

**THE EFFECT OF THE "NO NET LOSS"  
OF HABITAT GUIDING PRINCIPLE ON  
MANITOBA HYDRO'S CONAWAPA PROJECT**

**by**

**Caroline J. Dick**

**A practicum submitted to the  
University of Manitoba in partial  
fulfillment of the requirements for the degree  
of Master of Natural Resources Management**

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Winnipeg, Manitoba, Canada**

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on Manitoba Hydro's Conawapa Project.

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Management.

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1992

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## ABSTRACT

The purpose of this project is to assess the potential effect of the "no net loss" principle on Manitoba Hydro's Conawapa hydroelectric project. This paper includes an examination of the process by which the "no net loss" principle will likely be implemented at the site of the Conawapa project based on a review of past applications of the policy.

The "no net loss" principle was developed by the federal Department of Fisheries and Oceans (DFO) as part of their 1986 Policy for the Management of Fish Habitat. The overall objective of this policy is to achieve a "net gain" of the productive capacity of fish habitats in Canada. Application of the policy to specific developments is based upon maintaining the productive capacity of fish habitat as well as the needs of users groups.

While the "no net loss" policy has been applied across Canada, it has not yet been applied to an inland hydroelectric development. Achieving "no net loss" may be difficult in regard to large projects such as a hydro dam, however, a review of past applications of the policy reveals a number of concepts which have been employed by the DFO when applying the "no net loss" principle. These concepts were applied to the case of the Conawapa project to make recommendations to achieve "no net loss" if the project is developed.

At present there is insufficient information to indicate exactly how the "no net loss" principle will be implemented at Conawapa. The achievement of "no net loss" at the site of the Conawapa project will require ongoing research on the part of Manitoba Hydro and the development of a compensation plan which is flexible and can be altered depending on the success of mitigation measures and new research data.

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## **ACRONYMS**

<b>DFO</b>	- Department of Fisheries and Oceans (federal)
<b>DNR</b>	- Department of Natural Resources (Manitoba)
<b>DOE</b>	- Department of the Environment (Manitoba)
<b>EA</b>	- Environmental Assessment
<b>EARP</b>	- Environmental Assessment Review Process
<b>EIS</b>	- Environmental Impact Statement
<b>MFB</b>	- Manitoba Fisheries Branch
<b>PMFH</b>	- Policy for the Management of Fish Habitat

## **Chapter 1**

### **INTRODUCTION**

#### **1.1 Background**

Canada's fisheries face a wide variety of problems which threaten to undermine the quality and availability of productive fish habitat in both inland and coastal waters. During the past two decades, the number of activities which bear an impact on fisheries resources has greatly increased. These activities include a wide variety of industrial sectors such as forestry, mining and hydroelectric development. In the wake of industrial development, Canada's fisheries resources require greater consideration as a valuable component of industry, traditional livelihoods and recreation.

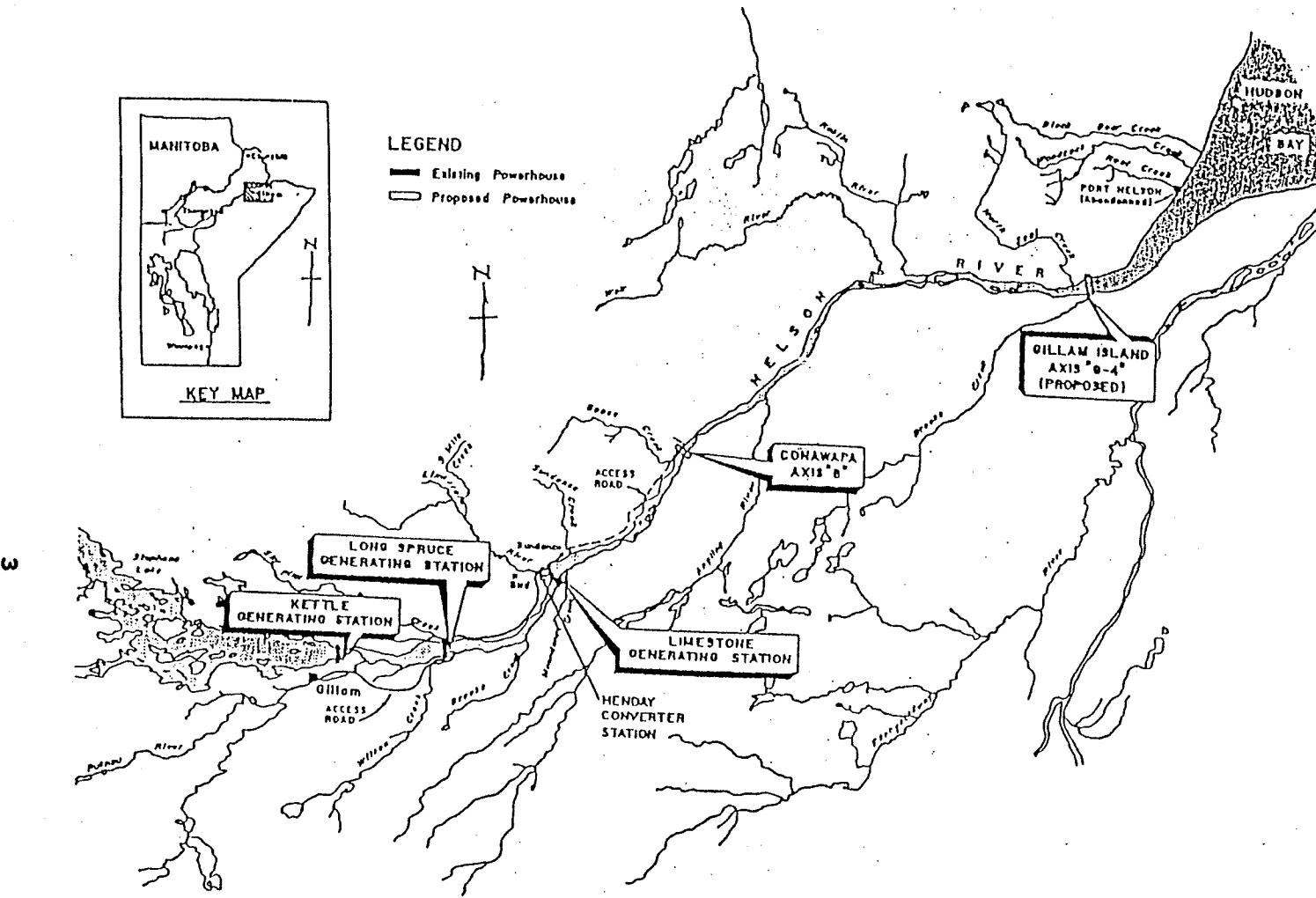
In 1986, the federal Department of Fisheries and Oceans (DFO) released its Policy for the Management of Fish Habitat (PMFH). DFO recognized the need to develop a more effective process to administer the habitat provisions of the Fisheries Act. The PMFH outlines a policy initiative which has the overall objective of increasing the amount of productive fish habitat in Canada. This initiative has been referred to as the "net gain" of habitat policy objective. The PMFH outlines several strategies to obtain this goal. Increased protection and compliance, integrated resources planning, habitat enhancement and improvement are among these strategies (Canada 1986a).

As part of the DFO policy objective to achieve a "net

gain" of fish habitat, the Department has developed what it has referred to as a **no net loss** guiding principle. The **no net loss** principle has borne a significant impact on proponents of both major and minor projects which affect productive fish habitat. The PMFH requires that proponents consider the effects which their developments may have on fish habitat. The **no net loss** principle was designed to ensure that proposed projects which affect fisheries resources take place without resulting in an overall **net loss** of productive fish habitat. This aspect of the PMFH will alter the way in which projects are created and operated.

While the **no net loss** policy has not been applied to an inland hydroelectric development, it may, however, be applied to the Conawapa hydroelectric generating station on the Lower Nelson River proposed by Manitoba Hydro. The Conawapa Generating Station (G.S.) will be the sixth G.S. to be built on the Nelson River. It will be located at a site 27 km downstream of the Limestone G.S. The Conawapa G.S. will consist of a concrete powerhouse and spillway with an earthfill dam (Manitoba Hydro 1990). The location of the proposed Conawapa G.S. is indicated in Figure 1.1.

The objectives of the PMFH do not constitute new legal requirements for project developers such as Manitoba Hydro. The PMFH does, however, specify new project licensing processes as well as new responsibilities for proponents by providing a framework for administering the habitat provisions



**Figure 1.1 Location of the Proposed Conawapa Project**  
 Source: KGS et al. 1991

of the Fisheries Act; Sections 35 to 43. Section 35 prohibits any work or undertaking which would result in a harmful alteration, disruption, or, destruction of fish habitat. Section 36 provides comprehensive powers to protect fish and fish habitat from the discharge of deleterious substances. Section 37 allocates the following powers to the federal government.

The authority to modify, restrict or prohibit any work or undertaking which is likely to result in the harmful alteration, disruption or destruction of fish habitat, a term that is defined in subsection 34(1) of the Act.

(Fisheries Act, sec 37(2))

The remaining habitat provisions pertain to related issues. Sections 35, 36 and 37 of the Fisheries Act are included in Appendix 1.

The PMFH asserts that under the **no net loss** principle, the DFO will try to balance unavoidable habitat losses with habitat replacement on a project by project basis.

The **no net loss** principle will not necessarily apply to all places where fish are found. It will apply to habitats directly or indirectly supporting those fish stocks or populations that sustain commercial, recreational, or Native fishing activities for the benefit of Canadians. It also applies to fish habitats which have demonstrated a potential to sustain fishing activities or ecological support for fisheries resources (Canada 1986a, p. 8).

The DFO, in consultation with the proponent, and other involved agencies must decide what measures would be

acceptable to achieve **no net loss** on a project specific basis. These measures must be incorporated into project development during its planning stages. The DFO may attempt to avoid loss of productive fish habitat either on a stock specific basis or on the basis of habitat lost in a particular geographic area. The DFO will use what it has termed as a "Hierarchy of Preferences" to administer the PMFH. These preferences are cited in the policy statement as follows:

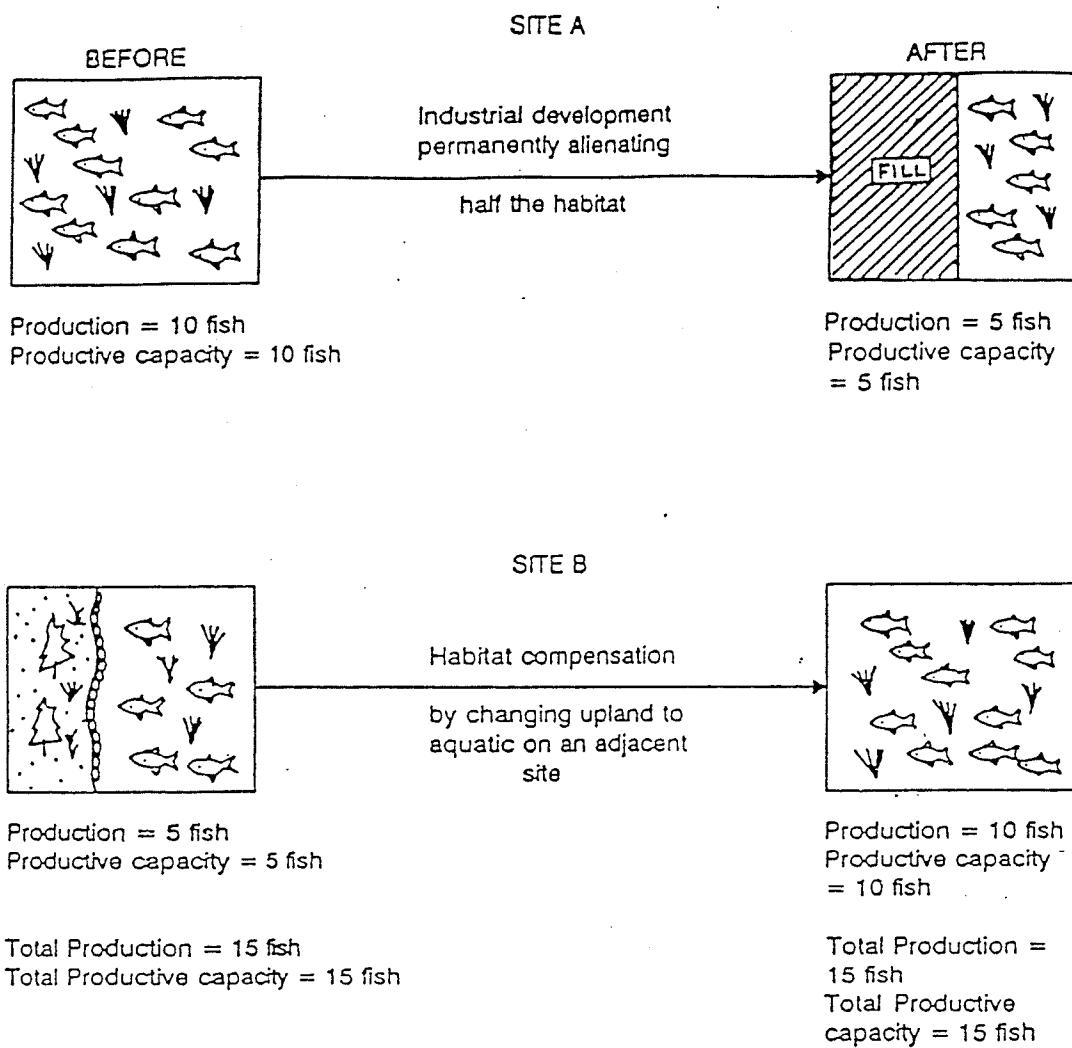
- 1) The first preference of the DFO will be to maintain the productive capacity of habitat by avoiding any loss or harmful alteration at the site of the proposed project. This may be achieved by modifying the project design or choosing an alternate site.
- 2) The second preference is compensation through the creation of 'like for like' habitat, that is, replacing natural habitat at, or, near the site. If this option is not feasible, the DFO may consider either moving off site with the replacement habitat, or, increasing the productivity levels of existing habitat for the affected stock.
- 3) In cases where it is not technically feasible to avoid potential damage to habitats or to compensate for the habitat itself, the DFO would consider proposals to compensate in the form of artificial production to supplement the fishery resource. This option would be considered acceptable if it is in accordance with the objectives established in local fisheries management plans if one is available. Genetic and

other biological factors must also be satisfied. The costs of these procedures will be the responsibility of the proponent (Canada 1986a, p.23-24).

In theory, the **no net loss** principle is based on the productive capacity of a fishery. The DFO attempts to use the level of productive capacity of habitat as its evaluation criteria to apply the policy. Productive capacity does not refer to the number of fish in the area. It is defined by the ability of a given habitat to produce fish (Canada 1990). It is the natural capacity of habitats to produce healthy fish which are safe for human consumption, or, to support or produce aquatic organisms which fish depend upon (Manitoba 1988). This concept is illustrated in Figures 1.2 and 1.3.

The problematic aspect of this management principle is the lack of effective methods to measure the productive capacity of fish habitat which would provide a means of determining how a **no net loss** or "net gain" of fish habitat can be achieved. In the case of a major hydroelectric development such as the Conawapa project, the productive capacity of the region where the project will be constructed is often unknown as is the extent to which the project will affect the productive capacity of the region under consideration.

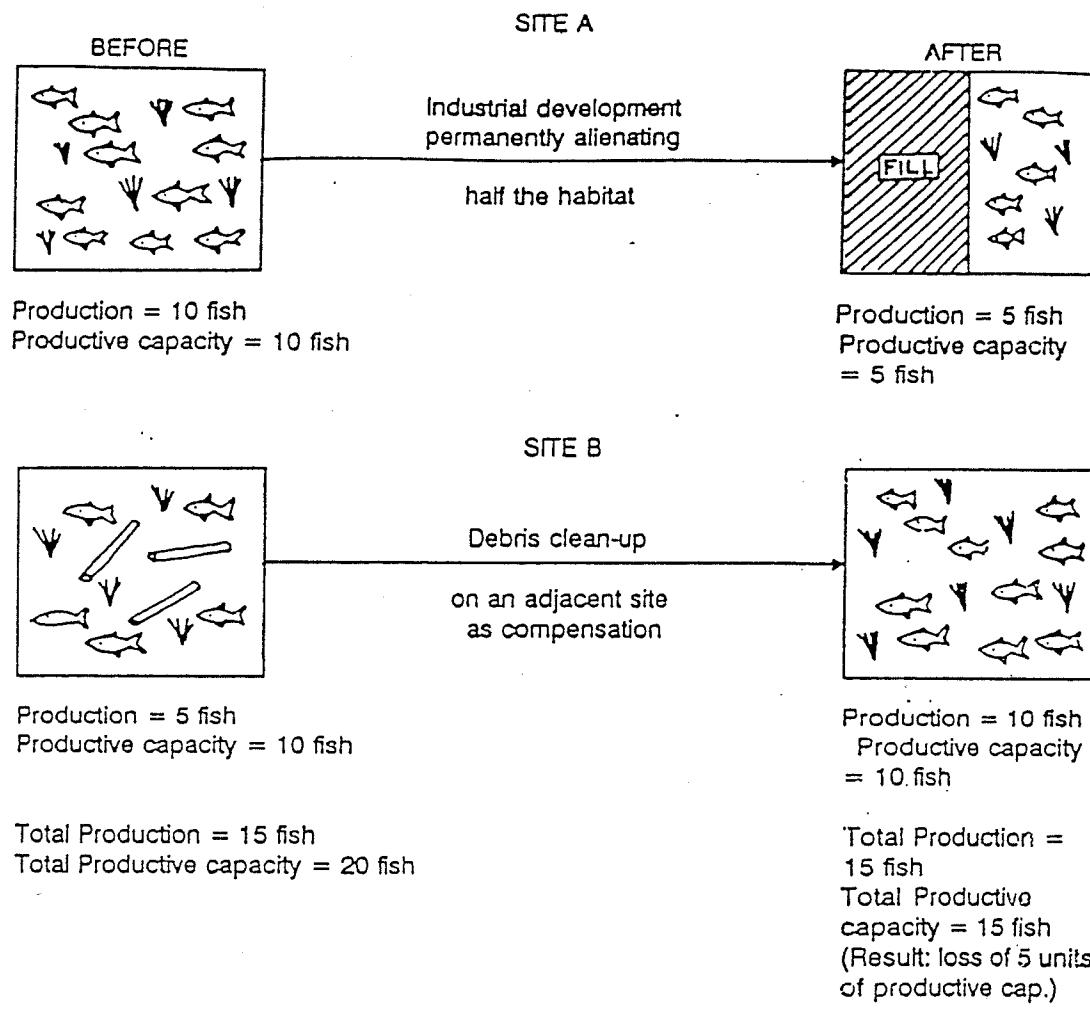
This problem is compounded further since the PMFH addresses a number of social and economic issues. The



Maintaining production and productive capacity in the face of industrial development (an acceptable "no net loss of productive capacity" solution).

**Figure 1.2: Example of an acceptable habitat compensation that considers the difference between production and productive capacity.**

Source: Procedures for the Application of 'No Net Loss' (Canada 1990).



Maintaining production but losing productive capacity as a result of industrial development (an unacceptable "no net loss of productive capacity" solution).

**Figure 1.3: Example of an unacceptable habitat compensation that considers the difference between production and productive capacity (unacceptable because of a "net loss" of productive capacity).**

Source: Procedures for the Application of 'No Net Loss' (Canada 1990)

description of what type of fish habitat would be defined as a "net loss" in a social and economic sense remains an elusive issue, however, the DFO has attempted to classify fish habitats which are important in a social, economic, and biological sense. The PMFH outlines four categories of fish habitat uses; commercial, recreational, Native fishing, and, ecological support for other fisheries resources (Canada 1986a). Application of the PMFH is therefore based on two criteria; 1. an evaluation of the productive capacity of the habitat under consideration, and, 2. the needs of the current and future users of the fishery. These issues are only loosely defined in the policy document itself.

Application of the **no net loss** principle to a development of the magnitude of the Conawapa project may be difficult due to the complexity of the impacts which the project will bear on the productive capacity of the lower Nelson River region. While there are proposals under consideration at a number of large hydroelectric projects across the country that may provide guidance in the application of the **no net loss** principle, most of these projects are still in the developmental stages, or, in the midst of an environmental assessment process, as is Conawapa. Application of the **no net loss** principle to these projects has posed some difficulties in the environmental assessment processes as many proponents are unsure as to how to meet its requirements.

There is no doubt, however, that impacts resulting from

past hydroelectric developments indicate that the **no net loss** principle should be applied in the Conawapa case. For example, hydroelectric developments have created significant impacts on several major river systems in Manitoba; the Winnipeg River, the Saskatchewan River, the Nelson River and the Churchill River. The key impacts of dams on fish populations are: loss of crucial habitat, increases of mercury levels in fish flesh caused by flooding, restricted fish passage, and, increased fish mortality due to injuries from turbines. The construction of a large generating station also changes the flow regime of rivers and streams which leads to changes in water temperature. The transformation of rivers to reservoirs results in changes in species composition and sometimes increases predation (Swanson 1991).

The case of the 1979 Churchill River diversion is a good example of the environmental impacts associated with the construction of a major hydroelectric development. This project resulted in extensive flooding of Southern Indian Lake. It led to the collapse of the lake whitefish fishery in Southern Indian Lake (Bodaly et al. 1984). Studies conducted by the Department of Fisheries and Oceans documented many of the effects of the diversion with extensive data on mercury levels in fish, mink and otter, water chemistry and primary production. While the effects of a particular hydroelectric development may be studied extensively, a considerable period of time may be required to evaluate the full impacts of a

major hydroelectric development.

A crucial aspect of the case of the Churchill River diversion was its effect on local communities which were dependent on the fisheries resources of Southern Indian Lake. Mercury levels increased in domestically harvested species such as walleye, lake whitefish, and northern pike (Krotz 1991). In the future, application of the **no net loss** guiding principle may benefit domestic users as the PMFH seeks to avoid losses of fish habitat supporting Native communities (Canada 1986a). This may be a difficult policy objective to fulfil as there are sometimes few replacement options within the immediate geographic area of the user communities. Accurate and comprehensive information on Native use of natural resources is also often difficult to obtain (Lorna McKerness, pers. comm.).

Two of the main fish species of concern to Manitoba Hydro, in view of the proposed Conawapa project, are brook trout and lake sturgeon. Brook trout and lake sturgeon are classified as heritage species. They are highly prized due to their cultural and historical significance as part of Manitoba's heritage on the Nelson River (Swanson 1990). The lower Nelson River and its tributaries from Kettle Rapids to Hudson Bay once provided habitat necessary for brook trout to grow to trophy size (Swanson 1990). Both of these populations were impacted by hydroelectric developments as early as 1960 with the construction of the Kelsey G.S. (Swanson 1991).

Adult brook trout remain within both the Limestone River, the Nelson River and their major tributaries in the summer and do not move significantly (Swanson et al. 1990). In the fall, the brook trout undertake migrations to spawning sites in the Limestone River, or, tributaries to the Limestone and Nelson Rivers and remain in these streams during the winter. A small anadromous portion of the population migrate as far as the Nelson River estuary at Hudson Bay (Swanson et al. 1990). The proposed Conawapa G.S. may restrict these species from migrating back to the spawning sites upstream of the station. Changes in water flow patterns which will result from the project may significantly alter habitat for brook trout, lake sturgeon and other fish species (Swanson 1991).

The transformation from a fast flowing river environment to a slower moving lake environment through the creation of a reservoir to store water for the dam will constitute a major alteration in fish habitat. Both the Fisheries Branch of the Manitoba Department of Natural Resources and Manitoba Hydro have been studying the impacts of hydroelectric development on fish populations of the lower Nelson River. Despite continuing research efforts devoted to these issues, there are still a number of questions left unanswered with regards to the effect of building another generating station on the Nelson River (Swanson 1990).

Although the PMFH was developed by the DFO, a federal department, implementation of the policy in the inland

provinces of Ontario, Manitoba, Saskatchewan and Alberta is undertaken by provincial fisheries authorities. The DFO has ultimate responsibility for managing fisheries resources, however, the role of the DFO in implementing the PMFH is largely one of an advisory body to the provinces. The Manitoba Department of Natural Resources endorses the PMFH and its overall objective to obtain a "net gain" in productive capacity of fisheries resources (Manitoba 1988).

In Manitoba, an environmental assessment of Manitoba Hydro's Conawapa hydroelectric project on the lower Nelson River is currently being undertaken. The **no net loss** principle may be applied to the Conawapa project through the joint federal/provincial environmental assessment process to ensure that the impacts of the project on fisheries resources on the lower Nelson River are mitigated.

## **1.2 Issue Statement**

The "no net loss" principle of the Policy for the Management of Fish Habitat has not yet been applied to any inland hydroelectric development of the magnitude of the Conawapa project. It may be applied to this project due to the identified importance of the policy and the potential impacts to fish habitat of the project. There are a number of questions surrounding the application of the "no net loss" principle which need to be addressed. Due to the lack of previous applications of the "no net loss" principle, Manitoba Hydro is uncertain of; 1. how it will be implemented and administered, and, 2. how the requirements of the "no net loss" principle can be met in the field.

Both of these issues will be examined in this paper.

### **1.3 Objectives**

The purpose of this research was to assess the potential effect of the "no net loss" guiding principle of the Policy for the Management of Fish Habitat (PMFH) on the Conawapa project. Objectives to achieve this included the following:

- 1)** Describe the provisions of the Fisheries Act, the Manitoba Environment Act of (1988), and the EARP Guidelines Order (1984) as they relate to the "no net loss" principle.
- 2)** Provide a conceptual definition of the term "no net loss" in relation to fisheries.
- 3)** Describe the process through which the "no net loss" principle may be applied to the Conawapa project.
- 4)** Compare the "no net loss" guiding principle of the Department of Fisheries and Oceans with the "no net loss" of wetlands policy in the United States.
- 5)** Review other relevant case applications of the "no net loss" principle.
- 6)** Review the potential impacts of the proposed Conawapa project on fisheries resources in the lower Nelson River region.
- 7)** Provide mitigation and compensation recommendations for the Conawapa project to meet the requirements of the "no net loss" principle.

#### **1.4 Research Procedure**

The methods used to achieve the stated research objectives consisted primarily of a review of relevant legislation and reports, and, personal communications with knowledgeable individuals from both the public and private sector. The following section describes the information which was collected and its sources. It also describes how the information is assessed and presented such that it meets the stated research objectives.

**1. Review the Policy for the Management of Fish Habitat and associated regulatory documents.**

This review included the DFO Policy for the Management of Fish Habitat (PMFH), the Fisheries Act, the Manitoba Environment Act (1988), and, the EARP Guidelines Order (1984). A review of these documents was supplemented by interviews with officials at the Manitoba Department of the Environment, the Department of Fisheries and Oceans, and the Fisheries Branch of the Manitoba Department of Natural Resources (Manitoba Fisheries Branch). These interviews consisted of scheduled structured interviews, non-scheduled structured interviews, and non-scheduled non-structured interviews. The purpose of these interviews was to gather a combination of both factual information with regard to the documents cited above and personal opinions on how the provisions of these documents are being administered.

Each of these documents is closely related to the application of the "no net loss" principle to Conawapa. The

section in which these documents are presented provides a brief description of the document, complemented by its relationship to the "no net loss" principle and the Conawapa project. The impact of the EARP Guidelines Order (1984) on the PMFH is discussed in general and in view of its relationship to Conawapa.

The Fisheries Act is presented in a similar manner. Administration and enforcement of the habitat provisions of the Fisheries Act prior to the development of the PMFH are discussed. The effect of the PMFH on improving administration of fisheries habitat regulations is also examined.

The Manitoba Environment Act (1988) is discussed in terms of a comparison between how the proposed Conawapa project would have been assessed under the provisions of the Act prior to the Rafferty-Alameda and Oldman decisions, and, the way in which these cases have altered the environmental assessment process for Conawapa.

**2. Review documents and publications related to the implementation of the "no net loss" principle to the Conawapa project**

The purpose of this review was to provide information with regard to the implementation process which may be used to apply the "no net loss" principle to the Conawapa project. This review describes the joint federal/provincial environmental assessment review process which has been developed to assess the Conawapa project. The way in which this process may serve to implement the "no net loss" guiding

principle is discussed. A flow diagram of this process is provided. This section describes how EARP is often used as a vehicle to implement the "no net loss" guiding principle.

The administrative responsibilities of the Department of Fisheries and Oceans, the Manitoba Fisheries Branch and Manitoba Hydro in relation to post-assessment administration and monitoring of the policy is discussed.

A description of the application of a "no net loss" principle to a recent Hydro-Quebec development is presented to provide information on approaches to the concept of "no net loss" outside of the Province of Manitoba from the point of view of initiatives taken by the proponent.

Government documents such as the Draft Guidelines for Conawapa are reviewed in this section. Personal communications with proponents and government officials formed part of the data base. Individuals were interviewed in the manner as outlined in Section 1 of this chapter. Individuals were contacted and asked questions relating specifically to the implementation of the "no net loss" principle from the point of view of the agency with which they were associated, and, the role their agency would have in implementing the policy. In the case of the review of the Hydro-Quebec's application of a "no net loss" principle, similar questions were asked to agencies involved in the environmental assessment process in Quebec.

3. Contact regional offices of the Department of Fisheries and Oceans and consulting firms to acquire examples of "no net loss" policy application

The Policy for the Management of Fish Habitat has been administered across Canada by the Department of Fisheries and Oceans since its introduction in 1986. There are numerous examples of application of the "no net loss" guiding principle. For the purpose of gaining an increased understanding as to how the "no net loss" objective is being met in a variety of situations, a number of examples of policy application were selected. These examples were selected in the following way.

- a) A search was conducted across Canada for examples of application of the "no net loss" guiding principle. Officials from the habitat management branches of the Department of Fisheries and Oceans in every region were contacted.
- b) Each official was asked if their region was applying the "no net loss" principle in their day to day activities. If the policy was being applied, as it was in all regions, information with regard to successful examples was requested. In some cases, information was received from consultants who had worked on projects to which the "no net loss" principle was applied.
- c) On the basis of information received from each DFO office, a number of examples representing a variety of situations were selected. When the search revealed that there were a number of situations in which one particular

application was repeated, an example of this application was selected.

While a number of ideas to achieve "no net loss" at major hydrotechnical projects are currently being proposed, there were no projects where the DFO "no net loss" principle had been applied to a hydroelectric development of the magnitude of Conawapa. In general, availability of information was a major limiting factor in the selection process. Most examples cited by DFO officials were not available in any written form. Follow-up information was seldom available. In one case officials at the same office held divergent opinions with regard to the success of a particular project and were reluctant to discuss projects which they viewed personally as unsuccessful.

Once a group of examples of "no net loss" applications had been selected, they were divided into three general categories of fish habitat for purposes of presentation. These categories are coastal habitat, lake habitat, and river habitat.

Each example is presented with a description of the project, its evaluation process, and a description of the mitigation or compensation option which was selected. This presentation is followed by a discussion of whether or not the project took place while incurring "no net loss" of fish habitat according to the conceptual definition which is developed in this report.

These examples serve as a basis from which to derive a set of concepts which have been employed by the DFO when applying the "no net loss" guiding principle. These concepts are used as a basis to indicate how "no net loss" may be applied to Conawapa, and, to make recommendations for mitigation and compensation measures for the proposed project.

