

**2000 FISH AND STREAM
INVENTORY PROGRAM
ANNUAL REPORT & SUMMARY**

**For
Weldwood of Canada Ltd. (Hinton Division)
And
Foothills Model Forest
By
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Summary

The overall goal of this fish and stream inventory program undertaken by the Foothills Model Forest (FMF) was to continue to increase the knowledge of the fish and fish habitat within the Weldwood Forest Management Agreement (FMA) area. Funding for this project was provided by Weldwood through the Forest Resource Improvement Program (FRIP) with additional funds and essential equipment resources provided by the Alberta Conservation Association (ACA) and the Canadian Forest Service (CFS). In 2000, this program had four high priority objectives and five medium priority objectives. The first high priority objective was to continue the operational fish and stream inventory. This project was intended to obtain fish information for forest development planning and was focused on sites identified by Weldwood forest planning staff. During the 2000 field season, a total of 74 operational sites were visited. The second high priority objective 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 2000 field season, a total of 136 sites were surveyed within ten monitoring watersheds. The third high priority objective was to complete a study of seasonal fish movements within MacKenzie Creek. A fish fence was operated for a total of 103 days and a total of 1,290 fish were captured. The fourth high priority objective was to continue with the development of stream classification protocols. Considerable progress was made in this area including development of a method for classifying all streams within any particular watershed using Geographic Information System (GIS). The streams within ten watersheds were classified using these methods. Other channel classification projects that were initiated included classification of additional field sites and development of a stream channel classification guidebook.

Acknowledgements

In 2000, this Foothills Model Forest project was funded primarily by Weldwood of Canada Ltd. (Hinton Division) through the Forest Resource Improvement Program (FRIP) and by the Alberta Conservation Association (ACA) - Fish Habitat Development Program. 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, Chris Spytz and Kelly Carpenter, 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 two additional field crews to join the FRIP crew. Paul Hvenegaard, of the Alberta Conservation Association, Peace River, arranged the loan of a fish trap for MacKenzie Creek. Sheldon Kowalchuk of the Alberta Conservation Association in Edson also responded to a request for manpower for one of our fall field surveys. Jasper National Park provided an alternate electrofisher and block-nets.

The field crew that undertook the inventories included Jason Cooper, Jason Blackburn, Jill Collyer, Lindsay Pellow and Twila Arsenault. Cameron Davis served a field crew leader.

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1. Introduction

This report describes activities that were completed in 2000 with resources provided by Weldwood of Canada (Hinton Division) through the Forest Resource Improvement Program (FRIP). This was the sixth year that the Foothills Model Forest had undertaken fish inventory and research work with funds available from FRIP.

Prior to 1998, the program was focused mainly on operational inventory of small streams within those lands included within the Weldwood Forest Management Agreement (FMA) area. Since 1998, the FMF fish and aquatics program expanded to include the following projects:

- a) Site based operational inventory.
- b) Watershed based monitoring.
- c) Stream channel classification.

In addition to funds provided through FRIP, additional funds for 2000 were provided by the Alberta Conservation Association (ACA), Fisheries Management Enhancement Program (FMPEP). The FMPEP funds (\$40,000) were used to fund two field crews during the 2000 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 FRIP project exclusively, but are the result of a combined effort between both FRIP and FMPEP.

1.1. Objectives

Nine different objectives were identified in the 2000-2001 work plan for funding by FRIP. These objectives were based on the second year of a three-year proposal. The objectives are described below:

1. Continue with operational fish and stream inventory as identified by Weldwood biologists and forest planners.

2. Continue to collect fish monitoring data in watersheds selected in 1999 – these watersheds include Lambert, Emerson, and Pinto creeks. It may be necessary to continue with data collection from watersheds sampled in previous years depending on results of data analyses.
3. Identify a watershed where seasonal fish movements are of interest to Weldwood and install a fish trap to monitor movement, and fish biological and population parameters. This objective was dependant on the availability of the fish trap from the Alberta Conservation Association (Peace River) or the construction of a similar trap.
4. Continue with development of stream classification protocols. Rick Bonar indicated that he and Golder Associates Ltd. would likely determine the specifics for this.
5. Develop a protocol to determine fish absence at a particular site. This will require a review of existing Foothills Model Forest fish inventory data and protocols established in other jurisdictions. Ongoing discussions regarding this new protocol for the Weldwood FMA will be made with George Sterling, Rick Bonar, and Chris Spytz during development.
6. Use gap analysis of lentic systems (lakes and ponds) within the Foothills Model Forest (to be completed in January 2000) to determine need for sampling. With agreement between partners, possibly implement the lentic sampling program during the 2000 field season.
7. Potential implementation of research project(s) as identified in 1999 annual FRIP report. The activity team will agree upon this list of research projects prior to implementation.
8. Review existing monitoring program and provide recommendations for changes if required.
9. Define basins or watersheds for the entire Weldwood FMA.

