Environmental Evaluation of the Proposed Five-Year Operating Plan for Forest Management District 16 (2002-2006)

Submitted to:

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September 27, 2001

EXECUTIVE SUMMARY

Corner Brook Pulp and Paper Ltd. (CBPP) has submitted its Five-Year Operating Plan for Forest Management District 16 (FMD 16), a large area that includes the watersheds of the Humber and Main Rivers. This Environmental Assessment document is submitted in support of the registration of this Plan under the *Environmental Assessment Act*. This document provides relevant environmental information regarding the proposed Five-Year Plan and provides an environmental evaluation of its contents and its implementation.

The proposed undertaking involves continued forest harvesting activities within FMD 16. These activities involve the construction and maintenance of forest access roads, harvesting and transportation of softwood to the mill in Corner Brook, and silviculture activities for the period 2002 to 2006 inclusive. The undertaking involves the harvesting of wood volumes set by the provincial Department of Forest Resources and Agrifoods (DFRA) as sustainable within FMD 16.

DFRA manages the timber resources of the Province by focussing on the recovery of material in an efficient manner and the optimal use of wood fibre. Therefore emphasis is placed, for example on harvesting over-mature and mature trees (i.e. harvest the oldest wood first), and on recovering trees which have been damaged by blowdown, fires and/or insect infestation before they are lost to rot and decay. The industry operates in compliance with this objective, and accordance with a comprehensive planning framework – a twenty-year overall plan as developed by DFRA, individual Five-Year Operating Plans for Forest Management Districts, and Annual Operating Plans with assignment of annual allowable cut limits to ensure against over-exploitation of the resource. A ten-year strategic document has also been recently developed and drafted for FMD 16 that outlines guiding principles of sustainable, multi-use forests.

Five-Year Operating Plans for FMD 16 have been developed by each proponent CBPP, Abitibi-Consolidated, and DFRA. All are required to undergo examination in accordance with the requirements of the *Newfoundland Environmental Assessment Act (NEAA).* As well, any proposed amendments to these plans must be registered in accordance with the Act.

The documents listed above are produced under the Adaptive Management Process outlined by the Department of Forest Resources and Agrifoods. Adaptive Management is a process of continual reassessment of management objectives and procedures to ensure continuous improvement. As such, research and policies are continually being “upgraded” as necessary.

Proposed Five-Year Operating Plans are developed by each proponent (i.e. CBPP, Abitibi-Consolidated (Abitibi), and DFRA) and all are required to undergo examination in accordance with the requirements of the *Newfoundland Environmental Assessment Act* (NEAA). As well, any proposed amendments to Plans must be registered in accordance with the Act. As part of the Adaptive Management Process, public planning meetings are conducted prior to development and submission of all Five-Year Plans for each forest management district. Prior to this submission, CBPP and other proponents completed 17 public planning meetings and two one-day workshops throughout communities in FMD 16 so that issues from interested and concerned individuals, government agencies, and non-government agencies could be addressed. This process began over 12 months ago as a combined process for all parties interested in pursuing forest harvesting operations in FMD 16. This is an integral process in addressing concerns prior to submission of any proposed Five-Year Operating Plan. In this way, issues and concerns regarding specific identified harvesting areas (eg. hunting lodge locations) and district-wide concerns (eg. Pine Marten and Forest Structure) have been considered and resolved prior to submission.

The current proposal is straight-forward. CBPP is proposing to continue its operations in FMD 16 in a sustainable manner. FMD 16 is an integral timber supply for the CBPP mill as it supplies approximately one-quarter of their annual timber consumption.

This Environmental Evaluation provides a discussion of various issues identified through the public planning meetings. The level of public participation is endorsed through the Adaptive Management Process. Each issue has been subjected to an evaluation using the available information on the issue from within the areas of concern as well as relevant literature on mitigation practices from around North America. Some issues identified are addressed within the scope of regulations from federal and/or provincial agencies. As such, permitting requirements, laws, and mandatory mitigation measures from both Provincial and Federal government agencies govern environmental aspects of forest harvesting operations of all companies in Newfoundland and Labrador. These requirements are based on current knowledge and corrective and preventative techniques that reduce or eliminate potential negative effects. Where these regulatory requirements are applicable to identified issues (eg. Navigable Waters, Historic Resources, Fish and Fish Habitat), they will be presented and incorporated into the evaluation.

For all appropriate issues, mitigation measures have been identified and a prediction made of the residual impact of the undertaking. It is recognized by CBPP that forest harvesting operations can never be conducted without any effect to the forest in question, however, in no case is the predicted impact significant for any identified major concern, given the commitments made by CBPP through the Adaptive Management Process.

The principal concerns regarding this Five-Year Plan submission are summarized below.

The **forest structure** within the Main River watershed has been identified as old growth boreal forest with gap replacement as the dominant regeneration dynamic. CBPP timber limits cover some 69% of the Main River watershed. The remaining 31% of the watershed is unalienated Crown land that is not scheduled for harvest. The Company has contributed more than 17,000 hectares of their limits to the Heritage River Special Management Area. More than 12,000 (12% of the watershed) hectares of this are is in no-cut zones. Nearly half (42%) of the watershed is not scheduled for harvest and another 5% will only be harvested under the auspices of the Main River Stewardship Agreement. The estimated extent of the contiguous old growth forest on the island has been determined to be much larger than the Main River watershed. This large area combined with the no harvest area of the Main River watershed provides ample opportunity to protect a representative area of this forest type. Commitments have been made by CBPP to ensure that this Newfoundland ecosystem is maintained:

- Harvesting a limited amount of timber within the Main River watershed. In total, approximately 25,000m^3 of wood will be extracted from the watershed annually.
- No clear-cutting within the Main River watershed. Various non-clearcut regimes will be conducted within the watershed. Harvest will be based on maintaining the uneven aged forest structure found there. Specific harvest methods may vary from stand to stand depending on the structural characteristics of each stand.
- A contribution of more than 17,000 hectares to the Main River Waterway Park and Special Management Area.
- Continued research and protection of this ecosystem.

A portion of the Newfoundland **Pine Marten** population is found within FMD 16. The species is listed as endangered by the Committee On the Status of Endangered Wildlife In Canada. CBPP cooperates with the Wildlife Division of the provincial Department of Tourism, Culture and Recreation for the recovery of Marten throughout western Newfoundland. The Company provides financial and in-kind support, jointly with other stakeholders, for several major research and management initiatives for the Pine Marten. Company staff serve on the Newfoundland Marten Recovery Team. A key objective of the partial harvest strategy is to conform to the new habitat guidelines developed by the recovery team.

Many other **Wildlife** species occur throughout Insular Newfoundland including birds, mammals and fish. An outline of current surveys and research is presented as well as the potential interaction between forest harvesting and each group. In most cases, a neutral or positive effect from forest harvesting is expected due to increases in the productive capacity of the regenerating forest (eg. moose and small game).

Tourism activities represent an important resource use in FMD 16. The recent designation of the Main River as a Canadian Heritage River will provide a base for an expanded eco-tourism industry in the White Bay South area. The Management Plan for the Heritage River calls for the formation of a Stewardship Committee to provide input to the Department of Tourism, Culture and Recreation on the management of a 200 square kilometre Special Management Area along the full length of the river.

Corner Brook Pulp and Paper is involved in ongoing meetings with the Department of Tourism, Culture and Recreation and the Newfoundland Outfitters Association to discuss harvesting plans in the Upper Humber/Main River area (*see* Five-Year Operating Plan Volume One). Separate follow-up meetings with individual outfitters have also been held. CBPP has made a commitment to ensure that forest harvesting and outfitting operations can work together without any significant constraints or conflicts.

The forest industry is a mainstay of the Newfoundland economy and Corner Brook Pulp and Paper is a significant part of the forest industry. The Company employs some 1,500 people directly in 40-50 communities throughout the province in high quality, long-term employment. The Company's annual payroll is in excess of $63 million. Most employees work 10-12 months a year at wages that are significantly higher than the provincial average. Including wages, CBPP spends some $100 - $150 million annually on goods and services in Newfoundland and Labrador and contributes more than $300 million to the province's Gross Domestic Product. Forest management activities in FMD 16 support more than 200 jobs in the Company's mill and woodlands operations. As well, CBPP provides logs to integrated sawmills in FMD 16, thus supporting significant additional economic activity and the associated employment in the district.

In summary, Corner Brook Pulp and Paper has made significant changes to its approach in managing its timber resources in the Main River watershed. No clear-cutting will take place in the watershed. All harvest will be some form of selection or variable retention harvest that will retain key structural elements of the existing forest stands. There will be no conversion of uneven-aged natural stands to even-aged, intensively managed stands. Harvest volumes will be minimized with some 25,000 cubic meters harvested annually. CBPP supports the protection of a representative area of the old growth forest ecosystem found on the eastern side of the Northern Peninsula. Nearly half (42%) of the Main River watershed is not slated for harvest. Additional areas of similar forest occur north of the Main River watershed and provide ample opportunity for protection of a representative, undisturbed area of this ecosystem. CBPP has contributed more than 17,000 hectares of its timber limits to provide for the designation of the Main River as a Canadian Heritage River. This designation was granted in August 2001 and will protect the natural and wilderness values along the full length of the river and provide for an expanded eco-tourism industry in the White Bay South area. Through the formation of the Gros Morne National Park Connectivity Working Group, the Company is working with the Park to ensure that forest management activities adjacent to the park do not negatively impact its ecological integrity. CBPP continues to co-operate with the Wildlife Division of the Department of Tourism, Culture and Recreation to ensure the provision of sufficient suitable habitat for the recovery of the Newfoundland Pine Marten in western Newfoundland. Tourism and recreation are important values derived form Newfoundland's forests. CBPP works with individual outfitters and the Newfoundland Outfitters Association to address their concerns with forest management activities on company timber limits. Forest management activities in FMD 16 support a significant portion of Corner Brook Pulp and Paper's contribution to the economic and social benefits derived from Newfoundland's forests. Corner Brook Pulp and Paper strives to achieve a balance of economic and environmental values such that no significant residual impacts on the Valued Ecosystem Components should result from the implementation of the proposed Five-Year Operating Plan.

Preface

Corner Brook Pulp and Paper Limited carries out wood harvesting across its timber limits to supply wood fibre to its paper mill in Corner Brook. Five-Year Operating Plans are developed for each Forest Management District, and these go through registration under the *Newfoundland Environmental Assessment Act*. Thus, the current (2002-2006) Five-Year Operating Plan for Forest Management District 16 is currently being submitted for registration with the Minister of Environment under this Act.

The Environmental Evaluation is submitted for review to the Minister as part of the Registration of the Undertaking, to determine conformance with the *Newfoundland Environmental Assessment Act*, the Adaptive Management Process, and to assist the Minister in determining whether further environmental assessment is required.

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1.0 INTRODUCTION

Corner Brook Pulp and Paper Limited (CBPP) proposes to continue wood harvesting operations in Forest Management District 16 over the period 2002-2006 inclusive. As part of the planning and approval process, two documents have been produced; a Five-Year Operating Plan (Volume One) and this Environmental Evaluation document (Volume Two).

The Five-Year Operating Plan (Volume One) provides a detailed description of the proposed Undertaking. It includes quantities to be harvested, harvest locations, infrastructure requirements, minutes from stakeholder consultation meetings and applicable environmental protection measures.

This Environmental Evaluation document (Volume Two) provides a comprehensive environmental impact assessment of the Undertaking. It includes a description of the existing environment, a determination of interaction between the project and the environment, an assessment of the level of potential effect, application of mitigative measures and subsequently, an assessment of the residual effects from the project.

These two documents together comprise a Registration in accordance with the *Newfoundland Environmental Assessment Act* (NEAA).

1.1 PROPONENT

The following corporate and contact information is provided for the proponent:

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1.2 REGULATORY FRAMEWORK

Forestry Planning in Newfoundland and Labrador involves a hierarchy of management plans. At the highest level is a Twenty-Year Plan that is developed by the Department of Forest Resources and Agrifoods (DFRA), and addresses the entire Province. The Twenty-Year Plan describes general policies and practices to be employed to attain a long term sustainable forest harvesting industry. For each District, DFRA may also develop a Forest Management Strategy to describe guiding principles for sustainable forest management that accommodate all resource users in the area. In addition, each operator in a District is required to develop a Five-Year Operating Plan which outlines general locations of harvesting activities and addresses specific actions required to harvest their allocated cut. Annual work schedules or plans are also required which identify the exact location and timing of forest operations.

All these plans are prepared in accordance with the *Forestry Act*, and are required to be approved by the Minister of Forest Resources and Agrifoods. Throughout, DFRA operates on the basis of an “Adaptive Management Approach” which is based on the principles of stakeholder participation in planning and an ecosystem approach to forest management. Five-Year Operating Plans for forest harvesting are also subject to environmental assessment in accordance with the NEAA. Forest harvesting is not an activity subject to the *Canadian Environmental Assessment Act* (CEAA).

Following approval under NEAA, a series of federal/provincial regulatory permits/authorizations are required prior to start of construction or during project implementation.

A list of anticipated federal, provincial and municipal permits/licenses/authorizations that may be required for this undertaking are presented in Table 1.1. Applications for these approvals will be submitted by CBPP or its contractors as required, and in a timely manner once the undertaking has been released from the Environmental Assessment Process.

Table 1.1 Permits/Licenses/ Authorizations that may be required for the 2002 – 2006 Five-Year Operating Plan for FMD 16.

PERMIT, AUTHORIZATION, APPROVAL	AGENCY
FEDERAL	
Transportation of Dangerous Goods	Transport Canada
Authorization for Works or Undertakings Affecting Fish and Fish Habitat	Department of Fisheries and Oceans
Permit for Construction Within Navigable Waters	Canadian Coast Guard, DFO

PERMIT, AUTHORIZATION, APPROVAL	AGENCY
Notification to Handle or Transport Dangerous Goods	Transport Canada
PROVINCIAL	
Release from the Environmental Assessment Process	Government of Newfoundland and Labrador Department of Environment and Labour Environmental Assessment Division
Certificate of Environmental Approval for any alteration to a body of water	Government of Newfoundland and Labrador Department of Environment and Labour Water Resources Division
Water Use Authorization	Government of Newfoundland and Labrador Department of Environment and Labour Water Resources Division
Permit for Access off any Highway	Government of Newfoundland and Labrador Department of Works, Services and Transportation Transportation Regulation Enforcement
Authorization to Handle or Transport Dangerous Goods	Government of Newfoundland and Labrador Department of Works, Services and Transportation Transportation Regulation Enforcement
Borrow and Quarry Permit	Government of Newfoundland and Labrador Department of Mines and Energy Mineral Lands Division
Authorization to Control Nuisance Animals	Government of Newfoundland and Labrador Department of Forest Resources and Agrifoods Wildlife Division
Permit to Burn	Government of Newfoundland and Labrador Department of Forest, Resources and Agrifoods Forest Fire Protection
Commercial Cutting Permit	Government of Newfoundland and Labrador Department of Forest, Resources and Agrifoods Newfoundland Forest Services

PERMIT, AUTHORIZATION, APPROVAL	AGENCY
Operating Permit	Government of Newfoundland and Labrador Department of Forest, Resources and Agrifoods Newfoundland Forest Service
Certificate of Approval for Storage and Handling of Gasoline and Associated Products as per Fire Protection Act and GAP Regulations.	Government of Newfoundland and Labrador Department of Government Services and Lands Operations Division
Certificate of Environmental Approval to establish, alter, enlarge or extend a waste management or a waste disposal site or incinerate as per Waste Material Disposal Act.	Government of Newfoundland and Labrador Department of Government Services and Lands Operations Division
Permit in accordance with Urban and Rural Planning Act for access onto a Protected Road.	Government of Newfoundland and Labrador Department of Government Services and Lands Operations Division
Permit for Flammable and Combustible Liquid Storage and Dispensing and for Bulk Storage	Government of Newfoundland and Labrador Department of Government Services and Lands Engineering Services
License of Occupation to Occupy Crown Land	Government of Newfoundland and Labrador Department of Government Services and Lands Customer Services
MUNICIPAL	
Approval for Waste Disposal	Town/Community Council

1.3 STAKEHOLDER CONSULTATIONS

Corner Brook Pulp and Paper Limited, Abitibi-Consolidated Incorporated and the Department of Forest Resources and Agrifoods all have plans to conduct forest harvesting activities in FMD 16 during the five year period from 2002 to 2006 inclusive. In September 2000, all three operators began a collaborative multi-stakeholder planning process in accordance with the provincial Adaptive Forest Ecosystem Management

Planning Strategy (Newfoundland Forest Service 1995). This process has several key elements:

- strives to have efficient and effective stakeholder participation;
- an ecosystem approach to forest management that integrates economic, social and ecological knowledge to develop sustainable forest management strategies;
- continuous learning about forest ecosystems while they are being actively managed; and
- an approach that includes a consensus based decision making process.

A multi-stakeholder planning team was established comprising environmental interest groups, local businesses, members of the public, regulatory and resource agencies and chaired by an impartial facilitator. A total of 17 planning meetings and two one-day workshops were held in various communities beginning in September, 2000 and ending in August, 2001. The minutes of each of these meetings are included as an Appendix in the Five-Year Operating Plan (Volume One). The purpose of the planning team was two-fold:

- To develop Five-Year Operating Plans for each of the three operators; and
- To develop a Forest Management Strategy for FMD 16.

The following list documents the broad range of stakeholder organizations in addition to numerous private citizens who took part in the planning:

Government Resource and Regulatory Agencies
Department of Forest Resources & Agrifoods
Canadian Forest Service
Parks Canada
Department of Environment
Department of Mines and Energy
Department of Tourism, Culture and Recreation
Department of Fisheries and Oceans

Pulp and Paper and Logging Companies
Corner Brook Pulp and Paper Limited
Abitibi-Consolidated Inc.
Burton’s Cove Logging and Lumbering

Stakeholders
Newfoundland and Labrador Outfitters Association
Main River Safari
Welco Ventures Limited
Tourism Operators on Main River Watershed
Western Newfoundland Model Forest
Hampden Economic Development Committee
Jackson’s Arm Town Council
White Bay South Development Association

Cormack Town Council
Hampden Town Council
Main River Economic Development Committee
Sop's Arm Local Service District
CEP Local 60N
U.B.C. 579
Chamber of Mineral Resources

The Main River Coalition and the Atlantic Salmon Federation were also invited to participate in the planning process, and did attend the early formative meetings, but subsequently withdrew from participation.

1.4 FOREST MANAGEMENT STRATEGY – FMD 16

Draft guiding principles of sustainable forest management have been developed for FMD 16 (as of April 20, 2001) as part of the Strategic Forest Management Plan. These principles were prepared and include proposed policies to protect and enhance:

- Historical Resources;
- Tourism;
- Parks;
- Outfitters;
- Timber (Commercial and Domestic);
- Agriculture;
- Employment; and
- Mining.

Each of the draft guiding principles is listed in bold and italics at the beginning of each relevant section of this Environmental Evaluation (Volume Two) document. The CBPP Five-Year Operating Plan (Volume One) was prepared in accordance with these draft principles. While the Strategic Plan is still in draft form, it was used as a template in addressing issues in the Five-Year Plan. When the Management Strategy becomes final, a more structured set of guiding principles will be available and CBPP commits to compliance with the direction provided by this planning process.

1.5 COMMITMENTS TO SUSTAINABLE DEVELOPMENT

The Company recognizes the value of the Main River to the Province and the importance of protecting its integrity for future generations. This river is valued for its unspoiled nature and ecological integrity. There are multiple users of the biophysical resources of this watershed including both consumptive and non-consumptive users. Corner Brook Pulp and Paper Limited is committed to co-exist with other users of the resources by harvesting in a sustainable manner the quantities of timber listed in its Five-Year Operating Plan (Volume One). To this end the Company has initiated, supported and entered into several legally binding agreements all with a goal of multi-stewardship and use of the resources of the Main River watershed.

1.5.1 Main River Waterway Provincial Park and Special Management Area

In May 2001 Corner Brook Pulp and Paper Limited and the provincial Department of Tourism, Culture and Recreation signed a Stewardship Agreement in support of and seeking proclamation of the Main River protected area corridor (Figure 1.1) as a Waterway Provincial Park under the *Provincial Parks Act* and the Main River's designation as a Canadian Heritage River. As part of this agreement the Main River Waterway Park will be preserved and no harvesting will be allowed within its boundaries. In addition, a Special Management Area outside the Main River Waterway Park boundary has been delineated consisting of two types of zones: (1) no cutting zones; and (2) modified harvest zones as identified in Figure 1.1. The commitment of CBPP to reduce harvest levels and thereby set aside large tracts of protected spaces enables the Main River to be used for Adventure Tourism activities and outdoor recreation for local residents.

To make this agreement possible, CBPP surrendered its harvesting rights to over 12,000 hectares of forest within Main River – equivalent to a multi-million dollar contribution, thereby demonstrating the depth of commitment by the company to sustainable development in the Province.

1.5.2 Canadian Heritage River

The objectives of the Canadian Heritage River System are to give national recognition to the important rivers of Canada and to make sure that they are managed such that:

- the natural and human heritage which they represent is protected and understood; and
- the opportunities they offer for recreation and learning are available for residents of and visitors to Canada.

Thus, selected rivers should have outstanding value with respect to at least one of three features: natural heritage; recreational features; and/or human heritage. The selection process for a Canadian Heritage River requires the submission of a formal Nomination, which can result in the acceptance of the river as a Candidate.

The next step is the development of a Management Plan, which includes consideration of stakeholder input, and which provides a mechanism to protect those values for which the river was nominated. Thus, as part of the selection process, the applicable government (in this case, the Province) must commit to the implementation of protection measures that can include special designation of the river. Only once a final approved Management Plan is in place will a candidate receive formal recognition as a Canadian Heritage River.

Figure 1.1

In August, 2001, Main River was officially granted Canadian Heritage River status, after first being nominated in 1991.

1.5.3 Pine Marten Strategy for FMD 16

Corner Brook Pulp and Paper Limited has been involved with provincial regulatory officials in the development of a strategy for protecting Pine Marten habitat within FMD 16. The Company also participates on the Pine Marten Recovery Team. The Company believes in the objectives of the Recovery Team. It provides financial and technical support to the team and has a representative on its board of directors.

CBPP and the Newfoundland Wildlife Division of the Department of Tourism, Culture and Recreation are currently working together on a five-year modified harvesting study within the Main River area. The Wildlife Division is monitoring various harvesting techniques to determine their effects on the marten. The results will provide a better understanding of potential effects and of the effectiveness of different management techniques.

In addition, CBPP have set aside large areas of Newfoundland Pine Marten habitat, in order to support the recommended population target of 240 individuals. CBPP are also working with the Wildlife Division in assessing new Marten guidelines to be used in the management of forest harvesting operations in areas of marten presence.

1.5.4 Gros Morne National Park Connectivity Committee

Corner Brook Pulp and Paper Limited has been working with Parks Canada officials and DFRA to develop a framework document for maintaining the connectivity of Gros Morne National Park with the adjoining ecosystems. The principles of this framework document recognize the importance of preserving the integrity of the Park while acknowledging that forest harvesting is an important and appropriate use of land. Goals of this framework are to allow both parties to identify issues and co-operative initiatives, to work together to study the natural environment, and to define where and to what extent forest harvesting can occur while maintaining ecological integrity/connectivity.

2.0 THE UNDERTAKING

The majority of the project description is provided in the Five-Year Operating Plan (Volume One). Provided here is selected relevant information required for the Environmental Evaluation. The reader is referred to Volume One where appropriate.

2.1 RATIONALE AND ALTERNATIVES

The Corner Brook Pulp and Paper Limited mill in Corner Brook is a modern facility that has won international awards for efficiency and product quality. It supplies paper to international markets and also provides considerable direct and indirect economic benefits to Newfoundland and Labrador.

Corner Brook Pulp and Paper Limited has timber rights in several districts across the Island (Figure 2.1). Commercial timber harvesting has occurred within Forest Management District 16 for decades and the significant timber supplies in this district represent an important source of current and future wood supply for the mill. Approximately 24% of the mill's total annual timber is provided by FMD 16 (Volume One).

2.1.1 Alternatives to the Project

There are no viable alternatives to replace the volume of wood fibre supplied to the mill from Forest Management District 16 (i.e. approximately 1,000,000m^3 over five years or 200,000m^3 annually). All Management Districts on the Island have sustainable harvest levels allocated by DFRA hence there is no unutilized capacity available from these sources. While a limited amount of the mill's fibre needs are currently met using recycled fibre, the capacity for expansion of this source of supply is restricted by logistical and financial factors.

The importation of wood to Newfoundland was considered and reviewed as an alternative, but is deemed not an acceptable alternative to the company or the Province for the following reasons:

- Negative Economic Effect: CBPP is a Newfoundland-based company employing local people with forestry operations of sufficient magnitude designed to support its operations. Importing wood from outside the Province would mean the loss of Newfoundland economic benefits from local forestry operations.

- Availability: The likely sources for wood importation is Quebec. The province of Quebec supports a large forestry industry and is involved in defining its sustainable harvesting limits. It is highly unlikely that an application for a five year alternative wood supply from Quebec would be approved.

- Cost: The importation of wood is cost-prohibitive compared to proper management of FMD 16.

Figure 2.1 Map of Newfoundland showing all FMDs with only the FMDs that CBPPs has rights within highlighted.

The Five-Year Operation Plan (Volume One) represents the preferred project as developed through a detailed, 12-month multi-stakeholder consultation process.

2.1.2 Alternatives within the Project

Within FMD 16 there are alternatives related to location and timing of harvesting activities. While the sequence of harvesting activities can vary and likely will as annual plans respond to unplanned events, the presented plan results in the minimum quantity of harvesting within FMD 16. Alternatives within the Project would result in higher harvest levels.

2.2 PROPOSED PROJECT

2.2.1 Project Location

A description of the project location is provided in the Five-Year Operating Plan (Volume One).

2.2.2 Capital Cost

The new infrastructure associated with the project includes approximately 200 km of new resource road construction. The total capital cost of the project is estimated at $6.25 million.

2.2.3 Proposed Harvest Blocks

The outlined specific areas and volumes designated for harvest are mapped and included in the Five-Year Operating Plan (Volume One).

While the forest age-class structure for FMD 16 is outlined in Volume One, a more detailed description of the forest structure in the Main River watershed area is provided in Section 3.2 (Forest Structure).

2.2.4 Harvesting Methods

Managing a forest has changed dramatically over the last 30 years. With increasing demand for non-timber forest resources, such as recreation, fish, wildlife, tourism, and biodiversity, the approach to forest management has changed. Instead of managing on a stand-based level, the new paradigm is management of the ecosystem on a landscape level. The biodiversity goal of responsible forest management is to maintain all native species and natural ecosystems across the forest landscape at viable levels (Loo 1997). Maintaining patches, corridors, and the overall matrix of the landscape provides for the ecological functions that maintain existing communities. Across Canada and the United States, forest companies have begun mimicking nature when harvesting. Forest fires, as an example, effect large tracts of land, but may leave behind small reserves of trees.

Recent harvesting by CBPP has followed this example, by leaving reserves of timber among cut areas, as well as having feather-like boundaries on cuts, instead of square perimeter cutblocks. The rationale behind mimicking nature is to have a forest structure that will not depart radically from that which would occur naturally within the area. To achieve the above objectives an attempt to mimic the natural gap dynamic disturbance regime should thereby exclude any even-aged harvesting techniques (e.g. clearcutting, shelterwood, and seedtree) within the Main River watershed.

If a goal of forest harvesting is to protect biodiversity, the preferred approach to forest harvesting is to use a technique that approximates the disturbance regime characteristic of the area or forest type (Woodley and Grahm 1997). Many scientists, forest managers, and generally concerned citizens have recognized this approach to forest harvesting (Bergeron *et al*. 1997; Bergeron *et al*. 1999; Patch 1997; Loo 1997; Forbes 1997; Smith 1986). In the following few pages an attempt is made to define different harvesting methods that may be considered more applicable to the forest structure within FMD 16. These harvesting techniques are described and analysed for applicability using various evaluation criteria.

2.3.4.1 Objectives

Objectives of the candidate harvesting techniques are to minimize ecological impacts of forest harvesting activity on Gros Morne National Park, and to maintain values deemed important within Main River by all stakeholders involved within the planning process of Forest Management District 16. These are as follows:

- to maintain the ecological integrity of the Main River watershed and FMD 16;
- to maintain uneven aged forest structure where currently present;
- to maintain viable populations of wildlife;
- to promote tourism;
- to maintain biological diversity; and
- to maintain the economic opportunities provided by the forest industry in Western Newfoundland.

2.2.4.2 Harvest Technique Selection Criteria

Habitat requirements

It is impossible to plan for the conservation of biodiversity on a species by species basis. There are simply too many species and information regarding all may be limited (Forbes and Woodley 1997). Because of this, four species were chosen by Gros Morne National Park as indicators of ecological integrity within the ecosystems surrounding the Park and have been reviewed here for potential use in the Main River watershed.

Newfoundland Pine Marten

Pine Marten have often been used as an indicator species in other regions of Canada. New draft guidelines have been developed for the Newfoundland Pine Marten which include recommendations such as minimum "leave" patch sizes of 20 hectares, retained basal tree areas of at least $18m^2$/hectare, and reservations of coarse woody debris (CWD). Traditionally, Newfoundland Pine Marten habitat has been classified as over-mature forest (i.e. >80 years old). Recent studies have concluded that marten respond to the structure available within a forest rather than actual stand age (Harrison *et al*. 1996; Sturtevant *et al*. 1996; and Drew 1995). Vertical stem structure and CWD appear to provide adequate security for the marten. CWD also offers interstitial spaces beneath the snow during winter months for prey species such as meadow voles, shrews and snowshoe hares. Therefore, new habitat guidelines have been developed based on forest structure requirements instead of primarily forest age.

Lynx

Lynx prefer older regenerating stands (i.e. approximately 20 years old), and rarely select mature stands (Ruggiero *et al*. 2000). Thompson (1988) suggested that logging practices that leave numerous small stands of mature forest actually increase hare and lynx populations. He also suggested that planted and tended boreal sites are used less by hares and lynx than naturally regenerating sites. Other studies have shown that lynx benefit from the edge effect of harvesting (due to ease of hunting) and regularly crossed several hundred meter wide openings (Kesterson 1988 and Staples 1995 *in* Ruggiero *et al*. 2000). The key to managing a forest for lynx is to provide a temporal and spatial mosaic of forest age-class structure (Koehler and Brittel 1990). For example, both hare and lynx favour regenerating stands as they provide understory protection and food. Lynx also require CWD or fallen trees as denning sites (Ruggiero *et al*. 2000 ; Koehler and Brittel 1990).

Passerine birds

Thompson *et al*. (1999) conducted a study within a section of FMD 16 with results indicating that 17 of the 32 bird species observed had no clear habitat selection based on forest age or site type. This study also recommended that the Black-backed Woodpecker (*Picoides articus*), Gray-cheeked Thrush (*Catharus minimus*), and possibly Dark eyed Junco (*Junco hyemalis*) and Hermit Thrush (*Catharus guttatus*) could be used as indicators of old growth forests, as they indicate a range of typical conditions such as large snags, large conifer trees, forest gaps, and shrub growth within gaps. However, this contradicts the work of Whitaker (1997) who classified only the Hermit thrush of the above four species as an interior forest species based on survey results in western Newfoundland.

Although no densities or specific habitat requirements were noted, different stages of forest succession favour different bird species (Thompson *et al*. 1999). Greatest bird species richness was found in young mature forest stands, and lower richness in oldest forest. It was also recommended that the small deciduous component in balsam fir forests be maintained, as they are an important consideration for conserving bird diversity in western Newfoundland forests.

Whitaker and Montevecchi (1997), conducted a study in the Corner Brook region, concluding that total bird abundance and species richness did not differ between riparian and interior forest transects, but were significantly higher on non-riparian edge (i.e. edge of a clear cut) than riparian transects. One of their most important findings in this study was the concern for the protection of interior birds. Interior forest habitat contributed greatly to the diversity of bird communities in the study region, with 24% of all bird observations being along the interior forest transects. For these species, it was suggested that interior blocks must be maintained to provide proper habitat.

According to Ecosystem Science Section of Gros Morne National Park (2001), by leaving at least 30% of merchantable timber standing, population declines in several species of forest songbirds and an altered assemblage of songbirds may be avoided. However, the scale to which this recommendation applies was not given.

Caribou

There has been little research conducted on specific habitat utilization of caribou within the Main River watershed. Northcott (1985) stated that caribou prefer both barren, open areas and areas of coniferous forests, where lichen are found providing an important food source.

Another study conducted in east central Newfoundland concluded that of 35 caribou monitored before and after forest harvesting, 12 stayed within similar distances of a clearcut, 15 moved further away, and 2 actually moved closer to the clearcut. Initial avoidance of clearcuts appeared to be mainly a response to ongoing operations, and not to habitat suitability (Chubbs *et al*. 1993). Therefore timing of harvesting operations may need to be considered with respect to calving season or calving areas.

According to Ecosystem Science Section (2001), caribou require a natural juxtaposition of open bogs and mature forest to provide alternate habitats and food sources. For example, during severe winters caribou will move into forested areas and undergo a switch in diet to forage primarily on arboreal lichens.

Mature coniferous forest habitat plays an essential role in providing arboreal lichen as a food source, preventing access by hunters, and acts as shade and shelter during appropriate seasons.

Summary of wildlife criteria

An indicator can be defined as a measurable variable used to report on the status or trend of a value (Beaudette 1999). Wildlife species, particularly vertebrates, are often selected to serve as indicators of sustainable forest management. In summarizing the criteria of the above noted wildlife, Newfoundland Pine Marten criteria best embodies the criteria of the other noted species for the forest component of their habitat requirements (eg. caribou). Therefore managing for Newfoundland Pine Marten would take into account other wildlife values. The guidelines are based on draft guidelines produced by the provincial Wildlife Division of the Department of Tourism, Culture and Recreation:

- the basic unit of evaluation will be $40km^2$;
- 70% or greater of that unit must be suitable Pine Marten habitat (eg. $28km^2$);
  - 40% or greater of the unit should have trees greater than 10m in height (eg. 16 km^2);
  - the remaining portion of the 70% (30% or less) unit should have trees between 6 and 10m in height;
  - 50% of the unit should be contiguous;
  - minimum habitat patch sizes of 20ha;
  - Basal area requirement is $40m^3$/ha (~$18m^2$/ha);
  - hardwood stands (insect, blowdown, fire) will be considered suitable habitat where crown closure is greater than 30%; and
  - there will also have to be "proximity rules" and also consideration to shape.