**4. Review documentation relating to the "no net loss" of wetlands policy currently being developed in the United States**

In the United States, the federal Department of the Interior and the Fish and Wildlife Service is currently in the process of developing a "no net loss" policy for wetlands preservation. A comparison between the American wetlands policy and the Canadian fisheries policy is presented to provide insight into the relative strengths of the DFO "no net loss" policy. This comparison is made on the basis of the background of the policies, their intent and the implementation process for each policy. The way in which the concept of "no net loss" has been treated in relation to the wetlands policy is examined.

**5. Review information regarding fisheries resources which will be impacted by the Conawapa project**

This review utilizes research reports from both private consulting firms and the Manitoba Fisheries Branch which discuss the biological impacts of previous hydroelectric developments on the lower Nelson River and Nelson River estuary. Reports pertaining to migratory patterns of both brook trout and lake sturgeon are reviewed. Most of the

information reviewed in this section consists of fisheries reports compiled as part of Manitoba Hydro's Conawapa environmental impact assessment program.

## **1.5 Organization**

This report is comprised of nine chapters in total. Following a brief introduction of the problem and a description of research procedures, this report provides a conceptual definition of the term "no net loss" (Chapter 2). Chapter 3 describes the government and regulatory documents which provide legislative support to the "no net loss" principle. Chapter 4 describes the process by which the "no net loss" principle may be applied to the Conawapa project. Two chapters present examples of policy application; Chapter 5 discusses attempts being made in the United States to develop a similar policy for wetlands, and, Chapter 6 reviews application of the policy across Canada. Chapters 7 and 8 review potential fish habitat alterations by Conawapa and provide mitigation and compensation recommendations. The final chapter presents a summary of the report concluding with general comments on the "no net loss" principle.

## **Chapter 2**

### **CONCEPTUAL DEFINITION OF "NO NET LOSS"**

One of the most crucial questions being posed in a discussion on the application of the "no net loss" guiding principle is the development of a workable conceptual definition of what constitutes a "net loss" of productive capacity. The development of a conceptual definition of "no net loss" is necessary prior to undertaking an evaluation of examples of policy application.

#### **2.1 DFO application of the "no net loss" principle**

Prior to a discussion of the components of the "no net loss" principle it is important first to address the definition which has been provided by the DFO in the policy document. The following definition of "no net loss" has been provided in the Policy for the Management of Fish Habitat (PMFH):

A working principle by which the Department strives to balance unavoidable habitat losses with habitat replacement on a project-by-project basis so that further reductions in Canada's fisheries resources due to habitat loss or damage may be prevented (Canada 1986a, p. 28).

The term fisheries resources is defined as such in the PMFH:

Fish stocks or populations that sustain commercial, recreational or native fishing activities of benefit to Canadians (Canada 1986a, p. 28).

The above stated definitions indicate that application of this principle is therefore based upon two criteria which while distinct, must be considered together. These criteria are; 1.

an evaluation of the existing or potential productive capacity of the habitat under consideration, and, 2. the needs of current and future users of the fish resources. The way in which these criteria are used by the DFO in applying the "no net loss" principle is explained below. The PMFH itself is provided in Appendix 2.

Productive capacity is a measure of a habitat's natural capacity to produce fish and/or food organisms for fish. In actual practice, it is difficult to measure the productive capacity of different fish habitats (Canada 1990). Estimating productive capacity also requires considerable time and money. The DFO has stated the following with regard to measuring productive capacity when applying the "no net loss" principle:

In the short term, the practical application of the "no net loss" principle and determination of DFO's success in achieving "no net loss" will often have to be based on surrogate or proxy data rather than actual measurements of productive capacity (Canada 1990, p. 13).

While proxy data can be used to estimate productive capacity, fishing activities and the needs of users also provide some measure of whether or not there has been "no net loss" of productive capacity.

In view of consideration of current and future users of fish resources, the DFO has stated the following with regard to application of the "no net loss" guiding principle. These procedures will be restricted to habitat which;

1. currently produces fish that are harvested in a commercial, sport, or subsistence fishery;
2. although not directly supporting fish, can be shown (either by measurements or in the professional opinion of DFO staff) to provide nutrients and/or food supply or to contribute to water quality for fish downstream or in an adjacent habitat;
3. supports fish that do not currently sustain a fishery but would contribute to a new fishery which, in the opinion of departmental staff, has a high probability of becoming established in the future;
4. supports fish species that are normally sought in a commercial, recreational, or Native fishery, but because of remoteness does not support a fishery currently; and,
5. currently does not support fish but which has been identified by departmental staff as a promising candidate for enhancement (Canada 1990, p. 4).

This illustrates an important principle which is embedded in the PMFH which is that when applying the "no net loss" principle, priority will be given to habitats which support, or have the potential to support fisheries. While it would be ideal to apply the policy to all fish habitat, the DFO does not possess sufficient resources to do so.

## **2.2 Interpreting the DFO "no net loss" principle**

An interpretation of the DFO "no net loss" principle must begin with an analysis of the stated goals and objectives of the policy. These policy statements provide a sound basis for

understanding the intent and purpose of the policy. The PMFH contains a "policy objective". The objective of the policy is to:

Increase the natural productive capacity of habitats for the nation's fisheries resources, to benefit both present and future Canadians (Canada 1986a, p. 10).

This policy objective is accompanied by the following three policy goals:

1. Maintain the productive capacity of fish habitats supporting Canada's fisheries resources, such that fish suitable for human consumption may be produced (Canada 1986a, p. 10).
2. Rehabilitate the productive capacity of fish habitats in selected areas where economic or social benefits can be achieved through the fisheries resource (Canada 1986a, p. 12.).
3. Improve and create fish habitat in selected areas where the production of fisheries resources can be increased for the social and economic benefit of Canadians (Canada 1986a, p. 13).

The stated objective and goals of the PMFH are indicative of the way in which the "no net loss" principle and the PMFH as a whole will be applied.

Based on the above stated information, it may then be concluded that while the DFO "no net loss" principle is derived from both a biological viewpoint and a socio-economic viewpoint, it cannot be interpreted as representing a purely biological viewpoint which would inevitably state or imply that destruction or alteration of fish habitat of any type would constitute a "net loss". This would necessitate

application of the "no net loss" principle to all places where fish are found. The PMFH states specifically that this is not its purpose. It reads as follows:

The policy applies to those habitats directly or indirectly supporting those fish stocks or populations that sustain commercial, recreational or Native Fishing activities of benefit to Canadians. In addition, DFO recognizes its responsibility to protect and increase fish stocks and their habitats that have either a demonstrated potential themselves to sustain fishing activities, or a demonstrated ecological support function for fisheries resources. In accordance with this philosophy, the policy will not necessarily be applied to all places where fish are found in Canada, but will be applied as required in support of fisheries resource conservation (Canada 1986a, p. 8). (emphasis added)

A strict definition of "no net loss" of productive capacity would be difficult if not impossible to implement in every situation. While biological values are recognized, the DFO definition of what constitutes a loss of productive fish habitat is viewed generally from a socio-economic perspective.

This concept is firmly imbedded in the PMFH.

The importance of socio-economic considerations in applying the "no net loss" principle is illustrated by posing the following questions: 'What exactly is the DFO referring to when the term "net loss" is employed?' Or, in other words, what or who is suffering a "net loss" of fish habitat? The assumption may be drawn from posing these questions that Canadian fisheries resources are, in a sense suffering a "net loss" of habitat.

This answer implies a biologically pure definition of

a "net loss" which would imply that all fish are included. The PMFH clearly affirms that this is not its intent. If it is not Canadian fisheries resources which are suffering a "net loss", then one may pose the question of 'who is incurring a net loss'? The answer would then be, that the existing or future user groups are incurring a "net loss." Therefore, the deciding factor in whether or not a particular population or stock of fish will be conserved by stopping, modifying, relocating, or replacing a development proposal, rests upon whether or not any group of users have defined that reserve of fish as a productive fishery by their fishing activities in that region, or, whether or not the resource under consideration has the potential to support fishing activities. The "no net loss" principle, therefore, may be characterized as a user-defined policy.

There are a number of statements within the DFO policy which support substantiate the above stated point of view. It is first introduced in the opening paragraphs of the policy where the DFO states that the policy will contribute to the management and human use of the biosphere so that it may yield the greatest sustainable benefit to mankind (Canada 1986a). The DFO has made the following statements with regard to the socio-economic importance of meeting the policy objectives:

Direct benefits of the policy will be as outputs from various fishing activities: sometimes as a source of food; or as wholesome fish caught and sold; or as income and pleasure from the vast amount of recreational fishing taking place in Canada.

Government, private sector and citizen-initiated projects to restore degraded habitats will generate employment opportunities. Furthermore, DFO recognizes the potential impact of fish habitat decisions on regional development, industrial development, other resource sectors, and public projects. The Department will consider the interests of other resource users and will strive under this policy to take reasonable, timely and consistent decisions to maintain and improve the productive capacity of fish habitats (Canada 1986a, p. 9).

The socio-economic importance of protecting fish habitat is explicitly recognized by the DFO.

Based on the above conclusion, a secondary assumption may be made which is that the measures taken by the DFO to attain "no net loss" must take place in ways which will fully benefit the present and potential future users of the habitat. It is for this reason that geographic considerations are specified in the PMFH. This is clearly stated as follows:

..the principle may be applied on either a fish stock specific basis, or on a geographic area basis, depending on how particular fisheries are managed and harvested. In cases where a mixture of stocks is fished, stock-specific application of the principle is important, for example, with most anadromous salmon. In circumstances, such as for resident freshwater species, the principle may be applied on a broader, geographic area basis, rather than on stock specific management. Local fisheries management plans, where available, will guide the application of the principle in specific cases (Canada 1986a, p. 12). (emphasis added)

The inclusion of geographic considerations to ensure that

the needs of current user groups are satisfied when applying the "no net loss" principle is an important concept in the PMFH. It implies that if productive fish habitat is developed at such a distance from the original habitat that it cannot be accessed by the present users, this situation may be viewed as a "net loss" of productive capacity in a geographic area, or, from a user perspective. It must be noted, however, that from the viewpoint of future users, the creation of a distant fishery may not be considered a "net loss."

Given the importance which the policy places on fish harvesting it is not surprising that the policy includes a discussion of the how it can accommodate the needs of Native harvesters. The following statement from the PMFH regarding application of the "no net loss" principle in the case of Native harvesting illustrates this point. It also provides additional indications of the importance which is placed on geographic considerations to satisfy the needs of users. The PMFH states the following in regard of Native communities:

If the affected fish stocks and habitats are adjacent to Native communities, it will be important that any habitat replacement be undertaken in the immediate area to avoid any negative effects on Native fishing rights (Canada 1986a, p. 12).

Not only does the PMFH refer specifically to the needs Natives communities it also states that Native users may benefit in a number of ways as a result of the policy. The PMFH states the following:

It is recognized that Native peoples could assume a greater role in local fisheries management and environmental protection in the future. Through this policy, Fisheries and Oceans offers useful approaches for effective habitat conservation that could be implemented within the context of both Native claims and self-government (Canada 1986a, p. 9).

As losses of fish habitat are defined here by the existence of groups of users, it then follows logically that these groups should play an important role in the development of mitigation and/or compensation measures to implement the "no net loss" guiding principle. The treatment of Native issues within the context of policy application supports this assumption. Further demonstration of this concept can be illustrated by the definition of compensation for loss which is provided in the PMFH. Compensation for loss is defined as:

The replacement of natural habitat, increase in the productivity of existing habitat; or maintenance of fish production by artificial means in circumstances **dictated by social and economic conditions**, where mitigation techniques and other measures are not adequate to maintain habitats for Canada's fisheries resources (Canada 1986a, p. 27). (emphasis added)

The importance of user groups is clearly demonstrated in the above definition.

This discussion of the importance of user groups in the application of the "no net loss" principle is directly relevant to the Conawapa project. A number of groups harvest in the lower Nelson River region. In the case of the Conawapa project, one of its most significant habitat alterations will be the replacement of riverine habitat with lake habitat. The

acceptability of this alteration should be decided upon in part by the willingness of local fishermen to accept this change and in part by the maintenance of biodiversity.

Due to the demonstrated importance of users groups, when applying the "no net loss" principle, the following issues must be kept in mind; 1. resource users are an important factor in deciding whether or not the "no net loss" principle will be applied to a specific habitat, and, 2. the measures used to apply the principle should also be defined in consultation with user groups.

The importance of users groups in the application of the "no net loss" guiding principle brings rise to the question of the development of mitigation and/or compensation measures in the case of competing user groups. This issue is not addressed in the PMFH. Mitigation and/or compensation measures developed at the site of the Conawapa project may take place to satisfy the needs of competing user groups. A consensus will have to be reached between these groups. In the case where Native groups are involved in allocating the right to take fish, Native food fishing is to be given priority over the interests of other user groups. The recent Supreme Court ruling on the R v. Sparrow case (1990) 111 N.R. p. 270 S.C.) would suggest this to be the case. Given this ruling it appears as if Native groups may play a leading role in implementing the "no net loss" principle in regions where domestic harvesting takes place.

### **2.3 Expanding the interpretation of "no net loss"**

An additional factor which requires considerable evaluation in the development of mitigation and/or compensation measures is the temporal dimension of habitat development. Timing of the creation of mitigation and/or compensation measures is not specifically referred to in the PMFH. The time period required by a specific compensation project to reach the estimated productive capacity of the habitat which was destroyed may be indefinite. Since there may often be a time period between the destruction of fish habitat and the creation of new habitat, the loss of productive capacity during this period of time and the reduction of available fisheries resources for user groups during this period of time may also be considered a "net loss." Whether or not this loss of fishing activities is viewed as a "net loss" will depend on the period of time for which fishing opportunities are decreased.

In view of applying the "no net loss" principle, the incorporation of a temporal dimension for habitat replacement may, however, be difficult to define. For example, while habitat replacement may be possible through the construction of marshes with specific physical dimensions, it could take a number of years for the development to become a productive self-sustaining fishery.

If at present productive fish habitat has been destroyed and the chosen replacement option requires several years

before becoming a viable fishery, this implies that although habitat replacement measures have been developed, a "net loss" has occurred in the sense that there is a considerable gap in the amount of time between the loss of habitat and the creation of new habitat. There has been a "net loss" of productive capacity up until the point when the new habitat has reached the productive capacity of the habitat which was destroyed.

Given this argument, it seems logical that an upward limit should be placed on the amount of time allowed for a given habitat compensation scheme to reach an estimated productive capacity which is equal to, or, in excess of the estimated productive capacity of that habitat which was destroyed. At the very least, a minimum time limit should be designated as a monitoring period to determine whether or not the project is successful. The level of uncertainty surrounding habitat replacement measures has been a key issue in defining whether or not a particular development has taken place with "no net loss" of productive capacity.

#### **2.4 Pure biological definition of "no net loss"**

A purely biological definition of "no net loss" would be based upon the relative importance of various fish species to Canadian fisheries resources as a whole. It would apply to all places where fish are found and place a strong emphasis on compensating or mitigating for fish species which have been

categorized as either rare, or, endangered. Under a purely biological definition of "no net loss", the maintenance of biodiversity would automatically supersede user considerations.

Questions concerning a biological definition of what constitutes a "net loss" of productive fish habitat are relevant within discussions of mega-projects such as the Conawapa project and other major power dams since these projects will create significant changes in available fish habitat and species composition. The transformation of a riverine environment to a lake environment has raised a number of questions as to whether or not these dramatic changes are acceptable from a biological point of view. They may not be. These habitat alterations, however, may be deemed acceptable from the perspective of a resource harvester who feels that the newly created habitat is equal to or preferable to the one which was destroyed, even if a rare or endangered species is impacted. This example illustrates the divergence between a purely user-defined definition of "no net loss" and a purely biological definition. The DFO attempts to combine both of these considerations in its application of the "no net loss" principle.

## **2.5 Working definition of "no net loss"**

The above interpretation of DFO policy documentation has led to the development of the following conceptual definition

of "no net loss" for the purposes of this research report. A situation in which the "no net loss" principle has been applied successfully may be defined as a situation in which:

1. there has been "no net loss" of productive capacity;
2. the habitat mitigation or compensation scheme took place such that the fishing activities of the local users were not negatively impacted;
3. the fishing activities of users in adjacent areas were not negatively impacted;
4. compensatory habitat was developed within a reasonable distance from the original habitat and was accessible to the users of the original habitat;
5. compensatory habitat was fully developed within a time period such that the fishing activities in the region under consideration were not negatively impacted; and,
6. if there were no present users, the potential for future users to harvest the region was not eliminated.

## 2.6 Conclusion

The conceptual definition of "no net loss" presented in this chapter has been developed on the basis of literature reviews and discussions. It is based upon the concept of productive capacity with a stronger emphasis on the consideration of user groups for fisheries resources.

## **Chapter 3**

### **REVIEW OF RELATED GOVERNMENT DOCUMENTS**

The "no net loss" principle of the Policy for the Management of Fish Habitat (PMFH) can be implemented in Manitoba through a number of regulatory mechanisms such as the Fisheries Act, the EARP Guidelines Order (1984), and the Manitoba Environment Act (1988). In the case of the proposed Conawapa project, the "no net loss" principle may be applied through the joint federal/ provincial environmental assessment (EA) process. This joint EA process combines both application of the Manitoba Environment Act (1988) and the EARP Guidelines Order (1984). This process will also include application of the Fisheries Act. A more complete understanding of how the "no net loss" principle may be implemented at the site of the Conawapa project requires a review of these three documents which addresses their role in applying the "no net loss" principle.

#### **3.1 Fisheries Act**

The most important legislative basis for the "no net loss" principle is the Fisheries Act. The PMFH was designed to provide guidelines for administration of the habitat provisions of the Fisheries Act. Administration of these provisions can be problematic due to the fact that the Fisheries Act is prohibitive in nature as opposed to being mandatory. That is, while an individual or developer is

required not to destroy productive fish habitat, that individual or developer is not directly required to incorporate habitat protection initiatives into the development proposal. The "no net loss" guiding principle represents a preventative approach to habitat management whereas previous administration of the Fisheries Act was largely punitive.

### **3.1.1 Contravention of the Fisheries Act**

The majority of prosecutions under the Fisheries Act are related to fishing offences such as overfishing and inappropriate equipment use (Pollard 1985). Approximately 50 prosecutions under the pollution control and habitat protection provisions of the Fisheries Act are handled each year by the provincial courts (Canada 1988). The penalties in place for contravening the Fisheries Act include the use of warnings, fines, closure of the operation which is creating the offence, or, an order to perform remedial work on the damaged area.

The majority of the charges which are brought upon private sector corporations relate specifically to Section 36(3) of the Act which prohibits the release of substances which are deleterious to fish into water bodies which are defined as 'fisheries' according to the provisions of the Act. Section 36 of the Fisheries Act is administered by the federal Department of the Environment.

Some previous Section 36 offences include the purposeful release of toxic substances on the part of the offender in an attempt to avoid expenses associated with proper disposal. A typical case of this took place in British Columbia involving the Central Fraser Valley Regional District (Canada 1988). The district was found guilty of discharging sewage into the Willband and Clayburn Creeks and fined \$5 000.

Other cases include accidents due to negligence on the part of the offenders. A typical case of this occurred in the Northwest Territories involving Canadian Marine Drilling Ltd (Canada 1988). Waste oils were improperly stored on a barge and began to leak into the harbour. A fine of \$20 000 was levied. There are a range of fines for these offences which could be as high as \$100 000. Most of the cases cited in Volume 4 of Fisheries Pollution Reports (1988) did not require fines which approached this figure. Recently, the DFO has increased the maximum range for fines to range from \$300 000 to \$1 000 000 (Fisheries Act R.S.C. 1985, S.C., 1991, c.1).

There were a number of offences under Section 35(1) of the Act. In the case of Chet Construction Ltd. v. the Crown before the British Columbia Provincial Court in 1985, the corporation was found guilty through the use of photographic evidence which demonstrated that the corporation could have taken more care in the work involved (Canada 1988). In addition to a fine of \$1 500 the Crown also asked for a Section 33(7) order which allows for the following:

"the Court may, in addition to any punishment that it may impose, order that person to refrain from committing any further such offense or to cease to carry on any activities specified in the order the carrying on of which in the opinion of the Court will or is likely to result in the committing of any further such offence or take such action specified in the order as in the opinion of the Court will or is likely to prevent the commission of any further such offence." (Canada 1988).

The Section 33(7) order required the company to perform remedial work in addition to paying a fine. The requirement was deemed unfeasible as it would involve a large number of parties such as the local forestry service who had not yet submitted any complaints with regard to the development.

The outcome of the case involving Chet Construction Ltd. clearly illustrates some important issues related to habitat loss. While the Chet Construction was faced with a Crown indictment and a fine, the overall result of the offence was a reduction in the amount of spawning habitat for Coho and Chum salmon, thus a "net loss" of fish habitat occurred.

A similar example of lost habitat occurred in New Brunswick when the defendant, Nelson Adams, was found guilty under Section 35(1) of the Act when the excavation of a river bank by his company resulted in heavy siltation which permanently altered the natural cycle of trout migration. Nelson Adams was found guilty and was required to stabilize the excavated region and pay a fine of \$100 (Canada 1988).

In both cases cited above, despite the enforcement of the

Fisheries Act, industrial development resulted in a "net loss" of fish habitat. These occurrences will not be completely eliminated by the new policy, however, their incidence will be significantly reduced.

The use of a punitive approach to enforcing the Fisheries Act remains an effective deterrent to destruction of fish habitat, however, protection of fish habitat is heavily reliant upon fishery officers to report offences and good will within the private sector to comply with the regulations. The money which is collected as a result of these fines does not contribute directly to the development of mitigation measures or fish habitat enhancement. This approach will, however, remain particularly useful in the case of industrial accidents such as the release of toxic substances.

Application of the "no net loss" principle of the PMFH is a more effective method of preserving productive fish habitat because of its implementation process. Once the local DFO office has been notified of a proposed development, either directly or through provincial environmental authorities, appropriate precautions can be taken to avoid the permanent habitat alterations which occurred in the two cases cited above. In the case where permanent habitat alterations cannot be avoided, habitat replacement options will be available to the proponent. In some cases the project may not be allowed to proceed (Canada 1986a).

### **3.1.2 Administration of the "no net loss" principle and the Fisheries Act**

The responsibility for administering the Fisheries Act differs across the country. Under the Constitution Act (1982), the federal government has authority for all fisheries in Canada (Canada 1986a). The federal government, through the DFO, maintains direct management control of fisheries resources in the Atlantic provinces of Newfoundland, New Brunswick, Nova Scotia, and Prince Edward Island, and, fisheries in the Yukon and the Northwest Territories. The federal government also maintains direct control for marine and anadromous salmon fisheries in British Columbia, and for marine fisheries in Quebec. In Quebec, responsibility to manage all freshwater, anadromous and catadromous fish species was delegated to provincial administrative authorities. In British Columbia, provincial authorities manage all freshwater fisheries except for anadromous salmon (Canada 1986a).

Responsibility for the management of fisheries was delegated to provincial administrative authorities in the inland provinces of Ontario, Manitoba, Saskatchewan and Alberta under the Resources Transfer Act of 1930 (Alberta Law Foundation 1984). The provinces, in these cases, did not acquire jurisdiction over the habitat provisions of the Fisheries Act. The authority to authorize destruction of fish habitat has remained with the federal government which means that final say with regard to application of the "no net loss" guiding principle rests with federal authorities except

in the case of Quebec where federal authority over fisheries resources is currently being disputed. Provincial officials in all provinces have the authority to enforce all aspects of the Fisheries Act.

The division of administrative authority brings to mind the question of whether or not the "no net loss" principle is being applied uniformly across the country. Although all of the provinces have formally endorsed the policy there are some significant differences in its application across the country. The "no net loss" principle has been applied extensively in British Columbia to anadromous salmon stocks where the DFO is directly responsible for administration of this resource. In the province of Alberta, jurisdictional disputes over fisheries management as well as other natural resources has led to formal rejection by provincial authorities of federal jurisdiction over environmental matters.

Provincial fisheries authorities in Alberta are currently applying a principle of "no net loss of recreational fishing opportunities" (Canada 1991a). Aside from Alberta's formal rejection of federal fisheries legislation, the Fisheries Act itself was found to be in direct contradiction with Alberta's Clean Water Act. This act prohibits the deposit of water contaminants which degrade or are likely to degrade or alter the chemical or biological quality of water (Albert Law Foundation 1984). Toxic releases can take place if they are approved by one or more government departments. This act led

to effluent releases which exceeded levels acceptable to the DFO while at the same time being acceptable to the Alberta Department of the Environment. In most cases, standards set by federal legislation should prevail over provincial legislation, however, in the field this is not always the case.

Complete uniformity in the application of the "no net loss" principle will be difficult if not impossible due to differences in administrative arrangements across the country.

### **3.1.3 Manitoba Hydro and the Fisheries Act**

Up to this point, administration of the Fisheries Act has been discussed with regard to private sector development. In theory, application of the Act to the public sector should not differ significantly, however, evidence suggests a certain degree of exemption from fisheries regulations for crown corporations. There are no cases of provincial crown corporations being charged with fisheries offences. In technical terms, all previous developments undertaken by Manitoba Hydro may be considered as not being entirely consistent the habitat protection objective of the Fisheries Act.

Officials at the Manitoba Department of the Environment feel that once it has issued a licence for the construction of a project such as a hydroelectric dam, the project may proceed and is legal from their point of view (Dan McNaughton, pers.

comm). Although there were no formal requirements for DFO approval and authorization, this does not necessarily mean that fish habitat considerations were not factored into the project (Dan McNaughton, pers. comm.).

It is unlikely that Manitoba Hydro will be able to proceed with projects in the same manner as it has in the past. The outcome of the Rafferty-Alameda/Oldman court cases have significantly increased the DFO's obligations to enforce fisheries regulations under the EARP Guidelines Order (1984). These court cases are discussed below.

### **3.2 Environmental Assessment and Review Process (EARP) Guidelines Order 1984**

The EARP Guidelines Order (1984) has borne a significant impact on the application of the "no net loss" principle. The outcomes of recent court decisions have defined the responsibilities of the federal government under the EARP Guidelines Order (1984) such that a large number of projects are now subject to review under the federal EARP. In these cases, the DFO becomes involved with the environmental assessment process and the "no net loss" principle is used as part of its project evaluation process.

There is a brief history of events leading to the current state of application of the EARP Guidelines Order (1984) which requires explanation.

In 1984, when the EARP Guidelines Order (1984) was released. These Guidelines were intended to be self-screening

procedures for federal agencies and were designed to apply to any proposal which met the following conditions:

- (a) that is to be undertaken directly by a federal initiating department;
- (b) that may have an environmental effect on an area of federal responsibility;
- (c) for which the Government of Canada makes a financial commitment; or
- (d) that is located on lands, including the offshore, that are administered by the government of Canada (SOR/84-467).

These Guidelines were written to set out the requirements of the EARP and the responsibilities of the participants therein. The Guidelines were created to ensure that the environmental implications of federal government actions could be taken into consideration as early in the project planning as possible (Canada 1986b).

Several years after its release, the application of the EARP Guidelines Order (1984) became the subject of several court battles which included the Rafferty-Alameda Dam case and the Oldman River Dam case. These cases raised many questions among proponents, government officials, lawyers and environmental groups as to the scope of environmental protection provided by the EARP.

Until 1988, the federal government applied the EARP Guidelines Order (1984) as discretionary and non-enforceable powers. The EARP was used as an internal environmental assessment process, however, a decision of the Federal Court of Appeal involving the Rafferty-Alameda held that the EARP

Guidelines Order (1984) is a legally enforceable law of general application (Canadian Wildlife Federation Inc. et al v. Canada (Minister of the Environment) and the Saskatchewan Water Corporation (1989), 99 N.R. 72 (F.C.A.).

The Rafferty-Alameda case centred on whether or not the provisions of the federal environmental review process had been applied correctly by the federal Minister of the Environment when the building licence for the project was issued. The building licence was issued under the International River Improvements Act and Regulations. The applicant felt that the EARP Guidelines Order (1984) had not been properly applied. The respondent Minister's position was essentially that he was not required to comply with the EARP Guidelines Order (1984) when issuing a licence under the International River Improvements Act and Regulations. The respondent pointed out that since the Rafferty-Alameda project was a provincial initiative funded by the Province of Saskatchewan, located on provincial land, and, had been subjected to a formal review and Board of Inquiry by the Saskatchewan Department of Environment and Public Safety, that to undertake a federal environmental assessment would be unwarranted duplication of assessment process (Canadian Wildlife Federation Inc. et al v. Canada (Minister of the Environment) and the Saskatchewan Water Corporation). Provincial crown corporations such as the Saskatchewan Water Corporation were not obligated to comply with the EARP

Guidelines Order (1984).

The court ruled that the project must be subjected to the EARP Guidelines Order (1984) as the project will have an environmental effect on fish, an area of federal responsibility.

The Rafferty-Alameda project bears a number of similarities to the Conawapa project. It is important to note that prior to the Rafferty-Alameda court ruling the Conawapa project proposal would have not have been obligated to undergo a full federal environmental impact assessment under the provisions of the EARP Guidelines Order (1984). The Conawapa project should have been subject to the EARP because the project will affect fish, an area of federal responsibility. Application of the EARP would have been discretionary rather than mandatory. DFO's increased responsibilities under EARP were not implemented until the Rafferty-Alameda decision.

Shortly following the Rafferty-Alameda case, a second hearing was initiated by the Friends of the Oldman River Society. The applicant stated that the federal Department of Transport and the Department of Fisheries and Oceans failed to comply with the EARP Guidelines Order (1984) (Friends of Oldman River Society v. Minister of Transport et al. (1990) F.C.A. A-395-89). This case created an awkward situation as two federal departments were being charged for failing to apply federal legislation. The most recent outcome of this case was a conclusion by the Supreme Court that Ottawa has the

constitutional power to order environmental studies of any project that impinges on any aspect of federal jurisdiction (York 1992). The obligation of provincial environmental authorities to undergo a federal EARP where applicable was reaffirmed.

### **3.2.1 EARP and the "no net loss" principle**

The outcomes of the court cases cited above have borne a number of important impacts on the application of the "no net loss" principle. Primarily, the number of projects which will be subject to the EARP Guidelines Order (1984) has been greatly increased. Every project which may have some degree of impact on fisheries resources must be reviewed by the DFO. Mitigation and/or compensation measures are outlined in an EARP screening document which is produced for each development proposal. The EARP has, in fact, strengthened the "no net loss" guiding principle by placing an added responsibility on developers to protect fisheries resources thus increasing the ability of the DFO to achieve habitat protection. The EARP brings the Fisheries Act into the review process, and, allows for incorporation of preventative approaches to environmental protection such as the "no net loss" principle, into the review process (Thomas Owen, pers. comm.).

As every project which may have an impact on fisheries resources is now reviewed by the DFO, the Department has been required to process hundreds of applications for project

approval. These projects are handled for the most part by provincial authorities, with the exception of provinces with coastal fisheries where administration of the habitat provisions of the Fisheries Act has not been delegated to provincial authorities, ie: British Columbia.

The recent increase in application of the EARP may be viewed positively by conservationists, however, the large number of projects which now require review has greatly increased the workload at the DFO and provincial environmental assessment agencies. This has led to delays in processing applications and frustration among developers who could not proceed without DFO approval.

The increased importance of the DFO in environmental assessment may seem to have placed fisheries resources on a higher level of importance relative to other natural resources. A project may require an environmental review for which fisheries impacts are only a minor consideration relative to the scope of the project. In such a case, when the DFO has initiated an EARP, all other areas of federal responsibility are also addressed. The EARP requires that the DFO, as initiating department is required to obtain protection for other resources.

