BOUNDARY DELINEATION OF WILDERNESS AND ECOLOGICAL RESERVES IN NEWFOUNDLAND

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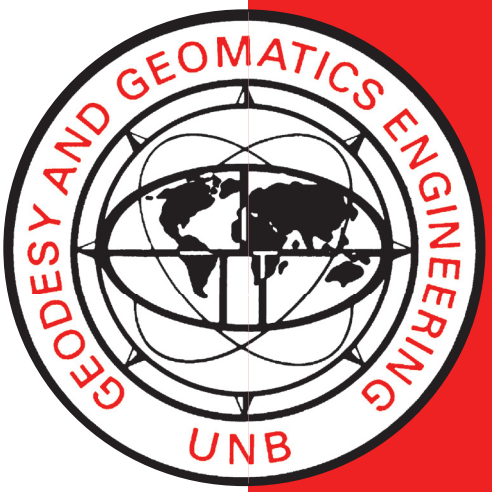
December 1992



TECHNICAL REPORT
NO. 163

PREFACE

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BOUNDARY DELINEATION OF WILDERNESS AND ECOLOGICAL RESERVES IN NEWFOUNDLAND

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PREFACE

This technical report is a reproduction of a report submitted in partial fulfillment of the requirements for the degree of Master of Engineering in the Department of Surveying Engineering, March 1992. The research was supervised by Dr. John McLaughlin, and funding was provided partially by Energy, Mines and Resources Canada.

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ABSTRACT

The Government of Newfoundland and Labrador passed the Wilderness and Ecological Reserves (WER) Act on May 28, 1980. Through the establishment of this act, the government formally recognized the need to protect a portion of the province's wildlands for future enjoyment. This legislation has provided the basis for site selection and reserve protection through a Wilderness and Ecological Reserves Program.

The strengths and weaknesses of the WER Program are reviewed in this report with particular emphasis placed on the need for, and use of, information in selecting reserve boundaries. Through a case study, the ABC Resource Survey procedures are applied to site selection and an attempt is made to incorporate Geographical Information System (GIS) technology in the process.

The results of the case study demonstrated how both the ABC methodology and GIS can be included in the reserve selection procedures, however, the quality of information presently available for applying this procedure is poor.

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ACKNOWLEDGEMENTS

The preparation of a report such as this would not be possible without the assistance of a large number of individuals. If one were to attempt to list them all including their contribution, the content of this particular section would be enormous. There is also a likelihood of failure to include any number of important individuals. However, I do feel particularly inclined to single out the following individuals whose support is gratefully acknowledged:

* Dr. John McLaughlin, my supervisor, for his continued support throughout the entire project.

* Energy, Mines and Resources Canada, for their partial funding of this project via the Resource Information Management Group, UNB.

* Ms. Sue Nichols, Ph.D. candidate in Department of Surveying Engineering, UNB, who seemed to always be there for me to listen and lend guidance.

* The Department of Environment and Lands, Parks Division, for the use of their resources thereby ensuring the project was completed.

* To my family, back in Newfoundland, for their moral support and understanding throughout these last few years of study. And I wish to dedicate this report to my niece, Sharayah who was born only hours after it was completed.

* To Christina, my very best friend, who took the leap of faith with me without hesitation, encouraged me and stood by me (always with a smile). Someday Babe, I hope to return the favour.

CHAPTER 1

INTRODUCTION

> Wilderness and natural areas serve not only to inspire and define our existence but properly managed they will ensure that the biological resources we will need to enhance agriculture, resource industries and medicine will be available to our scientists and resource managers. [WWF, 1990. Honourable Gary Filmon]

1.1 BACKGROUND

This report reviews the strengths and weaknesses of Newfoundland's Wilderness and Ecological Reserves Program. Particular emphasis has been placed on the information requirements of the Program in relation to the Wilderness and Ecological Reserves Act. In addition, a means of better information management has been proposed, keeping in mind the existing goals and objectives of the Program.

The Province of Newfoundland is renowned for its offshore fishery resources. Visitors and locals alike, however, soon find that the province has a great deal more to offer. Newfoundland has a land mass of 404 517 square kilometers [Times, 1978] and a population density of 1.5 persons per square kilometre [Statistics Canada, 1992]. The people of Newfoundland have, over the years, had the opportunity to enjoy a multitude of wilderness experiences including: sport

fishing, hunting, camping, canoeing, hiking and much more. These activities are very much responsible for making up a large part of the province's cultural heritage.

In 1980 the Government of Newfoundland and Labrador formally adopted the Wilderness and Ecological Reserves (WER) Act, recognizing the need to protect some of the 'untouched' lands of the province. Under this act, to date, the province has only been able to protect less than two percent of its land base.

1.2 WHY BE CONCERNED ABOUT THE ENVIRONMENT

In the past, concerns for the environment have come from a small portion of the world's population. Many people maintained a view that there seemed to be enough space for everyone. And while it may be true that presently there is enough land to support the world's population, its **resources** cannot continue indefinitely to support the growing population. [** Note: Text in bold type may be referred to in the glossary at the end of this report]

The Earth is a complex system of interacting organisms. The loss of elements in this system may cause temporary instability in the overall interactive processes. It is estimated that the world loses one wildlife species every hour [WWF, n.d.], resulting in the loss of at least one more connection to our past. Society must, therefore, make every effort to protect the interrelationships of environmental forces by protecting the land. Through such protection,

scientists would be provided the with opportunities to study species interrelationships which could otherwise not be duplicated in an artificial laboratory. These natural laboratories also allow others to enjoy and appreciate nature's beauty.

1.3 INFORMATION

1.3.1 How Can It Help

If the aim is to protect lands and environmental elements for future enjoyment, wildlife appreciation and scientific studies, it is necessary to have some form of decision making system in place to aid in the selection process. Dale and McLaughlin [1986] indicated, "the basic resource in all decision making is information"; thus the question arises, how can information help in the preservation process?

Lang and Arbour [1980] and Conant et al [1983] point out the usefulness of information for **resource management** purposes. They suggest information is necessary for establishing location and inventory of environmental elements and that this information can in turn be used for the modelling, analysis, and monitoring of species interactions. Modelling may then help identify the causes of specific interactions, the process involved in the interaction or the potential results of further interactions. Location information, if available at a suitable scale and accuracy, may be used to select more suitable protection boundaries for management purposes.

It must be recognized, however, that **resource information** is variable, depending on the resource being depicted; and always emerging, depending on species interactions. Such information also has a limitation in that it does not prevent managers from making misguided decisions; rather it merely provides them with a tool for better decision making.

1.3.2 Who Is Responsible For It

There exist three major complaints in relation to information and resource decision making: the information is not available; it is available but no one knows where to obtain it; it is available but not at the level of detail necessary for specific analysis. The users of existing information are interested in obtaining the most suitable data set for their specific need. In order to obtain the most suitable data sets to aid in the decision processes, the users no longer create their own version of the data, rather they now rely on those agencies with particular expertise as the means of obtaining necessary information. The integrated approach to resource management has therefore evolved, due to this need for more appropriate information. [Alberta, 1988; Lang, 1986]

In the integrated approach a holistic inventory of information is developed so that all interested parties may access information pertinent to their particular need. If however, such an initiative is to succeed everyone has to take responsibility for contributing to the information data bank. The users can then have some assurance that what they are

relying on has been collected by the most appropriate organization. The integrated approach does have its advantages but, it also has a number of disadvantages including: (a) each contributing agency does not always understand the reasons for integrated information collection; and (b) such a system requires a lead group to coordinate the collection activities thereby ensuring all users needs are met, but who should be the designated lead agency (the concept of Integrated Resource Management will be examined in detail in Chapter 4.)

1.3.3 Resource Information Criteria

Information collection may be the responsibility of all groups concerned with various aspects of resource management. If, however, agencies want to make the maximum use of information and ensure that the information they are collecting is meeting a maximum benefit, they should be aware of the characteristics (what makes it special) and the qualities of information, particularly from an environmental perspective. Dale and McLaughlin [1986], describe the characteristics as currency, precision, accuracy, verifiability, clarity, quantifiability, accessibility, freedom from bias, comprehensiveness, appropriateness, and interpretability.

In delivering quality information two basic goals are being accomplished. First, making the information presentable to the user in an effective manner. Second, ensuring the available information is also reliable for a given use. There

are, however, a number of potential problems unique to environmental information which are of concern to the collector and user. The discussion in this report will relate specifically to spatial representations of information, but non-spatial data can also pose a problem for multiple users (for example in defining an **ecosystem**).

Often maps are used to settle disputes relating to boundaries. It is commonly assumed that any boundary displayed on a map is accurate. While this may be an acceptable assumption in some instances, boundaries displayed to define many natural resource areas need to be interpreted with care. For example, a reader using a map to study geological features, must be aware of the fact that while the map shows features beginning and ending abruptly in relation to geographical space, they are not necessarily that way on the ground. Transition zones often exist between features and the linear depiction on the map is a representation of where the change takes place. Such situations are also common for depicting vegetation and wildlife zones. A map may show a wildlife habitat, but this area does not necessarily restrict the movements of the wildlife, rather the animals may wander far outside such an area.

Pictorial symbolization of some environmental features leads to a second problem. In map presentation, features such as wildlife sightings will occasionally be depicted in point form, only as a means of alerting the user that such a plant or animal exists within the area. The individual, however,

might interpret particular point symbols to represent a specific occurrence of that feature and not relate it to a more general spatial context. Therefore, the provider of the information must ensure that the user can interpret the data properly.

A third difficulty in depicting environmental information relates to map scale. When preparing information for general use, the scale at which the information is portrayed may be critical. The originator of the information must be sure to inform the user of the scale at which the material was prepared and/or depicted, otherwise misinterpretation of the data could be disastrous. Arnoff [1989], gives an example where three storage sites for environmentally sensitive PCB's were mapped in relation to three schools. In one small scale map the location of PCB's appeared to be very close to the schools. When presented on a larger scale map, however, these same three sites were in a better context in relation to the schools.

There are, of course, many other aspects of depicting environmental resource information which should be considered, some of which will be considered in Chapter 6. What must be recognized here is the importance of the information criteria when depicting spatial information.

1.4 APPROACH

This report examines environmental information needs required to establish wilderness and ecological reserves.

Particular emphasis has been placed on Newfoundland rather than attempting to deal with a national environmental picture. Chapter 2 presents a brief history of the Newfoundland, Wilderness and Ecological Reserves Program, and the enabling legislation (the WER Act). Also included in Chapter 2 is a description of the reserve designation process and a comparison is given of the Program's status in relation to programs in other provinces.

Chapter 3 outlines the present information needs for the program based on the management framework of the Parks Division. Chapter 4 addresses several methodologies for managing environmental data, with particular emphasis given to the Abiotic, Biotic, and Cultural (ABC) approach to boundary delineation developed at the University of Waterloo.

Chapter 5 integrates the Wilderness and Ecological Reserves Program and the ABC Resource Survey methodology via a case study. This study not only illustrates how well suited the ABC procedures are for the Program but also identifies many of the problems a resource manager might encounter when dealing with natural resource information and boundary delineation.

Chapter 6 reviews the strengths, weaknesses and requirements of the two conventional resource management procedures and the modified case study method, while emphasizing the management of information in order to achieve the goals and objectives of the WER Program. Chapter 7 presents conclusions drawn from the project and the

recommendations for both the Program's information management process and future research projects.

Throughout this report definitions for selected terms are provided in the text. In instances where bold type is displayed, the reader may wish to consult the glossary in Appendix A.

CHAPTER 2

THE WILDERNESS AND ECOLOGICAL RESERVES PROGRAM

2.1 INTRODUCTION

The Wilderness and Ecological Reserves (WER) Program in Newfoundland (also referred to here as the Program) is relatively new in comparison to other such programs in North America. The Wilderness and Ecological Reserves Act which governs the Newfoundland program, is considered to be a good legislative model for **wildland protection** and preservation [Halfyard, 1990; Minty, 1990].

In this chapter the background of the Program and the Act are outlined. A brief history is followed by an overview of the Program's objectives, showing how they are integrated with the Provincial Parks Policy. Consideration is then given to the Wilderness and Ecological Reserve classification and associated zoning system within the policy. This is followed by a description of the reserve selection process, and its management guidelines. Finally, a synopsis of the Program's status in comparison to other provincial reserve programs in Canada is presented.

2.2 THE HISTORY OF THE WER PROGRAM *[1]

2.2.1 Pre Parks Era

As with many committee oriented initiatives, there is no definitive date corresponding to the inception of the WER Program. It is, however, recognized by its visionaries that it was not originally intended to be referred to as the Wilderness and Ecological Reserves Program. Such status was not achieved until the early 1980's. Prior to this, the program was referred to as the Wildlands Program [Minty, 1990].

In 1974-75 a group of concerned citizens took it upon themselves to form what was to be known as the Wildlands Committee. The members of this committee were concerned with the rapid growth of development projects which were in danger of jeopardizing the province's **wildlands**. The first task of the committee was to determine whether or not the government had an interest in assisting in the development of a wildlands management system. In so doing the committee members began canvasing all departments of the provincial government to measure reactions to a systems approach to wildland establishments. While the departments reactions were encouraging, they were also slow in coming. This in turn resulted in a short dormant period in the Wildlands Program.

A 1975 report by R.T. Franson renewed the interest of the committee members and the Wildlands Program began moving once again [Minty, 1990]. Franson's report pointed out that preservation ideals and government's voluntary participation

were not enough to ensure wildland protection. In order to enable the committee to meet its goals some form of legislation was required. Existing legislation, such as the Provincial Parks Act and the Wildlife Act, had weaknesses in various aspects of wildland protection. For example, the Provincial Parks Act centered around a preservation mandate, but did not protect areas based on natural merits. The Wildlife Act meanwhile was very weak in its ability to protect a reserve in perpetuity.

The 1972 and 1975 reports by R.T. Franson were to become the bases for the creation of the Wildlands Legislation [Minty, 1990]. In order to add substance to the legislation there was recognized a need to establish a formal committee which would be responsible for developing a protection strategy for the wildlands. Cabinet, however, did not support the existing structure of the Wildlands Committee. Therefore, in the draft legislation, a provision was included that allowed Cabinet to establish an Advisory Council. This Council would advise Cabinet on avenues to take in relation to decision making issues directly related to wildlands of the province.

On May 28, 1980, five years later, the Wildlands Legislation was formally adopted by the House of Assembly as the Wilderness and Ecological Reserves Act. *[2] Responsibility for the Acts implementation was mandated to the Department of Tourism, Recreation and Culture, Wildlife Division. Simultaneously, the Wildlands Committee was dissolved and

Cabinet issued a directive to create the Wilderness and Ecological Reserves Advisory Council (WERAC). The first WERAC was officially appointed in 1981.

2.2.2 Parks Involvement

Prior to the 1980's Parks Division, Department of Culture, Recreation and Youth, was commonly viewed as the administrator of Newfoundland's parkland. As such, its involvement in the creation of the Wildlands Legislation, and the subsequent WER Act, was minimal [Minty, 1990]. In the mid 1980's, however, its perceived mandate changed. Parks Division had prepared a policy paper for the Provincial Cabinet, outlining what some viewed as an expansion of its existing mandate. As a result of the policy paper's particular emphasis on preservation, Cabinet saw how the WER Program would be better served by Parks Division. In 1986, the Program management was subsequently turned over to the Parks Division.

A number of housekeeping duties were the first items on the agenda of the Program's new administrator. Specific activities included bringing a number of sites presently under weak protective legislation into the WER Act. These areas included five seabird sanctuaries and one wilderness reserve then under the Wildlife Act [Halfyard, 1990].

2.3 WER PROGRAM OBJECTIVES:

2.3.1 Parks Policy

Prior to 1985, the Parks Division had operated its parks

system based on a limited three park classification process (Camping, Day Use, Natural and Scenic Attraction Parks) without any documented parks policy statement. In 1985 however, Cabinet approved a policy document which gave new direction to the division thereby allowing Parks Division to carry out its management duties more effectively. Further to this, in 1987, Cabinet also approved a Parks Classification and Zoning System [Parks, 1988]. Both initiatives sought to incorporate the WER Program more solidly into the parks system.

Parks [1988] outlines a consolidated version of the Policy and the Classification and Zoning system. In this document it is stated:

> [The goal of the Provincial Parks System is]... to provide a wide variety of high quality outdoor recreation opportunities for residents and visitors, and to preserve and protect in perpetuity provincially significant representative and special natural landscapes and features, and outstanding recreational environments, in a system of provincial parks. [p.6]

While this stated goal is rather straight forward, there are four basic objectives also presented which further reinforce the aim of the parks system (see Figure 2.1). These objectives include [Parks, 1988. pp. 7-8]:

1) Preservation and Protection -
   To preserve and protect in perpetuity outstanding and representative natural landscapes and features ... to preserve, in an unimpaired condition significant sites that are unique, rare or threatened, and ... to protect and preserve representative ecosystems.

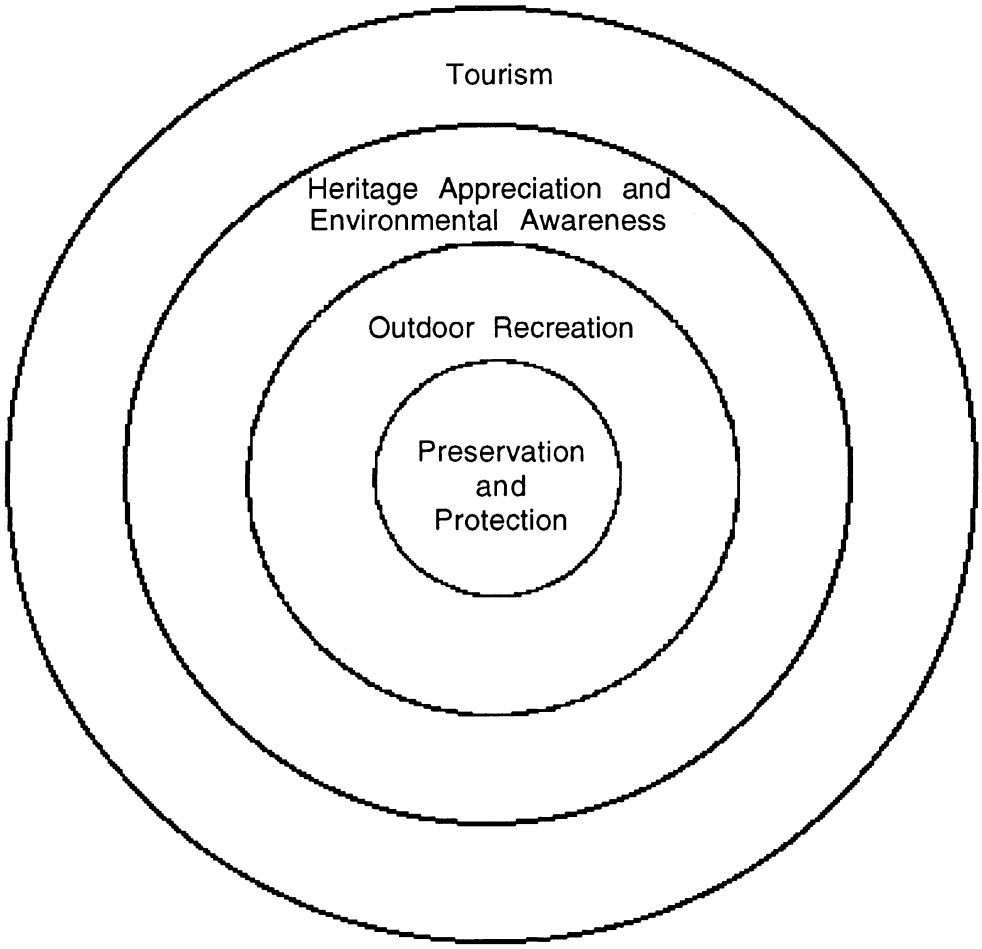


Figure 2.1
Four Objectives of Parks Policy
[after Parks, 1988]

2) Outdoor Recreation -
To provide diverse high quality reserve oriented outdoor recreation opportunities of sufficient quantity, variety and distribution to meet and satisfy the demands of ... residence and visitors ...

3) Heritage Appreciation and Environmental Awareness -
To provide opportunities for the exploration, understanding and appreciation of the province's natural and cultural heritage ...

4) Tourism -
To provide ... visitors with opportunities to discover, enjoy and appreciate the natural and cultural environment ...

2.3.2 Classification and Zoning

Until the classification and zoning systems are presented, the relationship of the WER Program to the overall parks policy may not be fully appreciated. As mentioned in the previous section, prior to Cabinet adoption of the new classification system, the Parks Division promoted their parks as being in one of three possible categories. Neither the Camping, Day Use nor the Natural Scenic Attractions park class were appropriate classifications for categorizing many of the WER defined areas. With the new system, the administration attempted to create a hierarchical structure for park management and planning. It organized parks (including reserves) into broad classes of similar functions, while the zoning system was applied to each park on a class by class bases. Figure 2.2 indicates the relationship between park classes and zones. For example, a WER would have only one zone (preservation) but a Waterway classed park might have both a preservation zone and a natural environment zone.

	Park Zone		
Park Classification	**Preservation**	**Intensive Recreation**	**Natural Environment**
Wilderness and Ecological Reserve	* *		
Natural Environment Park	* *	* *	* *
Waterway Park	* *		* *
Natural and Scenic Attraction Park	* *	* *	* *
Outdoor Recreation Park	* *	* *	* *
Park Reserve	* *		

Figure 2.2
Park Classes and Associated Zones
[after Parks 1988]

Chapter 6 will outline how this classification and zoning system may either hinder or help the WER Program in adopting a reserve delineation process.

While the other classes of parks are of interest, it is the Wilderness and Ecological Reserves which are of primary concern here. As outlined in Parks [1988], the objective of the WER classification is to:

> ... preserve and protect in an undisturbed state, representative and unique natural features, sites, objects and landscapes of provincial significance for scientific and educational purposes for the benefit of present and future generations. [p.14]

Because of the broad definition of each reserve type, it is necessary to deal with them separately.

Wilderness Reserves:

In comparison to other provinces' reserve legislation the WER Act is unique. With the exception of perhaps Alberta, Newfoundland's Act recognizes a special reserve category - Wilderness areas. The Act is very specific in its management guidelines for such an area. A **wilderness reserve** is defined as:

> ...a large natural area, or a large area that has been exposed to minimal human activity, which is protected so as to preserve its primitive character [anon, 1975].

or as the WER Act states:

> ... areas of the province that are at that time subject to no or little human activity [WER Act, c.2, s. 4].

Wilderness reserves are set aside to protect wildlife, vegetation, river systems and other natural features.