In addition, there may be a requirement to consider rules governing the use of younger stands that meet the minimum height requirements but may be "coarse woody debris" challenged.

Connectivity/Integrity

Taylor *et al*. (1993) defined landscape connectivity as the degree to which the landscape facilitates or impedes movement among resource patches. Due to Gros Morne's close proximity to FMD 16, connectivity will have to be sustained to allow the movement of organisms into and out of the Park. As an example, the Fundy Model Forest of New Brunswick is working towards the implementation and maintenance of forested connections of a minimum width of 300 m and a maximum length of 3km to meet requirements of connectivity (Woodley and Forbes 1997).

There is currently a working group discussing the issues and objectives of connectivity and integrity within FMD 16 with Gros Morne National Park (*see* Section 4.4.5).

2.2.4.3 Candidate Harvesting Methods and Evaluations

The following harvesting methods can be employed within the Main River watershed so as to conform to the applicable criteria. More than one technique may be used to meet the objectives and to overcome possible terrain/habitat restrictions. The objectives of the modified harvesting techniques are to achieve the wildlife requirements, achieve appropriate forest structure (uneven age), achieve any connectivity/integrity requirements, and achieve sustainable harvest levels for the mill.

Using coarse filter approaches (e.g. patch size, connectivity, and retention of old growth) and fine filter approaches (e.g. number of snags or amount of coarse woody debris to leave behind), management plans can maintain native biodiversity. Implementation of alternate harvesting methods can preserve the communities, composition, and age class distributions currently present inside the Main River watershed, thereby meeting all concerned values.

Selection Harvesting

Selection harvesting is an uneven aged management technique in which mature timber is removed individually or in small groups at relatively short intervals. Selection harvesting has often been compared to the concept of gap phase replacement (Watt 1947; Bray 1956; Pickett and White 1985; Nyland 1996). However, selection harvesting will differ from natural gap phase dynamics because more gaps per unit area on a more regular distribution are created than would occur due to natural processes (Nyland 1996). The goal of selection harvesting is to maintain canopy cover, age class distribution, species characteristics of the stand, and promotion of appropriate regeneration. It has generally been accepted that selection harvesting should remove approximately 30% of the merchantable volume of a forest stand at 20-year intervals. This is based, however, on western North America experience and should be reviewed for applicability in Newfoundland in terms of volumes, sustainability, and the maintenance of the above objectives.

Three selection-harvesting techniques are applicable to FMD 16 (single tree selection, group tree selection, and strip selection and are described below.

Single Tree Selection

Single tree selection is a method of regenerating new age classes in uneven aged stands by removing individual mature trees more or less uniformly across a stand (Nyland 1996).

Benefits of single tree selection include a stand that is continuously covered with trees thereby reducing erosion, maintaining proper microclimate, stand and habitat diversity, and also preserving the visual quality of the area. Disadvantages associated with single tree selection include harvesting being more time consuming and expensive. This technique results in a larger area being utilized in order to obtain the required volume compared to clearcutting. Other disadvantages of single tree selection include increases in road networking that, as a worst case scenario, may eventually dominate the balsam fir / black spruce matrix, creating unwanted corridors in the region thus prolonging the disturbance in any given area.

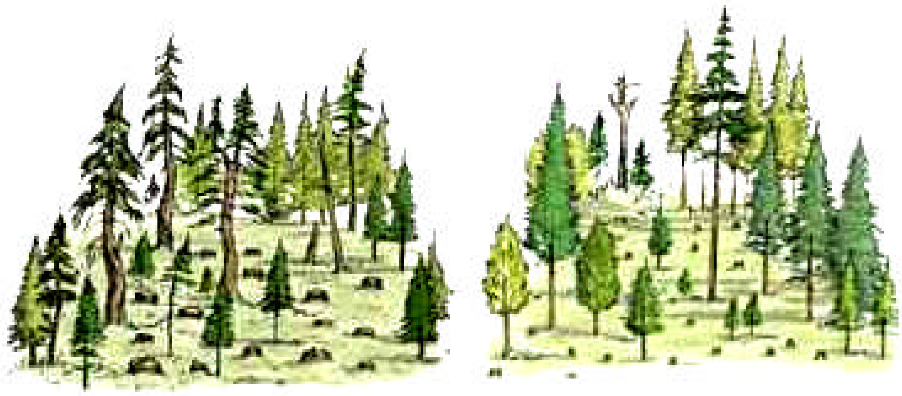

Figure 2.2. Diagram of single tree selection harvesting technique.

Group Tree Selection

Group tree selection is the removal of bunches of trees in the same size class that often occur throughout a stand. This type of harvest creates a condition where levels of light, nutrients and moisture increase, with the surrounding trees modifying the microclimate in the opening, thereby having little effect on the stand as a whole.

A concern of group tree selection is to determine a reasonable maximum opening size. The group cuttings would also have to be adequately dispersed, properly connected, and of appropriate size so it will not negatively affect the Newfoundland Pine Marten or other wildlife criteria. From a Pine Marten perspective, contiguous habitat is defined as that which is not separated by more than 200m (i.e. a 200m wide open area) (J. Brazil Pine Marten Presentation to the Planning Team Meeting May 23, 2001). In addition, the wildlife guidelines recommend at least $18m^2$ of basal tree area be left in each hectare and minimum patch sizes of 20ha.

Advantages associated with group over single tree selection include easier planning, control, and lower cost. Some wildlife may benefit due to increase in edge, and maintenance of good cover in those areas not harvested. Disadvantages include potential windthrow and browsing damage of the increased areas of regeneration compared to single tree selection.

Figure 2.3. Diagram of group tree selection harvesting technique.

Strip selection

Strip selection incorporates (i) the removal of all merchantable volume in an area (5m wide) strip and (ii) the removal of individually selected trees from (10m on) either side of the core 5m strip (for a total width of 25m). These measurements are typical, but they may vary depending on the equipment used and site conditions.

Advantages of strip selection include:

- removal of volume at a lower cost than other selection harvesting methods;
- the 5m wide openings would have limited influence on overall habitat in the area;
- areas outside of the harvesting strip would be left unharvested;
- the forest structure would be maintained alongside the 5m wide strip single selection; and
- the road network would be easier to layout, and can be reused.

Disadvantages associated with strip selection include a larger area would be affected to obtain the required volume compared to group selection, and strip selection has also been considered un-aesthetically pleasing, due to the arrangement of strips in the landscape. However this pertains more to the larger scale strip clear cutting, where strips can be up to 50m in width, thereby having a greater visual impact. Five-meter wide cuts will not affect the visual quality to the same degree.

Variable Retention

Variable retention (VR) may be thought of as managing what is to be left after a cut, instead of managing what will be cut. VR aims to retain enough trees to keep the elements of forest structure (Hamilton 1999) intact. VR is a fairly new practice, initiated in the early 1990s, and now used by forest companies such as Weyerhauser and the Plum Creek Timber Company.

Two types of VR exist. They are defined as dispersed (individual trees) and aggregate (groups of trees). Both aggregate and dispersed VR run the risk of being susceptible to blow down, especially in Newfoundland where fir and spruce are fairly shallow rooted. Windthrow cannot be eliminated, however careful planning and treatment would help reduce the risk. For example, tear drop shaped patches could be oriented to the prevailing wind direction, patches could be left in more sheltered areas when possible, highest valued retention trees could be pruned, and edges could be feathered by removing the most wind prone trees. Management of certain wind prone trees may also be a potential source of CWD.

Advantages of aggregate over dispersed VR include:

- it is more likely to be wind firm;
- it is more likely to retain all desired structures;
- it is more efficient and less costly;
- it is safer to implement; and
- will have less impact on growth of regeneration (Chilliwack Forest District 2000).

Aggregate retention also has the additional advantage of providing refuge for a number of organisms. The intact tracts of forest act as areas of unaltered habitat and allow organisms to populate adjacent areas. The key of VR is the establishment of sound objectives and the selection of the retention that best meets those objectives. For example, Weyerhauser of British Columbia implements variable retention using different criteria (i.e. timber zones, habitat zones, and old growth zones). If an area is delineated as a timber zone, having no other unique values, 80% of the trees are available for harvest, with 5 to 10% of the 80% retained. In a habitat zone, 70% of the cutblock is available for harvest, with 15% of that retained, and in an old-growth zone, up to two-thirds of the stand is conserved (Hamilton, 1999). This again applies to the west coast of Canada and will have to be altered if applied to the east coast due to differences in the physical environment and forest structure.

In FMD 16, retention levels need to be tailored to the specific wildlife, connectivity, forest structure, and sustainability objectives.

Figure 2.4. Photo of aggregate variable retention.

Figure 2.5. Photo of dispersed variable retention.

Modified Clearcutting

Modified clearcutting is the removal of all merchantable timber from a cutblock in one operation. Modified clearcuts employ several techniques that limit their potential negative effects such as leaving reserves of timber among the cut area, producing feather-like boundaries on cuts (instead of square perimeter cutblocks), and the use of appropriate buffers around any sensitive habitat.

It is the most economically productive and safest form of harvesting. It also requires the least amount of set up, control, and technical skills to implement. These advantages make it favourable for forest product producers. In addition, it is most similar to the typical large-scale forest dynamics of most of the forests on the Island (*see* Section 3.2). However, due to the different forest structure in the Main River watershed, it is not a harvesting option there as it will convert a presently uneven aged forest into an even aged forest.

2.2.4.4 Recommended Harvesting Technique(s)

As previously stated, no one technique is applicable throughout FMD 16; terrain conditions, habitat requirements, and forest structure requirements all play a role in determining what techniques should be used. Within the Main River watershed, both group selection and individual selection are recommended. This type of harvesting will maintain the "reversed-J distribution" that is associated with old growth forests, giving a good representation of all diameters and ages (*see* Section 3.2). By maintaining forest structure, wildlife will also be maintained. As research suggests, the natural disturbance regime within the watershed is a gap replacement dynamic. In all gap-type stands, the aim should be to maintain a predominantly closed canopy cover, mixed aged distribution, and sufficient regeneration to restock the forest. Selective harvesting (i.e. individual and group) will allow for removal of timber while maintaining the forest characteristic.

It should be noted that when retaining patches of trees, whether using VR or selection harvesting, there are associated safety issues. Snags and standing individual trees have the potential to create injuries.

2.2.4.5 Estimated Main River Harvest Area Requirements

DFRA has conducted a calculation of the estimated minimum volume required from the Main River area needed to meet the sustainable harvest level for FMD 16 as outlined in the Five-Year Plan. The calculation has determined that a minimum of 25,000m^3 would be required from the Special Management Area within the Main River watershed. With this level of harvest in mind, CBPP has proposed a minimum required annual harvesting of approximately 25,000m^3 within the Main River watershed. Based on this volume and varying harvesting techniques, the following table was developed to display the total estimated areas that may be utilized by each technique (Table 2.1). Note that modified clearcutting will not be employed within the Main River watershed, however, it is included in the table for comparison to the area requirements of other techniques.

Areas in the table below were calculated from densities and volume data from a 2ha experimental plot conducted by CBPP inside the Main River watershed. The block had all stems greater than 9cm in diameter measured. Tree density, diameter, species, and volume was recorded from the experimental plot thereby providing an estimate for the Main River area (Appendix A).

Table 2.1. Estimated areas required in the Main River watershed to achieve 25,000m3 annual harvest by selected harvesting techniques.

Harvesting Technique	Estimated Area
Clear cut	238 ha total
Selection Harvest	
i) individual selection	
remove 30% of cutblock	793 ha total
remove 40% of cutblock	595 ha total
remove 50% of cutblock	476 ha total
ii) group selection	
1 ha removal (238 cutblocks required)	238 ha total
5 ha removal (48 cutblocks required)	240 ha total
10 ha removal (24 cutblocks required)	240 ha total
20 ha removal (12 cutblocks required)	
iii) strip selection	
(25m X 1,000m) (183 cutblocks required)	457.5 ha total
(25m X 1,500m) (122 cutblocks required)	457.5 ha total
(25m X 2,000m) (92 cutblocks required)	460 ha total
Variable Retention (100 ha cutblocks)	
i) retain 25% (3 blocks required)	300 ha total
ii) retain 50% (5 blocks required)	500 ha total
iii) retain 75% (10 blocks required)	1,000 ha total
Variable Retention (10 ha cutblocks)	
i) retain 25% (32 blocks required)	320 ha total
ii) retain 50% (48 blocks required)	480 ha total
ii) retain 75% (95 blocks required)	950 ha total

2.2.5 Silviculture and Reforestation

Silviculture strategies are important elements of forest management, serving to maximize the quality and quantity of the future wood supply. Silviculture operations practiced by CBPP in FMD 16 involve pre-commercial thinning (PCT) and planting. These are presented in the Five-Year Operating Plan (Volume One).

2.2.6 Access Roads and Watercourse Crossings

Refer to the Five-Year Operating Plan (Volume One) for access road and watercourse crossing information. Two hundred kilometres of resource roads are proposed for construction in FMD 16 during the Five-Year Plan (approximately 40km per year). Estimated locations are provided on maps located in Appendix II of Volume One. All roads will be built to CBPP Class II and Class III standards, and subject to Environmental Guidelines for Forest Access Road Construction as outlined in Section 2.8.2 of Volume One.

2.2.7 Annual Allowable Cut (2002 – 2006)

Refer to the Five-Year Operating Plan (Volume One) for annual allowable cut information. Preliminary results of the wood supply analysis project the Maximum Sustainable Harvest (AAC) from CBPP limits in FMD 16 to be approximately 200,000 cubic metres per year (1,000,000 m^3 for the Five-Year Plan). *See* Section 2.3 in volume One on calculating maximum sustainable harvest.

3.0 EXISTING ENVIRONMENT

Forest Management District 16 covers a total area of 609,696ha (DFRA Draft 2001) and is characterized by the Long Range Mountains and productive forested land among its eastern limits. The climate, vegetation, soils, and the geology are considerably variable for such a small proportion of Newfoundland's landmass. Long-term natural succession acts on this environmental variation and sorts the regional flora into plant communities having a distinct structure and composition (Meades and Moores 1994).

3.1 BIOPHYSICAL DESCRIPTION

Most of FMD 16 lies within the Northern Peninsula, Central Newfoundland, and the Long Range Barren Ecoregions as classified by Damman (1983). These particular ecoregions can be further broken down into subregions, of which FMD 16 encompasses:

1. Northern Peninsula Ecoregion
   - i) Eastern Long Range subregion
2. Central Newfoundland Ecoregion
   - i) Northcentral subregion
   - ii) Red Indian Lake subregion
3. Long Range Barrens Ecoregion
   - i) Buchans Plateau Topsails subregion
   - ii) Northern Long Range subregion

Neither of the sub-regions are unique to FMD 16. Figure 3.1 illustrates the ecoregions and their respected subregions of Insular Newfoundland. Regional variation between subregions is due to differences in physiography and geology or to climate changes of smaller magnitude than those responsible for the differences between the larger ecoregions (Damman 1983). The following outlines these differences.

3.1.1 Climate

Meades and Moores (1994) state that the Northern Peninsula Ecoregion differs from most other forested parts of the island by the shortness of the vegetation season; 110-150 days compared to 145-170 days for other areas. The frost-free period is comparable to most other areas and somewhat better than central Newfoundland.

During the Summer months, the Northern Peninsula is significantly cooler than the interior of Newfoundland because of its higher latitude. Precipitation is lower, but, because of low summer temperatures and shorter vegetation season, soil moisture supply is probably adequate at most times (Meades and Moores 1994).

Figure 3.1. Ecogregions and subregions of Insular Newfoundland (after Damman 1983).

The Environment Canada Digital Database of Canadian Climate Normals (1961-1990) contains climate information compiled from long-term weather stations on the Northern Peninsula. Data has been collected from weather observations conducted at Cat Arm River, Cow Head, Corner Brook, Daniel's Harbour, Deer Lake, Hampden, Plum Point, Port Saunders, Rocky Harbour, St. Anthony, and White Bay. The monthly and annual means of those parameters recorded are presented in Table 3.1. The 1992 Department of Environment and Labour Water Resource Atlas of Newfoundland also provides summaries of mean yearly air temperature, mean annual precipitation, mean annual snowfall, and mean annual days between first ice and last ice for the Island of Newfoundland.

The Central Newfoundland Ecoregion has the highest summer and lowest winter temperatures of anywhere on the island, with precipitation and snowfall being about average. Due to the warm summers and high evapotranspiration losses this is one of the driest areas of the island (Meades and Moores 1994). Within the Central Newfoundland Ecoregion, the Northcentral and Red Indian Lake subregions differ, with the Northcentral subregion having higher summer maximum temperatures, lower rainfall and longer vegetative season than the Red Indian subregion.

Damman (1983) distinguishes the Long Range Barrens Ecoregion by its snow conditions and shortness of vegetative season. This ecoregion consists of three subregions, of which two, Buchans Plateau Topsails and Northern Long Range, occur in FMD 16. The Buchans Plateau Topsails is the least arctic of the three subregions with snow rarely persisting into the summer, whereas the Northern Long Range subregion includes the highlands of St. John's, the coldest part of the island (Damman 1976).

From the above data sources, the mean yearly temperature in FMD 16 is estimated to be between 3 and 4^{O}C. This compares with an Island-wide range of from 5^{O}C (on the Avalon and Burin Peninsulas) to 1^{O}C (on the northern portion of the Northern Peninsula). Mean annual precipitation in FMD 16 ranges from 1000mm along the southeastern portion to 1200mm at its western boundary. Mean annual snowfall for most of FMD 16 is 350cm and the mean number of days between first ice and last ice is approximately 115.

3.1.2 Geology

Within the Northern Peninsula Ecoregion, limestone underlies most, with acidic rocks more common on the eastern side of the peninsula. The bedrock within the area is composed of leucocratic to melanocratic gneiss, quartz-rich gneiss, and subordinate amphibolite and granitic to gabbroic gneiss (Northland Associates 1986).

Table 3.1. Climate data

Opposite of the Northern Peninsula region, the Central Newfoundland Ecoregion is underlain mainly by acidic bedrock, with limestone being absent (Meades and Moores 1994).

The Long Range Mountains consist of one billion year old gneiss, schist and granite that formed the margin of North America in the early Paleozoic and were upthrust as part of the Appalachian Mountains about 400 million years ago (Parks and Natural Areas Division 2001).

3.1.3 Soils

The soils in the Northern Peninsula Ecoregion are comparable to those of western Newfoundland (Meades and Moores 1994). The Main River area has been typified by high hills (up to 657 m ASL) with steep slopes (Northland Associates 1986). The hilltops are either exposed bedrock or contain a thin mantle of organic solids (10-30 cm deep) over bedrock. Farther down the slopes are relatively shallow podzolic soils which have formed on a thin till overburden. Iron pans are abundant and common on mid- and upper-slopes throughout the entire Main River area. Seepage gleysolic soils are present near the toe of most slopes. Slope fens, basin bogs and organic complexes are present in most depressions.

On the higher elevations of the Long Range Barrens Ecoregion, orthic and gleyed regosols are common, while on the steep slopes, mixed till and colluvium occurs and coarse textured well to moderately will drained Orthic Humo-Ferric Podzols dominate (Roberts 1983). Peatland covers extensive areas, as primarily shallow, oligotrophic patterned fens (Damman 1983).

The Central Newfoundland Ecoregion contain soils that are generally lighter in color and lower in organic matter content when compared to other ecoregions. The rolling to undulating topography of the Northcentral subregion is characterized by shallow, medium quality till with a soil texture range from sandy loam to loam, whereas within the Red Indian Lake Subregion the soils have been classified as ranging from silt loam to loam, usually with a fragipan that promotes seepage in the rooting zones (Meades and Moores 1994).

3.1.4 Vegetation

Balsam Fir is described as the dominant forest cover in the Northern Peninsula Ecoregion except at high elevations (300-400 m) on the eastern side of the peninsula, where black spruce appears to be a natural component of the stands (Meades and Moores 1994). The Eastern Long-Range Subregion includes the productive but inaccessible forest on the eastern slopes of the Long Range Mountains up to the 450m elevation. The forests tend to be somewhat open balsam fir-black spruce mixtures (Meades and Moores 1994). The most drastic, climate controlled change in the flora of the island occurs in the southern part of this ecoregion. White pine, yellow birch, red maple, and trembling aspen are mainly absent, reaching their northern limit at or near the southern boundary (Parks and Natural Areas Division 2001). Other species are also absent or restricted in the area, for example, speckled alder swamps and mountain alder and/or willows replace alluvial thickets.

Fire has not played a major role in the vegetative formation of the Long-Range Barrens. Topography of the area plays a critical role in determining the species that prevail. The area consists of mountainous highlands with elevations reaching greater than 650m, leading to a vegetative composition consisting of *Kalmia*, *Empetrum* and Alpine Heath. Damman (1983) states that the Long-Range Barrens Ecoregion is characteristic of extensive areas of tuckamoor. Tuckamoor are thick coniferous shrub thickets, less than 1 m in height, that consist mainly of black spruce.

Due to persistent snow cover in the area, snow bank species such as Moss Heather (*Cassiope hypnoides*), Mountain Sorrel (*Oxyria digyna*) and Dwarf Bilberry (*Vaccinium caespitosum*) are common in this ecoregion (Parks and Natural Areas Division 2001). Sheep laurel (*Kalmia angustifolia*) and arctic alpine vegetation (*Diapensia* and *Loiseleuria*) are also common on all highlands and exposed sites. Northern and arctic alpine plant species are widespread, with southern, coastal plain species being completely absent. Stands of balsam fir occur only in deep sheltered valleys.

On the upper slopes of the steep hills, where vegetation is supported, softwood scrub grows. As the slopes are descended, better quality stands of mature and over-mature balsam fir and black spruce occupy relatively shallow podzolic soils (Northland Associates 1986). The lower slopes usually support good quality balsam fir and black spruce stands.

The dominant forest-type in the Main River watershed is identified as *Pleurozium*-Balsam Fir (Northland Associates 1986). This forest type is characterized by Meades and Moores (1994) as having dry to well drained soil. The litter and humus layers are generally 10-20cm deep with a rooting zone at 30-40cm. The expected pH for this forest type is 3.8-4.2. Further detail on the forest structure, including age structure, is presented in Section 3.2 (Forest Structure).

The Central Newfoundland Ecoregion, in general, has the highest fire frequency of the island (Damman 1983). This results in a higher proportion of the Kalmia – Black Spruce forest type with aspen stands. Low moisture, coarser soils and the prevalence of black spruce has a negative influence on regeneration capability. Areas not disturbed by fire are considered to be of the Hylocomium - Balsam Fir type (Meades and Moores 1994). The Central Newfoundland Ecoregion is the best representation of the boreal forest zone on the island. Species of the southern boreal zone such as yellow birch (*Betula lutea*) are absent, and arctic alpine plants are less common here than in any of the other ecoregions (Damman, 1983).

Rare and Endangered Vegetation

As defined by AGRA Earth & Environmental (1997), rare and endangered are qualitative terms involving an assessment of a species' ability to survive as part of the ecosystem because of its seeming scarcity. The causes of such scarcity may be the lack of specific habitat conditions, geographic range limitations, destruction of habitat or other factors relating to a species ability to produce viable seed, its potential for vegetative propagation as well as its sensitivity to environmental change. A list of plant species of Newfoundland and Labrador is provided by Meades *et al.* (2000), including rare plants.

Floristic surveys have been conducted along the Main River and Humber River areas. In the two separate surveys conducted, no endangered plant species were noted in the Main River watershed. Other reports (LeDrew *et al*. 1989; Parks and Natural Areas Division 2001) also concluded that there were no rare or endangered plant species found within the Main River watershed. There are, however, several rare plants recorded along the shoreline of the Upper Humber River (AGRA 1997e; Brown 2000). In 1999, a three-year Newfoundland Rare Plant Project was initiated by the Wildlife Division of the Department of Tourism, Culture and Recreation to document distribution and density of vascular plants of conservation concern within FMD 16. During the 2000 field season, two rare plants were recorded in the Upper Humber area. They were: Yellow loostrife (*Lysimachia thyrsiflora)* and Broad leafed arrowhead (*Sagittaria latifolia)*. It is not known if the later species was introduced (DFRA Draft 2001).

3.2 FOREST STRUCTURE

Old growth forest on insular Newfoundland is a relatively new concept, however, it has been described in the Main River watershed (Fr. J. McCarthy pers. comm.). One of the first detailed descriptions and review of northern boreal forest gap dynamics (old growth) is presented in McCarthy (2001). Much of the following description and comparison to the typical boreal forest disturbance dynamic has been summarized from that document.

3.2.1 Typical Boreal Forest Disturbance Dynamic

Much of the boreal forest in Newfoundland has typically been described as having a large-scale disturbance dynamic in which large areas of forest canopy are disturbed at once through catastrophic events (eg. fire, insect infestations, blowdown). This tends to produce an even-aged forest structure over relatively large areas. Therefore, on a large-scale, the forest structure is a mosaic of large even-aged cohorts or patches in various stages of regeneration.

3.2.2 Gap Disturbance Dynamics

Gap dynamics is characterized by small- or micro-scale disturbances of a mature forest canopy. A small hole is created in the canopy that provides available growing space for advanced regeneration (i.e. smaller trees under the canopy) or recruitment from buried or dispersed seeds. This disturbance dynamic can occur, and has been observed, in boreal forests where typical large-scale, catastrophic disturbance has not occurred in a relatively long time (i.e. a climax forest). Bergeron and Dubuc (1989), in a study of succession in the southern Quebec boreal forest, concluded that in the absence of fire, gap dynamics could emerge as a driving force determining successional patterns. This disturbance dynamic creates an uneven-age forest structure with a relatively mature forest canopy with small gaps regenerating throughout.

On old burns in southeastern Labrador, Foster (1985) identified uneven-aged forests that had developed through slow progressive post-fire establishment of black spruce and balsam fir over a period of 70-100 years. The extremely long intervals between fires (estimated to be approximately 500 years) documented for southeastern Labrador have produced a landscape dominated by old, uneven-aged spruce-fir forests with individuals exceeding 250-300 years in age (Foster 1983; 1984). Even fire prone lichen-spruce forests in central Labrador-Ungava may escape fire long enough to develop into uneven-age stands exceeding 300 years in age and regenerating via gap dynamics (Treter 1995). Early studies in Labrador (Wilton 1959; 1965) and neighbouring Quebec (Hatcher 1963) have also confirmed the presence of old, uneven-aged black spruce forests with a high proportion of balsam fir or late successional undisturbed forests dominated by balsam fir with minor components of white spruce (*Picea gluca*) and white birch (*Betula papyrifera*).

Within an old, uneven-aged forest, gaps are created by trees that die standing, snap off, or uproot. Tree mortality from stem-snapping is dominant, due to the prevalence of decay fungi as the determining disturbance agent in old growth forests (McCarthy 2001). Results from studies on fir and spruce pathology repeatedly underline the importance of root and associated butt rots in determining growth increment patterns, timing, and cause of tree death (Whitney 1989; 1995; Whitney and MacDonald 1985). As root and butt decay progresses, trees are susceptible to windthrow and stem breakage. In boreal forests or high-altitude coniferous forests at lower latitudes, snow loading and ice damage may also open up gaps in the forest canopy through top and stem breakage (Gill 1974). In addition, some single-treefall gaps often enlarge as a result of subsequent fall of gap border trees (Lertzman and Krebs 1991). McCarthy (2001) summarizes mortality statistics (Table 3.2) as well as gap size statistics (Table 3.3) from numerous gap dynamic studies in boreal and subalpine forests.
In general, approximately 21% of the gap dynamic forest may be in various stages of regeneration, that is, approximately 79% is therefore in a “climax” state at any given time.

The size range of gaps can be quite variable but are usually less than $200m^2$ (McCarthy 2001). Gap turnover rates are defined as the mean time between gap creation events at any one point in the forest. Median values for the annual gap formation rate are quite similar for boreal, temperate hardwood, and tropical forests, ranging from 0.8-1.0% (McCarthy 2001). This translates into a median gap turnover rate of approximately 174 years for northern boreal forests.

Table 3.2 Summary of mortality statistics for numerous gap dynamic studies in boreal and subalpine forests (summarized from McCarthy (2001)).

Parameter	Range from all studies (%)	Median % from all studies
Standing Dead	8 – 44	17
Snapped Off	42 – 61	47
Uprooted	7 - 42	29
Other	0 - 2	1

Table 3.3 Summary of gap size statistics for numerous gap dynamic studies in boreal and subalpine forests (reproduced from McCarthy (2001)).

Parameter	Range from all studies	Median from all studies
Gap Fraction	6-36 %	21
Average Gap Size	41-141 m^2	78
Gap Size Range	15-1245 m^2	- -
Annual Gap Formation Rate	0.6-2.4 %	1.0
Gap Turnover Rate	87-303 years	174

According to Marks (1974), forests can respond to canopy openings from disturbance in two major ways: either through re-organization of vegetation established prior to disturbance, or with vegetation that becomes established following disturbance. The size of gaps in closed forests has been shown to determine the type of trees recruited into the gaps. Small gaps coupled with advance regeneration of shade-tolerant species (i.e. non-pioneer species) would favour the "re-organization" response, i.e., resident vegetation would fill the gap through the release of advanced-regeneration plants below the upper canopy. These trees quickly respond to higher light levels and do not allow pioneer species to establish themselves.

Seed colonization of large gaps by shade-intolerant species (i.e. pioneer species) would define the other phenomenon. That is, species considered intolerant are relatively more abundant in large gaps while tolerant species often grow more abundantly in smaller gaps.

In general, shade tolerant species, usually existing as advance regeneration, have a greater chance of responding to smaller gap openings. Less tolerant species, on the other hand, may still persist in canopies of shade-tolerant forests because of their opportunistic exploitation of larger gaps. A diversity of gap sizes may therefore be significant in the maintenance of canopy diversity in old-growth forests (Barden 1979; 1980; 1981; Busing and White 1997; Busing 1998a; 1998b).

The extent of the regeneration potential of each species group (i.e. pioneer and non-pioneer) depends on many factors, one of which is gap size. Factors other than gap size can also influence the successful regeneration of tree species in gaps. These factors can include time of gap occurrence, proximity of seed sources to gaps and their mechanism of seed dispersal, substrate conditions, root competition, and plant-herbivore relations. One interesting factor to note is that substrate disturbance (i.e. uprooting) tends to enhance pioneer species (McCarthy 2001). These factors should be considered with respect to appropriate harvesting strategies (*see* Section 2.2.4 Harvesting Methods).

3.2.3 Comparison of Catastrophic and Gap dynamics

The differences between catastrophic disturbance and gap dynamics are basically the scale of disturbance and forest development after the disturbance. Table 3.4 summarizes the differences between the two dynamics.

3.2.4 Newfoundland Forest Dynamics

Much of the boreal forest of insular Newfoundland has the typical large-scale disturbance dynamic, in which large areas of forest canopy are disturbed at once through catastrophic events (eg. fire, insect, blowdown) to produce an even-aged forest structure over relatively large patches within the forest mosaic. Although fire cycles are unknown, Meades and Moores (1989) consider the extensive balsam fir forests of western Newfoundland to have had a very low fire frequency. The predominance of balsam fir in this region indicates a fire rotation longer than the average of 100-150 years normally cited for the Canadian boreal forest as balsam fir will not usually reproduce immediately after fire (Damman 1964). The boreal forests of eastern Canada, particularly those of Newfoundland that are influenced by a humid, maritime climate, are dominated by late succession balsam fir in the absence of periodic fires (McCarthy 2001). Therefore, in the Canadian boreal forest, conditions exist that promote a climax boreal forest (i.e. old growth).

3.2.5 Extent of Old Growth

While gap dynamics can occur in any area where large-scale disturbance is absent for long time periods, the extent of contiguous old growth forest on insular Newfoundland has not yet been determined. It has, however, been identified within the Main River watershed through research of J. McCarthy. Sampling by McCarthy to date has been in the north-west area of the Main River watershed, along the forest access roads built by CBPP. The majority of the boreal forest in FMD 16 north of the Main River watershed is classified as greater than 120 years old in the forest inventory database. In this area, some balsam fir trees on the Northern Peninsula have been aged at greater than 200 years old (J. McCarthy pers. comm.). The oldest live balsam fir tree recorded so far in McCarthy's research is 252 years.

Table 3.4. Conceptual model of gap and patch (i.e. catastrophic) processes and attributes (reproduced from McCarthy (2001)).

Attribute of Process	Gap Dynamics	Patch Dynamics
Spatial Scale of change	Individual Tree	Stand or Portion thereof
Size of Canopy opening	<200m^2	>200 m^2
Temporal Scale of Change	Slow Change (10s to 100s years)	Rapid, often catastrophic change
Type of Change	Modification of original stand	Initiation of new cohorts
Change in Resource Availability	Little Change	Major Change
Forest Development	"Climax", old growth in quasi-equilibrium	"Pioneer", early successional or stand-initiation
Types of Disturbance	Decay (root and butt rots) or single-tree windthrow	Epidemic insect, fire, wind, avalanches, volcanoes
Stand Structure	Often uneven-aged, "reverse-J" diameter distribution	Even-aged or multi-cohort, normal diameter distribution
Regeneration Strategies	Release of advance regeneration	Seed propagule disperal, seedbanks, vegetative propagation, as well as seedling bank release
Forest Structure	"Homogenous" old-growth	Mosaic of seral stages

Timber cruising by the provincial Department of Forest Resources and Agrifoods (DFRA) occurs at pre-determined (Permanent Sampling Plot) and random (Temporary Sampling Plot) sites throughout the entire Island to collect data required for management of sustainable forest harvesting operations (eg. diameter breast height, tree age, species composition). Each site is located within a grid system whereby each 1:50,000 scale map sheet within a management district is sub-divided into sixteen sections. Therefore, data collected can be displayed by individual map section.

Historical insect outbreaks throughout the Island have been mapped by DFRA and It has been previously noted that the western boreal forests of insular Newfoundland have a low fire frequency (Meades and Moores 1989). DFRA have not as yet applied this information in the delineation of old growth, while the distributions of insect infestations are presented below along with the results of an analysis of the plot data. this information provides an indication of the extent of contiguous old growth forest on Insular Newfoundland.

3.2.5.1 Insect Infestation

Figures 3.2 and 3.3 show the historical insect damage for Insular Newfoundland. While the forests on the western and northern portions of the Northern Peninsula are susceptible to insect disturbance, a large portion of the eastern side of the Peninsula (approximately from Cloud River to Main River) has been free of large scale insect damage. This boundary will therefore, represent the initial delineation of boreal forest with the potential to contain contiguous old growth.