The recent court interpretation of the EARP Guidelines Order (1984) has altered the focus of environmental impact assessment in Manitoba. This is particularly evident in the case of acquiring an environmental approval for a

hydroelectric project such as Conawapa. Had Conawapa been subject to an assessment under the provisions of the Manitoba Environment Act (1988), approval for the project would have been issued from the Manitoba Department of the Environment (DOE). The provincial Fisheries Branch of the Department of Natural Resources (Manitoba Fisheries Branch) would have been a key player in the process. The role of the DFO, would have been advisory (Dennis Windsor, pers. comm.). All provincial departments were required to be consulted under the provincial licensing system. Under the EARP Guidelines Order (1984), the DFO is now more specifically involved with the environmental impact assessment of the Conawapa project (Thomas Owen, pers. comm.).

Overall, the EARP Guidelines Order (1984) has had a strong administrative impact on the application of the "no net loss" principle by increasing the number of projects which would require DFO approval. The role of DFO in the EARP has created an additional mechanism to apply the "no net loss" guiding principle.

### **3.3 Manitoba Environment Act (1988)**

A third regulatory document which will play a role in implementing the "no net loss" guiding principle is the Manitoba Environment Act (1988). The Act was developed to replace the Manitoba Clean Environment Act. It was designed to broaden the scope of environmental protection and formalize

the environmental regulatory process. The mandate of the Act is to ensure that all prospective developments, both private and public are planned by taking into consideration the interests of all parties who may become either directly or indirectly affected. The Act attempts to achieve this goal by requiring that anyone who plans a project that could have a negative impact on the environment register the project with the Manitoba Department of the Environment (DOE) and conduct an environmental assessment of the project before it can be allowed to proceed (Manitoba 1987). The Act was also intended to legislate the public consultation process and strengthen enforcement of existing regulations (Egan et al. 1987).

The Manitoba Environment Act (1988) was designed to provide an environmental licence for an approved project which has undergone a process of interdepartmental screening, environmental assessment and public review (Manitoba 1987). The project proponent can only receive an environmental licence upon approval of the project from either the Director in the case of a Class 1 or Class 2 development, or, the Minister of the Environment in the case of a Class 3 development. The Minister will make this decision based upon the recommendations of the Clean Environment Commission (CEC) which is authorized under the provisions of the Manitoba Environment Act (1988) to conduct investigations into the environmental impacts of the project proposal and conduct public hearings (Manitoba 1987).

The Manitoba Legislature has recently approved Bill 24 to establish a joint environmental assessment process between the federal and provincial levels of government. This process is being developed to avoid duplication of environmental assessment processes at both levels of government. The Conawapa project is currently being assessed under a joint process as discussed in the introduction to this chapter.

### **3.3.1 Application of the Manitoba Environment Act (1988) to Conawapa prior to 1989**

The Conawapa project will be the first major hydroelectric development to fall under the provisions of the Act. Prior to the Rafferty-Alameda/Oldman court decisions, the Conawapa project would have been assessed only according to the provisions of the Manitoba Environment Act (1988). According to the Act, Manitoba Hydro is required to submit a proposal to the DOE. Conawapa would be classified as a Class 3 development. The project would be subject to an interdepartmental review within the government. A list of departments with an interest in the assessment of the proposal would be represented on a Technical Advisory Committee (TAC). A TAC is established to issue guidelines to the proponent to prepare the Environmental Impact Statement (EIS), and, to review the completed EIS. The TAC would include a representative from the Manitoba Fisheries Branch and the DFO. Both of these departments will solicit fish habitat concerns, thus applying the "no net loss" principle.

For Class 3 developments, public hearings conducted by the CEC may take place at the discretion of the Minister. The findings of the CEC would be reported to the Minister of the Environment to make recommendations for licensing (Manitoba 1987). In the case of the Conawapa project, a TAC was established to study the potential effects of the Conawapa project on the lower Nelson River.

A Fisheries Mitigation Sub-Committee of the Conawapa TAC (or lower Nelson River TAC) was formed to evaluate various approaches to mitigating potential fisheries impacts while using the "no net loss" principle as a guideline for evaluating proposals. This five member committee included one member from the regional DFO, two members from the Manitoba Fisheries Branch, one member from the DOE, and, one member from Manitoba Hydro (FMSC 1989).

Under provincial assessment procedures, the DFO had formal membership on the TAC. The "no net loss" principle would have been engaged as a guideline to mitigation procedures. There were no formal requirements for DFO approval of mitigation and/or compensation measures. Manitoba Hydro was, however, required to meet DFO regulations upon construction of the project.

### **3.3.2 Present application of the Manitoba Environment Act (1988) to Conawapa**

The Conawapa project will undergo an environmental impact assessment under a joint federal/provincial process which will

combine the provisions of the Manitoba Environment Act (1988) with the requirements of the EARP Guidelines Order (1984). The application of the Manitoba Environment Act (1988) will not differ considerably from the assessment process that would have taken place prior to the Rafferty-Alameda/Oldman decisions, except for the joint initiative and the added responsibilities of the DFO and other federal agencies under the EARP Guidelines Order (1984).

### 3.4 Conclusion

There are three legislative mechanisms in place to incorporate the "no net loss" principle into provincial and federal environmental protection measures in Manitoba. Administration of the Fisheries Act can be used as a vehicle to apply the "no net loss" principle as inability to meet its requirements is likely to equate a fisheries regulation contravention. Enforcement of a Fisheries Act regulation may not necessarily mean that restoration of the damaged resource will take place. Application of the "no net loss" guiding principle will mean that preservation and restoration of fisheries resources will take place.

The EARP Guidelines Order (1984) provides a legislative basis to the "no net loss" principle because it has increased the number of projects to be examined by the DFO and has provided an obligation on the part of proponents from both the public and private sector to mitigate or compensate for any

negative impacts which a project may have on fisheries resources.

The Manitoba Environment Act (1988) plays a role in applying the "no net loss" principle through its use of a Technical Advisory Committee. The joint assessment process which requires a federal approval provides another supporting mechanism to the "no net loss" principle.

The following chapter will examine the process by which the "no net loss" principle might be applied to the Conawapa project, and, its day to day administration following implementation.

## **Chapter 4**

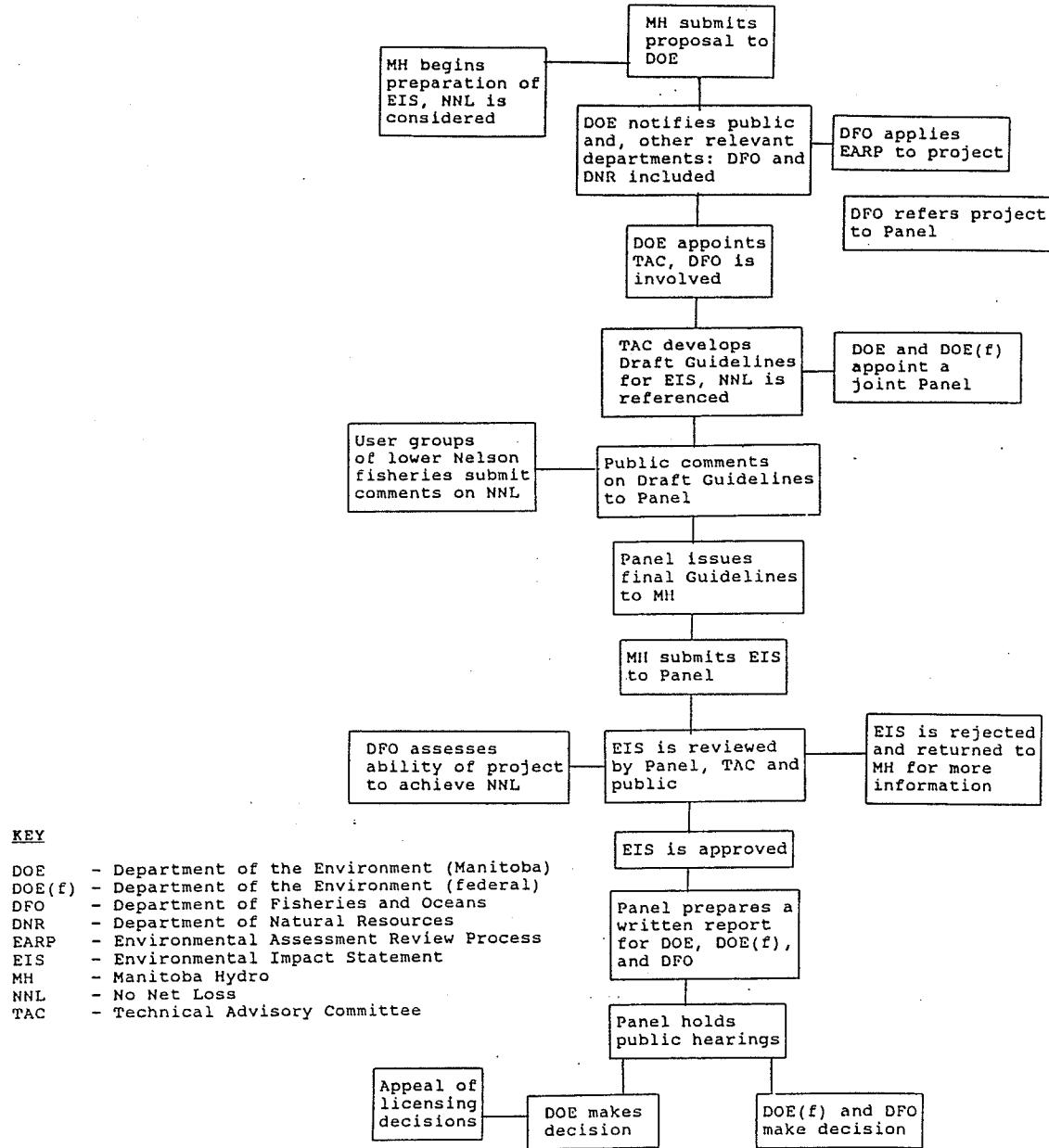
### **IMPLEMENTATION OF THE "NO NET LOSS" PRINCIPLE THROUGH THE JOINT FEDERAL/PROVINCIAL ENVIRONMENTAL ASSESSMENT PROCESS**

The "no net loss" principle may be applied to the Conawapa project through the joint federal/provincial environmental assessment (EA) process. This process combines the provisions of the Manitoba Environment Act (1988) with the requirements of the EARP Guidelines Order (1984). An examination of this process will discuss the agencies which may play a role in implementing the "no net loss" guiding principle at Conawapa. A brief description of the application of a "no net loss" principle to a recent Hydro-Quebec development is also provided.

#### **4.1 Environmental Assessment Process for Conawapa**

The Conawapa project will be reviewed in two stages. Stage 1 will include a review of the proposed Conawapa Generating Station (G.S.) including the cofferdam, spillway, powerhouse and dikes. For the purposes of this discussion, only Stage 1 of the EA process will be included as it is the stage of the project where the "no net loss" principle will most likely be applied. A flow diagram illustrating the joint EA process is provided in Figure 4.1.

The joint EA process began with a submittal of the entire project proposal to the Manitoba Department of the Environment (DOE) by Manitoba Hydro. Upon receipt of the project



**Figure 4.1: Flow diagram of the joint EA process for Conawapa and its relationship to application of the "no net loss" principle.**

Source: Manitoba 1991, Manitoba Department of the Environment, and, Manitoba Hydro.

proposal, the DOE notified the public through advertisements. A copy of the proposal was filed with the public registries, the Interdepartmental Planning Board (IPB), and the Federal Environmental Assessment Review Office (FEARO). Interest groups such as the Manitoba Eco-Network, the Manitoba Environmental Council and the Manitoba Keewatinow Okimakinak also received copies of the proposal (Manitoba 1991).

The DOE classified the project according to its magnitude. The Conawapa project was designated as a Class 3 development. Very large scale projects are designated as Class 3. These projects are subject to an interdepartmental review within the government. This review includes both federal and provincial departments. Reviewing departments will forward their advice to the Director of the Environment concerning the level of detail which will be required for the proposal (Manitoba 1987).

A review of the Conawapa proposal by the Department of Fisheries and Oceans revealed that the project would have significant impacts on fisheries resources in the region, thus the proposal would have implications for the habitat provisions of the Fisheries Act including Section 35. As the project was deemed to have impacts on fisheries resources, an area of federal responsibility, the Conawapa project was subject to the EARP Guidelines Order (1984).

After the screening process, the DFO assumed the role of "initiating department". An "initiating department" is

defined in the EARP Guidelines Order (1984) as any department, that is, on behalf of the Government of Canada, the decision-making authority for a proposal.

The DFO then submitted a letter to the federal Minister of the Environment requesting that EARP be invoked and recommending the appointment of an EARP Panel. Under the joint EA process, a review Panel was jointly appointed by officials from both the federal and provincial levels of government.

Once this Panel was established, communication between the proponent and the DFO was minimized to avoid any perception that the two agencies are collaborating in any way. Prior to the establishment of the Panel, the proponent may communicate freely with government departments.

All departments with an interest in the proposal are represented on a Technical Advisory Committee (TAC) (Manitoba 1987). The TAC is appointed by the DOE as a technical resource to the Panel during the EA process. As a joint federal/ provincial EA process was established in the case of the Conawapa project, the TAC carries members from both levels of government.

At the same time as the Conawapa proposal was being made public, the TAC developed Draft Guidelines for the preparation of the Environmental Impact Statement (EIS). These Draft Guidelines defined how the EIS would be prepared and what issues would be included in it. The Draft Guidelines were

released on June 11, 1991.

Section 5 of the Draft Guidelines, entitled "Impact Mitigation" stated the following with regard to the "no net loss" guiding principle. The proponent is required to provide the following:

'information on how impacts identified in the Environmental Impact section of the EIS will be mitigated. These may include the selection of an alternative means of electrical supply, changes in design or operation of facilities, routing of corridors or transmission lines, siting of stations, water control proposals, fish and terrestrial animal habitat development to achieve the objectives of the "no net loss" policy of the Federal Fisheries Act or compensation where mitigation measures are not feasible. (Manitoba 1991, p. 12).

Other references were made to the "no net loss" principle in relation to the bio-physical environment in which the project will take place. The Draft Guidelines stated that Manitoba Hydro must provide information in relation to the following:

aquatic resources, streams, rivers lakes, flood plains, the Nelson River estuary and their water quality classification, research sites, fish habitat that sustains or supports (or has the potential to support) commercial, Native and recreational activities including fishing and information on the existing fisheries including mammals (Manitoba 1991, p. 9).

Since the release of these Draft Guidelines, the Panel has stated that it would ignore these guidelines and would produce its own set of guidelines. The Panel may or may not accept the Draft Guidelines which were developed by the TAC (Thomas Owen, pers. comm.). Despite this procedural change, in all likelihood, the final guidelines will also require the

proponent to provide information as to how the requirements of the "no net loss" principle will be met.

In 1987, a Fisheries Mitigation Sub-Committee of the Conawapa TAC (referred to in the final report as the Lower Nelson River TAC) was formed to evaluate various approaches to mitigating the impacts of the proposed Conawapa project on fisheries resources in the lower Nelson River, in an attempt to meet the requirements of the "no net loss" principle. The committee was composed of representatives from the DOE, the Manitoba Fisheries Branch, the DFO, and, Manitoba Hydro. The conclusions drawn in this report are expected to be reviewed by the Panel as part of the environmental assessment process.

Once the Panel's Draft Guidelines have been developed they will be made available for public comment. Comments can be submitted to the Panel in writing or at public meetings. At this stage members of the public are provided with the opportunity to provide input into the scoping of the EIS. It is at this point in the EA process where members of the public from Native Groups such as the Fox Lake Band, and, sport fishing groups such as the Manitoba Fly Fishermens' Association, Fish Futures, and, the Gillam Brook Trout Association, may wish to make requests that specific information be included in the EIS with regard to the "no net loss" guiding principle. These groups have no formal decision-making authority with regard to how the environmental impacts of the project will be mitigated and/or compensated

for aside from the stages of the joint EA process which have been designated for public comment. These groups may wish to apply for intervenor funding if they feel it is necessary.

Manitoba Hydro has been meeting with the Fox Lake Band and sport fishing groups to discuss concerns related to the potential impacts of Conawapa on the lower Nelson River (Dennis Windsor, pers. comm.).

When the final guidelines have been developed, they will be presented to Manitoba Hydro to be followed in the preparation of the EIS. In the meantime, Manitoba Hydro has been in the process of collecting data for the Conawapa EIS while keeping the DFO "no net loss" policy objective in mind. The final guidelines which are issued will delineate information requirements and how the information which has been accumulated by the Corporation will be assessed and presented.

When the EIS has been prepared by Manitoba Hydro, it will be submitted to the Panel and the TAC. The EIS will also be filed in the public registries. Copies will be sent to interested parties such as the Manitoba Eco-Network, the Manitoba Environmental Council, and, the Manitoba Keewatinow Okimakinak. This will allow for public comment on the document.

The TAC will review the EIS and submit a report to the Panel. A copy of this report will also be made available for public review. The public may submit written comments and

objections on this report.

After reviewing the EIS, the TAC report, and, any public comments received, the Panel may issue a deficiency statement with instructions that the proponent collect additional data and conduct further assessment work (Manitoba 1991). The perceived effectiveness of the mitigation measures provided to achieve "no net loss" will also be evaluated by the Panel at this stage of the assessment process.

When the Panel determines that the EIS is acceptable, public hearings will be held. Following these hearings, the Panel will prepare a written report with conclusions and recommendations which will be submitted to the Manitoba and federal Ministers of the Environment. Each of these agencies will submit a separate decision on the project. These decisions may or may not be the same. The project will require both federal and provincial approval. Both the provincial licence and federal "approval" may contain conditions for project development which pertain directly to the "no net loss" principle.

The federal Minister of the Environment will make a decision on the project based on the provisions of the EARP Guidelines Order (1984). This recommendation will be passed on to other federal departments for comments. As an initiating department, the Minister of Fisheries and Oceans will be responsible for preparing the "federal" response to the Panel report. The decision will be based upon all issues

concerning the project. The Minister of Fisheries and Oceans may use the acceptability of the mitigation and/or compensation measures developed in the EIS as one of the guidelines to recommend an approval or disapproval for the project. These federal agencies will make a final decision on the acceptability of the proposal based on the issues and information which were developed during the joint EA process. An environmental licence may be awarded to Manitoba Hydro by the Manitoba Minister of the Environment in accordance with the Manitoba Environment Act (1988). This decision is appealable by Manitoba Hydro and any other interested party.

#### **4.1.1 Post-Assessment administration and monitoring of the "no net loss" principle**

Implementation of the "no net loss" principle may be viewed as a two part process which begins with the development of appropriate mitigation measures during the EA process combined with an effective administration and monitoring program.

While the Conawapa project is still in the assessment phase of its development, some predictions can be made as to how mitigation and/or compensation measures will be administered and monitored if an environmental licence and approval are awarded. It must be noted that these predictions are based on information gathered directly from government documents, government officials, Manitoba Hydro, and, from the examination of past applications of the "no net loss"

principle which will be presented in Chapter 6 of this report.

The environmental licence which may be awarded for the Conawapa project may include specifications to the proponent as to how the requirements of the "no net loss" principle will be met. The environmental licence is likely to outline the objectives of the mitigation programs designed to achieve "no net loss". Further details on the mitigation and/or compensation plan may be contained in a separate document such as a compensation agreement. An example of a compensation agreement for a minor project is presented in Appendix 3.

The mitigation plan may be developed jointly by the Manitoba Fisheries Branch, the Department of Fisheries and Oceans (DFO), the Manitoba Department of the Environment (DOE) and Manitoba Hydro based on evidence presented during the EIA process. Other agencies and interest groups may be involved.

#### **Post-Assessment Responsibilities of Manitoba Hydro**

According to the Policy for the Management of Fish Habitat (PMFH), Manitoba Hydro must assume financial responsibility for administration and monitoring to ensure that the chosen mitigation and/or compensation measures meet policy objectives (Canada 1986a). The EARP Guidelines Order (1984) sets out proponent requirements with regard to post-assessment administration and monitoring in Section 34(f).

34. It is the responsibility of the proponent in a public review to;

(f) ensure that appropriate post-assessment monitoring, surveillance and reporting, as required by the initiating department, are carried out (SOR/84-467).

The post-assessment responsibilities of Manitoba Hydro are to carry out these duties according to the specifications of the DFO as initiating department.

#### **Post-Assessment Responsibilities of the DFO**

The legal authority for administration of the mitigation plan will fall under the jurisdiction of the DFO as final authorization to alter fish habitat by the construction of the Conawapa project will be issued by this department. According to the Section 14 of the EARP Guidelines Order (1984), as initiating department, the DFO will have the following responsibility:

Where, in any case, the initiating department determines that mitigation or compensation measures could prevent any of the potentially adverse environmental effects of a proposal from becoming significant, the initiating department shall ensure that such measures are implemented (SOR/84-467).

The DFO will also be responsible for advocating the protection of the specific interests for which it is responsible as a federal department. This requirement is set out in Section 19(b) of the EARP.

The role of the DFO in post-assessment and administration of the "no net loss" principle at the site of the Conawapa

project will be that of an auditor to ensure that the goals of the principle are achieved. The DFO will also be responsible for ensuring that the conditions for federal approval are met.

#### **Post-Assessment Responsibilities of the Manitoba Fisheries Branch**

It is likely that once the mitigation plan for Conawapa is instigated, the Manitoba Fisheries Branch will take a lead role in the day to day administration of the mitigation plan. The Manitoba Fisheries Branch has formally endorsed the PMFH (Manitoba 1988). The Manitoba Fisheries Branch was responsible for investigating the impacts of hydroelectric development on the lower Nelson River prior to the decision to allocate responsibility for these studies to Manitoba Hydro. Any problems encountered in the field with regard to the mitigation plan will be reported to the Manitoba Fisheries Branch. In the case of past applications of the "no net loss" principle, such as the Namew Lake Mine example cited in Chapter 6 of this report, the Manitoba Fisheries Branch is playing a lead role in managing the fishery (Manitoba 1989). The Natural Resources Officer (NRO) appointed by the Department of Natural Resources (DNR) who is posted in the Nelson River region, will also play an active role in ensuring that the mitigation plan is implemented.

#### **Post-Approval Public Participation**

The enlistment of post-approval public participation the

development and implementation of a compensation plan to meet the "no net loss" objective at Conawapa will greatly improve application of the policy. Although only partial attempts have been made to implement ongoing public participation in resource development in Canada, post-approval public participation can be an important part of impact assessment and management (Bush 1990).

#### **4.2 Application "no net loss" by Hydro-Quebec**

In the Province of Quebec, the DFO has responsibility for marine fisheries. Quebec provincial authorities manage all freshwater fisheries, and, all anadromous and catadromous fish species (Canada 1986a). This administrative agreement has created a situation in which Hydro-Quebec reports their activities relating to fisheries management to the provincial Minister of Hunting, Fishing and Recreation. Therefore, the "no net loss" principle of the PMFH is being applied to marine fisheries in the province, however, it is not currently being applied to Hydro-Quebec developments as the majority of their operations affect freshwater fisheries. Marine fisheries, however, may be impacted by Hydro-Quebec projects.

The Quebec regional office of the DFO is currently seeking to alter this arrangement by claiming that the responsibilities designated to provincial authorities in a 1922 federal/provincial agreement included only management of fisheries and not responsibility for habitat management. The

DFO is currently attempting to assume responsibility over habitat management issues. This would include inland fisheries and the operations of Hydro-Quebec. The Department is in the process of discussing application of the "no net loss" principle to the proposed Great Whale project (Yvan Vigneault, pers. comm.).

Although the "no net loss" policy as it was designed by the DFO is not being applied at present by Hydro-Quebec, the utility has applied the principle of "no net loss" to one of their most recent developments. It has been described as a "philosophy which is applied when evaluating projects." It is not cited directly in Hydro-Quebec reports (Gaetan Geurtin, pers. comm.). The principles which have been endorsed in the environmental impact assessment of one of Hydro-Quebec's most recent developments clearly reflect the goals of the DFO "no net loss" principle. Hydro-Quebec applied a principle of "no net loss" specifically to meet user needs by preventing a reduction in the productive capacity of the Moisie River.

A review of implementation of the "no net loss" principle to Hydro-Quebec's Ste. Marguerite 3 project reveals some interesting points which may be useful in applying the "no net loss" principle to Conawapa.

The use of a minimum flow requirement is the mitigation measure currently being proposed to alleviate the impacts of this development on a large population atlantic salmon. This proposal has been developed on the basis of an estimated loss

of 5-6% of the population as a result of reduced flow conditions (Hydro-Quebec 1991).

In 1987, Hydro-Quebec launched a series of public information and consultation campaigns. The purpose of these activities was to receive public comments as early in the project development process as possible. Hydro-Quebec also held a number of meetings with Les Gestionnaires de la Moisie (Moisie River Association) and the Montagnais First Nation (Hydro-Quebec 1991).

Hydro-Quebec also appointed an independent Scientific Committee in 1988 mandated to provide a means to "avoid a net loss of salmon habitat and a reduction in the productivity that the structures are likely to cause" (Hydro-Quebec 1991). The Committee was mandated to advise Hydro-Quebec on the following: methods and analysis of studies in progress, mitigation measures, and, recommendations for additional studies for 1989. The Committee was not required to state an opinion on the overall environmental acceptability of the project. The opinions of the Committee members were not binding upon the institutions with which they were associated (Hydro-Quebec 1991).

The measures taken by Hydro-Quebec are likely to facilitate the environmental assessment process.

#### **4.2.1 Environmental assessment process for Ste. Marguerite 3**

The EA process to evaluate the Ste. Marguerite 3 project will include both a federal and provincial EA process. These

processes will be undertaken separately except for the case of the public hearings which will be held jointly. Quebec is currently contesting federal jurisdiction over environmental matters within the province.

In Quebec, the Ministry of the Environment issues a 'certificate of authorization' which is the same thing as an environmental licence under the Manitoba process. This certificate will stipulate the conditions under which the development can take place (Quebec 1988). Fisheries mitigation measures required by Hydro-Quebec to alleviate the negative impacts of the project will be included in these conditions. This mitigation program will be developed and administered by the Department of Fishing, Hunting and Recreation of Quebec. The costs associated with monitoring the programs is the responsibility of Hydro-Quebec (Gaetan Geurtin, pers. comm.). Monitoring and day to day administration of the program in this case will be quite similar to what will occur at Conawapa as provincial fisheries authorities will play a lead role in ensuring that the objectives of the monitoring program are met. An important difference between the two provinces is that the DFO will have no defined role in the process.

#### **4.3 Comparison between Manitoba and Quebec**

A comparison of the application of the "no net loss" principle to a Manitoba Hydro project and the Hydro-Quebec

project revealed two interesting approaches which may be applied to the Conawapa project. In their application of the principle of "no net loss", Hydro-Quebec placed a strong emphasis on public opinion namely Native groups and recreational fishermen in ensuring that there was "no net loss" of habitat. The appointment of an independent Scientific Committee was useful in providing additional information to the utility from independent sources free of affiliations with interest groups and government agencies. This type of forum for discussion could prove to be a more effective forum to evaluate mitigation and compensation measures than the Fisheries Mitigation Sub-Committee which was created to evaluate options for "no net loss" at the Conawapa site.

It would be inappropriate to provide any definitive statements as to the relative effectiveness of the resulting mitigation and/or compensation programs under the implementation processes cited above. Such an evaluation is premature at this point.

#### **4.4 Conclusion**

The implementation of the "no net loss" guiding principle to the Conawapa project entails a two step process which includes; 1. determination of mitigation and/or compensation measures through the joint federal/provincial EA process, and, 2. post assessment monitoring and administration.

As application of the "no net loss" principle has been included in the Draft Guidelines, it is likely that it will be included in the final guidelines. Responsibility for ensuring that the mitigation plan fulfills the "no net loss" objective will largely be undertaken by the DFO as its role as initiating department stipulates that it is responsible for ensuring that the recommendations of the joint Panel are implemented. Provincial fisheries authorities, (Manitoba Fisheries Branch), will play a leading role in day to day administration of the mitigation plan as in past applications of the policy within Manitoba and in other provinces.

The principle of "no net loss" is being applied to the Ste. Marguerite 3 hydroelectric project in the Province of Quebec. Licensing and post-assessment responsibilities in Quebec are handled by provincial authorities with no defined role for the DFO. Hydro-Quebec employed an independent Scientific Committee to provide further information on the project. The utility has attributed the quality of their proposed mitigation measures to this committee. This initiative may be useful in the Conawapa joint EA process.

## **Chapter 5**

### **COMPARISON OF THE DFO "NO NET LOSS" POLICY TO THE UNITED STATES "NO NET LOSS" OF WETLANDS POLICY**

The concept of approaching environmental management and assessment through a "no net loss" of habitat perspective is currently being developed in the United States. In 1988, President George Bush's campaign included a pledge of achieving "no net loss" of wetlands habitat. Since this time, the U.S. Department of the Interior (DOI) and the U.S. Fish and Wildlife Service (FWS) have initiated a broad based effort to address wetlands issues and work towards President Bush's goal (United States 1990). A document published by the DOI and FWS entitled the Wetlands Action Plan outlines a "three pronged approach" to the achievement of "no overall net loss of wetlands". This goal closely reflects the objectives of the Canadian Department of Fisheries and Oceans (DFO) "no net loss" policy. This "three pronged approach" includes wetlands protection, restoration, enhancement and management. Wetlands research, information, and education is also included. Although the U.S. "no net loss" of wetlands policy is still in the developing stages, there are some fundamental similarities and differences between the two policies. Some comparisons can be made between the U.S. "no net loss" policy and the Canadian policy.

### **5.1 Administration of the U.S. "no net loss" Policy**

As in the case of the PMFH, the Wetlands Action Plan is a federal initiative. Implementation of this policy is the responsibility of a number of federal departments as there is more than one department which has jurisdiction over wetlands in the U.S. The Wetlands Action Plan outlines how the government will attempt to achieve "no net loss" of wetlands.

The DOI is comprised of a number of bureaus such as U.S. Geological Survey, Bureau of Indian Affairs, Bureau of Land Management, Minerals Management Service, Bureau of Mines, the National Park Service, the Bureau of Reclamation, and, the Office of Surface Mining. All of these agencies have various responsibilities with regard to wetlands (United States 1990).

The FWS, as in the case of the DFO, will draw upon their existing legislative authority, regulations, and directives to implement this policy. Some of the existing authorities which the FWS will draw upon to achieve "no net loss" of wetlands will be the National Wildlife Refuge System Administration Act, the Emergency Wetlands Resource Act, the Fish and Wildlife Coordination Act, the Migratory Bird Conservation Act, etc. (United States 1990).

The "no net loss" policy will be administered through a number of other acts which do not fall under the responsibility of the FWS. These include the Clean Water Act, the Food Security Act, and the Water Resource Development Act. The FWS is seeking to establish cooperative relationships with

other federal departments such as the Army Corps of Engineers (CE), the Soil Conservation Service (SCS) and the Environmental Protection Agency (EPA). These departments also possess some jurisdictional authority over wetlands. The FWS is conducting an inventory of U.S. wetlands to produce a series of national wetlands inventory maps for the entire country (United States 1990).