Protection is provided by not permitting construction, or development in the area. In drafting the legislation for such areas, however, it was recognized that because of the cultural heritage of Newfoundland, placing a complete ban on wilderness reserve activities would not be politically acceptable. The Act does, therefore, allow traditional **passive recreational activities** within a reserve such as hunting, fishing, trapping, hiking, camping, canoeing. *[3]

Ecological Reserves:

As noted in section 2.4.2 many provinces have some form of ecological reserve category and while each province may have a slight variation in their definition of an ecological reserve, the underlying theme is the same. An **ecological reserve** is defined as:

> ... a legally protected natural area where human influence is kept to a minimum. [And where] change, itself a natural phenomenon, is not interfered with, but is allowed as far as possible to proceed uninterrupted by man [Taschereau, 1985. p.5].

The WER Act defines it as:

> ... areas of the province that contain a representative or unique ecosystem, species or natural phenomena [WER Act c.2, s. 5].

Ecological reserves are usually smaller than wilderness reserves and are set aside to protect some form of rare plant or animal species. Ecological reserves are strictly preservation oriented and the guidelines in the legislation and subsequent management plans for established areas are very specific. Within such areas, passive research and educational

practices are permitted and passive recreation may be allowed, but under no circumstance is development permitted. *[4]

2.3.3 Selection Process

With human influences becoming more pronounced in many areas of Newfoundland, new sites for preservation and protection are becoming difficult to select. The WER Act does state that its reserves do not have to be untouched areas, but rather, they simply have to be sites of representative significance.

How does the Program select areas for inclusion into the Wilderness and Ecological Reserves classification? Figure 2.3 shows the procedure utilized for selecting and establishing a reserve under the Act. The first step is to have an area identified as a potential site for consideration. Anyone may contact the Advisory Council and nominate an area they feel merits consideration for reserve status. Once a site has been proposed, the WERAC reviews its outstanding characteristics and determines if it is suitable for wilderness or ecological reserve status. With such categorization determined, the Council then considers current uses of the area and attempts to determine if any of these uses conflict [Minty, 1990]. Based on their review, the Council may reject or accept the proposal. If the proposal is accepted, a more specific study area is defined. In the past, new sites have been selected in a subjective manner, not always taking into consideration the area's natural region boundaries, such as watersheds.

Section 12.1 of the Act outlines the next phase of the

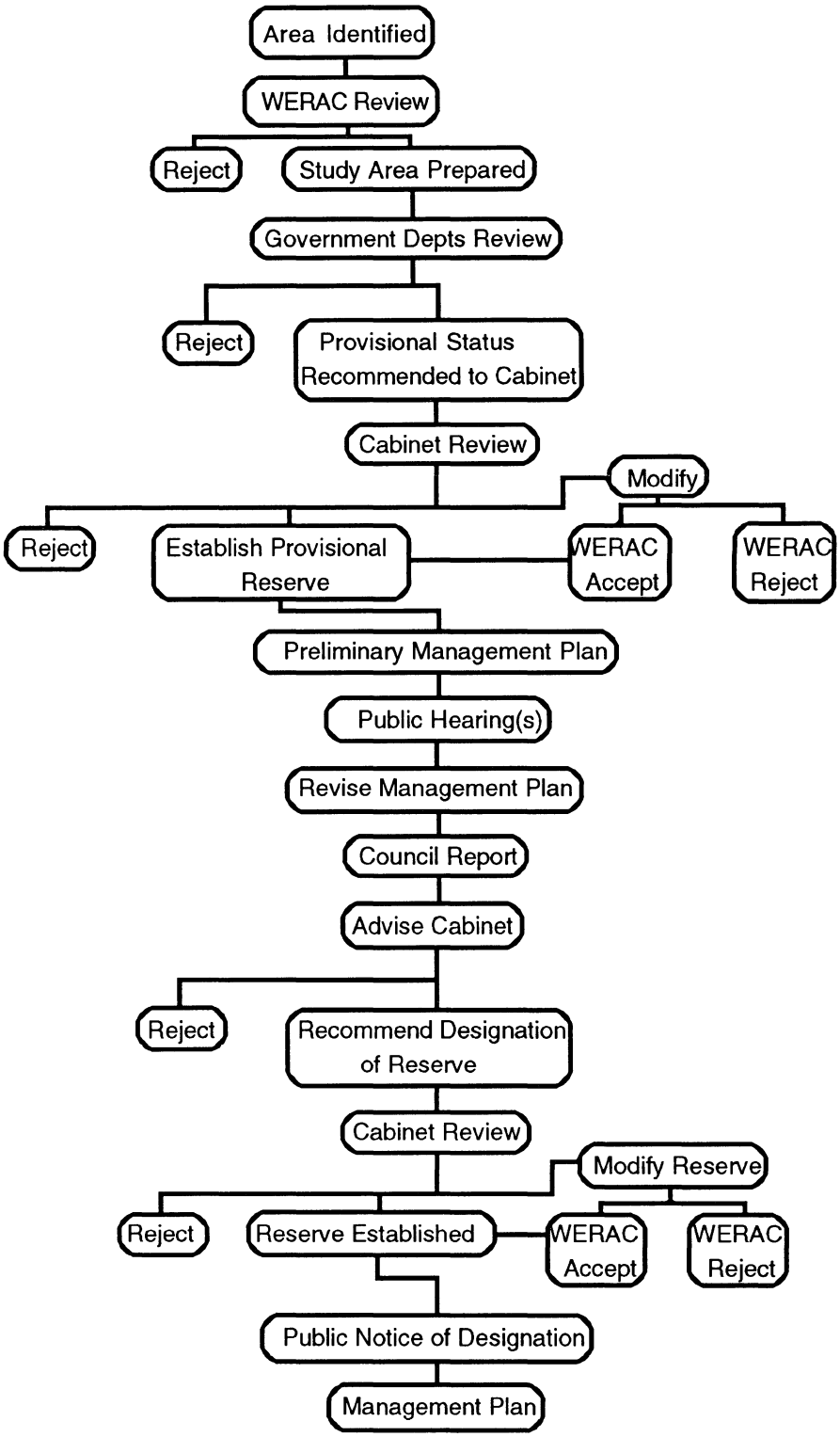


Figure 2.3
Reserve Designation Process
[after Halfyard, 1990 and WER Act, 1980]

establishment process. The Council must submit to all interested federal and provincial agencies, boards, commissions and other organizations " ... appointed by an Act or by the Lieutenant-Governor in Council," [WER Act, RSN, 1980], a copy of an outline for this new study area. As a result of this submission, Council is able to determine the level of conflict which might result if further steps were taken to protect a site.

At this stage of the process, the Council again may see fit to reject an area for reserve status, if there are sufficient conflicting land uses with regards to activities being considered by other government agencies. If, however, there are no conflicts, the area is recommended to the Provincial Cabinet for provisional reserve status. During Cabinets review, they can either reject the recommendation, accept it with modifications or accept the recommendation as is. In the case of unconditional acceptance, the area is assigned provisional status.

With provisional status declared, the Council, with the assistance of the WER Program staff, proceeds to prepare a Preliminary Management Plan. This plan serves as the basis for public review, the next phase of the process. Based on the outcome of these hearings, a revised plan is prepared and a report is drafted advising Cabinet of the results of the public hearing process and the Council's final recommendations. If the report recommends the revised provisional reserve be accepted, Cabinet then reviews the

report and again may take one of three avenues: (a) reject the reserve; (b) accept it with modifications; (c) accept it as per the results of the public hearings. In either of the latter two situations, the Council prepares a Public Notice of Designation, notifying the public of the newly established reserve.

2.3.4 Management Guidelines

The WER Program formulates all its management decisions in relation to the WER Act. However, as the Act points out, any provisional or established reserve must have a management plan prepared for that specific area. While sections 19, 23, 24, 25, and 26 of the Act are concerned with many of the restrictions within any reserve, they do not address specific regulations for particular sites. Each reserve has some particularly site specific features to protect and preserve, therefore, each site will require special regulatory consideration.

Parks Division and the WER Program do not have a systematic approach to preparing a management plan for a given area [Halfyard, 1990]. In most cases, the details of a management plan are developed from consultations with those concerned with the area. While this may make the management plan very site specific, difficulties may arise in the management of these areas due to the fact that the consulted person(s) may have personal bias.

The strict preservation mandate of the Program must be reflected in any management plan. It must also contain

descriptions of the area, laying out as much of the **resource information** as is available. The plan must indicate the issues and problems of the region (this however, is lacking in many of the present management plans due in part to the lack of reliable information). It should also outline out the management policies based on the issues and the intended guidelines for implementing the plan and in addition to the Act's regulations, it should present more specific regulations for each site [Halfyard, 1990].

Management guidelines are also reenforced through a permit system. Any individual wishing to enter a particular reserve area must first obtain an entry permit. Failure to do so is a violation of sections 24 and 25 of the WER Act.

2.4 PROGRAM COMPARISONS

2.4.1 Protected Lands

How much land should the WER Program protect? Is 10 percent of the land base sufficient for protection or should the response to such a question be 'as much as is necessary'? The Bruntland Commission Report entitled Our Common Future, recommended that an international preservation goal of 12 percent be achieved by the next decade, thereby protecting a representative portion of all ecosystems. The WER Program never set a definite figure for preservation purposes, however, they have adopted this same 12 percent mark as part of their management strategy [Halfyard, 1990].

How does the Program efforts to reach the 12 percent mark

compare to other provinces? As Table 2.1 indicates, Newfoundland presently has less than 2 percent of its land mass protected through legislation. This is significantly less than it's adopted mark of 12 percent, as compared to provinces such as Alberta which had 11.7 percent of its provincial land mass protected in one form or another in 1988 [Alberta, 1988].

2.4.2 Legislation

Since its enactment in 1980, the Newfoundland WER Act has received a great deal of praise [Minty, 1990]. Prior to this legislation, Canadian protection agencies tended to look to the United States for guidance in regulating protection [Franson, 1972]. Although other provinces had legislation for ecological reserve protection before Newfoundland, their approaches always seemed to be lacking in some area.

In March 1980 the Newfoundland Government's attitude towards protection of wildlands was evident in the Speech from the Throne:

> ... Unparalleled natural resource development and the rapid expansion of our economy will place new and potentially dangerous stress on both our natural and social environments. Indeed, as resources are developed, it seems inevitable that changes of a physical and social nature will take place. However, we must be careful, in each instance, to first evaluate both the benefits of resource and economic development and the consequential environmental, social and economic impacts. Only then should we decide, on a rational basis, whether the resource or economic development in question is justified.
>
> The Wilderness and Ecological Reserves Act ... will reinforce the concept that we must be willing to forgo some economic development in the

Table 2.1
Protected Areas Summary of Newfoundland
[after Parks 1990; Parks n.d.a;
Parks n.d.b; Parks n.d.c]

Designated Areas:		
NAME	**YEAR**	**AREA**
Funk Island	1983	0.19
Cape St. Mary's	1983	12.10
Witless Bay Islands	1983	1.14
Gannet Islands	1983	2.02
Hare Bay Islands	1983	4.42
Avalon Wilderness	1986	1070.00
Mistaken Point - First reserve to be proclaimed under full WER process	1987	2.50
Bay Du Nord Wilderness	1990	2895.00
Table Point	1990	1.16
Watts Point	1990	30.90
Provisional Areas:		
The Grass	1984	11.00
King George IV	1984	19.00
Fortune Head	1990	2.25
West Brook Red Pine	1990	unavailable
Hawke Hills	1990	unavailable
Others:		
Main River - Canadian Heritage River		216.10
Other Provincial Park Classifications		342.52
National Parks (2)		2338.00
National Historic Parks (5)		90.00
Salmonier Nature Park		11.00
TOTAL		7049.30

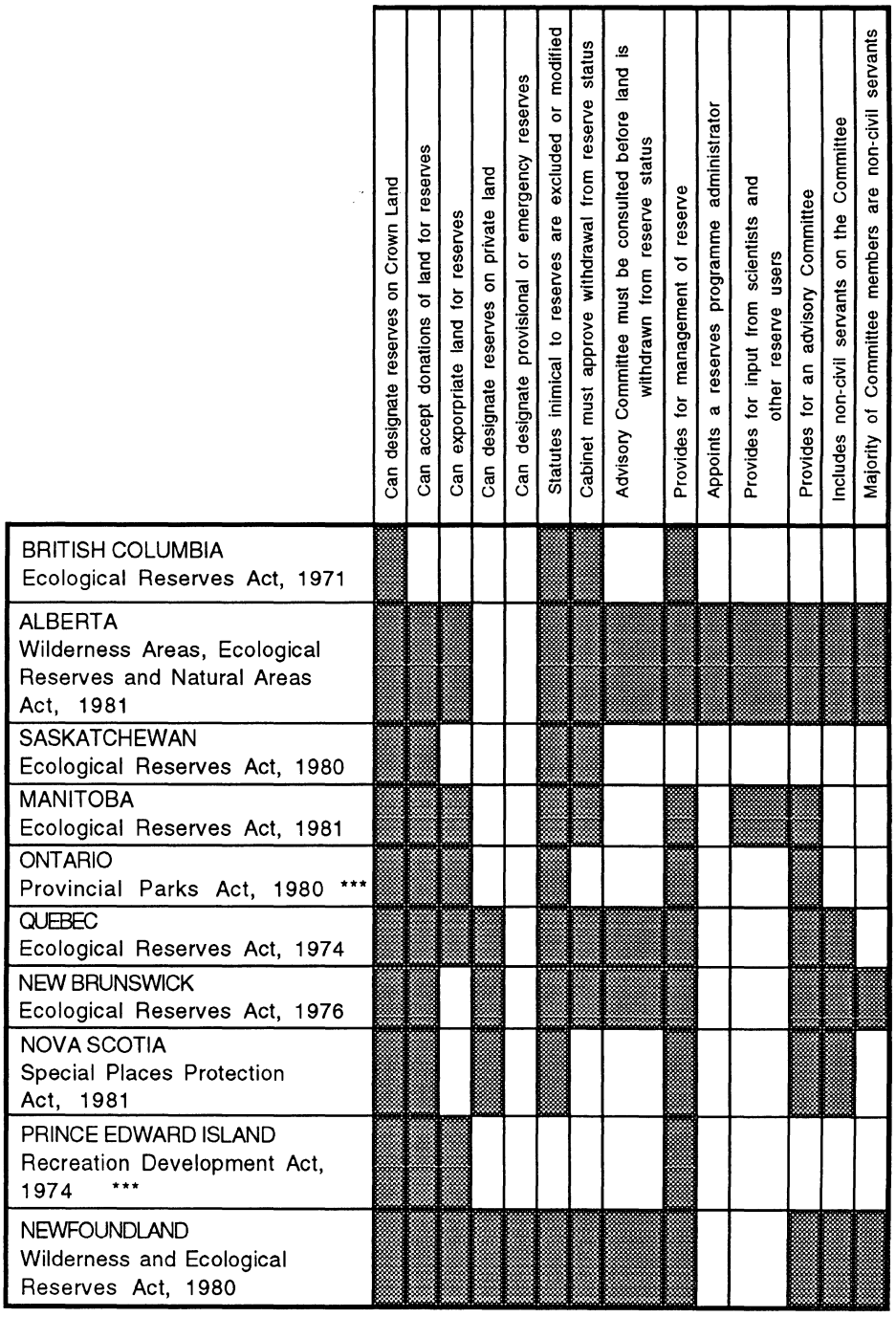
Total Area of Province = 404 517 km2
Result: Parkland for Newfoundland = approx. 1.7%

> interests of the preservation of certain of our wilderness areas which are an essential part of the social and cultural heritage, not only of our native peoples, but of the vast majority of the residents to the Province. [Taschereau, 1985, p.90]

During the development of the Act many experts were consulted as to their opinions on its content and structure. Given the nature of the Act, environmentally oriented with political overtones, Franson stated the Act was "as good as (politically) possible" [Taschereau, 1985, p.90]. As can be seen from Table 2.2, comparing Newfoundland's WER Act with those of other provinces, Newfoundland's Act excludes two management categories: (a) it does not appoint a reserves administrator, (b) it does not provide for input from scientists and other reserve users. It might, however, be argued that these two features are indeed covered, if not in the Act, at least in the actual running of the Program [Halfyard, 1990].

Indeed Newfoundland has a statute, which for the most part, parallels no other. In this respect it has the potential to be a trend setter in protecting and preserving natural regions of the country.

Table 2.2
A Comparison of Major Provincial Legislation Used to Establish Reserves
[after Taschereau, 1985]



*** Province does not have an Ecological Reserves Act

Chapter 2 Endnotes:

1. The historical outline of the Wilderness and Ecological Reserves Program was compiled primarily from personal communications with:

a) Mr. R. Halfyard -- May 31, 1990. Mr. Halfyard is the Parks Division's Natural Heritage Planner and Chairperson for the Wilderness and Ecological Reserves Advisory Council (WERAC).

b) Mr. D. Minty -- June 27, 1990. Mr. Minty was one of the original members of the Wildlands Committee and a long standing member of the WERAC.

2. The complete title of the Act is:
An Act to Provide for Natural Areas in the Province to be Set Aside for the Benefit, Education and Enjoyment of Present and Future Generations in the Province.

3. Sections 4, 23.1 (a), 23.3 (a,b,c) outline more specifically the types of activities permitted in a wilderness reserve.

4. Sections 5, 23.1 (a), 23.3 (a,b,c) outline more specifically the types of activities permitted in an ecological reserve.

CHAPTER 3

A MANAGEMENT FRAMEWORK FOR THE WER PROGRAM

3.1 INTRODUCTION

Understanding the information requirements for a program, such as the Wilderness and Ecological Reserves Program, requires an initial understanding of the management framework of the organization. This chapter will look at a three tiered management framework consisting of strategic planning, management control, and operational control. These same levels will be further refined so as to demonstrate the level of information detail necessary in the decision making process. Then, some of the information sources, which the Program may be able to incorporate into its selection procedures, will be described. This will be followed by a description of a number of information constraints placed on the Program. These constraints will be viewed not from a source perspective, but rather from an organizational perspective.

3.2 PROGRAM MANAGEMENT FRAMEWORK

Management may be defined as the art and science of making decisions in support of perceived objectives. The information used in the decision making process is related to the framework or structure of management within a given organization. It is, therefore, important to understand the

management structure of that organization if one is to begin appreciating the types of information necessary to make decisions.

In a management framework, various levels of decision making exist. Differing amounts and kinds of information are necessary for each level. Gorry and Morton [1987], outline three levels of a management framework for an information system: **strategic planning**, **management control**, and **operational control.** Figure 3.1 illustrate how the three categories of managerial activities relate to one another and how information, action and planning functions relate to these levels.

This management framework model, however, is not complete. To better understand the decision process, the three management activities must be related to the actual approaches available for dealing with a problem. There exist two extremes in handling any given information system problem: structured and unstructured [Gorry and Morton, 1987]. In a structured process, decisions are considered repetitive and/or routine in nature. In such instances, management decisions are relatively straight forward and are usually reflective of past decisions. Unstructured decisions on the other hand are not routine and may have little or no ties to past decisions. In the case of unstructured processes, solutions are dependent on the problems at hand and are usually dealt with independently.

In addition to structured and unstructured decision

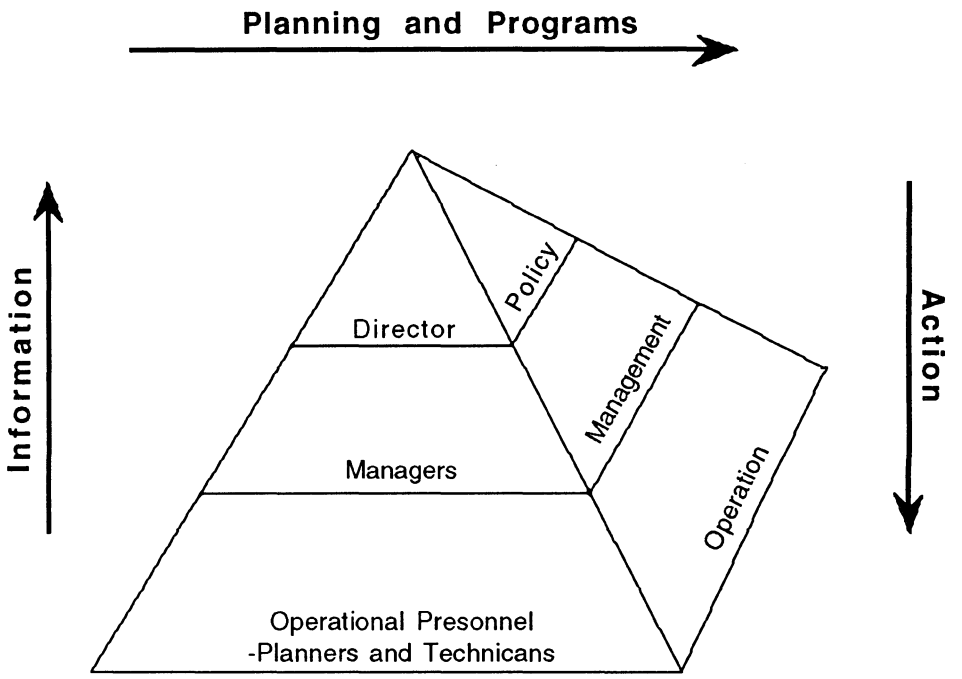


Figure 3.1
Relationship of Managerial Activities to
Information, Action and Planning
[after Huxhold, 1987]

processes, a third possible class of decisions exist. A semi-structured process is a middle ground approach to the above mentioned extremes. In such a situation some aspects of the problem solving process are structured while others are not. In a system where decision making has been semi-structured, the organization may be aiming for a completely structured process but failed to reach such a goal for one reason or another.

When attempting to understand a given organization's management framework and decision making processes, it must be realized that the organization is often only a small part of a larger system. Such is the case with the Wilderness and Ecological Reserves Program in Newfoundland. In the larger department context, the Program might be considered a small part of operational control. With respect to Parks Division, the Program's activities are more in line with management control, in as much as the Program attempts to assure that **resources** (natural areas) are obtained and used effectively. In either case, their efforts to preserve and protect natural areas of the province are considered to be, at best, semi-structured. The structured approach to their management activities relates to their dependency on the Wilderness and Ecological Reserves Act, while the unstructured elements relate to current reserve selection procedures. One of the WER Program's aims is to make the reserve selection process more structured [Halfyard, 1990].

3.3 INFORMATION NEEDS

Each of the three levels in a management framework require different amounts of information for their decision making process. Figure 3.2 relates the management framework and the level of information to selecting a reserve site for the WER Program. In the initial stage of reserve selection there is the need to consider the original site proposal. As the pyramid shape suggests, large amounts of information are necessary to evaluate such a proposal. Without diverse information about a site and its surroundings, assessment cannot be considered complete.

The second stage of reserve selection is the management control phase. Here the WER Program begins formulating a reserve management plan and begins the public hearings process. Program staff focus on a more precise area in comparison to the original site proposal. It is at this stage that the public want to know how such a site will affect them, not how it will benefit the surrounding ecological processes. The level of detail of information at this stage is, therefore, more site specific. The amount of information being handled, meanwhile, is much less because interest is within the site itself.