2. Summary of Work Completed

This portion of the report summarizes the progress made in each of the nine objectives that were identified within the 2000 work plan. The summary tables and charts presented in this section of the report are excerpts from other reports and these parent reports describe the findings in more detail.

2.1 Operational Fish and Stream Inventory

Weldwood staff identified a total of 77 sites at the beginning of the season. An additional seven sites were identified during the field season in the Seabolt Creek and Paradise Creek watersheds. A total of 74 of the 84 identified sites were visited in order to collect information on fish and fish

habitat for forest planning. The remaining 10 sites were not visited for a number of reasons including: access difficulty; fish presence or absence may have been inferred from other sites located in close proximity; or end of field season. Any follow-up sampling requirements identified by Weldwood staff will be incorporated into the 2001 field-sampling program. Fish were captured at 26 of the 74 sites that were sampled (Table 1).

Table 1. Summary of fish sampling at operational sites.

Fish Sampling Results	# of Sites
Fish captured	26
Fish not captured	48
Total	74

Most operational sites were located in the southern portion of the FMA (Figure 1), within the Embarras Working Circle (Table 2).

Table 2. Summary of location of operational sites by working circle.

Working Circle	Number of Sites	Percentage of Sites
Berland	10	14
Marlboro	0	0
Athabasca	8	11
McLeod	4	5
Embarras	52	70
Total	74	100

In addition to the methods used in previous years for surveys of fish and fish habitat (McCleary and Johnson 2000), additional data was collected at each backpack inventory site. This information included Level 2 Stream Classification (Rosgen and Silvey 1998), as well as pool depth and pool frequency (Johnston and Slaney 1996). The results from the operational inventory (Objective 1), monitoring program (Objective 2) and seasonal fish movements study (Objective 3) were entered into the Foothills Model Forest database. A report which summarized these findings was produced (FMF 2000). The binder and accompanying maps were delivered to the partnering organizations in January 2001.



Figure 1. The Foothills Model Forest and locations of 2000 operational inventory sites.

2.2 Monitoring Watersheds

In 2000, 10 watersheds were sampled as part of an ongoing watershed monitoring program. This four-year study was initiated in 1998. The methods and results from 1998 and 1999 were described in two separate reports (McCleary and Johnson 2000, Johnson and McCleary 2001). A total of 14 watersheds have been included within this program, including two additional watersheds that were added in the year 2000. These two additional watersheds were Teepee Creek and Antler Creek, which are located within the McLeod River basin. During the year 2000, sampling occurred at a total of 136 sites (Table 3), within 10 of the 14 watersheds (Figure 2).

Table 3. Summary of location of monitoring sites by watershed.

Watershed	Number of Sites	Number of Sites that were also Operational Sites
Pinto	14	
Emerson	26	
Lambert	18	
Anderson	8	
Teepee	15	
Antler	12	
Mary Gregg	1	
Tri Creeks	10	
MacKenzie Creek	11	2
McLeod River*	21	
Total	136	2

* This represents three separate reaches of the McLeod River that were sampled using float electrofishing.