The EPA and the CE are responsible for making jurisdictional determinations of wetlands regulated under Section 404 of the Clean Water Act. Section 404 of the Clean Water Act prohibits the deposition of dredged or fill materials into water bodies including wetlands. The EPA and CE share enforcement authority under Section 404 of the Act and have entered into a memorandum of agreement to formalize agency roles. Both the EPA and CE share responsibilities for providing permits for activities which affect wetlands. The EPA is the lead agency for pursuing unpermitted discharges. These permits are issued under Section 404 of the Clean Water Act. The CE plays a lead role in enforcing violations of Section 404 permit conditions.

The EPA has an important role in developing guidelines to administer Section 404 of the Clean Water Act and in defining the geographic extent of waters of the United States including wetlands. The EPA is also responsible for Section 404(c) of the Clean Water Act which authorizes the EPA to prohibit or restrict discharges of dredged or fill material into waters of

the United States when such discharges would have unacceptable adverse effects on municipal water supplies, shellfish beds, fishery areas, wildlife or recreational areas. To date, the EPA has enforced only Section 404(c) only 11 times out of an estimated 150 000 permit applications received since these regulations went into effect in 1979, and, only 3% of the total number of permit applications received have been rejected (United States 1991a).

The Secretary of the Army acting through the Chief of Engineers is authorized to issue permits for the discharge of dredged or fill material into waters of the United States including wetlands. The CE makes jurisdictional determinations under Section 10 of the Rivers and Harbours Act (1899) and is responsible for issuing permits for filling, dredging, and construction in certain wetlands under Section 10. Under the authority of the Fish and Wildlife Coordination Act, the FWS and the National Marine Fishing Service review applications for these federal permits and provide comments to the CE on the environmental impacts of the proposed work. The FWS can appeal decisions made by CE. The CE has sole responsibility for issuing these permits while the EPA has jurisdictional responsibility for developing the guidelines by which these permits are issued (United States 1991b).

The SCS is involved with wetlands preservation through the "Swampbuster" provision of the Food and Security Act of 1985. The "Swampbuster" provision is part of the U.S. Farm

Bill. This provision provides incentives for farmers not to cultivate wetlands.

As in the case of the destruction of fish habitat under the Canadian Fisheries Act, the destruction of wetlands in the United States carries penalties which range from payment of fines to incarceration (Gary Taylor, pers. comm.).

Conservation approaches to wetlands vary from state to state. Theoretically, requirements for the issuance of permits by the state are similar if not more stringent than federal requirements (Gary Taylor, pers. comm.). The CE may delegate authority to issue permits to use wetlands to the state, however, the State of Michigan is the only state to date which has opted to enforce the Section 404 program (Gary Taylor, pers. comm.).

The State of California allows mitigation of wetlands destruction through the creation of new wetlands. Where feasible, the State of California requires the creation or restoration of four (4) units of marsh habitat for every one unit of marsh habitat altered or destroyed (Race and Christie 1982). Race (1985) describes 11 of 33 California based restoration projects. Restoration projects presented by Race (1985) do not reveal a single project that approaches a 4:1 ratio. All of the projects reviewed were approximately 10 years old. It is apparent that practices do not follow policy. Currently, the EPA and the CE are working with the California Department of Transportation to provide clear

guidance on mitigation requirements (United States 1991a).

The failure of these projects combined with the lack of knowledge about artificial wetlands were most likely factors which led to the following 1990 U.S. Government statement; 'at present, wetlands creation as a tool to achieve "no net loss" has limited application' (United States 1990). The recent initiatives taken by the EPA and the CE in California indicate that the government may be altering this standpoint.

The EPA has initiated the State Wetlands Protection Grants Program. This program provides funding for restoration, creation and enhancement of wetlands. It also provides funding for the development of statewide strategies for strengthening and coordinating programs that may affect wetlands within a particular state. Some of these funds may also be allocated to design wetlands banks to account for wetlands losses and gains (United States 1991a).

## **5.2 Definition of a Wetland**

The creation of a "no net loss" of wetlands policy in the U.S. has been greatly hampered by a dispute over the definition of what constitutes a wetland.

The process of developing a clear definition of a wetland began in 1989 with the release of a document entitled the Federal Manual for Identifying and Delineating Jurisdictional Wetlands. This manual was developed by the EPA, the CE, the SCS, and, the FWS. Prior to 1989, each agency had its own

procedures for identifying and delineating wetlands. These procedures often differed from other agencies. Variations in interpretations of the definition often occurred within these agencies as well (United States 1991b). This document created a single consistent approach to identifying wetlands. The manual described the technical criteria, field indicators, and other sources of information necessary to make wetland jurisdictional determinations. It established a uniform national procedure for wetland identification and delineation and terminated the use of previously locally implemented approaches by the signatory agencies. The EPA has stated that it would be appropriate to include parts of the final manual into the Code of Federal Regulations (United States 1991b).

On August 14, 1991, the Bush administration narrowed the 1989 definition of a wetland. Many biologists feel that this new definition is so narrow that millions of acres which would have been included under the old definition are now excluded from consideration for protection. Seasonal wetlands such as prairie potholes will no longer be part of the definition (Lemonick 1991). The 1989 manual generated considerable opposition from industry groups and landowners because it substantially expanded the scope of the wetlands definition to such an extent that it would include 5% of all the continental land in the U.S., 75% of the usable land in Alaska, and, as much as half of U.S. farmland (Gray 1991). The new proposed definition has raised many serious questions as to whether "no

"net loss" of wetlands can really be achieved.

The new definition has been viewed as a retraction from the original policy proposal of "no net loss" of wetlands. Despite this apparent weakening of the original policy proposal, the U.S. Government holds that the proposed changes were not developed to reduce jurisdictional authority over wetlands. These guidelines are expected to tighten the evidence requirements for the three parameters of definition of wetlands (United States 1991a).

The characteristics which will be used to delineate a wetland differ greatly from the definition of fisheries resources (Chapter 2) from the DFO. The final definition which will be used in the "no net loss" of wetlands policy will be based on the biological, geological, and, hydrological characteristics of a given region.

The three criteria for delineating wetlands are; 1. wetland hydrology, the presence of water in a region and the length of time which water is present, 2. hydrophytic vegetation, the existence of plants that grow on wetlands, and, 3. hydric soils (United States 1991b).

The extent to which the region supports wildlife is not a factor in delineating wetlands. Many of the regions which will fail to qualify as wetlands under the new classification system support waterfowl and migratory birds. The U.S. National Wildlife Federation has stated that the new policy represents a death sentence for much of this critical American

resource (Lemonick 1991).

In addition to a new definition of what constitutes a wetland, the EPA has relaxed the rules for filling in a wetland. The former regulatory provision which required proof of no viable alternative to filling in a wetland will only apply to "highly valuable" areas, the top rung of a new wetlands classification ladder which will be developed by a federal panel (Lemonick 1991). The creation of a wetlands classification ladder may also be viewed as a retraction from the original policy intent of achieving "no net loss" of wetlands.

### **5.3 Definition of "no net loss"**

The definition of what constitutes a loss has not yet been fully developed. The Wetlands Action Plan stated that "no net loss" is defined as meaning that wetlands losses must be offset by wetlands gains in terms of acreage, and, to the extent possible, ecosystem function. This definition is based upon President Bush's speech on June 6, 1989 at the Waterfowl Symposium in Washington D.C. This has been considered an interim definition that may need future refinement and revision (United States 1990).

### **5.4 Conclusion**

The creation of the "no net loss" of wetlands policy in the U.S. is still in the developmental stages and it is

unlikely that this policy will become as effective as the Canadian fisheries "no net loss" policy in the near future. A summary of the characteristics of the two policies is presented in Table 5.1. It appears that the primary obstacle to the development such a policy in the U.S. is the level of opposition from land owners and industry groups who prefer to use wetlands for development purposes.

The large number of agencies which have some jurisdiction or responsibility over wetlands may also have a negative impact on the development of a "no net loss" of wetlands policy. Administrative responsibility over fisheries in Canada is more clearly defined with the final say over fish habitat matters being the responsibility of the DFO.

The current dispute over the definition of what constitutes a wetland will also hamper the development of a "no net loss" policy similar to the DFO policy. The DFO has been more successful in producing a workable definition of what constitutes a loss of productive fish habitat.

Another important difference between the policies is the nature of the resources under consideration. In Canada, fisheries are areas of federal jurisdiction. In the U.S., 74% of the nation's wetlands are privately owned (United States 1990). This considerably weakens the ability of the U.S. Government to implement a "no net loss" policy for wetlands.

There is a divergence between the strategies used by each government to achieve "no net loss". Mitigation through the

creation of replacement fish habitat is used in Canada. The objective of the DFO is to balance unavoidable habitat losses with habitat gains. The emphasis taken by the U.S. Government is to strengthen the current guidelines for issuing permits for activities that affect wetlands. The primary mechanism for enforcing the "no net loss" policy in the U.S. is Section 404 of the Clean Water Act. Destruction of wetlands is still allowed if a permit has been issued, and, in most cases compensation is not required. Attempts are being made to reduce wetlands losses rather than eliminate or compensate for them.

Overall, the Canadian "no net loss" policy is more effective than the U.S. policy and it is unlikely that the U.S. policy will ever become a workable policy to the extent of the Canadian policy. The change in President Bush's statement on the policy from 1988 to 1991 indicates that the political will to achieve "no net loss" of wetlands from the point of view of the U.S. Government is weak. President Bush has recently stated that the new manual is "designed to slow and eventually stop the net loss of wetlands and takes a significant step toward the goal of "no net loss" of wetlands (Gray 1991).

The following table provides a summary of the key points of the two policies.

**Table 5.1 Summary of "No net loss" policies**

	<u>Fish Habitat</u>	<u>Wetlands Habitat</u>
	<u>Canada</u>	<u>United States</u>
1. Level of government	federal	federal
2. Responsible agency	DFO	FWS, CE, SCS and others
3. Administration	federal and/or provincial	federal/state
4. Mitigation decision	federal or joint federal and provincial	federal/state where applicable
5. Payment for mitigation	proponent	proponent
6. Penalties for non-compliance	fines/court action	fines/ incarceration
7. Definition of a fishery/ wetland	productive capacity and fishing activities	not developed
8. Definition of a loss	must support a fishery	not clearly defined
9. Mitigation of habitat losses	relocate, redesign, project; provide habitat compensation	not required

## Chapter 6

### REVIEW OF EXAMPLES OF APPLICATION OF THE DFO "NO NET LOSS" GUIDING PRINCIPLE

A variety of representative examples have been chosen which illustrate application of the "no net loss" principle in a diverse number of situations since its inception in 1986. While it is not possible to present every type of example in this study, the applications chosen will provide the reader with an overview of the types of situations in which the "no net loss" principle has been applied.

The examples will be presented on the basis of application of the policy to one specific project, or, to a specific region. Each example will be presented with; 1. a physical description of the project and its ecological impacts, 2. a brief discussion of the approval process for the mitigation and/or compensation procedures, 3. a description of the mitigation plan, and, 4. some discussion of monitoring programs. Each presentation will also conclude with a description of how "no net loss" was achieved and the extent to which the project meets the six points in the conceptual definition of "no net loss" which was developed in Chapter 2. Definitive statements with regard to whether or not "no net loss" of productive capacity has taken place will be based upon subjective value judgements from involved parties.

It is important to note that although the PMFH has been in place since 1986, it was difficult to find many projects which had been developed under the policy and have had ample

time for quantitative monitoring and conclusive evidence to have been collected. The minimum amount of time necessary for project evaluation is approximately 3 years. All of the examples presented will contain mostly qualitative data except for one rehabilitative project which was initiated to achieve a "net gain" of fish habitat in a degraded region.

Each example presented will illustrate a number of principles which have been employed by the DFO in applying "no net loss." These principles will be utilized in Chapter 8 where mitigation and compensation recommendations for the Conawapa project will be developed.

#### **6.1 General Application of the "no net loss" Principle**

The "no net loss" principle has always been an integral part of the management objectives of the DFO. In some sense, the DFO has always been applying the "no net loss" principle in their day to day administration of the Fisheries Act. One of the most common and simple applications of the policy is through the installation of a culvert to maintain stream flow in cases where a development includes crossing a stream. In the case of the forest industry, a common example of "no net loss" is the protection of buffer zones along the edges of lakes and streams to prevent sedimentation. Removal and relocation of fish habitat in the case of dock construction is another common example of policy application or Fisheries Act administration. For the purposes of this study, it was not

necessary to examine simple examples. The examples presented are more complex and require long term monitoring to evaluate their level of success.

## 6.2 Coastal Habitat

The creation of the Policy for the Management of Fish Habitat (PMFH) was initiated in the Pacific region of Canada (Jeff Stein, pers. comm.). In fact, it appears to have been applied most intensively in this region. One of the most prominent examples of regional application of the "no net loss" principle is in British Columbia's Fraser River Estuary.

The Fraser River provides important habitat for fish, wildlife and migratory birds. In October of 1985, the Fraser River Estuary Management Program (FREMP) was initiated by a five year agreement involving Environment Canada, the British Columbia Ministry of the Environment, the Department of Fisheries and Oceans (DFO), the North Fraser Harbour Commission, and, the Fraser River Harbour Commission. The FREMP was developed with the following objective:

To provide the means for accommodating a growing population and economy while maintaining the quality and productivity of the Fraser River Estuary's natural environment (FREMP 1990a).

What this program represents, essentially, is a sustainable development program for the estuary. In 1992, FREMP was renewed for an additional three years.

Among the key recommendations of FREMP, there are a

number of issues which pertain directly to the PMFH. These recommendations relate to improving log storage and dredging methods (Kennett and McPhee 1988). Both of these activities have contributed greatly to the loss of productive fish habitat in the region. The Pacific region DFO has published reports on both of these topics which detail guidelines for environmental improvements.

In December of 1990, a report was published by the Habitat Activity Work Group (HAWG) appointed by FREMP. This report addressed estuary wide activities related to habitat management in the region. The key areas of concern to the HAWG were habitat protection, conservation, restoration and enhancement. In its review of habitat protection and conservation, the HAWG concluded that recent applications of the "no net loss" guiding principle have substantially improved conservation and protection of fish habitat in the region. They also felt that recent progress in the application of the EARP had improved the process for environmental review of federal projects (FREMP 1990b).

The primary importance of FREMP in view of the "no net loss" principle was its development of a habitat classification system for classifying and mapping fish habitat in the region. In July of 1986, a shoreline habitat inventory of the North Fraser Harbour was undertaken jointly by the North Fraser Harbour Commission (NFHC) and the DFO. The NFHC and the DFO are two of five executive agencies of FREMP.

The overall objective of the habitat inventory was to develop practical, consistent and ecologically based procedures to provide guidance to habitat biologists, fisheries officers and other field staff who conduct habitat assessments and evaluations as part of the project referral process. It provided a current audit of the amount of habitat remaining in the North Fraser Harbour (Williams 1989). The inventory entailed mapping of mudflat, marsh and riparian habitats. It included a three colour-coded rating system to designate habitat existing productivity and development suitability. The inventory served as a foundation for the North Fraser Harbour Environmental Management Plan (1988).

The habitat inventory contains species/habitat outlines for 49 species important to the commercial, sport and Native fisheries. The species included in the study were of both ecological and economic importance. The work also produced a species/habitat reference appendix, habitat description procedures manual, and a discussion paper on habitat evaluation procedures (Williams 1989). This program was extended in the summer of 1990 under the jurisdiction of the Fraser River Harbour Commission to include the remainder of the Fraser River Estuary.

The three colour-coded map is employed by potential developers in the conceptual stages of their project. It provides them with information regarding where they can or cannot proceed with development in the estuary. Officials at

the North Fraser Harbour Environmental Management Plan and FREMP use the map to dictate whether or not a development can take place in a specific part of Fraser River estuary. The three colours used are red, yellow and green. Red indicates highly productive habitat. It is primarily composed of gently sloped or benched intertidal area with marsh vegetation, substrate fluvial or marine fluvioglacial, and, dense riparian vegetation. No development can take place unless the proponent demonstrates that no alienation or alteration of the habitat will occur. Yellow indicates moderately productive habitat composed of moderately sloped intertidal areas with sand or mudflat, or, moderately dense riparian vegetation. This habitat can be altered but these alterations must be compensated for with 'like for like' habitat replacement in the river zone under consideration. Green indicates habitat of low productivity such as steep foreshore with little or no vegetated fringe, industrial areas consisting of substrate comprised of rip-rap, refuse, etc, or, no riparian vegetation. Development will be permitted in these regions but will be subject to environmentally sound design and timing. No compensation is required (Williams 1989). In 1990, the ratings were revised to include migratory birds and wildlife (Williams and Colquhoun 1991). Habitat maps are also available which characterize the vegetation in the region (FREMP 1990b). This habitat classification system evolved from an "Area Designation" exercise under the Fraser River

Estuary Study. Even though the previous system included habitat aspects such as conservation of highly productive areas, developers were still proposing to alter habitat in conservation zones. The DFO then proposed a more rigorous habitat classification with a "no alter" option.

In addition to habitat mapping, the DFO developed a habitat replacement formula for the Fraser River estuary. This formula has been called a habitat compensation ratio. For marsh habitat, the compensation ratio is 2:1 such that twice as much marsh habitat is replaced as is lost or damaged. This replacement ratio is derived by taking into account the time period for a newly created marsh to reach the productive capacity of the one which was destroyed, and, the risks involved in successfully achieving this goal. For mudflat and riparian habitat the compensation ratio is 1:1 (FREMP 1990b).

In an attempt to facilitate approval processes for developments, the North Fraser Harbour Environmental Management Plan has developed the first fish habitat compensation bank in Canada with the Fraser Port. This bank will be used for approved waterfront dependent projects. Habitat banking is the practice of creating and saving (banking) new habitat in the estuary for the purpose of future habitat compensation needs. These habitat credits may be made available to qualified developers to compensate for unavoidable habitat losses resulting from development (FREMP 1990b). To date, no habitat has been developed in the

proposed bank, however, when habitat has been developed it will provide a practical mitigation alternative for developers.

Proponents wishing to develop in the Fraser River estuary must receive a recommendation from the FREMP Environmental Review Committee (ERC) 'coordinated project review process' in addition to DFO approval. Any developments within the North Fraser Harbour must be approved by the North Fraser Harbour Commission (NFHC 1988). The FREMP coordinated project review process is used instead of the EARP screening process to evaluate projects. The documentation which is used to evaluate projects may serve as a basis for an EARP screening document if one is required (Steve MacFarlane, pers. comm.).

Some of the positive gains in the estuary as a result of FREMP have been stated by Langer (1989) as follows:

1. With predetermined habitat values, developers are discouraged from disproving the habitat value of an area and instead focus their attention on mitigation and compensation work.
2. The risks and losses from the creation of replacement habitat can be addressed by applying compensation ratios greater than 1:1, and, follow-up long term monitoring agreements with the proponents to ensure that they carry out remedial measures.
3. Compensation habitat can also be pre-built prior to any losses. The concept of habitat banking fits well into this need.

Langer's report identifies one of the key advantages of the program which is that it has altered the methods by which

developments are undertaken such that environmental considerations can be included.

FREMP has been successful in developing over 40 habitat compensation sites, however, information with regard to the extent fish are benefitting from these sites is lacking. There has been little research and monitoring at habitat compensation sites and it is difficult to determine how these sites will function over time. It is for this reason that there is little conclusive evidence with regard to the overall success of the projects in the region (FREMP 1990b). At present, however, research is now being undertaken to assess the success of compensation sites. Two to three sites will be selected and sampled to assess fish food production, fish utilization, and, plant growth.

An important measure of the success of the FREMP in protecting fish habitat in the estuary was illustrated in the federal EARP which was undertaken within the North Arm of the Fraser River to assess the feasibility of developing a fuel barge facility at Sea Island. The existence of the habitat classification system in addition to information gathered from a number of habitat enhancement projects evolving in the region provided the Environmental Review Panel with substantial evidence that the development of such a facility would, according to the Panel's conclusions 'pose unacceptably high risks of damage to valuable fish and wildlife resources in the Fraser River estuary' (Canada 1989). A reference was

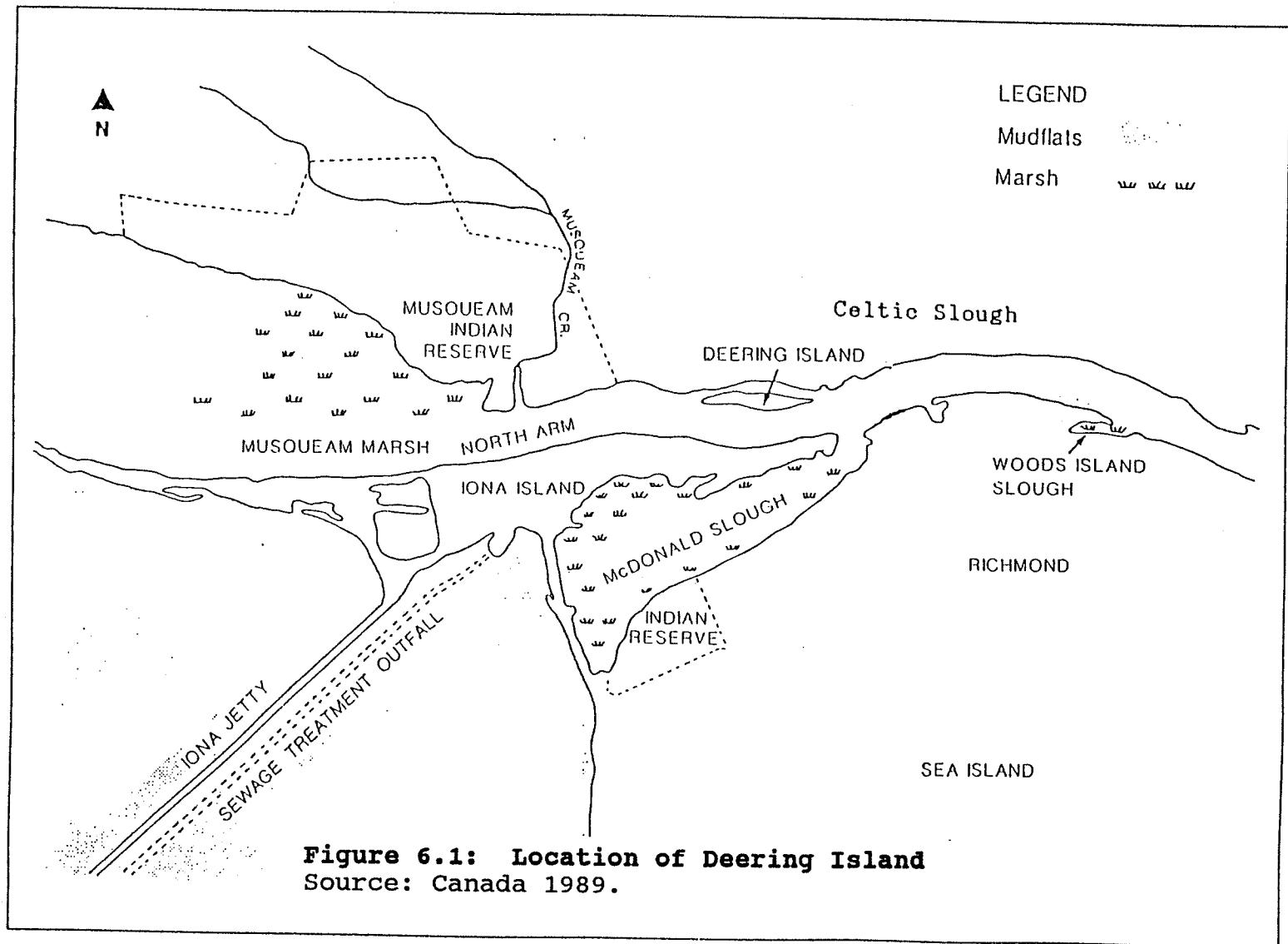
made to the PMFH in a section of the Panel report entitled Resources at Risk. The Panel also felt that there was not a demonstrated regional economic benefit associated with the proposal. This example illustrates the importance of fisheries resources in the estuary and the potency of the DFO policy as a measure of protecting fisheries resources.

FREMP has been criticised by wildlife managers for failing to consider usage of compensation sites by birds before fish habitat development takes place. HAWG has recommended that these considerations be evaluated (FREMP 1990b). The loss of wildlife habitat to obtain fish habitat is becoming an important issue in the estuary. This problem may be solved to some extent by the revised habitat classification system. This problem raises many questions as to the objectives of the PMFH relative to other resources such as wildlife.

Some of the merits of FREMP are illustrated by the Deering Island Project.

#### 6.2.1 Deering Island Project

The Deering Island project has been cited by the DFO as a successful application of the "no net loss" principle (Canada 1991b). This project was developed within the Fraser River estuary at the time which FREMP was being created. The location of the development is illustrated in Figure 6.1.



**Figure 6.1: Location of Deering Island**  
Source: Canada 1989.

### **Description of Deering Island Project**

In 1988, the DFO received a proposal for a housing and marina development on Deering Island near the mouth of the North Arm of the Fraser River from Deering Island Development Ltd (Canada 1991b). The project involved filling riverine and estuarine foreshore areas and would result in the loss of rearing habitat for juvenile salmonids. The impacted areas included the north shore of Deering Island and part of Celtic Slough. These areas are illustrated in Figure 6.1.

A consultant report concluded that the area affected by the project included 486 linear metres of riparian fringe, 527 square metres of marsh, and 2210 square metres of mudflats (Adams 1988).

### **Project Approval Process for Deering Island**

Once the impacts of the project had been assessed, the development of a compensation proposal was greatly facilitated by the DFO shoreline classification system (NFHC 1988). The habitat under consideration was classified as yellow. The existence of the shoreline classification system precluded the preparation of an initial environmental evaluation for the project (Canada 1991b). Using this information the Department knew the extent to which salmon were using the area, thus its productive capacity could be estimated (Canada 1991b).

The DFO decided that it would be necessary to construct compensatory habitat if the project was to proceed. It then

requested that the proponent prepare a detailed habitat inventory of the development site foreshore. The DFO applied compensation ratios (compensatory:natural) of marsh:marsh at 2:1, marsh:mudflat at 1:2, riparian:riparian at 1:1, and, marsh:riparian at 1:2. In most cases, habitat lost due to the development would be replaced by marsh habitat (DFO 1991, unpublished report). Once these compensation measures were established, a complete habitat compensation proposal was required by the DFO, the ERC and the NFHC.

When the involved parties had agreed upon compensation, a formal compensation agreement was drawn up between the DFO and Deering Island Developments Ltd. which specified the implementation of a three year monitoring period. This agreement required that the proponent perform any such remedial works as the DFO determines are necessary on the basis of the monitoring program to ensure that the productive capacity of the habitat is maintained. The agreement also stated that the costs of this work would be borne by the proponent.

Prior to the formal approval of the project, the ERC produced a detailed list of 'environmental conditions' under which the project would be approved. This list included a more detailed description of the monitoring program such as requirements for protection of the created marsh from any future disturbances. These environmental conditions were to be followed to ensure the success of the habitat development.

The proponent was provided with a copy of these conditions.

### **Compensation for the Deering Island Project**

One compensation site was considered for the establishment of intertidal marsh vegetation. This site is located downstream of Celtic Slough, Figure 6.1. It is important to note that the physical works which were required to construct this compensation site impacted 3850 square meters of intertidal bottom substrate. Of this area, 2284 metres was compensated for. The remaining substrate was characterized by debris and gravel which resulted from erosion of a foreshore bank in an adjacent area (Adams 1988). This area was considered poor fish habitat because of its low benthic food production, however, the compensation plan provided bank stabilization which would not have otherwise occurred. The total amount of habitat created was 3350.5 square metres (Adams 1988). The compensatory habitat was planted during March-April 1990 (Steve MacFarlane, pers comm).

In addition to habitat construction, the compensation plan required transplants of marsh plants. Marsh plants were taken from donor sites which exhibit slow growth or poor habitat conditions so that new habitat is not created at the expense of existing habitat. The DFO has established guidelines for extraction of marsh plants from donor sites (Steve MacFarlane, pers. comm). Some areas are seeded to produce vegetation (Adams 1988).

**Evaluation of the "no net loss" principle at Deering Island**

So far there is no quantitative data available on the progress of the Deering Island Project, therefore evaluation of the achievement of "no net loss" could be premature. It is felt by DFO officials that it was a successful project due to the level of engineering expertise employed when the compensation site was constructed (Cynthia Powell, pers. comm.). The monitoring program which was to begin when the project was completed in 1990 did not begin until 1991 after considerable pressure from the DFO (Steve MacFarlane, pers. comm.).

Although there is a need for follow-up data on this project, it appears that it endorses the principle of "no net loss" in Chapter 2 of this report. If the compensation site performs as expected, "no net loss" of productive capacity will have taken place. The replacement habitat was created adjacent to the place where the original habitat was lost indicating that fishing activities in the region would not be disrupted. Assessment of the temporal dimension of the compensation scheme is premature, however, if the marsh created is able to reach a level of productivity which exceeds that of the lost marsh, this dimension of the "no net loss" conceptual definition will have been fulfilled, and, the potential for fishing activities by future users would not have been disrupted. The DFO, however, has stated that construction of compensatory habitat prior to the destruction

of the habitat under consideration is preferable (Steve MacFarlane, pers. comm.). This did not take place at Deering Island.

#### **6.2.2 Campbell River Estuary**

The Campbell River estuary is located on the northeast coast of Vancouver Island. The Campbell River is regulated by a hydro electric dam built in 1947 and discharges are partially controlled. The estuary was not developed as a compensation site for any specific project. It may be viewed as an experiment in which the potential to achieve the "no net loss" or "net gain" objective of the PMFH may be assessed. This example makes a useful contribution to this study since the research was undertaken within the same geographical region as the Fraser River estuary with similar fish habitat.

The study conducted by Levings and MacDonald (1991) at the Campbell River estuary involved a detailed evaluation of the use of artificial islands by juvenile salmonids and their epibenthic prey species. The islands were monitored for a five year period. The objectives of the monitoring study were to:

- 1. Asses whether or not juvenile salmonids occupied the island habitats and whether or not their abundance and patterns of use were comparable with other habitats within the estuary.**
- 2. Assess whether or not macrobenthic invertebrates used as fish food colonized all intertidal elevations of the new islands, and, whether or not the community type, abundance and species composition differed from a reference habitat.**

3. Assess the role of vegetation in the development of the invertebrate communities (Levings and MacDonald 1991, p. 176).

The artificial islands were designed by biologists from the DFO and the Canadian Wildlife Service with assistance from consultants and other agencies. The objective of the project was to create hydraulically stable islands in various configurations while maximizing the intertidal area and providing a suitable substrate for marsh transplanting (Brownlee et al. 1984).

In 1981, an area within the estuary used for storage and sorting of logs since 1904, was reduced from 32.8 hectares to 6.8 hectares by B.C. Forest Products Limited (now Fletcher Challenge Canada). In 1982, wood debris and wastes from log storage were removed and four artificial islands were constructed within about 3.2 hectares (including side slopes) of the middle sector of the estuary. Gravel dredged from construction of a new dryland log sorting facility was used to construct the islands. The small remnant marsh areas which would be lost due to the construction of a dryland log sorting operation were used as donor sites for vegetation transplants (Brownlee et al. 1984). This vegetation was planted in specific patterns in the islands. Wetland vegetation was transplanted from donor sites and half of the area of the islands was left vacant to see if adjacent vegetation would colonize the vacant areas.

Each year, following the construction of the islands, the

Quinsam River hatchery, located 8km upstream of the estuary on a tributary of the Campbell River, released 2.3 million salmonids as fry or smolts. The salmon species released were chum, chinook, coho, pink, and steelhead. Cutthroat trout were also released.