In stage three reserve establishment is the goal. Information becomes more site specific and is restricted to the inner regions of the area's boundary and little concern is given to its exterior surroundings. The political decision makers become involved at this stage. The process no longer

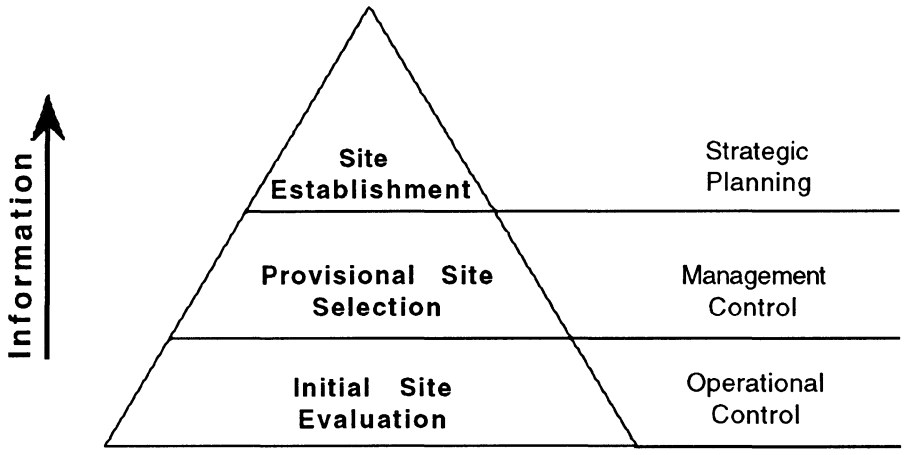


Figure 3.2
Level of Information Necessary in
the Management Framework

focuses specifically on environmental significance, but rather, looks at the overall political picture.

Reviewing the selection process in this framework suggests that reserve sites become progressively smaller, but in fact, this does not have to be the case. After an original proposal is made, significant findings for a site may point to a need for a larger delineation of the area. It is therefore, not the reserve size itself that reflects the amount of information needed, rather it is the focus of the decision process which determines the information requirements.

3.4 INFORMATION AVAILABLE

Given the described management structure and specified information required by each level of the framework, what types of information are presently available to the Program? Existing policies for the Parks Division do not give direct consideration to the needs for, or use of, information in its management activities. Parks, [1988], does not include the need for information as a fundamental ingredient to achieving the Provincial Parks System's goal, rather the need for or dependency on information is only inferred.

Many sources of information exist and are available to the WER Program. Some of these sources are presently utilized, while others are not. In the following sections a number of sources will be reviewed and efforts will be made to indicate their suitability for site selection. Other sources of data will be described in Chapter 5 as part of the pilot

study carried out over the past year.

3.4.1 Wilderness and Ecological Reserves Advisory Council (WERAC)

WERAC consists of eleven members, of which six are public representatives and the remaining five are civil servants [WER Act c.2 s.7(1)]. Each member is appointed by the Lieutenant Governor in Council for a term of three years, with the possibility of reappointment. The members of the WERAC are not considered experts in environmental issues or reserve selection processes; rather they are citizens who have a concern for the land and its uses. These same members may indeed be experts in selected fields of study, for example biology, geology, environmental sciences, or geography, however, their role on the advisory council is to be a sounding board for ideas put forth by the Program administrators (Parks Division staff) [Minty, 1990]. At the same time, because they may be experts in one field or another, council members can provide some guidelines for Program staff to follow when selecting a reserve site.

Civil service representation on the council has some distinct advantages. For example, as information becomes necessary for site selection, these same civil servants can direct the Program's staff to suitable sources of information. Of course, such an advantage is best exercised if the civil servants are from different government departments and are collectively aware of all possible information sources. Department's which have no representation on Council should be

encouraged to become involved, as the opportunities arise, thereby allowing them to gain first hand knowledge of how the program works.

3.4.2 Interdepartmental Land Use Committee (ILUC) Data

The Interdepartmental Land Use Committee is considered to be a major participant in the process of selecting reserve sites [Halfyard, 1990]. As with the Wilderness and Ecological Reserves Advisory Council, the members of ILUC are not so much an information source, but more a means of identifying the most suitable source. ILUC is made up of director level, or equivalent, personnel from departments or agencies having a vested interest in land development within the province. They coordinate government resource development activities, attempting to reduce conflicts in land use. While ILUC cannot prevent agencies from proposing land use activities to Cabinet, they can give assistance to those departments wishing to avoid conflicts over developmental proposals [Lang, 1986].

ILUC allows the WER Program to access the most suitable information pertinent to the reserve selection process particularly when land use issues threaten a sensitive site. The committee assesses land use proposals only for Crown land, but considering Crown land comprises approximately 90% of the province's land base [Lang, 1986], ILUC's potential cannot be overlooked.

There are, however, limitations to the actual information that is available to the Program. When the WER Program is considering a site for reserve status, it submits a proposal

to ILUC. The committee's evaluation process includes a conflict analysis. This activity is limited to investigating conflicts in relation to issues such as present site claims or a site's adjacency to potential conflicting uses. It does not work in reverse; that is, the committee does not consider the effects on present land uses if a reserve were to be established at a given site. The conflict analysis also does not take into consideration localized environmental interactions based on the elements of a given site.

Another limitation to the ILUC process centres around the fact that some agencies are involved voluntarily, and hence may only be involved when it suits their particular need. Others are obligated to be involved because of specific Cabinet Directives. Forced involvement may create reluctant participation and may, at times, do more harm than good [Agee and Johnson, 1988]. The Reserves Program must, therefore, carefully weigh the information needs in relation to the circumstances at hand.

3.4.3 Resource Inventory Index Data

The Resource Inventory Index is a compendium of information which is provided to government land managers as a means of quick reference, enabling them to determine availability of selected resource data. This index has been compiled via solicitation from all potential resource information agencies within government [Price, 1984]. Throughout the index, various categories of information are supplied to the land managers, such as geology, hydrology,

wildlife studies, forest inventory, peatland inventory and much more. As its name indicates, the information supplied serves as an index for the managers. In some instances the text directs its user to a specific bureau for additional information.

While the Resource Inventory Index provides the WER Program with an initial point of reference for collecting information, a number of its features provide cause for concern. First, the index was initially distributed in 1984 and has not been updated [Ryan, 1991]. Thus the currency of both the information and the listed contacts for additional data are questionable. Second, the maps supplied with the text are at a scale of 1:3 000 000 and therefore the accuracy of the information is suspect [Ryan, 1991]. Third, because the information contained in the index was supplied by 'willing participants', it is not known how many other sources were missed. Finally, even with information being supplied by 'willing participants', it is not clear how much information may have been withheld because it was considered sensitive, or unimportant.

3.4.4 International Biological Programme (IBP) Data

In 1964, Canada along with 57 other nations adopted a ten year program to locate, document, and seek protection of a portion of major natural ecosystems [Taschereau, 1985]. The ecologists involved in the project found themselves faced with the difficult task of matching their knowledge to basic information on the earth's ecosystems. IBP established a

subcommittee for the Conservation of Terrestrial Communities (IBP-CT). IBP CT's aim was to preserve samples of the ecosystems for both educational and demonstration purposes. Underlying this aim, IBP-CT was also interested in having these sample areas protected as ecological reserves.

IBP-CT's first activity was to create an inventory of the candidate areas and to conduct basic biological surveys of the sites. The inventory and site analysis was prepared primarily from personal experience and local expert opinions. Only those sites deemed suitable, after field checks, were inventoried. The check sheets prepared in the field contain a wealth of information for each site. Site sketches, vegetation and soil analysis, an indication of outstanding flora and fauna, and significant human impacts on the sites are some items contained in each check sheet [Peterken, 1970].

By 1974, IBP had registered 964 sites in ten Canadian regions, 66 of which were located in Newfoundland and Labrador [Taschereau, 1985]. A number of these sites are presently under consideration for reserve status through the WER Program and others will continue to be investigated in the future.

3.4.5 Canada Land Inventory (CLI) Data

In the early 1960's the Federal and Provincial governments began a joint program entitled the Canada Land Inventory (CLI) [Gierman and MacDonald, 1981]. The objectives of the program were, "to classify lands as to their capabilities; to obtain a firm estimate of the extent and location of each class and to encourage use of CLI data in

planning" [Scace, 1981]. CLI mapped approximately one third of Canada, primarily at a scale of 1:250 000. The categories of information mapped included: Land Capability for Agriculture, Recreation, Forestry, and Wildlife, along with Present Land Use. Table 3.1 lists the CLI data available for Newfoundland.

As with other data sets mentioned above, CLI is not without its limitations [Lang and Armour, 1980]. First, the CLI maps are more suited for reconnaissance purposes rather than site specific activities, and although there exists a classification system for each map theme, mapping at 1:250 000 required a great deal of generalization. *[1] Second, the CLI maps display land capability without regard for the area's present use. Third, CLI areas do not give an indication of a site's best use. It does categorize each individual use, such as agriculture and forestry, but the untrained user is unaware of the sites most productive potential. Fourth, because CLI was a national program, the categorization of land use and capability were ranked on a nation wide basis. Analysis on a national basis may have, therefore, indicated a site to be unsuitable for a particular use, but on a regional basis, that use may be very acceptable. Using such nationally based data may, therefore, restrict interpretability of information on a regional basis. For example, in Newfoundland, the agricultural ratings start at CLI class 3 and only covers an area of 5500 hectares [Light, 1989]. Such ranking would not give these areas of the island a very favourable rating for

Table 3.1
Canada Land Inventory Maps Available for Newfoundland
[after Canada, 1991]

MAP SCALE: 1:250 000	Information			
Map Sheet	Agricultural	Forestry	Wildlife (Ungulate)	Recreation
Trepassey	*	*	*	*
Belleoram	*	*	*	*
St. John's	*	*	*	*
Bonavista	*	*	*	*
Gander Lake		*	*	*
Botwood	*	*	*	*
Burgeo		*	*	*
Red Indian Lake		*	*	*
Stephenville	*	*	*	*
Sandy Lake	*	*	*	*
Port Saunders		*	*	*
St. Anthony		*	*	*
Goose Bay		*		
MAP SCALE: 1:1 000 000				
Atlantic Provinces	*	*	*	*

agricultural potential. In a national context this may be so, but, in the provincial context these areas would be prime agricultural land. Fifth, there are omissions in the CLI data set. For a number of reasons some areas have not been mapped, making the data incomplete. Finally, there exists a lack of confidence in the CLI data because the information is old and in many, if not all, instances requires updating.

On the positive side, CLI data provides another starting point for natural resource programs which have limited access to information. The information may be generalized, but for initial site evaluations, CLI data may provide a limited site overview. While successes have been varied, Manitoba [Scace, 1981], Nova Scotia [Duinker, 1981], and Alberta [Petch, 1985], have taken steps to apply the inventory to creating more detailed land use information. Other provinces, including Newfoundland, have used the CLI as a base map for referencing more recent information. They have not, however, completely incorporated the CLI system for their particular needs [Easley and McIntosh, n.d.].

3.4.6 Provincial Parks Atlas

The Provincial Parks Atlas was initially developed as a quick reference tool for use by Parks staff and various Federal and Provincial agencies. In its original form, the atlas was intended to give a brief description of all parklands under the administration of the Provincial Parks System. The information available in the Atlas included both textual and graphic data pertaining to all provincial parks,

wilderness reserves and ecological reserves. Information included: where feasible, a copy of a 1:50 000 scale map for the site; park reference number; date parkland was proclaimed and gazetted; and the area coverage of the land.

In the late 1970's, Parks staff began collecting flora and fauna information related specifically to each park, although it was not until the late 1980's that this data was incorporated into the atlas. Due to the fact that the data was collected during summer student work projects, not all parks were completed. In some instances, it is believed the current data would require updating and further verification.

It is beyond the scope of this report to provide an indepth critique of the Provincial Parks Atlas. It is worth noting, however, that throughout the history of the Parks Division, the potential benefits of such a document have not been fully measured. As time passes, more information should be added to the atlas making it as comprehensive a document as is possible. Such a text, while not completely relevant to wilderness and ecological reserves selection processes, can, and will, assist the Program in better managing its existing areas.

3.5 INFORMATION CONSTRAINTS

There are two main types of constraints on information, acquisition and use. Given the potential information sources mentioned above, a number of constraints are more evident than others. For example, having to use old material or incomplete

information; attempting to manipulate data that is too general for reserve selection needs; or, in terms of acquiring information, having to deal with agencies which lack a cooperative spirit. In the following sections a number of constraints are outlined which are not so evident. They relate more to the use of the information as opposed to those of acquiring information

3.5.1 Reserve Selection Time Frame:

In Chapter 2 it was noted that the WER Program has a strong legislative foundation. It was also noted that these same legislative guidelines have an important part to play in reserve selection. During the provisional and establishment stages of the reserve selection process, however, time constraints are placed on the resource manager, particularly in terms of gaining sufficient information to make educated selections.

Figure 3.3 illustrates a time line for reserve selection as outlined in the Act. As indicated by the figure, the initial stages of reserve selection have no set time frames in which tasks must be completed. In the proposal stage, the administration can freely collect data on given areas without fear of reprisal. As the process moves into the provisional reserve selection stage, the time frames become more rigid. While initial stages of provisional status activities do not have specific time frames attached, concerned citizens often begin demanding answers as to the future use of their land.

Recognizing the fact that as one moves down the time

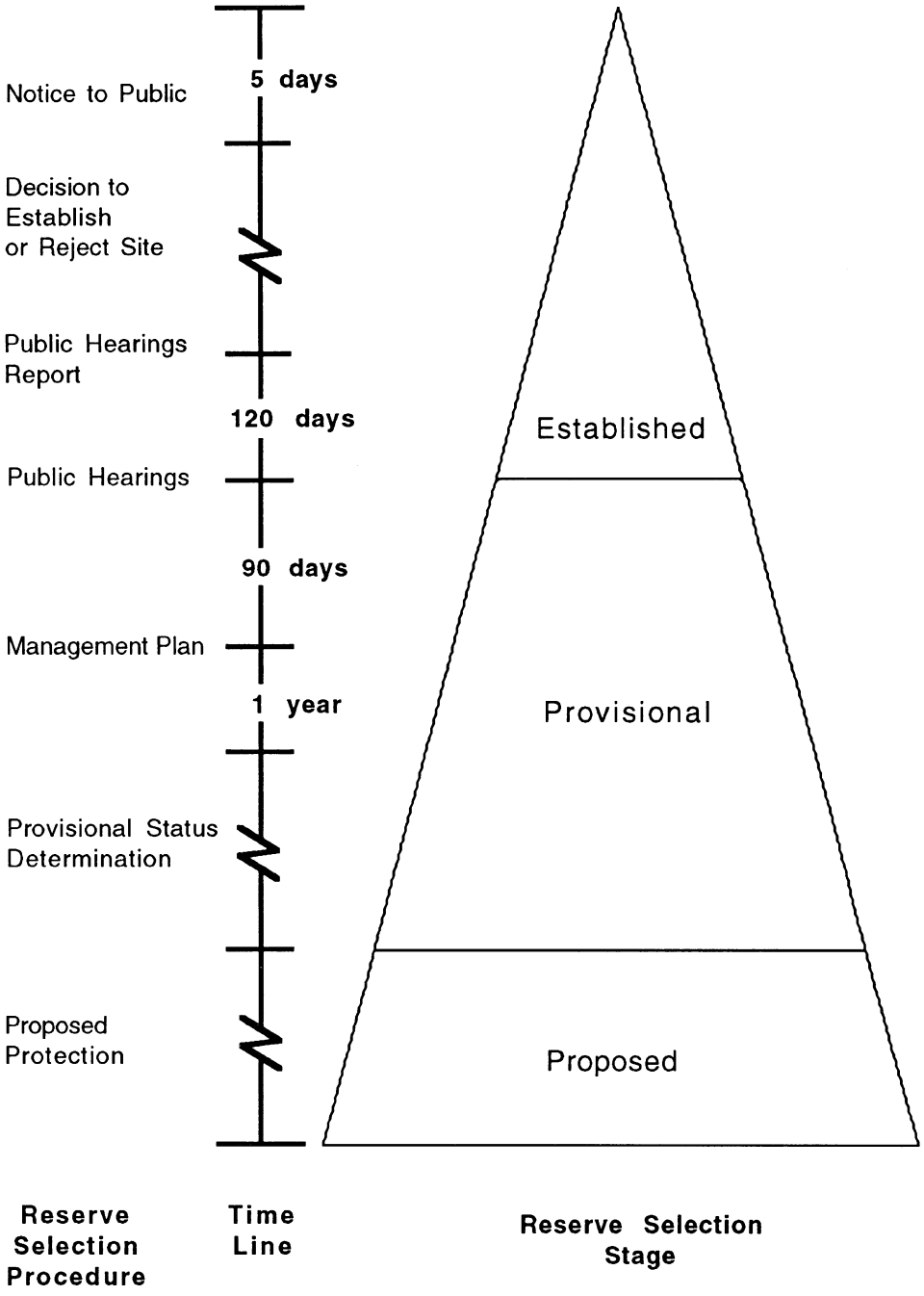


Figure 3.3
Time Constraints to Information Collection
During Reserve Selection

line, the area in question becomes better defined, it must also be realized that the amount of site specific information necessary, increases. This is when the age of the information, it's availability, and agency cooperation problems become evident and one can begin to understand how the time constraints begin to create barriers for the reserve boundary selection process.

The establishment stage is similar to the proposal stage in that the time constraints are once again removed. At this point, the critical decisions have been made based on the information at hand and further detail is not relevant. (i.e. structured decision making processes are instituted.)

3.5.2 Use of the Permit System:

One area of information availability noted in Chapter 2 relates to the present permit system, as enforced under sections 24 and 25 of the WER Act. The permit system ensures existing reserves are being used in an acceptable manner. While the information collected from reserve users would do little to help in selecting the boundary for the reserve they are occupying, it could allow the Program managers to collect information for better management of that site. Such information may also allow a better understanding of the ecological processes in other similar sites in the province.

A problem arises, however, in that the permit system does not make the release of information mandatory. In order to ensure information release, the Act would have to be amended so as to allow Parks staff to ensure compliance. Such an

effort would not be feasible because it would have a negative impact on the Program's efforts to promote wilderness experiences.

3.5.3 Lack of Personnel:

In numerous consultations with Parks Division staff it became quite apparent that a major internal barrier to obtaining reliable resource data, was a lack of qualified personnel to collect the required information. Within the present staffing model, the WER Program is embedded within the Planning Section of the Parks system. The existing staff consists of a Natural Heritage Planner, a Parks Planner, and a seasonal/temporary Biologist. For the program to function effectively permanent staff positions, such as a Biologist and a Botanist, are required. Such staffing positions are vital to information collection and would be valuable to the reserve selection process. Personnel with proper expertise can ask more relevant questions and therefore, obtain more appropriate information that will ultimately lead to more reliable decisions. The additional personnel would, in turn, allow the Natural Heritage Planner and the Parks Planner more freedom to perform their prescribed administrative duties.

3.6 CONCLUSION

The Wilderness and Ecological Reserves Program's management framework has been outlined as a hierarchical system consisting of strategic planning, management control, and operational control. By analyzing the information

requirements in relation to this framework it is possible to gain a better understanding of how existing information can best be used in the reserve selection process.

Only a portion of the information presently available to the program is being utilized in the management process. Partly, this can be attributed to the Program's current policies and objectives which do not give direct consideration to the needs for information in managing the program. It is true that some of the more obvious information sources are being called upon in reserve selection procedures, however, others are not.

The lack of use of various sources results from a lack of confidence in that source. Another reason for not using particular sets of data is the result of existing institutional problems, such as legislative time constraints and personnel problems.

Chapter 3 ENDNOTES:

1. It should be noted that the 1:250 000 maps for CLI data were compiled based on information supplied by the individual provinces. However, this researcher was unable to locate the original data for Newfoundland.

CHAPTER 4

APPROACHING THE RESOURCE MANAGEMENT

> The challenge facing nations today is no longer deciding whether conservation is a good idea, but rather how it can be implemented in the national interest and within the means available in each country. [World Commission, 1987 p.147]

4.1 INTRODUCTION

Providing sound management for the land's resources requires achieving a balance between ecosystem stability and improvements in resource productivity. In order to achieve this delicate balance, each sector of land use, including agriculture, forestry, and transportation, must be committed to gathering information pertaining to the land and its resources. Many forms of information gathering have been attempted so as to enable resource management to take place, each with its own advantages and disadvantages. In this chapter, two different approaches to information gathering will be examined, the **component approach** and the **holistic approach**. After each type is outlined and some examples are described, the later portion of this chapter will focus attention on a holistic methodology believed to be a good means of collecting and analyzing information for proposed wilderness and ecological reserve sites.

4.2 COMPONENT APPROACH

A component approach to resource management refers to a general approach whereby each element of the land is separated out to create a unique classification. Much of the work to date relating to land use and resource management has been based on a component perspective. In a component approach, resource managers work with only the information which is of direct importance to their purpose and as a result, they infrequently go beyond the boundaries of their given resource specialty.

Figure 4.1 provides an example of the component system. It displays three different disciplines interested in the same parcel of land, each with a partial view of that land. In theory, in a component system the views of the different disciplines are independent. Those interested in the forest resource do not take into direct consideration the soil structure of the specific area. As a result, the forester creates a classification inventory for that site based strictly on vegetation information. A similar relationship exists with the soil surveyor and the hydrologist.

The component method has been viewed as a quick means of collecting data on particular resources. Such a method might also be labelled as a project approach to information gathering. The end result in such a system is a large amount of potentially interdisciplinary material which, in its existing form, can only be related to a given geographical location.