3.2.5.2 Statistical Analysis

For this analysis, data from known old growth within the Main River watershed, which was collected by CBPP, has been used as the typical or expected balsam fir uneven-age diameter distribution of the insular Newfoundland old growth forest (Figure 3.4 and *see* Appendix A). In general, the diameter distribution (dbh) of balsam fir is expected to be a "reversed J-distribution" in an old growth forest. The diameter distribution of an even-aged stand would typically have a normal (i.e. bell-shaped) distribution around the dominant age-class (Figure 3.5).

The typical age distribution of an uneven-age forest would indicate that some trees, regardless of diameter and species, may be greater than the estimated minimum fire frequency (estimated at 150 years) and even the median gap turnover rate (estimated at 150-175 years) (Figure 3.6). An even-age forest would have trees typically aged younger than the time-span when gap dynamics would start to appear (i.e. less than 150-175 years) (Figure 3.7).

Figure 3.2. Historical Hemlock Looper Outbreak Locations in Newfoundland (1983-1999).

Figure 3.3. Historical Spruce Budworm Outbreak Locations in Newfoundland (1980-1992)

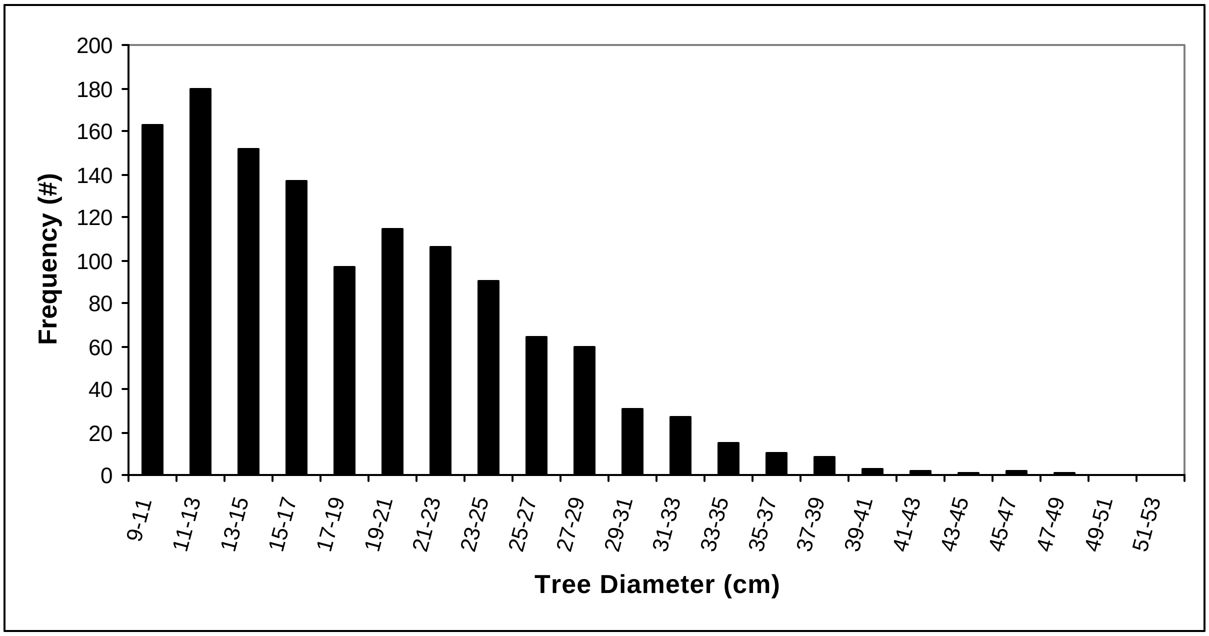

Figure 3.4. Typical diameter distribution of balsam fir in old growth forest structure (data taken from CBPP test plot in Main River watershed). Excluded are trees less than 9cm in diameter (i.e. non-merchantable).

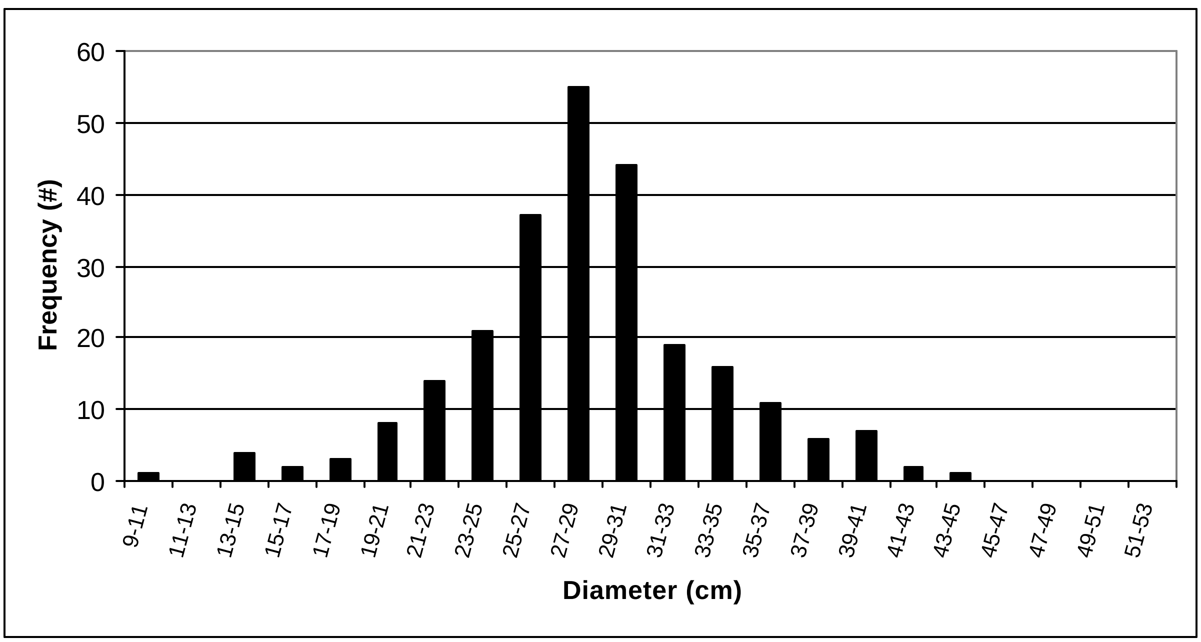

Figure 3.5. Schematic diameter distribution of balsam fir in an even-age forest structure.

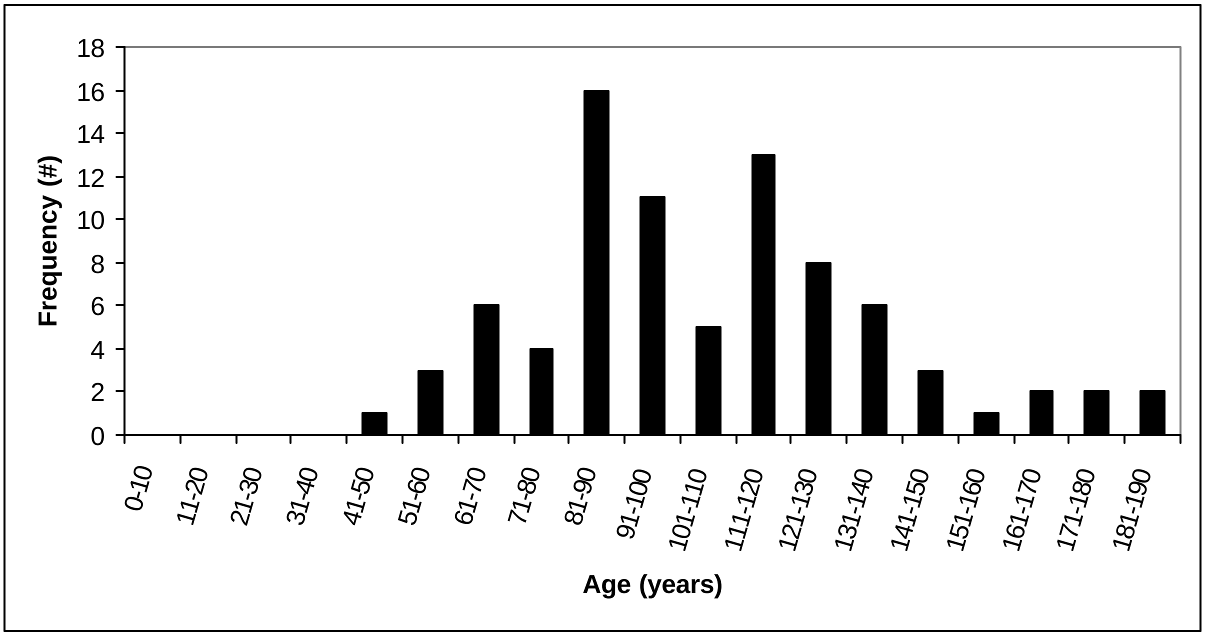

Figure 3.6. Schematic age distribution of old growth forest structure (note trees beyond the 150 and 175 year old age).

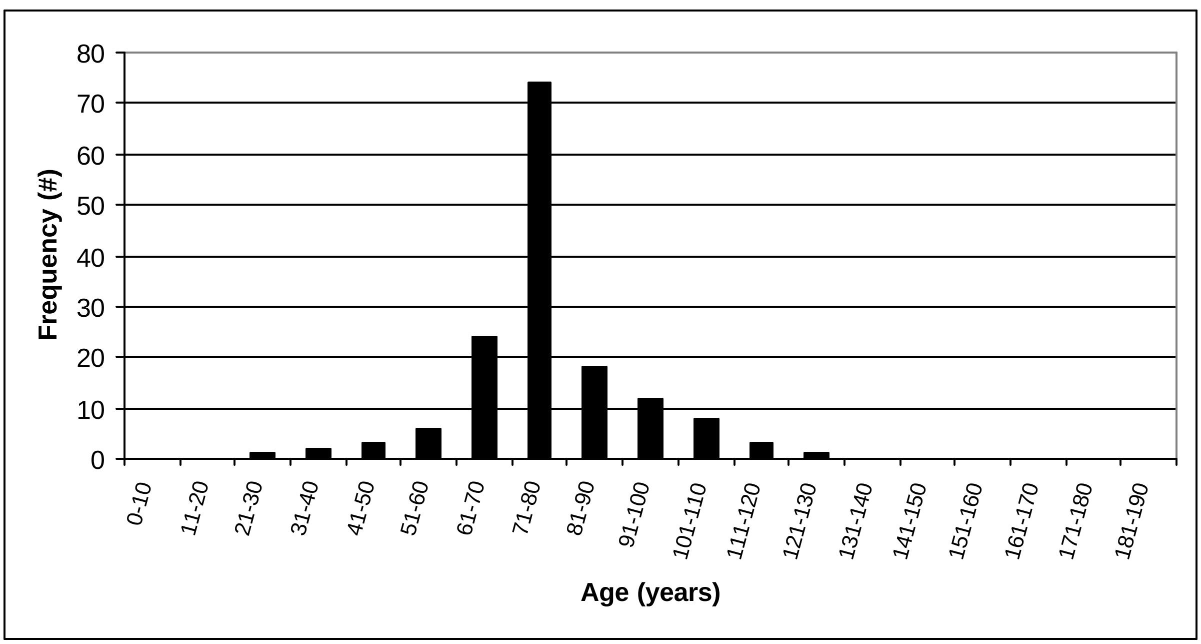

Figure 3.7. Schematic age distribution of an even-age forest structure.

The assumption in comparing a known old growth diameter distribution and sampled data from potential old growth locations is that old growth distributions can be statistically differentiated from those collected from a large-scale disturbance patch. If this assumption is correct, measured dbh and age frequency distributions from DFRA survey plots can be statistically compared to known old growth distributions and the results used in estimating extent of old growth.

Statistical analysis of sampling plot data was conducted in two phases; one for diameter distribution and another for age distribution. DFRA data collected from across Forest Management Districts 16, 17, and 18 were used (particularly along the eastern side of the Northern Peninsula) to determine whether the forest structure is comparable to old growth. All relevant collected data from each map section were combined into a single dataset for that section. PSP and TSP diameter data were combined into a single diameter file for each section. Age data was combined into a single file for each section from all TSP plots. Since PSP data is collected on the same set of trees over many years, only the most recent measurements were used so that the dataset would not be skewed. All comparisons were conducted without the exact location of each map section being known to the investigator until all analysis was complete.

3.2.5.3 Diameter Distribution

All data comparisons were conducted using chi-square analysis between sample plots and the known old growth diameter distribution. A chi-square analysis compares the proportions of an observed frequency distribution to an expected frequency distribution in order to determine whether they are statistically similar. The diameter dataset used to represent old growth was that collected from the Main River watershed by CBPP in 2000 (i.e. the expected old growth diameter distribution). The site surveyed was 2ha in size and every tree within the site was measured for diameter breast height (dbh) using the same techniques employed by DFRA in their PSP and TSP plots. A total of 1,683 trees were measured above the commercial diameter of 9cm, of which 1,263 were balsam fir. Only the diameter distribution of those trees greater than 9cm diameter were used in the comparisons (commercial diameters are what DFRA and CBPP typically measure).

All chi-square analyses of diameter distributions were conducted at the 0.05 level of statistical confidence. That is, the calculated chi-square value from each sampled dataset was compared to the 0.05 critical value (i.e. 32.67) and was accepted as having an old growth diameter distribution if the calculated value was lower than this critical value.

3.2.5.4 Age Distribution

All age data from DFRA plots were compared to the estimated fire frequency for Canadian boreal forests (approximately 150 years) and the estimated gap turnover rate (estimated at 175 years) to determine if the area has evidence of a relatively current disturbance event. The results were combined with the diameter results in order to determine if the sampled map sections can be considered old growth.

3.2.5.5 Results

Since ages may have been taken by DFRA at breast height, this dataset may under-represent the age of some trees as advanced regeneration may be quite small and old prior to release and hence data may be missed at breast height. In addition, some sampling (diameters and aging) may have been conducted in areas of actual regeneration (i.e. inside a regenerating gap). Therefore, nether analysis was used to overturn the other. That is, if either the diameter distribution (statistically similar to known old growth) or the age distribution (greater than 150 years old) from any map section indicated the presence of old growth, then that section was shown as old growth.

Figure 3.8 shows the estimated extent of the contiguous old growth forest on Insular Newfoundland. In general, it extends from the Main River watershed to the southern shore of Hare Bay. Table 3.5 summarizes the data analysis for each sampled map section. It should be noted that all map plots did not have survey data and hence the

From the above available data, a conservative estimate of the boundary of old growth on insular Newfoundland is an area of approximately 5,400km^2 which includes the eastern portion of the Northern Peninsula from Main River to Hare Bay inclusively (Figure 3.8). A more detailed consideration of the forest ecosystem is discussed in Section 4.4.6.

The portion of FMD 16 identified as containing the old growth forest structure (i.e. Main river) is approximately 20% of that area of the eastern Northern Peninsula identified above. The areas identified for potential harvest within the proposed Five-Year Plan in the Main River watershed is approximately 5% of the watershed (i.e. 5,000ha) or approximately 1% of the potential old growth.

Figure 3.8. Potential old growth forest (eastern side of N.P.).

Table 3.5. Summary statistics of DFRA survey section data for FMD 16, 17, and 18.

Site[f]	Diameter Distribution		Age Distribution				Old Growth?
	Chi-square value	**Sample Size (n)**	**Trees >150 and <175 years**	**Trees ≥175 years**	**Maximum Age at Site**	**Sample size (n)**	
166044	**19.83**	19	0	0	51	4	Yes[ae]
166043	**5.43**	3	0	0	122	8	Yes[ae]
166042	-	0	0	0	59	4	Unknown (No)
166041	**9.55**	8	0	0	52	6	Yes[ae]
166034	**18.84**	4	0	0	67	20	Yes[ae]
166033	**27.33**	65	0	0	63	4	Yes[e]
165141	361.87	240	0	0	53	16	No
162324	**8.55**	4	0	0	80	17	Yes[ae]
165123	**19.28**	19	0	0	109	19	Yes[ae]
165121	**9.77**	4	0	0	130	2	Yes[ae]
165114	-	0	0	0	72	16	Unknown (No)
165113	**19.35**	48	0	0	137	16	Yes[e]
165112	57.14	202	0	0	146	23	No
165044	54.18	65	0	0	75	24	No
165043	118.69	278	0	0	140	56	No
165042	49.08	89	0	0	142	31	No
165041	**25.52**	198	1	0	160	24	Yes
165034	38.98	157	0	0	118	49	No[b]
165033	**28.38**	50	0	0	64	40	Yes[e]
165032	265.34	226	0	0	62	40	No
165031	47.40	159	0	0	141	23	No
165024	138.83	336	0	0	116	52	No
165023	67.97	41	1	0	159	16	Yes[c]
165022	55.51	38	0	0	36	5	No
165021	188.49	290	0	0	112	33	No
165014	270.69	163	0	0	143	50	No
165013	72.84	56	0	0	83	9	No
165012	-	0	0	0	59	17	Unknown (No)
164044	45.30	274	1	1	200	38	Yes[d]
164043	**17.30**	79	0	0	132	11	Yes[e]
164042	**22.43**	174	2	0	160	20	Yes
164041	**30.29**	195	1	0	155	38	Yes
164034	**23.45**	18	0	0	122	4	Yes[ae]
164033	**21.69**	129	0	0	126	39	Yes[e]
164032	**16.56**	183	0	0	144	71	Yes[e]

Table 3.5 (continued).

Site[f]	Diameter Distribution		Age Distribution				Old Growth?
	Chi-square value	**Sample Size (n)**	**Trees >150 and <175 years**	**Trees ≥175 years**	**Maximum Age at Site**	**Sample size (n)**	
164031	**18.07**	77	0	0	143	18	Yes[e]
164024	60.48	199	0	0	84	19	No
164023	41.22	233	0	0	135	39	No
164022	**20.86**	293	0	0	147	56	Yes[e]
164021	**19.05**	128	0	0	135	22	Yes[e]
164014	**26.68**	8	-	-	-	0	Yes[a]
164013	**16.58**	68	0	0	118	11	Yes[e]
164012	**13.92**	54	0	0	148	12	Yes[e]
164011	**26.90**	234	1	0	170	29	Yes
163233	150.29	248	0	0	145	31	No
163232	**15.22**	254	1	0	154	19	Yes
163231	32.94	208	0	0	132	27	No[b]
163224	**29.86**	228	1	0	172	43	Yes
163223	**26.83**	176	1	0	156	24	Yes
163222	75.73	30	0	0	114	8	No
163221	72.63	60	0	0	114	8	No
163214	**16.64**	81	0	0	120	8	Yes[e]
163213	134.20	520	0	2	187	83	Yes[d]
163212	**16.52**	208	0	2	185	34	Yes
163211	**22.01**	307	1	0	160	48	Yes
172742	**21.77**	201	1	0	153	27	Yes
172741	41.10	108	0	0	130	7	No
172731	**7.61**	31	0	0	69	7	Yes[e]
172722	**16.75**	29	0	0	134	6	Yes[e]
172444	53.36	317	1	0	150	32	Yes[c]
172443	35.59	217	4	0	167	16	Yes[bc]
172434	33.00	41	7	1	175	16	Yes[bd]
172433	**28.37**	167	1	1	180	16	Yes
172424	**12.08**	69	0	0	120	8	Yes[e]
172423	**10.28**	54	1	0	152	7	Yes
172422	**21.17**	76	0	0	141	10	Yes[e]
172413	**24.49**	228	0	0	145	15	Yes[e]
172412	**12.39**	51	-	-	-	0	Yes
172344	47.32	103	0	0	135	27	No
172342	344.67	104	0	0	71	15	No
172341	463.69	504	1	0	150	30	Yes[c]
172334	**17.08**	170	0	0	116	21	Yes[e]
172333	37.77	151	-	-	-	0	No[b]
172332	160.22	484	0	0	120	38	No
172331	189.34	589	0	0	115	62	No
172323	66.52	177	0	0	97	20	No
172322	41.52	193	0	0	103	24	No
172321	43.72	108	0	0	68	4	No
172312	33.79	50	0	0	110	2	No[b]

Table 3.5 (continued).

Site[f]	Diameter Distribution		Age Distribution				Old Growth?
	Chi-square value	Sample Size (n)	Trees >150 and <175 years	Trees ≥175 years	Maximum Age at Site (Years)	Sample size (n)	
181544	90.93	380	3	0	160	67	Yes[c]
181543	97.31	258	0	0	128	59	No
181542	68.83	169	2	0	155	26	Yes[c]
181541	40.25	245	2	0	155	40	Yes[c]
181534	198.89	395	2	0	161	49	Yes[c]
181533	54.05	235	0	0	130	39	No
181532	46.79	324	0	0	145	89	No
181531	**14.05**	36	0	0	69	4	Yes[e]
181524	88.66	323	0	0	145	58	No
181523	54.52	141	2	0	168	20	Yes[c]
181521	33.93	185	1	0	160	23	Yes[bc]
181514	**18.84**	23	0	0	81	3	Yes[ae]
181513	**26.24**	51	0	0	68	28	Yes[e]
181511	**18.53**	14	1	0	155	4	Yes[ae]
181444	**31.54**	57	0	0	131	14	Yes[e]
181414	38.67	100	0	0	125	12	No[b]
181242	**8.98**	2	0	0	57	7	Yes[a]
181241	98.45	166	0	0	130	24	No
181232	211.71	375	1	0	157	46	Yes[c]
181231	129.78	241	0	0	108	28	No
181222	**25.61**	118	1	0	159	8	Yes
181212	**30.00**	63	1	0	153	15	Yes
181211	**31.71**	163	0	0	130	30	Yes[e]
180644	308.93	327	0	0	121	20	No
180624	**32.60**	36	0	0	140	8	Yes[e]
180623	38.93	167	0	0	97	8	No[b]
180621	369.29	498	0	0	99	20	No
180614	308.57	306	0	0	109	8	No
180613	223.16	301	0	0	145	26	No
180611	114.92	130	0	0	86	11	No
180524	162.63	162	0	0	63	8	No
180514	54.96	137	0	0	120	8	No
180513	179.70	124	0	0	67	8	No

[a] – Site has old growth diameter distribution but the sample size is considered small (i.e.<25).
[b] – Site is not considered to have an old growth diameter distribution at the 0.05 level of acceptance but would be at the 0.01 level of acceptance.
[c] – Site diameter distribution is not statistically considered old growth, however, trees greater than 150 years old were sampled.
[d] – Site diameter distribution is not statistically considered old growth, however, trees greater than 175 years old were sampled.
[e] – Maximum age was not used to "overturn" an acceptable diameter distribution.
[f] –The site number indicates that location of each sampling section as per DFRA and CBPP standard. For example, 166044 is FMD 16, Map 60, Section 44.

3.3 NEWFOUNDLAND PINE MARTEN

The Newfoundland Pine Marten (*Martes americana atrata*) has been listed as endangered since 1996 by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Historically, Pine Marten were distributed throughout the boreal forests of North America (Hagmeier 1956). On the Island of Newfoundland, Pine Marten were once found in most forested areas, although never in great numbers (Bergerud 1969; Snyder and Hancock 1985). Historical densities on the island appear to have been highest in the Grand Falls and Corner Brook sections of the boreal forest (Bergerud 1969). By the early 1900s, Pine Marten populations had begun to decline (Snyder 1984).

Trapping is thought to have been extensive in the early 1900s (Bissonette *et al*. 1988) and was perhaps one of the major causes of the initial decline of the island population. Habitat disturbance may have also played some role in the initial decline. Forest fires and insect damage destroyed extensive portions of the Island's suitable Pine Marten habitat in the late 1890s and early 1900s (Northland Associates 1990). The practice of clear cutting for pulp wood began about 1920 for the Grand Falls mill, while the Corner Brook mill did not open until 1925. Commercial wood harvesting is therefore considered to have had a minor role in the initial decline (Northland Associates 1990).

While trapping of Pine Marten on the island has been closed since 1934, the population appears to have continued its decline so that, by 1960, the species' range was no longer contiguous. At that time, it was estimated that there was one remnant population in north-central Newfoundland in the vicinity of Gander Lake (Northwest Gander River, and Gambo Pond) and a second population in the western part of the island, concentrated in and south of the Grand Lake-Little Grand Lake area (Bergerud 1969). By 1994 the island population was estimated to be approximately 300. In 1985, Pine Marten were thought to be primarily restricted to a few isolated areas of mature and over-mature forests in western and central Newfoundland (Snyder and Hancock 1985). By 1995, they were considered to be restricted to a few areas of mostly mature forest in western Newfoundland (Forsey *et al.* 1995).

Pine Marten on the Northern Peninsula do not appear to have ever been present at high densities. Bergerud (1969) stated that Pine Marten north of Parson's Pond were probably never common. A live-trap survey of the valley around St. Paul's Big Pond in 1975 revealed no Pine Marten (or scat) in the area despite the fact that it was considered good habitat (Mayo 1975). It was concluded that if a population existed, it was small and scattered. In 1997, a Pine Marten baiting program was initiated in the Silver Mountain/Burnt Hill Lakes area as part of the proposed Silver Mountain Hydroelectric Project's baseline data collection (AGRA 1997a). In this study, no Pine Marten were baited within the Silver Mountain/Burnt Hill Lakes area however, one Marten was baited just north of Birchy Flats in a forested area which had been previously harvested approximately 60 years ago.

Sightings and accidental trappings have been recorded near Main River and the north side of Deer Lake during the late 1960s and early 1970s (Skinner 1974). Pruitt (1970) recorded a single Pine Marten sighting in the Silver Mountain area and there are trapping records from the 1920s of Pine Marten in the area that is now Gros Morne National Park (Mayo 1975). There have also been unconfirmed Pine Marten sightings near White's River (south of Silver Mountain) and animals snared near Taylor's Brook (AGRA 1997a).

In an attempt to establish populations outside the known concentration areas, Pine Marten were introduced into the headwaters of the La Poile River (Mayo 1976a), the Main River area (1976b), Siviers Island (Porter 1976), and Terra Nova National Park (Bateman 1985). It appears that the introductions to Siviers Island and La Poile River have been unsuccessful (Bissonette *et al*. 1988). In the Main River area, Pine Marten were released by the Provincial Wildlife Division at the upper end of Big Steady. In total, eleven animals were released; six in 1976 and five in 1978 (Northland Associates 1986).

Gros Morne National Park is presently conducting an experiment on the status of Newfoundland Marten in the greater Gros Morne area. Objectives of this study are: determine the distribution of Marten; determine the minimum abundance of Marten in areas where they are known to occur; and determine the minimum abundance of Marten in potential flow (i.e. corridor) or proximate areas between Gros Morne National Park and the surrounding landscape. Marten were found to occur in the Adies Pond, White's River, Big Barren and Upper Humber areas of the greater Gros Morne landscape. In total, two marten were trapped, five bait stations were visited and tracks were also observed at seven other locations (Gerrow 2001).

CBPP and the Newfoundland Wildlife Division are currently working together on a five-year modified harvesting study within the Main River area. By monitoring marten in areas of modified harvesting it is hoped to provide direction for long term sustainability of both.

3.4 MIGRATORY BIRDS

Waterfowl information is available for FMD 16 from studies conducted by Northland Associates (1986), Parks and Natural Areas (1998; 2001), Montevecchi *et al*. (1995), and AGRA (1997b).

As part of the Upper Humber/Main River Wood Harvesting Operations Environmental Impact Statement, waterfowl studies were conducted on the main stem of the Main River (Northland Associates 1986). A review of literature, helicopter surveys, and ground field trips were conducted to gather information regarding the species and numbers present within the study area. Helicopter surveys were conducted on May 31, June 5-9, June 25-28, and September 10-13, 1985. Ground surveys were conducted on the above dates except May 31. It should be cautioned, however, that due to the recognized importance of Big Steady as waterfowl habitat, the specific data related to this area (i.e., densities of waterfowl, breeding success, and sensitivity of the habitat) cannot be extrapolated to describe the general area (Northland Associates 1986).

Big Steady contains approximately 200ha of suitable waterfowl habitat including waterways, riparian meadowland, peat land, and wet fir forest which has been identified as very good waterfowl habitat by Newfoundland standards (Northland Associates 1986). The species identified along the main stem of the river were: Canada Goose (*Branta canadensis*), Black duck (*Anas rubripes*), Green-winged teal (*Anas crecca*), Blue-winged teal (*Anas discors*), Ring-necked duck (*Aythya collaris*), Common Goldeneye (*Bucephala clangula*), Red-Breasted Merganser (*Mergus serrator*), and Common Merganser (*Mergus merganser*). All of the species identified above, except Blue-winged teal, were also identified in the area during the summer months by a Canadian Wildlife Service researcher (Northland Associates 1986). The species composition described above is also comparable to the species identified during surveys conducted in the Silver Mountain area during the Spring and Summer of 1997 (AGRA 1997b). The exception being Scaup (*Aythya marilla*) which were identified in a small pond in the Silver Mountain area. This species was identified in 1986 as one that was thought to be expanding its range in the western portion of the Island (Northland Associates 1986).

A range of sizes in waterbodies and watercourses can be found throughout FMD 16. The information provided by surveys, suggest that Canada Goose, Black Duck, Green-winged Teal, Scaup and possibly Ring-necked Ducks would be most likely to utilize the available aquatic habitat. Harlequin Duck have been identified as utilizing portions of the Humber River watershed (AGRA 1997b), however, they have not been recorded on the Main River system (Parks and Natural Areas 2001). Common mergansers (*Mergus merganser*) and red-breasted mergansers (*Mergus serrator*) would also utilize areas of faster flowing water.

The Upper Humber Wetlands Complex contains valuable breeding, nesting, brood rearing and/or staging habitat for a variety of waterfowl species. Birchy Basin was found to be the most productive waterfowl area near FMD 16, followed by Neds Steady, Gales Bottom and the Adies Pond area (DFRA Draft 2001).

3.5 RAPTORS AND OWLS

Raptors identified during previous surveys in FMD 16 have been Bald Eagles (*Haliaeetus leucocephalus*), Osprey (*Pandion haliaetus*), Northern Goshawk (*Accipiter gentilis*), American Kestrel (*Falco sparverius*), Merlin (*Falco columbarius*), Rough-legged Hawk (*Buteo lagopus*), Northern Harrier (*Circus cyaneus*), and Northern Hawk Owl (*Surnia ulula*) (AGRA 1997b). These and other raptors such as Sharp-Shinned Hawk (*Accipiter striatus*), Red-tailed Hawk (*Buteo jamaicensis*) and owls such as the Short-eared Owl (*Alio flammeus*), Great Horned Owl (*Bubo virginianus*) and possibly Boreal Owl (*Aegolius funereus*) could be expected to utilize the habitat in FMD 16.

Osprey and bald eagle have also been noted in the Gros Morne area. Both these species are protected by law. Ospreys consume fish and so inhabit areas near lakes and rivers. Nests are usually built on top of tall trees or dead snags, frequently located on hillsides (Northland Associates 1986).

3.6 CARIBOU

Several studies have been conducted over the years on the caribou (*Rangifer tarandus*) herds on the Northern Peninsula. The results of available reports are compiled here in order to give a consolidation of information and a large-scale picture of caribou population changes and movement patterns/habitat relevant to FMD 16.

3.6.1 Populations

The caribou on the Northern Peninsula were investigated in 1966-67 as part of a report to inventory the wildlife within the proposed boundaries of Gros Morne National Park (Pruit 1967). Pruitt described three, apparently separate, caribou herds: the Gregory Plateau, the Humber River, and the Northern Peninsula.

Bergerud (1971) estimated the number of caribou in insular Newfoundland during the period 1900-1910 to have been approximately 40,000 animals. From 1915-1925, caribou numbers apparently declined rapidly and only 1,000 to 2,000 animals persisted on the island during this time. There were probably fewer than 100 animals remaining in each of the Northern Peninsula and Humber River herds in 1930 (Bergerud 1971). The herds began to increase again by 1932-35, however, Bergerud stated that the Humber River herd showed no change in numbers between 1956-64 and that it averaged only 111 animals throughout this time. Likewise, there was no detectable increase in numbers for the Northern Peninsula herd in the two aerial censuses made in 1958 (450 animals) and 1966 (400 animals). By 1986, the Humber Herd was estimated to contain between 300 and 400 animals and the Northern Peninsula Herd was estimated at between 1,000 and 2,000 animals (Northland Associates 1986). In 1993, a complete census of caribou within the Gros Morne Park boundary during the post-calving period produced an estimate of 1,500 adults (AGRA 1997d).

Recent population counts conducted by the Wildlife Division of the provincial Department of Forest Resources and Agrifoods have been based on Management Areas rather than specific herds. Caribou estimates in each area are provided in Table 3.6. There are indications that surveys conducted by them have not been completed in any particular season or at any standard date between years, therefore an estimate of individual herd size is not possible (AGRA 2000). Conversations also indicate that caribou numbers in the area have been increasing but are starting to level off. License increases in the Management Areas reflect a general increase in population density (AGRA 2000).

Table 3.6. Summary information of Caribou Management Areas in FMD 16.

Management Area	Date Last Surveyed	Estimated Caribou in Area
62	2000	7,500
66	1989	4,500
69	1996	8,500
78	1989	600
79	1998	4,000
Gros Morne	1993	1,500

3.6.2 Ranges and Movements

The summer range of the Humber River herd pre-1967 was described by Pruitt as that area of the Long Range Mountains and Eastern Hills regions between Western Brook Pond, Silver Mountain and north to include the watershed of Main River (Pruitt 1967). Pruitt went on to describe the winter range of this herd as the Humber Valley between Aides River, Sandy Lake and the CN railway tracks. The calving grounds were unknown at that time. Pruitt also indicated that the Humber River herd moved predominantly north and south, while the Northern Peninsula herd moved predominantly east-west along the eastern slopes of the Long Range and the Cat Arm River and its watershed (Pruitt 1967).

The Upper Humber Valley was described by Pruitt as an area of exceptional snow Fall, with snow up to 3 m (10 ft) deep. He also stated that the Humber River herd would have a low chance of over-wintering west of a line boundary drawn from Bonne Bay Big Pond in the south to Eagle Mountain in the north (Pruitt referred to this line as the St. Barbe Boundary). Caribou wintering west of this line would be confined to alpine domes or windswept bogs, with occasional forays into intervening forests. Winter snow cover was described as well beyond the caribou's tolerance for digging feeding craters in the forest (Pruitt 1967).

In 1986, the Humber Herd was described as occupying a restricted range at the base of the Peninsula. The Northern Peninsula Herd was said to range from Roddickton Road in the north, to Adies Pond in the south, and from White Bay to the western edge of the Long Range Mountains (Northland Associates 1986; MacLaren Plansearch 1982). It was also stated that these herds intermingled to an unknown extent in Gros Morne National Park and in the Adies Pond area.