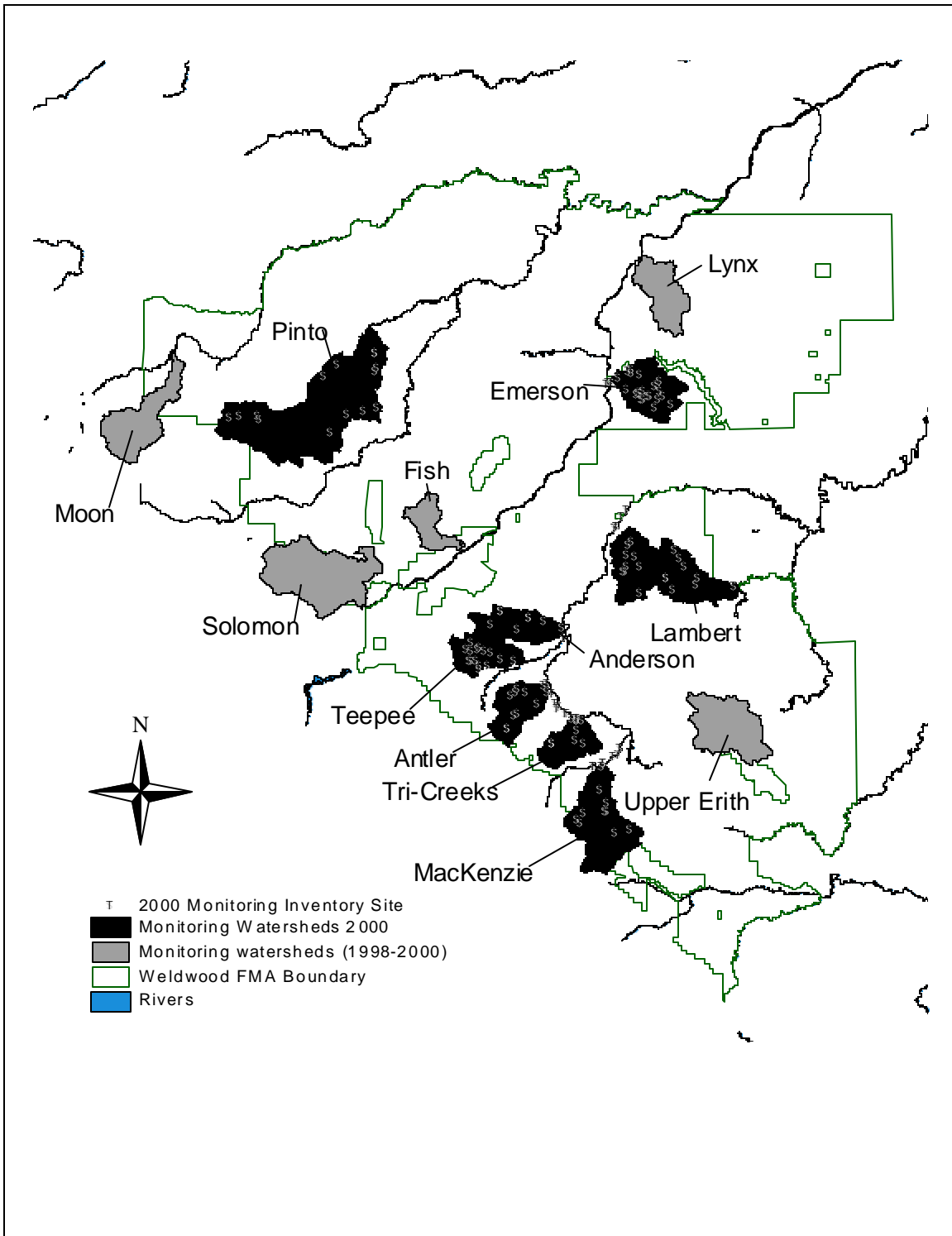


Figure 2. Locations of the monitoring watersheds and the 2000 monitoring inventory sites.

2.3 Seasonal Fish Movements

The watershed selected for a study of seasonal fish movements was MacKenzie Creek (Figure 2). A fish trap was obtained on loan from the Alberta Conservation Association - Peace River Office, for this study. The trap was installed on July 17, 2000 and was operated continuously until October 23, 2000. The trap was checked on a daily basis during periods of active migration. Over the 103 day period, a total of 1,290 fish were captured (Table 4).

Table 4. Summary of fish captured at the MacKenzie Creek fish trap during the 2000 field season.

Species	Number Caught	Min Fork Length (mm)	Max Fork Length (mm)	Mean Fork Length (mm)
Bull trout	168	285	729	502
Mountain whitefish	1,122	22	387	253
Total*	1,290			

*For additional information on the study of seasonal fish movements into MacKenzie Creek the reader should refer to FMF (2000).

2.4 Stream Classification

In 2000, one of the FRIP program objectives was to continue developing a protocol for conducting stream classification. This project was given a high priority and evolved over the course of the year. The desired system for classifying stream channels within the Weldwood FMA was to group streams with similar physical features and provide linkages to both forest and fish management.

A pilot project was initiated in 1999 using an existing methodology for Level 2 classification (Rosgen and Silvey 1998) at a total of 44 field locations. Early in 2000, a decision was made to proceed using the same methodology at all field inventory sites during the 2000 field season. This methodology, which included field measurements of the stream channel and floodplain at a particular site, was referred to as Level 2 classification. Level 2 classification was completed at a total of 113 locations during the 2000 field season.

Early in 2000, another pilot study was completed where information from digital topographic maps and digital orthophotos was used to classify the entire stream network within a selected watershed. The results from this pilot study are presented in Figure 3. The methods used for this Level 1 classification exercise were also based on Rosgen and Silvey (1998).