During the five year monitoring period, fish samples were taken from the region to assess the extent to which hatchery salmon colonized the islands. Vegetative growth was monitored. Colonization of the islands by invertebrates was also noted. The study results were assessed and compared with data from reference islands within the estuary.

In 1982, the vegetation which was planted had already expanded onto vacant sites on the island. Samples of benthic organisms taken from the islands were representative of most of the organisms in the estuary. In May 1982, three months after the islands were built, there was a fair degree of faunal similarity between Nunn's Island (a reference island) and the artificial islands.

After the five year study period, data indicated that wild salmon fry, particularly chinook salmon were caught in the created habitat in numbers equal to those in the reference habitats. Hatchery fish were less abundant on the islands although all of the species released were caught in the islands. With the exception of one, the islands were used infrequently by hatchery produced fish. Juvenile salmon, however, used the shorelines of the islands.

Overall, the project resulted in a "net gain" of about 3.2 hectares of intertidal marsh habitat and a total "net gain" of 18.8 hectares of usable fish habitat. The creation of a log sort pond for temporary storage of logs resulted in a "net gain" of 7.8 hectares of open water habitat. The middle of the estuary, previously used for log storage, is now almost completely available for aquatic biota (32.8 hectares). The authors noted that the creation of the islands resulted in a small loss of fish habitat which was located at a lower level in the estuary where the islands were constructed. This loss was relatively small as the productivity of this region had already been significantly decreased as a result of log storage (Levings and MacDonald 1991).

The authors concluded that while an increase in the productive capacity of the estuary was achieved, it is difficult to measure the benefits of this "net gain" in terms of fish production. There are a number of problems associated with evaluating the complex and variable ecosystems which support salmon such as the evolution of macrobenthic invertebrate communities which serve as fish food. Precise figures in terms of actual fisheries values are difficult to obtain for an economic analysis of the rehabilitation. Overall, the authors feel that the work undertaken at the Campbell River estuary could be used as a benchmark to evaluate future restoration and compensation projects in British Columbia as it indicates the potential of projects to

succeed and the amount of time which may be required for their success.

### **6.3 Lake Habitat**

Application of the "no net loss" principle to lake habitats is an important step in preserving productive fish habitat as lakes are in heavy demand from mining companies in many parts of Canada for disposal of tailings and mining effluent. When a lake is used for disposal of mine tailings, fish habitat is significantly altered or, completely destroyed in some cases. The following example illustrates one of the ways in which the "no net loss" guiding principle is currently being applied in the case of mining developments.

#### **6.3.1 Namew Lake Mine**

The most recent application of the "no net loss" guiding principle to a lacustrine environment in Manitoba was by Hudson's Bay Mining and Smelting (H.B.M.S.). Mitigative measures to meet the "no net loss" objective were included their environmental licence to open the Namew Lake copper mine.

#### **Project Description of Namew Lake Mine**

In 1988, Hudson's Bay Mining and Smelting submitted an application to the Manitoba Department of the Environment (DOE) to use Chocolate Lake for disposal of effluent releases.

The nature of materials which would be dumped in the lake would decrease its productive capacity. The lake was supporting a small northern pike population. Since the fish population in the lake was relatively small, there were no significant fishing activities taking place in the lake (Doug LeRoux, pers. comm.). Chocolate Lake is located in the north-western Manitoba region.

#### **Approval Process for Namew Lake Mine**

The H.B.M.S. proposal to release pollutants into Chocolate Lake was subject to the Manitoba Environment Impact Assessment Process which included Clean Environment Commission hearings. The outcome of this process was that H.B.M.S. was required to develop a rainbow trout fishery at Chocolate Lake as part of the requirements to receive an Environmental Licence to develop the Namew Lake Mine. This was specified in Term #8 of the provincial environmental licence which was issued (Manitoba 1989).

The Chocolate Lake Project was developed and is maintained through joint consultation and cooperation between H.B.M.S. and the Department of Natural Resources (DNR). The Manitoba Fisheries Branch is playing a lead role in managing the fishery. The parties involved in the project have agreed that due to the experimental nature of this project, alterations to the development process may occur as required and mutually agreed upon between H.B.M.S. and the Manitoba

Fisheries Branch (Manitoba 1989).

The role of the DFO in this project was limited as the development took place prior to the Rafferty-Alameda/Oldman decisions before the scope of application of the EARP Guidelines Order (1984) was interpreted. Recently, the DFO has initiated an EARP screening due to public concerns which have been raised since the project was created. Any project initiated since the EARP was released is subject to screening.

#### **Compensation for Namew Lake Mine**

The creation of a rainbow trout fishery was undertaken by applying rotenone to Chocolate Lake to eliminate the existing population of northern pike. The dead fish were collected, counted and then buried. The lake was then stocked with 208 000 rainbow trout fingerlings in the spring of 1990. These fish were dispersed throughout the entire lake. Physiological characteristics of rainbow trout would allow them to survive in the lake with effluent releases. Monitoring of bird predation was required to ensure the survival of the fish. Subsequent annual fish stockings will depend on monitoring results (Manitoba 1989).

The creation of the rainbow trout fishery required the construction of a percolating weir at the west end of the lake to maintain lake water levels while at the same time prohibiting the migration of fish from Chocolate Lake (Manitoba 1989).

H.B.M.S. is required to conduct an annual netting program to assess the age structure and abundance of the rainbow trout population. This program will be used to measure metal levels in fish flesh and assess stocking requirements (Manitoba 1989).

Hudson's Bay Mining and Smelting provided a boat launch, a parking area and a fish cleaning facility to improve the recreational quality of the fishery (Manitoba 1989).

**Evaluation of the "no net loss" principle at Namew Lake Mine**

The development of Chocolate Lake as a rainbow trout fishery as compensation for the loss of a small population of northern pike has been viewed as a "net gain" of habitat by the Manitoba Fisheries Branch. Officials feel that the Province of Manitoba has gained a valuable recreational fishery where previously, there existed a fishery of 'very limited value' (Doug LeRoux, pers. comm.). No official data have been collected on the trout population to date, however, there are reports from local fishermen that rainbow trout are being caught in Chocolate Lake (Doug LeRoux, pers comm.).

This project endorses the principle of "no net loss" as defined in Chapter 2. There is, however, some question as to whether or not "no net loss" or productive capacity has taken place. If the rainbow trout population becomes a self-sustaining population, there will have been "no net loss" of productive capacity.

Chocolate Lake was not being used as a fishery by any group, therefore the elimination of its pike population would not have been classified as a "net loss" of fish habitat to present user groups. It may have been classified as a "net loss" to future users if the rainbow trout fishery had not been developed. Chocolate Lake may be considered a "net gain" of productive capacity from the viewpoint of its potential to benefit future users. The fact that the lake was not being used as a fishery prior to the development of the mine reduces the need to evaluate the temporal dimension of the "no net loss" definition which was provided in Chapter 2. This example would best be classified as a "net gain" situation rather than a "no net loss" situation because a new fishery was created.

#### **6.4 River Habitat**

The "no net loss" principle has been applied to riverine environments across Canada. It has been applied in a diverse number of situations such that it would be difficult to provide representative examples from this category. The search for examples did not reveal that any particular method of applying the "no net loss" principle to river habitats was common as in the case of the coastal and lake habitat examples cited above.

#### **6.4.1 Sackville River Fishway Compensation Package**

One of the most commonly used techniques in the application of the "no net loss" guiding principle on rivers prior to its formal documentation in the PMFH was through the use of fishways (more commonly referred to as fish ladders). Fishways are often integrated into the construction of major power dams to prevent the structure from becoming an obstruction to natural fish migration. In Halifax Nova Scotia, a fish ladder was constructed to 'open up' or, increase access to new habitat for existing fish populations as compensation for lost habitat in an adjacent area.

#### **Project Description of the Sackville River Project**

In 1988, National Gypsum of Canada submitted a proposal to the Nova Scotia Department of Natural Resources to extend their open pit gypsum mine under a small stream. The stream under consideration was a tributary to the Shubenacadie River near Halifax, Nova Scotia. The Shubenacadie River supports sea-run atlantic salmon. The stream which was to be affected by the proposal supported nursery habitat for this species. The productive capacity of this habitat was unknown (Shane O'Neil, pers. comm). The proposed open pit mine would require excavation of an area located underneath the stream, thus destroying the stream. In many cases a stream diversion may have been viewed as a feasible compensation option, however, in this case a stream diversion was not possible (Donny Cox,

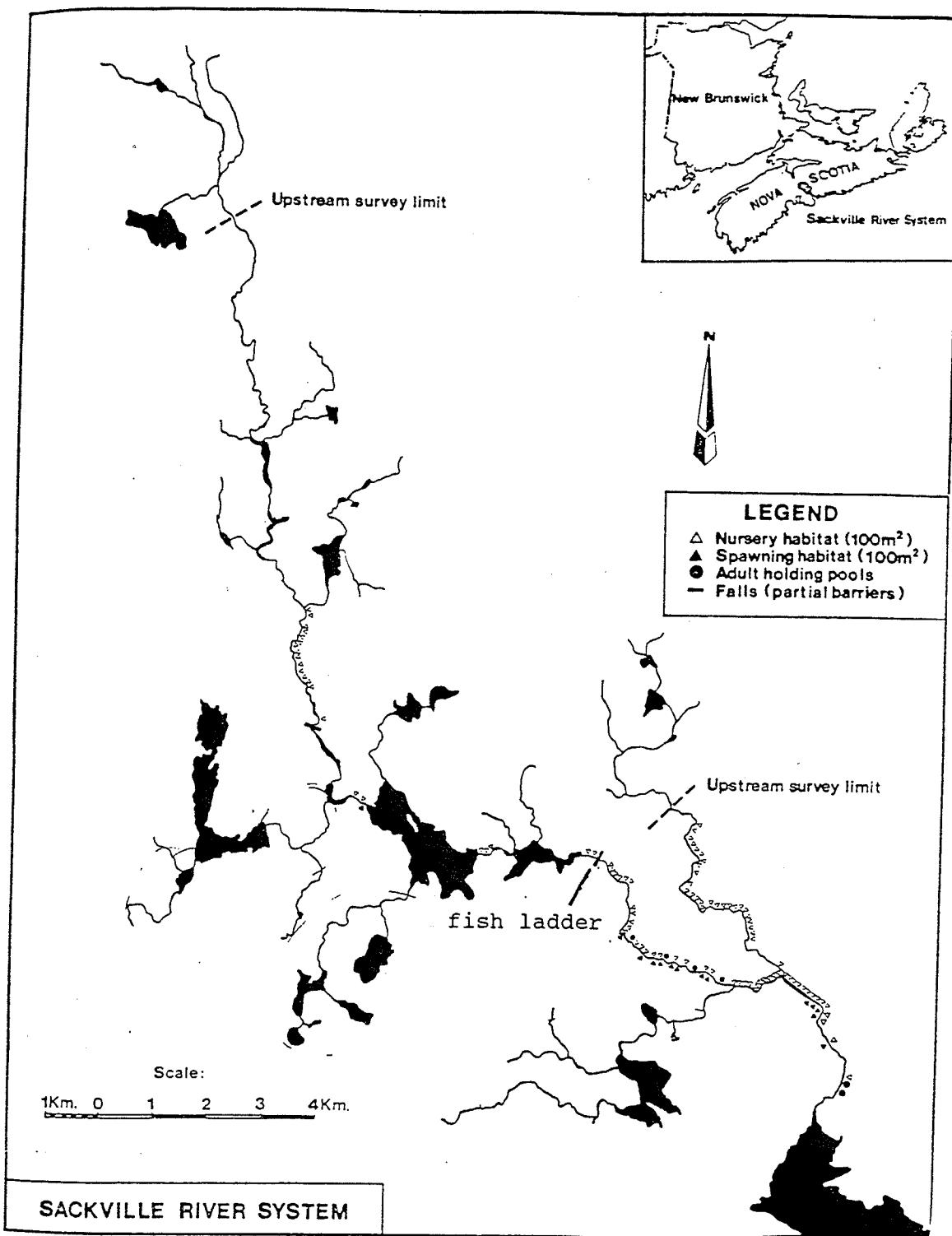
pers. comm.).

#### **Approval Process for the Sackville River Fishway Compensation Package**

The development proposal was originally submitted to the Nova Scotia Department of the Environment as an application for a water rights permit. The proposal fell under the jurisdiction of the DFO who reviewed it under the EARP. The review involved a number of government agencies including the Nova Scotia Department of the Environment which would be responsible for issuing the licence. The regional DFO was also contacted. Once the DFO had examined the proposal it was decided that the "no net loss" principle would be applied to the development as atlantic salmon is important to both commercial and recreational fisheries in Nova Scotia.

While the productive capacity of the stream was described subjectively by DFO habitat specialist Donny Cox, as being low, in his opinion two salmon are just as important as 3000 salmon and thus merit protection. He disagreed with the use of subjective value judgements to evaluate the relative importance of various quantities of fish habitat.

After some research and discussion, the DFO selected the use of a fish ladder to enhance habitat in the Sackville River as an acceptable compensation option for the loss of fish habitat which would occur as a result of the mine. The Sackville River is located approximately 50 km from the Shubenacadie site. It is located on Figure 6.2.



**Figure 6.2: Location of Sackville River and Fish Ladder**  
 Source: Sackville River 1990.

The proposal was also examined by the Nova Scotia Department of Lands and Forests to evaluate whether or not the area under consideration was serving as wildlife habitat. The Department concluded that it was not. The provincial Department of Fisheries had very little input into this decision. The Provincial Fisheries Department in Nova Scotia is mainly responsible for the development of fisheries resources and local aquaculture (Donny Cox, pers. comm.).

Having been informed by the DFO of the "no net loss" guiding principle, National Gypsum hired consultants to conduct research to attach a monetary value to the habitat under consideration. The consultants produced a subjective estimate of \$45 000 as a value for the habitat as a sport fishery. This estimate was calculated on the basis of the number of salmon believed to be in the stream and the value of each fish to an angler. These calculations included the money that would be spent by an angler on a fishing trip for atlantic salmon. This estimate is highly subjective and exclusive of ecological considerations. Aesthetic values were also considered in this estimate.

Coincidentally, the DFO estimated the price of implementing the compensation plan at \$40 000. The final amount contributed by National Gypsum was \$42 000 with limited funding being provided by the DFO.

There were a number of other parties involved in assessing National Gypsum's proposal. Local land owners who

held wells adjacent to the stream were concerned about their water supply. These concerns were dealt with by National Gypsum who offered to drill new wells if the present wells were affected by the proposed development. There were a number of cattle herds who are also dependent on the stream. National Gypsum offered to build retention dams for use by these herds. Donny Cox described the National Gypsum as a cooperative company.

One important factor to note in this case is that there was agreement between the proponent and the DFO with regard to the value of the habitat under consideration. Had there been a significant difference between these two estimates National Gypsum may not have been willing to pay \$42 000 for the project if the estimate given by their consultant had been lower. It is important to note, that as in the discussion of the Fisheries Act presented in Chapter 4, it is possible that the company may have been able to proceed with their development, destroy the stream and subsequently take the chance of going to court and paying a fine. It is the opinion of the DFO that the fines implemented are often much lower than the costs of mitigation and/or compensation (Donny Cox, pers. comm.).

#### Compensation for the Atlantic Salmon Stream

As compensation for the fish habitat lost in the stream, a fishway was constructed on a waterfall located roughly 10 km

upstream from the mouth of the Sackville River. The location of this structure is illustrated in Figure 6.2. The figure also illustrates the location of habitat which will be made available to fish ascending the ladder. Atlantic salmon were known to pass the falls during high water conditions only. Gaspereau were not known to pass the falls at all (Shane O'Neil, pers. comm.). The fishway was constructed with the intention of creating access for a number of fish species, including salmon and gaspereau, to the habitat available above the waterfall. Data collected on the region revealed that there is productive fish habitat available in this area for a number of anadromous fish species such as salmon (Cameron 1986).

The amount of habitat 'opened up' in the Sackville River was approximately 370 000 square metres. This region includes 20 km of river, 10 additional lakes and several dozen kilometres of stream (Sackville River 1990). Construction was completed in October 1990. Several atlantic salmon were seen ascending the structure in the fall of 1990. In the fall of 1991, several dozen salmon were observed passing through the fishway. Hundreds of gaspereau were also observed (Shane O'Neil, pers. comm.).

Implementation of the compensation package involved a number of parties other than provincial and federal government agencies. A local landowner donated the land for the project. The Sackville River Association provided volunteer labour and

paid labour through a Section 25 Employment and Immigration Commission Grant (Sackville River 1990). Assistance from the Sackville River Association also includes fish stocking activities and continual maintenance of the fish ladder (Shane O'Neil, pers comm.). The level of cooperation between the agencies involved appears to have been an important factor in the success of this project.

The DFO is planning further stocking in the river for the next several years and has assumed financial responsibility for these activities (Shane O'Neil, pers. comm.). This annual stocking program is part of an overall effort to restore the salmon population of the river. The Sackville River Association is playing an active role in this restoration effort. The Sackville River system has been degraded by urban development, acid rain, and gravel mining and cannot yet support a large self-sustaining population of salmon.

Despite ongoing efforts to improve the productive capacity of the Sackville River, National Gypsum was only required to pay for the fishway construction and was not responsible for further maintenance of the structure, or, monitoring of its use by fish populations. The involvement of the company in the project was on a short-term basis.

#### **Evaluation of the "no net loss" principle at Sackville River**

This project endorses the principle of "no net loss" as defined in Chapter 2 of this report. The construction of the fish ladder is viewed by the DFO as a "net gain" of productive

capacity. While the exact amount of habitat lost by destroying the stream is unknown, the amount lost is believed to be far less than what has been gained. The replacement habitat was within the same geographic region. Up until this point, the mine has not yet opened, therefore, the new habitat was created even before the habitat under consideration was destroyed. In this way there was no time factor involved between the destruction of existing habitat and the creation of new habitat which may have been defined as a loss of productive capacity. The fishway represents a "net gain" of fish habitat for future users.

#### **6.4.2 Seal Cove Brook Stream Replacement Project**

Application of the "no net loss" principle to the Seal Cove Brook Stream Replacement Project (SCBSRP) has been cited by the DFO in Ottawa as an outstanding example of the creation of 'like for like' habitat (Canada 1991b).

#### **Seal Cove Brook Stream Replacement Project Description**

In September of 1987, the Newfoundland regional DFO received a referral from the environmental planning division of the Newfoundland Department of Work Services and Transportation (NDWST). NDWST required a diversion of a stretch of Seal Cove Brook to the north side of the Trans Canada Highway in order to accommodate the twinning (double laning) of this stretch of the highway. The project included

the diversion of about 162 metres of Seal Cove River from the east to the west side of the Trans Canada Highway near the Butterpot Park intersection. The stream would be buried under the construction of the new highway. There was no opportunity to relocate the road or mitigate the habitat loss due to the proximity of Butterpot Park to the site of the proposed development. The stream under consideration was supporting a resident brook trout population (SCBSRP 1990). Brook trout is an important recreational species in Newfoundland.

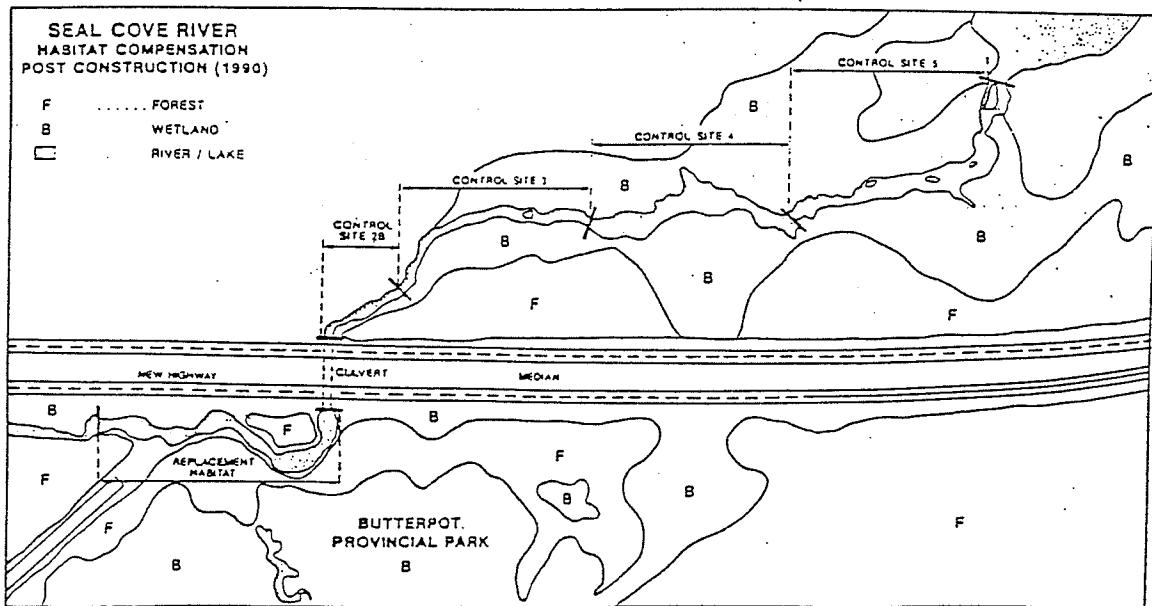
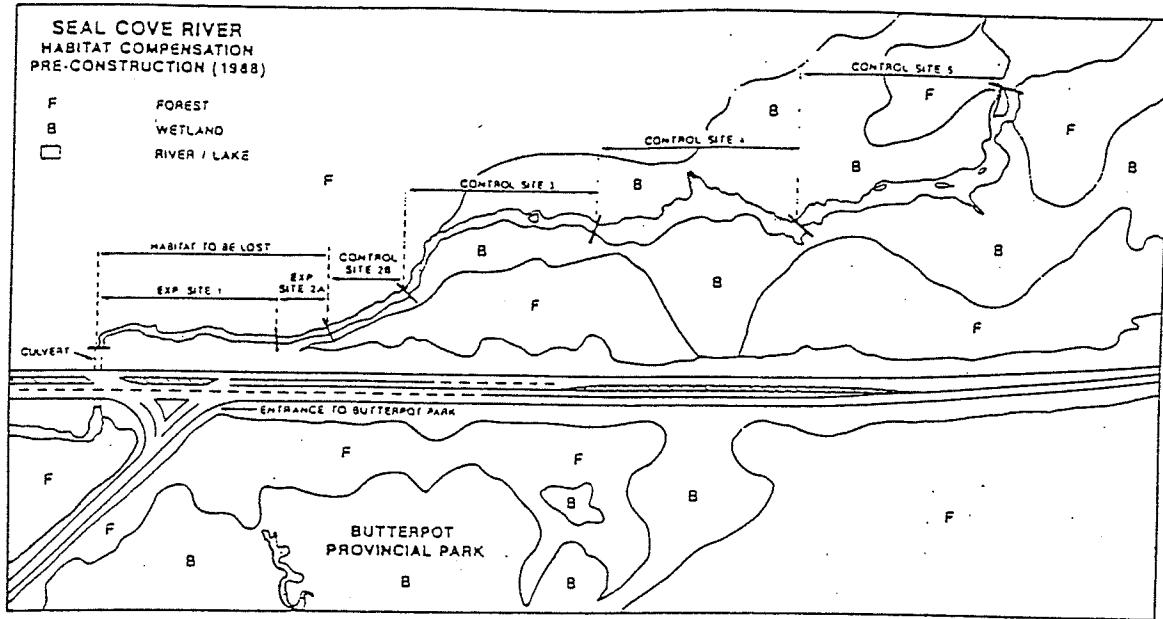
#### **Approval Process for the (SCBSRP)**

The SCBSRP was reviewed by the DFO and 'like for like' habitat compensation was viewed as the only option to ensure achieving "no net loss" of the productive capacity of the region. The DFO then conducted an extensive physical and biological characterization of the stream habitat to determine its productive capacity. The information gathered would also be used as baseline data to evaluate replacement habitat.

In April of 1989, NDWST submitted a compensation proposal for DFO approval. Once these plans were reviewed and revised by the DFO, a contractor was employed by NDWST to construct the stream diversion (SCBSRP 1990).

#### **Compensation for Seal Cove Brook**

Figure 6.3 illustrates the compensatory habitat which was developed at Seal Cove Brook. The compensation project



**Figure 6.3: Seal Cove Brook Compensation**  
Source: SCBSRP 1990

included changing the location of the culvert at Seal Cove Brook. A new strip of stream habitat was constructed to connect the stream to its original location on the other side of the highway. 'Lunker', a bank cover technique which was developed and used in the midwest United States was employed for the needs of the brook trout population (SCBSRP 1990). The 'Lunker' structures were installed and added to two pools in the stream.

The construction of the new habitat had to be done when the area was dry. The stream water was pumped away from the construction area. All fish were removed from the stream prior to dewatering and were held out by barrier nets. Because of the large amount of silt which was introduced into the stream by the construction effort, the stream had to be flushed prior to rewatering (SCBSRP 1990).

Construction of the new stream was completed and connected to the existing stream in August of 1989. Additional work was required to complete the project in 1990. This work included cultivation of riparian habitat around the river. Some other minor alterations were required to accommodate the new habitat to the hydrological cycle of the river. These remedial activities were paid for and undertaken by the Newfoundland Department of Works, Services and Transportation under the supervision of the DFO (M.A. Barnes pers. comm.). It was noted, however, by the Newfoundland DFO that under normal circumstances, this type of stream

construction for habitat compensation would be completed under a tendered contract and DFO would not be involved in any aspect of the construction or funding (SCBSRP 1990).

#### **Evaluation of "no net loss" at Seal Cove Brook**

This example conformed only partially to the conceptual definition of "no net loss" which was developed in Chapter 2. Overall, there was a "net gain" in the total amount of habitat available to fish because the dimensions of the new habitat were greater than that of the habitat which was destroyed. The new strip of stream habitat was longer than the original by 33 metres. Most of the habitat gained was pool type habitat. These pools are important for fish to overwinter and for feeding in the summer.

Some loss of fish habitat may have occurred as a result of disruptions to fish due to blockage of the stream during the summer while construction was taking place. The Newfoundland regional DFO has also noted that it is unlikely that an artificial habitat will become stable immediately and an undetermined time period is required to assess the productive capacity of the newly created habitat (SCBSRP 1990). Both of these factors may have caused a disruption of fishing activities in the region.

In this case, as in the case of the examples cited above, the question of whether or not there has been "no net loss" of productive capacity cannot yet be addressed. In view of

habitat attributes, "no net loss" has been achieved, however, whether or not the habitat will be used by fish is still unsure (David Scruton, pers. comm.). The Regional Science staff, however, have collected baseline data along with two years of a proposed five year post construction evaluation.

According to these facts, it may be concluded that at present the Seal Cove Brook Stream Replacement Project does not meet all of the qualifications of the "no net loss" definition in Chapter 2. In order to be considered a "no net loss" situation, the replacement habitat must exceed the productive capacity of the original habitat to compensate for the loss of productive capacity which has been incurred during the time which the newly created habitat has taken to reach full productivity. This is not yet known.

#### **6.4.3 Nova Scotia Department of Transportation and Communications**

The following is a brief description of application of the "no net loss" principle in a way which differs somewhat from the cases cited above. In 1988, the Nova Scotia Department of Transportation and Communications was reported to have drained a small stream to fill their water tanks. This action resulted in the death of the trout population which inhabited the stream. This action was reported to the DFO by a local citizen. The DFO approached Transportation and Communications and informed them that their actions constituted an offence under Section 35 of the Fisheries Act.

It is the policy of the DFO in Nova Scotia to approach the offender and offer them the opportunity to compensate for their offence rather than resorting immediately to court action. The offender may rehabilitate the habitat under consideration as opposed to paying a fine. The DFO prefers this approach because the money that may have been paid in the case of a fine to the provincial government is then diverted to the DFO so that compensation measures may be developed which will achieve a "no net loss" situation. In this case, Transportation and Communications offered to restock the stream.

The DFO habitat branch proceeded to develop a set of guidelines for water tankers to prevent the reoccurrence of such an event. These guidelines state that water tankers should only remove one third of the prevailing flow in the stream under consideration.

This application of the "no net loss" principle is a simple example which endorses all of the issues outlined in Chapter 2 with the exception of temporal considerations as there was a period of time when the stream was almost completely dry. This application did, however, consider all of the other issues in addition to the development of a set of guidelines which would serve to further improve administration of the habitat provisions of the Fisheries Act by increasing the level of industry and public awareness as to the scope of fish habitat concerns. The strategy of offering an offender

the opportunity to pay for compensation rather than court costs and the possibility of a fine is an innovative example of how a "no net loss" of fisheries resources can be achieved by working within the government and legal system to divert funds to attain the goals of the policy

#### **6.5 Concepts Derived from DFO "no net loss" Principle Application**

All of the projects presented above conform to some extent to the conceptual definition of "no net loss" which was developed in Chapter 2 of this report. These examples illustrate how the "no net loss" principle has been applied since its creation in 1986, and, the extent to which its application reflects the original intention of the PMFH. The examples presented reveal a number of concepts which may be useful in deciding how the "no net loss" guiding principle may be applied to the Conawapa project from a conceptual point of view. These concepts are listed below.

##### **1) Like for like habitat compensation is most commonly applied**

In most of the cases presented in this chapter, 'like for like' habitat compensation took place. This concept was particularly visible in the case of applying the "no net loss" in the Fraser River estuary.

##### **2) Geographic location of replacement habitat is within close proximity of lost habitat**

In all of the cases presented above, the compensatory habitat was located approximately within the same geographic

region as the lost habitat if not directly adjacent to it.

**3) Mitigation and/or compensation measures are developed to accommodate users of fisheries resources**

In all cases presented, the habitat compensation packages were developed to meet the needs of either present or future users. This research process has not uncovered any cases where a fish population was compensated for which was not part of a valued fishery of some sort. In many cases, even if the fish population under consideration was not being harvested, compensation took place if the species was either of commercial, recreational or subsistence value.

**4) One species may be substituted for another if it is considered to be of equal value**

While the majority of projects reviewed were able to create 'like for like' habitat, this was not the case with the Namew Lake Mine. In this example, the local DFO found it acceptable to replace a small northern pike population with rainbow trout. This was deemed acceptable as the new habitat could be used as a sport fishery and the species was better suited to polluted waters.

**5) The "no net loss" principle may be applied on a regional basis to achieve "no net loss" or a "net gain" of fish habitat**

Application of the "no net loss" principle to the Fraser River estuary illustrates an example in which the "no net loss" principle is applied to an entire geographic area, or ecosystem. The DFO attempts to balance habitat losses and gains over the whole geographic area or ecosystem rather than

at one site. This method of "no net loss" principle application will serve to fulfil the requirements of the PMFH effectively as it combines both conservation and rehabilitation of fisheries resources to achieve "no net loss" and possibly a "net gain" of fisheries resources on an geographic area or ecosystem basis rather than a case by case basis.

Regional policy application can provide important benefits for future users.

**6) Compensation projects are designed to accommodate for uncertainty in project outcomes**

The creation of artificial habitats is relatively new and little is known about how well these newly created habitats function over time. It may take a considerable amount of time for a newly created habitat to reach full productivity. Given this level of uncertainty, DFO officials have attempted to compensate for this by creating a greater amount of habitat than is lost. The pacific region DFO has formalized this approach through their development of compensation ratios which require more habitat to be replaced than was lost at the original site.