In the Upper Humber/Main River Wood Harvesting Operations Environmental Impact Statement, it was stated that the Humber Herd calved in Gros Morne National Park and over-wintered to the north-east of Adies Pond (Northland 1980; Bateman 1980), however, in 1980 an expansion eastward across Highway 420 (Hampden Highway) was identified. The seasonal movement from Gros Morne to Adies Pond and back was in an east-west direction, with little divergence to the north or south. Animals were found in their wintering range between November and late April.

The major winter concentrations of the Northern Peninsula Herd were located on the barrens on the western edge of the Long Range Mountains (Northland 1980). Small groups of animals from this herd were also found over-wintering in the central, eastern, and northern parts of the Peninsula (Slaney 1979; Shawmont 1980).

Animals of the Northern Peninsula Herd begin moving from their over-wintering range to their calving areas in May. Two major calving areas were identified in 1980 (Northland 1980); one on the high barrens north of Parsons Pond and another approximately 20km east of Portland Creek Pond. The Big Level area of Gros Morne National Park has since been identified by park biologists as the main calving ground for the majority of caribou on the Northern Peninsula, and the peak calving period is between May 20 and the First of June (AGRA 1997d).

By June, and continuing through the Summer, caribou move from the calving grounds onto the bogs and fens in the centre of the peninsula to take advantage of new vegetation growth. During this period, some animals move into the lowlands near the southern end of Big Steady, perhaps using the cooler timber stands to escape the heat and biting flies (Northland Associates 1986). By late October, most of these caribou are again heading toward their winter range at the western edge of the mountains. A radio-telemetry tracking study of 15 caribou carried out in 1981 (MacLaren Plansearch 1982) found similar patterns of seasonal movement. Recent radio-collaring of caribou which had calved in Gros Morne has indicated that after calving, a portion of the animals migrate out of the Park and some move to the coastal plains within the Park boundary (AGRA 2000). AGRA (2000) also indicated that most caribou that move east of the park generally utilize the habitat west of Main River.

3.7 MOOSE

Moose Management Areas within the limits of FMD 16 include: 3 (Harbour Deep), 4 (Taylors Brook), 12 (Buchans), 13 (Gaff Topsails), and 14 (Sheffield Lake). The moose estimates in each Area are provided in Table 3.7 based on the most recent surveys flown - 1997. Conversations with Wildlife personnel indicate that moose numbers in the area have generally been increasing but are starting to level off. License numbers in the Moose Management Areas reflect a general levelling-off in population density (AGRA 2000).

Table 3.7. Summary information of Moose Management Areas in FMD 16.

Management Area	Estimated Moose in Area
4	5,000
41	2,000
3	7,000
12	1,200
13	2,000

Moose Management Area 4 is relatively good for moose production with a population that is stable or increasing in number. This is a reflection of the animals' positive response to wood harvesting (AGRA 2000). Because moose prefer the early successional stages of forest development attributed to harvesting, there is no immediate concern that harvesting will negatively affect moose populations in FMD 16 (AGRA 2000).

The Main River area, which falls into Moose Management Area 4, contains one of the densest populations of moose on the island. When the area was surveyed in 1997 it were estimated to have a population of 5,000 animals (Parks and Natural Areas Division, 2001). Lush meadows provide excellent grazing, making the Big Steady area a favourite destination of moose.

Surveys conducted in 1980 by Northland Associates on the Northern Peninsula indicated that moose numbers were high. The largest number of animals or tracks were noted at the eastern border of Gros Morne National park, as the transition of vegetation from alpine to forest provided good browse and shelter for moose. The upper slopes of the Main River valley was also considered an important moose wintering area, due to the transition from barren to forest vegetation which also provided suitable shelter and browse. Mature and overmature timber around the Main River and on the eastern side of the park may represent good overwintering areas, but it is not suitable habitat for the rest of the year. The majority of moose observed by the Northlands Associates survey (1980) were in river valleys and near ponds.

3.8 BLACK BEAR

Black bears are native to the island of Newfoundland and inhabit areas of FMD 16. These animals may range in size up to 320kg but average weights would be about 90kg and 140kg for mature females and males respectively (Mahoney 1985). The estimated population of black bear for the island is around 6,000 animals (Parks and Natural Areas Division, 2001).

3.8.1 Food Habits

Early successional plant species, including raspberry, mountain ash, and blue berries are used heavily by black bears (Day 1997). Studies have documented increased food availability in disturbed sites (Lindzey and Meslow 1977, Young and Beecham 1986, Unsworth *et al*. 1989, Boileau *et al.* 1994, Costello and Sage 1994, Sampson and Huot 1994 *as taken from* Day 1997). Pioneer species such as raspberry and blue berries develop soon after forest harvesting takes place, providing black bear with a suitable food source. In the fall, black bears are more abundant in open areas during midday than at other times of the year (Mahoney 1985). This is due to the cooler temperatures and ripening of the berries.

Other important food sources of black bear include predation upon moose and caribou. As an example, Mahoney (1985) estimated black bears to be responsible for 46 percent of adult caribou deaths within the Grey River herd. Garbage is available and consumed by bears in landfill sites, thereby supplementing their natural foods. Whether this is an essential component of their diet is still unknown (Day 1997).

3.8.2 Home Ranges

Home ranges of male adult black bears are usually much larger than those of adult females (Reynolds and Beecham 1980, Young and Ruff 1982 as taken from Day 1997). This allows the male to find more than one breeding companion. Day's (1997) study involved the radio collaring of five female black bears. She concluded that adult female bears in Gros Morne National Park (GMNP) had moderate home range sizes and exhibited territorial behaviour. Overlap of their home ranges may have likely been caused by communal use of a land fill site. Table 3.8 (taken from Day 1997) compares the home ranges of female black bears in GMNP to that of northern North America.

3.9 UPLAND GAME

Upland game considered important within FMD 16 (from a socio-economic and prey-base viewpoint) are snowshoe hare (*Lepus americanus*), arctic hare (*Lepus arcticus*), willow ptarmigan (*Lagopus lagopus*), ruffed grouse (*Bonasa umbellus*), and spruce grouse (*Dandragapus canadensis*).

Ruffed grouse were successfully introduced into the Hawkes Bay area in the 1960's. Both ruffed and Spruce grouse inhabit conifer forests in various stages of successional growth.

Table 3.8. Adult female black bear home ranges in northern regions of North America.

			Home Range km^2	
Location	n	No.of locations	Mean	Range
GMNP, Newfoundland	5	207	47.7	27.7-79.9
Adirondacks, New York	5	493	31.2	7.0-55.1
Gaspesie, Quebec	5	-	47	8-65
PNM, Quebec	24	-	68.2	-
Western Manitoba	5	399	23.9	16.1-32.1
Riding Mt.Nat.Park, Man	14	-	169	-
Northern Alberta	3	63	7.5	6.2-9.3
Cold Lake, Alberta	12	542	19	-
Southern Yukon	9	128	28.1	6.8-75.4

Willow ptarmigan (*Lagopus lagopus*) are fairly common in cut-over areas. Like the snowshoe hare, it prefers areas of early successional growth. Ptarmigan will move to slopes of mountains, particularly in spring and summer, such as those along the western slopes of the Long Range Mountains.

The snowshoe hare thrives in cutovers and other areas that have vegetation in the early stages of development (Dodds 1960 *as taken from* Northland Associates 1986). Arctic hare (*Lepus arcticus*) occur on the barren upland regions along the eastern boundary of Gros Morne Park (Pruitt 1967).

Upland game provides crucial prey for such predators as fox, lynx, and birds of prey. Natural or cyclic fluctuations in small game animals are quite normal and are believed to be influenced by many factors such as habitat, levels of predators and weather conditions (DFRA Draft 2001).

During these periods of cyclic abundance, populations of upland game can build to very high numbers. The early successional stages of vegetation resulting from clear-cutting or road right-of-way clearing are favoured feeding areas for hares, ptarmigan and ruffed grouse. Ptarmigan are especially capable of forming considerable winter concentrations in such habitats, particularly if willow (*Salix* spp.) is present (Northland Associates 1986).

3.10 FURBEARERS

All species of furbearers present on the Island may occur within FMD 16.

These include:

- Beaver (*Castor canadensis*)
- Muskrat (*Ordatra zibethicus*)
- Red Fox (*Vulpes vulpes*)
- Weasel (Ermine) (*Mustela erminea*)

- Mink (*Mustela vison*)
- Otter (*Lontra canadensis*)
- Lynx (*Lynx canadensis*)
- Coyote (*Canis latrans*)

River and stream banks, forests and forest edges represent the preferred habitat for most furbearers (Northland Associates 1986), and such habitat abounds within FMD 16. Also, small and medium-sized mammals and game birds (mice, hares, ptarmigan and grouse) represent a basic part of the diet of predatory furbearers.

The following, as taken from DFRA Draft (2001) gives a brief description of the furbearers in FMD 16.

Lynx are known to occur throughout FMD 16, although populations are currently not considered high.

Red Fox occur throughout FMD 16, and a healthy population is supported in the Main River area.

FMD 16 has a considerable amount of suitable wetland habitat for **beaver**, resulting in the beaver population doing well within the area.

No data is available on the distribution or density of **otter** in FMD 16

No data is available on the distribution or density of **muskrat** in FMD 16.

No data is available on the distribution or density of **Ermine** in FMD 16.

Mink are currently distributed throughout the island and appear to have had a depressing effect on muskrat populations.

It is believed that the **coyote** arrived in Newfoundland in the early 1980's, via pack ice from Nova Scotia. Coyotes will occupy any habitat that supports prey, including areas in FMD 16.

3.11 NON-CONSUMPTIVE AVIFAUNA (FOREST BIRDS)

Over 42 species of forest birds are reported for Newfoundland (Parks and Natural Areas 2001), however, extensive surveys of many areas of the Island have not been conducted. The species that occur in FMD 16 are listed below based on survey work of the Main River Forest Landscape Design Report (CBPP 1998) and Whitaker (1997). The groupings by habitat selection guilds are as described by Whitaker (1997):

3.11.1 Riparian Habitat Selection Guild

- Common snipe (*Gallinago gallinago*)

- Waterthrush (*Seiurus noveboracensis*)
- Greater yellowlegs (*Tringa melanoleuca*)
- Tree swallow (*Tachycineta bicolor*)
- Spotted sandpiper (*Actitis macularia*)
- Belted kingfisher (*Ceryle alcyon*)
- Yellow warbler (*Dendroica petechia*)
- Rusty blackbird (*Euphagus carolinus*)

3.11.2 Open/Edge Habitat Selection Guild

- Gray jay (*Perisoreus canadensis*)
- Magnolia warbler (*Dendroica magnolia*)
- Mourning warbler (*Oporornis philadelphia*)
- Dark-eyed junco (*Junco hyemalis*)
- White-throated sparrow (*Melospiza lincolnii*)
- Lincoln sparrow (*Melospiza lincolnii*)

3.11.3 Interior Habitat Selection Guild

- Myrtle warbler (*Dendroica coronata*)
- Goldfinch (*Carduelis tristis*)
- Evening grosbeak (*Coccothraustes vespertinus*)
- Redpoll (*Carduelis flammea*)
- Redstart (*Setophaga ruticilla*)
- Ovenbird (*Seiurus aurocapillus*)
- Yellow-bellied flycatcher (*Empidonax faviventris*)
- Red-breasted nuthatch (*Sitta canadensis*)
- Hermit thrush (*Catharus guttatus*)
- Swainson's thrush (*C. ustulatus*)
- Black-throated green warbler (*Dendroica virens*)

3.11.4 Forest Generalist Guild

- Ruffed grouse (*Bonasa unbellus*)
- Black-backed woodpecker (*Picoides arcticus*)
- Downy woodpecker (*P. pubescens*)
- Hairy woodpecker (*P. villosus*)
- Black-capped chickadee (*Parus atricapillus*)
- Boreal chickadee (*P. hudsonicus*)
- Winter wren (*Troglodytes troglodytes*)
- Golden-crowned kinglet (*Regulus satrapa*)
- Ruby-crowned kinglet (*R. calendula*)
- Black-and-white warbler (*Mniotilta varia*)
- Pine Grosbeak (*Pinicola enucleator*)
- Pine siskin (*Carduelus pinus*)
- Purple finch (*Carpodacus purpureus*)

3.11.5 Ubiquitous Habitat Selection Guild

- American robin (*Turdus migratorius*)
- Blackpoll warbler (*Dendroica striata*)
- Yellow-rumped warbler (*D. coronata*)
- Fox sparrow (Passerella iliaca)

While these species do not represent a total list of all forest birds within FMD 16 they represent the more abundant species.

3.12 FISH, FISH HABITAT AND FISHERIES

The two principal watersheds within FMD 16 are the Humber River and the Main River. Both river systems are scheduled salmon angling rivers and have Atlantic salmon (*Salmo salar*) runs that are not only important to the ecosystem but also to sport fishing Provided below is an overview of the available information regarding these two systems.

3.12.1 Humber River

The Humber River basin is approximately 7,679km^2 with a mean width of 49.2km (Porter *et al*. 1974). The Humber River is pre-glacial in origin, lying in an old zone of structural weakness (Seabrook 1962). The basin consists of about equal amounts of acidic intrusive rocks, Mississippian sedimentary, gneisses and a small amount of Cambrian sedimentary, Ordivician sedimentary, and Ordivician Volcanic.

Deer Lake has an area of approximately 57km^2 (mean width of 2.25km and a length of approximately 17.7km). It has a mean depth of 44m and a maximum depth of 94.5m (Porter *et al*. 1974). Deer Lake lies predominantly in a bed of Mississippian sediments (sandstones and sandstone derivatives). The southern end lies in a region of gneisses of undetermined age and there is a bed of Precambrian sediments outcropping on the southwest shore (Seabrook 1962). The bottom is brown mud, with considerable bark material mixed therein. The shoreline is regular and composed of boulder, rubble, sand, and gravel (Seabrook 1962). Deer Lake has two major inflow sources; the upper portion of the Humber River (3,070 mean annual cfs) and Grand Lake via the Deer Lake powerhouse (5,070 mean annual cfs) (Seabrook 1962).

The main stem of the Humber River is approximately 152km long, including standing water (Porter *et al.* 1974). Anadromous Atlantic Salmon, however, can only access the first 112.6km of the main stem due to a complete obstruction to fish passage called Main Falls (Riche 1971; Porter *et al*. 1974; Dawe 1976; Moores & Ash 1984; Mullins & Reddin 1995; AGRA 1997f; Anonymous no date) (Figure 3.9). Main Falls is approximately 6 m in height with a 90% slope (Porter *et al.* 1974).

The chief Atlantic Salmon (*Salmo salar*) spawning area for the main stem of the river (not including Adies Stream and Taylor' Brook) may well be the area between the inlet of Birchy Basin Dam and Main Falls (the Birchy Basin area) (Porter *et al.* 1974).

Riche (1971) described the habitat above Main Falls as comprising some 48km of main stem and 39 tributaries with a total length of 190km. Lakes and ponds were estimated to cover approximately 137km^2. The main stem above the falls was generally described as a wide stream of medium velocity and moderate depth. Toward the upper end, wide steadies and long shallow lakes are common. The terrain was described as gentle in slope, lending itself to the formation of ideal gradient for salmonid rearing areas.

During low flow conditions in July and August, aerial and ground stream surveys were conducted to determine the general quality and quantity of fish habitat (particularly spawning and rearing habitat) within the Upper Humber area (AGRA 1997f). All habitat within the study area was classified using the Beak classification system (1980), that is, as Type I - Type IV habitat.

Stream habitat surveys were conducted on Silver Mountain Pond Brook by AGRA (1997f) as per Scruton *et al*. (1992) as it was considered one of the only small streams draining into Silver Mountain Pond with a high proportion of Type I (spawning) habitat.

It appears from preliminary habitat classification surveys and existing literature, that most Type I (spawning) habitat above Main Falls is restricted to the uppermost reaches of the watershed. Aerial surveys indicated streams with Type I habitat along the north side of the River just inside the Park boundary. Only limited Type I habitat was identified between the Park boundary and Main Falls; these being along the main stem at the inflows of many of the ponds such as Hoover Steady, Outback Pond, Silver Mountain Pond, and Outflow Pond. There may be other areas, such as smaller streams, which have not been quantitatively surveyed to date that may have isolated pockets of spawning habitat.

The bottom composition of the river above the Falls was also surveyed by Riche (1969). He estimated the composition of the main stem of the river to be 12% bedrock, 50% boulder, and 37% rubble. The tributaries were estimated to contain 20% bedrock, 41% boulder, 36% rubble and 3% gravel with the majority of the gravel being found in the upper most tributaries.

3.12.1.1 Fish Populations

Anadromous Atlantic Salmon have been known to migrate throughout the Humber River as far upstream as the base of Main Falls throughout the summer months (Riche 1969). Data to date indicate that there is a run of large salmon that enters the Humber River in August and September. This population appears to be a discrete stock which spawns downstream from Deer Lake (DFO 1997).

Radio tags were implanted in brook trout (*Salvelinus fontinalis*) and Atlantic salmon within the Birchy Basin/upper Humber area to assist in determining movement patterns and habitat utilization (AGRA 1997f). In particular, the spawning movements of salmon in Birchy Flats and trout in the ponds around Silver Mountain Pond were monitored. Transmitters were implanted and tracked as per McCarthy (1996).

Figure 3.9. Humber River map

Radio transmitters (model FSM-3) were surgically implanted in fish of suitable size using the technique outlined by McKinley *et al.* (1992).

The location of each fish was determined using a hand held receiver (Lotek model # SRX-400) and an “H” antenna from fixed land positions around the watershed. The daily point-locations were plotted on maps of the watershed to determine habitat use and range of movements for each implanted fish.

Fish large enough to tag during angling and fyke netting also had individually numbered fingerling Floy tags (model # FTF-69) attached in the dorsal area just anterior to the dorsal fin. All recaptures were also recorded so possible patterns in movements may be established.

Brook trout movement within the Humber River, above Main Falls generally appeared to be limited. The recapture of Floy tagged individuals was never outside the pond of original capture and two of the three radio tagged trout also stayed in one pond throughout monitoring. There does, however, appear to be a possibility that larger trout move extensively throughout the watershed. Tag #3 was the largest of the trout radio tagged and its movements ranged from Outflow Pond to the inflow of Outback Pond, an instream distance of over eight kilometres. From anecdotal information, there is evidence that larger fish move through the system during the high flow of spring, starting from somewhere between Outflow Pond and North Brook. They move north through the system and by August can only be caught near Hoover Steady. This anecdotal evidence supports the idea that there are larger individuals within this population and that they probably move throughout the system, however, quantitative support as to their numbers or movement patterns was not gathered through this study.

All radio tagged Atlantic Salmon appeared to have similar movement patterns with varying individual distances between approximate spawning and overwintering habitat locations. In general, the majority of tagged salmon spawned between the upper end of Birchy Basin (Big Bend) and Taylor’s Brook. No tagged salmon went any further up the Humber than to the head of Big Bend. All tagged salmon appeared to migrate back downstream to overwinter between Birchy Lake and Birchy Hill Brook, located approximately 11km below the existing Birchy Lake Dam.

Mullins and Reddin (1995) state that the number of eggs to meet minimum conservation requirements on the Humber River is 28.3 million for habitat below Main Falls. Based on the estimated average number of eggs per salmon for the Humber, this would translate into approximately 16,683 (15,749 small and 934 large) fish needed to achieve this goal. Recent years have fallen below this potential (Mullins & Reddin 1995). Table 3.9 presents the most recent data on the Humber River salmon stocks calculated by the Department of Fisheries and Oceans (DFO 1997).

The mean potential egg deposition between 1974-91 represented about 63% of the conservation requirement. The 1992-95 mean was 95% requirement and the mean potential egg deposition in 1996 represented 186%, 31% above the 1995 level. The status of the stock in 1996 was considered the best since 1974 (DFO 1997). However, the increases in percentages of conservation requirement met since the commercial moratorium in 1992 has given a false impression that the status of stocks have improved relative to long-term abundance (DFO 1997). Assessments of this river have shown that this is not the case.

During low flow conditions, quantitative electrofishing as per Scruton and Gibson (1995) was conducted on representative sites classified as Type I and/or Type I/II habitat within the Birchy Basin/upper Humber area (AGRA 1997f). Electrofishing was used to quantify the species, size classes, and abundance of fish utilizing each area. In addition to fish numbers caught, habitat attributes of each station were also recorded. The results of the electrofishing results were used to estimate the number of each species present in each station. Index electrofishing within the study area was also performed at sites where quantitative electrofishing stations were not possible due to excessive depth, velocity, width or inaccessibility. They were performed over a set minimum level of effort (300 seconds) so that these stations may be comparable to the quantitative electrofishing stations.

Fyke nets were used in several accessible locations (Outflow Pond and Silver Mountain Pond) within the study area to gather data on fish numbers and movement patterns. Fish captured in each net, when possible, were anaesthetised, identified to species, measured, and weighed.

Table 3.9. Summary of recent stock calculations for the Humber River (taken from DFO (1997)).

Year	1991	1992	1993	1994	1995	1996	Min[a]	Max[a]	Mean[a]
Returns: [b]									
Small	5,724	17,571	18,477	7,995	27,898	30,445	4,868	24,588	13,074
Large	401	2,945	636	1,030	2,064	2,679	341	2,945	915
Estimated Spawning Escapement:									
Small	4,293	13,222	14,316	5,472	22,748	26,478	3,651	18,441	9,805
Large	401	2,945	636	1,030	2,064	2,524	341	2,945	850
Conservation Requirement % eggs met:									
Small + Large	27	117	96	40	129	186[c]	24	119	63

[a] Values are for 1974-91.
[b] Total runs for 1974-91 were estimated based on an angling exploitation rate of 25% adjusted for tag loss and reporting rate.
[c] Preliminary data based on tags returned up to January 6, 1997.

Land-locked Atlantic Salmon (Ouananiche), brook trout, and arctic char have been identified in the upper Humber River above Main Falls (Ryan & Kerekes 1988) in addition to a subspecies of Pygmy Arctic Char (*Salvelius alpinus oquassa*) found in

Candlestick Pond (Anions 1994). The subspecies of arctic char at Candlestick Pond, may persist as a genetically isolated relict population (Anions 1994).

While quantitative population estimates were not completed, populations of brook trout and ouananiche in the main stem ponds above Main Falls appeared to be high, however, larger individuals (>25 cm) were rarely captured despite local anecdotal evidence. In fact, only three brook trout were captured which were large enough to implant with radio transmitters. Fyke net captures appeared to always be relatively high however, angling captures were comparatively lower. Areas that were thought to have large numbers of individuals had relatively few during electrofishing surveys, particularly at index sites. Hoover Steady had a large area of suitable spawning gravel at its inflow, however, index surveys showed very few fish.

Likewise, index sites along the Humber River between Main Falls and Silver Mountain Pond had very low fish numbers compared to quantitative surveys. These results may be due to higher water velocities and depths which may either obscure shocked fish from researchers before they are collected or may indicate general low densities of fish.

3.12.1.2 Water Quality

Water quality parameters have been measured in several ponds of the Humber system within Gros Morne National Park in August and September of 1975, 1976, and 1977 (Ryan & Kerekes 1988). Chlorophyll a values were found to range between 0.3 mg/m^3 (Candlestick and Wigwam Ponds) and 0.7 mg/m^3 (Half Moon Pond). Pond pH values ranged between 5.2 (Candlestick Pond) and 7.6 (Half Moon Pond).

3.12.2 Main River

In the Upper Humber/Main River Wood Harvesting Operations Environmental Impact Statement, fish and fish habitat surveys were conducted in Main River (Northland Associates 1986). Field investigations were conducted in the watershed between August 23 and August 28, 1985. Mapping was conducted using visual assessment procedures and helicopter support. Visual assessments of the main stem and other tributaries were also conducted by DFO and reported in Riche and Traverse (1971) and Porter *et al*. (1974).

Fish habitat mapping in the Main River watershed was concentrated in second and third order tributaries situated adjacent to areas which may have been impacted as a result of forest harvesting and/or road construction. These watercourses provided excellent salmonid rearing habitat and several contained significant areas of potential spawning substrate (Table 3.10). More detailed habitat assessment conducted at electrofishing stations (Table 3.11) revealed that some small deposits of potential spawning gravel were located in some watercourses which were judged to be primarily rearing habitat. No habitat mapping was conducted on the main stem of the river as habitat assessment presented by Riche and Traverse (1971) was considered adequate. This latter study reported extensive areas of potential spawning and rearing habitat, especially in the "Big

Habitat surveys revealed impassable obstructions that preclude access by anadromous salmonids on tributaries T3, T4, T5, T6, and T7. The obstruction on T7 had not been recorded on previous habitat mapping presented by Porter *et al*. (1974). Tributaries T2 and T8 (Big Brook) provide excellent rearing habitat and some spawning substrate (Table 3.11). Most of the other accessible watercourses within the study area (T9, T10, T11, and T12) were small streams, but provided some good rearing habitat.

Tributaries T13 (St. Paul's Big Pond) and T14, situated at the western limit of the area examined during the field program, are both large third order streams; the watersheds of both provide excellent spawning and rearing habitat.

Excellent salmonid habitat upstream of impassable obstructions was identified in many smaller tributary streams, but T1, T2, T7, and upper reaches of T8 account for most of this habitat in Main River.

The habitat identified above does not include ponds or steadies, both of which are used as rearing habitat in Newfoundland, although fish densities are usually lower than in classical Atlantic salmon habitat.

3.12.2.1 Fish Populations

Fish species found within Main River are sea-run and resident brook trout (*Salvelinus fontinalis*) and both the anadromous and land-locked forms of Atlantic Salmon (*Salmo salar*). Fisheries within the watershed may include trout fishing and salmon angling. Both activities would occur primarily within the main stem of the river with some remote activities (i.e. lodges) in some of the larger tributaries.

Concurrent with habitat mapping, fish density estimates were also performed within representative stream reaches (Figure 3.10). A selected stream site was enclosed with barrier nets and electrofished in order to get a population estimate. The densities of salmon fry, salmon parr, and brook trout were computed separately and the mean biomass of the catch of each of these groups at each site was used to provide an indication of the relative importance of small stream habitat within the study area.

During the Northlands surveys (1986), Atlantic salmon were present in six of eight sites sampled within the Main River watershed. Density estimates were obtained at six of these sites (Table 3.12) and fry were encountered at only three of these sites. The presence of fry apparently was correlated with the presence of gravel substrates either within the electrofishing station or nearby. No fry were encountered in tributary streams that did not have gravel substrates.

Table 3.10. Amount of salmonid habitat accessible to anadromous salmon in Main River tributaries (taken from Northlands 1986 and Riche and Traverse 1971).

Tributary	Spawning Habitat (Type I) ($100m^2$)	Rearing Habitat (Type I & II) ($100m^2$)	Steady Habitat (Type IV) ($100m^2$)
MAIN STEM	4,510	13,890	0
T2	75	450	75
T8 (Big Brook)	400	1,600	400
T9	0	100	70
T10	0	280	0
T11	0	140	0
T12	0	260	0
T13 (St. Paul's Big Pond Trib)	200	850	0
T14	600	2,000	200
T15	0	70	0
T16	40	750	0
T17	<10	170	0
T18	0	90	0
TOTAL	5,835	20,950	745

Table 3.11. Aspects of the physical environment at electrofishing stations in Main River.

Site	Tributary Number	Stream Order	Width (m)	Mean Depth (cm)	Substrate	Riparian Cover
1	T10	2	3.4	12	Cobble-boulder	Extensive
2	T8 (Big Brook)	3	9.4	<15	Cobble-gravel	Nil
3	T8 (Big Brook)	2	4.1	16.7	Boulder-bedrock	Extensive
4	T2	3	14.3	14	Cobble-boulder	Extensive
5	T8 (Big Brook)	3	18	23	Boulder-cobble	Nil
6	T11	2	3.5	12	Boulder-cobble	Extensive
7	T13	2	6.0	10	Boulder-cobble-gravel	Extensive
9	T7	3	13.5	16	Boulder-cobble	Fair

Table 3.12. Salmonid densities recorded from quantitative electrofishing surveys, Main River, 1985 (data adapted from Northland Associates 1986).

Site	Tributary	Density (#/100m^2)			Mean Biomass (g)			Standing Stock (g/100m^2)		
		salmon			salmon			salmon		
		fry	parr	Trout	fry	parr	trout	fry	parr	trout
1	T10	- -	36.6	25.3	- -	7.2	2.9	- -	263.5	73.4
2	T8	52.3	33.9	2.8	0.6	4.8	30.2	31.4	162.7	84.6
3	T8	- -	- -	11.1	- -	- -	9.4	- -	- -	104.3
4	T2	73.2	45.0	4.3	0.6	3.3	7.8	41.7	148.5	33.5
5	T8	- -	25.6	5.6	- -	11.0	1.9	- -	281.6	10.6
6	T11	- -	89.8	9.3	- -	5.9	12.2	- -	529.8	119.6
7	T13	74.1	55.3	33.6	0.7	8.0	15.8	51.8	442.4	530.9
9	T7	- -	- -	40.2	- -	- -	3.7	- -	- -	148.7

Figure 3.10. Locations of Fish and Fish Habitat Surveys.

Brook trout were present at all sites examined, both upstream and downstream of impassable waterfalls. The greatest densities of brook trout were encountered where Atlantic salmon were absent. However, the maximum biomass of brook trout occurred at Site 7 which also supported a very high density and biomass of Atlantic salmon fry and parr. Site 3 supported a low density of brook trout despite the absence of Atlantic salmon. No reasons for this low fish density were apparent at the time of sampling, however, aerial reconnaissance performed by Fisheries and Oceans circa 1970 reported that this stream had no flow. Therefore, this habitat may be subject to intermittent flows.

Total salmonid biomass was variable, ranging from a low of 104.3 g/100m^2 at Site 3 to a high of 1,025.1 g/100m^2 at Site 7. The lowest biomass occurred at Sites 3 and 9 where Atlantic salmon were absent. The two highest biomasses recorded were from Sites 6 and 7, both of which were small, second order tributaries.

3.12.3 Summary

In summary, fish species likely present at any possible areas of interaction (eg. proposed stream crossings) may include various life-cycle stages of brook trout and Atlantic salmon. Fish habitat would most likely include rearing and some spawning. Some streams may be intermittent at some times during the season. There would be very little direct fishing likely in the immediate area of most potential stream crossings as they are selected to cross small headwater tributaries where possible. However, the affected areas would probably contribute to downstream fish stocks within each watershed.

3.13 HISTORIC RESOURCES

As part of the proposed Silver Mountain Hydroelectric Development, a study was conducted to characterize possible historical resources in the Silver Mountain area, Upper Humber River, Newfoundland (AGRA 1997e). The study followed the Guidelines for Stage 1 Historic Resources Overview Assessment issued by the Cultural Heritage Division, Department of Tourism, Culture and Recreation, Government of Newfoundland and Labrador. As part of this report, published and unpublished reports of the study area and adjacent areas were consulted, as were the site files maintained on 1:50,000 maps by the Cultural Heritage Division. These generally encompassed FMD 16 and surrounding area. An interview was also conducted with Mr. G. Beaulieu of Cormack and a field reconnaissance survey was performed in the Silver Mountain/Upper Humber area.

3.13.1 Field Reconnaissance

The specific study area surveyed was the Upper Humber River on the Northern Peninsula, between Birchy Basin on the east and Gros Morne National Park on the west. Although previous surveys of the interior of the Northern Peninsula have produced meagre, or entirely negative results, the presence of a major watercourse in this area may have made it somewhat more attractive to aboriginal peoples. The area is one of considerable relief containing steep hillsides, extensive areas of bog and the banks of the Humber River itself. The area supports a forest cover of birch, spruce, fir and other lesser species. Shrubs, grasses and other typical bog plant species are found in wetter habitats. Much of the area has recently been logged, particularly the survey areas away from the river. The banks of the Humber River, however, remained essentially untouched and provide locations where aboriginal peoples could have camped had they lived in, or travelled through, the study area.

The area targeted for intensive survey were selected sites along the Upper Humber River between Birchy Basin and Silver Mountain Pond (Figure 3.11). Each of the areas was surveyed on foot and, where practical, test-pits were dug to sterile subsoil. All of these areas were inspected closely for signs of aboriginal or other use or occupation. Several promising locations within and around this area were thoroughly surveyed, but no trace of human activity was found.

3.13.2 Document Search

The document search included:

- a check of extant records including the Newfoundland and Labrador Archaeological Site Inventory and other pertinent records and inventory files;
- a review and summarization of all previous archaeological investigations or surveys in the study area and in immediately adjacent areas; and
- a review of relevant information from published and unpublished regional archaeological sources.

Archaeological Site Record Forms and Site Reports maintained by the office of the Resource Archaeologist, Cultural Heritage Division, Department of Tourism, Culture and Recreation were used to locate reported archaeological sites and to obtain information about cultural affiliation, size and condition of existing sites. Regional maps were consulted to obtain information about areas where surveys have been conducted.

The search of site files and other relevant documents revealed no reported sites in the target areas, nor in the entire Silver Mountain area. A summary of archaeological findings in adjacent areas follows.

3.13.2.1 Adies Pond (12H/6)

In his *Report of a Journey across the Island of Newfoundland* Robinson (1877:282) mentions an historic Indian camp at the southwest extremity of Adies Lake (Map 12H/6). The site was occupied by a trapper called Andrew Joe, probably a Micmac, who had pitched his wigwam there and left beaver pelts to dry. This is the site nearest to the actual area of the proposed Silver Mountain Hydroelectric project.

Figure 3.11. Archaeological survey locations.

3.13.2.2 Deer Lake and the Upper Humber Valley

Extensive surveys in the Deer Lake and Upper Humber River areas (Carignan 1975; Reader 1993; 1994; 1995) located a number of archaeological sites affiliated with Maritime Archaic Indian and Recent Indian.

In the immediate vicinity of Deer Lake (Maps 12H/4, 12H/3) five sites containing Recent Indian and Maritime Indian material are reported: DgBJ-3 (Maritime Archaic, Reader 1995); DgBj-1 and DgBj-2 (cultural affiliations unknown, reported by Gerard Beaulieu); DhBi-1 (Maritime Archaic, discovered by Gerard Beaulieu, visited by Carignan); DhBi-6 Deer Lake Beach site (Recent Indian, 1230±70 BP and 1220±60 BP, reported by Beaulieu to Thomson in 1986, at that time then called DhBi-2, see Reader 1996).