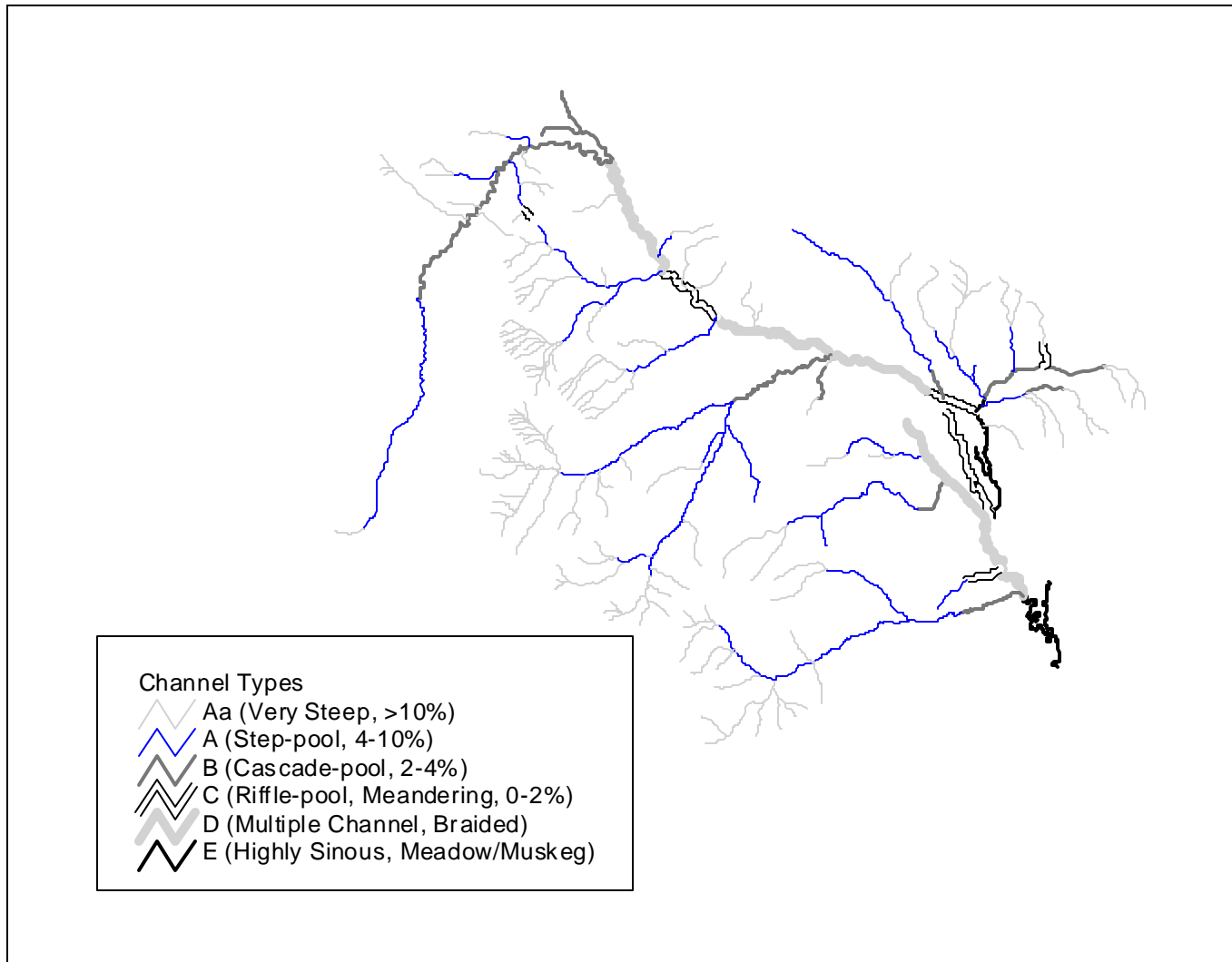


Figure 3. Level 1 classification for streams within the Solomon Creek watershed.

A number of additional projects originated from the pilot study on Solomon Creek. The first project was to complete Level 1 classification within all FFMF monitoring watersheds and also within a number of basins where forest planners were at the initial planning stage. At the end of 2000, Level 1 classification was completed in 10 of the 14 monitoring watersheds and two additional basins for forest planning (Figure 4). The total area classified represents approximately 16% of the total area of the FMA (Table 5).

Table 5. Summary of area and basin type for each classified watershed during the year 2000.