**7) Compensatory habitat should be developed prior to the destruction of natural fish habitat**

The question of when a compensation project should begin relative to the destruction of the original fish habitat is not explicitly outlined in the PMFH, however, the conceptual definition of "no net loss" developed in Chapter 2 states that

the timing of a compensation project is an important factor in deciding whether "no net loss" is actually achieved. DFO officials have stated that it is preferable for replacement habitat be completed prior to destruction of existing habitat (Donny Cox, pers. comm.). This situation occurred only in one of the examples reviewed (Sackville River). It therefore may be assumed that while pre-development of habitat is a preferable option, it is not a mandatory requirement and will not be enforced in a situation where it is unfeasible.

**8) Compensatory habitat can be developed in degraded regions**

Three of the examples reviewed, Deering Island, the Campbell River estuary and Sackville River met the requirements of the "no net loss" principle by rehabilitating regions which had been degraded by anthropogenic factors.

**9) Funding for compensation projects can be allocated from a variety of sources**

In the majority of examples reviewed, funding for compensation projects was provided by the proponent, however, in the case of the Sackville River Compensation Package, and the Seal Cove Habitat Replacement Project, some funding for the project came from the regional DFO. In the case of Sackville River, a large part of the success of the program may be attributed to the contribution in time and effort by volunteers from the Sackville River Association.

**10) Innovative approaches to "no net loss" are acceptable**

Application of "no net loss" in the case of the Nova

Scotia Department of Transport illustrated two innovative approaches to "no net loss". Providing the offender with the opportunity to compensate rather than pay court fees and a fine was an effective method of diverting funds to fish habitat management. The development of a set of guidelines with the objective of explaining how a "net loss" of habitat could be avoided in one specific situation will be useful in preventing future disturbances of fish habitat.

#### **6.6 Conclusion**

The examples presented illustrate the way in which a variety of issues were dealt with in the application of the "no net loss" guiding principle across Canada. In general most of the examples comply with the conceptual definition of "no net loss" which was developed in Chapter 2. In most of the cases presented 'like for like' habitat compensation took place, however, there was a considerable amount of variation as to how the "no net loss" objective was met.

The examples served as a useful information base from which to derive a diverse set of concepts which represent acceptable methods of meeting the objectives of the "no net loss" guiding principle. These concepts can be employed in determining how "no net loss" might be applied in the development of mitigation and compensation proposals for the Conawapa project.

## **Chapter 7**

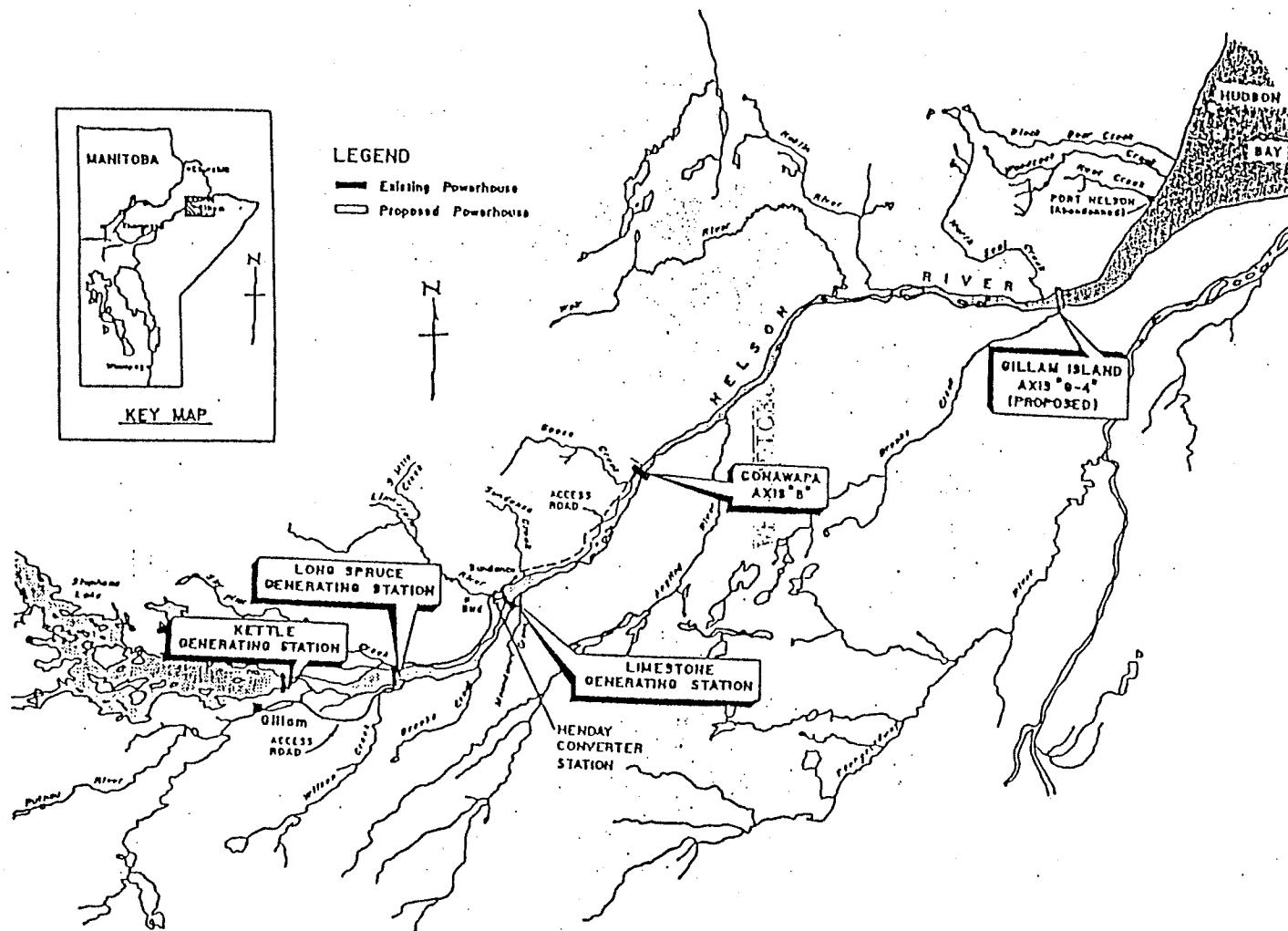
### **REVIEW OF POTENTIAL FISH HABITAT ALTERATIONS BY CONAWAPA**

#### **7.1 Introduction**

Hydroelectric development has affected the landscape and ecosystem of the Nelson River since the completion of Kelsey Generating Station (G.S.) in 1960. Kettle G.S. came into service in 1970 followed by Long Spruce G.S. in 1977, and Limestone G.S. in 1990. Regulation of Lake Winnipeg through the Jenpeg Control Structure in 1975 and the diversion of the Churchill River in 1976 has contributed to the hydroelectric potential of the Nelson River (Swanson 1990). The impacts of these developments has considerably altered the availability and condition of fish habitat on the Nelson River.

The proposed Conawapa G.S. will be constructed at a site 27 km downstream from Limestone G.S. The location of the proposed development is indicated in Figure 7.1. The project will flood approximately 10 hectares of land. The extent of flooding will be minimal due to the high banks of the Nelson River (Manitoba Hydro 1990).

The existence of previous dams on the Nelson River will provide a reliable information base which can be used to predict the potential effects of the Conawapa project. Due to the similarity in location, size, geomorphology and biological characteristics between Long Spruce G.S., Limestone G.S. and the proposed Conawapa G.S., previous developments may serve as



**Figure 7.1: Location of the Proposed Conawapa Project**  
Source: KGS et al. 1991

models to predict the environmental impacts of Conawapa (Baker 1990a). The existence of these generating stations, however, may also hamper the collection of accurate data on the impacts of the Conawapa project as an individual entity. The effects of each generating station cannot be isolated from one another at all stages of the data collection process. When estimating the impacts of the development on fish movements down the Nelson River from as far as Kettle River, individual impacts of each station cannot be easily separated. The extensive level of development on the Nelson River has created a number of cumulative impacts in the region. It therefore may be difficult to estimate the loss of productive capacity in the Nelson River which is directly attributable to Conawapa. It is for these reasons that application of the "no net loss" guiding principle to a project of the magnitude of Conawapa has many complicating factors.

For the purposes of this study, the fish habitat alterations by the Conawapa project will be discussed in three sections; the Nelson River mainstem and tributaries, the creation of a reservoir, and, the Nelson River estuary.

## **7.2 Impacts on Nelson River Tributaries and Mainstem**

### **7.2.1 Brook trout**

Brook trout has been identified as one of the most important fish species in the Nelson River system. It has been classified as a heritage species. Brook trout are highly

prized because of its sport fishing attraction and its cultural and historical significance as part of Manitoba's heritage on the Nelson River (Swanson et al. 1990). A considerable amount of research related to the impacts of hydroelectric development on brook trout has been conducted relative to other fish species in the Nelson River system.

#### **7.2.2 Brook trout population decline**

The population of brook trout in the Nelson River has declined significantly due to direct and indirect impacts of hydroelectric development. Brook trout prefer fast running riverine environments and cannot adapt to the creation of reservoirs on the upper reaches of the Nelson River. A study conducted to assess the species composition of Long Spruce Reservoir revealed that there may be no brook trout in the reservoir. The sample of 841 fish taken from the reservoir in July and October of 1989 did not contain any brook trout (Baker et al. 1990). Several projects were undertaken by the Manitoba Fisheries Branch (MFB) to enhance brook trout habitat in the Kettle River region, however, the populations did not fully reestablish themselves (Swanson and Kansas 1987). The location of the Kettle River is provided in Figure 7.2.

The lack of brook trout captured from Long Spruce Reservoir does not necessarily imply that no brook trout live in the reservoir. A radio tag study conducted as part of a Kettle River enhancement project indicated that three trout

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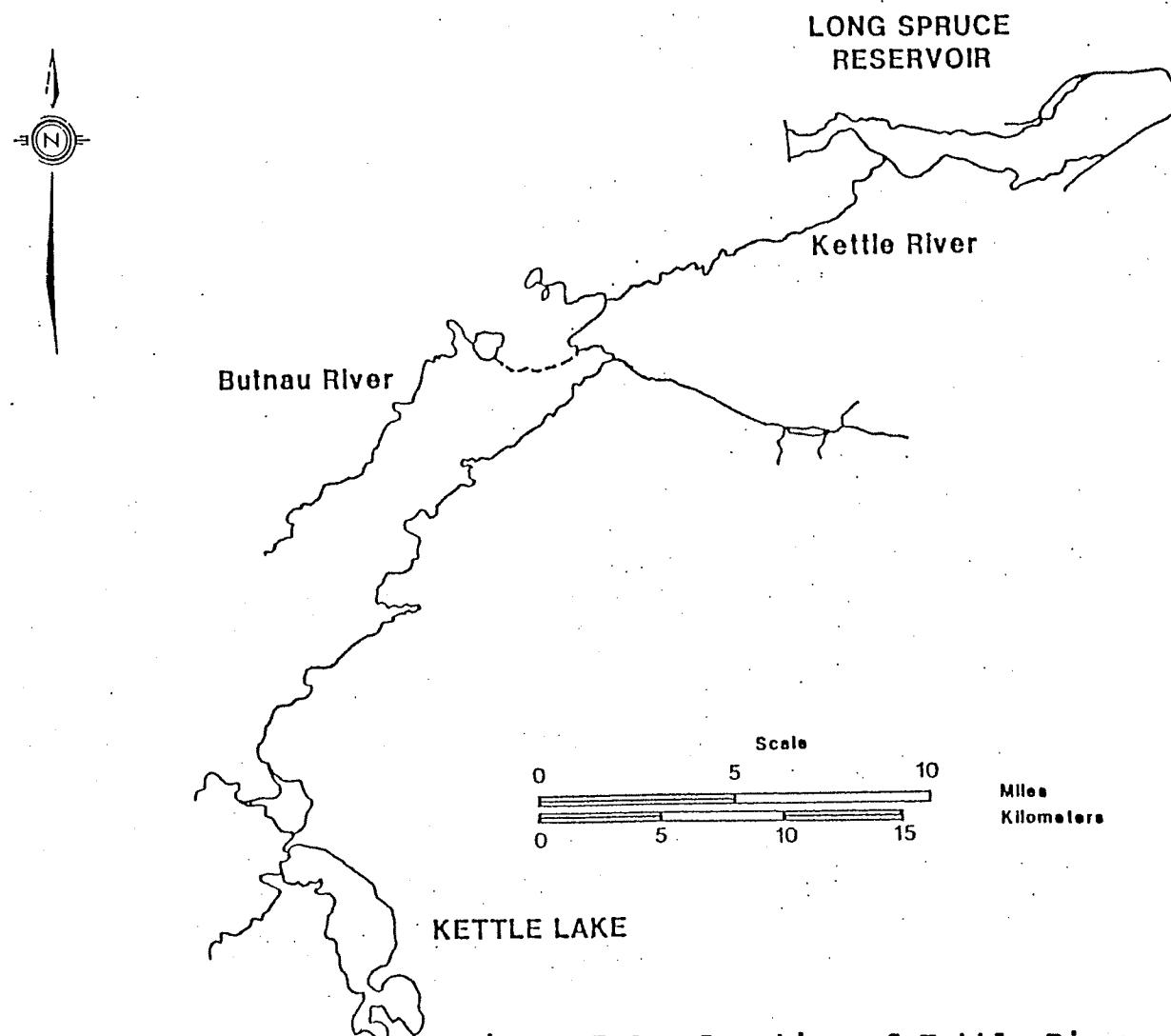
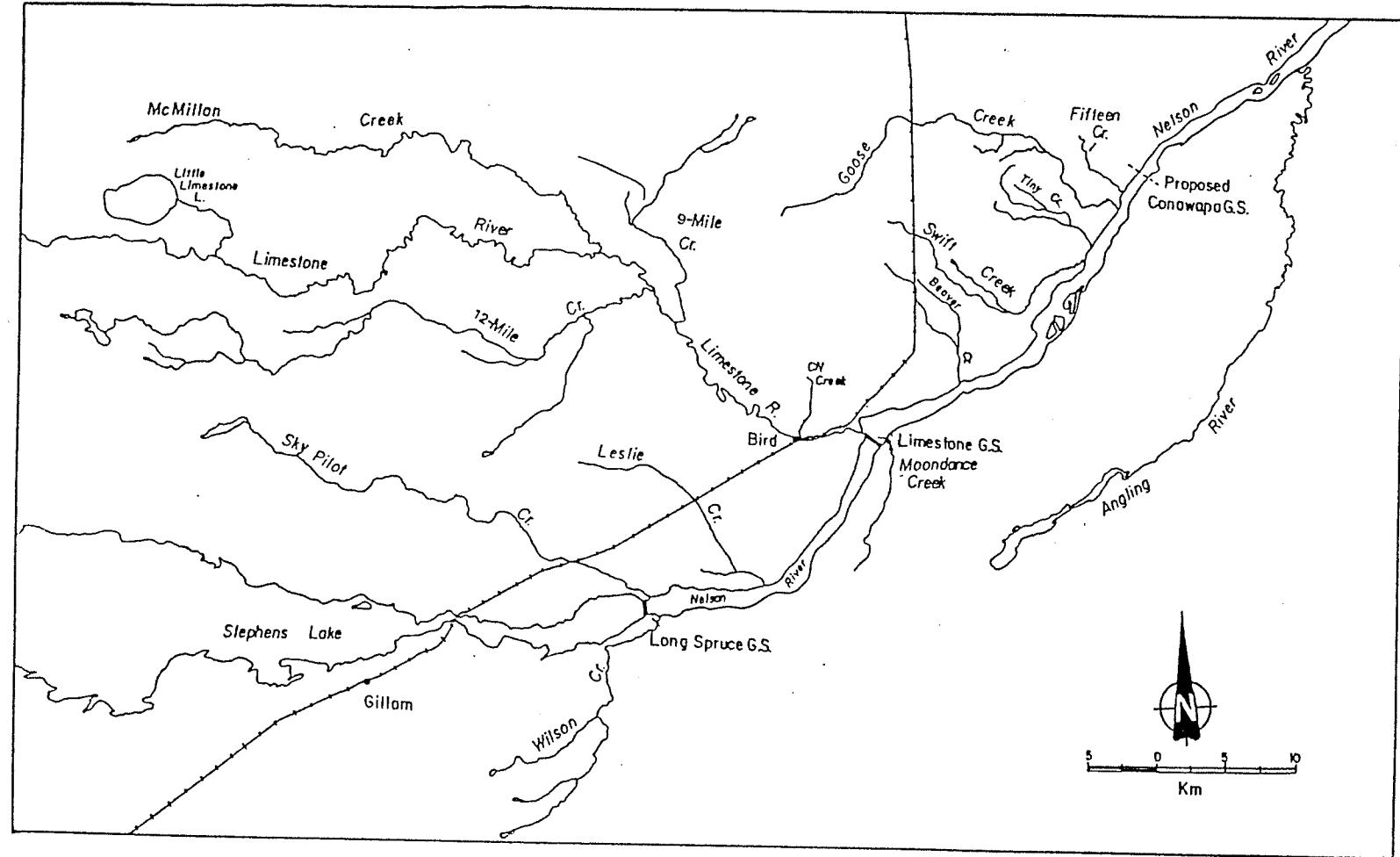


Figure 7.2: Location of Kettle River  
Source: Swanson et al. 1990

remained in Long Spruce Reservoir for the life span of the tags which was about 7 months. The trout were reported as being healthy (Swanson et al. 1991).

Despite the survival of trout in the reservoir, a comparison with data taken from Limestone Forebay revealed that brook trout generally do not reside within impounded regions. In 1990, 1556 fish were captured in Limestone Forebay, none of which were brook trout (Baker 1991). Other data collected indicate that brook trout migrate out of impounded regions (MacDonell 1991a). Brook trout tagged in Limestone Forebay were retrieved below Limestone G.S. from Moondance Creek. This may be contributing to a short-term increase in fish utilization of Moondance Creek (MacDonell 1991a). A second report documenting brook trout spawning movements supported this conclusion. Numbers of brook trout encountered that inhabit Wilson Creek and Sky Pilot Creek, located above Limestone G.S., indicated a decrease from the number of brook trout which was recorded in these creeks in comparison to the previous year. These creeks are illustrated in Figure 7.3. The decline in numbers encountered does not necessarily indicate a decrease in the size of the brook trout population. The decline could indicate, however, that brook trout are leaving the system. Recaptures of tagged fish indicated that a significant number of fish migrated down from Limestone Forebay during the fall, winter, or spring 1989/1990 (MacDonell 1991b).



**Figure 7.3: Location of Tributaries of the Nelson River**  
Source: MacDonell 1991b

Strontium is an element which becomes concentrated in the tissue of anadromous fish. Anadromous fish migrate down to marine environments to increase their feeding opportunities. Strontium was present in high concentrations in less than 1% of brook trout monitored in tributaries of Limestone Forebay suggesting that few of the brook trout within this region are anadromous. The low number of anadromous brook trout (1%) indicates that these fish probably feed within the Nelson River tributaries. These are the brook trout that were directly impacted by the flooding of the forebay region. It was predicted by Swanson et al. (1990) that these fish would be restricted to becoming tributary resident populations of small, slower growing brook trout.

Hydroelectric developments have already impacted trout populations below Limestone G.S. This is the region which will become Conawapa Forebay. As stated earlier, tag returns indicate that fish which have migrated out of Limestone Forebay may be using Moondance Creek for spawning and foraging. The populations which have migrated out of the impounded region may have been subjected to increased mortality due to passage through turbines.

Moondance Creek currently serves as a refuge for juvenile trout from predators which inhabit the Nelson River mainstem (MacDonell 1991a). It has also been noted by Kroeker (1991) that there is a resident population of brook trout in Moondance Creek.

There has been some speculation that the potential for immigration of juveniles and young of the year from Beaver, Goose, 15 and Tiny Creeks to use habitat above Limestone G.S. no longer exists (Kroeker 1991). Since the extent to which brook trout were moving between tributaries located above and below Limestone G.S. has not been documented, this is merely a speculative comment.

Other impacts downstream of Limestone G.S. include variable water levels due to discharges from the dam. These conditions have created fluctuations at the mouths of Nelson River tributaries. These habitat changes may have increased pressure on the remainder of habitat available for brook trout in streams such as Moondance Creek.

Given this brief summary of data, it appears as if brook trout have not disappeared completely from upper reaches of the Nelson River as a result of hydroelectric development, however, the population has been impacted significantly. Swanson et al (1990) and MacDonell (1991b) have pointed out that although there have been a substantial number of habitat changes as a result of hydroelectric developments, it is difficult to distinguish between population decline caused by anglers and that which was caused by hydroelectric development. It must be noted however, that the influx of construction workers into the area has resulted in increased angling pressure. This situation has created an indirect impact on the brook trout population which is associated with

hydroelectric development.

The impacts of hydroelectric development on brook trout populations located near Long Spruce G.S. and Limestone G.S. can be used to predict the potential population changes from the proposed Conawapa project.

#### **7.2.3 Potential brook trout habitat alterations by Conawapa**

The most significant impact of the proposed Conawapa project on the Nelson River brook trout population will be the creation of Conawapa Forebay. The Conawapa Forebay area is presently used as feeding habitat for brook trout from the Limestone River. Although there are no population estimates available, the Limestone River has been described as one of the most productive brook trout streams in Manitoba. The Limestone River is located on Figure 7.3.

Radio telemetry studies revealed that brook trout spawn at most of the major tributaries of the Limestone River such as 9 Mile Creek, 12 Mile Creek, and CN Creek (Swanson et al. 1991). Most of these fish stay within the Limestone River and do not use the Nelson River or the Nelson River Estuary (Swanson 1986, Swanson and Kansas 1987, MacDonell 1991a). The fish which do leave the region are often brook trout fry migrating within Conawapa Forebay to find streams which provide nursery habitat.

Swanson et al. (1988) has estimated that historically, 24% of Limestone River trout may have been anadromous. Recently, it has been estimated that less than 1% of all trout

inhabiting the Limestone River and its tributaries are anadromous (Swanson et al. 1991 and MacDonell 1991a). Brook trout inhabiting the Limestone River mainstem seem to have a higher incidence of anadromy than those inhabiting its tributaries. Formation of the Conawapa Forebay may eliminate riverine feeding habitat for those fish which seek alternative feeding habitat to that available in the Limestone River.

There is speculation that the section of the Nelson River mainstem which may become the Conawapa Forebay is currently being utilized as overflow feeding habitat for brook trout from the Limestone River. Because the Limestone River has been impacted by angling, there are fewer fish utilizing habitat in the river. It is likely that, historically, a larger population of brook trout inhabited the Limestone River. Under these circumstances a larger number of fish would have left the river to increase their feeding opportunities.

This Limestone River brook trout population has been affected by the construction of Limestone G.S. and will be further impacted by Conawapa. Studies undertaken by both the MFB and Manitoba Hydro indicate extensive use of the Limestone River and other Conawapa Forebay tributaries by brook trout. Work undertaken by Gaboury and Spence (1981), Swanson (1986), Swanson and Kansas (1987), Swanson et al. (1988) identified the Limestone River and Moondance Creek as spawning areas. Most of the creeks which drain on the north shore of the

Nelson River serve primarily as nursery habitat.

The MFB has predicted that Moondance Creek is unlikely to suffer any direct physical impacts from Conawapa because this creek is at the headwater of Conawapa Forebay (Swanson 1991). MacDonell (1991a) however, reported that increased water levels at the mouth of the creek may reduce its suitability for juvenile brook trout because it may increase predator access.

The Conawapa project will affect brook trout populations which currently inhabit tributaries of the Nelson River which are located downstream of the proposed Conawapa G.S. Very little information has been assessed with regard to these populations. A report published by Baker (1990b) presents a physical description of the Weir River, an overview of fish species located in the river, and an evaluation of the existence of groundwater upwellings suitable for brook trout spawning. It must be noted that groundwater upwellings are important to incubate brook trout eggs. Groundwater may provide the necessary flow of oxygenated water to allow egg development in fine substrate. Fine substrate may be detrimental to egg development. Upwelling may also serve to loosen the fine substrate (Swanson et al. 1990).

At this time, no recent information regarding the life history of Weir River brook trout has been collected. Movements and anadromy of Weir River brook trout have been investigated by Gaboury (1980), Swanson (1986), and Swanson

and Kansas (1987). Floy tagging of brook trout by Gaboury (1980) revealed that there was some interchange between brook trout of the Weir and Limestone Rivers. Limited radio-tagging studies by Swanson and Kansas (1987) suggested that Weir River brook trout may utilize the Nelson River estuary to overwinter. The level of anadromy reported by this study was 74%. This preliminary data suggests that the proposed Conawapa G.S. may restrict the movements of these populations.

According to the data presented above, the proposed Conawapa project is likely to have the following impacts on Nelson River brook trout populations:

1. Flooding of the Limestone Rapids will cause a reduction in the amount of habitat which is available for feeding.
2. At a maximum water level of 60 m in Conawapa Forebay, approximately 7 km of rearing habitat on the north shore of the river will be flooded.
3. Brook trout have a tendency to migrate out of impounded regions and may therefore migrate out of Conawapa Forebay.
4. Flooding at the mouths of tributaries of the Nelson River will allow access to predators such as northern pike.
5. The Conawapa G.S. will prevent the use of upstream habitat such as the Limestone River by brook trout inhabiting tributaries located below the G.S. such as Weir River.
6. Increased angling in the lower Nelson River region which may occur as a result of an increased work force to construct the Conawapa project may also impact the species.

7. Flow changes may also impact brook trout populations located below the proposed dam.

While relative predictions can be made as to the nature and location of impacts by the proposed dam on brook trout, no numerical estimates have been generated by either the MFB or Manitoba Hydro. There is ongoing research on this species.

#### **7.2.4 Lake sturgeon**

Lake sturgeon, like brook trout has been classified as a heritage species. Lake sturgeon is also a prized species for recreational fishing and is harvested for domestic consumption. The decline of lake sturgeon within the Nelson River system appears to be more severe than that of brook trout.

#### **7.2.5 Lake sturgeon population decline**

The unique life history of lake sturgeon has been a major deterrent to its ability to sustain itself in the midst of extensive habitat alteration. Harkness and Dymond (1961) made comparisons of sturgeon age at sexual maturity between various locations. In the Nelson River, they estimated that males reach sexual maturity between the ages of 15 to 20. Females reach sexual maturity between the ages of 25 to 33. Magnin (1966) felt that depending on locality south to north, females spawned every 4 to 6 years and males every 2 to 3 years. These life history patterns have created difficulties in

assessing the impacts of habitat alteration on the species.

Lake sturgeon have suffered from habitat changes due to hydroelectric development. Lake sturgeon prefer to make long ranging movements which are not possible in an impounded region (Swanson et al. 1991). A reservoir such as the one located at the Long Spruce G.S. does not provide sufficient habitat feeding to sustain a self propagating population of lake sturgeon (Swanson 1991). A sample of fish was taken from Long Spruce Reservoir in 1989 to assess its species composition. It did not contain any lake sturgeon (Baker et al. 1990). Similar sampling efforts in Limestone Forebay revealed very few lake sturgeon (Baker 1990a, Baker 1991). A radio tag study revealed that sturgeon are likely to leave a lacustrine environment to search for improved feeding opportunities (Swanson 1991).

Habitat changes resulting from hydroelectric development may have negatively impacted sturgeon spawning. A study in the spring of 1988 which involved placing a test net below Long Spruce G.S. was initiated to determine if the species spawns at the base of the dam. Fourteen sturgeon were captured, however, there was no sign of spawning taking place (Swanson et al. 1990). Swanson et al. (1990) believe that they may have missed the spawning period during the year which the study was conducted. Swanson (1991) has reported that prior to construction of Long Spruce G.S. and Kettle G.S., Kettle Rapids was identified as a lake sturgeon spawning area.

Research efforts up to the summer of 1991 have not yet revealed a sturgeon spawning area (Don MacDonell, pers. comm.). Data presented by Swanson et al. (1990) suggest that no successful spawning of lake sturgeon has taken place since the completion of Kettle G.S. A number of studies were initiated in 1986 to investigate the life history of Nelson River lake sturgeon utilizing radio telemetry and gill netting. The studies failed to pinpoint any spawning locations of lake sturgeon and no lake sturgeon under 10 years of age was captured (Swanson et al. 1991).

Aside from habitat changes and blockage of migratory movements, disturbances of sturgeon eggs may also have led to the decline of the lake sturgeon population. Lake sturgeon have been seen "rolling" and "breaking" the surface of the Lower Limestone Rapids in the spring of 1986 and 1988 (Swanson et al. 1990). This behaviour is often associated with spawning (Swanson 1991). Despite these reports no lake sturgeon eggs or fry were found during sampling of the Lower Limestone Rapids (Swanson et al. 1990). Swanson et al. (1990) believe that any eggs from sturgeon spawning in the Lower Limestone Rapids in 1988 may have been destroyed due to air exposure for 2-20 hours per day during a period of drought. Extreme flow variations in the lower Nelson River appear to have had a detrimental effect on lake sturgeon stocks.

Given this information, one may speculate that previous hydroelectric development has contributed to the decline of

the lake sturgeon population of the Nelson River region and the proposed Conawapa project will also contribute to this decline.

#### **7.2.6 Potential lake sturgeon habitat alterations by Conawapa**

Information on lake sturgeon in the lower Nelson River is limited, thus the ability to accurately predict the impacts of the Conawapa project will be limited. Most of the predictions presented are inferential with little supportive data.

Radio tracking showed that lake sturgeon use Angling Lake throughout the year (Swanson et al. 1990). Angling Lake serves as a refuge from the Nelson River and provides a suitable feeding environment (Figure 7.3). Occasionally they may emigrate to overwinter in the Nelson River. No other studies have been initiated to investigate the impacts of the Conawapa project on lake sturgeon specifically, and, other studies conducted in the Conawapa Forebay area did not uncover any lake sturgeon populations or spawning areas.

Despite the quantitative limitations of this information, several predictions can be made with regard to the impacts of the proposed Conawapa project on the lake sturgeon population of the lower Nelson River.

1. After the creation of the Conawapa Forebay, movements upstream into the Limestone Rapids will be prevented. These feeding and spawning opportunities will no longer exist.
2. Lake sturgeon may not be able to find suitable foraging habitat in Conawapa Forebay.

3. Water level fluctuations caused by the Conawapa G.S. may expose lake sturgeon eggs.
4. Reduced flow conditions in the Nelson River may encourage larger numbers of lake sturgeon to migrate down to the estuary to feed.

### **7.3 Other Species**

The proposed Conawapa project will impact a number of other species within the Nelson River mainstem and tributaries. Up until 1989, there was little research on species in the Nelson River system other than brook trout or lake sturgeon. Tentative conclusions with regard to potential impacts on these species has been made by reviewing information available from both Manitoba Hydro and the MFB since 1989. There was a limited amount of information presented on the four species discussed below. A complete list of the species which are present in the Nelson River system is presented in Table 7.1 at the end of this chapter.

#### **Longnose Sucker**

Longnose sucker is considered to be the most abundant species in the Nelson River mainstem (Baker 1990a, Swanson et al. 1990). It is also the most abundant species in the Limestone Forebay and all other tributaries and creeks in the Nelson River region (Baker 1990a and 1991).