Upper Humber area

Three sites along the Upper Humber River are reported. Of these, two contain Maritime Archaic material and the other Dorset material: DhBi-3, Upper Humber 1, (Dorset site reported to K. McAleese by Gerard Beaulieu); DhBi-4, Upper Humber 2 (Maritime Archaic, reported by Gerard Beaulieu); DhBi-5, Upper Humber 3 (Maritime Archaic, reported by Gerard Beaulieu).

Junction Brook

A local resident reported a chisel-like artifact made of slate along Junction Brook (DhBh-1). Another find is reported near the narrows at the northwest end of Grand Lake (DhBi-2).

Old Man's Pond

A survey of Old Man's Pond (12H/4), between Deer Lake and the Bay of Islands, did not produce any evidence of cultural remains (Renouf 1991; Schwarz 1992).

3.13.2.3 West Coast

Parsons Pond

One site was recorded in this area; DlBj-1, Parsons Pond 2 (unknown cultural affiliation; Thomson 1987 unpublished report, map ref. 12H/13).

Cow Head Area

Four sites are reported from the Cow Head area. They have produced evidence of Maritime Archaic, Palaeo-Eskimo (Pre-Dorset, Shallow Bay complex, Groswater and Dorset cultures) and Recent Indian (Cow Head complex and Beaches complex) occupations. Sites include: DlBk-1, Cow Head site (Maritime Archaic, Pre-Dorset, Shallow Bay complex, Cow Head complex, Tuck 1973); DlBk-2, Cow Head Point (Recent Indian site, Tuck 1973); DlBk-3, Factory Cove site (Groswater manufacturing site, Auger 1985; LeBlanc 1996); DlBk-4, Cow Head Fish Plant (Recent Indian site, Tuck 1973).

St. Paul's Inlet

Three sites are reported from St. Paul's Inlet. They are: DlBk-5, St. Paul's Bay-1 (Recent Indian, Penney 1989); DlBk-6, St. Paul's Bay-2 (Recent Indian ["or Palaeo-Eskimo" added in a different hand], archaeological site record form); DlBk-7, Eastern Arm-1 (unknown cultural affiliation, Reynolds, archaeological site record form).

Broom Point

One site was identified in this area: DlBl-1, Broom Point-1 (Palaeo-Eskimo, Groswater and Dorset, Krol 1987); DkBl-1, unnamed (unknown prehistoric occupation and historic European, Tuck 1973).

Bonne Bay

Seven sites have been identified in the Bonne Bay area: DjBl-1, Paynes Head (south of Rocky Harbour, small Dorset campsite, Tuck 1973); DjBl-2, Norris Point (large site with Groswater and possible Maritime Archaic component, Bishop 1974; Harp 1964; Tuck 1973); DjBl-3, Bear Cove (nineteenth or early twentieth century habitation, Tuck 1973:4); Dlbj-5, Deckers Cove (also called Norris Point 2, small Dorset Eskimo site, Harp 1949, 1964; Tuck 1973); DjBl-6, Salmon Point (unknown cultural affiliation, possibly Dorset Eskimo, Tuck 1973); DjBl-7: Woody Point (also called Lighthouse Point, Dorset lamp and Maritime Archaic spearpoint, Wintemberg 1939; Harp 1949; Tuck 1973). DiBk-1, Payne's Cove (late nineteenth century European site, Tuck 1973).

Birchy Lake

Thomson (1989) reported two sites, DhBe-1 and DiBe-1, on the south shore of Birchy Lake. The former contained no diagnostic material and the latter a single unspecified artifact identified as Maritime Archaic. A "very recent hearth" was also located by Thomson (1989) on the summit of Mt. Sykes.

3.13.2.4 Main River

A survey conducted along the Main River on the east coast of the Northern Peninsula produced no evidence of aboriginal remains.

White Bay

Fifteen sites are reported from White Bay, all in coastal locations. They include: DlBe-1, Jackson's Arm-1 (Dorset Eskimo, Penney 1980); DkBe-1, Pittman site (Dorset Eskimo, Groswater and Maritime Archaic, Linnamae 1975); DkBe-2, Sop's Island (Dorset, Groswater(?) and Maritime Archaic, Linnamae 1975); DkBf-3, Budden Garden site (Maritime Archaic, site record forms); DkBd-1, Westport-1 (Groswater Palaeo-Eskimo, site record form); DkBd-3 Wiseman's Cove (Maritime Archaic, site record form); DkBf-2, Pollard's Point-1 (Dorset, site record form); DkBf-4, Pollard's Point-2 (Maritime Archaic, site record form); DjBf-1, Gold Cove-1 (Maritime Archaic, Harp 1964); DjBf-2, Gold Cove-2 (Maritime Archaic, Harp 1964); DjBf-3, Browns Cove barrens (unknown, five stone hunting blinds, site record form); DjBe-1, Brown's Cove (Maritime Archaic, Harp 1964); DkBd-2, Purbeck's Cove-1 (Dorset, site record form); DkBe-3, Granby Island-1, Middle Dorset, site record form); DkBe-4, Pumbly Cove burial (Dorset, Anderson and Tuck 1974).

Lunch Point

Local resident found a hearth feature and cache of Maritime Archaic Indian lithic artifacts on the south side of the peninsula.

3.13.3 Informant Interview

Several hours were spent with Gerard Beaulieu, of Cormack, Newfoundland. Mr. Beaulieu is an outfitter who has in the past, reported several archaeological sites in the Deer Lake area. He is, therefore, able to recognize archaeological remains and is familiar with the terrain where archaeological sites are likely to be located. Mr. Beaulieu is also very knowledgeable about faunal resources, particularly caribou, near the study area. He was asked, or volunteered information, about both the lack of archaeological sites in the study area and the present migration routes of caribou and salmon that may have potentially been a factor in aboriginal occupation of the area.

Although he reports numbers of caribou in the area**,** which might have made it attractive to aboriginal hunters, neither he or any of his companions have recognized any trace of aboriginal occupation.

3.13.4 Summary/Conclusions

The results of this study indicate that the target areas surveyed are not of high potential for the discovery of aboriginal remains. The background research revealed no trace of aboriginal remains in adjacent, or near-adjacent, areas except for sites around Deer Lake, the major waterbody in the region. Remains of aboriginal peoples -- Maritime Archaic, Early Palaeo-Eskimo, Dorset Eskimo and Recent Indian -- abound in coastal areas on both the east and west sides of the Northern Peninsula. Present available evidence suggests that Native groups had little interest in what would have been long distance travel to interior locations, despite the seasonal presence of attractive resources such as caribou. A likely explanation for this apparent lack of interest in the interior is that the same resources that were available there were also available in coastal areas much closer to base camps and the remainder of the Native peoples' seasonal grounds (AGRA 1997e).

Field reconnaissance confirms this low potential for the discovery of sites in the target areas, despite the fact that the Humber River is a major waterway and that at least two attractive camping or settlement locations were discovered and intensively test-pitted. Of the target areas, three were removed a kilometre or more from the main stem of the upper Humber River. They were also located on topography (i.e. hillsides of boggy areas) not traditionally attractive to aboriginal peoples.

Given the distances involved, and the fact that all resources found in the study area are available in other areas nearer known concentrations of prehistoric peoples, it is probably unlikely that the study area was ever exploited in a significant way by aboriginal hunters. Travel through the area, using the Humber or Main River, is, however, still a possibility.

3.14 MAIN RIVER AND THE CANADIAN HERITAGE RIVER SYSTEM

The Main River has been studied and identified since the early 1970s as an area deserving of protection because of its high quality natural features and relatively pristine condition. Areas of the river such as Big Steady have a high value with respect to their natural features that facilitate low impact recreational activities. Progress towards achieving special designation of the area has been slow, and usually associated with environmental impact assessments of proposed intrusive developments such as the Lower Churchill HVDC Transmission Line (1979-80) and potential forest harvesting operations (1982 and 2000).

In 1985–86 the province's Wilderness and Ecological Reserves Advisory Council (WERAC) became an active intervener with respect to the Environmental Impact Assessment completed on the proposed wood harvesting program for the Upper Humber/Main River area. In developing a set of mitigation measures, the Proponent (Corner Brook Pulp and Paper Ltd.) defined a proposed corridor along the river valley within which wood harvesting activities were to be restricted. It was proposed that 5,234ha of land around the Big Steady area be set aside as a "reserve", and that a buffer zone comprising an additional 2,382ha of land along the river corridor be set aside to reduce the impact of development along the entire river (Figure 3.12). Corner Brook Pulp and Paper Ltd. agreed to suspend logging activity within this zone, and to return timber rights to the Province. In accepting the Upper Humber/Main River EIS, the Province (through Minute of Council 949-87) approved this boundary, which has since been identified as a "Protected area Corridor".

Since 1987, efforts have been made by officials in the Parks Division (now Parks and Natural Areas Division, Newfoundland Department of Tourism, Culture and Recreation)

Figure 3.12. Main River Protected Area Corridor.

to achieve some level of special status for the river in order to preserve it as an area with outstanding natural and recreational features. These efforts have focused on the designation of Main River as a Canadian Heritage River.

The objectives of the Canadian Heritage River System are to give national recognition to the important rivers of Canada and to make sure that they are managed such that:

- the natural and human heritage which they represent is protected and understood; and
- the opportunities they offer for recreation and learning are available for residents of and visitors to Canada.

In 1989, a Background Study was completed (LeDrew, Fudge and Associates 1989) to determine whether the Main River merited designation as a Canadian Heritage River. This study confirmed that the watershed contained valuable natural and recreational features, along with potential for human heritage features, and that these features made the system a suitable candidate for nomination.

As a result of the recommendation of the Background Study, the Main River was formally nominated as a Canadian Heritage River (Department of Environment and Lands 1990). The Nomination was accepted by the CHRS Board, and the process of developing a Management Plan initiated.

In July 1992, Parks Division staff held Public Open Houses in Sop's Arm and in Corner Brook on concept alternatives for a management plan and to receive comments on the concept of managing the Main River as a Canadian Heritage River. A second round of Public Open Houses were held in June, 1995 to discuss contents of the draft Management Plan. Key concerns expressed were with respect to achieving the required level of protection without impeding local patterns of resource utilization.

In its identification of Concept Alternatives, the Province considered legislative mechanisms which could be applied to the Main River area, and replace the temporary measures put in place by the 1987 Cabinet directive. The choices included designation (under the Wilderness and Ecological Reserves Act) as a Wilderness Reserve or an Ecological Reserve, or designation (under the Provincial Parks Act) as a type of Waterway Park. The latter choice was identified as most appropriate to meeting the management objectives for the area (but could affect some resource uses, e.g hunting). In 1997, amendments were made to the Provincial Parks Act with respect to Waterways Parks. These amendments were directed towards accommodating the proposed management objectives for Main River, and it's designation as a Canadian Heritage River.

The present intent is to designate an area of 105km^2 as a Waterway Park and another 95 km^2 as a Special Management Area to provide an additional level of protection for the heritage river. This area comprises approximately 20% of the Main River watershed and encompasses the designated "Protected Area Corridor", plus Crown Land in the headwaters and near the mouth of the river. The draft Management Plan for the Main River has been revised, and has now been submitted and approved (Parks and Natural Areas Division 2001). As of August, 2001, the Main River has been granted Heritage River status and hence the Management Plan has been accepted by the Canadian Heritage River System as applicable and appropriate for the preservation of heritage values of Main River.

3.15 NAVIGATION OF PROPOSED WATERCOURSES

Final locations of any watercourse crossings (eg. culverts and bridges) will depend on many factors including size of watercourse to be crossed, slope, substrate stability, erosion potential, and navigability. If navigability is determined to be an issue at any potential crossing, it will be subject to the *Navigable Water Protection Act*.

At this time, there is no direct information available on utilization of any proposed watercourse crossings. No recreational (canoe/kayak) routes have been indicated within either Five-Year Plan harvesting block (Murphy *et al.* 1995). Further, the proposed road crossing locations are typically in stream sections that have periodic low flow regimes. Commercial and subsistence navigational activities are not expected to occur in these areas. At the current stage of planning, no crossings have been identified which will require approval under NWPA.

3.16 CONNECTIVITY/INTEGRITY OF GROS MORNE NATIONAL PARK

Connectivity has been defined as the degree to which the landscape facilitates or impedes movement among resource patches (Tischendorf and Fahrig 2000).(**George to redefine**) Connectivity has both a structural and functional component, in that structural connectivity is equated with habitat contiguity and is measured by landscape structure. The functional concept of connectivity considers the behavioural responses of an organism to the various landscape elements (Tischendorf and Fahrig 2000). Lack of connectivity will affect species in different ways. For example, With (1997) states that structurally connected habitat patches may not be functionally connected and non-contiguous habitat patches may be functionally connected, depending on the species. Representatives from CBPP, GMNP, Department of Forestry and Agrifoods, and Natural Resource Canada have put together a Connectivity Working Group to deal with such issues and to better understand the effects that connectivity and fragmentation, due to forest operations, could have on the integrity of the Greater Gros Morne area. A copy of the signed Memorandum of Understanding (MOU) between all participants is presented in Appendix B.

Gros Morne National Park is concerned with commercial forestry operations that may affect the integrity of the park both inside and outside its boundaries. To achieve ecological integrity, park management aims to maintain native biodiversity in viable populations, as well as natural processes and ecological functions (Ecosystem Science Section 2001).

To better understand the threat of decreased integrity within GMNP, forest structure, Newfoundland pine marten, woodland caribou, and passerine birds were suggested as indicators by a panel of experts and management recommendations presented. Where applicable these recommendations are used within the Environmental Evaluation. For more information *see* Ecosystem Science Section (2001).

Integrity concerns include that of connectivity and accessibility, as they are all related with respect to their influence on wildlife and forest characterization. Increasing road networks will influence poaching, hunting, and contribute to habitat loss. Constructing woods roads, as well as harvesting activities will fragment the forested landscape, thereby affecting connectivity in the area.

Organisms need to be able to move from one location to another for two main reasons: (1) to find food, and (2) for breeding purposes. Resources in their present home range may be limited due to competition, territoriality, or habitat loss, which results in the organism moving to find other areas that can provide these necessary resources. Also, animals such as caribou migrate seasonally in search of food. Proper corridors are needed so these organisms can maintain their life processes. If the forested landscape becomes too fragmented, patch isolation may occur, whereby the rate of immigration into the patch is greatly reduced.

Species react differently to varying amounts of fragmentation. Fragmentation may be defined as the breaking up of a habitat, ecosystem, or land use type into smaller parcels (Foreman, 1997). Some animals, (e.g. meadow voles) will avoid crossing fragmented areas, such as wide forest roads, whereas larger animals, such as moose and caribou may actually prefer the ease of travelling these corridors. Corridors are features, such as roads, streams, forested areas that connect through space and time. The degree to which corridors contribute to landscape connectivity depends on the nature of the corridors, the nature of the matrix and the response of the organism to both (Rosenberg et al. 1997, Beier and Noss 1998 as taken from Tischendorf and Fahrig 2000). These issues are still being considered within the Connectivity Working Group.

Objectives of the Connectivity Working Group are to:

- review existing literature;
- identify potential connectivity areas at risk in approved plans, and
- undertake primary research where there are gaps in the literature and/or disagreement in areas of expert opinion. Their work is presently ongoing.

3.17 SOCIO-ECONOMIC ACTIVITIES

Socio-economic activities in and around FMD 16 are described below. The nearest communities to FMD 16 are Jackson’s Arm, Sop’s Arm, Hampden, Deer Lake, Cormack, and Pollard’s Point.

3.17.1 Population

The 1996 population of the immediate surrounding area of FMD 16 is 39,261 which is a -2.3% change from 1991 (Table 3.13.). The largest negative percentage change has occurred in the communities located in White Bay (Jackson's Arm, Pollard's Point, Norris Point and Sop's Arm) as well as White Bay South, Hampden and Howley.

In general, most communities located in or near FMD 16 are declining in population, but statistics show that the larger the community or the closer the community to a larger center such as Corner Brook or Deer Lake, the lower its population decline (*see* table above). The exception is Corner Brook, which has had a slight decrease (-2.3%) in population between 1991 and 1996.

Table 3.13. Populations of Communities in the Vicinity of FMD 16.

Town	1991 Population	1996 Population	% Change
Cormack	788	767	-2.7
Corner Brook	22,410	21,893	-2.3
Deer Lake/Nicholsville	5,161	5,222	+1.2
Gillams	496	465	-6.3
Hampden	716	651	-9.1
Howley	363	336	-7.4
Jackson's Arm	533	470	-11.8
Kitty's Brook	244	230	-5.7
Little Rapids/Pynn's Brook	416	413	-0.7
Massey Drive	619	736	+18.9
Reidville	502	496	-1.2
Norris Point	927	850	-8.3
Sop's Arm	869	802	-7.7
Spillway	244	230	-5.7
Rocky Harbour	1,138	1,066	-6.3
Pasadena	3,428	3,445	+0.5
Pollard's Point	269	207	-23
White Bay South	587	515	-12.3
Wiltondale	37	51	+37.8
Steady Brook	421	416	-1.2
Total	**40,168**	**39,261**	**-2.3**

Source: Statistics Canada

3.17.2 Forest Resources

Information on forest resources is contained in Volume One.

3.17.3 Agrifoods

The majority of farms in FMD 16 are located in the Cormack, Howley and Reidville areas. Although these areas are within FMD 16, they are obviously managed differently than forest operations within the area. Outside the boundaries of FMD 16, the majority of farms are dairy.

3.17.4 Mining

Limited mining activity is carried out in FMD 16. As of December 20, 2000 numerous "map staked" mineral licences, some "ground staked" mineral licences and a small amount of land classified as mineral impost lands have been registered. These are scattered throughout FMD 16 but the majority are located in the northern section. Quarries are also located on the southern boundary of FMD 16 (Figure 3.13).

3.17.5 Water Resources

Numerous lakes and rivers are found in FMD 16. Two principal watersheds located within FMD 16 are The Humber River and the Main River. The Humber River is approximately 7,679 km^2. The main stem of the Humber River is approximately 152 km long, including standing water (Porter *et al.* 1974). Main River is situated in a wilderness area on the southern portion of the Great Northern Peninsula. The entire Main River watershed is 1,048.17 km^2 in area and rainfall amounts are estimated at between 1,400 and 1,500 mm annually (Northland Associates 1986). The river has many headwater ponds located at high elevations within the Long Range Mountains, some near the border of Gros Morne National Park to Big Steady. From Big Steady the river runs through deep canyons and empties into White Bay.

3.17.5.1 Drinking Water Quality

In FMD 16, there are a total of eight communities within the District that have water supplied. Five of these supplies are protected under the Province's Protected Water Supply Program (Deer Lake, Hampden, Beaches (Hampden), Pollard's Point, and Sop's Arm) and the remaining three are categorized as unprotected although still monitored by the program.

Figure 3.13 Mining

Within the District, there are three permanent non-drinking water monitoring stations located at Main River, Upper Humber, and Humber Canal along with five drinking water stations in each of the major communities within the District that have designated water supplies. All stations are examined for a standard suite of parameters including physical, nutrients, major ions and metals. Drinking water samples are also analyzed for Trihalomethanes (THM). Many of the stations have been established since the mid 1980s and are sampled either on a monthly, bimonthly, or quarterly basis. In general, all parameters measured meet the Canadian Drinking Water Quality Guidelines with the exception of aluminium and iron, which can naturally exceed these limits in Newfoundland (DFRA Draft 2001). THM results can exceed recommended limits at times however their formation is more related to the chlorination process than land use.

3.17.6 Fishing, Hunting and Trapping

3.17.6.1 Fishing

More detailed information on fish populations is found in Section 3.12. The information presented below relates to the recreational fishery.

Humber River

The Humber River is one of the largest rivers on the island and a very popular Atlantic salmon (*Salmo salar*) fishing destination for residents and non-residents. It is currently classified as a Class I Salmon River under the new river classification system and is in Zone 1 of the trout management zones. In general, the Humber River produces about 40% of the small salmon catch in Salmon Fishing Area (SFA) 13 (DFO 1997), i.e. on average just over 3,200 fish per season (Table 3.14.). Recreational catches estimated in 1992 and 1993 were among the highest on the river since the early 1980s.

Brook trout (*Salvelinus fontinalis*) are also found and angled within the watershed, however, at a much lower effort. Trout angling would be more active in the Humber River above Main Falls in what is known as the Burnt Hill Lakes area. Angling for brook trout is also conducted in Deer Lake primarily during the beginning of the season.

Fishing season activity for the Humber River is generally as follows:

Trout:	Winter Fishery February 01 to April 15 Summer Fishery May 15 to September 07
Salmon:	June 01 to September 07 Fall Fishery Catch & Release September 08 to October 07

Main River

Main River falls in Zone 1 of the trout management zones and SFA 3 for the salmon fishing season. It is classified as a Class II Salmon River, which is the second highest rating under the river classification scale. Both Atlantic salmon and brook trout are found in the Main River system. Approximately 80% of the fishing effort occurs within the first 10-km of the river. However, angling also occurs on the upper "fly in" sections.

Historical and current angling effort on Main River are presented below in Table 3.15. Between 1953 and 1999, the number of salmon caught on the Main River steadily

Table 3.14. Summary angling records for the Humber River, 1953-1979 (adapted from Moores and Ash 1984) and 1991-1996 adapted from information provided by Department of Fisheries and Oceans (DFO 1997).

Year	Rod Days	Total Salmon Caught	CPUE
1953	3715	1409	0.38
1954	4161	1013	0.24
1955	2177	1514	0.70
1956	6953	1186	0.17
1957	2637	1867	0.71
1958	3350	1880	0.56
1959	3681	2183	0.59
1960	3511	2116	0.60
1961	3639	2001	0.55
1962	4017	2498	0.62
1963	5348	4058	0.76
1964	7222	4949	0.69
1965	6551	4144	0.63
1966	8842	4311	0.89
1967	5317	2412	0.45
1968	5104	2264	0.44
1969	9690	4937	0.51
1970	1785	3311	0.28
1971	9027	4324	0.48
1972	9413	4180	0.44
1973	9612	3715	0.39
1974	8976	2849	0.32
1975	9611	6261	0.65
1976	10489	5163	0.49
1977	6127	2203	0.36
1978	7633	2909	0.38
1979	7961	3370	0.42
1980-90 [a]	- -	- -	
1991	- - [b]	1,442	
1992	- -	4,720	
1993	- -	4,874	
1994	- -	3,152	
1995	- -	6,088	
1996		6,629	
1997			
1998			
1999			

[a]Data not provided for the period 1980-1990 or 1996-2000.

[b]Effort data not provided for the period 1980-1999.

Table 3.15. Angling records for the Main River, 1953-1999 (adapted from Porter *et al*. (1974) and information provided by Department of Fisheries and Oceans).

Year	Rod Days	Total Salmon Caught	CPUE
1953	17	11	0.65
1954	48	25	0.52
1957	4	2	0.50
1958	10	3	0.30
1959	40	5	0.13
1960	5	2	0.40
1961	110	24	0.22
1962	112	60	0.54
1963	164	89	0.54
1964[a]	465	284	0.61
1965[a]	666	542	0.81
1966[a]	1350	931	0.69
1967[a]	891	129	0.14
1968[a]	771	644	0.84
1969[a]	1585	726	0.46
1970[a]	832	473	0.57
1971[a]	713	414	0.58
1972[a]	703	281	0.40
1973[a]	669	692	1.03
1974	797	464	0.58
1975	1231	782	0.64
1976	1082	501	0.46
1977	1041	693	0.67
1978	616	252	0.41
1979	830	983	1.18
1980	916	1011	1.10
1981	1098	1277	1.16
1982	1848	1707	0.92
1983	1812	483	0.27
1984	723	302	0.42
1985	1051	599	0.57
1986	979	489	0.5
1987[b]	438	230	0.53
1988	1204	988	0.82
1989	540	285	0.53
1990	1639	776	0.47
1991	1841	537	0.29
1992	1570	1032	0.66
1993	2150	2460	1.14
1994	3329	2759	0.83
1995	2246	1024	0.46
1996	1609	933	0.58
1997	N/a	1046	N/a
1998	N/a	1467	N/a
1999	N/a	1019	N/a

[a] angling data estimated to be 80% accurate

[b] bridge across Main River was constructed

increased, reaching a peak in 1994 of 2,759 salmon. Since then, the number has fluctuated at around the 1,000 mark.

As a result of woods roads and the bridge built across the river in 1987, access to Main River has increased. This has resulted in a 50% increase in angling effort, from a 10-year average of 1,091 rod-days per year before 1986, to 1,657 rod-days since that date. However, the catch per unit effort has not changed significantly over the same time period ($p<0.01$), i.e., the increase in salmon caught is likely a result of increased angling effort as opposed to increased efficiency in capture.

Brook trout are also fished in the system, but since it is not a licensed activity, the number caught in any one season is difficult to determine. Recreational brook trout fishing is more likely to occur south of the Main River system in the area known as Burnt Hill Lakes in the Humber River watershed.

Fishing season activity for the Main River is generally as follows:

Trout:	Winter fishery February 01 to April 15 Summer fishery May 15 to September 07
Salmon:	June 15 to September 07

Each year the Department of Fisheries and Oceans conducts salmon stock assessments for the rivers in Newfoundland. In 1999 they published a report on the status of the Atlantic salmon stock of Humber River. There has not been such a study done for the Main River but the general Stock Status Report for Fishing Area (SFA) 3 gives an overview of the most recent trends.

Other Areas in FMD 16

Recreational fishing for brook trout and ouananiche does occur in the southern portion of FMD 16, however, it is difficult to determine the number of fishers and the amount taken.

Ice fishing is also conducted throughout FMD 16 by many snowmobilers. However, the regulatory regime does not provide a record of the numbers of ice fishers or the amount of fish caught.

3.17.6.2 Hunting

Woods roads throughout FMD 16 are commonly used as access points for hunting.

FMD 16 is located primarily in Moose Management Areas 4, 3, 12, 13, and 41 and Caribou Management Areas 62, 66, 69, 78, and 79. The number of licenses issued for these areas has remained constant for moose over the last two years and have slightly increased for caribou. Tables 3.16 and 3.17 display licenses issued in 1999 and 2000 for caribou and moose respectively. Table 3.18 lists the number of black bears harvested from 1996 through 1999.

Table 3.16. Licenses issued for caribou management areas within FMD 16.

Management Area	1999 Licenses Issued	2000 Licenses Issued
62	500	500
66	350	370
69	450	490
78	100	100
79	250	250
Gros Morne	N/A	N/A

Table 3.17. Licenses issued for moose management areas within FMD 16.

Management Area	1999 Licenses Issued	2000 Licenses Issued
4	1,200	1,200
41	500	500
3	1,300	1,300
12	200	100
13	400	400

Table 3.18. Harvest of black bears, by bear management area, within FMD 16 (DFRA Draft 2001).

Management Area	1996	1997	1998	1999
3	1	4	3	1
4	4	6	2	2
12	2	0	10	4
13	11	1	7	5
41	2	0	2	5

Ruffed grouse, Spruce grouse, willow ptarmigan, scaup, black ducks and some Canadian geese, teal, and merganser are found throughout FMD 16 in appropriate habitats. Snowshoe hare are also found throughout the area. The waterfowl-hunting season generally extends from the second week in September to the second week in December.

For more detailed information on wildlife species *see* Sections 3.3 - 3.11.

3.17.6.3 Trapping

Beaver, fox, lynx, coyote, mink, muskrat, otter, red squirrel and weasel are trapped in FMD 16. The island is closed to Pine Marten trapping. The trapping season for most species opens on or about annually on October 20 with the exception of the mink and lynx which annually opens on or about November first and December first respectively. The closing date varies depending on the species. The beaver, muskrat and otter seasons annually close on March 15; the fox, coyote, and lynx seasons close on February first, and the squirrel, weasel and mink seasons close on February 28. Beavers are harvested on a registered trapline system.

Unfortunately, statistics are not provided for animals trapped solely within FMD 16, although some statistics are available for the entire area. Below are trapping statistics for Zone 10 (Table 3.19).

Table 3.19. Trapping statistics for Trapping Zone 10.

Species	**1997-98 (72)**	**1998-99 (92)**	**1999-2000 (103)**
	# of Furbearers Exported	**# of Furbearers Exported**	**# of Furbearers Exported**
Beaver	371	430	419
Weasel	121	285	260
Silver Fox	18	13	70
Cross Fox	44	75	77
Red Fox	87	226	161
Lynx	0	3	9
Mink	194	436	434
Muskrat	60	139	62
Otter	27	43	48
Red Squirrel	91	275	51
Coyote	0	0	2
Total	**1,013**	**1,925**	**1,593**

* Number in brackets indicate the number of trappers in Fur Zone 10 exporting fur that season.

* Source: Department of Tourism, Culture and Recreation, Inland Fish and Wildlife, Pasadena, NF.

In addition, in order to protect the Marten, a restriction has been imposed on the types of traps used in certain areas of the Island. Only traps designed so as not to capture Marten, or which allow them to escape, are allowed. Currently, a no-trapping (dry-land) policy exists in the Main River area which extends throughout the entire former Pine Marten study area. A submerged or drowning trap-set can be used, but given the current low market value of fur and limited issues of trap licenses, it is doubtful that anyone traps in the area. The beaver traplines in the Main River and Upper Humber areas have been inactive for several years (AGRA 1997a).

3.17.7 Tourism

3.17.7.1 General Tourism

To date, very little interest has been given, from a general tourism perspective, to any of the areas identified as harvesting areas in the Five-Year Plan. Discussions with the staff at the Deer Lake tourist chalet (December 1997) indicated that general tourists had not expressed any interest in visiting these particular areas (AGRA 1997c). With the recent announcement (June 27, 2001) that the Main River has been given heritage status, interest in ecotourism on that river will most likely increase.

3.17.7.2 Ecotourism

One operator has offered wilderness canoeing/kayaking trips on the Main River for the last fourteen years and rafting for the past seven years. The majority of trips are one day in duration and are conducted between the Kruger Bridge (which is two kilometres into the canyon section) and the mouth of the river at Sop's Arm. Occasionally, small groups are taken on a four to five day trip from the headwaters at Four Ponds Lake to the mouth at Sop's Arm. Although the river is not long, it contains a diversity of wilderness and canoeing experience from tundra-like barrens, through expanses of softwood forests, and through an unusual area of grass land called Big Steady. The river completes its journey through a spectacular 23km (14 mi.) canyon (Murphy *et al.* 1996).

3.17.7.3 Guides and Outfitting Lodges

Approximately 18 tourist and outfitting operators in FMD 16 cater to individuals interested in hunting (e.g. moose, caribou and bear) and fishing (e.g. salmon and trout). Some outfitters also offer snowmobiling and cross country skiing. The lodges operate for about 10 weeks from early September to October for the moose and caribou hunt and from May to June for the bear hunt. Fishing is usually carried out during July and the first week of August but sometimes extends until October. One outfitter reported about a 25% occupancy rate for fishing with hunting being the main source of income. Another outfitter reported that fishing accounted for less than half of the company revenue. The majority of guests come from the United States; the remainder are from Europe, Atlantic Canada and other parts of Canada. The average weekly cost of a hunt (excluding airfare) is:

- Moose, $3800;
- Caribou, $4000;
- Bear, $1900;
- Combination moose/caribou hunt, $5500;
- Combination moose/caribou/bear hunt, $5700;
- Fishing trip, $2100.

Some outfitters offer a free bear hunt with the purchase of a moose and/or caribou hunt. Others only charge a minimal fee to include the bear hunt in the combination hunt. Below are the results of interviews with eight of the eighteen outfitters operating in FMD 16 (Table 3.20). This survey does not include the cost of airfare or the value of any equipment or gifts bought in the area, which can be substantial.

Some outfitters cater to cross country skiers. This usually consists of a weekend group of up to 18 skiers.

Since the mid 1990s, snowmobiling has grown in popularity, especially on the Northern Peninsula. In 1996, the Department of Tourism, Culture and Recreation published a provincial snowmobile strategy. This strategy indicates that the most attractive part of the island for tourists is the Northern Peninsula and Gros Morne National Park area where snow conditions, as well as season length and uniqueness of natural scenery, are most appealing. Since then, the sport has been increasingly promoted, clubs have been formed, tours have become established and significant amounts of public funding have been directed towards this activity. As a result, in just four years, snowmobiling activity (both tourist and recreational) has tripled.

Several recently established snowmobile tourism companies operate out of the Sop's Arm/Deer Lake/Gros Morne area. Some hunting and fishing outfitters have expanded their previous operations into snowmobiling, thereby achieving a longer operating season and, consequently, a more profitable operation. Tourists come primarily from Newfoundland, although out-of-province numbers are increasing steadily.

The cost to snowmobile ranges between $1300 and $1700 per night for a group of up to 14 people or approximately $125/person, guide costs not included.

The Main River is used as one of the primary access routes to the high country of Gros Morne National Park and vicinity. Snowmobilers come up through Leslie Lake, into Lynn's Brook down to the Big Steady on the Main River; travel up to Caribou Lake; on to Taylor's Book and subsequently into the high country of Gros Morne National Park. The woods roads also provide access to the backcountry and snowmobilers forecast that groomed trails will soon be operating throughout the area.

Table 3.20. Summary questionnaire statistics for outfitters interviewed.

Questions	1	2	3	4	5	6	7	8
Origin of Guests	100% US	100% US	80% US 20% Europe	100%US	100%US	100% US	100% US	95% US 5% NS/NB/Can.
Number of Guests Per year	Approx 50	27	Over 100	32	50		40	64
Number of guests the lodge can accommodate per week	Approx 50	6-7	20	4-6	8-10	24-30	12	12
Occupancy rate for the past 5 years	100%	100%	Hunting 100% Fishing 25%	95%	100%		100%	100%
% of repeat guests	50-60%	35%	25%	50%	50%	25-30%	65%	75%
% of guests that have come up to 5 years	25-30%		25%	30%		5%	20%	
Up to 10 years	25-30%			5%			5%	2%
10 years or more							5%	5%
% of successful hunts	95-100%	90%	90%	95%	100%	90% Moose 100% Caribou 50% Bear	95%	99%
Number of weeks in hunting season	6-7	4-6	7-8	6-7	5-6	5-6	8	6
Number of weeks in fishing season			8	3-4		Varies	4	
Number of weeks in combined season	6-7	4-6	16	9-11	5-6	5-6	16	6
Cost of a weeks Moose hunt	$3250 US	$3500 US		$2900 US	$5000	$3000	$3500	$3000
Cost of a weeks Caribou hunt	$3250 US	$3500 US		$3000 US	$5000	$3500	$3500	$4000
Cost of a weeks Bear hunt	$1500 US	Additional $300 US		Free with license	Free with license	$2000	$2200	$1500
Cost of a weeks combination Moose/Caribou	$4700 US	$4500 US		$3100 US	$7500	$5000	$5700	$5000
Cost of a weeks combination Moose/Caribou/ Bear	$ 5000 US	$4800 US		$ 4100 US		$5200	$6000	$5250
Cost of a week's fishing		$5000 US		$1550 US		$2000	$1600	
Number of Moose/ Caribou/ Bear licenses	84	64	48	44	112		47	

The snowmobiling season extends from December until early May (approximately 18 weeks). Although most activity occurs in March and April, when the days are warm, sunny and relatively windless.