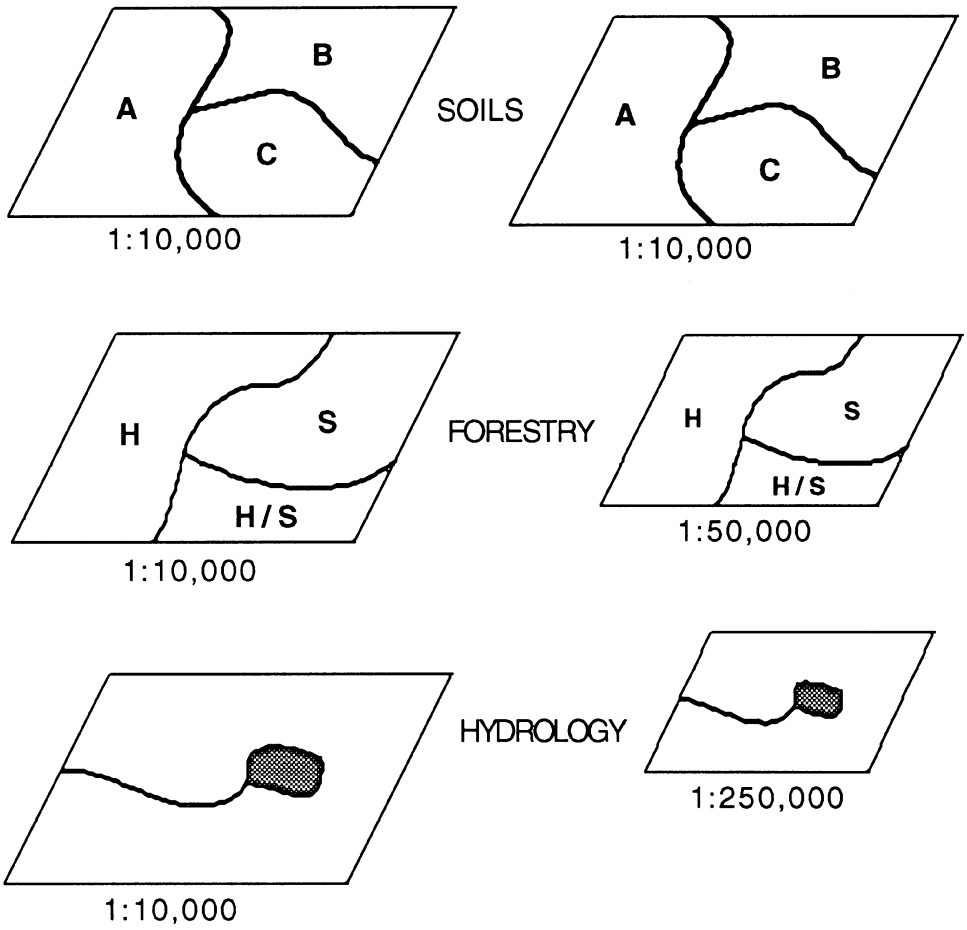


Figure 4.1
Component Approach to Information Gathering

A practical example of the component approach is the Canada Land Inventory, as described earlier. This joint federal/provincial project dealt with four types of land use categories: agriculture, forestry, wildlife and recreation. During the project, provinces were requested to supply land use information based on these four classes and in practically all cases, each class of land use was prepared without consideration for other land uses of the same area. While CLI information was portrayed nationwide at a primary scale of 1:250 000, compilation was carried out at various scales [Dilworth, 1991].

4.3 HOLISTIC APPROACH

Although the component approach has been extensively utilized, over the past two decades resource managers have realized the limitations imposed because of the approach's data handling capabilities. Therefore, they have been in search of a more holistic approach to resource management issues. *[1] A holistic approach reflects an attempt to

> "invite all parts of the landscape ... to form as complete a description as possible of an [area], with the goal of expressing the interactive character of the land's [components] and comparing them to surrounding systems such that the areas spatial function relations are also understood" [McLaughlin, 1991].

4.3.1 Integrated Resource Management

Integrated resource management is not an idea introduced by the current environmental movement; it was, in fact, envisioned during similar movements of the 1970's [Agee and

Johnson, 1988]. At that time, people realized that single agency campaigns to save resources were not the solution to the growing environmental problems. It became obvious that an alliance of mutually interested institutions in a cooperative spirit was required to protect the resources. In some instances Federal and Provincial Governments have recently taken it upon themselves to develop some form of a holistic management scheme. Later some examples will be outlined and the advantages and disadvantages of the holistic approach will be discussed.

The underlying theme to integrated resource management is the development of a holistic inventory of information that can be used by any interested parties. To create such an inventory requires a base of information from which to build on. Recently a popular foundation for creating the inventory has been the collection of information based on an area's **ecosystem** characteristics. An ecosystem is defined as " all plants and animals that live in a particular area together with the complex relationship that exists between them and their environment" [Light, 1991]. By dealing with information in an ecosystem context, the resource manager has established a base upon which he or she can begin to understand the complex relationships within a given site.

A problem arises, however, when attempting to describe the ecosystem of interest. Although it is the foundation of a resource manager's plan, depending on the manager's need and/or background, an ecosystem may be viewed in either a

large or small spatial context. For example, a Park Planner may see an entire park area as an all encompassing ecosystem composed of a multitude of subsystems. A botanist may, however, view a particular marsh in that same park as being an ecosystem and activities within that marsh as subsystems of that marsh.

The idea behind using the ecosystem as the starting point for resource management is not to define the spatial context of all resource management, but to establish the foundation from which to build a management system. In doing so, the necessary contributors of information would be better equipped to focus their information gathering. A holistic ecosystem approach to natural resource management, therefore, allows the resource manager to aggregate a diverse set of data which is based on complex relationships within a particular environment. There exists a number of examples of efforts to initiate a more holistic approach to natural resource management. Table 4.1 illustrates how various countries use different terminologies to classify land using an ecological bases.

Looking closer at the Canadian Ecological Land Classification (ELC), each ecological classification has not only been subdivided into classes, but also into levels of map detail (see Table 4.2). Through the ELC system, the Federal Environmental Assessment and Review Process has also developed a means of representing its data for a diverse user group. ELC uses a hierarchical system of abbreviations and numbers to

Table 4.1
Systems of units in ecological land classification
[after Conant et al, 1983 and Statistic Canada, 1992]

Australian Land Research Approach	British Land Unit Appraoch	Canadian Ecological Land Classification	United States Land Systems/ Ecosystem Approach
		Ecozone	Domain
	Land Zone	Ecoprovince	Division
	Land Region	Ecoregion	Province
	Land District	Ecodistrict	Section
Land System	Land System	Ecosection	District
	Land Type	Ecosite	Landtype
Land Unit			Association
Land Type	Land Phase		Landtype
Site		Ecoelement	Landtype phase
			Site

Table 4.2
Levels of Map Detail in the
Canadian Ecological Land Classification
[after FEARO, n.d]

Hierarchy:	Map Detail:
Ecoregions	1:3 000 000 to 1:1 000 000
Ecodistricts	1:500 000 to 1:125 000
Ecosections	1:250 000 to 1:50 000
Ecosites	1:50 000 to 1:10 000
Ecoelements	1:10 000 to 1:2500

signify the level of detail by which a potential user can address a given set of information. For example, NM.d.1.2.1 can be broken down into the following levels of detail:

> NM - Northern Mountains ecoregion
> d - an ecodistrict made up of a chain of angular limestone foundations
> 1 - ecosection
> 2 - ecosite
> 1 - ecoelement
> where 1.2.1 represents " the crustose lichen community which covers pinnacles of limestone; such units are favoured raptor nesting areas." [FEARO, n.d.]

Through such subdivisions, users can decide on the level of detail required for study purposes and acquire the appropriate base map(s).

On a provincial level, several jurisdictions have used integration to their advantage. As mentioned in Chapter 3, the Government of Newfoundland has been coordinating some of its resource management efforts via the Interdepartmental Land Use Committee (ILUC). The Government of Alberta is also using an integrated approach to resource management in an effort to ease the burden encountered in land use decision making. In the Alberta model there are at least three ways of allowing the government to determine if integration is a success [Alberta, 1988]:

(1) The system must provide maximum benefits for the people, the land and its resources.

(2) It must allow meaningful consultation with all parties affected by a particular land use.

(3) It must ensure land use considerations are both for

present and future needs.

4.3.2 Two Holistic Initiatives

The holistic approach to resource management is predicated on the concept of a cooperative spirit. How that spirit is achieved can itself be an issue. Two techniques can be considered when formulating a holistic scheme, either an **informal** initiative, or a **formal** one.

The informal approach deals with resource management activities on an issue by issue bases. A formal initiative, on the other hand, approaches holistic management via legislated mandates. It is also involuntary for those agencies which are seen as being key contributors but who otherwise do not wish to participate. The formal approach may also be semi-voluntary, i.e. only those agencies which have a desire to become part of the management process need do so.

The primary advantage of an informal holistic approach is that it ensures participation by only those groups which truly wish to contribute and this can lead to more effective management decisions. The disadvantage to such an approach relates to a potential of ignoring critical information contributors either because of oversight or because they do not consider themselves as essential to the process.

The major advantage of the formal holistic approach is that key groups are instructed to participate. With a formal approach, strict legislative guidelines are necessary for enforcement purposes. These rigid rules may then result in better planning efforts. Forced participation, however, may

lead to morale or communication problems. These problems may surface either during decision making activities or when the conflicting groups work together on issues far removed from the existing resource management process. Table 4.3 outlines additional advantages and disadvantages of both the informal and formal holistic approaches.

4.4 ABC RESOURCE SURVEY

The ABC Resource Survey was developed in the early 1980's at the University of Waterloo, Faculty of Environmental Studies [Grigoriew et al, 1985]. It was originally intended for use in the planning and management of Canada's larger, more remote National Parks. Those interested in its methodology, however, soon realized its potential for use in other resource management activities.

ABC stands for the abiotic, biotic, and cultural components which make up an ecosystem. The methodology attempts to incorporate all three of these aspects of the environment into resource management activities. The integration of the three elements results in the ABC method as being viewed as a holistic approach to natural resource management. In the past, component approaches have concentrated primarily on abiotic elements, incorporating the occasional biotic element. ABC meanwhile, not only ensures abiotic features are studied, but reinforces the need for both biotic and cultural features as well.

The mixture of information necessary for the ABC method

Table 4.3
Formal vs Informal Holistic Management Techniques
[after Agee and Johnson, 1988]

FORMAL HOLISTIC MANAGEMENT	INFORMAL HOLISTIC MANAGEMENT
ADVANTAGES: • ensures key groups are given a mandate to participate • ensures continuity independent of personalities. • encourages goal definitions. • improves interagency databases. • encourages forecasting.	ADVANTAGES: • concentrates efforts through issue by issue cooperation. • permits more flexible thereby allowing each problem to be handled on its own merits/needs. • agencies proceed at their own pace (this can also be a disadvantage depending on participants). • less threating to interest groups.
DISADVANTAGES: • forces compromise with respect to future willingness to cooperate • potential decline in overall financial assistance to participating agencies because of combined efforts, goals and interests. • too many participants may result, therefore requiring complex management - resulting in inefficiencies. • may cause exclusion of participants who are viewed as not being able to contribute.	DISADVANTAGES: • cooperation more likely to fall apart. • management decisions become issue by issue. • database planning focuses on single issues. • relies on crises management not avoidance or risk management. • does not tend to deal with thorny issues.

is not usually obtainable from a single resource agency, thus, the manager(s) instituting the method must make an effort to integrate the potential sources of information in order to bring together all three elements.

With the ABC methodology being a relatively new management tool, its potentials/limitations have not been extensively explored. As applications of the system increase, the list of adaptable purposes will surely grow. The following, however, are some of the more obvious reasons for using the ABC Resource Survey technique [Grigoriew et al, 1985]:

- its hierarchical approach to information manipulation enables the data to be used for boundary delineation. In fact, this was the original intent of the system and as will be demonstrated later via a case study, ABC may be a consideration for the WER boundary selection process.
- it provides key information to build solid planning and management techniques.
- it integrates wildlife, cultural resources and land use issues into the resource management process.
- it is able to help identify areas where cooperative management is desirable, thereby ensuring compatible resource uses.
- it can be used in "the determination of complementary institutional arrangements for the management of lands adjacent to a park." [Grigoriew et al, 1985 p.8]
- it highlights areas requiring constraint designations and

significance designations.

- it can identify areas of possible threat of resource depletion.
- it can aid in addressing the issues of competing land use.

The underlying theme of the ABC method relates to the fact that ABC means a more complete resource management process. To better understand the reasons for using ABC, they should be put into the context of the actual process behind the methodology.

The ABC method involves four levels of analysis [Grigoriew et al, 1985]: collection of raw data; interpretation of raw data; preparation of summary data; boundary delineation. (see Figure 4.2) In each of these levels maps are used as a tool to simplify the collection and analysis processes.

4.4.1 Level I Collection of Raw Data

The ABC method does not describe to a potential user how data should be physically collected, rather it outlines how to approach data for collection. For instance, in this initial stage there are two sets of maps prepared for each of the three ecosystem components, one set of maps are labelled as **functional** while the other set is labelled **structural**.

The data associated with functional maps display the relationships of an area's **ecological processes**, for example, erosion, migration areas, and activity corridors. Structural maps portray the features associated with the area, such as moraines, vegetation communities, archaeological sites.

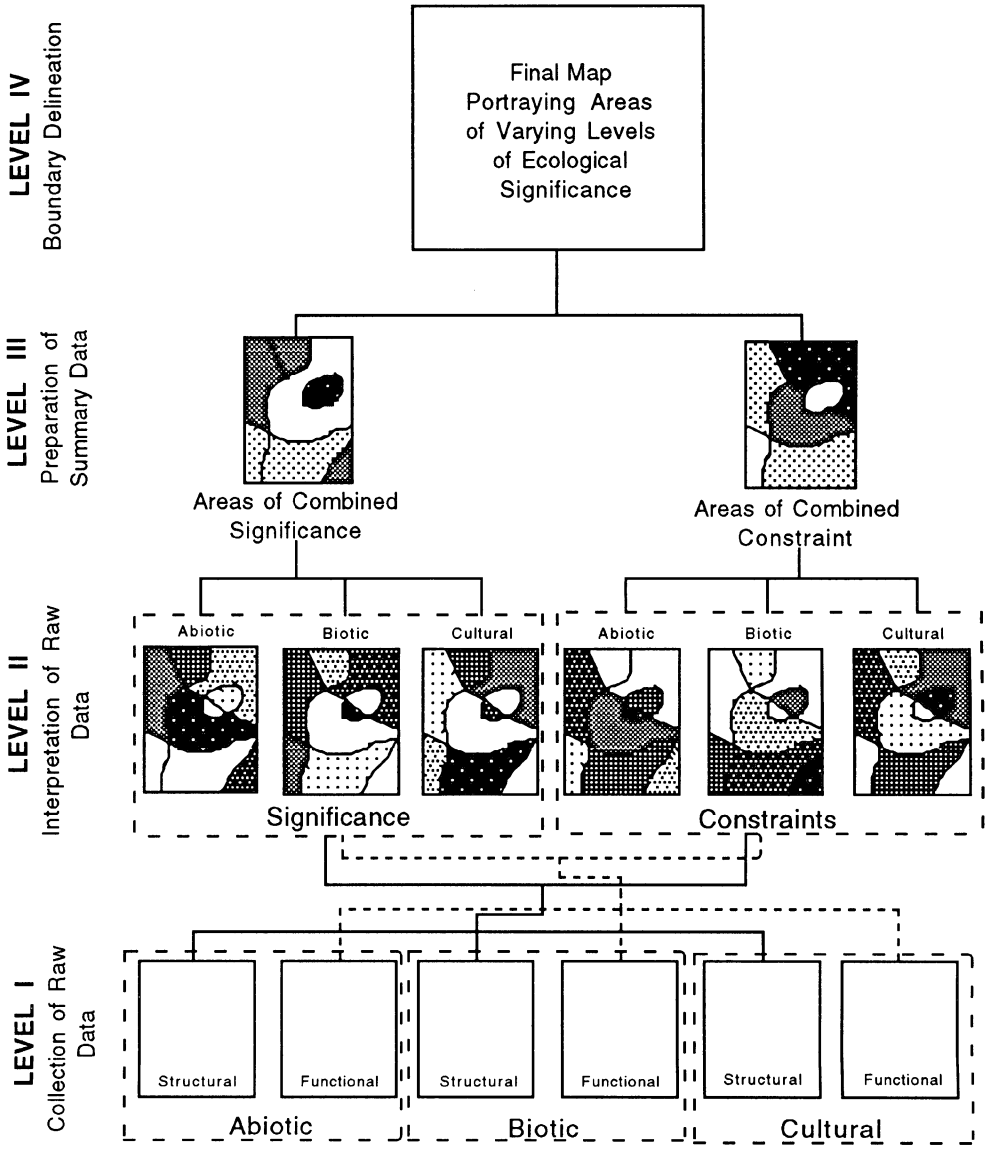


Figure 4.2
ABC Resource Survey Approach
for Selecting Areas Ecological
Significance
[after Grigoriew et al, 1985]

4.4.2 Level II Interpretation of Raw Data

Level II is a refinement of Level I. In level II data is converted into a more usable form by further subdividing information into areas of environmental **significance** and **constraint**. This enables the manager to compare a region's natural and cultural resource values. To accomplish the necessary comparisons, the manager must quantitatively rank the significance and constraint features of the region. ABC does not instruct the manager how to go about selecting a ranking system, nor does it suggest a means of application, therefore, the quantitative ranking is user dependent. By encouraging such data refinement, the manager is forced to consider an area's diversity, uniqueness and historical significance in order to legitimize their quantitative ranking.

4.4.3 Level III Preparation of Summary Data

The developers of the ABC method point out that Level III, while not a necessary step in the process, can be quite helpful to the resource manager [Grigoriew et al., 1985]. Level III allows the manager to focus more specifically on the ranked significance and constraint regions. At this level of analysis, the individual maps are integrated into two final maps. One showing abiotic, biotic, and cultural constraints, and the other show abiotic, biotic, and cultural significance areas. These combinations result in an identification of areas requiring specific management planning.

4.4.4 Level IV Boundary Delineation

Level IV combines the final significance and constraint maps, resulting in a map portraying areas of varying levels of ecological importance. Such a map does more than simply depict areas which are not in conflict with other land uses, it also graphically "indicates desirable buffer areas, appropriate zoning schemes and other forms of land use control." [Grigoriew et al, 1985 p.35]

4.5 ADVANTAGES AND DISADVANTAGES

The ABC methodology has a number of advantages in resource management, not the least of which is that it brings together the three components of an ecosystem into a single map. Other advantages of ABC include [Grigoriew et al., 1985]:

- may be applicable to many different environmental studies.
- presents information on both structural features (landforms, human settlement) and cultural processes (erosion, hunting areas).
- encourages multi-level mapping of data for ease of data presentation.
- forces the resource manager to look at resource significance and constraints and relate the two.
- encourages a comprehensive resource data base.
- can lead to more reliable results because of a great deal of initial planning.

A criticism of the ABC Resource Survey process is that it

attempts to incorporate as much detail as is available, however, it does not recognize the fact that not all elements concerning boundary delineation and/or resource management have been investigated. It also makes an assumption that the information needed for analysis is available. As will be seen in the case example, this is not always so. The fact that level II requires quantitative ranking processes introduces a level of interpretative flexibility, but also causes some loss of management objectivity [Graham, 1989]. Finally, ABC was, in its original form, developed as a management tool requiring reconnaissance surveys, and although it results in more up to date information, it also requires extensive field investigations. Data collection of this sort is costly and requires a survey team consisting of multi-disciplinary individuals.

4.6 CONCLUSION

Depending on the task at hand, a resource manager may elect to use either a component or holistic approach in dealing with a given situation. If the speed for which a decision is to be made is the key issue, the component approach may be chosen for solving the problem. If, however, a more rigid set of guidelines are in place and the results of the decision are critical, the manager should use a system which incorporates as many elements as possible into the final decision. In such an instance, a holistic/ integrated approach may be preferred.

In the case of the Wilderness and Ecological Reserves Program and this study, the ABC approach to boundary delineations is one holistic method which might be considered when attempting to select reserve boundaries. ABC's method of reducing the necessary information into workable parts (abiotic, biotic, and cultural features) gives the Program administrators a means of better handling the volumes of data necessary to make decisions. The actual application of the ABC philosophy will be demonstrated in the next chapter.

Chapter 4 ENDNOTES

1. While the term used here is holistic, other sources prefer the term integrated. In some instances these terms will be interchanged so that the reader might appreciate the intended flexibility of the two terms.

CHAPTER 5

MAIN RIVER BOUNDARY SELECTION: A CASE STUDY

5.1 THE STUDY AREA

Located on the lower end of the Great Northern Peninsula (see Figure 5.1), the Main River possesses abundant natural beauty. Many wilderness enthusiasts have labelled the river as one of the last areas on the island relatively untouched by human intervention. From its headwaters to its mouth, the Main River stretches through 55 kilometres of changing landscapes. From river deltas to white water rapids, from rolling, well vegetated river banks to steep, rugged unvegetated banks, it provides pleasure for both the novice and experienced adventurer.

Big Steady, a 10 kilometre stretch of the Main River, located approximately halfway between the headwaters and the mouth, is made up of island grasslands. This area offers a great deal of excitement for canoeists and hikers and is a key focal point upon which the WER Program builds its preservation arguments. The opportunities for observing wildlife and rare flora are high. Osprey, Bald Eagles, Pine Marten and Caribou are just some of the wildlife species to be seen in the area [Ledrew, 1989].

In the 1970's, the river was rated the third most important river for protection consideration amongst 50 wild

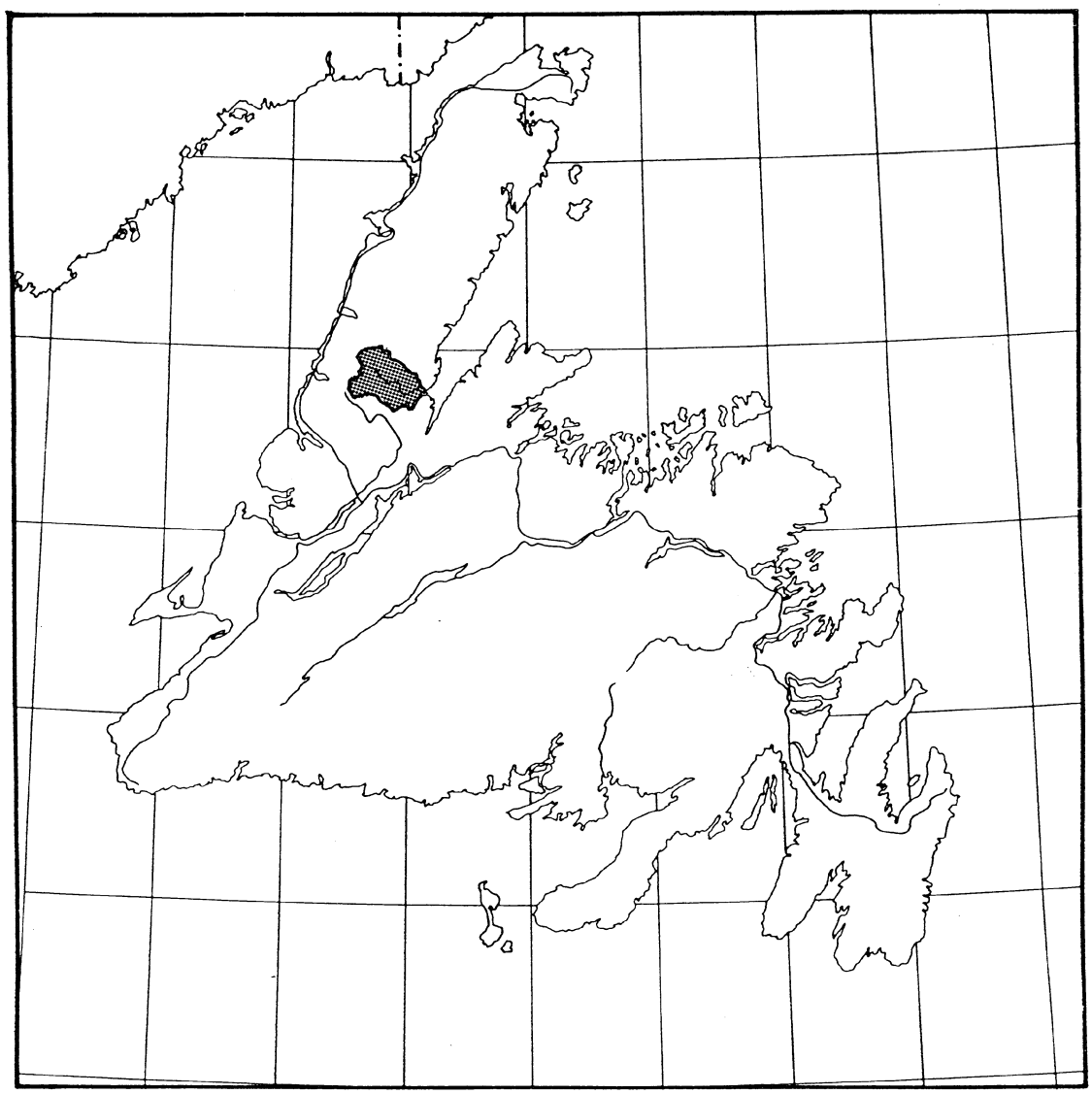


Figure 5.1
Location of Main River Study Area

rivers in all of Canada [anon. n.d.]. Since that time, interest in protecting the river has increased. Besides the interests of the Wilderness and Ecological Reserves Program, the Canadian Heritage Rivers System (CHRS) has also been investigating the river's potential for protection.

