1.30	2.0	1.63	3.38	Low	Fines	Blackburn Bambrick	E5	99226
99227	Solomon Ck	442848 5913386	22-Oct-99	5.10	20.30	1.0	3.98	6.02	Low	Cobble	Davis Cooper	G3c	99227-2

A4 Stream. Site 99196. Bacon Creek.

B2c Stream. Site 99208. Mitchell Creek.

B3 Stream. Site 99221. Seabolt Creek.

B3 Stream. Site 99224. Unnamed Creek. Tributary to Embarras River.

B3c Stream. Site 99193. Anderson Creek.

B3c Stream. Site 99209. Thistle Creek.

B4c Stream. Site 99178. Anderson Creek.

B5c Stream. Site 99188. Unnamed Creek. Tributary to Edson River.

G2 Stream. Site 99184. Solomon Creek.

G3c Stream. Site 99204. Embarras River.

G3c Stream. Site 99227. Solomon Creek.

G4c Stream. Site 99210. Unnamed Creek. Tributary to Thistle Creek.

G5c Stream. Site 99197. Erith River.

C3 Stream. Site 99182. Unnamed Creek. Tributary to Lynx Creek.

C3 Stream. Site 99183. Lynx Creek.

C3 Stream. Site 99187. Unnamed Creek. Tributary to Gregg Lake.

C3 Stream. Site 99203. Grave Creek.

C4 Stream. Site 99186. Unnamed Creek. Tributary to Wildhay River.

C4c- Stream. Site 99195. Halpenny Creek.

C4c- Stream. Site 99214. Unnamed Creek. Tributary to Bailey Creek.

C6 Stream. Site 99213. Unnamed Creek. Tributary to Lovett River.

E3 Stream. Site 99185. Unnamed Creek. Tributary to Wildhay River.

E3 Stream. Site 99194. Unnamed Creek. Tributary to Anderson Creek.

E3 Stream. Site 99219. Unnamed Creek. Tributary to Pembina River.

E3 Stream. Site 99220. Unnamed Creek. Tributary to Embarras River.

E3 Stream. Site 99223. Embarras River.

E3 Stream. Site 99225. Unnamed Creek. Tributary to Thompson Creek.

E4 Stream. Site 99191. Unnamed Creek. Tributary to Anderson Creek.

E4b Stream. Site 99205. Unnamed Creek. Tributary to Embarras River.

E5 Stream. Site 99180. Unnamed Creek. Tributary to Hightower Creek.

E5 Stream. Site 99226. Unnamed Creek. Tributary to Thompson Creek.

E5b Stream. Site 99201. Unnamed Creek. Tributary to Embarras River.

E6 Stream. Site 99181. Unnamed Creek. Tributary to Hightower Creek.

E6 Stream. Site 99190. Embarras River.

E6 Stream. Site 99200. Unnamed Creek. Tributary to Embarras River.

E6 Stream. Site 99202. Unnamed Creek. Tributary to Grave

E6 Stream. Site 99206. Fish Creek.

E6 Stream. Site 99215. Unnamed Creek. Tributary to Lovett River.

E6 Stream. Site 99217. Unnamed Creek. Tributary to Beaverdam Creek.

E6 Stream. Site 99218. Unnamed Creek. Tributary to Unnamed Creek.