3.17.8 Recreation

There are few cabins in FMD 16, with the exception of Partridgeberry Point, Lunch Point, Kelly's Point, Birchy Lake and Sheffield Lake and on the Eagle Mountain and Silver Mountain roads. Fifty-four cabins are located on Crown Land on the eastern portion of Sheffield Lake and another 46 lots are available from Crown Lands. Several cabins are also located on the western portion of the Lake. Remote cottage development has been approved for the Upper Humber area.

Recreational snowmobiling for provincial residents has increased in recent years. Upwards of 200 machines at a time can be recorded travelling between the high country of Gros Morne National Park to the West, Sop's Arm to the East and Deer Lake to the south.

Canoeing and Kayaking are popular recreational activities on both the Humber and Main Rivers. Canoeing on the Main River principally occurs during June, July and August between the Kruger Bridge and the mouth of the river at Sop's Arm. During June of each year, when the water is high, approximately 10-12 individuals kayak between the Kruger Bridge and the mouth of the Main River at Sop's Arm. Some canoeing occurs on Sheffield Lake by cabin owners. The Lower Humber sees significant amounts of canoeing particularly when the water is high. However, it is difficult to quantify these numbers.

Little hiking is known to occur in any of the harvesting areas, except that which relates to hunting, fishing and canoeing/kayaking. Rock climbing is not known to occur within FMD 16.

3.17.9 Parks

Three parks are located near or adjacent to FMD 16. A private park is located in Sop's Arm. Consisting of a small picturesque campground with 25 campsites and a day use/picnic area, it is adjacent to the mouth of the Main River. The nearest provincial park is Sir Richard Squires Memorial Park located 47km northeast of Deer Lake. Gros Morne National Park is located approximately 30km to the west of Main River and borders the western boundary of FMD 16.

Sir Richard Squires Memorial Park is known for its salmon fishing as well as the opportunity to watch salmon leaping Big Falls. The park has 159 campsites and 20 rental boats are available for salmon fishing. Other activities include a playground and short hiking trails.

Park day visitation has increased in the last two years (Table 3.21), but those spending the night have continued to decrease each year (Table 3.22). About 85% of those visiting the park for the day are from Newfoundland and about 95% of those camping in the park are from Newfoundland. The majority are senior citizens from Deer Lake, followed by St. John's and then the Lewisport-Bay of Islands area. This has been the pattern for approximately 25-30 years.

Gros Morne National Park offers hiking, backpacking, kayaking and boat tours. Gros Morne National Park has five campgrounds. Berry Hill is a large, centrally-located campground with wooded sites; Shallow Bay is the northernmost campground with fifty campsites; Green Point has 18 campsites with a nearby fishing area; Lomond has 29 campsites and offers outstanding views of Bonne Bay and the Long Range Mountains; Trout River Pond is located in the southern part of the park and has 33 campsites.

Table 3.21. Summary of Park Usage, Sir Richard Squires Memorial Provincial Park, 1990-1996, Visitors by Origin.

Year	Visitors	NFLD %	Other Canada %	U.S. & Foreign %
1987	13,531	77.0	14.0	9.0
1988	29,619	85.0	9.0	6.0
1989	23,906	87.2	8.2	4.6
1990	19,782	85.9	9.4	4.8
1991	13,014	86.2	9.5	4.2
1992	17,423	90.9	6.4	2.7
1993	20,175	88.3	8.2	3.5
1994	15,985	86.8	9.7	3.5
1995	23,403	82.5	11.4	6.1
1996	28,090	88.7	8.0	3.3

Table 3.22. Camper-Nights by Origin.

Year	# of Camper Nights	NFLD %	Other Canada %	U.S. & Foreign %
1987	16,872	94.0	4.0	2.0
1988	20,456	95.0	3.0	2.0
1989	16,260	94.6	3.2	2.2
1990	11,040	96.5	2.1	1.4
1991	9,792	94.6	3.7	1.8
1992	7,111	95.8	3.2	1.0
1993	7,498	95.0	3.0	1.9
1994	5,248	94.4	4.1	1.5
1995	5,630	93.4	4.5	2.1
1996	5,756	94.5	4.5	1.0

3.18 PRESENT AND KNOWN FUTURE RESOURCE USE(S)

In order to ensure that this requirement is met, the following table is included which summarizes the present and "known" future resource use(s) and identifies known data gaps. Where present resource use is described in other sections, they are referenced.

Table 3.23. Present and known future resource uses and known data gaps.

Issue	Description of Resource Use(s)		Data Gaps
	Present	Future	
Marten	Section 3.3 Species is Protected	Will remain protected	Utilization of FMD 16 is not documented
CHRS	Section 3.14 Nominated and Management Plan Submitted	Will become a CHR	None Identified
Navigation	Section 3.15 (addressed through permitting process)	Will continue to be addressed through permitting process	Detailed survey data at each crossing is required for permits.
Fish	Brook trout & Atlantic salmon	Brook Trout & Atlantic salmon	Detailed surveys at crossing locations may be required for permits.
Fish Habitat	Utilized by species present	Utilized by species present	Detailed habitat survey data at each crossing is required for permits.
Fisheries	Under-utilized	Under-utilized	No specific angling data from harvesting areas except for Humber and Main Rivers.
Outfitters	Sectio 3.17 ~18 Outfitters in FMD 16	No outfitter increase likely	None Identified.
Ecotourism	Section 3.17 One outfitter takes kayak/canoe tours down Main River. Some snowmobiling tours and cross country ski tours also provided in FMD 16	Ecotourism increase likely in certain areas such as main stem of Main River	None Identified
Forest Structure	Section 3.2 Old Growth and even-age forest structure	Old Growth and even-age forest	Distribution of old growth forest throughout Newfoundland (Section 3.2)
Migratory Birds	Section 3.4 Some species present	Some species present	Detailed survey data from within the proposed harvesting areas
Other Wildlife	Section 3.5-3.11 some species present	Some species present	Site specific surveys on species present and habitat utilization in harvesting areas

4.0 ENVIRONMENTAL EVALUATION

This Environmental Evaluation provides an analysis of the potential biophysical and socio-economic effects of the Five-Year Plan. Issue scoping has identified potential interactions between the Five-Year Plan and the environment. Potential effects (positive and negative, short and long term, direct and indirect) have been defined qualitatively and quantitatively. Effects predictions are explicitly stated and the theory or rationale upon which they are based is also presented. Environmental effects have been defined and discussed in the following context: significance, nature and magnitude, spatial extent, frequency, probability, duration and level of knowledge.

In addition to identifying the potential effects, this section also identifies the mitigative measures, rehabilitation plans, residual effects, and monitoring associated with the Five-Year Plan. Mitigative measures and their effectiveness proposed to reduce or eliminate negative effects or enhance positive effects are described and discussed. A description of rehabilitation plans intended for the undertaking are also described.

Residual effects, or those which remain after mitigative measures have been implemented, are defined in terms of significance, nature, magnitude, spatial extent, probability, duration and frequency. Irreversible impacts have clearly been identified. In this manner the environmental effects of the undertaking can be determined.

4.1 ASSESSMENT PROCEDURE

Assessment of the potential effects of each phase of the undertaking involved three steps:

- preparation of interaction matrices, i.e. issue scoping (level 1);
- identification and evaluation of potential effects; and
- description of mitigation measures and identification of any predicted residual impacts.

4.1.1 Preparation of Interaction Matrices

Level 1 interaction matrices were prepared for construction (right-of-way and road construction), operation (forest harvesting), and revegetation/silviculture components of the undertaking. A level 1 matrix identifies all possible activities associated with the undertaking, which could interact with any of the identified Valued Environmental Components (VECs). These matrices are only used to identify potential interactions and, therefore do not make assumptions about the potential effects of the interactions.

4.1.2 Identification and Evaluation of Potential Effects

Interactions identified in the Level 1 matrices were evaluated for their potential to cause effects. An interaction was considered to potentially affect a VEC if it could change abundance or distribution, change the prey species or habitats used by species of concern, or affect resource user activities. Impact predictions followed three general steps as outlined below:

- determine whether a potential environmental effect is adverse;
- determine whether an environmental effect is significant (as defined by impact significance criteria discussed in Section 4.1.5); and
- determine whether a significant adverse environmental effect is likely to occur.

The evaluation identifies and takes into account mitigation practices and monitoring that is prescribed by federal and provincial agencies through permitting processes, and regulations. For example; the protection of navigable watercourses is addressed through the permitting requirements of the *Navigable Waters Protection Act* as administered by the Department of Fisheries and Oceans (Canadian Coast Guard). Hence this process and its requirements for permitting ensure that potential effects are mitigated. Also, any potential effects that were deemed impossible or extremely remote were not considered further. In this way, the evaluation could focus on key issues and the more significant environmental concerns identified through issue scoping and public comments.

In addition to describing the nature of the potential effect, the evaluation employs a numerical rating system to indicate the magnitude, duration, geographical extent and frequency of occurrence of expected interactions.

The significance of the effects of the undertaking on each identified VEC was evaluated based on a review of relevant literature, consultation with experts, and professional judgement of the study team. In some instances, impact predictions were affected by limitations on data from within FMD 16. Ratings are therefore provided to indicate the level of confidence associated with each impact prediction.

The impact analyses generally followed the steps:

- consider potential (project-environment) interactions associated with identified issues from the Guidelines or from public comments;
- issues and concerns – a statement of major concerns expressed or hypotheses stated regarding the effects of a project activity on a VEC;
- existing knowledge – a review of current knowledge concerning the sensitivity of each VEC to a project activity; and
- impact prediction – an assessment of potential impacts associated with each project activity rated against significance criteria.

4.1.3 Description of Mitigation Measures and Residual Impacts

Residual impact analysis is conducted on the basis of the undertakings as described in the Five-Year Operating Plan (Volume One) and is based on standard mitigative measures incorporated into the design of the undertaking.

In the Evaluation, mitigation measures are typically identified in a generic way. Details necessary for the implementation of mitigation measures are contained in the Forest Management Planning and Operating Practices (FMPOPs) (Mercer 1998) supplied to all employees and contractors of CBPP. This document outlines government environmental protection guidelines, permitting requirements, and CBPP's operating guidelines for forest management planning and operating practices. This document can be viewed in its entirety at **http:www.cbppl.com/fmpop.htm**. The evaluation is based on the current version of the FMPOP (1998). Updates will be developed and applied as new information is obtained, hence the evaluation is conservative in that it is based on a set of "best" practices that will the subjected to continual improvement.

The system used to rate residual impacts is presented below (Table 4.1). The table is a template that was used to summarize the residual impact assessment for each VEC. The impact between an activity, or a component of the undertaking, and a VEC was rated as significant or not significant. An asterisk below the impact-rating symbol indicates that the significant impact will be indirect (e.g. the undertaking affects a food source or habitat rather than directly affecting the VEC).

Numerical descriptors appear in each cell of the table in order to describe the nature of the interaction and the level of confidence associated with each rating. The ranges of these variables were selected to reflect the scale of the undertaking and the characteristics of the VEC under consideration.

The confidence that the study team has in their impact prediction is rated on a scale of 1-3; a rating of one indicating that existing scientific data on the effects of that type of interaction are insufficient to predict accurately the nature and magnitude of impact. A rating of three indicates that there is a strong basis for the prediction that is made.

Information on the duration and frequency of impacts are also provided in the table. Effects that are expected to occur throughout the life of the project and beyond are assigned a value of four or five. Impacts that occur as discrete events are categorized by their expected frequency of occurrence. Other impacts are characterized by the time period or duration over which the particular interaction will occur.

The total area extent of a residual impact is also indicated in the summary table. When considering the effects of infrequent or accidental events, such as hydrocarbon spills or forest fires, the impact characterization is based on a postulated "worst-case" scenario, unless specific information regarding such events is available.

Table 4.1. Residual Impact Summary Table

	Construction Activites	Operation Activities	Revegetation[a]	Accidental Events [b]
Residual Impacts				
Significance				
Geographical Extent				
Duration of Interaction				
Frequency of Occurrence				
Level of Confidence				
Irreversible Impact				

IRREVERSIBLE IMPACT DESCRIPTION (IF APPLICABLE)
Negative effects only; describe duration (short or long term) and nature (direct or indirect)

MONITORING
Define any required or commitments to monitoring.

KEY

Significant:
SM Major
Sm Moderate

Not Significant:
N-M Minor
N-N Negligible
N/A Not Applicable
* = indirect

Frequency:
1= <1 event per decade
2 = yearly < decade
3 = monthly < yearly
4 = daily < monthly
5 = continuous

Extent:
1 = <1 ha
2 = 1 ha < 1 km^2
3 = 1 km^2 < 10 km^2
4 = 10 km^2 < 100 km^2
5 = $\geq$ 100 km^2

Confidence:
1 = low
2 = moderate
3 = high

Duration:
1 = <1 week
2 = 1week < 1 month
3 = 1 month < 1 year
4 = 1 < 10 years
5 = ≥ 10 years

[a] – refers to any silviculture works and re-growth of forest structure.
[b] – refers to fire and/or fuel spill events.

4.1.4 Cumulative Effects

Past and anticipated forest harvesting operations in Forest Management District 16 are considered in the context of the cumulative effects that the harvesting areas will have in combination with other activities. The identified activities include past, current and anticipated/committed other undertakings (eg. forestry on Crown Lands or on Abitibi Consolidated areas). Cumulative effects have been considered and evaluated in a manner which is compliant with the intent of federal environmental assessment (CEAA) procedures.

The provincial Department of Environment and Labour Environmental Assessment Bulletins were reviewed back to January of 1998 for undertakings registered or released for the FMD 16 area. At the time of this Evaluation, the following undertakings were considered reasonable potential future undertakings in FMD 16:

- forest harvesting activities associated with Abitibi-Consolidated;
- forest harvesting activities associated with the Department of Forest Resources and Agrifoods (i.e. Crown Lands);
- the Newfoundland Integrated Snowmobile Trail (and associated trails); and
- road construction/maintenance as part of normal provincial Department of Works, Services and Transportation operations.

4.1.5 Impact Definitions

The definitions outlined in this section have been applied to all impact predictions in Section 4.4 unless otherwise noted. For any such exceptions, applicable definitions are presented within the text of that particular section.

PROBABILITY OF OCCURRENCE

Any potential effects that were deemed impossible or extremely remote were not considered further in this assessment. Unplanned events (forest fire/oil spill) have been considered with respect to their probability of occurrence based on historical records. For all other potential effects, the probability of occurrence is considered to be high.

ECOLOGICAL BOUNDARY

The ecological boundary for each VEC has been defined with respect to the distribution range of the affected population, species/habitat/ecological unit. Most boundaries include the forest structure present within FMD 16 that is represented within the identified harvesting areas of the Five-Year Plan (*see* maps in Five-Year Plan).

RESIDUAL IMPACT SIGNIFICANCE CRITERIA

The terminology used to describe potential impact should be clear, objective, and easily understood. This section provides criteria for evaluating the significance of environmental effects (negative or positive). Precise definitions for the ranking of potential effects on populations (i.e. wildlife), where applicable, are used in this EPR, as follows:

A **Major (significant)** residual environmental impact is one affecting a whole stock or population of a VEC in such a way as to cause a change in abundance and/or change in distribution beyond which natural recruitment (reproduction and immigration from unaffected areas) would not return that population, or any populations or species dependant upon it, to its former level within several generations.

A **Moderate (significant)** residual environmental impact is one affecting a portion of a population in an area that results in a change in abundance and/or distribution over one or more generations of that portion of the population, or any populations or species dependant upon it, but does not change the integrity of any population as a whole; it may be localized. A change in habitat (including food sources) that produces the same result in populations would be moderate.

A **Minor (not significant)** residual environmental impact is one affecting the population or a specific group of individuals in a localized area and/or over a short period (one generation or less), but not affecting other trophic levels or the integrity of the population itself. As above, equivalent ratings are assigned to indirect (habitat) effects.

A **Negligible (not significant)** residual environmental impact is one affecting the population or a specific group of individuals in a localized area and/or over a short period in such a way as to be similar in effect to small random changes in the population due to natural irregularities, but having no measurable environmental effect on the population as a whole.

POTENTIAL INTERACTIONS

Unless otherwise stated, the potential interaction between the undertaking and the VEC is the alteration of habitat within the applicable identified harvesting area(s).

Construction Activities

Construction activities would be considered those activities associated with road construction and maintenance. These activities would include right-of-way clearing, organic matter removal (grubbing), sub-grade construction, and road surface construction. These activities are considered to be more or less continuous since roads need to be in place (and of suitable condition) for transportation prior to harvesting operations. Therefore, road construction will usually take place the season before the road is required in order to allow it to settle. Maintenance of roads will also be required as needed.

The potential effects will be the loss of forest habitat and noise from machinery. The total length of road within each harvesting area is presented in the Five-year Plan (Volume One). In total, it is estimated that 200km of resource roads will be required throughout the duration of the Five-Year Plan (approximately 43km within the Main River watershed and 157km elsewhere in FMD 16). The total loss of habitat would be approximately 160ha (approximately 8m wide X 200km in length). This corresponds to a total habitat loss of 35ha within the Main River watershed and 125ha elsewhere in FMD 16.

Operation Activities

Operation activities would see the harvesting of 1,000,000m^3 of over-mature softwood over a five-year period (approximately 200,000m^3 per year) from the proposed Five-Year Plan harvesting areas. This would be taken from the approximately ____ha of balsam fir and black spruce present within the proposed harvesting areas that is considered mature enough to harvest (greater than 80 years old). The total volumes estimated from each harvesting block is provided in the Five-Year Operating Plan (Volume One).

Rehabilitation Activities

Once harvesting is completed, re-growth of the trees occurs either with or without silviculture operations. Silvicultural activities, such as planting and thinning will be periodic throughout the district. Re-growth to commercially harvestable stands can take up to sixty years.

IMPACT ANALYSIS

Unless otherwise stated in each applicable impact assessment, the activities that would potentially affect the identified VEC would be (road) construction, (timber harvesting) operation, and/or (vegetation re-growth) rehabilitation activities.

4.2 ISSUES SCOPING

The potential issues/concerns identified in the evaluation are listed as:

- the Main River portion of the **Newfoundland Marten Population**;
- the **Forest Structure** of the Main River area;
- status of Main River to the **Canadian Heritage River System**;
- increased natural **Resource Utilization** resulting from access provided by resource roads;
- **Integrity/Connectivity of Gros Morne National Park**;
- **Watercourse Navigation** of affected stream crossings;
- effects on **Fish, Fish Habitat and Fisheries**;

- potential **Historic Resources**;
- effects on **Tourism and Recreation** (eco-tourism, guiding, recreational hunting and fishing, snowmobiling);
- effects on **Wildlife** (avifauna, big game, furbearers);
- **Water Quality** (particularly drinking water); and
- Cumulative effects of **Forest Harvesting** in District 16.

Thus, for this analysis, there are twelve potential VECs, three of which (Pine Marten, CHRS Status, and Forest Structure) apply only to the proposed Main River harvesting areas.

4.2.1 Interaction Matrices

Interaction matrices for the three identified phases of the undertaking (construction, operation, and revegetation) are presented below in Tables 4.2-4.3.

Table 4.2. Interaction matrix for the construction phase.

Preparation activity	Newfoundland Marten	Forest Structure	CHRS Status	Forest Harvesting (cumulative)	Watercourse Navigation	Resource Utilization	Fish/ Habitat	Park Integrity	Historic Resources	Wildlife	Tourism (outfitting)	Water Quality
Cutting of Right-of-way	X	X	X	X		X	X			X		X
Road Construction	X	X	X	X	X	X	X	X	X	X	X	X
Noise	X					X				X	X	
Dust/sediment						X	X			X		X
Equipment refuelling							X			X		X
Human Presence	X								X	X	X	X

Table 4.3. Interaction matrix for the operation phase.

Operation activity	Newfoundland Marten	Forest Structure	CHRS Status	Forest Harvesting (cumulative)	Watercourse Navigation	Resource Utilization	Fish/ Habitat	Park Integrity	Historic Resources	Wildlife	Tourism (outfitting)	Water Quality
Cutting of Merchantable Wood	X	X	X	X		X	X	X	X	X		X
Trucking of Wood	X					X				X	X	X
New Road Construction	X	X	X	X	X	X	X	X	X	X	X	X
Noise						X				X	X	
Dust/sediment							X			X		X
Equipment refuelling							X			X		X
Human Presence	X			X		X	X	X	X	X	X	X

Table 4.4. Interaction matrix for the revegetation phase.

Revegetation activity	Newfoundland Marten	Forest Structure	CHRS Status	Forest Harvesting (cumulative)	Watercourse Navigation	Resource Utilization	Fish/ Habitat	Park Integrity	Historic Resources	Wildlife	Tourism (outfitting)	Water Quality
Revegetation Surveys									X			
Planting of Seedlings		X		X						X		
Thinning	X	X		X		X				X		
Noise	X					X				X		
Equipment Refuelling							X			X		X
Human Presence	X					X	X	X		X	X	X

4.3 SCREENINGOF VECS

As stated previously, various VECs will, or have been, addressed through appropriate regulatory agencies, applicable permitting requirements, and required mitigation practices:

- Navigable Waters;
- Fish and Fish Habitat;
- CHRS;
- Water Quality;
- Historic Resources; and
- Gros Morne Park Integrity.

In addition, as part of the Adaptive Management Process, the issue of Gros Morne National Park's integrity has been raised. This issue includes the ecological integrity of the Park, the connectivity of the Park to the greater Gros Morne ecosystem, and Park access issues. In dealing with these, a sub-committee (Scientific Panels) has been formed with participation from Corner Brook Pulp and Paper Limited, Parks Canada, Forest Resources and Agrifoods, and scientific advisors (*see* Appendix B).

The following VECs therefore do not require further evaluation as they are dealt with through appropriate regulatory procedures or through ongoing research and Adaptive Management processes. Each is discussed in more detail below to explain why further impact assessment is not required.

4.3.1 Navigable Waters

Five-Year plans and even Annual Work Schedules (AWS) as submitted to DFRA are too broad to pinpoint the exact location of stream crossings and the associated infrastructure. Roads are usually constructed in the summer or fall before the operating season in which they are needed. When a crossing site is determined, a de tailed engineering survey is conducted of the area in order to pinpoint the most suitable location. This survey is also required to determine the ground profile and the expected extreme flows in a given return period (typically 25 years). The survey information is then available for submission of applications for needed permits and approvals to the Provincial Department of Environment (*Department of the Environment Act*), the Federal Department of Fisheries and Oceans (*Fisheries Act*), and the Canadian Coast Guard (*Navigable Waters Protection Act*). Work can proceed <u>only</u> once approvals are granted from all regulatory bodies. Once an application is submitted (or the requirement to do so identified), any required screening to satisfy the Canadian Environmental Assessment Act would be carried out by the appropriate federal agency. When approval of the permit or authorization is given, actual construction work is conducted in accordance with CBPP's Environmental Protection Plan. Therefore, potential effects are predicted to be **negligible (not significant)** as they are dealt with by both provincial and federal departments prior to any activities being approved.

4.3.2 Fish and Fish Habitat

The potential interaction between the undertaking and fish and fish habitat includes any disturbance as a result of instream works, siltation caused by construction/harvesting near watercourses, and potential hydrocarbon spills into the aquatic environment.

CBPP is committed to protecting fish habitat, particularly sensitive areas such as spawning and rearing areas throughout its harvesting areas by taking the following measures:

- application for any required permits (Water Resources Division DOE) and/or authorizations (DFO), and compliance with Terms and Conditions;
- properly planned and constructed roads and stream crossings;
- properly planned and located harvest blocks, landings and proper logging practices; and
- establishment of treed buffers adjacent to watercourses all as described in the FMPOP (Mercer 1998).

Watercourse Crossings

Guidelines are available for proper design, installation and maintenance of stream crossing facilities, and these have been incorporated into CBPP practices.

Harvesting

Since the value of specific riparian zones varies between sites, a single guideline for buffer retention to address all values and situations is not possible or desirable in all cases, however, as part of the Forestry Guidelines for the protection of fish habitat in Newfoundland and Labrador, a minimum 20m buffer must be retained on all waterbodies (Scruton *et al.* 1997). Site specific factors such as season of harvest, slope, soils, timber health (insect and disease damage), and stand age must also be considered. As part of CBPP's planning process, a watercourse classification system has been established in the FMPOP. All watercourses within CBPP timber limits are evaluated and classified using this system and protection buffers are prescribed within the limits of Provincial guidelines. Using this classification system, some rivers and tributaries will be given a larger buffer than the minimum 20m (plus slope factor).

Riparian zones contribute significantly to the biodiversity of the boreal forest and hold a variety of important values. The protection and management of riparian zones is an important component of forest management and planning. Four key resource values associated with riparian zones that require special consideration when developing and implementing forest management plans are:

- Water quality
- Fish Habitat
- Wildlife Habitat
- Aesthetics

A primary management tool employed by CBPP to protect these values is the maintenance of treed buffers adjacent to watercourses. A buffer includes woody vegetation including willow and alder from the high water mark of the watercourse.

Treed buffers serve a variety of functions including:

- Filter strips to capture sediment and organic matter from entering a watercourse from adjacent disturbed land;
- Maintenance of water temperature, in rivers and streams;
- Maintenance of wildlife habitat and wildlife habitat corridors; and
- Maintenance of aesthetic quality.

Accidental Spills

An accidental hydrocarbon spill of sufficient size would have the potential of a serious negative effect upon the fish and fish habitat within and downstream of all activity Areas. Data regarding spills in FMD 16 indicate that no large spill as a result of CBPP operations has been recorded. The frequency of any spill event would therefore be very low. With mitigation measures to prevent the loss of hydrocarbons into the environment (including self-containing fuelling systems, dedicated fuelling locations, spill containment equipment), the potential of a large hydrocarbon spill into the aquatic/wetland environment is extremely low.

Routine monitoring of mitigation structures such as filter fabric placement, culvert installations, buffer zones, fuel containment systems, and fuelling stations is mandatory and is conducted by CBPP and DFRA.

As a result of properly designed stream crossings, adherence to permits and approval processes, compliance with all Provincial and Federal guidelines, and strict monitoring by CBPP and regulatory agencies, the potential effects to fish and fish habitat due to forest harvesting activities are adequately addressed by all agencies involved. Therefore, the potential effect is predicted to be **negligible (not significant)**.

4.3.3 Canadian Heritage River System

Canadian Heritage River Status has recently been granted to the Main River based on the submitted Management Plan to CHRS (Parks and Natural Areas Division 2001). The management Plan defines a protected Waterway Park boundary and a Special Management Area (SMA) surrounding the Waterway Park. The Plan also defines the roles and responsibilities of each stake-holder in the Main River area including CBPP. Restrictions on harvesting locations within the Special Management Area (SMA) and the use of modified harvesting techniques within the watershed ensure that the Park and the River are protected. The reader is referred to the Management Plan for Main River as a Canadian Heritage River for further details on such things as the management framework, goals and objectives, management of heritage values, and management plan implementation.

The Management Plan associated with the Heritage River designation addresses the potential effects of forest harvesting within and near the new park boundaries. The overall goal of the management plan is to maintain the integrity of the Main River Waterway Park. The Park will serve as an outstanding example of a river environment characteristic of the Island of Newfoundland and, in particular, of the Great Northern Peninsula (Parks and Natural Areas 2001). It will be managed in a manner that protects the natural heritage values of the river and facilitates opportunities for water and land based outdoor recreation, adventure, and ecotourism.

The objectives of the management plan are;

- to ensure that the integrity of the natural and recreational heritage values of the Main River, as part of the Canadian Heritage Rivers System, are effectively conserved and protected in perpetuity;
- to ensure that the river's recreational uses are compatible with the protection of the river's natural heritage;
- to encourage development of sustainable recreational opportunities within the Main River watershed using the waterway park as a focus for related activities;
- to provide opportunities for increased natural history appreciation and interpretation of the waterway park and its watershed through adventure and ecotourism.

To ensure that activities which occur in the watershed area, beyond the Provincial Waterway Park and Special Management Area, do not negatively impact upon the integrity of the natural and recreational values for which the river was nominated, a stewardship agreement has been developed (*see* Parks and Natural Areas 2001). Measures to maintain and enhance the marten population in the watershed have also been discussed by all stakeholders. This agreement is the result of extensive consultation and represents a strong commitment by the signatories that are the key stakeholders in resource management and development in the watershed. This includes CBPP.

"With the appropriate management strategies, legislative controls, and clearly defined roles and responsibilities, it has been determined by the Management Plan that timber harvesting activities can occur within the watershed without having negative effects on the natural and recreational values for which the Main River was nominated (Parks and Natural Areas 2001)."

4.3.4 Historic Resources

Guiding Principles of Historic Resources as stated in the draft FMD 16 Strategy Document are:

- ***Any project involving land-use has the potential to adversely impact upon historic resources; therefore, it is important that the Provincial Archaeology Office be involved at the planning stage in order to ensure that mitigative measures to protect historic resources are developed at the earliest possible stage;***
- ***In order that known archaeological sites and potential unknown sites are protected from forestry activities buffer zones will be necessary in some areas whereas archaeological assessments may be required in others. Known archaeological sites must be avoided along***

rivers and ponds, as well as along the coastline where there is potential for archaeological resources to be found.

- ***Occasionally, there are accidental discoveries made in historic resources. In the event that this does happen, activities should cease in this area and contact be made immediately with the Provincial Archaeologist at 729-2462***.

Potential interactions between forest harvesting operations and historic resources involve the disturbance of historic sites due to road construction activities and wood harvesting activities. No identified issues and concerns were raised through the consultation process, however, the issue and concern of the Department of Tourism, Culture, and Recreation would presumably be the loss of culturally significant sites, artifacts, and historic resources before they can be documented and possibly removed for analysis.

The results of the Stage 1 Historic Resources study conducted in 1997 indicates that the interior of FMD 16 does not have a high potential for the discovery of aboriginal remains AGRA 1997e). Background research revealed no trace of aboriginal remains in adjacent, or near-adjacent, areas of Silver Mountain except for sites around Deer Lake, the major waterbody in the region. Remains of aboriginal peoples -- Maritime Archaic, Early Palaeo-Eskimo, Dorset Eskimo and Recent Indian -- abound in coastal areas on both the east and west sides of the Northern Peninsula. Present available evidence suggests that Native groups had little interest in what would have been long distance travel to interior locations, despite the seasonal presence of attractive resources such as caribou (AGRA 1997e). A likely explanation for this apparent lack of interest in the interior is that the same resources that were available there were also available in coastal areas much closer to base camps and the remainder of the Native peoples' seasonal grounds. Travel through the area, using the Humber River, is, however, still a possibility.
The Guiding Principles of Sustainable Forest Management with respect to Historic Resources have been agreed to by all stake-holders within FMD 16 through the strategic planning sessions which have been ongoing through the last year. These principles have been reflected in CBPP's Standard Operating Practices since 1998 (Mercer 1998). In the FMPOP, the following practices are outlined and followed in such a manner that historic resource values will be respected:

- The Company will co-operate with the Historic Resources Division in protecting known historical resources, with suitable mitigative measures identified on site-specific work permits.
- The *Historical Resources Act* dictates that when an archaeological site or artifact is found, all forestry activity will temporarily cease and the discovery reported to the Historical Resources Division (709) 729-2462. The Historic Resources Division will respond immediately with appropriate mitigation measures within 7 days as agreed upon by the Division and the operator. Forestry activity can then resume.
- The Historic Resources Division will be contacted during the preparation of Five Year Operating Plans to determine the location of historic resources and appropriate mitigation measures will be designed and may include the use of buffers, modified operations or surveys. Mitigative measures will be specific to the requirements of the particular site and

may further include the selection of harvest blocks, equipment specifications for the various forest management activities and restricting harvest to certain time periods.

Monitoring

As stated above, communication with the Historic Resources Division has been conducted during the preparation of this Five-Year Plan. In addition, any accidental discoveries made of historical resources will be reported immediately to the Provincial Archaeologists.

Due to the unlikely event of historic resources being located within the interior of the Northern Peninsula, and the fact that many recorded sites are located adjacent to the shores of rivers and waterbodies (where forest harvesting activities do not occur and buffers are required as part of the protection of fish habitat), a predicted **minor (not significant)** impact, is expected to occur as a part of the proposed forest harvesting plan.

4.3.5 Connectivity/Integrity of Gros Morne National Park

Potential interaction between the proposed undertaking and connectivity within the area include construction, operational, and rehabilitation activities. Removal of habitat can result in an increase of fragmentation, possibly decreasing integrity of the area. As stated previously, connectivity deals with three issues surrounding Gros Morne National Park; connectivity, integrity, and access. While many of the concerns deal directly with specific VECs and populations (eg. Pine Marten), connectivity and integrity will play an important role in maintaining the Park as a viable, "non-isolated" refuge for species found there.

The Connectivity Working Group classifies Newfoundland Pine Marten, lynx, caribou and passerine birds as four focus species that should be studied in more detail. Knowledge of their habitat requirements will aid in determining forest management objectives and provide habitat for other populations on the landscape level.

The primary challenge for national parks in maintaining ecological integrity is the fact that most parks, including Gros Morne, are part of larger ecosystems, and a recognition has evolved that the areas set aside may not be large enough to protect the full integrity of those ecosystems (Ecosystem Science Section 2001). With increased commercial harvesting within areas adjacent to the Park, connectivity has become an issue. Expansion of forest access roads, loss of late successional forest habitat, and fragmentation of forested habitat are all concerns of GMNP.

Road networking has both direct and indirect effects on forested landscapes. Direct effects include a conversion of habitat and fragmentation of the landbase. How these changes will affect resident species within the area is a concern that is presently being examined by the Connectivity Working Committee. Indirect effects of roads include improved public access. Areas that were previously inaccessible could become more accessible, thereby creating concerns of hunting, poaching, and general disruption of areas that had been relatively inaccessible.

From a socio-economic perspective, increased road networks can also take away the "wilderness experience" that outfitters would like to preserve for their clients. Increased woods roads in the area would also likely increase access to the region by both recreational and tourist snowmobilers.