Watershed	Area (ha)	Basin Type
Upper Pembina	28,956	Operational
Paradise	2,555	Operational
Mary Gregg	5,484	Monitoring
Antler	7,372	Monitoring
Teepee	6,951	Monitoring
Pinto	33,595	Monitoring
Emerson	9,335	Monitoring
Lambert	18,014	Monitoring
Anderson	7,497	Monitoring
Tri-Creeks	2,822	Monitoring
Eunice	1,638	Monitoring
Deerlick	1,514	Monitoring
MacKenzie	14,105	Monitoring
Solomon	19,235	Monitoring
Total Area Classified	159,074	
Total FMA Area	1,007,053	
Percent Classified	16 %	

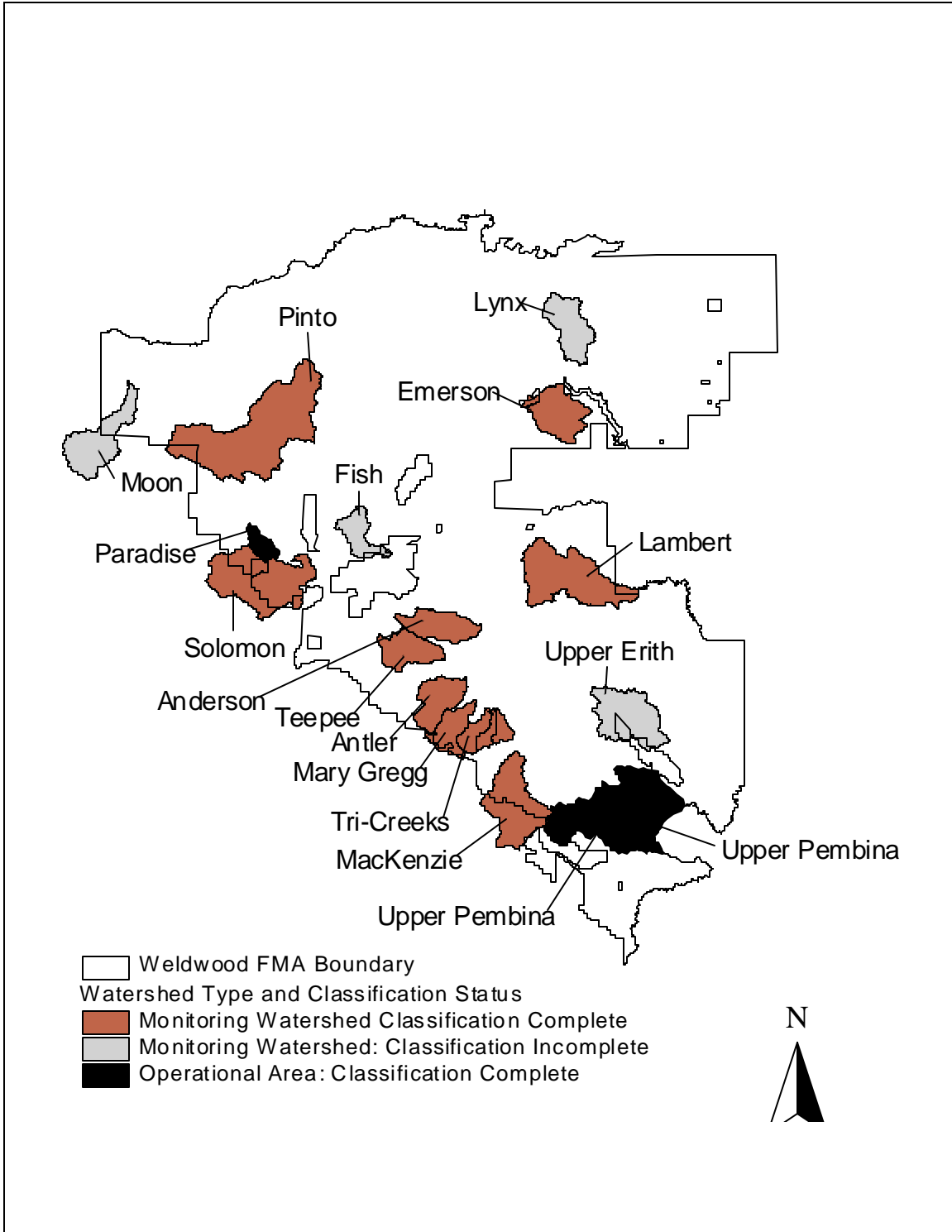


Figure 4. Summary of Level 1 stream classification completed for FMA watersheds during the year 2000.

A second project initiated in 2000 was Level 1 classification for the Weldwood FMA using an automated GIS procedure. This project was contracted to Golder Associates Ltd.

A third project initiated in 2000 was the development of a stream channel classification guidebook. The FMF and Golder Associates Ltd. are working in co-operation on this project.

Preliminary work completed on this project during 2000 included development of an outline for the guidebook and initiating work on the management interpretations section of the report.

FMF and Golder Associates Ltd. developed the following outline with input from Rick Bonar, Weldwood Biologist. The guidebook will include the following sections:

1. Field techniques for Level 2 classification.
2. Descriptions and representative photographs for the stream types that occur within the FMF boundaries.
3. Description of the natural resources associated with each stream type. This will include:
 - The fish species, their life stages and activities (spawning or over-wintering).
 - Frequency of beaver activity.
 - Bankfull width and flood-prone width by stream order for each stream type. The range of values for these two attributes will be based on Level 2 field surveys. The bankfull width information may provide some information for preliminary stream crossing planning. The width of flood-prone area is associated with width of functional riparian zone and may provide useful information for riparian area management.
4. Management interpretations for each stream type including considerations for stream crossings and riparian zone management.