Environmentally concerned individuals are not the only ones interested in what the river system, and it's surrounding area, has to offer. The southern portion of the Main River watershed is rich in harvestable timber. In the last 10 - 15 years the interest in timber harvesting has increased as fast, or faster than the interest in the preserving of unspoiled wilderness [Halfyard, 1990]. Given such varied interests conflict is inevitable.

The Main River region is believed to hold at least six important wilderness components: landscape variety, vegetation variety, wildlife, recreation, aesthetics, and solitude [Northland, 1986]. These components, in addition to the impending threat to the area by pulp and paper industry, has led to a belief that a holistic approach to selecting a reserve boundary might be necessary. In the sections to follow, an attempt will be made to apply a holistic methodology to the Main River area. The objectives of this practical holistic study are as follows:

(1) to investigate the information needs of the WER Program when boundary delineation is necessary.

(2) to demonstrate a new holistic procedure (ABC Resource Survey) in relation to the Program's goals and objectives.

(3) to demonstrate the appropriate use of technology showing how a GIS could be used to help organize and analyze data.

5.2 DATA COLLECTION

In November 1989, steps were taken to investigate the potential for the ABC Resource Survey for use by the Newfoundland Wilderness and Ecological Reserves Program. During the study, particular emphasis was to be placed on ABC's efforts to select boundaries for environmentally sensitive areas. Prior to this study, ABC's methods had been used extensively as a management tool in a number of National Parks and therefore the validity of the procedure was not in question [Forbes et al., 1989; Peterson, 1988; Swinson and Greig, n.d; Smith et al., 1986]. It was, however, the application of the methodology to the WER Program which was of interest. In addition, it was felt the ABC process had potential to be applied in a computer enhanced environment. Therefore, the application of ABC to the Program was to incorporate the use of a Geographical Information System (GIS).

The long and sometimes frustrating task of data collection took place from November 1989 to April 1991. During this time numerous departments throughout the Government of Newfoundland were contacted and requested to assist in the information collection process of this research. Initial response was encouraging. As time past, however, interest faded. In May 1990, it was realized that long distance

correspondence was not practical, and a prolonged visit to the island to meet with perspective participants was required.

In some instances the information collection entailed formal interviews, thus allowing more detail to be shared than would have otherwise been possible through written correspondence. In early September 1991, research resumed at the University of New Brunswick at which point, where necessary, follow-ups for information were initiated. As with the initial research efforts, the level of cooperation was high at first, but faded rather quickly. Finally in April 1991 follow-ups ceased and data refinement and analysis was initiated.

5.3 ANALYSIS TOOLS

As mentioned above, one of the goals of the Main River Study was to demonstrate an appropriate use of technology in selecting a wilderness or ecological reserve boundary. The ABC Resource Survey method had been developed using a manual resource analysis procedure. Prior to this study, delineating boundaries using ABC had depended on hardcopy, overlay analyses.

The selection of a geographical information system as a tool for applying ABC centred around two facts: (a) the methodology required a large amount of semi-correlated data to be analyzed as a single entity; (b) the methodology's analysis procedure depended on overlay processing, i.e. looking for spatial relationships between geographically similar features.

After numerous consultation with Universal Systems Ltd. it was determined that their CARIS system had the functionality to deal with the tasks required for this study. The system selected for the study was therefore CARIS version 4.1 operated on a Micro VAX II VMS version 5.3. This system was made available through the Department of Surveying Engineering, University of New Brunswick.

5.4 THE DATA

5.4.1 Digital Base Maps

From the outset of the study, it was recognized that the data being collected from the various resource agencies would undoubtably be in different forms and formats. In order to attempt to accommodate the differing material, an appropriate base map was sought upon which information could be compiled.

After consultation with the Department of Environment and Lands, Surveying and Mapping Branch, it was learned that a new contract for digital 1:50 000 scale mapping had been issued. This contract would see the Main River study area digitally compiled by the end of March 1991. The WER Program staff confirmed that such a scale would be acceptable for reserve management. Thus, the Surveying and Mapping Branch agreed to assist in obtaining the necessary digital files prior to implementing the ABC procedures.

Through the use of the digital data, it was believed that the project could be implemented in a short period of time. The use of the digital data also meant the project might be

given serious consideration with the Newfoundland Government because the results of this project could be incorporated into other provincial resource management studies.

5.4.2 Natural Resource Data

Requests for information from the various resource agencies did not make reference to a need for abiotic, biotic, or cultural data. The data received was later categorized into the appropriate abiotic, biotic, and cultural classes. The types and sources of information initially sought for the study have been presented in Table 5.1.

The information requests from each source specifically stated a need for any information they may have been able to supply with regards to the study area. The requests also encouraged the agency to include information they might have felt would be helpful yet might not have been specifically indicated.

Of the 34 specific information requests, 10 were received in full, 7 received incomplete, 9 requests were simply not available (i.e. the agency did not keep such records and did not know where such requests might be fulfilled), and 8 requests were not acknowledged, even after request follow-ups. In the case of the 7 incomplete information requests received, 4 were adapted for use in the case study. The three remaining incomplete information requests (cutting history, existing harvesting roads, and climatic information) were not appropriate either because they did not cover the site or were of very poor quality (i.e. unable to identify within the study

Table 5.1
Information Requests for Main River Study Area

Information Requested	Source	Response (as of May, 1991)
Digital Base Map	Environment and Lands - Surveys and Mapping	Received incomplete
Forestry Inventory - Stands Type - Height - Productive Forest Area - Cutting Area Rights - Cutting History (5 yrs) - Existing Roads (level of importance) - Planned Roads (level of importance) - Insect Infestation - Reforestation Program (5 yrs)	Foresty and Corner Brook Pulp and Paper	 Received Not Received Not Received Incomplete Incomplete Incomplete Not Received Not Received Not Received
Hydro Electric Development	Newfoundland Hydro	No Activity in area
Rare Plant Sitings IBP Sites Provincial Parks	Environment and Lands - Parks Division	Received No Sites in area Received
Leasehold/Freehold Dispute Holdings Electorial Districts - Federal - Provincial	Environment and Lands - Land Management	Received Incomplete No Activity in area Received
Climatic Zones - Temperature Regimes - Moisture Regimes	Environment Canada	Received Incomplete
Flora Fauna Rare Sitings for Flora Rare Sitings for Fauna Endangered Species Feeding Areas Rutting Grounds Calving Grounds Migration Paths Nesting Habitat	Environment and Lands - Wildlife Division	Not Available Not Available Not Available Not Available Received Incomplete Not Available Not Available Not Available Not Available Not Available
Municipal Boundaries Dump Sites	Municipal Affairs	Received Received
National Park interests	Gros Morne National Park	No Activity in area
Archeological Sites Sites of Historical Significance	Historic Resources	Not Received Not Received
Soil Surveys	Agriculture	Not Received

area).

During the data collection phase of the study, the lack of cooperative spirit from potential source agencies was of great surprise. Even more surprising was the lack of information which one would have thought existed. For example, when attempting to obtain flora and fauna data from the Wildlife Division, it was learned that information pertaining to caribou, endangered species, canada geese, etc. had "never been systematically assessed" [Curnew, 1991]. Such findings made ABC analysis difficult. It was further noted that any information the division may have had with regards to the Main River would have come from a 1986 Environmental Impact Statement (EIS) prepared by Corner Brook Pulp and Paper Ltd. Such a document would not necessarily completely reflect the information needs of the wildlife division.

The information available from the Department of Forestry provided additional surprises. The department has been using a GIS as a resource management tool for many years. In their data base they store a great deal of information with regards to forest cover, at a modified scale of 1:12 500 [Brown, 1991]. This data is available in digital or hardcopy format, and therefore would be expected to be available at a variety of scales. Based on research requests, however, the department's response was "information you request...does not exist on 1:50 000 NTS map sheets" [Brown, 1991].

The actual information collected for the Main River study is listed in Table 5.2. As can be seen from this table, the

Table 5.2
Detailed Listing of Information Received for Main River Case Study

Type	Scale	Source
Alluvial/Fluvial and Sensitive Sites	1:50 000	EIS Addendum
Wetlands	1:50 000	EIS Addendum
Old Growth	1:50 000	EIS Addendum
Visual Corridor	1:50 000	EIS Addendum
Sound Corridor	1:50 000	EIS Addendum
Fishing and Hunting Camps	1:50 000	EIS Addendum
Caribou Summer Range	1:50 000	EIS Addendum
Caribou Winter Area	1:50 000	EIS Addendum
Canada Goose Nesting	1:50 000	EIS Addendum
Canada Goose Travel Route --- Potential	1:50 000	EIS Addendum
Harlequin Duck Area	1:50 000	EIS Addendum
Water Fowl	1:50 000	EIS Addendum
Pine Marten	1:50 000	EIS Addendum
Raptors (Bald Eagle & Osprey)	1:50 000	EIS Addendum
Salmon Spawning Area	1:50 000	EIS Addendum
Moose Sitings	1:50 000	EIS Addendum
Rare Plant Sites	1:50 000	Rare Plant Study, Parks Division
Private Leases	1:50 000	Lands Branch Correspondance
Provincial Parks	1:50 000	Parks Atlas, Parks Division
Community Boundary	1:50 000	Municipal Affairs Correspondance
Waste Disposal Sites	1:50 000	Municipal Affairs Correspondance
Bridge Locations	1:50 000	EIS Vol. 1
Roads and Trails	1:250 000	EIS Vol. 1
	1:30 000	CBPP Dispute Overview
	1:12 500	Forestry Department
Productive Forest Areas proposed for harvesting	1:250 000	EIS Vol. 1
WER Boundary	1:250 000	EIS Vol. 1
	1:50 000	EIS Addendum
CBPP Boundary	1:250 000	EIS Vol. 1
	1:50 000	EIS Addendum
Main River Study Area	1:250 000	Interpolated from NTS Map Sheets
	1:50 000	Interpolated from NTS Map Sheets
Ecoregions	1:250 000	EIS Vol. 1
Ecodistricts	1:50 000	EIS Vol. 1
Delineation of Big Steady area for protection purposes	1:250 000	EIS Vol. 1
Vegetation around Big Steady	Unknown	Botanical Study
Climate Stations	Unknown	Environment Canada
Climate Data	Unknown	Environment Canada
Digital Base Map	1:50 000 (incomplete)	Surveys and Mapping
Forest Stands	1:12 500	Forestry
Electorial Districts	1:1 000 000	Land Management

majority of the information used was derived from the 1986 EIS. In the case of this study, government offices placed a great deal of dependency on the EIS thus causing this research effort to also become heavily dependent on it's content.

5.5 DATA MANIPULATION

5.5.1 Level I - Categorizing Data into A,B,and C

With the data in hand, it was necessary to categorize it into the appropriate classes of information. Based on the definitions of abiotic, biotic and cultural features, Table 5.3 lists the available elements associated with each category.

Level I of the ABC methodology, however, was not complete. Breaking down the A,B, and C categories into structural and functional components was required. For the most part, the original form of the data could be categorized as functional or structural but in a number of instances further data refinement was necessary, as for example, with the depiction of raptor buffers and sound corridors. In order to initiate these refinements a number of assumptions were necessary. Section 5.6.3 briefly describes these assumptions. Table 5.4 lists the A, B, and C features divided into their functional and structural categories while Maps B.1 - B.4 in Appendix B display the features graphically.

5.5.2 Level II - Data Refinement

As described in Chapter 4, Level II is a refinement stage for Level I, where functional and structural abiotic, biotic,

Table 5.3
Data Received for Study Based on ABC Classes

ABIOTIC	BIOTIC	CULTURAL
Water Features	Alluvial/Fluvial Zones	CBPP Limits
Wetlands	Harlequin Sites	Bridge
Watershed **(D)**	Raptor Sites	Canoe Route
Erosion Zones **(D)**	Old Growth Forest	Roads
	Canada Goose Sites	Tracks
	Pine Marten Sites	Trails
	Waterfowl Areas	Powerlines
	Caribou Areas	Cutlines
	Other Wildlife Sitings	Cabins
	Pine Marten Release Site	Campgrounds
	Raptor Buffer **(D)**	Pits
	Pine Marten Habitat **(D)**	Sound Corridor **(D)**
	Harlequin Buffer **(D)**	Visual Corridor **(D)**
		Road Buffer **(D)**
		Bridge Buffer **(D)**

*** **Note: (D)** represents data which had to be derived from material received, i.e. assumptions about the original data was necessary in order for it to be incorporated into the study.

Table 5.4
Functional and Structural Categories of ABC Study Data

CLASS	FUNCTIONAL	STRUCTURAL
Abiotic	Watershed Erosion Zones	Water Features Wetlands
Biotic	Alluvial/Fluvial Zones Harlequin Zone Raptor Zone Canada Goose Zone Pine Marten Habitat Waterfowl Zone Caribou Zones (Winter and Summer)	Old Growth Forest Pine Marten Release Site Wildlife Sitings (point data)
Cultural	CBPP Limits Sound Corridor Visual Corridor Bridge Bubber Road Buffer Canoe Route	Main Roads Minor Roads Cart Tracks Trails Powerlines Cutlines CBPP Limits Cabins Bridges Campgrounds Pits

and cultural data sets are further subdivided into elements of significance (those which add to the selection of an environmentally sensitive area) and constraint (elements which are seen as constraining an area from being considered an environmentally sensitive area).

In the original ABC methodology, the resource manager would subjectively assign a quantitative ranking to all significance and constraint elements. In this study, however, because the WER application was being tested for the first and because the Program has a very specific preservation mandate, it was decided that (a) all elements of significance were to be treated with equal importance; (b) all elements of constraint were also to be treated equal; and (c) where constraints overlapped significance, the constraints would outweigh significance elements.

Table 5.5 and Figures 5.2 to 5.5 illustrate the significance and constraint information for the Main River Study area. Based on Figures 5.2 to 5.5 the true extent of environmental sensitivity for the Main River watershed was evident. The abiotic significance information, however, was particularly overwhelming. To incorporate such a large area into the reserve selection procedure would not be publicly acceptable. The abiotic significance regions were therefore removed from further decisions.

5.5.3 Level III and Level IV

Level III analysis required all significance and constraint data to be incorporated into two maps. In the

Table 5.5
Level II - Reclassification of Functional and Structural Categories
into Significance and Constraint Classes

SIGNIFICANCE	CONSTRAINT
Water Features	Road Buffer
Watershed	Bridge Buffer
Erosion Zones	Roads (Minor and Major)
Wetlands	Tracks
Alluvial/Fluvial Zone	Trails
Harlequin Zone	Powerlines
Raptor Zone	CBPP Limit
Canada Goose Zone	Bridge
Pine Marten Habitat	
Waterfowl Zone	
Caribou Zones	
Old Growth Forest	
Pine Marten Release Zone	
Wildlife Sitings	
Sound Corridor	
Visual Corridor	
Canoe Route	
Campground	