Maps produced by CBPP have outlined specific features of FMD 16, such as forest types, water bodies, and protected areas (Volume One). These maps display both the barren and productive land between GMNP and FMD 16, providing a visual estimate on what currently exists in terms of forested connectivity. The Main River watershed, which is a protected area, provides the largest vegetative corridor between GMNP and FMD 16.

CBPP, GMNP, Newfoundland Department of Forests and Agrifoods, and Natural Resources Canada have formed a Scientific Working Group with the intent of ensuring landscape connectivity in the Greater Gros Morne Ecosystem. The mandate of the group is to contribute to maintaining the ecological integrity of Gros Morne National Park by:

- developing scientifically based solutions to maintaining connectivity for agreed upon indicator species between Gros Morne National Park and the larger landscape; and
- identifying the habitat needs and sensitivity to disturbance of these indicator species.

The Working Group has begun discussions on the issues and have begun a literature review of connectivity/integrity research throughout the world which may be applicable to the current situation. The group intends to meet on a regular basis in order to ensure that continued progress is maintained on this issue.

With the above considerations and practices in place, the predicted effect of wood harvesting operations in FMD 16 is predicted to be **negligible and not significant**.

4.3.6 Water Quality

With the increased awareness of potential water quality issues arising from improper treatment, distribution and storage of water for community use, comes an increased awareness of activities within Protected Water Supply Areas. CBPP has a long-standing commitment to proper operations within Municipal Water supplies (*see* Volume One and Mercer 1998). The primary function of a protected water supply area is to provide the public with an adequate quantity of safe and good quality water on a permanent basis, to meet its present and future demands. Any other activity within a water supply area is considered secondary and if permitted, must be strictly regulated and monitored to ensure that the water supply integrity is not threatened and the quality of the water is not impaired. Human activity on the land has the potential to alter water quality and water quantity. Within FMD 16, forest harvesting is the predominant activity in the area along with an extensive network of associated access roads. These activities and roads, on occasion, enter Protected Water Supplies. In Newfoundland, forestry operations are permitted in protected water supply areas on a limited and controlled basis provided the proposed operations have no, or minimal, water quality impairment potential.

In FMD 16, there are a total of eight communities within the District that have water supplied. Five of these supplies are protected under the Province's Protected Water Supply Program (Deer Lake, Hampden, Beaches (Hampden), Pollard's Point, and Sop's Arm) and the remaining three are categorized as unprotected although still monitored by the program.

Within FMD 16, there are three permanent non-drinking water monitoring stations located at Main River, Upper Humber, and Humber Canal along with five drinking water stations in each of the major communities within the District that have designated water supplies. All stations are examined for a standard suite of parameters including physical, nutrients, major ions and metals. Drinking water samples are also analyzed for Trihalomethanes (THM). Many of the stations have been established since the mid 1980s and are sampled either on a monthly, bimonthly, or quarterly basis. In general, all parameters measured meet the Canadian Drinking Water Quality Guidelines with the exception of aluminium and iron, which can naturally exceed these limits in Newfoundland. THM results can exceed recommended limits at times however their formation is more related to the chlorination process than land use. To date, effects from land use activities have not been detectable for any parameters being measured (DFRA Draft 2001).

In this current Plan, no protected water supplies are within or near any proposed harvest blocks. The boundary of the Deer Lake water supply area is not within a harvest area however, the water supply does come from the Grand Lake system which has a number of harvest blocks around it (eg. Kitty's Brook, Hinds Lake, Junction Brook, White Spruce Brook, and Canoe Pond). These blocks are sufficiently far away from the Deer Lake water supply area so that no negative effects can be expected due to the cumulative effect of harvesting. With the above considerations and practices in place, the predicted cumulative effect of wood harvesting operations in FMD 16 is predicted to be **minor (not significant)**.

4.4 ENVIRONMENTAL EVALUATION OF SELECTED VECS

4.4.1 Forest Structure

The potential effects of the undertaking on the Gap Replacement forest structure only applies to a relatively small proportion of FMD 16, i.e. the Main River watershed.

4.4.1.1 Existing Conditions

See Section 3.2 for a description of the existing old growth forest structure.

4.4.1.2 Ecological Boundaries

See Section 3.2 for a description of the old growth forest structure boundary. The harvesting blocks within Main River fall within the regional distribution of old growth forest structure.

The boundary of potential impact is within the extent of the proposed harvesting blocks within the Main River watershed. The duration of disturbance within these blocks is considered extended; i.e., until forest regeneration is completed within the harvest block boundaries.

4.4.1.3 Impact Significance Criteria

The following criteria have been applied to this issue.

A **major (significant) residual environmental effect** is one affecting all of a land type (or plant community) in the area in such a way as to cause a change in abundance and/or change in distribution of species comprising this community. This change would be such that natural recruitment (reproduction and immigration from unaffected areas) would not return the system, to its former level of diversity within several generations.

A **moderate (significant) residual environmental effect** is one affecting a portion of a land type in the area that results in a change in abundance and/or distribution over one or more generations of that portion of the land type dependent upon it, but does not change the integrity of the area as a whole; it maybe localized.

A **minor (not significant) residual environmental effect** is one affecting a specific example of a land type community in the area at a localized level and/or over a short period (one generation or less), but not affecting other trophic levels or the integrity of the vegetation community itself.

A **negligible (not significant) residual environmental effect** is one affecting the land type in the area at a localized level and/or over a short period in such a way as to be similar in effect to small random changes due to natural irregularities, but having no measurable effect on the land type as a whole.

4.4.1.4 Potential Interactions

Potential interaction between the proposed undertaking and the forest structure is the harvesting of softwood (Black Spruce and Balsam Fir) during road construction and harvesting operations within the proposed harvest blocks. Other potential interactions would be soil or substrate disturbance that would affect the future regeneration potential of the area.

4.4.1.5 Identified Issues and Concerns

The issue raised throughout this assessment is the contention that harvesting in the proposed Main River harvesting blocks will "destroy the only remaining old growth forest in

Newfoundland". The concern is that this harvesting would result in the permanent loss of this forest structure and its associated ecosystem components such as avifauna, raptors, furbearers, and root-fungi such as ectomycorrhizal (EM) fungi associated with conifer roots.

4.4.1.6 Existing Knowledge

Plant communities play a critical role in the functioning of terrestrial and aquatic ecosystems. Plant communities in the terrestrial environment provide food and shelter for wildlife and assist in controlling erosion and drainage. Some plant communities are also valuable because they occur infrequently and therefore a loss may threaten the viability of the population. In that regard, the old growth forest structure present along the eastern side of the Northern Peninsula differs from the typical large-scale disturbance forest structure found more generally throughout Insular Newfoundland (*see* Section 3.2).

The dominant forest-type in the Upper Humber/Main River area is identified as *Pleurozium*-balsam fir (Northland Associates 1986). This is a stable forest-type that re-develops into the same type after logging (Northland Associates 1986; Meades and Moore 1994), however, fire would likely change this type into a black spruce-feathermoss dominated forest-type. Regeneration under the *Pleurozium*-balsam fir stand type is considered adequate throughout the Upper Humber/Main River area (Meades and Moores 1994). To date, natural re-growth in the southern portion of the Main River area which has been harvested is adequate and seeding has not been necessary (AGRA 2000).

An estimate of the delineation of old growth forest on the Northern Peninsula is presented in Section 3.2. The estimated extent of the contiguous old growth on the Island has been determined to be much larger than the Main River watershed. This large area combined with the no harvest area of Main River provides ample opportunity to protect a representative area of this forest-type. With this extent in mind, approximately 50km^2 are located within the potential harvest block boundaries of the Special Management Areas in the Main River watershed. This represents a minimal volume of all old growth estimated to be in the watershed and on the Northern Peninsula.

4.4.1.7 Mitigation

Standard and approved mitigation techniques will be employed in order to reduce effects. These mitigation techniques are outlined in the FMPOP (Mercer 1988). These mitigation techniques also address all applicable regulatory and permit requirements.

Unmerchantable softwood, hardwood stands, and all scrub within the harvest blocks will not be harvested. In addition, leave-zones (buffers) of forest will be left around all watercourses >1m wide. These buffers are a minimum of 20m in width.

Modified forest harvesting methods (non-clearcut) will also be employed within any harvest block area in the Main River watershed so that regeneration of pioneer species (i.e. advanced regeneration) is promoted and encouraged, thus not deviating significantly from the old growth regeneration dynamic. A combination of selctive harvesting and variable retention techniques will be employed and monitored for regeneration characteristics.

4.4.1.8 Cumulative

The forest structure along the eastern side of the Northern Peninsula from Main River up to the southern shore of Hare Bay inclusive has been identified as old growth with a gap replacement dynamic (*see* Section 3.2). As a result, the practice of clearcutting has been considered inconsistent with the forest disturbance and regeneration dynamics typical of the area. Therefore, CBPP has made a commitment to utilize "non- techniques which are considered more applicable harvesting strategies in the Main River watershed harvest areas outlined in the Five-Year Plan.

In addition, the majority of the old growth forest is within Provincial control (Crown Lands). As part of the Province's recently announced Natural Areas Strategy, a candidate area, in an area north of Main River will be identified for inclusion in this program. This area will provide a good representative example of this special gap replacement forest-type within a pristine watershed and will be recommended for long term protection as an ecological reserve within the Province's Proposed Natural Areas System Plan (Parks and Natural Areas 2001).

While unencumbered cumulative clearcut harvesting could potentially affect the contiguous old growth forest of the Island, the recent concern and attention has ensured that practices are conducted that do not jeopardize this forest dynamic. Also, little other development has been registered in the last four years in the area leaving much of the eastern side of the Northern Peninsula undisturbed. With the above considerations and practices in place, the predicted cumulative effect of wood harvesting operations in FMD 16 is predicted to be **minor (not significant)**.

4.4.1.9 Residual Impact Analysis

Table 4.5 summarizes the residual impact predictions of the proposed undertaking on the old growth forest structure on the Northern Peninsula. Ratings are based on activities as explained in Section 4.1.5.

Construction activities include road construction and maintenance. It is estimated that $0.35km^2$ of forested habitat will be disrupted by road construction within the Main River watershed (based on approximately 43km of resource roads to be built at an average width of 8m). If these roads were maintained as resource roads, this would represent a long-term loss of forested habitat even though it is not considered a significant loss of habitat, nor to cause fragmentation. These roads are also considered to be present for at least as long as the Five-Year Plan (i.e. Duration value of 4) and have a continuous frequency of occurrence (i.e. frequency of occurrence value of 5) as roads are more or less permanent if maintained.

Operational and revegetation activities are related, in that they have similar geographic areas (i.e. harvested areas will be those that revegetate). This results in similar ratings of geographical extent for both activities. Revegetation activities are periodic and are shorter in duration (planting and thinning) compared to operational activities, resulting in lower criteria ratings with respect to the existing old growth forest structure.

A **minor (not significant) residual environmental impact** is predicted upon the old growth forest structure within the harvest blocks. That is, the effect is expected to affect a specific example of a land type community in the area at a localized level and/or over a short period (one generation or less), but not affecting other trophic levels or the integrity of the vegetation community itself.

4.4.1.10 Accidental Events

A large-scale forest fire would have the potential to create a significant impact on the forest structure in the Main River area. The DFRA fire summary data for FMD 16 over the last ten years indicates that forest fires are very infrequent (approximately 0.17/month) and of a small size (approximately 7ha in size) and are therefore considered to be of very low frequency, duration and extent (Table 4.6). The Residual Impact Summary addresses an average fire based on the information provided by DFRA. With the current mitigation techniques utilized by CBPP during harvesting activities, forest fires are unlikely.

A rating of 2 (i.e. moderate) has been given to Level of Confidence of Accidental Events in Table 4.5. As with any accidental event, total confidence cannot be assured.

4.4.1.11 Monitoring

Revegetation surveys are conducted as a routine part of site follow-up monitoring and silviculture analysis. Surveys will identify areas as having sufficient natural revegetation or requiring supplemented planting. If planting is required, natural species will be used. To date, the revegetation surveys conducted on the previously harvested area in FMD 16 in the southern portion of the Main River area indicates sufficient natural revegetation (G. VanDusen pers. comm.). Additional surveys of the modified harvesting techniques will also be monitored to determine the actual regeneration pattern associated with them.

Table 4.5 Residual Impact Summary of the proposed undertaking upon the forest structure of the area.

Forest Structure	Construction Activities	Operation Activities	Revegetation[a]	Accidental Events[b]
Residual Impacts				
Significance	N-M	N-M	N-M	N-N
Geographical Extent	3	4	4	2
Duration of Interaction	4	4	3	1
Frequency of Occurrence	5	5	3	2
Level of Confidence	2	2	1	2
Irreversible Impacts	Yes	No	No	No

Irreversible Impacts

If roads are left and/or maintained as public access and not revegetated, the 0.35km^2 of road surface will be a permanent loss of forested habitat (long term; direct).

Monitoring

Revegetation surveys are conducted as a routine part of site follow-up monitoring and silviculture analysis. Surveys will identify areas as having sufficient natural revegetation or requiring supplemented planting. If planting is required, natural species will be used. Additional surveys of the modified harvesting techniques will also be monitored to determine the actual regeneration pattern associated with them.

KEY

Significant:
SM Major
Sm Moderate

Not Significant
N-M Minor
N-N Negligible
N/A Not Applicable
* = indirect

Frequency:
1= <1 event per decade
2 = yearly < decade
3 = monthly < yearly
4 = daily < monthly
5 = continuous

Extent:
1 = <1 ha
2 = 1 ha < 1 km^2
3 = 1 km^2 < 10 km^2
4 = 10 km^2 < 100 km^2
5 = $\geq$ 100 km^2

Confidence:
1 = low
2 = moderate
3 = high

Duration:
1 = <1 week
2 = 1week < 1 month
3 = 1 month < 1 year
4 = 1 < 10 years
5 = ≥ 10 years

[a] - refers to any silviculture works and re-growth of forest structure.
[b] – refers to a fire event.

Table 4.6. DFRA Fire data summary for FMD 16 for the last eleven seasons (in hectares).

Year	Final Size	No. of Fires	Mature Timber	Regen / Immature Timber	Cut-over	Non-productive
1990	0	1	0	0	0	0
1991	53	1	0	0	0	53
1992	6	3	0	0	3	3
1993	0	1	0	0	0	0
1994	2	4	0	0	1	0
1995	0	0	0	0	0	0
1996	0	6	0	0	0	0
1997	4	3	0	3	1	0
1998	0	1	0	0	0	0
1999	1	3	0	0	0	1
2000	n/a	0	0	0	0	0
Average	6.0	2.1	0	0.3	0.5	5.2
Total	66	23	0	3	5	57

4.4.2 Newfoundland Pine Marten

4.4.2.1 Existing Conditions

See Section 3.3 for a description of existing conditions for the Newfoundland Pine Marten in FMD 16.

4.4.2.2 Ecological Boundaries

Newfoundland Pine Marten occur within the boundary of FMD 16. In particular, there is considered to be a viable population within the Main River area. In order to protect the population of Pine Marten in the area, a no-trapping zone was identified and closed to all dry-land trapping (AGRA 2000).

4.4.2.3 Impact Significance Criteria

Section 4.1.5 describes the criteria used to assess the residual impacts of the undertaking upon this VEC.

4.4.2.4 Potential Interactions

In addition to the potential interaction identified in Section 4.1.5, other potential interactions would be the connectivity issue of potential Marten movement between the surrounding landscape into Gros Morne National Park.

4.4.2.5 Identified Issues and Concerns

Harvesting within FMD 16 will alter the present existing environment. Guidelines have been recommended to minimize these effects (*see* Section 2.2.4). Major issues and concerns include: protecting the existing marten population, maintaining proper connectivity, protection of the present forest structure, and maintaining proper habitat for the Newfoundland marten.

4.4.2.6 Existing Knowledge

Life History

Studies on Newfoundland Pine Marten have begun to piece together the life history of these animals in Insular Newfoundland.

Bissonette *et al.* (1988) found that female Marten in Newfoundland probably breed successfully during their third summer. Kits are usually born in March-April (O'Driscoll 1994) and litters usually contain 2-3 kits (Bissonnette *et al*. 1988). Each Marten maintains a territory that it defends from other Marten. The size can vary, however, the average home range size of an adult male Marten in Little Grand Lake was $16km^2$ (JWEL 1998). Females usually have a home range approximately two-thirds that of a male ($11km^2$). Territories of same-sex Marten do not generally overlap.

If no room exists within a kit's natal home range to establish a territory, it will become transient and disperse to a new area in an attempt to establish one. Transient Marten that were dispersing from the Little Grand Lake study area were generally less than two years old (dispersing was defined as a permanent move from the animals natal home range; Bissonette *et al.* 1988). It appeared that kits were most likely to be transients and yearlings were more likely to remain and colonize an area. One of 16 kits studied managed to establish a permanent home range within the study area (a female) while at least five of ten yearlings established permanent home ranges (Bissonette *et al.* 1988). Most dispersion occurred from September through December. Long distance dispersal was documented for five animals in the study. The linear distances traveled were between 24 and 40 km, however one had to traverse around Grand Lake to get to its new range and therefore probably traveled much farther than the linear distance suggests.

Throughout most of the study, adults and yearlings were found to be in a 1:1 ratio and sex ratios were not significantly different from 1:1 for all age classes.

Effects of Forest Harvesting

As part of the Little Grand Lake Environmental Impact Statement submitted in 1990, Corner Brook Pulp and Paper cooperated in an extensive study on the effects of forest harvesting on Marten and small mammals in Western Newfoundland (Bissonette *et al*. 1988). This work was conducted in the Grand Lake-Little Grand Lake area by the Utah Cooperative Fish and Wildlife Research Unit, the Department of Fisheries and Wildlife, Utah State University, and the

Newfoundland and Labrador Wildlife Division. Marten were tracked using radio-telemetry before, during, and after logging activities in order to determine its effects. In addition, small mammal trapping in uncut and harvested areas was conducted to determine the effect of harvesting on the food-base of marten. Animals trapped were principally meadow vole (*Microtus pennsylvanicus*) and masked shrew (*Sorex cinereus*).

The study determined that Marten use of clear-cuts was limited; kits were located in clear-cuts 11.5% of the time and older Marten 2.2% of the time. Another study has also indicated that Marten of all ages avoided clear-cuts during logging operations and for the first nine months afterward (Fredrickson and Bissonette 1990). Only three of the ten Marten provided sufficient radio signals to compare pre- and post-logging home range size (Bissonette *et al*. 1988). One experimental animal (located within the cut area before it was harvested) relocated from one part of the experimental zone to another before logging activities began; the new home range was 25% smaller than the old. Two control animals (located in the uncut control area before harvesting) showed an increase of 100 and a decrease of 13 percent respectively in home range size. The increased home range was primarily harvested forest within the experimental area.

Marten deaths during the study were attributable to at least four factors; disease, predation, handling, and accidental trapping. The number of Marten succumbing to each factor was 10, 3, 2, and 1 respectively.

Trapping of food-prey indicated that shrew numbers tended to remain unchanged between the old-growth (control) and harvested (experimental) areas until cut-overs became approximately 13 years of age. At that time, shrews became 3-7 times more abundant in the cut-over areas. In addition, meadow voles showed a similar pattern, whereby the old-growth and harvested areas had similar populations. It was noted that during the study, a significant drop in the overall food-prey density occurred over all habitat types sampled. Meadow vole populations apparently crashed in the Spring of 1987 and shrew populations did not show the typical population trend of an increase during the Summer and decrease in Winter. It appeared that something happened during the Summer of 1986 to prevent shrews from increasing.

The National Recovery Plan for the Newfoundland Pine Marten (Forsey *et al*. 1995) has identified the need for background studies to fill information gaps and gather necessary data pertinent to recovery efforts. Among the goals is the need to determine population status and distribution of Pine Marten and to conduct research into the suitability of older second-growth forests for Pine Marten.

One of the objectives of the Western Newfoundland Model Forest (WNMF) was to develop a Decision Support System (DSS), which would assist resource managers in developing forest harvesting plans that also consider other resources such as wildlife (JWEL 1998). The WNMF developed habitat suitability indexes (HSI) for a number of species including Marten. HSI rank habitat preference between 0.0-1.0; a 0.0 being unsuitable and 1.0 being most suitable.

Using the large amount of Marten data that has been collected in the Little Grand Lake area, HSI were developed for various stand types and age-classes used in the forest inventory database. The indexes were developed for stands in terms of food value and cover value for Marten. Table 4.7 shows the HSI values given. DFRA has determined that habitat types having less than a 0.5 HSI are not considered suitable habitat (JWEL 1998). Modern research and discussions between the National Recovery Team has changed past attitudes of Pine Marten habitat. This has led to some variability of the following table as forest structure, not age, is now considered a more important value for Pine marten.

Table 4.7. Pine Marten HSI ratings for forest stand and age classification for food and cover value (reproduced from JWEL 1998). Cover ratings are in parentheses. The shaded areas represents what would be considered suitable habitat.

Stand Age	Working Group (Forest Type)		
	Balsam Fir/ Black Spruce	**Softwood Dominated Stands**	**Hardwood Dominated Stands**
81+	1.0 (1.0)	1.0 (0.8)	1.0 (0.8)
60-80	0.8 (1.0)	0.8 (0.8)	0.8 (0.8)
40-60	0.5 (0.8)	0.6 (0.4)	0.6 (0.4)
20-40	0.3 (0.2)	0.4 (0.1)	0.4 (0.1)
0-20	0.2 (0.0)	0.2 (0.0)	0.2 (0.0)

Sturtevant *et al*. (1996) provides stand level management prescriptions that will maintain proper habitat for resident marten, as they are likely to respond to the structure available within a forest, rather than the actual stand age. Marten require overhead cover as an escape from predators, as a source of thermal cover, and for prey availability. Coarse woody debris is also required as it provides a source of cover for marten and for their prey during the winter months. Sturtevant *et al*. (1996) suggests applying silvicultural techniques to younger forest stands, which will mimic that of older more suitable forest structure. Such recommendations include pre-commercially thinning stands to 1,100 stems/ha and providing for coarse woody debris. As a stand develops it will naturally thin and provide CWD. Manipulation of the stand at an earlier age can produce these results at a faster rate than would naturally occur. See Section 2.2.4 for a more detailed description of harvesting techniques and their implications on the forest structure.

Snyder and Bissonette (1987) concluded, in a study conducted in an area adjacent to Little Grand Lake, that marten seldom used clearcuttings and used residual stands greater than 25ha and undisturbed forests in proportion to their occurrence, but the use of smaller residual stands less than 25ha was greater than expected. Ninety percent of the captures were in forested areas, with 9% being in residual stands less than 15ha, 35% in residuals of 15–34.9ha , and 46% in larger stands. Ten percent of marten captures in the summer and fall were in clearcuts less than 15 years old and characterized by balsam fir regeneration less than 2m in height. Marten were not captured in older clearcuts 16 to 23 years after a harvest.

As taken from the Recovery Teams position on marten conservation, the classification of forest for Newfoundland marten within the Main River is no longer an age-based classification. It is now a height-based classification, including some softwood scrub as suitable marten habitat.

4.4.2.7 Current Main River Research

Gros Morne National Park is presently conducting an experiment on the status of Newfoundland Marten in the greater Gros Morne area. Objectives of this study are to: determine the distribution of Marten, determine the minimum abundance of Marten in areas where they are known to occur, and to determine the minimum abundance of Marten in potential flow (i.e. corridor) or proximate areas between Gros Morne National Park and the surrounding landscape. Marten were found to occur in the Adies Pond, White's River, Big Barren and Upper Humber areas of the greater Gros Morne landscape. In total, two marten were trapped, five bait stations were visited and tracks were also observed at seven other locations (Gerrow 2001).

CBPP and the Newfoundland Wildlife Division are also working together on a five year modified harvesting study in the Main River area, whereby the new harvesting techniques will be monitored in an effort to continue the research and study of harvesting effects on the Newfoundland Marten.

4.4.2.8 Mitigation/Marten Protection

Since mid-December 1998, the DFRA and CBPP have met on a regular basis to explore the incorporation of habitat requirements for the maintenance and recovery of the Newfoundland Marten within the context of CBPP's annual operating plans. To facilitate the process, CBPP and District Managers have identified areas that would not be harvested in the near future, if at all. These areas were evaluated in terms of the amount of forest that exists within various age-classes, the quantity of preferred Marten habitat, as well as the spatial relationships between these. Short-term Marten population and habitat goals for FMD 14, 15, and 16 have been identified and are used to help determine if habitat objectives are being met.

The short-term population goal for Districts 14, 15, and 16 is a minimum of 260 adult or territorial Marten. The long-term population goal is a minimum of 400 Marten. CBPP and DFRA have recently reached an agreement on habitat protection that will maintain the short-term Marten population goal, consisting of three separate populations each with a minimum viable population of 50 animals. The locations of the three populations are:

- the area north of the Humber River up to the northern boundary of FMD 16 including Gros Morne Park (70-80 Marten);
- the Little Grand Lake Reserve area (130+ Marten); and
- the western portion of FMD 15 and FMD 14 (50 Marten).

Meetings between CBPP, DFRA, DTR, as well as the Recovery Team, have evolved a set of marten habitat management guidelines. They are as follows: minimum patch sizes of 20 ha, a basal area requirement of 40 m^3/ha (18m^2/ha), and that 50 % of the area is to be continuous. The basic unit of evaluation will be 40 km^2, with forest types being considered if they meet the following requirements of (i) 70% or greater of that unit must be suitable habitat, (ii) 40% or greater of the unit should have trees $\geq$10m in height, and (iii) the remaining portion of the 70% unit should have trees between 6 and 10m in height.

4.4.2.9 Residual Impact Analysis

Table 4.8 summarizes the residual impact prediction of the proposed undertaking on the Pine Marten population in the Main River area and on the current Newfoundland Marten studies in the area. With the agreements between CBPP and DFRA regarding the protected habitat for Newfoundland Marten populations and the utilization of the new guidelines in the Main River watershed, **a minor (not significant) residual environmental effect is predicted**.

Ratings given in the following impact summary tables are based on activities as explained in Section 4.1.5.

Construction activities include road construction and maintenance. It is estimated that 0.35km^2 of forested habitat will be disrupted by road construction within the Main River watershed (assuming approximately 43km of resource roads are to be built at an average width of 8m). If these roads were maintained as resource roads, this would represent a long-term loss of forested habitat even though it is not considered a significant loss of habitat nor to cause fragmentation. These roads are also considered to be present for at least as long as the Five-Year Plan (i.e. Duration value of 4) and have a continuous frequency of occurrence (i.e. frequency of occurrence value of 5) as roads are more or less permanent if maintained.

Operational and revegetation activities are related, in that they have similar geographic areas (i.e. harvested areas will be those that revegetate). This results in similar ratings of geographical extent for both activities. Revegetation activities are periodic and are shorter in duration (planting and thinning) compared to operational activities, resulting in lower criteria ratings with respect to Newfoundland marten.

4.4.2.10 Accidental Events

A large-scale forest fire would have the potential to create a significant impact on the Newfoundland marten habitat in the Main River area. As shown earlier, the DFRA fire summary data for FMD 16 over the last ten years indicates that forest fires are very infrequent (approximately 0.17/month) and of a small average size (approximately 7ha in size) and are therefore considered to be of very low frequency, duration and extent. The Residual Impact Summary considers an "average" fire based on the information provided by DFRA. With the current mitigation techniques utilized by CBPP during harvesting activities, forest fires are considered to be highly unlikely.

A rating of 2 (i.e. moderate) has been given to the Level of Confidence of Accidental Events in Table 4.8. As with any accidental event, total confidence cannot be ensured.

4.4.2.11 Monitoring

There is currently an ongoing study being conducted within the Greater Gros Morne area, as well as the 5 year modified harvesting study being conducted by the Newfoundland Wildlife Division and CBPP in the Main River area.

Table 4.8. Residual Impact Summary of the proposed undertaking upon the Pine Marten population and current study.

Pine Marten	Construction Activities	Operation Activities	Revegetation[a]	Accidental Events[b]
Residual Impacts				
Significance	N-M*	N-M*	N-M*	N
Geographical Extent	3	4	4	2
Duration of Interaction	4	4	3	1
Frequency of Occurrence	5	5	3	2
Level of Confidence	3	3	3	2
Irreversible Impact	Yes	No	No	No

Irreversible Impact

If roads are left and/or maintained as public access and not revegetated, the 0.35km^2 road surface will be a permanent loss of forested habitat within the Main River watershed (long-term; indirect).

Monitoring

There is currently an ongoing study being conducted within the Greater Gros Morne area, as well as the 5 year modified harvesting study being conducted by the Newfoundland Wildlife Division and CBPP in the Main River area.

KEY

Significant:
SM Major
Sm Moderate

Not Significant
N-M Minor
N-N Negligible
N/A Not Applicable
* = indirect

Frequency:
1= <1 event per decade
2 = yearly < decade
3 = monthly < yearly
4 = daily < monthly
5 = continuous

Extent:
1 = <1 ha
2 = 1 ha < 1 km^2
3 = 1 km^2 < 10 km^2
4 = 10 km^2 < 100 km^2
5 = $\geq$ 100 km^2

Confidence:
1 = low
2 = moderate
3 = high

Duration:
1 = <1 week
2 = 1week < 1 month
3 = 1 month < 1 year
4 = 1 < 10 years
5 = ≥ 10 years

[a] – refers to any silviculture works and re-growth of forest structure.
[b] – refers to a fire event.

4.4.3 Wildlife

Wildlife resources include:

- Migratory birds
- Raptors
- Caribou
- Moose
- Upland game
- Furbearers
- Non-consumptive avifauna.

4.4.3.1 Existing Conditions

See Sections 3.4-3.11 for a description of the existing wildlife conditions and species which utilize areas in FMD 16.

4.4.3.2 Ecological Boundaries

Particular boundaries for specific wildlife resources are listed below, if different than that identified in Section 4.1.5.

Waterfowl

Waterfowl habitat within FMD 16 is considered to be the marshes, ponds, lakes and flowing water. Activities required for the undertaking will not take place within waterfowl habitat areas, with the exception of possible road crossings over flowing water.

The Main River corridor not only provides an exceptional waterway for waterfowl, it also offers riparian meadowlands, peatland and wet fir forests, which are ideal habitat for such waterfowl as Canada Geese, Black Ducks, Green and Blue winged Teal, Red breasted Mergansers and Common goldeneye.

The Upper Humber Wetlands Complex contains valuable breeding, nesting, brood rearing and/or staging habitat for a variety of waterfowl species. Birchy Basin was found to be the most productive waterfowl area, followed by Neds Steady, Gales Bottom and the Adies Pond area (DFRA Draft 2001).

4.4.3.3 Impact Significance Criteria

See Section 4.1.5.

4.4.3.4 Potential interactions

See Section 4.1.5. In addition to those outlined in Section 4.1.5, specific potential interactions related to each wildlife resource are listed below.

Migratory Birds

Potential interactions include the interruption and possible decrease in breeding and brood success as a result of excessive noise levels and/or an accidental hydrocarbon spill into the aquatic environment. Increased hunting/poaching pressure due to increased access may also occur.

Caribou

Potential interaction between the undertaking and the Upper Humber and Northern Peninsula caribou herds is the disruption of migration routes between summer and winter grounds due to noise and/or human presence.

Other Wildlife

Other wildlife includes raptors, moose, black bear, upland game, furbearers, and non-consumptive avifauna. Other potential interaction between the undertaking and other wildlife is the disturbance of animals due to noise and human presence. Increased trapping pressure on furbearers may also result due to increased access.

4.4.3.5 Identified Issues and Concerns

Specific concerns outlined with respect to the wildlife species that may be affected by the undertaking were the potential increased hunting/poaching pressure and the potential loss of forest habitat.

4.4.3.6 Existing Knowledge

Migratory Birds

The Canada Goose is a large plant-eating bird which nests in open places near water. Palmer (1976) states that in spring these geese seek remote areas, free from disturbance, for nesting. In general, they prefer nest sites that provide clear views in all directions, and permanent water not far away. Nest sites tend to be higher and drier than the surrounding country-side. Canada Geese are very selective about nest sites (Palmer 1976). Very little suitable habitat exists elsewhere in the Main River area outside Big Steady, although isolated pairs may nest throughout (Northland Associates 1986). Meadowlands near water are highly preferred for nesting and feeding.

Black ducks are medium-sized dabbling ducks that make greater use of woodland habitat than other *Anas* species (Palmer 1976). They are fairly adaptable when selecting habitat but nest in low densities. Therefore, extensive areas of suitable habitat are needed to support moderate numbers of breeding pairs. Besides Big Steady, such expanses of habitat were identified as lacking in the Main River study area (Northland Associates 1986). It is therefore suggested that Black Ducks could utilize ponds within FMD 16 outside of the Main River corridor, although utilization would be expected to at low densities.

The Green-winged Teal is the smallest of the dabbling ducks found on the Island. Its preferred habitat is a mixture of grassy and sedgy terrain plus brush or scattered trees, usually not distant from water (Palmer 1976). In barren country, the Green-winged Teal will nest in open areas with patches of low deciduous growth near water. Green-winged Teal could nest in small numbers throughout FMD 16.

Greater/Lesser Scaup are thought to have the potential to increase in number on the Island. They prefer grass-margined waters, floating shorelines and islands, and seasonally flooded river deltas. These species may utilize the water throughout FMD 16, however, utilization is expected to be minimal.

Ring-necked Ducks are medium-sized diving ducks. They prefer sedge marches and ponds with emergent vegetation. They will nest in forested areas and prefer to feed in shallower water than most divers. Brushy hummocky and floating islands are preferred for nesting sites. Ring-necked ducks could make use of the wooded ponds throughout FMD 16.

Raptors

Raptors in close proximity to construction can be affected by the disturbances created. Raptors will usually avoid areas of human presence and activity (Stalmaster 1987; Nelson 1979). However, there have been some reports of raptors continuing normal activities in areas of construction or human disturbance (reviewed in Nelson 1979). Stalmaster and Newman (1978) reported that bald eagles can tolerate and habituate to some levels of activity.

Caribou

Activities associated with construction (eg. heavy equipment, blasting, and human presence) may affect caribou. Caribou may avoid habitat where levels of noise and human/equipment activities are high. Such a reaction is considered temporary, since caribou tend to habituate quickly to disturbance (VBNC 1997). A review of the effects of industrial activities and transportation corridors on the demography, movement, and behaviour patterns of eight caribou populations concluded that caribou can withstand periodic severe disturbance without long-term adverse effects on productivity and survival (Bergerud *et al.* 1984). Caribou seem to be most sensitive to noise disturbance during the calving period, with cows and calves being the most sensitive groups (Calef and Lortie 1973; Harrington and Veitch 1992).