Preliminary management considerations were developed and presented to a number of audiences including Weldwood forest planners (Oct. 11, 2000) and the Canadian Institute of Forestry, Rocky Mountain Chapter (Oct. 20, 2000). Feedback from individuals who may apply this system on the ground was gained as a result of these presentations and a poster summarizing these considerations was produced (Appendix 1).

A final project that was initiated in 2000 was retroactive Level 2 classification of all previous fish inventory sites within the Weldwood FMA. A number of tasks have been planned in order to facilitate the completion of this project. These tasks include:

- 1. A review of the location of previous FMF fish inventory sites on a new digital streams layer.** The new digital streams layer that contained the Strahler stream order was called the single line hydrography (S.L.H.) stream network. This new layer was mapped using the NAD 83 map projection, which is the provincial standard, whereas the old streams layer and sites were mapped using the NAD 27 map projection. As a result of the use of this new streams layer, the exact location of all previous inventory sites with respect to these new spatial data (especially for those sites located near a stream confluence) required confirmation. This location review project was planned for the early part of the year 2001.
- 2. Linking the digital photograph to the photographic record for each inventory site within the FMF database.** The FMF database presently contains information for 1,297 sites and photographs were taken for most of these locations. At present, all photographs for FMF inventory sites have been digitized; however they are not linked to the database. These photographs should be used when conducting the retroactive classification, however the large number of images is very difficult to manage. In order to facilitate the use of these photographic records, a project to link the digital photographs to their photographic record within the FMF database was initiated early in 2001. If the resources to complete this project internally are not available, there may be some potential to have this project completed under contract through one of the companies that frequently undertakes GIS contracts through the FMF. Completion of this project should also facilitate the easy use of the photographic records for future studies.
- 3. Completion run of the model Hydrologic Attributes Generated by Geographic Information System (HAGGIS) for all inventory sites.** This procedure will calculate the slope and sinuosity for the 300 m stretch of stream originating from the location and proceeding upstream. These values are required to determine the channel type at any particular location. This task can be undertaken following the completion of Task 1.
- 4. Comparing the retroactive Level 2 results with the Level 1 results for the entire FMA.** Once the results from both classification efforts are available, comparison of the results will be useful to guide users in the interpretation of the findings.

2.5 Protocol to Determine Fish Absence

This project was initiated in 2000. Additional work during 2001 will be required to finalize a protocol. Preliminary work completed on this project indicated that biologists might want to consider the results of field sampling at a particular site in combination with map generated

information including stream order and channel type. Obtaining the map measurements in a consistent manner through the use of a GIS was determined to be prerequisite for associating sample locations with map generated data. In 2000, several projects were initiated that will facilitate further development of this protocol. These projects include:

1. Assignment of Strahler order to all streams within the Northern East Slopes Region.

This project was completed in 2000 and the information was available for use with GIS.

2. Channel classification for all streams within the Weldwood FMA. In 2000, channel classification was completed for 16% of the FMA by the Foothills Model Forest. The remainder of this project was planned for completion during the early part of 2001 through a Weldwood contract to Golder Associates Ltd.

2.6 Gap Analysis of Lentic Systems

The gap analysis of lakes and ponds was completed and presented within the 1999 FRIP Annual Report (McCleary and Johnson 2000). Two recommendations were made based on the findings from the analysis. The first recommendation was to review additional existing information for the lakes within the FMA (Forest Management Area) as it becomes available through Alberta Environment. The second recommendation was that 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.

During the year 2000, Alberta Environment was planning to incorporate all previous lake inventory information into a database. At the end of 2000, the Foothills Model Forest was awaiting word of completion of this project. Planning for future surveys could be initiated in the year 2001, as the lake inventory database becomes available.

2.7 Implementation of Research Projects

In the year 2000, several potential research projects were identified. They included:

1. A comparison of stream slope values generated from a variety of field and GIS methods.
2. Development of stream stability evaluation protocols.

Further review and determination of specific objectives and deadlines was required prior to project initiation. Additions to this list of research projects were expected prior to the start of the 2001 field season.

2.8 Review Existing Monitoring Program

During the year 2000, several changes were made to the methods for determining fish sampling locations within the monitoring watersheds. Once the Level 1 classification was completed, sample sites were selected to ensure that all stream types within a watershed would be represented. In addition, efforts were made to define the fish species distributions within all watersheds. Therefore, sample sites were located in streams that may or may not support fish populations. In previous years, priority sample sites were located within streams that would also provide suitable locations for permanent sample sites.