While little is known about the life cycle of this species, studies have indicated that they utilize both the

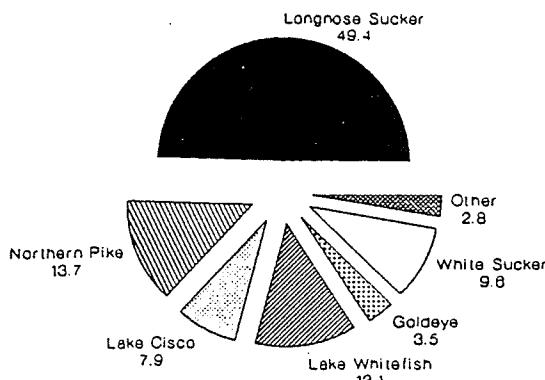
Nelson River mainstem and its tributaries. A gill netting study conducted in the proposed Conawapa Forebay area in 1988 revealed that longnose sucker is the most common species inhabiting the region. Out of a total of 508 fish gillnetted, 49.4% of the sample were suckers (Swanson et al. 1990). Longnose Sucker is the most predominant species in Moondance Creek followed by white sucker (MacDonell 1991a).

The potential effect which the Conawapa project will have on longnose sucker can be estimated by examining how it has been impacted by previous hydroelectric developments. A comparison of the species composition in Long Spruce Reservoir with that of Limestone Forebay and the Nelson River mainstem is provided in Figure 7.4. This data indicates how various species may react to impoundment. It appears as if longnose sucker has a tendency to decline in impounded regions. The populations of longnose sucker in the Nelson River mainstem and tributaries are likely to decline as a result of the Conawapa project.

#### **Lake Whitefish**

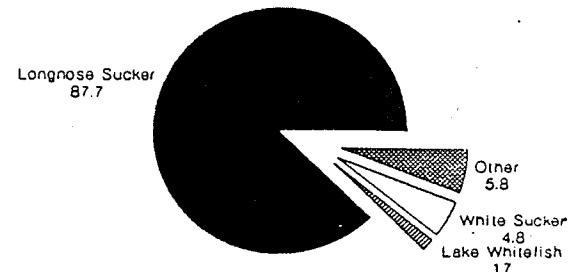
Lake whitefish is the second most abundant species within the Nelson River mainstem and has continued to survive in Long Spruce Reservoir (Figure 7.4). Baker et al. (1990) reported that a survey conducted to assess species composition and abundance in Long Spruce Reservoir in 1988 produced a sample which consisted of 18.7% whitefish. The information on

Nelson River Mainstem 1988



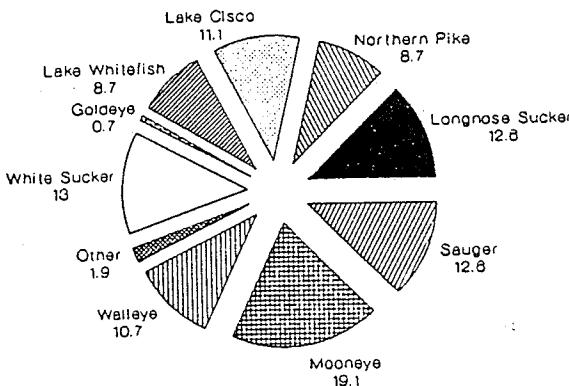
Source: Swanson et al. 1990

Limestone Forebay 1990



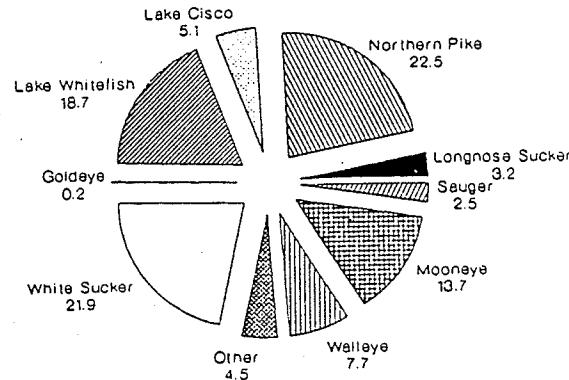
Source: Baker 1991

Long Spruce Reservoir 1986



Source: Swanson and Kansas 1987

Long Spruce Reservoir 1989



Source: Baker et al. 1990

**Figure 7.4: Species Composition Comparison (%)**

Source: Swanson et al. 1990, Swanson and Kansas 1987, Baker et al. 1991, 1990a.

species composition presented in Figure 7.4 indicates that the population of whitefish will likely increase in the Conawapa Forebay over time.

A survey of migrating fish in the Limestone River revealed a relatively low number of lake whitefish indicating that it is not a significant spawning area for this species (MacDonell 1991c). MacDonell (1991c) reported that it is likely that lake whitefish spawn in the Nelson River mainstem. Strontium levels of lake whitefish captured in the Limestone River indicate that the population may be anadromous. If these fish are anadromous, the Conawapa G.S. may inhibit their downstream movements. The extent of this potential impact is unknown.

Unpublished research results have revealed that there was a spawning population of over 3000 lake whitefish which utilized the Angling River during the fall of 1991 (Don MacDonell, pers. comm.). The potential impacts of the Conawapa project on these fish is not yet known.

#### **Northern Pike**

Northern pike is expected to increase in abundance in Conawapa Forebay. A survey of the species composition of Long Spruce Reservoir revealed that northern pike was its most abundant species, comprising 22.4% the sample taken (Baker et al. 1990). Data collected by MacDonell (1991c) indicated that most northern pike do not undertake significant migrations and

that their movements are generally localized. Given this information, it appears as if this species is more likely benefit from the habitat alterations which will be caused by the Conawapa project

#### **Lake Cisco**

In 1990, lake cisco was the most abundant species moving in and out of the Limestone River. It comprised 93% of the catch, or, 15 983 out of 17 066 fish (MacDonell 1991c). Strontium levels in these fish suggest that they may be anadromous. Lake cisco utilize the Limestone River during the fall (MacDonell 1991c). Swanson et al. (1990) also reported that lake cisco use the Nelson River rapids during the fall.

The potential impacts of the proposed Conawapa project on this species are at present unknown, however, Figure 7.4 indicates that lake cisco is capable of surviving in a lacustrine environment. Despite the ability of this species to survive within an impounded region, it is important to note that research results up to 1991 have not yet uncovered a spawning region for the lake cisco other than the Limestone River.

While the potential changes in the population of lake cisco as a result of the proposed Conawapa project are unknown, the impacts of blocking migrations of this species may be felt within the Nelson River estuary ecosystem where the fish may be a source of food for beluga whales.

### **Walleye**

The 1988 survey of species composition in the Nelson River mainstem indicated that walleye accounted for approximately 1.4% of its species composition. Walleye is sensitive to light and prefers deep or turbid streams (Scott and Crossman 1973). There are indications that the walleye population will likely increase if the Conawapa project is constructed. The potential for this population to increase in Conawapa Forebay is illustrated in Figure 7.4.

### **7.4 Reservoir Creation**

The proposed Conawapa project will transform a section of the Nelson River mainstem into a reservoir, or, forebay. Conawapa Forebay will include a 27 km stretch of the Nelson River and will flood an area of 10 hectares. The level of flooding caused by the project will be minimal due to the high banks of the Nelson River at the proposed Conawapa site.

The characteristics of both Long Spruce Reservoir and Limestone Forebay can be used to predict the species composition of the forebay which will be formed by the proposed Conawapa project, however, since it takes several years for these newly created aquatic communities to stabilize, only tentative predictions can be made. A study conducted by Baker et al. (1990) in Long Spruce Reservoir indicated that stabilization is still occurring 13 years after impoundment.

Fish species composition in Long Spruce Reservoir was described as being similar to that of a northern Manitoba lake. Northern pike was the most abundant species in Long Spruce Reservoir followed by lake whitefish, white sucker and longnose sucker (Baker et al. 1990). This is indicated in Figure 7.4.

It is expected that a comparison between 1985/1986 Long Spruce Reservoir data to a riverine section of the lower Nelson River would show a higher level of productivity while a comparison to a lacustrine system, such as Split Lake would show a lower level of productivity (Baker et al. 1990).

Low levels of mercury have been recorded in both Long Spruce Reservoir and Limestone Forebay. Baker et al. (1990) reported that the mean mercury levels were relatively low for all species in Long Spruce Reservoir and did not exceed the Canadian export limit for consumption of 0.5 ppm of mercury. Similar findings have been reported for Limestone Forebay, however, it often takes several years after impoundment for muscle mercury concentrations to increase (Baker 1990a). Swanson (1991) has stated that the Limestone and Conawapa Forebays will probably have resident fish stocks with mercury levels similar to those in Long Spruce Reservoir due to the downstream movement of fish containing mercury.

Given this preliminary data, it may be assumed that the construction of the Conawapa project will create a reservoir with a species composition which is similar to that of Long

Spruce Reservoir. The low level of flooding will likely result in mercury levels which do not exceed the Canadian export limit for consumption of 0.5 ppm.

### **7.5 Turbine mortality**

Fish mortality as a result of passage through turbines on the lower Nelson River has not yet been assessed. KGS et al. (1991) report that mortality for passage of fry through a turbine, such as the one to be installed at Conawapa, may be as high as 10 to 20%, while mortality for adults may be as high as 60 to 80%. Rough estimates can be derived from the literature, however, these numbers cannot be utilized as researchers are still unsure as to the extent to which fish populations attempt to pass through the turbines as they migrate out of impounded regions.

The cumulative environmental impacts of constructing a series of generating stations on one river is especially important in the case of turbine mortality. Drifting larval fish may pass through as many as three generating stations. Turbine mortality could have a significant impact on passively migrating fish.

### **7.6 Potential Impacts by Conawapa on the Nelson River Estuary**

The impacts associated with the construction of the Conawapa project have the potential to extend as far as the /Nelson River estuary. As very little is known about the

ecosystem of the Nelson River estuary, only tentative predictions can be made with regard to the potential impacts of the Conawapa project on this ecosystem.

A study was undertaken in the Nelson River estuary in the open water season of 1988 utilizing gill nets, beach seines, and zooplankton nets (Baker 1989). A total of 2603 fish, comprised of 27 species, representing 13 families, were captured between June 30 and October 7, 1988. Twenty-four of these species were classified as freshwater species. Within this group there was a wide range of tolerance and degree of utilization of salt water. The most common species identified was longnose sucker at 46% of the total, followed by emerald shiner comprising 40% of the catch. In the gill nets only, longnose sucker accounted for 54% of the catch followed by lake whitefish at 24% and lake cisco at 17% (Baker 1989). Several of the species identified such as lake cisco, lake whitefish, lake sturgeon, and stickleback are diadromous. Diadromous fish make daily or seasonal migrations between fresh and salt water.

Baker (1989) reported that brook trout were conspicuously absent from the fish collections in the estuary. Brook trout has previously been captured in the estuary and it is known that a percentage of the Nelson River population utilizes this area for feeding (Gaboury 1980, Swanson 1986, Swanson et al. 1988). Swanson (1988) believes that their absence may be explained by a large decline in their abundance during the

past decade as a result of overfishing and habitat alteration.

Very little is known about fish utilization of the estuary. There is insufficient information about spawning locations and dispersal of whitefish, longnose sucker and lake cisco in the Nelson River system to draw conclusions regarding the possible spatial and temporal structures of these populations (Baker 1989). Baker (1989) compared data from the Nelson River with data obtained from the LaGrande and Eastmain Rivers in Quebec. He stated that the life history patterns of the Nelson River lake whitefish and lake cisco are probably similar to those in the LaGrande and Eastmain Rivers. Three different annual migrations are undertaken by these species in the LaGrande and Eastmain Rivers. These can be categorized as feeding, spawning, and overwintering.

Despite the fact that general assumptions can be made with regard to lake whitefish and lake cisco use of the Nelson River estuary, the importance and extent of utilization of the estuary is not known. Its significance as a feeding ground is unknown as is the location of overwintering grounds for the fish (Baker 1989). No species in the Nelson River estuary was captured in sufficient abundance or exclusively during spring or fall which would indicate presence of a spawning migration. The lack of sexually mature fish captured during the study also supports this (Baker 1989).

The preliminary data collected within the estuary is not sufficient to evaluate potential fish habitat losses from the

proposed Conawapa project, however, a review of data pertaining to the use of the region by beluga whales can be used as some measure of how this ecosystem may be impacted by the Conawapa project.

#### **7.6.1 Potential habitat alterations for beluga whales**

Estuaries in general are believed to be important to beluga whales as nursery areas, feeding, social activity and reproduction. The increased temperatures in estuaries during the summer provide a favourable environment for the growth of newborn calves. A study conducted in the Churchill River estuary during July and August of 1988 tentatively revealed the following three observations; 1. beluga whale distribution in estuaries may be partially determined by water temperature, 2. adult beluga whales were relatively more abundant in warm estuary waters, and, 3. water temperature may be an important factor for skin moult in adult beluga (Watts et al. 1991).

The potential effect of the proposed Conawapa project on the beluga whales in the Nelson River estuary has become a focus of discussion from both members of the public and environmentalists. The beluga whale population of the Nelson River estuary is believed to be the largest concentration in the world. This population is harvested domestically by communities located north of the Nelson River. While the effects of previous hydroelectric developments on this population are unknown, a number of potential impacts of the

proposed Conawapa project have been identified.

In November of 1990, a workshop was organized by Manitoba Hydro and the DFO to discuss the potential effects of hydroelectric development on the beluga whales of the Nelson River estuary. The findings of this workshop will form the bulk of information presented in this section.

The workshop discussed the potential effects of the proposed Conawapa project and its relationship to changes in water temperature, sedimentation, river discharge and changes in water chemistry (Lawrence et al. 1991). A number of potential impacts which the Conawapa project may have on the Nelson River estuary, and its beluga whale population were identified, however, no assessment was made by the workshop members as to the magnitude or occurrence of potential impacts. Some of the potential impacts identified by the workshop include:

1. Changes in sedimentation may result in loss of spawning sites for capelin and filter feeding invertebrates, a food source for beluga whales.
2. The Conawapa G.S. may create a physical barrier to anadromous and diadromous fish which could affect beluga food supply.
3. Changes in Nelson River hydrology could alter estuarine food webs by altering freshwater food sources. This could affect beluga whale feeding habits.
4. Changes in water temperature may affect molting of the whale epidermis.
5. Increases in mercury levels from flooding may accumulate in whale flesh.

6. The Conawapa project will facilitate access to the estuary which could result in increased hunting and harassment of whales.
7. Increased fishing in the Nelson River region could contribute to whale mortality through entanglement of beluga in gill nets.

### 7.7 Conclusion

The data presented above is a short summary of the potential impacts of the proposed Conawapa project on fisheries resources in the lower Nelson River. Several important conclusions may be drawn from this data. Primarily, past experience indicates that both brook trout and lake sturgeon populations will suffer from a variety of impacts if the Conawapa project is built.

Other species which are believed to be anadromous such as lake whitefish and lake cisco will also suffer if their life histories include migration from habitat below the Conawapa G.S. to utilize habitat located above the structure. Unlike brook trout and lake sturgeon, these species may find suitable habitat within a newly created reservoir. The creation of a reservoir will favor northern pike and the population density of longnose sucker is likely to decline. The reservoir community itself may take over ten years to stabilize and will likely be more productive than the unimpounded region of the Nelson River while at the same time being less productive than other northern lakes in the region. Mercury accumulation in

muscle tissue is not expected to a major problem in the newly created reservoir. The impacts associated with the construction of an additional generating station on fish populations in the Nelson River estuary are largely unknown, however, a number of potential impacts have been identified with regard to the beluga whale population of the estuary.

The information presented in this chapter indicates that there may be a "net loss" of fish habitat if the Conawapa project proceeds. This information will be used to make recommendations for mitigation and/or compensation measures to meet the objectives of the "no net loss" guiding principle if the proposed Conawapa project is constructed.

**Table 7.1**  
**Fish Species Distribution in the Lower Nelson River**

Species	Distribution	Study
lake sturgeon ( <i>Acipenser fulvescens</i> )	collected in Nelson River mainstem and in estuary - see text for details	(Swanson and Kansas, 1987; Baker, 1989b; Swanson et al., 1990)
brook trout ( <i>Salvelinus fontinalis</i> )	collected throughout system - see text for details	(Gaboury, 1978; 1980; Gaboury and Spence, 1981; Swanson, 1986; Swanson and Kansas, 1987; Swanson et al., 1988; Swanson and Kansas 1989; Baker, 1989a, 1990; Swanson et al., 1990)
lake whitefish ( <i>Coregonus clupeaformis</i> )	collected in Nelson River mainstem and estuary - abundant in estuary	(Gaboury, 1980; Baker, 1989a,b, 1990; Swanson et al., 1990)
cisco ( <i>Coregonus artedii</i> )	collected in Nelson River mainstem and estuary - abundant in estuary	(Baker, 1989b, 1990; Swanson et al., 1990)
goldeye ( <i>Hiodon alosoides</i> )	collected in Nelson River mainstem and in estuary	(Baker, 1989b; Swanson et al., 1990)
northern pike ( <i>Esox lucius</i> )	collected throughout system	(Gaboury, 1980; Gaboury and Spence, 1981; Swanson and Kansas, 1987; Baker, 1989b, 1990; Swanson et al., 1990)
lake chub ( <i>Culaeus plumbeus</i> )	collected in Weir River and in estuary	(Baker, 1989b, 1990)
emerald shiner ( <i>Notropis atherinoides</i> )	collected in estuary	(Baker, 1989b)
spottail shiner ( <i>Notropis hudsonius</i> )	collected in Weir River and in estuary	(Baker, 1989b, 1990)
fathead minnow ( <i>Pimephales promelas</i> )	collected in tributaries upstream of proposed dam	(Swanson and Kansas, 1987; Baker, 1989a)
pearl dace ( <i>Semotilus marginatus</i> )	collected in tributaries both upstream and downstream of proposed dam, and in estuary	(Gaboury and Spence, 1981; Swanson and Kansas, 1987; Baker, 1989a,b)
northern redbelly dace ( <i>Phoxinus eos</i> )	collected in Goose Creek - first record of this species in a Nelson River tributary	(Baker, 1989a)
finescale dace ( <i>Phoxinus neogaeus</i> )	collected in Goose Creek and in estuary - first records of this species in this region	(Baker, 1989a,b)
blacknose dace ( <i>Rhinichthys stratalus</i> )	collected in Goose Creek	(Swanson and Kansas, 1987)
longnose dace ( <i>Rhinichthys cataractae</i> )	collected in tributaries both upstream and downstream of proposed dam, and in estuary	(Gaboury, 1980; Gaboury and Spence, 1981; Swanson and Kansas, 1987; Baker, 1989a,b, 1990)
longnose sucker ( <i>Catostomus catostomus</i> )	collected throughout system in large numbers	(Gaboury, 1980; Gaboury and Spence, 1981; Swanson and Kansas, 1987; Baker, 1989a,b; Swanson et al., 1990)
white sucker ( <i>Catostomus commersoni</i> )	collected throughout system	(Gaboury, 1980; Gaboury and Spence, 1981; Swanson and Kansas, 1987; Baker, 1989a,b, 1990; Swanson et al., 1990)
brook stickleback ( <i>Culae inconstans</i> )	collected in tributaries both upstream and downstream of the proposed dam, and in estuary	(Gaboury, 1980; Gaboury and Spence, 1981; Swanson and Kansas, 1987; Baker, 1989a,b, 1990)

Source: KGS et al. 1991.

Table 7.1 (continued)

Species	Distribution	Study
ninespine stickleback ( <u>Pungitius pungitius</u> )	collected in estuary	(Baker, 1989b)
threespine stickleback ( <u>Gasterosteus aculeatus</u> )	collected in estuary	(Baker, 1989b)
johnny darter ( <u>Etheostoma nigrum</u> )	collected in Weir River and estuary	(Baker, 1989b, 1990)
trout-perch ( <u>Percopsis omiscomaycus</u> )	observed in pools in the Nelson River, collected in estuary	(Baker, 1989b, 1990)
burbot ( <u>Lota lota</u> )	collected throughout system	(Gaboury, 1980; Gaboury and Spence, 1981; Swanson and Kansas, 1987; Baker, 1989a,b, 1990; Swanson et al., 1990)
yellow perch ( <u>Perca flavescens</u> )	collected in estuary	(Baker, 1989b)
sauger ( <u>Stizostedion canadense</u> )	collected in Nelson River mainstem	(Swanson et al., 1990)
walleye ( <u>Stizostedion vitreum</u> )	collected in Nelson River mainstem and in estuary	(Baker, 1989b; Swanson et al., 1990)
spoonhead sculpin ( <u>Cottus ricei</u> )	collected in estuary	(Baker, 1989b)
slimy sculpin ( <u>Cottus cognatus</u> )	collected in several Nelson River tributaries both upstream and downstream of proposed dam and in estuary	(Gaboury, 1980; Gaboury and Spence, 1981; Swanson and Kansas, 1987; Baker, 1989a,b)
fourhorn sculpin ( <u>Myoxocephalus quadricornis</u> )	collected in estuary - a truly estuarine species	(Baker, 1989b)
river darter ( <u>Percina shumardi</u> )	collected in estuary - not previously recorded in Churchill-Nelson River watersheds	(Baker, 1989b)
Arctic shanny ( <u>Stichaeus punctatus</u> )	collected in estuary - not previously recorded in Churchill-Nelson River watersheds	(Baker, 1989c)
capelin ( <u>Mallotus villosus</u> )	found in estuary (on beaches and in stomach contents of beluga whale)	(Baker, 1989b)

## **Chapter 8**

### **MITIGATION AND COMPENSATION RECOMMENDATIONS TO ACHIEVE "NO NET LOSS" AT CONAWAPA**

The final component of this research is to present a discussion of how the "no net loss" principle may be applied to the proposed Conawapa project. An evaluation of potential mitigation and compensation measures will be presented. The selection of these measures will be based upon the concepts which were derived from the policy application examples cited in Chapter 6, and, the potential habitat alterations outlined in Chapter 7. Some of the compensation proposals reviewed by the Lower Nelson River Fisheries Mitigation Sub-Committee will be reviewed in this chapter. Some general suggestions as to how the "no net loss" principle can be implemented by Manitoba Hydro are also included.

It is important to note that at present, no mitigation or compensation measures have been proposed by Manitoba Hydro in regards to the "no net loss" principle.

#### **Concepts derived from DFO "no net loss" principle application**

- 1) Like for like habitat replacement is most commonly applied.
- 2) Geographic location of replacement habitat is within close proximity of lost habitat.
- 3) Mitigation and/or compensation measures are developed to accommodate users of fisheries resources.
- 4) One species may be substituted for another if it is considered to be of equal value.

- 5) The "no net loss" principle may be applied on a regional basis to achieve "no net loss" or a "net gain" of fish habitat.
- 6) Compensation projects are designed to accommodate for uncertainty in project outcomes.
- 7) Compensatory habitat should be developed prior to the destruction of natural habitat.
- 8) Compensatory habitat can be developed in degraded regions.
- 9) Funding for compensation projects can allocated from a variety of sources.
- 10) Innovative approaches to "no net loss" are acceptable.

### **8.1 Concepts #1, #2, and #3 Mitigation and Compensation Proposals**

#### **8.1.1 Brook trout**

The brook trout population of the Nelson River system has been identified by the Manitoba Department of Natural Resources as a heritage species. Brook trout are important to anglers as well as being a domestic food source. Domestic harvesters such as the members of the Fox Lake Band have indicated a strong preference for brook trout (Dennis Windsor, pers. comm.). Mitigation and compensation measures should be developed specifically for the brook trout population due to the specific cultural importance of brook trout and legal priority of Native harvesters over fisheries resources as established in the R. v Sparrow case. Under these circumstances, failure to compensate for lost brook trout habitat may be socially unacceptable.

In Chapter 6, in the case of the brook trout population in Seal Cove River, the first three concepts of "no net loss"

application outlined above were fully endorsed. In the case of Namew Lake Mine, where species substitution took place, it may be noted that originally, little fishing activity was taking place in the lake and there was no group of current users to define the lake as a fishery, therefore, creation of 'like for like' habitat was not necessary in this case.

The recommended mitigation measures for brook trout are listed below.

#### **Closure of streams to anglers**

Aside from population decline due to hydroelectric development, a secondary factor in the reduction of the brook trout population cited throughout the literature was angling pressure. The Manitoba Fisheries Branch has stated that in the Nelson River and its tributaries, all brook trout and lake sturgeon must be released for the 1992 season. The tributaries to the Nelson River will be closed to all fishing from September 1 to September 30 during the 1992 season (Manitoba 1992). These restrictions should be maintained until the populations have rebounded.

These restrictions are viewed as an effective fishery management tool as there is a high compliance rate among local harvesters. These regulations have been requested by recreational fishermen. Native harvesters maintain their rights to fish, however, it does not appear as if they have been harvesting extensively. Enforcement of fishing regulations in the Nelson River region is not perceived as a

problem (Carl Wall, pers. comm.).

#### **Kettle River enhancement**

In 1988, the potential for rehabilitation of the Kettle River brook trout population was investigated through the transfer of radio-tagged adults from other rivers. The fish remained in the Kettle River-Long Spruce system throughout the transmitting life of the tags and appeared to have found suitable winter habitat (Swanson et al. 1990). Swanson et al. (1990) and Swanson et al. (1991) have recommended that annual transfers of adult brook trout to the Kettle River be undertaken to increase the potential of this river to develop a self-sustaining population. The Kettle River is a good location to increase the brook trout population as it historically contained brook trout. Groundwater upwellings have been identified in the Kettle River.

#### **Wilson Creek and Sky Pilot Creek enhancement**

Brook trout populations within Sky Pilot Creek have declined to some extent as a result of fish emigrating out of Limestone Forebay (MacDonell 1991b). Enhancement programs should be developed to sustain these populations at levels estimated prior to the construction of the Limestone G.S. These populations are likely to require protection from predators such as northern pike when its predicted population increase in Limestone Forebay occurs. Protection from predators can be achieved through the creation of barriers

which inhibit passage of non-leaping fish.

#### **Tributary enhancement**

If further research and monitoring indicates that the recommendations listed above prove insufficient to mitigate for losses of the brook trout population, additional studies should be conducted in the tributaries of the Nelson River below Conawapa G.S. to assess their potential to sustain brook trout populations. Swanson et al. (1990) have reported that almost all of the streams located within the proposed Conawapa Forebay contain at least one groundwater upwelling.

Enhancement possibilities within the Hayes River, located south of the Nelson River may also be investigated.

#### **Limestone River monitoring**

Research conducted by Swanson et al. (1990) and MacDonell (1991a) indicate that there is a large population of brook trout which remain in the Limestone River throughout the year. The status of this population should continue to be monitored after the construction of Conawapa G.S. The potential to control increased predation which may result from the creation of a reservoir should be investigated.

#### **Fish ladder**

The installation of a fish ladder at the proposed Conawapa G.S. is currently being debated as a measure to conserve the Nelson River brook trout population. This facility would be designed to allow passage of brook trout past the G.S. to habitat above the dam such as the Limestone

River. The cost of a fish ladder was estimated at \$11 million (FMSC 1989). More recent estimates of the costs of this structure and a downstream fish passage facility run as high as \$20 million (Dennis Windsor, pers. comm.).

There are a number of problems associated with a fish ladder.

1. It is anticipated that the number of brook trout which may use this ladder is small (FMSC 1989). The most recent estimate of anadromous brook trout inhabiting the Limestone River is only 1% as mentioned in Chapter 7.

2. No fish passage facility exists, in North America, that is designed for non-salmonid species of fish such as lake whitefish and lake cisco over dams as high as Conawapa, for example (Randy Baker, pers. comm.).

3. Fish ladders should be installed in conjunction with facilities to protect fish returning downstream from turbines. This would further increase the cost of the fish ladder.

Overall, the installation of a fish ladder at Conawapa currently does not appear to be an effective method of meeting the requirements of the "no net loss" principle. The costs associated with a fish ladder are also relatively high when compared with the potential benefits of the structure.

#### **8.1.2 Lake Sturgeon**

The sturgeon population in the Nelson River system has also been identified as a heritage species for the same

reasons as brook trout. Failure to provide mitigation measures for the sturgeon population would be socially unacceptable due to the cultural importance of the species.

#### **Closure of streams to anglers**

Due to the unique life history of lake sturgeon, restrictions on harvesting for a period of up to twenty years would not be unreasonable given the length of time required by the species to reach sexual maturity. Restrictions for harvesting of sturgeon in the Nelson River region are the same as those cited for brook trout in Section 8.1.1 of this report.

#### **Minimum flow requirements**

Extreme variations in water flow patterns on the lower Nelson River appear to have had a detrimental effect on the recruitment of sturgeon (Swanson et al. 1990).

Minimum flow requirements was one of the mitigation proposals which was reviewed in the report by the Fisheries Mitigation Sub-Committee (FMSC) in 1988. The establishment of minimum flow requirements would mean that Manitoba Hydro would be required to maintain a minimum flow rate from all the generating stations on the Nelson River to protect fish habitat on the downstream portion of the river. The FMSC dismissed this proposal on a number of grounds stating that the nature of the forebays of the lower Nelson would require

that minimum discharge levels be applied to all generating stations unless a wide range of forebay levels can be accommodated (FMSC 1989). The FMSC also felt that the imposition of minimum flow requirements would only be effective until the proposed Gillam Island G.S. was constructed (FMSC 1989).

Some positive aspects of minimum flow requirements were outlined in the FMSC report such as the recreational benefits of constant boating conditions.

Based on estimates derived from two minimum flow modelling methods, the FMSC has recommended a minimum flow level of 25 000 cubic feet per second (cfs). The maintenance of this minimum flow requirement could benefit sturgeon populations in the Nelson River system.

#### **Habitat enhancement**

The creation of artificial sturgeon spawning habitat has been recommended by KGS et al. (1991). Blast rock could be placed at the tailrace and/or downstream of the Conawapa spillway, or, an artificial spawning habitat could be built (KGS et al. 1991).

#### **Angling River monitoring**

Lake sturgeon populations have been identified in the Angling River system. Further research on these populations will be required in this region to assess any population

changes which may occur as a result of the construction of the Conawapa project. The possibility for enhancement measures within this system should be investigated.

#### **8.1.3 Other species**

Mitigation measures for species other than brook trout and lake sturgeon have not been cited in any of the literature reviewed. The primary obstacle to providing any such suggestions to meet the requirements of the "no net loss" guiding principle is the lack of detailed information with regard to the life histories of other species in the Nelson River system. Despite this information gap, some recommendations can be made based on the information that was presented in Chapter 7.

Two other species which may require specific attention are lake whitefish and lake cisco. These species are believed to be anadromous. They are important to the Nelson River ecosystem as any effects on these species may have detrimental impacts to the ecosystem of the Nelson River estuary.

#### **Lake Whitefish**

A large population of lake whitefish was located in the Angling River. The existence of this population may preclude any significant negative impacts which the Conawapa project may have on lake whitefish, however, it is recommended that monitoring of whitefish be continued. If further evidence is

uncovered to support the conclusion that beluga whales are partially dependent upon lake whitefish as a food source, mitigation of any impacts will be required.

### **Lake Cisco**

At this point the only spawning location identified for lake cisco is the Limestone River. The importance of lake cisco to the Nelson River system is similar to that of whitefish as it may be a food source for beluga whales. If no other spawning location for lake cisco are identified, potential impacts of the Conawapa project on this population could become an important issue for mitigation. Protection from increased predation from the reservoir, and, habitat enhancement within the Limestone River system may be used to mitigate impacts for this species.

#### **8.1.4 Reservoir creation**

##### **Concept #4 - Substitution of fish species**

The construction of the Conawapa G.S. will impound approximately 27 km of the Nelson River thus changing the fast flowing habitat of the river to a slow moving lacustrine environment. The forebay which will be created is likely to be similar to Long Spruce Reservoir and Limestone Forebay.