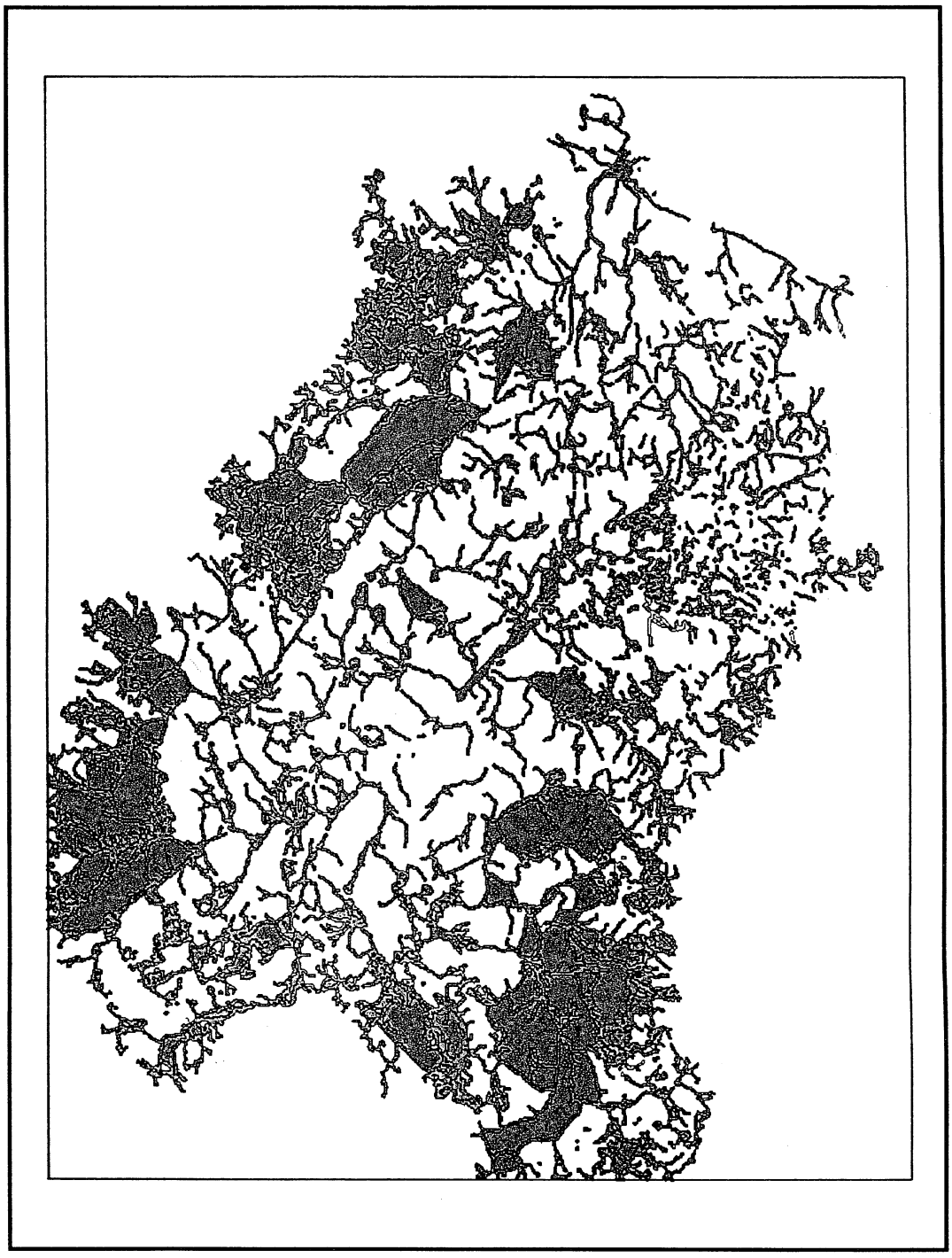


Figure 5.2
Abiotic Significance Features

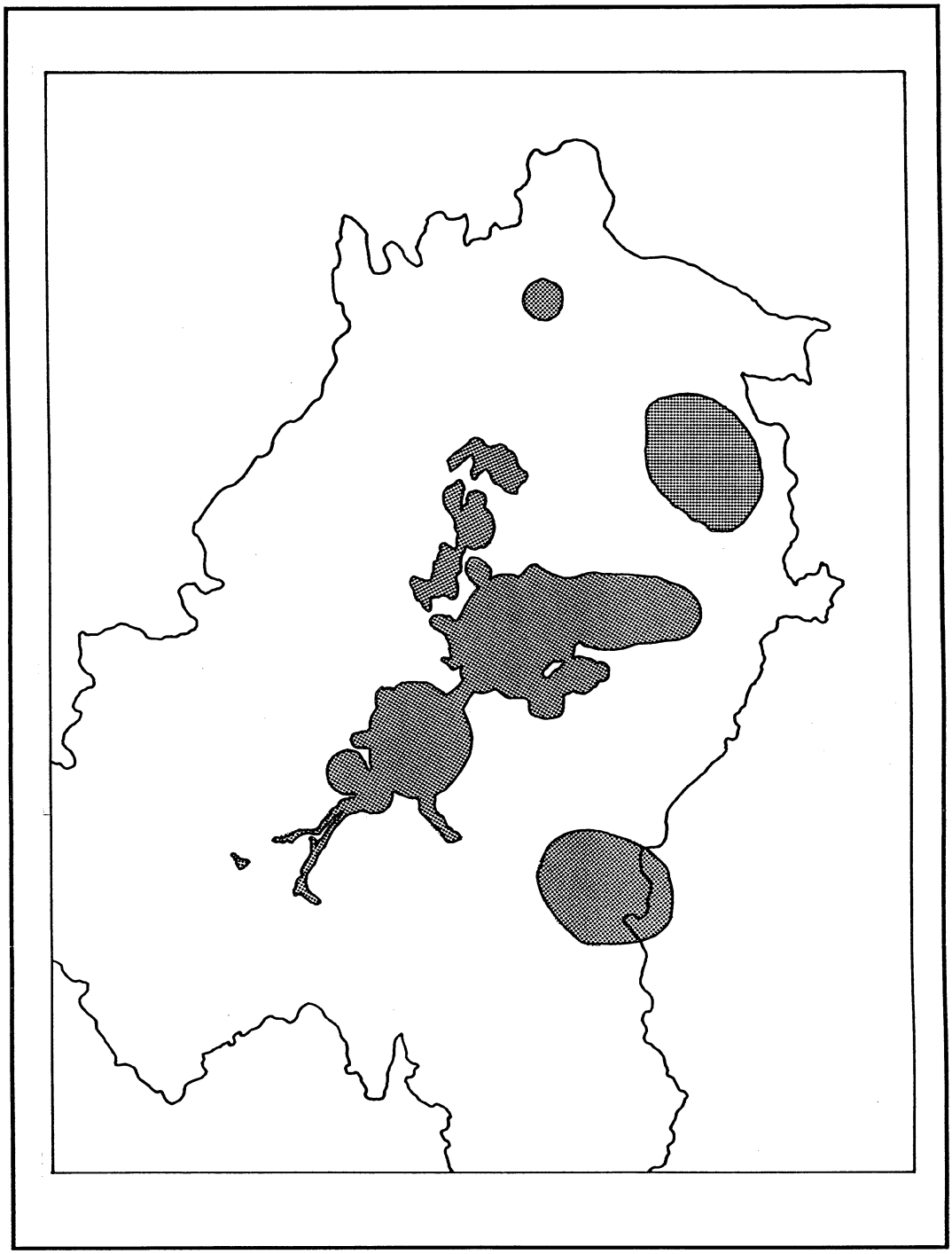


Figure 5.3
Biotic Significance Features

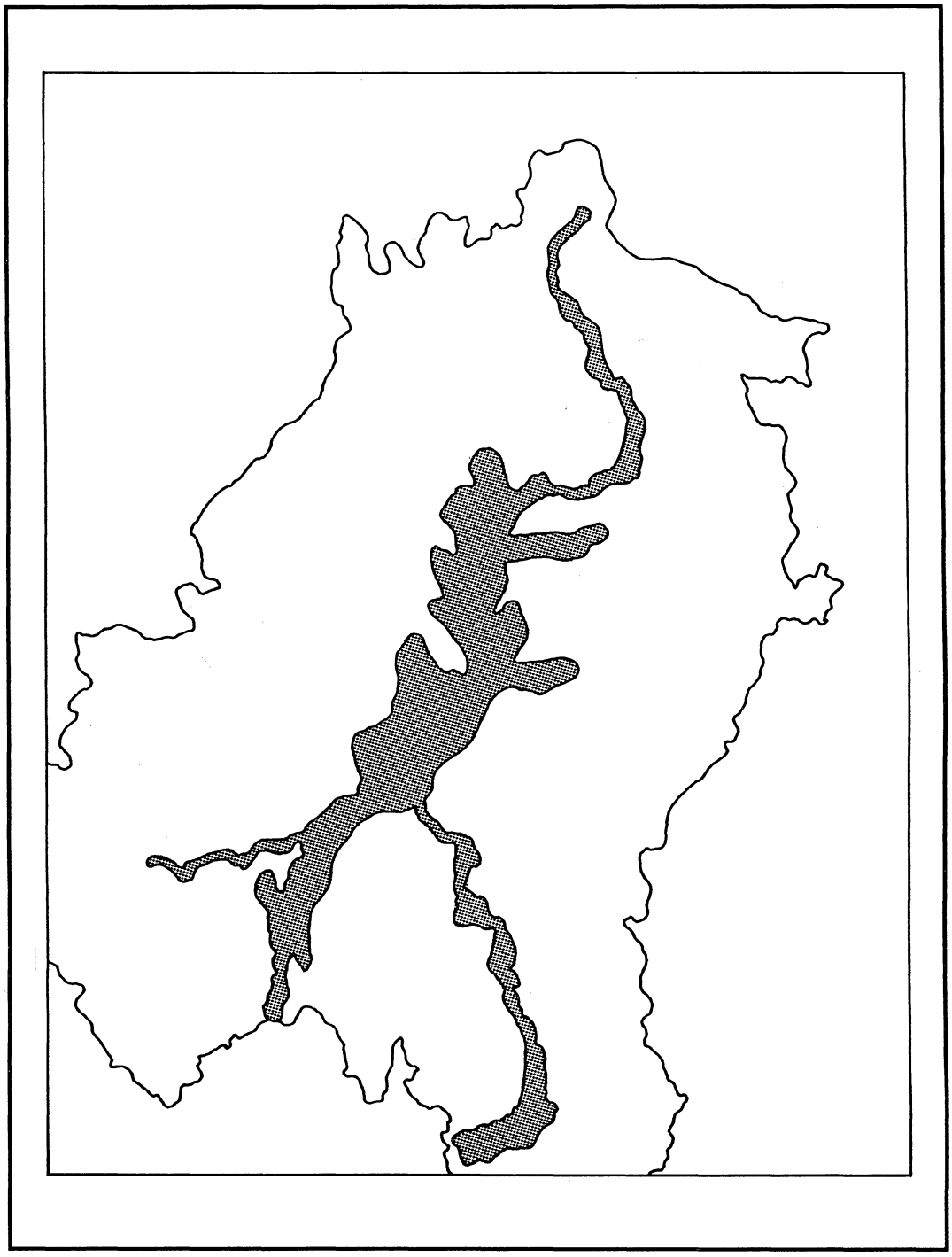


Figure 5.4
Cultural Significance Features

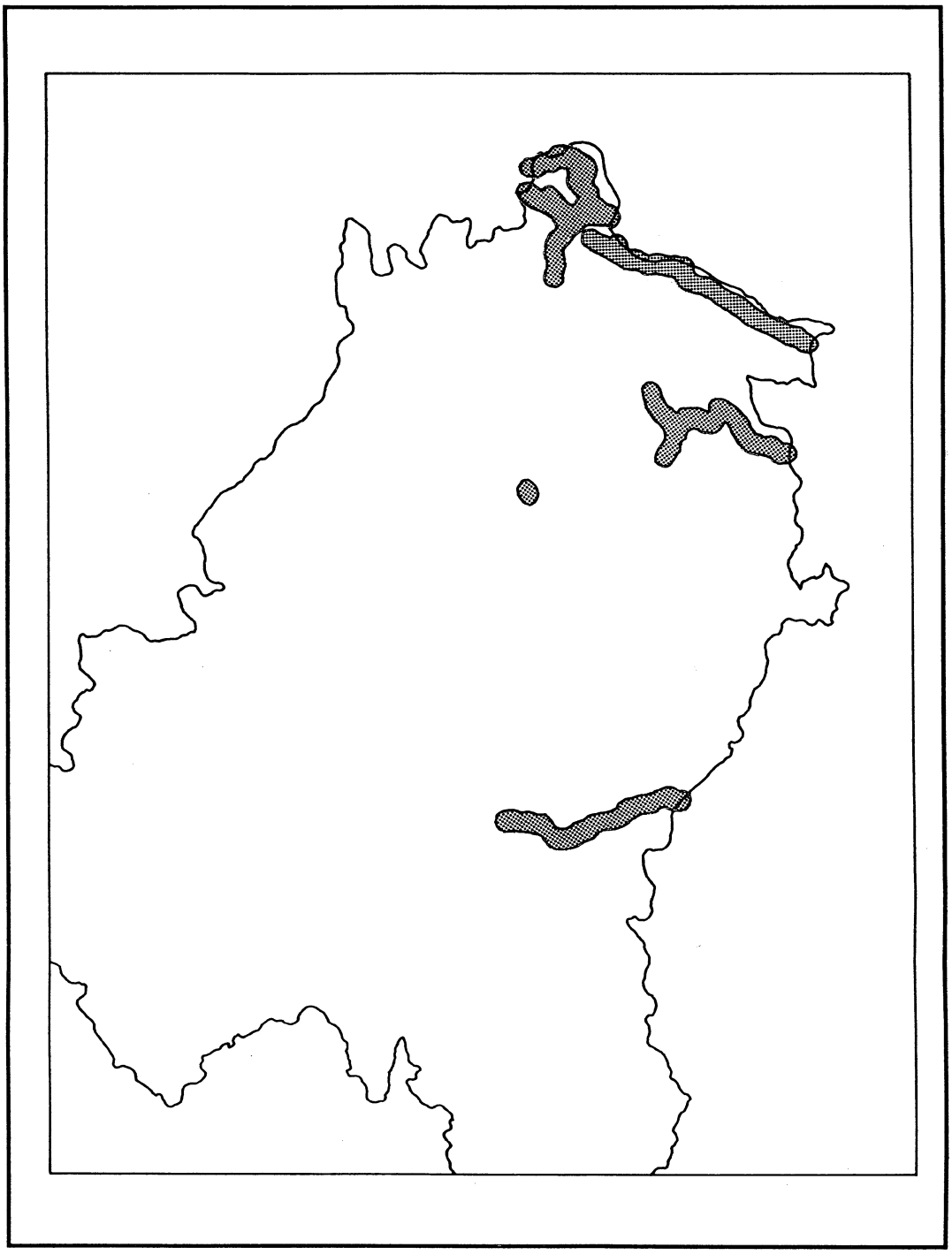


Figure 5.5
Cultural Constraint Buffers

study, only one constraint map existed, thus no further constraint compilation was necessary. As for aggregating significance features, after removal of the abiotic elements, only two maps were overlayed. The combination of biotic and culturally significant features created the area shown in Figure 5.6.

Moving to Level IV, in order to determine the area of optimum environmental significance, the resulting constraint features had to be subtracted from the combined significance features. This procedure was not possible on CARIS version 4.1, however, a simulated subtraction was carried out for demonstration purposes only (see Figure 5.7).

5.6 DATA ANALYSIS PROBLEMS

Throughout a project such as this, problems should be expected. In fact, from the outset, the project faced numerous difficulties. Some were overcome while others had to be noted and accepted. The following sections, while not comprehensive, does reflect the more severe problems encountered.

5.6.1 Collecting Natural Resource Data

Three major problems were encountered during data collection activities. The first was referred to earlier, a lack of cooperation on the part of source agencies. This uncooperative spirit might exist for a number of reasons: (a) the agencies approached did not have the staff available in order to respond to the requests; (b) the agencies were able to respond but did not feel the research efforts warranted the

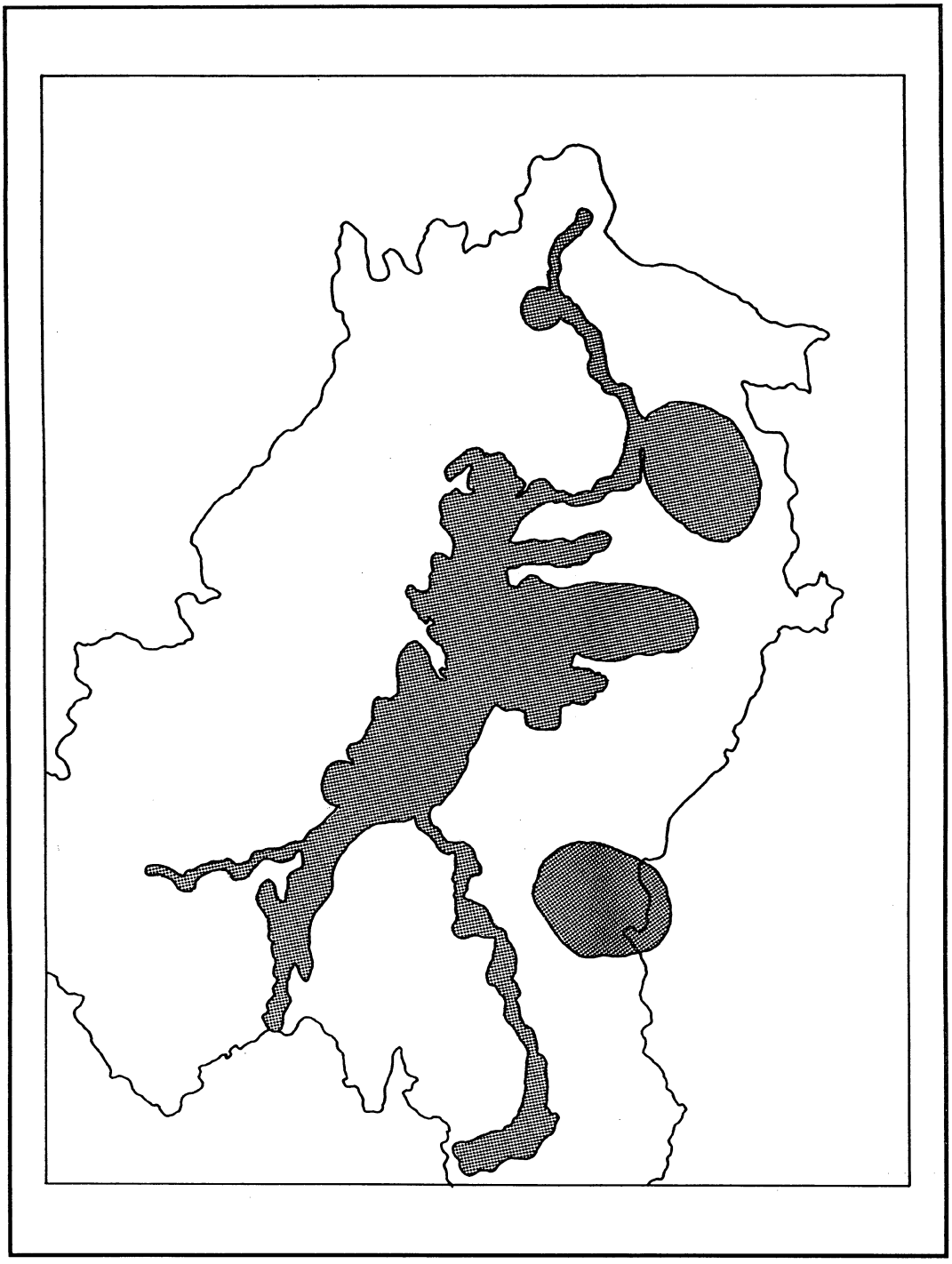


Figure 5.6
Aggregrated Significance Features

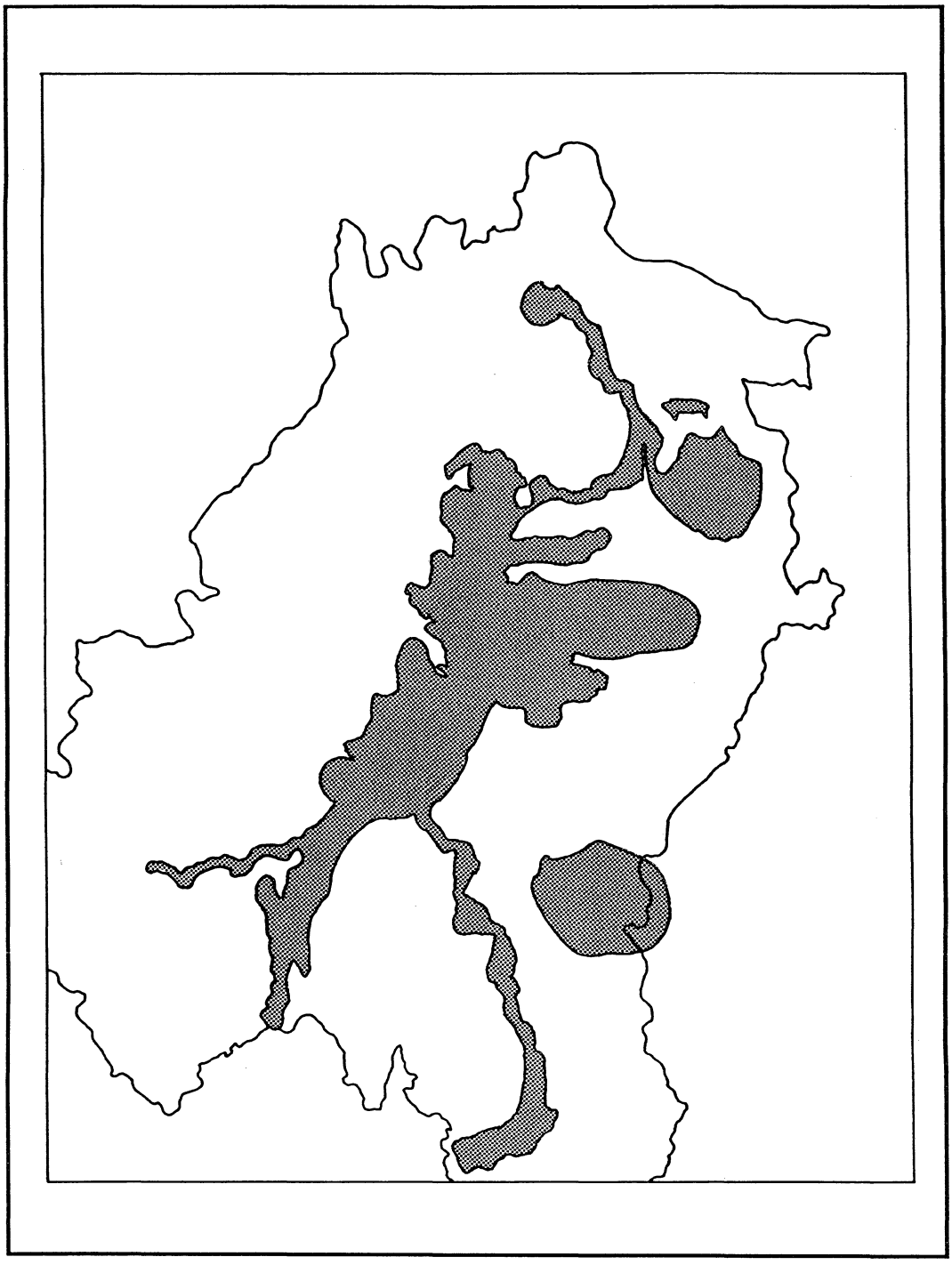


Figure 5.7
Optimum Environmentally Significant Areas

turning over of information for analysis; (c) the agencies felt the information being requested was not of a public nature; (d) they did not have the data requested. In many instances it was believed that requests were simply unable to be fulfilled because the information did not exist.

Secondly, the data which was received came in various forms including: tables, charts, maps and sketches. Integration of such data into a single workable form therefore required both generalization and interpolation. In a number of instances the materials received could not be used and were discarded because they did not cover the site or were of very poor quality (for example Environment Canada's weather data for the Main River area was of poor quality).

The third problem relates to the over dependency on the 1986 Environmental Impact Statement prepared for Corner Brook Pulp and Paper Limited. The EIS may be a compendium of natural resource data suited for such a study. The shear dependency of the government agencies on such documents, however, as the only source of information for the area may be cause for concern. Not one contacted government department which referred to this study voiced concerns over the potentially biased nature of the EIS's content. The EIS was prepared for the pulp and paper industry. It is therefore not unreasonable to assume that the data content primarily reflects the pulp and paper industry's best interest.

5.6.2 The Digital Base Map

When requesting the original digital files, it was

clearly indicated that the mapping system being used for this study was a CARIS version 4.1 operated on a Micro VAX II VMS version 5.3 and that the storage medium was TK50 cartridges. Requested information was received on three 6250 CPI 9 track tapes that contained data in Standard Interchange Format (SIF). Such data therefore required a facility capable of downloading the tapes to the cartridges. With the aid of Universal System Ltd (USL), this transfer was easily made. After running the SIF to CARIS NTX REFORMAT procedure [USL, 1990], the data was unreadable. After further investigation into the problem USL modified their REFORMAT procedures to accommodate the received digital files.

When it was determined that the base maps for the study area were to be obtained in a digital format, plans for data manipulation included the creation of a digital terrain model (DTM). It was anticipated that the DTM would be used to build a slope analysis map. Upon receipt of the base map, however, it was determined the files did not contain contour information. Further investigation of the data revealed that what was received had not been approved as a final product by the Government of Newfoundland. If elevation information was necessary for the study a delay of up to one calendar year would be highly probable, therefore the creation of DTM's was eliminated from the study. If slope analysis had been possible, appropriate riparian erosion buffers could have been selected based on existing terrain characteristics.

The importance of the protection of rivers from the undue

influences of forest harvesting required some form of protective buffer around all water courses. Given a lack of slope maps, a broad assumption had to be made in order to create some type of protective riparian zone. A buffer of 60 meters was selected for all water features in the Main River watershed. In order to place such a buffer around all courses, a number of additional assumptions were necessary: (a) because Newfoundland does not have an established set of guidelines for forest harvesting near water courses, the New Brunswick regulations were adopted; (b) in the New Brunswick regulation a buffer of 60 meters reflected a slope of greater than 10 percent [Dick, 1989], therefore it was assumed that all water features had at least a 10 percent slope adjacent to the water's edge.

The digital files also were configured as separate NTS map files. (see Figure 5.8) In order to enable continuous area analysis of the watershed, the sheets had to be joined. A map with 'dirty edges' resulted from the merging process. Some features on the map did not intersect as required, therefore necessitating some editing of the files.

Then, once the files were cleaned, because the final file was so large, the data was difficult to work with. In order to facilitate easier file manipulation a number of steps were necessary: (a) as seen in Figure 5.8, the map was cropped into a more workable size; (b) the watershed study area was placed on this new map and all features outside the watershed area were deleted.

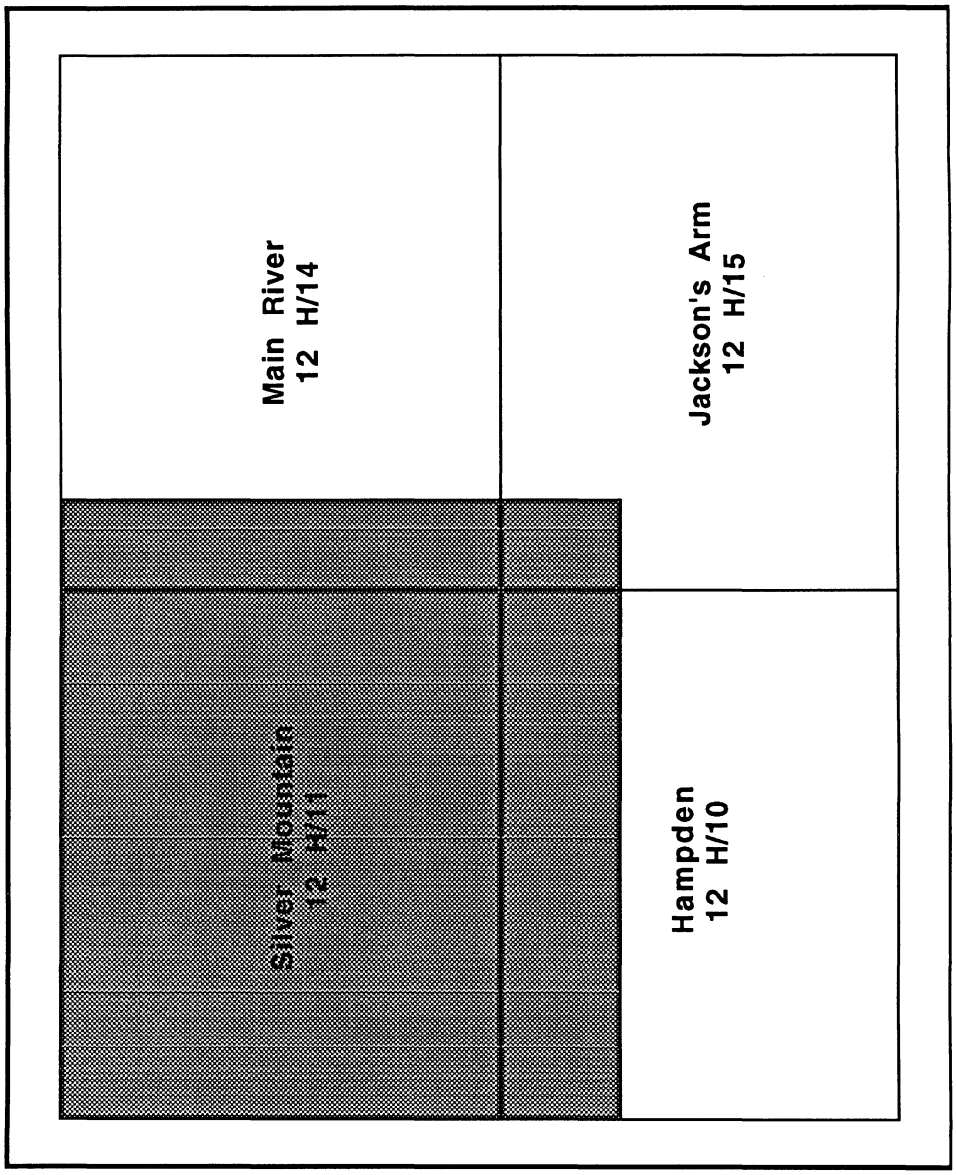


Figure 5.8
1:50 000 Reference Sheets for Study Area

The original map (consisting of the four NTS files) occupied 45 MB of disk space while the cropped version, shown in Figure 5.8, occupied 29 MB of space. It was noted that even this file was difficult to manipulate, thus a number of features were removed including, forested and non-forested data, and marsh themes. This resulted in a base map requiring approximately 15 MB of disk space. With the addition of the collected thematic data, the final analysis file was slightly less than 20 MB in size.