2.9 Define Basins for the Entire Weldwood FMA

The methodology for defining watershed boundaries at the mouth of each order 3,4, and 5th order basins within the FMA was as follows:

1. Create a hydrological correct DEM.
2. Divide the FMA into four separate basins to ensure that file size is suitable for computer analysis.
3. Create pour points where the stream order changes.
4. Identify and correct the location of pour points that are too far from definable watershed boundaries.
5. Create basins.
6. Complete a visual check for anomalies.

As of January 1, 2001 progress has been made on steps 1-3 within the McLeod watershed.

3. Recommendations for 2001 Work Plan

Based on the progress made in 2000, suggested recommendations for each of the nine objectives for 2001 were made (Table 6). Prior to finalization, several management groups at the Foothills Model Forest including the Fish and Aquatics Activity Team will review the 2001 work plan. The final work plan will incorporate their recommendations.

Table 6. Summary of remaining items and proposed timelines for each of nine objectives from the 2000 work plan.

Objective	Items for 2001 Work Plan	Proposed Timeline
1. Operational fish and stream inventory	<ul style="list-style-type: none"> • Sample additional sites as identified by Weldwood planners. • Produce report and summary binders. 	<ul style="list-style-type: none"> • Field Sampling: Summer 2001 • Reporting: Fall 2001
2. Fish monitoring in selected watersheds	<ul style="list-style-type: none"> • Identify sites and basins for follow-up sampling. • Produce report that incorporates and analyzes all previous fish inventory data. • Produce basin atlas summarizing fish and land condition information. • Include links to indicators program (based on progress made in Criteria & Indicators Program). 	<ul style="list-style-type: none"> • Spring 2001 • Winter 2001/2002
3. Seasonal fish movements	<ul style="list-style-type: none"> • If weather and funding permit, operate fish fence throughout open water season in Mackenzie Creek • Produce report. 	<ul style="list-style-type: none"> • Spring – Fall 2001 • Winter 2001
4. Stream classification	<ul style="list-style-type: none"> • Link research project on slope calculation methods back to classification results. • Level 1 classification for remaining basins. • Level 2 classification on all 2001 field sites. • Retroactive Level 1 classification on all previous inventory sites. 	<ul style="list-style-type: none"> • Spring – Summer 2001 • Winter – Spring 2001 • Field season 2001 • Winter – Spring 2001

Table 6(continued). Summary of remaining items and proposed timelines for each of nine objectives from the 2000 work plan.

Objective	Items for 2001 Work Plan	Proposed Timeline
	<ul style="list-style-type: none"> Determine protocol for Level 3 and Level 4 classification. Complete channel classification field guide. 	<ul style="list-style-type: none"> Field season 2001 Draft April 1, 2001 and revisions made throughout field season.
5. Fish absence protocol	<ul style="list-style-type: none"> Review of site and map data for previous locations 	<ul style="list-style-type: none"> Fall 2001- following completion of retroactive stream classification.
6. Lake sampling priorities	<ul style="list-style-type: none"> If previous data are available, make recommendations for lake inventory locations. Potential to initiate program within FMF Phase 3 should be addressed. 	<ul style="list-style-type: none"> 2001 Phase 3 begins April 1, 2002
7. Implementation of research projects	<ul style="list-style-type: none"> Review list of research projects and consider any new projects. Undertake study of calculation methods for water surface slope. 	<ul style="list-style-type: none"> Spring 2001 Field season 2000
8. Review existing monitoring program	<ul style="list-style-type: none"> Prepare report for end of Phase 2 with recommendations for future monitoring and Phase 3. 	<ul style="list-style-type: none"> 2001
9. Define basins for all stream orders	<ul style="list-style-type: none"> Produce digital maps of basin boundaries by stream order. 	<ul style="list-style-type: none"> 2001

4. Summary

As described in this report, timelines for high priority objectives were met. In 2000, significant resources were put towards development of channel classification protocols and the progress made in this area will facilitate the completion of projects associated with other objective areas. The work in 2000 was completed within the budget and the partnerships with other agencies permitted an effective use of the available resources. As in previous years, in the fall of 2000 a proposal was submitted for ACA funding in the year 2001 and we look forward to continuing to participate in this effective partnership.

Phase 2 of the FMF will end on March 31, 2002. Planning for Phase 3 was initiated in 2000 and the programs are expected to continue for another five years. The work completed in 2000 and planned for 2001 will provide a succinct closure for Phase 2 and also form the foundation for Phase 3. Phase 3 initiatives that are tied to current FMF fish projects include the Criteria and Indicators program. In addition, the FMF will continue to make contributions to the Northern East Slopes Integrated Resource Management Strategy.