Caribou avoided, or showed reduced use of areas when construction activity was taking place in the Upper Salmon hydroelectric project (Hill 1985). Following construction of this project and the Hope Brook gold mine, caribou occupation of adjacent habitat in these areas returned to approximate pre-development levels (Upper Salmon) or showed some recovery toward pre-development levels (Hope Brook) (Tucker and Mahoney 1990). While roads and other linear structures can block or deflect caribou movement, the principal avoidance stimulus is the presence of people or vehicle traffic, rather than the constructed features themselves (Klein 1980; Shideler *et al*. 1986).

Moose

Moose (*Alces alces*) were introduced to Insular Newfoundland at the turn of the century and have since occupied most of the Island. Their preferred habitat is coniferous forest, especially near swamps and lakes in areas of secondary growth (Hydro 1999). Their summer diet consists of aquatic vegetation, broad-leaved trees, shrubs and grasses, while Winter conditions necessitate feeding on balsam fir and the bark of various trees (Northcott 1974).

Construction activities have the potential to cause adverse effects to moose. Cow-calf pairs may be particularly sensitive to human disturbance. Experience with some development suggests that these effects may not be significant. Sopuck *et al.* (1979) reported that among ungulates, moose are relatively tolerant of disturbance, although they avoid heavily used roads and areas of intense activity. Such avoidance is usually temporary, as moose have been observed to habituate to disturbance (Geist 1980; Supock and Vernam 1986).

Black Bear

Black bear are one of the few large mammals native to Newfoundland. Like any other animal, they require a number of resources including escape and hiding cover, appropriate denning areas and food. Research has shown that disturbed areas, whether natural or human influenced, may actually increase bear habitat, as they feed upon such pioneer species as mountain ash and berries.

Upland game

As stated in Section 3.9, Ruffed Grouse, Spruce Grouse, Willow ptarmigan, and Snowshoe Hare inhabit conifer forests in various stages of successional growth and most prefer areas of early successional growth.

During periods of cyclic abundance, populations of upland game can build to very high numbers. The early successional stages of vegetation resulting from clear-cutting or road right-of-way clearing are favoured feeding areas for many upland game (Northland Associates 1986).

Furbearers

The effects of development and human disturbance on furbearers are difficult to study due to low or fluctuating population numbers and their wide ranging movements (Sopuck *et al.* 1979). In general, however, furbearers tend to avoid areas of development and human activity. A possible exception to this general statement is the red fox, which has been shown by several studies to frequent areas of disturbance (Sopuck *et al.* 1979).

Aquatic furbearers such as mink, otter, and beaver could experience intestinal damage due to the ingestion of oil during grooming and through ingestion of tainted fish (Geraci and St. Aubin 1990). Studies on aquatic furbearer species have found oil exposure to result in thermal conductivity of coats after exposure to oil (*see* Geraci and St. Aubin 1990).

In general, furbearers benefit from fire due to the renewed vigour of well fertilized plant succession and subsequent prey density increase that occurs following a fire (Kelsall *et al.* 1977).

Non-consumptive avifauna

Some species of woodland avifauna prefer mature forest structure, eg. the members of the interior habitat selection guild, and therefore a major loss of mature forest would represent a loss of habitat. These birds require interior forests large enough so that they are not near an edge, therefore remaining forest blocks must be of an appropriate size in order to ensure their utilization by these species (Whitaker 1997). Other habitat selection guilds such as the open/edge guild will benefit from cuts and edge habitat created by harvesting.

4.4.3.7 Mitigation

Routine mitigation techniques as outlined in Mercer (1998) will be implemented to reduce possible negative effects on all wildlife species. These techniques include emergency preparedness measures to reduce hydrocarbon spill potential and forest fires.

Hydrocarbon containment systems and dedicated fuelling stations will be used to eliminate the possibility of a hydrocarbon spill into the existing waterways. These mitigation techniques will be as per all applicable regulations and CBPP's FMPOP.

CBPP's District Operations Supervisors are responsible for the allocation and testing of fire suppression equipment on all work sites in their respective areas, as well as the establishment of reserve supplies of equipment for use during a major outbreak. At the startup of each session, the Operations Superintendent will do an inspection of each jobsite in his District to determine whether adequate fire suppression equipment is on hand. During the off-season, all equipment will be taken by the Contractor to a safe, dry location for storage. Any Contractor who has been assigned fire equipment by CBPP is responsible for maintenance, as well as replacement of any missing equipment.

Prior to the start of the fire season, CBPP will submit maps to the Newfoundland Forest Service showing the locations of operating areas, as well as lists detailing the fire suppression equipment established at each location. These mitigation techniques will be as per all applicable regulations and CBPP's FMPOP.

Outlined below are specific mitigations for each wildlife resource.

Migratory Birds

Unmerchantable softwood, hardwood stands, and all scrub within FMD 16 will not be harvested. In addition, leave-zones (buffers) of forest will be left around all watercourses greater than 1m in width. These buffers are a minimum of 20m in width.

Raptors

Habitat requirements for raptors such as the boreal owl, American Kestrel and sharp shinned hawk, would be accommodated by leaving wildlife trees in the form of green trees or snags, as outlined in the FMPOP (Mercer 1998), and by leaving blocks of contiguous mature forest for other wildlife species such as Marten, moose and caribou. Some raptors such as great Horned Owls, northern hawk owls and merlins use deserted nests made annually by other common species such as crows. Buffering of such structures will not be required except where nesting raptors are encountered during logging operations. When nesting raptors are encountered, a protective buffer of 800m will be retained until July 31 when young are likely to be fledged.

Other mitigation techniques for raptors include:

- The location of any raptor nest site must be reported to the Wildlife Division;
- Because eagles and osprey utilize the same nest year after year, a protective buffer of 200m will be established around nest sites of these species. When operations are scheduled during the nesting season (March 15 to July 31) harvesting will not occur within 800m of the nest; and
- Forest access roads, borrow pits and quarries must also avoid eagle and osprey nest sites.

Caribou

Mitigation techniques for the reduction of negative effects to caribou have been incorporated into the FMPOP (Mercer 1988). These techniques include:

- Slash should be maintained on sites to provide caribou with an opportunity to access lichens from the branches of harvested trees;
- In areas where caribou utilize arboreal lichens during the summer and/or winter and terrestrial lichens during the summer, a minimum amount of lichen forest must be maintained to facilitate the continued use of these areas by woodland caribou. Forest activity will be designed in consultation with the Wildlife Division where this situation has been identified;
- Special consideration will be given to known calving and wintering areas. This may include modifications to road locations and restricted activity during certain seasons. Harvesting for example, is not permitted within caribou calving areas from May 15-June 15 or within post-calving areas from June 15 to July 31. These areas would be identified by the Wildlife Division.

Moose

Mitigation techniques for the reduction of negative effects to moose have been incorporated into the FMPOP (Mercer 1988). These techniques include:

- Where established moose yards have been identified, forest access roads, borrow pits and quarries must not be located within 1km;
- Small isolated stands of timber on bogs will be retained as security cover; and
- Where important habitats are identified (eg. moose wintering yards) a special effort will be made to protect these areas through the development of modified harvesting practices such as leave blocks or buffers which incorporate the important habitat. The size of the leave blocks will reflect natural stand boundaries.

Black Bear

Mitigation techniques for the reduction of negative effects to black bear have been incorporated into the FMPOP (Mercer 1988). This follows provincial guidelines as follows:

- A 50m no cut treed buffer must be maintained around known black bear denning sites (winter) or those encountered during harvesting. These den sites must be reported to the Wildlife Division.

Upland game

No mitigation techniques have been identified for upland game specifically by CBPP or DFRA (Mercer 1998). However, where snowshoe hare are identified as the primary species for which an area is being managed, the following guidelines apply (Mercer 1998):

- The size and configuration of cut harvest blocks will reflect the natural stand boundaries. Harvest cutblock size should not exceed 25 hectares;
- Special consideration will be given to maintaining security cover adjacent to harvest blocks. Stands between the ages of 10-30 years provide optimal security cover; and
- In areas where pre-commercial thinning occurs, special consideration will be given to maintaining unthinned areas adjacent to, or within, thinned areas.

Furbearers and Non-consumptive avifauna

To protect beaver habitat, all hardwoods within 30 meters of a waterbody occupied by beaver are to left standing during harvesting operations (Mercer 1998). No other specific mitigation techniques have been identified for furbearers and non-consumptive avifauna by CBPP or DFRA. However, general wildlife considerations are outlined in CBPP's FMPOP. CBPP cooperates with the Newfoundland Wildlife Division and other wildlife management agencies to ensure that forest operations are carried out in a manner that maintains adequate habitat for all wildlife (Mercer 1998). The following general planning principles guide CBPP when developing forest management plans with respect to wildlife habitat (Mercer 1988):

- Development of area specific criteria for harvest cutblock size, shape and spatial arrangement;
- Development of area specific criteria of residual vegetation and cover within harvest blocks;
- Maintenance of treed buffers adjacent to riparian habitats; and
- Provision of travel corridors across the landscape.

4.4.3.8 Cumulative

Twenty-two mammal species, more than sixty species of birds, and four amphibian species make their home in the forests managed by CBPP. To sustain the variety of wildlife species in the forest, a mosaic of forest types and age classes, sizes and shapes should be available through time. CBPP is committed to maintaining the diversity of wildlife habitat capable of supporting resident (including seasonally resident) wildlife species (Mercer 1998).

Timber harvesting and associated forest management activities influence wildlife in a variety of ways. For example, species oriented to older age classes will not benefit from timber harvesting, while species oriented to forest openings, edges and younger forests, will respond positively. Many species such as moose, snowshoe hare and grouse thrive in the early successional stages of a forest after harvesting, while species such as pine marten and boreal owls require over-mature forests. In addition, some species are adapted to the interior forests and favour large contiguous forest stands. Therefore, the size of the residual stands and the leave blocks remaining after harvest have a varying influence on these species.

The following general planning principles guide CBPP in developing forest management plans with respect to wildlife habitat:

- development of area-specific criteria for harvest cut-block size, shape and spatial arrangement;
- development of area-specific criteria for retention of residual vegetation and cover within harvest blocks;
- maintenance of treed buffers adjacent to riparian habitats; and
- provision of travel corridors across the landscape.

CBPP co-operates the Newfoundland Department of Tourism, Culture and Recreation (Wildlife Division) and other wildlife management agencies to ensure that forest operations are carried out in a manner that maintains adequate habitat for all wildlife. Through the Adaptive Management Process, concerns raised have been addressed. Particular emphasis has been placed on the Newfoundland Pine Marten population within the Main River watershed. Concerns over the cumulative effects of forest harvesting on this species and the effects of “habitat isolation” were identified by numerous participants in the process.

In addition, the Wildlife Division has recently changed the habitat requirement guidelines for Newfoundland Pine Marten based on ongoing research throughout North America. These guidelines are currently being adapted and evaluated by Wildlife Division for use in

Newfoundland. These new guidelines use a size-class based suitability rather than an age-class system (*see* Section 4.4.7.8). These new guidelines are currently being applied to any harvesting activities planned for the Main River watershed. The incorporation of these guidelines will allow extraction of timber from areas where Pine Marten occur without negative effects to the habitat utilization of the area.

The Main River area is also subject to new Pine Marten research initiatives in order to determine the overall extent of the population and their potential immigration into Gros Morne National Park. Therefore, a no clearcutting policy within the Main River watershed and a Scientific Panel on connectivity/integrity of the Park have been implemented. As a consequence of these measures, the predicted cumulative effect of wood harvesting operations in FMD 16 is predicted to be **minor (not significant)**.

4.4.3.9 Residual Impact Analysis

Areas affected by construction, operation, and revegetation activites are similar for the following wildlife, with the exception of migratory birds. Construction activities result in approximately 1.6km^2 of forest roads being developed and maintained throughout the life of the project (approximately 200km of road at an estimated 8m width). Because FMD 16 will have this amount of area disturbed within its boundaries, all wildlife will be assumed to be affected, even though forest roads may not necessarily be constructed through a particular habitat.

Operational and revegetation activities include the harvesting and silvicultural works within FMD 16 boundaries. They will be the same in geographical extent, as areas harvested will be those revegetated. Duration and frequencies will vary as the activities are periodic and have varying implementation times.

Migratory Birds

Table 4.9 summarizes the residual impact predictions of the proposed undertaking on the migratory birds. Since migratory bird habitat is located outside areas of merchantable wood (bogs, marshes, and watercourses), appropriate buffers around watercourses will be left, and marshy areas will be avoided for road construction and harvesting, a **negligible (not significant) residual environmental impact is predicted**.

Raptors

Table 4.10 summarizes the residual impact predictions of the proposed undertaking on raptors. A **minor (not significant) residual environmental impact is predicted**. This effect includes the positive effect of the secondary growth as food and cover for some species. Revegetation may also affect raptors as successional growth continues after harvesting, however, activities involved with it are not likely to cause an impact. Revegetation would be considered a positive effect as prey bases would increase within a successional forest structure.

Caribou

Table 4.11 summarizes the residual impact predictions of the proposed undertaking on the caribou herds of the northern Peninsula. A **negligible (not significant) residual environmental impact is predicted** upon the caribou populations. Caribou within Gros Morne National Park need to have an effective link between the park and the surrounding area in order to remain healthy. This is currently being addressed by the Connectivity Committee (*see* Section 4.4.5).

Moose

Table 4.12 summarizes the residual impact predictions of the proposed undertaking on the moose population of the northern Peninsula. **A minor (not significant) residual environmental impact is predicted**. This effect also includes the positive effect of the secondary growth as food for moose. Revegetation as the area goes through successional stages may benefit (positive impact) moose populations.

Black Bear

Table 4.13 summarizes the residual impact prediction of the proposed undertaking on black bear population in the area. **A minor (not significant) residual environmental impact is predicted.** This effect includes the positive effect of secondary growth as food for black bear.

Upland game

Table 4.14 summarizes the residual impact predictions of the proposed undertaking on the upland game populations in the area. A **minor (not significant) residual environmental impact is predicted**. This effect includes the positive effect of the secondary growth as food and cover for upland game. Revegetation may also affect upland game populations (positive impact) as successional growth continues after harvesting.

Furbearers

Table 4.15 summarizes the residual impact predictions of the proposed undertaking on the furbearer species within FMD 16. A **minor (not significant) residual environmental impact is predicted**. This effect includes the positive effect of the secondary growth as food and cover for some species. Revegetation may also benefit furbearers as successional growth continues after harvesting.

Non-consumptive avifauna

Table 4.16 summarizes the residual impact predictions of the proposed undertaking on non-consumptive avifauna. A **minor (not-significant) residual environmental impact is predicted.** This effect includes the negative effect on the interior habitat selection guild and the positive effect on the open/edge habitat selection guild. Recent research has suggested that revegetation and buffer strips will benefit a majority of non-consumptive avifauna (positive impact) as successional growth continues after harvesting. Buffer strips will provide refuge for edge species. Interior bird species may need additional reserves throughout a cutblock, as buffers may not be adequate to represent interior habitat.

4.4.3.9 Accidental Events

Accidental events are identified as primarily hydrocarbon spills and forest fires.

An accidental hydrocarbon spill would have the potential to have a negative effect upon the wildlife within FMD 16. This would be particularly true for aquatic animals such as migratory birds and some furbearers. Data regarding spills in FMD 16 indicate that no large spills have been reported. The frequency of such a spill would therefore be very small. With mitigation measures to prevent the loss of hydrocarbons into the environment (self-containing fuelling systems, dedicated fuelling locations, spill containment equipment, etc.), the potential of a large hydrocarbon spill into the environment is insignificant.

As discussed in Section 4.4.7.10 (Pine Marten), a large-scale forest fire would have the potential to create a significant impact on the wildlife habitat in FMD 16. However, with the current mitigation techniques utilized by CBPP during harvesting activities, forest fire is very unlikely.

With any accident, total confidence cannot be guaranteed, therefore a rating of 2 has been give to the Level of Confidence with respect of Accidental Events in the previous Impact Summary Tables.

4.4.3.10 Monitoring

Routine monitoring of mitigation structures such as filter fabric placement, culvert installations, buffer zones, fuel containment systems, fuelling stations and fire suppression equipment is mandatory. Unless specified, no specific monitoring programs are scheduled or anticipated.

Specific monitoring includes Raptors during activities in the area and will consist of identification of raptors and potential nesting sites.

Table 4.9. Residual Impact Summary of the proposed undertaking upon the Migratory Birds.

Migratory Birds	Construction Activities[a]	Operation Activities[a]	Revegetation[b]	Accidental Events[c]
Residual Impacts				
Significance	N-N	N-N	N/A	N-N
Geographical Extent	N/A	N/A	N/A	2
Duration of Interaction	3	3	N/A	1
Frequency of Occurrence	5	5	N/A	1
Level of Confidence	3	3	N/A	2
Irreversible Impacts	No	No	N/A	No

Irreversible Impacts
None identified.

Monitoring
Routine monitoring of mitigation structures such as filter fabric placement, culvert installations, buffer zones, fuel containment systems, fuelling stations is mandatory.

KEY

Significant:
SM Major
Sm Moderate

Not Significant

N-M Minor
N-N Negligible
N/A Not Applicable
* = indirect

Frequency:
1= <1 event per decade
2 = yearly < decade
3 = monthly < yearly
4 = daily < monthly
5 = continuous

Extent:
1 = <1 ha
2 = 1 ha < 1 km^2
3 = 1 km^2 < 10 km^2
4 = 10 km^2 < 100 km^2
5 = $\geq$ 100 km^2

Confidence:
1 = low
2 = moderate
3 = high

Duration:
1 = <1 week
2 = 1week < 1 month
3 = 1 month < 1 year
4 = 1 < 10 years
5 = ≥ 10 years

[a] road construction and harvesting would not occur within wetland/waterways, therefore, impact summary more relates to noise disturbance.
[b] - refers to any silviculture works and re-growth of forest structure.
[c] – refers to a fuel spill event.

Table 4.10. Residual Impact Summary of the proposed undertaking upon raptors.

Raptors	Construction Activities	Operation Activities	Revegetation[a]	Accidental Events[b]
Residual Impacts				
Significance	N-M*	N-M*	N-M*	N-N
Geographical Extent	2	4	4	2
Duration of Interaction	4	4	3	1
Frequency of Occurrence	5	5	3	2
Level of Confidence	3	3	3	2
Irreversible Impacts	Yes	No	No	No

Irreversible Impacts
If roads are left and/or maintained as public access and not revegetated, the 1.6km^2 of road surface will be a permanent loss of forested habitat (long-term; indirect).

Monitoring
Potential raptor nests will be identified and appropriate mitigation conducted.

KEY

Significant:
SM Major
Sm Moderate

Not Significant
N-M Minor
N-N Negligible
N/A Not Applicable
* = indirect

Frequency:
1= <1 event per decade
2 = yearly < decade
3 = monthly < yearly
4 = daily < monthly
5 = continuous

Extent:
1 = <1 ha
2 = 1 ha < 1 km^2
3 = 1 km^2 < 10 km^2
4 = 10 km^2 < 100 km^2
5 = $\geq$ 100 km^2

Confidence:
1 = low
2 = moderate
3 = high

Duration:
1 = <1 week
2 = 1week < 1 month
3 = 1 month < 1 year
4 = 1 < 10 years
5 = ≥ 10 years

[a] - refers to any silviculture works and re-growth of forest structure.
[b] – refers to a fire event.

Table 4.11. Residual Impact Summary of the proposed undertaking upon caribou.

Caribou	Construction Activities	Operation Activities	Revegetation[a]	Accidental Events[b]
Residual Impacts				
Significance	N-N*	N-N*	N-N	N
Geographical Extent	2	4	4	2
Duration of Interaction	4	4	3	1
Frequency of Occurrence	5	5	3	2
Level of Confidence	3	3	3	2
Irreversible Impacts	Yes	No	No	No

Irreversible Impacts

If roads are left and/or maintained as public access and not revegetated, the 1.6km^2 of road surface will be a permanent loss of forested habitat (long-term; indirect).

Monitoring

No specific caribou monitoring is identified.

KEY

Significant:
SM Major
Sm Moderate

Not Significant
N-M Minor
N-N Negligible
N/A Not Applicable
* = indirect

Frequency:
1= <1 event per decade
2 = yearly < decade
3 = monthly < yearly
4 = daily < monthly
5 = continuous

Extent:
1 = <1 ha
2 = 1 ha < 1 km^2
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5 = $\geq$ 100 km^2

Confidence:
1 = low
2 = moderate
3 = high

Duration:
1 = <1 week
2 = 1week < 1 month
3 = 1 month < 1 year
4 = 1 < 10 years
5 = ≥ 10 years

[a] - refers to any silviculture works and re-growth of forest structure.
[b] – refers to a fire event.

Table 4.12. Residual Impact Summary of the proposed undertaking upon moose.

Moose	Construction Activities	Operation Activities	Revegetation[a]	Accidental Events[b]
Residual Impacts				
Significance	N-M*	N-M*	N-M*	N-N
Geographical Extent	2	4	4	2
Duration of Interaction	4	4	3	1
Frequency of Occurrence	5	5	3	2
Level of Confidence	3	3	3	2
Irreversible Impacts	Yes	No	No	No

Irreversible Impacts
If roads are left and/or maintained as public access and not revegetated, the $1.6 km^2$ of road surface will be a permanent loss of forested habitat (long-term; indirect).

Monitoring
No specific monitoring programs are scheduled or anticipated.

KEY

Significant:
SM Major
Sm Moderate

Not Significant
N-M Minor
N-N Negligible
N/A Not Applicable
* = indirect

Frequency:
1= <1 event per decade
2 = yearly < decade
3 = monthly < yearly
4 = daily < monthly
5 = continuous

Extent:
1 = <1 ha
2 = 1 ha < $1 km^2$
3 = $1 km^2$ < $10 km^2$
4 = $10 km^2$ < $100 km^2$
5 = $\geq 100 km^2$

Confidence:
1 = low
2 = moderate
3 = high

Duration:
1 = <1 week
2 = 1week < 1 month
3 = 1 month < 1 year
4 = 1 < 10 years
5 = ≥ 10 years

[a] - refers to any silviculture works and re-growth of forest structure.
[b] – refers to a fire event.

Table 4.13. Residual Impact Summary of the proposed undertaking upon black bear.

Black Bear	Construction Activities	Operation Activities	Revegetation[a]	Accidental Events[b]
Residual Impacts				
Significance	N-M*	N-M*	N-M*	N-N
Geographical Extent	2	4	4	2
Duration of Interaction	4	4	3	1
Frequency of Occurrence	5	5	3	2
Level of Confidence	3	3	3	2
Irreversible Impacts	Yes	No	No	No

Irreversible Impacts

If roads are left and/or maintained as public access and not revegetated, the 1.6km^2 of road surface will be a permanent loss of forested habitat (long-term; indirect).

Monitoring

No specific monitoring programs are scheduled or anticipated.

KEY

Significant:
SM Major
Sm Moderate

Not Significant
N-M Minor
N-N Negligible
N/A Not Applicable
* = indirect

Frequency:
1= <1 event per decade
2 = yearly < decade
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Extent:
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Duration:
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4 = 1 < 10 years
5 = ≥ 10 years

[a] - refers to any silviculture works and re-growth of forest structure.
[b] – refers to a fire event.

Table 4.14. Residual Impact Summary of the proposed undertaking upon upland game.

Upland Game	Construction Activities	Operation Activities	Revegetation[a]	Accidental Events[b]
Residual Impacts				
Significance	N-M*	N-M*	N-M*	N-N
Geographical Extent	2	4	4	2
Duration of Interaction	4	4	3	1
Frequency of Occurrence	5	5	3	2
Level of Confidence	3	3	3	2
Irreversible Impacts	Yes	No	No	No

Irreversible Impacts
If roads are left and/or maintained as public access and not revegetated, the 1.6km^2 of road surface will be a permanent loss of forested habitat (long-term; indirect).

Monitoring
None outlined

KEY

Significant:
SM Major
Sm Moderate

Not Significant
N-M Minor
N-N Negligible
N/A Not Applicable
* = indirect

Frequency:
1= <1 event per decade
2 = yearly < decade
3 = monthly < yearly
4 = daily < monthly
5 = continuous

Extent:
1 = <1 ha
2 = 1 ha < 1 km^2
3 = 1 km^2 < 10 km^2
4 = 10 km^2 < 100 km^2
5 = $\geq$ 100 km^2

Confidence:
1 = low
2 = moderate
3 = high

Duration:
1 = <1 week
2 = 1week < 1 month
3 = 1 month < 1 year
4 = 1 < 10 years
5 = ≥ 10 years

[a] - refers to any silviculture works and re-growth of forest structure.
[b] – refers to a fire event.

Table 4.15. Residual Impact Summary of the proposed undertaking upon furbearers.

Furbearers	Construction Activities	Operation Activities	Revegetation[a]	Accidental Events[b]
Residual Impacts				
Significance	N-M*	N-M*	N-M*	N-N
Geographical Extent	2	4	4	2
Duration of Interaction	4	4	3	1
Frequency of Occurrence	5	5	3	2
Level of Confidence	3	3	3	2
Irreversible Impacts	Yes	No	No	No

Irreversible Impacts

If roads are left and/or maintained as public access and not revegetated, the 1.6km^2 of road surface will be a permanent loss of forested habitat (long-term; indirect).

Monitoring

Routine monitoring of mitigation structures such as filter fabric placement, culvert installations, buffer zones, fuel containment systems, fuelling stations is mandatory. No specific monitoring of furbearer species (other than Pine Marten) is outlined or proposed.

KEY

Significant:
SM Major
Sm Moderate

Not Significant
N-M Minor
N-N Negligible
N/A Not Applicable
* = indirect

Frequency:
1= <1 event per decade
2 = yearly < decade
3 = monthly < yearly
4 = daily < monthly
5 = continuous

Extent:
1 = <1 ha
2 = 1 ha < 1 km^2
3 = 1 km^2 < 10 km^2
4 = 10 km^2 < 100 km^2
5 = $\geq$ 100 km^2

Confidence:
1 = low
2 = moderate
3 = high

Duration:
1 = <1 week
2 = 1week < 1 month
3 = 1 month < 1 year
4 = 1 < 10 years
5 = ≥ 10 years

[a] - refers to any silviculture works and re-growth of forest structure.
[b] – refers to a fire and/or fuel spill event.

Table 4.16. Residual Impact Summary of the proposed undertaking upon non-consumptive avifauna.

Non-consumptive Avifauna	Construction Activities	Operation Activities	Revegetation[a]	Accidental Events[b]
Residual Impacts				
Significance	N-M*	N-M*	N-M*	N-N
Geographical Extent				
Duration of Interaction	3	3	5	1
Frequency of Occurrence	5	5	5	2
Level of Confidence	3	3	3	3
Irreversible Impacts	Yes	No	No	No

Irreversible Impacts
If roads are left and/or maintained as public access and not revegetated, the 1.6km^2 of road surface will be a permanent loss of forested habitat (long-term; indirect).

Monitoring
No specific monitoring of avifauna species is outlined or proposed.

KEY

Significant:
SM Major
Sm Moderate

Not Significant
N-M Minor
N-N Negligible
N/A Not Applicable
* = indirect

Frequency:
1= <1 event per decade
2 = yearly < decade
3 = monthly < yearly
4 = daily < monthly
5 = continuous

Extent:
1 = <1 ha
2 = 1 ha < 1 km^2
3 = 1 km^2 < 10 km^2
4 = 10 km^2 < 100 km^2
5 = $\geq$ 100 km^2

Confidence:
1 = low
2 = moderate
3 = high

Duration:
1 = <1 week
2 = 1week < 1 month
3 = 1 month < 1 year
4 = 1 < 10 years
5 = ≥ 10 years

[a] - refers to any silviculture works and re-growth of forest structure.
[b] – refers to a fire event.

4.4.4 Socio-economic

Guiding Principles of Socio-economic (principally Tourism) as stated in the FMD 16 Strategy Document are:

- ***protect the ecological integrity of Gros Morne National Park;***
- ***ensure connectivity between Gros Morne National Park and the Main River watershed;***
- ***ensure forest harvesting does not in any way prevent the designation of the Main River as a Canadian Heritage River or degrade the wilderness qualities for which the river was initially nominated;***
- ***protect a representative sample of old growth forest, thus enhancing tourism in the area;***
- ***protect the viability of the current outfitting/adventure tourism businesses and outdoor activities; and***
- ***work with Newfoundland and Labrador Snowmobile Federation to strive for a trail system that offers a high quality wilderness experience.***

All of the above identified principles have already been addressed in previous section of the document except for the last two bullets. These are the two addressed in this section.

4.4.4.1Ecological Boundaries

As many of the above principles are dealt with in other sections of the document (eg. ecological integrity of GMNP, connectivity, forest structure) the ecological boundaries have generally been restricted to outfitting activities in the identified harvest areas (*see* Volume One).

4.4.4.2 Impact Significance Criteria

Due to the nature of socio-economic issues, neither typical impact significance criteria nor the summary table apply. It is therefore appropriate to apply the applicable guiding principles in assessing impact significance. They are to protect the viability of the current adventure tourism businesses (includes outfitters) and outdoor activities.

4.4.4.3 Potential Interactions

Potential interaction between the undertaking have been restricted to outfitting activities in FMD 16. Potential interactions include construction and/or harvesting activities that could increase access and decrease “wildness” which could lead to effects to outfitters in the area.

4.4.4.4 Identified Issues and Concerns

Specific concerns identified during the evaluation are the potential conflict between outfitting and forest harvesting.

Approximately 18 lodges have been identified operating in the FMD 16 area. While some large game populations respond positively to increased regenerating forests (eg. moose), there is the potential of lower outfitter demand due to a perceived loss of "wilderness experience" due to forest harvesting.

4.4.4.5 Impact Analysis/Mitigation

CBPP has been involved in ongoing meetings with the Department of Tourism, Culture and Recreation and the Outfitters Federation to discuss harvesting plans in the Upper Humber/Main River area (*see* Five-Year Operating Plan Volume One). Additional follow-up meetings with individual outfitters were also held. CBPP has made a commitment to continue discussions to ensure that forest harvesting and outfitting operations can work together without any significant constraints or conflicts.

4.4.4.6 Cumulative

The primary potential cumulative effects of forest harvesting activities in FMD 16 relate to the Main River and its potential as a major new ecotourism destination as a result of its new Heritage River status. The other cumulative issue potentially within Tourism and Recreation is the loss or disruption of locations for established outfitting lodges to conduct their operations. However, the accepted Management Plan for Main River as a Heritage River has recognized and addressed all concerns regarding the preservation of the values of which Main River was nominated. Parks and Natural Areas have laid out careful management goals and objectives and have formulated an acceptable plan to meet them. Therefore, cumulative affects of forest harvesting on the Main River watershed will not occur. Additionally, other industrial/commercial activities such as mining, agriculture, and lodge/cabin development have also been restricted inside the watershed boundary.

Ongoing, productive meetings with the Department of Tourism, Culture and Recreation, the Outfitters Federation, individual outfitters operating in FMD 16 and CBPP will continue to foster an appreciation for each party and will address any potential cumulative effects.

With the above considerations and practices in place, the predicted cumulative effect of wood harvesting operations in FMD 16 is predicted to be **minor (not significant)**.

4.4.4.7 Residual Impact Analysis

The residual impact analysis of the Five-Year Plan once all mitigation strategies are employed indicates that a **minor (not significant) residual environmental effect is predicted**. Ongoing meetings with local outfitters ensure continued discussions and conflict resolution between them and CBPP.

4.4.4.8 Accidental Events

A large-scale forest fire would have the potential to create a significant impact on the Main River Waterway Park and outfitter's operating areas. As shown in the DFRA fire summary data for FMD 16 over the last ten years, forest fires are very infrequent (approximately

0.17/month) and of a small average size (approximately 7ha in size). They are therefore considered to be of very low frequency, duration and extent. The Residual Impact Summary considers an "average" fire based on the information provided by DFRA. With the current mitigation techniques utilized by CBPP during harvesting activities, forest fires are considered to be highly unlikely.

4.4.4.9 Monitoring

Mandatory monitoring of harvesting operations will be conducted as part of normal operation procedures and as additionally required under the Park Management Plan within the Main River watershed.

5.0 CONCLUSION

While a primary objective of CBPP's forest management is to provide a sustainable supply of high quality raw materials to the mill at a competitive cost, CBPP recognizes that forests offer a multitude of economic, environmental, and social values and benefits. CBPP is committed to managing the forests under its stewardship in a sustainable manner to ensure the full range of forest values and benefits are respected. The Company's initiative of developing a forest management system that meets the requirements of a system such as ISO 14000 Series or the CSA Standard for SFM Certification demonstrates its commitment to sustainable forest management.

The *Forestry Act* of 1990 signalled the Province's shift from single resource management to ecosystem-based management of the province's forests, a strategy that focuses on ecological principles. This provincial initiative, together with national and international initiatives, provides direction for implementing ecosystem-based management. These initiatives also provide the framework for CBPP in initiating and implementing ecosystem-based management within its sustainable Forest Management Plan.

Wide ranges of values are associated with forested lands, including environmental, social, and economic. Under ecosystem-based management, forest management activities strive to recognize and maintain the integrity of these values. Considerable effort must be directed to ensure that timber harvesting, together with forest renewal programs, not only result in a sustainable supply of timber, but also sustain all forest values.

Ecosystem-based management recognizes that knowledge of forest ecosystem structure and function is paramount, and requires appropriate input into the planning process from stakeholders. As a relatively new and evolutionary approach, this process of Adaptive Management strives to meet objectives of sustainable forest management.

The proposed Five-Year Operating Plan for FMD 16 (2002-2006 inclusive) has been devised to provide a sustainable supply of wood fibre to the mill within the Annual Allowable Cut (AAC) set by DFRA. In order to maintain the health of the forest ecosystem, the amount of wood removed yearly cannot exceed the growth of the forest. As part of the five year planning process, DFRA sets annual allowable cuts (AAC) based on maximum sustainable harvest levels. The maximum sustainable level is considered the quantity of wood that can be harvested in a manner that preserves the young growing forest and allows for the harvesting of those stands that are deemed eligible for cutting. The AAC is calculated every five years, or sooner if necessitated by major changes to the forest occurring in the interim. DFRA bases the AAC on their models that consider such parameters as growth-rate and wood volumes available over time to derive sustainable levels of harvest. Therefore, the total volume of wood fibre allocated for harvest from FMD 16 is within sustainable limits for the District.

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APPENDIX A

Old growth forest data collected by CBPP

APPENDIX B

Copy of Connectivity MOU