The final map was still not ready for ABC implementation. In order to manipulate features and explore relationships between them, the data had to be topologically structured. The steps to topology building required first, the building of the network relationships followed by the building of any necessary polygon relationships.

What appeared to be a simple task turned out to be one of the longest processes of the entire project. The building of the network topology for the water course theme, the BUILD NETWORK FOR <filename> /THEME= <theme number> [USL, 1990] took approximately 8 hours to complete. While the water courses themselves did not require polygon topology, their associated erosion zones did. The time required for topology building of these features was in excess of 30 hours.

5.6.3 Boundary Selection

In order to select appropriate areas for inclusion in a wilderness or ecological reserve boundary, sites required some spatial coverage. Based on information received for analysis,

spatial extent of some features, such as wildlife habitat, did not exist. What did exist was a series of point data locating a general position of field sightings for a particular wildlife species. Nowhere in the EIS, or other information sources, was there reference given to an area of species habitat. If ABC was to be applied, an area extent for the sites would have to be established. This required further investigation into wildlife habitat interactions.

Bateman (1991) and Dilworth (1991), pointed out that wildlife habitat areas are dependent on a wide variety of factors. These factors, if incorporated into the ABC methodology required additional unavailable information. This forced a number of assumptions to be made based strictly upon past habitat studies. In the first instance, arbitrarily selecting a buffer around a sighting did not ensure the habitat was being protected. The assumption, therefore, was that the local of the sighting was not the centre of the habitat, rather the sighting was located on the outer edge of the habitat. In order to ensure a species was to be amply protected, the habitat extent was therefore doubled. Figure 5.9 illustrates the concept of doubling the habitat extent in order to ensure the species' actual habitat was protected. The second assumption then related to the actual buffer selection for each wildlife sighting, for example: *[1]

(i) Raptor Zones - 900 m buffer [Ingram, 1983]
(ii) Pine Marten Zones - 25 sq km [Bateman, 1991]
(iii) Harlequin Zone - 900 m buffer [Bateman, 1991]
(iv) Sound Corridor - 167 m buffer [Corner, 1986]

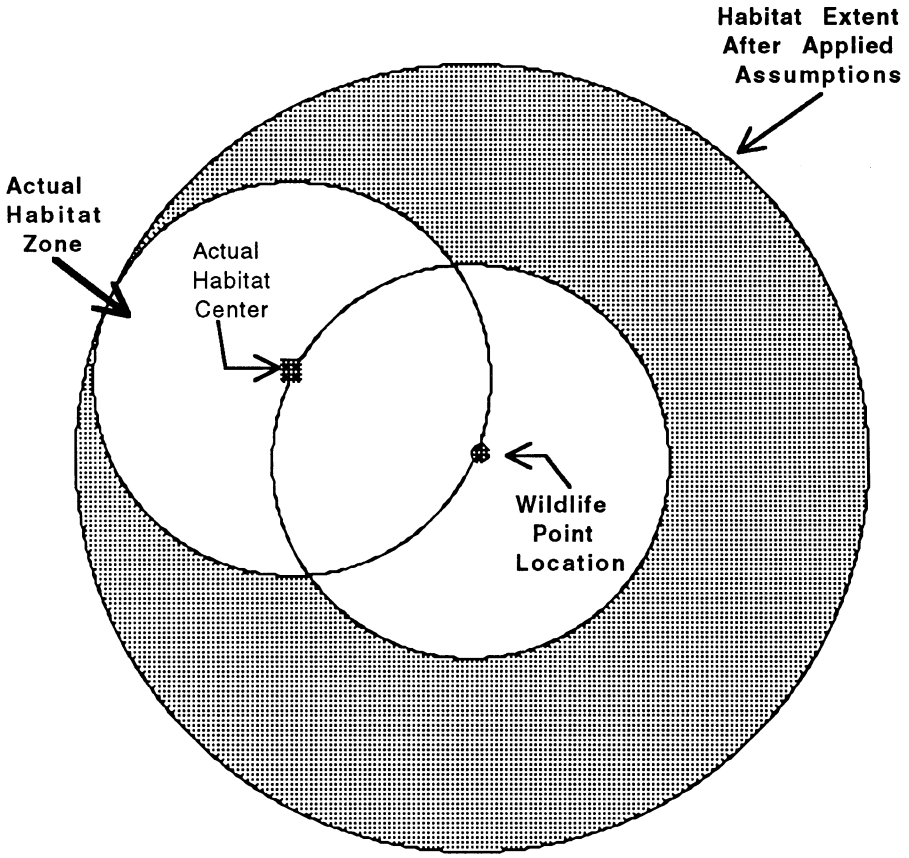


Figure 5.9
Establishing a Habitat Extent Based on Wildlife Point Sites

A further analytical problem occurred when attempting to apply the final phase of the ABC methodology. Level IV required the final constraint map to be overlayed with the final significance map. The map resulting from the overlay would be the optimum, environmentally sensitive reserve area. The overlay process therefore required constraint features to be 'subtracted' from significance features. As mentioned previously, CARIS version 4.1 did not allow such subtraction to be performed. Subtraction procedures could be simulated however, by simply making constraint features appear black against the significance features. Upon printing such a combination the final reserve area would appear to exclude constraint features, however, queries on this final map would not be possible.

5.7 SUMMARY - COMPARISON OF DELINEATED BOUNDARIES

The Main River study area was selected because of the amount of resource interest in the area. It was also selected because the river area had a number of boundaries proposed for reserve consideration. The Wilderness and Ecological Reserves Program had gone through a process of defining a proposed boundary for the reserve. Negotiations with Corner Brook Pulp and Paper Ltd (CBPP) were also in progress and attempts were being made to select an optimum boundary by taking into consideration concerns of both agencies. The results of this study could therefore be compared to both the CBPP's boundary selection and the WER selection. While it was not known how

CBPP went about selecting a reserve site, it might be assumed that the primary element of concern for them was to ensure a boundary was selected to minimize the loss of harvestable timber.

The area being recommended for protection by each of these methods included: 7810 ha for CBPP, 18490 ha for WER and 21610 ha for ABC.*[2] Figures 5.10 to 5.12 show the relationship between WER and CBPP, WER and ABC, and CBPP and ABC selections respectively. It is obvious from these figures, there exist areas of conflict. The CBPP boundary is considerably smaller than either of the other two, indicative of the fact that the WER and ABC selections did not factor in harvestable timber as a constraint.

In terms of a comparison of the WER and ABC boundaries the areas where the WER boundary extends past the ABC boundary may represent a potential over estimation of protection on the part of the WER administration. Where ABC extends beyond WER and CBPP, these areas should be of prime concern to the Program administrators. Such areas may reflect the need for some further refinement to the ABC procedures particularly with regards to including more subjectivity into ranking area importance. Then again, because the subjectivity was reduced, these areas of overextension may be used as a bargaining tool in the boundary negotiation process.

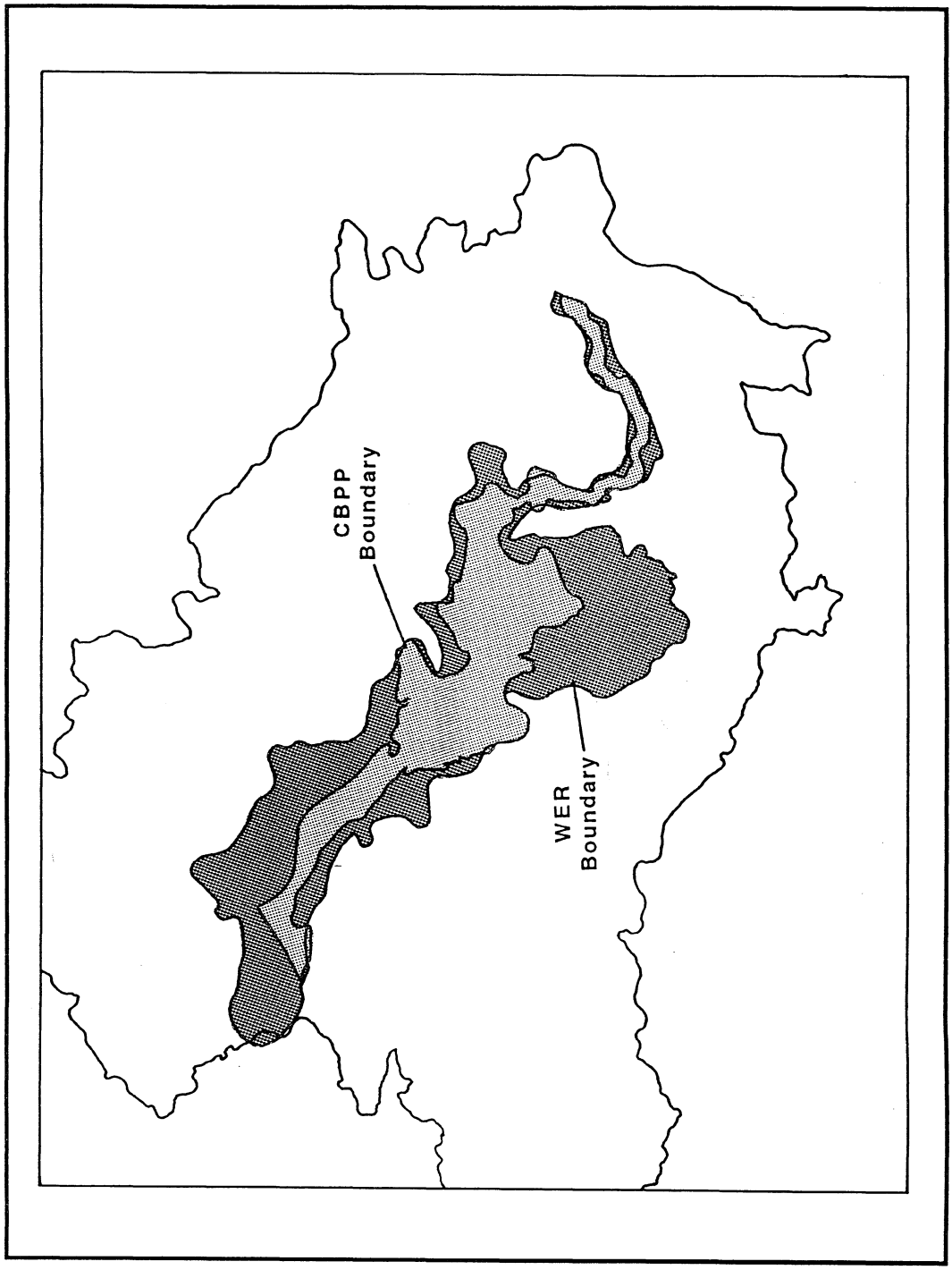


Figure 5.10
Comparison of WER and CBPP Boundary Selections

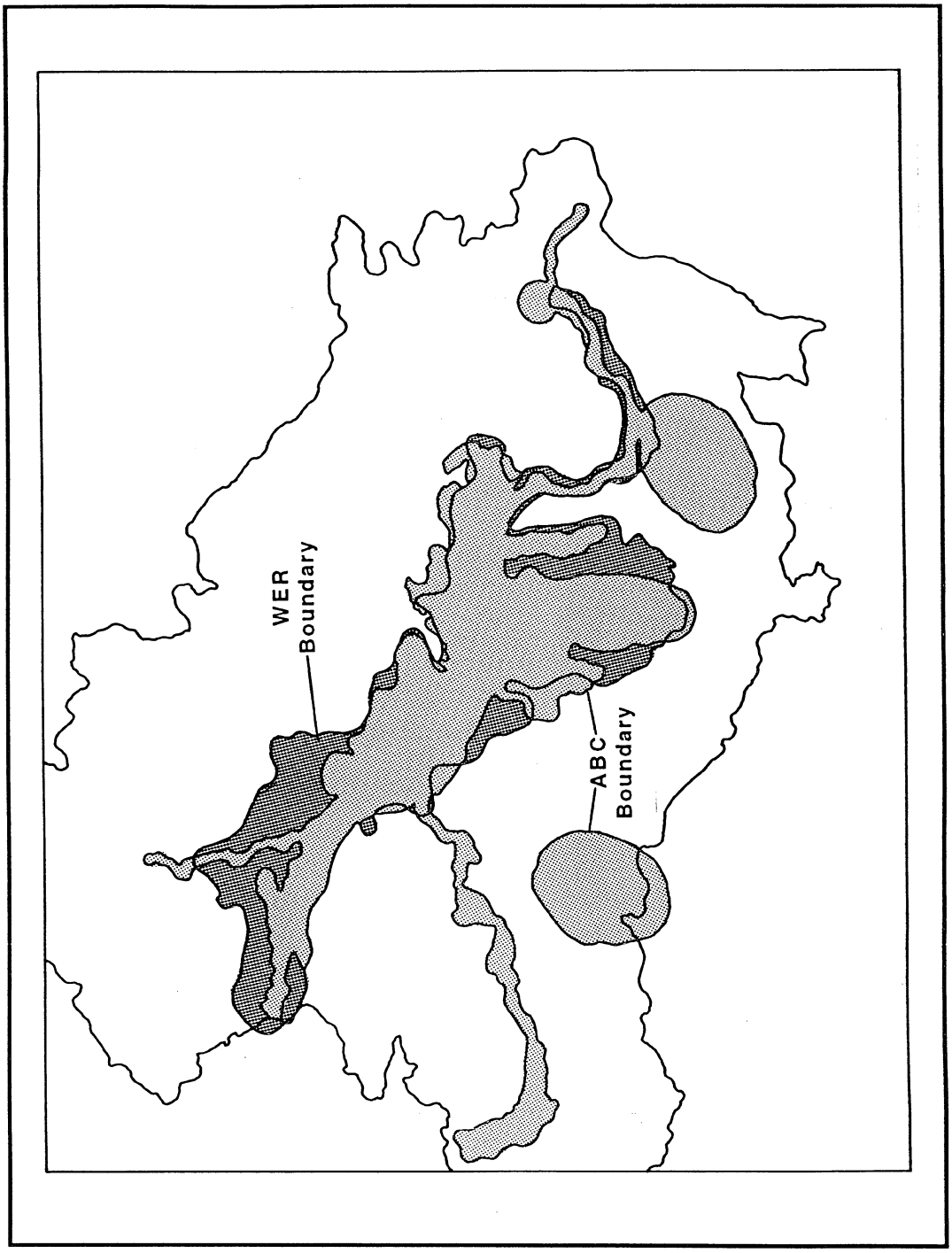


Figure 5.11
Comparison of WER and ABC Boundary Selections

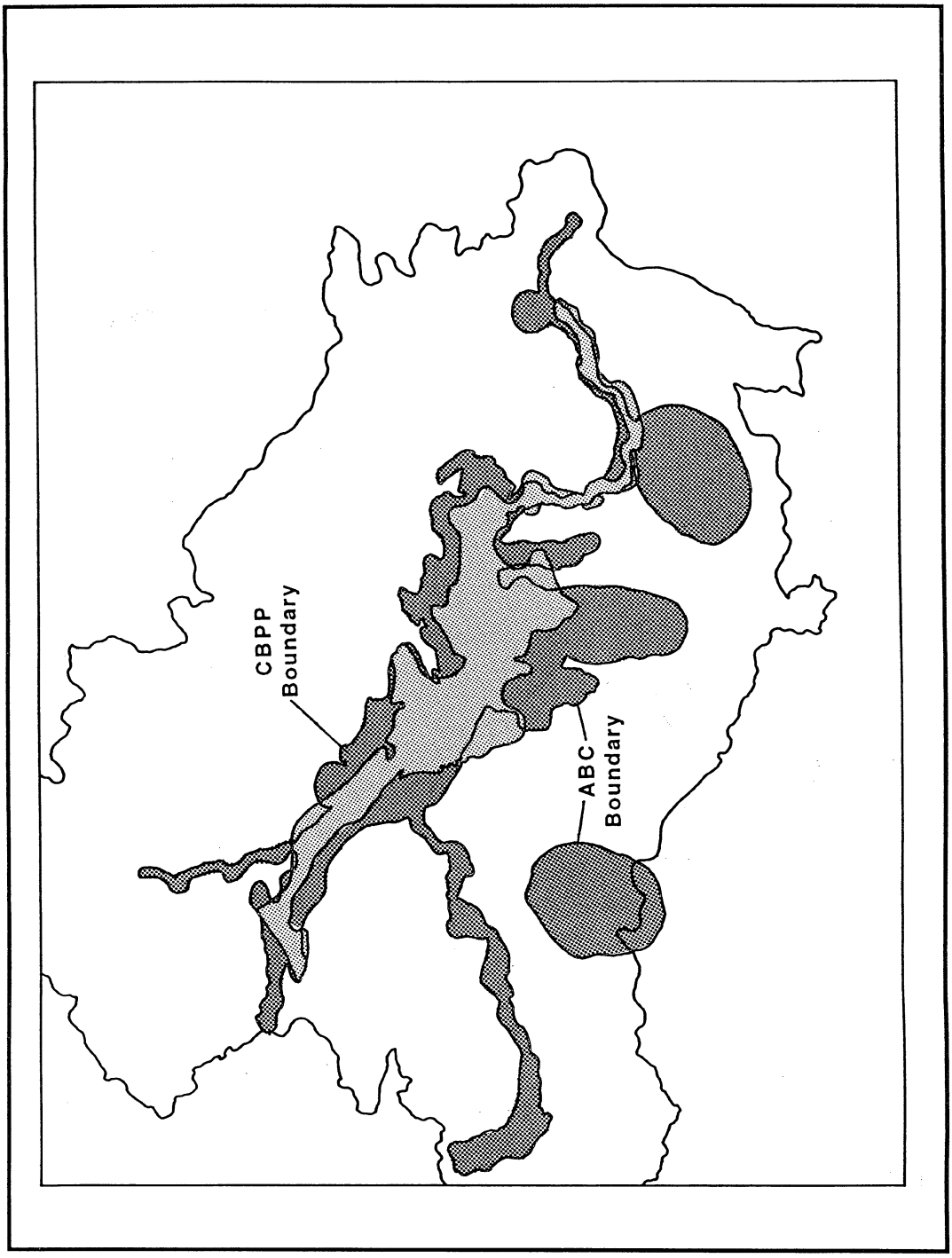


Figure 5.12
Comparison of CBPP and ABC Boundary Selections

Chapter 5 ENDNOTES:

1. Habitat selection was based not only on literature searches but also based on personal communication with staff of the Canadian Wildlife Service, Sackville New Brunswick.

2. These figures are rounded to the nearest 10's digit and the ABC figure does not take into consideration the subtraction of the constraint areas.

CHAPTER 6

METHODOLOGY COMPARISONS

6.1 INTRODUCTION

In previous chapters a number of systems for delineating environmentally sensitive areas were examined. The WER selection procedure, the ABC Resource Survey process and the computer-aided ABC method, while somewhat different in their approaches, are all designed to determine the optimum geographical extent on which to manage the sensitive resources for that area. In order to achieve this goal, all three methodologies need information.

Through the case study, it was clearly demonstrated that information necessary to make resource decisions, such as boundary selection, simply was not available, at least as far as the Main River watershed in Newfoundland. Such a lack of information can be considered a major stumbling block for boundary selection. Which system is the best, or is any one system better than the other? In the sections to follow, some of the strengths and weaknesses of each method will be reviewed.

6.2 WER SELECTION PROCEDURE

6.2.1 Strengths

The WER Act has to be considered one of the Program's

most important strengths influencing the selection process. While the Act does not outline specifically how an area should be evaluated, it does set time constraints on the selection procedure. Given the fact that the WER Program cannot possibly collect all relevant information concerning environmental factors, the Act's time constraints ensure that the decision process does not become preoccupied with information collection. The Act also ensures the public has fair representation in the selection process. This is accomplished not only through the public hearings, but also through the fact that sites, particularly wilderness reserves, do allow some traditional activities to continue in an area, even after preservation status has been adopted.

The WER selection procedure also requires a rigorous approval phase with sites being potentially being totally rejected modified or modified at anytime (see figure 2.3). The procedure also considers issues such as diversity, uniqueness and conflicting uses in the area. Finally, the fact that the WER Program has been evolving since the late 1970's and that its procedures for resource selection have not drastically changed since adoption of the WER Act in 1980, suggests that public familiarity with its procedures may be considered a strength for this method.

6.2.2 Weaknesses

It could be argued that some of the above mentioned strengths may also be its weaknesses. For example, time constraints specified by the Act may indeed be good for any

number of reasons, but what if the information necessary to make appropriate decisions simply is not available. The time constraints do not allow the program managers flexibility to obtain information to make informed reserve selections. Add this to the fact that there are staffing problems i.e. not enough staff available to ensure proper information is gathered, one must become concerned as to the validity of a reserve's protective extent.

Looking back at the case study and comparing its delineation results to that of the WER selection procedure, it is noted that the WER boundary takes in much more land than is needed for an effective reserve. This may be a result of a lack of information upon which the program administrators could make a complete decision. As a result, they overestimated the reserve area in order to ensure it would be amply protected.