5. Literature Cited

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Appendix 1. Management Considerations from Stream Channel Classification



Management Considerations from Stream Classification

Channel Type	Description	Considerations for Stream Crossings	Riparian Zone Management
Aa: Steep Headwater Stream 	Channel: <ul style="list-style-type: none"> Very steep gradient Subject to debris torrents Confined within gorge Waterfalls and chutes common Floodplain Width (relative to channel width): <ul style="list-style-type: none"> Very narrow 	<ul style="list-style-type: none"> Approaches with sharp bends and steep hills due to steep inner gorge Minimal fish use. Inventory fish if gradient < 20% Ensure structure designed for peak flow events and debris Ditch runoff / sediment control difficult due to steep road approaches and narrow riparian zone 	<ul style="list-style-type: none"> Slope of inner gorge typically beyond limit of operability Very narrow riparian zones
A: Drop / Pool Stream 	Channel: <ul style="list-style-type: none"> Steep gradient Often confined within gorge Cascades common Boulders create majority of pools and cover for fish habitat Floodplain Width (relative to channel width): <ul style="list-style-type: none"> Narrow 	<ul style="list-style-type: none"> Road approaches with bends and hills due to gorge Consider fish migration: Inventory stream to determine fish use Ensure structure designed for peak flow events and debris Ditch runoff / sediment control difficult due to steep road approaches and narrow riparian zone 	<ul style="list-style-type: none"> Slope of inner gorge may be beyond limit of operability Narrow riparian zones
B: Rapid / Pool Stream 	Channel: <ul style="list-style-type: none"> Moderate gradient Moderately confined Rapids common, chutes occasional Boulders and LWD create pools and cover for fish Floodplain Width (relative to channel width): <ul style="list-style-type: none"> Narrow - medium 	<ul style="list-style-type: none"> Road approach with hills and bends due to confined valley Consider fish migration: Inventory stream to determine fish use Bedrock or boulder footings often available for bridge Ditch runoff / sediment control difficult due to steep road approaches and narrow riparian zone 	<ul style="list-style-type: none"> Slope of inner gorge may be within limit of operability Moderately narrow riparian zones Riparian buffers will allow recruitment of LWD
C: Riffle / Pool Stream 	Channel: <ul style="list-style-type: none"> Low gradient Low confinement LWD creates pools and cover for fish Streamside trees maintain bank stability and undercut Floodplain Width (relative to channel width): <ul style="list-style-type: none"> Wide, well developed floodplains 	<ul style="list-style-type: none"> Straight approaches with few bends and few hills Consider fish migration: Inventory stream to determine fish use Ensure debris passage Ditch runoff / sediment control options with flatter approaches and wide riparian areas 	<ul style="list-style-type: none"> Slope of riparian zone within limit of operability Wide riparian zones Riparian buffers important for recruitment of LWD, bank stability and shade
D: Braided Stream 	Channel: <ul style="list-style-type: none"> Low gradient Subject to debris flows and active channel migration Very little cover for fish Floodplain Width (relative to channel width): <ul style="list-style-type: none"> Wide floodplains 	<ul style="list-style-type: none"> Road crossings not recommended because of active sediment transport, high maintenance and risk to structure High risk for permanent bridges Culverts not recommended 	<ul style="list-style-type: none"> Slope of riparian zone within limit of operability Wide riparian zones Channel subject to relocation within riparian zone Riparian buffers important for bank stability and channel recovery following relocation
E: Muskeg / Meadow Stream 	Channel: <ul style="list-style-type: none"> Low gradient Very little debris transport Stream banks, LWD and deep channel provide cover for fish Beaverdams common Floodplain Width (relative to channel width): <ul style="list-style-type: none"> Very wide floodplains 	<ul style="list-style-type: none"> Elevate road grade above floodplain Consider culverts within floodplain to pass peak flows Consider fish migration for species including burbot, cyprinids and suckers Inventory stream to determine fish use Ditch runoff / sediment control options with flatter approaches and wide riparian areas 	<ul style="list-style-type: none"> Slope of riparian zone within limit of operability Wide riparian zones Riparian buffers important for bank stability, LWD recruitment and channel recovery after floods

These preliminary considerations will be reviewed by the Foothills Model Forest, Fish Activity Team. This group includes representatives from Weldwood of Canada - Hinton Division, Natural Resources Service, Lands and Forest Service and Foothills Model Forest staff. The classification system and the above considerations were based on the the stream classification system developed by D. Rosgen, Wildland Hydrology, Pagosa Springs, Colorado.

Poster prepared by Rich McCleary, Fish and Aquatics Research Program, FMF, October 2000.