The existing WER selection process does consider a site's uniqueness, diversity and cultural heritage, but it does not look at all elements in every case. A site's uniqueness is considered if the evaluation of the area is based on the assumption that the area will become an ecological reserve. Diversity, meanwhile, is associated with wilderness reserves. A procedure such as ABC attempts to incorporate uniqueness and diversity regardless of the area's intended designation.

With regards to the actual assemblage of information, the WER process is a manual one, therefore, when collecting and analyzing information the procedure can become very

cumbersome. Paper maps, charts and tables obtained from various sources must first be placed on a common base and then evaluated. In so doing, there exists a chance that information may be lost and/or misrepresented during data transfer. Once the information has been compiled, performing the necessary conflict analysis, to determine an area's protective extent can prove to be difficult and awkward.

6.2.3 Requirements

The WER procedure has been operating for quite some time and it has been applied to a number of areas throughout Newfoundland and Labrador. It could, therefore, be argued that the WER selection procedure does not require assistance or refinement. Information, however, is the base upon which effective decisions are made. Based on the case study, presented in Chapter 5, the information needed for decision making is not available. If the program wishes to make proper management decisions which will not be contested, then their efforts must place more emphasis on the need for and collection of information. It must also give some consideration to prioritizing these needs and consider refining the existing program's goals and objectives to reflect the importance of information.

Education is also necessary for both existing staff and for those outside agencies considered important information suppliers. To help determine who the important outside suppliers are, Program staff must know what types of information they require to make management decisions. It is,

therefore, important for the Program to have on staff a professional(s) who is able to relate to those outside agencies considered important information suppliers.

6.3 ABC DELINEATION PROCESS

6.3.1 Strengths

An initial strength of the ABC process is that it is a holistic means of dealing with reserve delineation. As such, ABC attempts to incorporate as many elements of the environment, as is possible, in selecting a reserve site. The method of breaking down information into feature categories of abiotic, biotic, and cultural allows the resource manager to better organize the information. Establishing the information into functional and structural elements along with significance and constraint features also allows the manager to better understand the dynamics taking place within the subject area.

As with the WER procedure, ABC forces the resource manager to look beyond the physical features of the area and consider such characteristics as uniqueness and diversity, as well as cultural heritage. The ABC method, however, goes one step further, in that it requires the manager to assign a quantitative ranking of importance to these special characteristics. These labels in turn require the manager to gain a greater appreciation for the ecological relationships existing within the region.

The fact that the ABC Resource Survey method has a proven

record within the management scheme of the Canadian National Parks System, is a further measure of its strength in the delineation process. The ABC method also allows the resource manager to consider, if so desired, management activities outside the site in question. For example, during the case study, delineating the abiotic features for the watershed area was important for the management of the proposed reserve. It may not have been appropriate to include these features within the final reserve, but the manager could now appreciate how much of an effect the abiotic elements of erosion would have on the site.

6.3.2 Weaknesses

With regards to the method's weaknesses in boundary delineation for the WER Program, one might consider the fact that it is a method not yet fully tested for reserve establishment procedures. The fact that the original design requires extensive field work to collect needed information, may make it unsuitable for implementation in Newfoundland. Unlike the WER procedures, ABC's method also does not take into consideration the time constraints imposed by the WER Act. Finally, the ABC method, like the WER procedure, is a manual analysis procedure. It is therefore susceptible to the same analytical problems as the WER process.

6.3.3 Requirements

If the ABC method were to be considered as a means of organizing information for, and delineation of, wilderness and ecological reserves in Newfoundland, a number of items would

have to be considered. As with the WER process the need to emphasize the importance of information cannot be stressed enough. Internal and external education regarding the need for good, reliable information to aid in the proper selection of a reserve must be at the forefront.

Based on the method's field analysis requirements, consideration should be given to broadening the time constraints imposed by the Act so that appropriate data collection could take place. Such a suggestion might, however, be dangerous to implement because if it were acted upon, then the question might be asked, 'why not change other aspects of the Act as the need arises'. The fact that the Act is in place and that it is rigid, gives the Program strength in enforcing the mandates of preservation and protection. If tampering with the Act is not viable then a further course of action would be a reduction in the amount of field research thereby allowing the ABC method to be considered.

In order to eliminate field data collection, at least to the extent suggested by ABC originators, the WER Program would require very experienced staff to deal with collecting information pertinent to ecological processes. These persons may not be able to collect the data in the field, but they could obtain it from other sources, as it becomes available.

A further consideration relates to the Program's classification and zoning system (see Chapter 2). In its present state, the Reserves Program administers lands contained within the selected boundaries. They have no

jurisdiction outside of a reserve boundary. ABC's method encourages management even on the outskirts of an environmentally sensitive area. The WER Program, meanwhile, is forced to acquire as much land as is necessary to ensure a site is amply protected. If the classification and zoning system were broadened to allow for limited management outside a reserve site, i.e a buffer or secondary reserve, then management of a reserve's interior elements would be more secure.

6.4 THE CASE STUDY APPROACH

6.4.1 Strengths

The case study approach to boundary delineation attempted to incorporate the ABC design into the institutional arrangements of the WER Program. At the same time, efforts were made to modify the ABC procedure by utilizing GIS technology. Many of the strengths of this procedure are, therefore, similar to those of the manual ABC method mentioned above.

Other strengths of this approach result from the application of technology, to an otherwise manual procedure. For example, through the use of the GIS, much more information can be analyzed than would be possible in a manual procedure. The overlay analysis capabilities of the GIS are outstanding attributes. The fact that a GIS is able to incorporate both spatial and non-spatial data into the analysis procedures is also a plus, particularly if the information is coming from a

variety of sources and formats. Temporal data analysis can also be incorporated into the GIS applications, such that the resource manager can study the changing land uses of an area prior to making a site selection. The manager can also model the impact a reserve might have on other activities in an area. GIS can also assist the manager in generating information for reports during public hearings.

Through the modified approach, consistency of selection can be better controlled as the program moves from one proposed site to the next. While ecological influences are not the same in every situation, some selection criteria can be consistent, eg. selection of the abiotic buffer zone for erosion adjacent to water features.

6.4.2 Weaknesses

The weaknesses of this approach can also be related to its use of technology in evaluating a region for protection. Technology requires experienced staff who can operate and manage the equipment. Such requirements reflect a need either to retrain existing staff or hire new personnel to fulfill the procedures needs. Regardless of the approach, retraining or recruitment will require additional financial resources. Add to this the need for additional capital for acquisition of hardware and software and it becomes apparent that technological advancement can be expensive.

As with the manual ABC method, quantitative ranking of abiotic, biotic, and cultural elements requires a great deal of subjective influences into the analysis process. While the

case study did not rank its elements during analysis, it is recognized that such a procedure may still be necessary in future applications.

6.4.3 Requirements

Applying such a procedure to the delineation process would not be a simple task. First, the Program would have to overcome the problems associated with the influences of technology. Second, Parks Division would have to make efforts to further test this procedure in areas where sites are being established and in areas where sites are being considered. As with the manual ABC method, more emphasis would have to be placed on gathering information from source agencies, rather than on field collection. This procedure would also require the manager to consider the problems associated with collecting information, which might come in digital format (e.g. data compatibility issues).

6.5 CONCLUSION

The most important issue facing any and all of these three methodologies is the need for reliable, acceptable and plentiful information upon which a reserve selection may be justified. Since it is not possible for a single agency to collect the necessary information, the process will be dependent on other agencies. Dependency, however, also brings with it additional problems, such that those agencies being depended upon, have to realize their importance and what it is that is required of them. Through education of the public and

private sectors on the importance of a cooperative spirit and the benefits of information, in reserve selection, a better selection procedure is possible. The education process must, however, begin in-house. The WER Program staff must first recognize the need for information and understand the uses to be applied to that same information before they can begin to demand information from others. They must also appreciate the types of information required in the decision process and understand the levels of detail necessary at each stage of the selection procedure.

Presuming the required information was available and using the case study approach as the means of selecting/ delineating wilderness and ecological reserves, the following benefits would result:

(a) an improved selection procedure via the automation of a previously manual holistic methodology.

(b) a further step to encourage information compatibility.

(c) an improved service to government agencies interested in the same areas.

(d) and an improved service to the public, as they would be involved in a more reliable delineation process and thereby receive the benefits of a more reliable delineation area.

CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

> In wilderness protection every victory is temporary, every defeat is permanent. [Foster, 1990]

7.1 CONCLUSIONS

A rapidly growing world population, a static land base on which to support such growth and the depletion of natural resources are all reasons for concern with regards to the environment. But these same concerns must become more than words of feelings, they must be put into action. Programs such as the Wilderness and Ecological Reserves Program in Newfoundland exemplify the types of processes necessary to manage sensitive and/or representative samples of the environment. Based on such programs, there exists a need for a cooperative spirit and sound programming along with reliable information, if goals of protection and preservation are to be achieved.

Since its adoption in 1980, the Wilderness and Ecological Reserves Act has been viewed as the cornerstone upon which the existing WER Program has been built. Through this legislation the Program has been able to establish numerous wilderness and ecological reserves throughout Newfoundland. The Act, however, is not the only instrument necessary for the Program to achieve its goals. In order for sites to be selected for protection and preservation, sound management decisions must

be made based on the characteristics of that site. In turn, achieving these decisions requires reliable information. The types of information necessary for the decision process also depends heavily upon the stage at which the decision is being made. At the initial proposal stage, extensive amounts of detailed information are necessary upon which to base a selection. In the final establishment stage the detail required reduced.

Depending on the stage of selection, the WER Program staff are able to utilize a number of information sources. For the most part these sources are best suited for the initial evaluation stage. With regards to detailed site selections, however, the number of sources directly accessible is much less. Perhaps the greatest amount of information detail is needed during the boundary delineation procedure. Obtaining such information has caused problems for the WER Program. In an effort to alleviate the problems resulting from a lack of information, the WER Program must make its information needs known to those sources believed capable of supplying pertinent material.

The present selection procedure, while semi-systematic, does not approach all reserve selections based on the same criteria. Sites considered for wilderness reserve status are evaluated based on the area's diversity while ecological sites are considered based on a site's uniqueness. Differentiating sites using such criteria can have a limiting effect on the selection procedure. Therefore, chapters 4 and 5 looked at

the possible incorporation of the ABC Resource Survey method and GIS as a means of taking an area deemed important and selecting a reserve boundary based on the area's abiotic, biotic, and cultural significance and constraint features.

Through the Main River case study, actual information collection and methodology adaption was possible. Based on the results of the computer-aided method it was determined that the ABC process may have a role to play in the WER Program. Also, GIS may be a feasible tool for handling the potentially large volumes of data generated from such an analysis. Finally, the case study illustrated the lack of available information required by the WER Program for boundary selections. This lack of information makes any WER decision making difficult.

7.2 Recommendations

Recommendations resulting from this project are designed to help the WER Program become more systematic in its handling of resource information. In this regard, the following recommendations can be broken up into three classes: organizational, operational, and research and development. It is not always obvious, however, which of the three should come first, particularly when considering organizational and operational activities. This again demonstrates, the complexity of dealing with resource information. It must also be recognized that the classes of recommendations do not all work independently, especially in relation to organizational

recommendations.

7.2.1 Organizational Recommendations

1. The existing policies for Parks Division, for which the Wilderness and Ecological Reserves Program is a very important part, do not consider the need for, or use of, information in management procedures. Resource information is, however, vital to the management procedures of the WER Program. If the Program wishes to develop an awareness of the importance of information, they too must take steps to internally reenforce the collection, creation and maintenance process. Accordingly it is recommended that Parks Division's policies no longer infer the need for information, rather the Division's policies should indicate the importance of resource information for achieving its goals and objectives.

2. In Chapter 2, section 2.3.1, the relationship of the WER Program to Parks Division was noted and reference made to the Division's Classification and Zoning System. Figure 2.2 noted the existing program has one type of zone, the preservation zone. If the Program is to consider adapting the ABC methodology as part of its management procedures, it must recognize that the ABC method allows a program, such as WER, to be much more flexible when managing reserve sites. The ABC method allows resource managers the freedom of selecting a core preservation zone, but it also allows them the opportunity to select buffer management zones. Such additional zones ensure the ecological processes within the

core are not adversely affected by neighbouring activities, such as forest harvesting. It is therefore recommended that the existing classification and zoning system, as it relates to Wilderness and Ecological Reserves, be upgraded to allow for the adaption of, for example, some form of Level I, II, and III wilderness and ecological reserve, where Level I would be the core reserve and Levels II and III would reflect buffer management zones to protect the core.

3. Chapter 5 reviewed the concept of merging the ABC Resource Survey method with the boundary selection needs of the WER Program. In so doing, the case study attempted to use an existing technology, i.e. GIS as a tool to better manage the anticipated large volumes of resource information.

In order to introduce such technology into the WER Program, the ideas, equipment and applications associated with the technology must be phased in over a period of time. In order to encourage GIS implementation into the reserve selection procedures, one of the initial steps necessary is to educate management and staff as to GIS capabilities and limitations. It is recommended that Parks Division take steps to adopt GIS technology. Part of this process must provide top management the opportunity to gain an appreciation of the technology and its capabilities. By allowing top management the first chance at understanding technology, they would be in the position to better appreciate ongoing GIS development issues.

4. In order for the Program to collect the information necessary for reserve selection and management, staff must have an appreciation for that information. Such an appreciation must include an understanding the types of information, the relationships of various types of information and an understanding of limitations to some information and its sources. The existing staff of the WER Program consists of a Natural Heritage Planner, Parks Planner and a seasonal Biologist. For the program to achieve proper information collection and use, the administrating staff must be upgraded. The recommendation would be to at least bring on as permanent staff a botanist and a biologist.

5. Chapter 3, section 3.4, outlines a number of sources of information presently available to the Program. Much of the information available from these sources is presented at a small map scale. This information may be sufficient for initial site selection, however, as site selection becomes more detailed, i.e. management plans and boundary selection stages, the need for information detail increases.

Even with a full complement of highly qualified individuals it would not be feasible for the WER Program to attempt to collect all of the resource information. They must therefore, encourage other agencies to become regular suppliers of resource information. It is therefore recommended that the WER Program institute a program to educate those agencies capable of supplying resource

information as to their role in assisting the Program to better manage Newfoundland's wilderness and ecological reserves.

7.2.2 Operational Recommendations

1. The sources of information must be understood before the information gathered can be considered reliable. The reliability of a specific set of information must also be judged based on the intended use of that material. For example, if one is selecting a specific reserve boundary and the majority of the information to be used is at a large scale, but a number of sources are at a smaller scale, the resulting boundary selection can only be considered as good as the worst case data set. Sources such as International Biological Programme (IBP) and Canada Land Inventory (CLI), as indicated in Chapter 3, are relevant sources for some aspects of wilderness and ecological reserve management, however, dependency on these sources can be troublesome. It is recommended, therefore, that sources such as IBP and CLI continue to be used in the reserve selection process, but, in a conservative manner. The information can indeed be valuable, particularly if it is used as a starting point for building a stronger information data base. Specifically regarding IBP data, the WER Program must take steps to further investigate the IBP sites to determine what changes have occurred to the selected areas, since IBP's termination in 1974.

2. The incorporation of the ABC Resource Survey into the WER Program as a means of selecting resource boundaries is a possibility. ABC's holistic approach to boundary delineation ensures the Program will consider a candidate site in a more comprehensive fashion. In order to incorporate the ABC methodology into the Program, however, Program personnel must begin to familiarize themselves with the ideas of abiotic, biotic and cultural elements. It is therefore recommended that the data being collected for proposed sites and existing sites, be classified as abiotic, biotic, or cultural elements.

3. In a 1980 report entitled Land Use In Canada: The Report on Interdepartmental Task Force on Land Use Policy, [Buckley, 1980], the importance of land and the strategic role it plays in the national economy were outlined. The report concluded: "In the opinion of the task force it is essential that there be coordination and cooperation between the various levels of government on all matters that affect land." The report also states that "the scope of land problems often transcends jurisdictional boundaries further complicating their solution. No single level of government can unilaterally solve all land problems because the factors influencing land are so diverse." Given the strict guidelines of the reserves program, the opportunity exists for establishing reserve areas using the ABC Resource Survey. The information to assist in the establishment of these areas, however, is lacking. It is therefore recommended that the WER Program make their needs

known to the Federal Government, and other agencies, obtaining their assistance in collecting needed information for reserve establishment.

4. In an effort to control activities on a reserve site, the WER Program has implemented a system requiring all reserve users to carry entry permits while in a reserve. The potential for information collection as part of this permit system has not been fully explored. The WER Program must therefore take steps to ensure information gathered by the permit holder is shared with the Program personnel. To ensure information release, the WER Act would have to be amended thereby giving program staff the authority to enforce compliance.

While the information collected from reserve users would do little to help in selecting the boundary for the reserve they are occupying, it would provide Program managers information for better site management. Such information may also allow a better understanding of the ecological processes in other, similar sites of the province.

5. The importance of research within a protected site cannot be over emphasized. Research provides the resource manager with information that is necessary to make better management decisions. For this reason Parks Division should encourage research to continue, particularly when the activities will supply the Program with information pertaining to site inventories. In turn, this information may be utilized for the monitoring of interrelationships of resource elements.

6. Daley, (1989), recommended "Parks should attempt to ascertain the specific habitat requirements of all animal species occurring within [reserves] i.e the location and size of the homerange, breeding range, wintering area, etc." It was further suggested that a "thorough biophysical inventory of each [reserve] would enable planners to outline natural areas of differing sensitivity to human activity." Such recommendations in and of themselves are warranted. If implemented they would allow the Program to gain a better understanding of the processes within a site. To suggest that Parks Division attempt to carry out these tasks alone, however, would not be met with favourably by other agencies. While other agencies may be willing to allow Parks Division to pursue these interests alone, ultimately the goal of such an information collection endeavour would be to have an information data base useful for all concerned agencies. Without assistance from other agencies, believed to have a vested interest in such data, the validity of the final information might be in question. Therefore, in addition to the basic ideas of Daley (1989), one might add the solicitation of cooperation from those interested in such data, thereby calling upon their individual areas of expertise in the process.

7.2.3 Research and Development Recommendations

The most important recommendation resulting from the case study is that further testing of the ABC methodology should be

performed. Specifically:

1. Further comparison testing should be carried out. Through the case study, comparisons were made of the applied ABC selection, Reserves Program site selection and an industry selected site. While comparison tests with industry selected sites will not always be possible, the WER Program should attempt to carry out further comparison tests between ABC and WER selections in relation to proposed, and even established reserve sites.

2. The results of an ABC reserve delineation should be integrated with the public hearings process. Such a suggestion can be costly, particularly if the public feels uncomfortable having to deal with new selection processes. Thus, caution is warranted. If, however, the Program is so inclined as to adopt the ABC procedures, ABC delineated sites would one day be put to the test, regardless of public discomforts/mistrust.

3. Further tests might be considered where other technologies, such as remote sensing, would be incorporated into the site selection process. While remote sensing technology was not considered by this project, it has obvious potential to function as a source of information for the decision processes. When it became evident that basic resource information did not exist for incorporation into the delineation process, remote sensing was viewed as a means of collecting at least some of the necessary resource information.

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APPENDIX A

GLOSSARY OF TERMS

ABC Resource Survey - a four stage holistic approach to resource information management intended to delineate protected area boundaries taking into consideration an areas abiotic, biotic and cultural elements.

Abiotic Features - resource elements characterized by the absence of life or living organisms (for example: soils, climate, water and geology).

Biotic Features - resource elements characterized due to, or pertaining to, life (for example: crops, natural vegetation, fish and wildlife).

Component Approach to resource management - a general approach to resource management whereby each element of the land is seperated out to create a unique classification.

Constraint Features - those resource features reflecting limitation to a site being selected for protection.

Cultural Features - resource elements characterized by the influences of human activity (for example: population, statistics, recreation, infrastructure).

Ecological Processes - the activities or interactions between abiotic, biotic, and cultural elements.

Ecological Reserve - a legally protected natural area where human influence is kept to a minimum. Where change itself a natural phenomenon, is not interferred with, but is allowed as far as possible to proceed uninterrupted by man.

Ecosystem - a biotic community of plants and animals within an abiotic setting of water, minerals, atmosphere and climate.
- all plants and animals that live in a particular area together with the complex relationships that exists between them and their environment.

Formal Holistic Resource Management - an approach to managing resources where agency participation in the management process is, for the most part, legislated.

Functional Components - selected areas of a given site within which major ecological processes occur (for example: erosoin, plant productivity, activity corridors).

Holistic Approach to Resource Management - a general approach to resource management which attempts to express the interactive nature of all aspects of the landscape simultaneously, so as to form a complete desrciption of the ecosystem and its surrounding systems.

Informal Holistic Resource Management - an approach to managing resources whereby agency participation is primarily voluntary and holistic management is used on an issue by issue bases.

Integrated Approach to Resource Management - (see Holistic Approach to Resource Management).

Management Control - process by which managers assure that all forms of matter and energy are obtained and used effectively in accomplishing the organization's objectives.

Natural and Scenic Attraction Parks - areas with significant natural features and/or with special high quality scenic attributes.

Natural Environment Park - areas with representative natural features and landscape, that combine with outstanding resources to provide high quality intensive and dispersed outdoor recreation opportunities in aesthetic natural settings.

Operational Control - process of assuring specific tasks are carried out effectively and efficiently.

Outdoor Recreation Park - areas with natural attractions and special scenic qualities that can be extensively deveopled to accommodate a variety of recreational activities of a moderately intensive to intensive nature, emphasizing camping and/or water related activities and facilities.

Passive Recreational Activity - including hunting, fishing, trapping, etc. however these activities do not have the aid of ATV, snowmobiles or other equipment which might adversely affect the natural environment.

Resources - pertaining to the natural resources of the land and its ecological processes.

Resource Information - information pertaining to natural resources of the land, for example, vegetation, wildlife, goelogy, etc.

Resource Management - a process of decision making whereby [natural resources] are allocated over space and time according to the needs, aspirations and desires of man.

Significance Features - those resource features reflecting importance to a site being selected for protection.

Strategic Planning - process of deciding on organization objectives, on changes to these objectives, on the resources employed to achieve them, and the policies that are to govern the acquisition, use and disposition of these resources.

Structural Components - selected features of a given area relating to such items as landforms, vegetation communities and past and present land uses.

Waterway Park - significant rivers or sections of such rivers including where desirable headwaters, tributary and/or intermediate lakes, together with adjacent land necessary for their use for recreational purposes and/or protection.

Wilderness Reserve - a large natural area, or a large area that has been exposed to minimal human activity, which is protected so as to preserve its primative character.

Wildlands - areas unmodified by human development.

Wildlife (Ungulate) - a hoofed mammal

APPENDIX B

MAPS (as found in pocket attached)

NOTE: These maps are obtainable from the Department of Surveying Engineering, as the need arises.

B.1 Abiotic Class: Structural (S) and Functional (F)
B.2 Biotic Class: Structural (S) and Functional (F)
B.3 Cultural Class: Structural
B.4 Cultural Class: Functional

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