As mentioned in Chapter 7, Baker et al. (1990) have stated that it is expected that a comparison between 1985/1986 Long Spruce Reservoir data to a riverine section of the lower

Nelson River would show a higher level of productivity while a comparison to a lacustrine system, such as Split Lake would show a lower level of productivity. Similar results were predicted for Limestone Forebay over time (Baker et al. 1990). Swanson (1991), however, has predicted that the Limestone and Conawapa Forebays will have a lowered productive capacity due to a number of factors associated with impoundment such as high turbidity and decreased light penetration.

If future research results indicate that the productive capacity of Conawapa Forebay is equal to, or, higher than the Nelson River mainstem, and, that mercury levels are acceptable, it will have the potential to serve as both a domestic and recreational fishery. This newly created habitat could be considered as compensation for habitat alterations incurred as a result of the Conawapa project. Case studies reviewed in Chapter 6 of this report indicated that substitution of one species for another of equal value is acceptable to the DFO even though this option would qualify as third on the PMFH "Hierarchy of Preferences".

The acceptability of this proposal will be defined to a large extent by fishermen in the lower Nelson region. Compensation proposals for major hydrotechnical developments such as the Oldman River dam, reviewed in (KGS et al. 1991) cited reservoir management and creation of a reservoir fishery as part of their proposed compensation plans.

The primary drawback in this situation is the number of

years required for a the newly created ecosystem to stabilize. The Conawapa Forebay may be used as future compensation but cannot be considered immediately as part of the requirements to achieve "no net loss" due to the importance of the temporal dimension of the conceptual definition of "no net loss" (Chapter 2) which requires that compensatory habitat be developed prior to habitat destruction.

#### **8.1.5 Northern Indian Lake**

The final recommendation of the FMSC to compensate for habitat losses as a result of Conawapa was the creation of fish habitat by rewatering Northern Indian Lake (NIL). This lake was drained as a result of the Churchill River Diversion. The plan would create habitat suitable for northern pike and walleye. Unlike brook trout and lake sturgeon, these species are not considered heritage species. The FMSC reported that this was the only option which would satisfy the requirements of the "no net loss" guiding principle. This proposal would create fish habitat sufficient to balance the unavoidable loss of fish habitat in the Nelson River upon the flooding of the Conawapa Forebay (FMSC 1989).

This option has three drawbacks. First, the fishery will be located at a considerable distance from the Nelson River such that it will not comply with the conceptual definition of "no net loss" developed in Chapter 2 of this report unless Manitoba Hydro provides transportation to the lake from the

Nelson River region. This would increase the capital cost of the structure which has already been estimated at \$4 to 5 million. Off site compensation is not a preferred option according the "Hierarchy of Preferences" outlined in the PMFH.

Second, the NIL option will create habitat for the purposes of recreational fishermen and the newly created fishery will not meet the needs of domestic harvesters of the lower Nelson River region. Third, there is the potential for conflicts to arise between competing user groups if a new fishery is created in the NIL region.

While this option alone may be insufficient to meet the requirements of the "no net loss" principle because it will not compensate for lost populations of heritage species such as brook trout and lake sturgeon, it could be useful as an additional measure if the recommendations cited above prove insufficient to compensate for the potential loss of productive capacity in the Nelson River.

#### **8.2 Implementation of "no net loss" at Conawapa**

Implementation of the "no net loss" principle at the site of the Conawapa project can take place by employing concepts 5 to 10 listed at the beginning of this chapter.

#### **Concept #5 - Regional policy application**

The Fraser River Estuary Management Program (FREMP) illustrates the merits of applying the "no net loss" principle

rigorously in a specific geographic area. Although there are many significant differences between the Fraser River estuary and the Northern Manitoba, the concepts which were developed in British Columbia are applicable.

The Fraser River estuary is similar to Nelson River region in that it is a region in which extensive economic development has taken place within a highly productive ecosystem which many local harvesters rely upon. Application of the "no net loss" principle on a regional or ecosystem basis rather than a site specific basis may lead to a "net gain" of fish habitat in the Nelson River region. Implementation of the "no net loss" principle on a regional basis could greatly increase the amount of fisheries resources available to current and future harvesters in the north.

#### **Concept #6 - Uncertainty in project outcomes**

In general, application of the "no net loss" principle is based on estimates of productive capacity as no consensus has been reached as to how productive capacity should be measured. As stated in Chapter 7, there are no reliable estimates available for the percentage of the brook trout population which could be lost as a result of the Conawapa project, therefore, no figures can be estimated for the exact amount of habitat which must be developed. This lack of information should not pose any significant problems for Manitoba Hydro as continuing research on the brook trout population will help

provide estimates on the extent of habitat loss for the species. Whatever estimates are developed, mitigation and/or compensation proposals must be developed to achieve a level of habitat compensation above the estimated loss to compensate for uncertainty in the success of these measures. This concept is applied in the Fraser River estuary.

Uncertainty in view of the success of particular mitigation measures has also been dealt with by the DFO through the development of mitigation plans and compensation agreements which are flexible such that the proponent is required to perform additional measures if the overall objective of "no net loss" is not met by the original plan. The Deering Island Project reviewed in Chapter 6 was completed by the signing of a compensation agreement which stated specifically that the following requirement would be the responsibility of the proponent:

"to perform such remedial works as DFO determines are reasonably necessary, on the basis of the monitoring program, to ensure that the productive capacity of the compensation habitat is maintained"  
(Deering Island Development 1990).

The important point to be made here is that the application of the "no net loss" principle at a specific project is an ongoing process which requires continuous monitoring and the possibility of changes to the original mitigation plan.

A review of six hydrotechnical projects concluded that one of the primary obstacles to implementing the "no net loss" principle was the lack of quantification of pre and post

development productive capacity combined with a lack of long term, comprehensive baseline data on pre-development conditions (KGS et al. 1991). This should not be viewed as an obstacle as accommodation for deficits in information can be met through a carefully planned compensation agreement.

#### **Concept #7 - Timing of compensation plans**

Timing of mitigation and compensation will be an important issue with regard to Conawapa. The mitigation plan must be implemented prior to the beginning of the project before fish habitat is impacted by the construction of the first cofferdam. While this concept has not been applied in the majority of cases, it is viewed as preferable by the DFO.

#### **Concept #8 - Compensation in degraded regions**

When implementing the "no net loss" principle in the Fraser River estuary and Sackville River, rehabilitation of degraded areas was used as compensation for lost habitat. This concept may be applied to northern Manitoba as the extent of hydroelectric development in the region has created a number of areas where the requirements of the "no net loss" principle can be met. A project such as the construction of a weir to raise the water level at Northern Indian Lake could help achieve "no net loss". Manitoba Hydro should examine compensation possibilities in regions impacted by previous hydroelectric developments to fulfil the requirements of the

"no net loss" principle at the Conawapa site and for future projects.

#### **Concept #9 - Funding of compensation projects**

In Chapter 6, a number of the examples reviewed included compensation projects which were developed through cooperation with volunteer agencies. The Sackville River Fishway Compensation Package is a good example of volunteer cooperation. The role of the Sackville River Association in ensuring the success of the project was significant as the costs of maintaining the fishway were lowered by their contribution. In this case, the total cost of the project was not borne by the proponent.

In the case of implementing "no net loss" at Conawapa, it may be useful to involve volunteers from agencies such as Fish Futures, the Manitoba Fly Fisherman's Association and the Gillam Brook Trout Association to ensure a greater level of project success.

#### **Concept #10 - Innovative approaches**

Application of the "no net loss" principle in the case of the Nova Scotia Department of Transportation and Communications sets an example for DFO offices in their use of guidelines to inform outside agencies as to how the objectives of the "no net loss" principle can be met. Guidelines could be developed to inform proponents as to how "no net loss" can

be achieved in a variety of situations. In the case of a major hydrotechnical project, there is a certain degree of confusion surrounding the application of the "no net loss" principle. The proponents of projects such as Conawapa may find it useful to work with the DFO to develop a set of guidelines which can be referred to for future developments.

### 8.3 Conclusion

These mitigation and compensation recommendations are based upon the concepts derived from the review of the DFO "no net loss" policy applications which were presented in Chapter 6. From a biological or habitat related point of view, the first four concepts may be used to achieve the requirements of the policy.

From a broader perspective, the application of the six remaining concepts outlined at the beginning of this chapter will provide Manitoba Hydro with ideas for implementation of the "no net loss" guiding principle.

## Chapter 9

### CONCLUSIONS AND RECOMMENDATIONS

#### 9.1 Conclusions

The "no net loss" principle was created as part of the 1986 Policy for the Management of Fish Habitat (PMFH). This policy was developed by the federal Department of Fisheries and Oceans (DFO) to achieve an overall "net gain" of fish habitat in Canadian fisheries. It represents a new approach to fisheries habitat management which is preventative rather than punitive. The administration of punitive fines under the Fisheries Act often results in money being spent on court action and fines that could be better redirected towards protection of fish habitat.

The "no net loss" principle has a legal basis in the Fisheries Act. It was developed by the DFO as an improved method of administering the habitat provisions of the Fisheries Act, Sections 35 to 43. The "no net loss" principle itself is not a new legal requirement for developers, however, failure on the part of the proponent to meet the "no net loss" objective could be considered a contravention of the Fisheries Act. Implementation of the "no net loss" principle by the DFO imposes the following duties on project proponents:

1. The effects which their developments may have on fish habitat must be considered.
2. These considerations should be integrated into project planning as early as possible.

3. Financial resources must be allocated towards measures to achieve "no net loss."
4. Responsible actions must be taken such as post project monitoring to ensure that the "no net loss" objective has been met.

The "no net loss" principle is based upon two important concepts which must be considered jointly. These concepts are:

1. **Productive capacity of fish habitat**

Productive capacity is difficult to assess. In most cases the DFO applies the policy based upon surrogate or proxy data rather than an actual measure of productive capacity.

2. **Consideration of resource users**

Consideration of resource users is an important aspect of policy application. The DFO states that the policy will not necessarily apply to all places where fish are found but to those habitats which support commercial, recreational, and, Native fishing activities for the benefit of Canadians.

The "no net loss" principle may be characterized as a user defined policy. These assumptions suggest the following:

1. Projects undertaken to meet the requirements of the "no net loss" principle must be conducted such that fishing activities are not negatively impacted.
2. User groups should play a role in developing measures to meet the "no net loss" objective.

3. As the Supreme Court of Canada has reiterated the importance of Indian food fishing over other resource uses, Native groups should play a key role in defining application of the "no net loss" principle where applicable.

Implementation of the "no net loss" principle

In Manitoba, the "no net loss" principle may be implemented through the following mechanisms:

1. It may be applied as result of direct application to prevent a contravention of the habitat provisions of the Fisheries Act, and/or,
2. mitigation and compensation measures to achieve the objectives of the policy may be implemented as a result of conditions for an environmental licence issued under the Manitoba Environment Act (1988), and/or
3. The "no net loss" principle may be applied through the provisions of Fisheries Act, as a result of an EARP screening under the EARP Guidelines Order (1984).

The Fisheries Act, the Manitoba Environment Act (1988), and the EARP Guidelines Order (1984) all provide a legislative basis for application of the "no net loss" principle in the case of the proposed Conawapa project.

The provisions of the EARP Guidelines Order (1984) have strengthened the "no net loss" principle by placing added responsibilities on developers and the DFO. Sections 35 and 37 of the Fisheries Act trigger a large number of EARP reviews. Recent court decisions such as the Rafferty-Alameda and Oldman decisions have increased the number of projects

which must be reviewed under the EARP Guidelines Order (1984). The "no net loss" principle is often implemented as a result of these reviews.

In the case of the proposed Conawapa project, the "no net loss" principle may be applied through the joint federal/provincial environmental assessment (EA) process. This joint EA combines application of both the Manitoba Environment Act (1988) and the EARP Guidelines Order (1984). This process will also include application of the Fisheries Act.

If the "no net loss" principle is applied to the Conawapa project through the joint EA process, the development of mitigation and compensation measures may occur as a result of;

1. fish habitat concerns solicited by the DFO as they are ultimately responsible for administration of the Fisheries Act,
2. fish habitat concerns solicited by the Manitoba Fisheries Branch,
3. participation in the EA process by local harvesters from the lower Nelson River such as the Fox Lake Band,
4. participation in the EA process by recreational fishing groups such as Gillam Brook Trout Association, and,
5. participation in the EA process by public interest and environmental groups.

Even given the importance which the "no net loss" principle places upon resource users, there appears to be a lack of formal mechanisms in place to enlist user participation in its application. In the case of the Conawapa project, resource users may provide input into the development

of mitigation and compensation measures by participating in the joint EA process as members of the public. There are no other formal mechanisms to incorporate their participation.

At the conclusion of the EA process, the joint Panel may consider the fish habitat issues which have been raised. The joint Panel may make recommendations to the federal and provincial Ministers of the Environment, and the DFO, with regard to overall acceptability of the project.

If the project is approved, the Manitoba Department of Environment will issue a licence and the federal Department of Environment will issue an approval. Both the licence and the approval will outline the conditions under which the project will be developed. Specifications to meet the requirements of the "no net loss" principle may or may not be included in these documents.

In the case of the Conawapa project, the "no net loss" principle may become an important element of the EA process. The "no net loss" principle is a workable concept which can be employed during EA processes as a reference point from which project impacts on fisheries resources can be evaluated.

If Manitoba Hydro is required to implement "no net loss" at the site of the Conawapa project the following departments will play a role in its implementation:

1. The Department of Fisheries and Oceans (DFO) will have final responsibility for policy application.

2. Day to day management of the policy will be conducted by the Manitoba Fisheries Branch (MFB). The MFB will play a lead role in monitoring and follow-up of the effectiveness of mitigation and compensation measures.
3. Information gathered from local harvesters will also play a role in this process.

**Review of examples of "no net loss" principle application**

A review of previous applications of the "no net loss" principle revealed the following:

1. In general, application of the "no net loss" principle reflected the objectives set out by the DFO in the PMFH.
2. In most cases, 'like for like' habitat compensation took place.
3. Substitution of one species for another of equal value is acceptable to the DFO.
4. In some cases, fish habitat may have been created at the expense of wildlife habitat.
5. Participation in compensation projects by volunteer groups can play an important role in the success of "no net loss" principle application.

In most cases, the "no net loss" principle was applied to maintain the productive capacity of fisheries resources which were being utilized presently for either commercial or recreational fisheries.

Among the examples reviewed, there was a striking absence of quantitative data on follow-up and monitoring. Also, availability of quantitative pre-development data was generally very limited. In the case of the Deering Island

project, the monitoring program was initiated by the proponent only after considerable pressure from the DFO. Due to the critical lack of monitoring data, it is impossible to make definitive statements as to whether or not "no net loss" of productive capacity was actually achieved at any of the sites.

The review of cases in this practicum suggest that the application of the "no net loss" policy in Canada is more successful in comparison to the current attempt being made in the United States to develop a "no net loss" of wetlands policy.

#### The United States "no net loss" of wetlands policy

The United States federal department of the Interior and the U.S. Fish and Wildlife Service is currently in the process of developing a "no net loss" of wetlands policy. This policy has the following characteristics:

1. There are a large number of government agencies with some jurisdictional responsibility over wetlands.
2. There is a debate over the definition of what constitutes a wetland.
3. The primary mechanism for enforcing the policy is Section 404 of the Clean Water Act which prohibits the release of dredged and fill material into bodies of water including wetlands.
4. Compensation for lost wetlands through artificial creation is not a widely used practice.

It is unlikely that this policy will ever become as widely applied as the Canadian fisheries policy as the

political will to implement the "no net loss" concept is weak. Attempts made in the State of California to create artificial wetlands were unsuccessful.

Application of "no net loss" to Conawapa

The review of examples of "no net loss" principle application were useful in deriving 10 concepts (pages 126 to 130) which were employed by the DFO in its application of "no net loss." These concepts related to both field application of the "no net loss" principle and general implementation. They were used in conjunction with a review of potential fish habitat alterations by the Conawapa project to develop mitigation and compensation measures to meet the "no net loss" objective at the site of the Conawapa project.

If the Conawapa project is built, fish habitat alterations in the lower Nelson River region will be extensive. The following impacts have been speculated:

1. Loss of critical feeding habitat for brook trout in the Nelson River.
2. The Conawapa G.S. will restrict movements of brook trout, lake sturgeon and other fish species in the Nelson River.
3. The creation of the Conawapa Forebay will result in dramatic changes in species composition within the Nelson River mainstem. It may take up to 13 years for this newly created ecosystem to stabilize.

4. The Conawapa project may negatively impact the beluga whale population in the Nelson River estuary. These whales are harvested domestically north of the Nelson River.

The extent of these impacts is unknown at present. Data collected from previous hydroelectric developments on the Nelson River may, however, be used to predict habitat changes as a result of Conawapa.

If the "no net loss" principle is implemented at the site of the Conawapa project, this research process has indicated that the following issues must be considered:

1. Mitigation and compensation measures must be developed to achieve "no net loss" of habitat for both brook trout and lake sturgeon habitat because; a) 'like for like' habitat replacement is first on the DFO "Hierarchy of Preferences", b) Native harvesters should be given priority over other resource harvesters, and, c) brook trout and lake sturgeon are important to Native harvesters.
2. Mitigation and compensation measures should include a combination of habitat enhancement measures and increased protection and compliance.
3. Mitigation and compensation measures should be developed for other species such as lake cisco and lake whitefish, pending an evaluation of their relative importance to the Nelson River. Both of these species may be a food source for beluga whales.

The Conawapa Forebay, created as a result of the

construction of the Conawapa Generating Station (G.S.) should be given some consideration as compensation for lost habitat. The aquatic environment of the Conawapa Forebay will be dominated by northern pike and walleye. This change in habitat should only be considered as compensation if;

1. after a period of stabilization, the newly created ecosystem proves to have a productive capacity equal, or, greater than the Nelson River mainstem,
2. mercury levels in fish flesh do not exceed the Canadian export limit for consumption of 0.5 ppm, and,
3. this option is acceptable to local harvesters.

A fish ladder is not a feasible mitigation measure. It is a relatively expensive option and its benefits are unknown. The creation of a recreational fishery on Northern Indian Lake will not be sufficient alone as compensation for lost habitat in the Nelson River. It will not compensate for lost populations of brook trout and lake sturgeon. It may be useful as an additional measure to supplement the compensation plan.

#### **9.2 Recommendations**

This research process has indicated that if Manitoba Hydro is required to implement the "no net loss" principle at the site of the Conawapa project, the following recommendations will improve implementation of the policy.

1. Manitoba Hydro should continue research in the lower Nelson River region. This research should include the following;

- a) further information on brook trout habitat use, experiments on egg incubation and stream enhancement measures,
- b) further information on lake sturgeon habitat use and enhancement techniques,
- c) monitoring in the Long Spruce Reservoir and Limestone Forebay to determine changes in species composition and mercury levels in fish flesh,
- d) beluga whale use of the Nelson River estuary and the importance of species such as lake cisco and lake whitefish to the estuary, and,
- e) effectiveness of measures to reduce angling in the lower Nelson region.

A strong commitment to ongoing research on the part of Manitoba Hydro will be crucial to meeting the objectives of the "no net loss" principle.

2. Manitoba Hydro should consider the following with regard to the development of a compensation plan to meet the "no net loss" objective at Conawapa:

- a) This plan should be flexible so that it may be changed if new information reveals that proposed measures will not achieve "no net loss." These changes may be made with regard to project implementation, monitoring and regular management.
- b) The creation of compensatory habitat should take place before fish habitat at the site of the Conawapa project is impacted by construction of the first cofferdam.

- c) Creation or protection should take place for amounts of habitat which exceed predicted losses.

There is insufficient information available at present to develop a compensation plan to achieve "no net loss" if the Conawapa project is built. This obstacle can be overcome if the above listed baseline research recommendations are implemented.

3. Manitoba Hydro should improve the effectiveness of the compensation plan for the Conawapa project by enlisting both pre and post-approval public participation. This can be achieved by;

- a) developing formal measures to incorporate local input into the development and implementation of the compensation plan, and,
- b) consulting with local resource users to provide information with regard to the effectiveness of the compensation plan.

Public participation after project approval should be designed as part of the overall compensation plan.

4. Manitoba Hydro should apply the "no net loss" principle on a regional basis in northern Manitoba as part of an ongoing effort to restore the productive capacity of fish habitat which has been degraded by previous hydroelectric development. It should be noted, however, that the policy itself cannot be applied retroactively.

5. The DFO should incorporate temporal guidelines into the Policy for the Management of Fish Habitat. Proponents should be allotted time limits in which to achieve "no net loss." It is important that these time limits;

- a) include maximum periods for project success, and,
- b) are outlined specifically in compensation plans.

These time limits would be allotted with the intention of placing an upward limit on the amount of time provided for the proponent to develop viable fish habitat.

6. In the future, after the completion of the EA process for Conawapa, the DFO, Manitoba Hydro and other utilities should work together to develop a set of guidelines to facilitate application of the "no net loss" guiding principle to major hydrotechnical projects.

#### **9.3 Concluding comments**

The "no net loss" principle represents an effective method of administering the habitat provisions of the Fisheries Act. With its emphasis on habitat protection, the "no net loss" principle should contribute to the conservation of a valuable resource.

Application of the "no net loss" principle, to date, has placed a strong emphasis on harvesting. It appears as if the majority of decisions taken to mitigate or compensate for the

effects of a development on a particular ecosystem are defined primarily by the value of the species from a harvesters point of view.

The user-defined nature of the "no net loss" policy is associated with several difficulties. The existence of competing user groups such as in the case of the Conawapa project has the potential to result in disputes between affected parties. While the final decision in the R v. Sparrow case can provide some general guidance as to how natural resources such as fish can be allocated, it does not explain the course of action to be taken in the case that there is more than one Native group utilizing the resource. It also cannot be used as a guideline to allocate resources among non-Native users. The decision as to who will be the beneficiaries of any measures implemented to achieve "no net loss" at Conawapa will be a difficult one.

The user-defined nature of the "no net loss" policy may also have the tendency to ignore issues such as biodiversity in its application. As discussed in Chapter 2, there can be a striking difference between application of the policy from a user perspective and from a purely ecological perspective. Loss of biodiversity can be a significant side effect of user oriented resource management.

At present, application of the "no net loss" principle leaves a number of questions unanswered which should be addressed in future research. Primarily, the concept of

productive capacity itself presents a number of difficulties in policy application such as; 1. uncertainty with regard to measuring the productive capacity of an ecosystem, and, 2. the largely experimental nature of habitat enhancement techniques. It is therefore difficult to make definitive statements as to whether or not the policy objective of "no net loss" of productive capacity is truly being met. This issue should become a focus of future research. It may be useful to examine past applications of the policy and attempt to ascertain the extent to which "no net loss" of productive capacity has been achieved from a biological perspective. The extent to which resource users have been satisfied by application of the "no net loss" principle should also be examined.

A final question which remains unanswered relates to the ability to effectively implement the "no net loss" principle. As discussed earlier, the "no net loss" principle may be applied to the Conawapa project through the joint EA process. The ability of this process to bring the "no net loss" principle into reality should be examined. The Conawapa project is a large undertaking which involves impacts to fisheries resources that have not yet been completely predicted, and, the extent to which these impacts can be accurately predicted is dubious. Given these circumstances application of the "no net loss" principle to Conawapa becomes an extremely complex process. A successful application of the

policy to this project may not be possible through the existing EA processes. The joint EA process lacks a comprehensive approach to enlisting public participation which can be an important factor in a successful application of the "no net loss" principle.

If, in future, if there is a consensus that the "no net loss" objective is met at the site of the Conawapa project, it may become a project precedent for future application of the "no net loss" principle to major hydrotechnical projects.

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## **APPENDICES**

## Appendix 1

### Sections 35, 36 and 37 of the Fisheries Act

Fisheries

Chap. F-14

2-13

"deposit"  
"déversement"

"deposit" means any discharging, spraying, releasing, spilling, leaking, seeping, pouring, emitting, emptying, throwing, dumping or placing;

"fish habitat"  
"habitat des poiss-

"fish habitat" means spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes;

"water  
frequented by  
fish"  
"eaux fréquentées par les poiss-

"water frequented by fish" means Canadian fisheries waters.

Regulations for  
purpose of  
definition  
"deleterious  
substance"

(2) The Governor in Council may make regulations prescribing

- (a) substances and classes of substances,
- (b) quantities or concentrations of substances and classes of substances in water, and
- (c) treatments, processes and changes of water

for the purpose of paragraphs (c) to (e) of the definition "deleterious substance" in subsection (1). R.S., c. F-14, s. 31; R.S., c. 17(1<sup>st</sup> Supp.), ss. 2, 3; 1976-77, c. 35, ss. 5, 7.

Harmful  
alteration, etc.,  
of fish habitat

35. (1) No person shall carry on any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat.

Alteration, etc.,  
authorized

(2) No person contravenes subsection (1) by causing the alteration, disruption or destruction of fish habitat by any means or under any conditions authorized by the Minister or under regulations made by the Governor in Council under this Act. R.S., c. F-14, s. 31; R.S., c. 17(1<sup>st</sup> Supp.), s. 2; 1976-77, c. 35, s. 5.

Throwing  
overboard of  
certain  
substances  
prohibited

36. (1) No one shall

- (a) throw overboard ballast, coal ashes, stones or other prejudicial or deleterious substances in any river, harbour or roadstead, or in any water where fishing is carried on;
- (b) leave or deposit or cause to be thrown, left or deposited, on the shore, beach or bank of any water or on the beach between high and low water mark, remains or offal of fish or of marine animals; or
- (c) leave decayed or decaying fish in any net or other fishing apparatus.

gnées en application de l'alinéa (2)a), l'eau contenant une substance ou une catégorie de substances en quantités ou concentrations égales ou supérieures à celles fixées en vertu de l'alinéa (2)b) et l'eau qui a subi un traitement ou une transformation désignés en application de l'alinéa (2)c).

(2) Pour l'application de la définition de substance nocives au paragraphe (1), le gouverneur en conseil peut, par règlement :

- a) désigner certaines substances ou catégories de substances;
- b) fixer les quantités ou concentrations de certaines substances ou catégories de substances admissibles dans l'eau;
- c) désigner certains traitements ou transformations qui, apportés à l'eau, en font une substance nocive. S.R., ch. F-14, art. 31; S.R., ch. 17(1<sup>er</sup> suppl.), art. 2 et 3; 1976-77, ch. 35, art. 5 et 7.

35. (1) Il est interdit d'exploiter des ouvrages ou entreprises entraînant la détérioration, la destruction ou la perturbation de l'habitat du poisson.

(2) Le paragraphe (1) ne s'applique pas aux personnes qui détériorent, détruisent ou perturbent l'habitat du poisson avec des moyens ou dans des circonstances autorisés par le ministre ou conformes aux règlements pris par le gouverneur en conseil en application de la présente loi. S.R., ch. F-14, art. 31; S.R., ch. 17(1<sup>er</sup> suppl.), art. 2; 1976-77, ch. 35, art. 5.

36. (1) Il est interdit de :

- a) jeter par-dessus bord du lest, des cendres de charbon, des pierres ou d'autres substances nocives dans une rivière, un port, une rade, ou dans des eaux où se pratique la pêche;
- b) laisser ou déposer ou faire jeter, laisser ou déposer sur la rive, la grève ou le bord de quelque cours ou nappe d'eau, ou sur la grève entre les laisses de haute et de basse mer, des déchets ou issues de poissons ou d'animaux marins;
- c) laisser du poisson gâté ou en putréfaction dans un filet ou autre engin de pêche.

Détérioration  
de l'habitat du  
poisson, etc.

Exception

Interdiction de  
rejet

Disposal of  
remains, etc.

(2) Remains or offal described in subsection (1) may be buried ashore, above high water mark.

Deposit of  
deleterious  
substance  
prohibited

(3) Subject to subsection (4), no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substance or any other deleterious substance that results from the deposit of the deleterious substance may enter any such water.

Deposits  
authorized by  
regulation

(4) No person contravenes subsection (3) by depositing or permitting the deposit in any water or place of

(a) waste or pollutant of a type, in a quantity and under conditions authorized by regulations applicable to that water or place made by the Governor in Council under any Act other than this Act; or

(b) a deleterious substance of a class, in a quantity or concentration and under conditions authorized by or pursuant to regulations applicable to that water or place or to any work or undertaking or class thereof, made by the Governor in Council under subsection (5).

Regulations for  
authorizing  
certain deposits

(5) The Governor in Council may make regulations for the purpose of paragraph (4)(b) prescribing

(a) the deleterious substances or classes thereof authorized to be deposited notwithstanding subsection (3);

(b) the waters or places or classes thereof where any deleterious substances or classes thereof referred to in paragraph (a) are authorized to be deposited;

(c) the works or undertakings or classes thereof in the course or conduct of which any deleterious substances or classes thereof referred to in paragraph (a) are authorized to be deposited;

(d) the quantities or concentrations of any deleterious substances or classes thereof referred to in paragraph (a) that are authorized to be deposited;

(2) Les déchets ou issues de poissons peuvent être enterrés sur la grève, au-delà de la laisse de haute mer.

Déchets

(3) Sous réserve du paragraphe (4), il est interdit d'immerger ou de rejeter une substance nocive — ou d'en permettre l'immersion ou le rejet — dans des eaux où vivent des poissons, ou en quelque autre lieu si le risque existe que la substance ou toute autre substance nocive provenant de son immersion ou rejet pénètre dans ces eaux.

Dépôt de substances nocives prohibé

(4) Par dérogation au paragraphe (3), il est permis d'immerger ou de rejeter :

a) les déchets ou les polluants désignés par les règlements applicables aux eaux ou lieux en cause pris par le gouverneur en conseil en application d'une autre loi; pourvu que les conditions, notamment les quantités maximales, qui y sont fixées soient respectées;

b) les substances nocives des catégories désignées ou prévues par les règlements applicables aux eaux ou lieux en cause, ou aux ouvrages ou entreprises ou à leurs catégories, pris par le gouverneur en conseil en application du paragraphe (5), pourvu que les conditions, notamment les quantités maximales et les degrés de concentration, qui y sont fixées soient respectées.

Immersion  
permise par  
règlement

(5) Pour l'application de l'alinéa (4)b), le Règlement d'application de l'alinéa (4)b)

gouverneur en conseil peut, par règlement,

déterminer :

a) les substances ou catégories de substances nocives dont l'immersion ou le rejet sont autorisés par dérogation au paragraphe (3);

b) les eaux et les lieux ou leurs catégories où l'immersion ou le rejet des substances ou catégories de substances visées à l'alinéa a) sont autorisés;

c) les ouvrages ou entreprises ou catégories d'ouvrages ou d'entreprises pour lesquels l'immersion ou le rejet des substances ou des catégories de substances visées à l'alinéa a) sont autorisés;

d) les quantités ou les degrés de concentration des substances ou des catégories de substances visées à l'alinéa a) dont l'immersion ou le rejet sont autorisés;

(e) the conditions or circumstances under which and the requirements subject to which any deleterious substances or classes thereof referred to in paragraph (a) or any quantities or concentrations of those deleterious substances or classes thereof are authorized to be deposited in any waters or places or classes thereof referred to in paragraph (b) or in the course or conduct of any works or undertakings or classes thereof referred to in paragraph (c); and

(f) the persons who may authorize the deposit of any deleterious substances or classes thereof in the absence of any other authority, and the conditions or circumstances under which and requirements subject to which those persons may grant the authorization.

**Directions by  
the Minister**

(6) A person authorized to deposit a deleterious substance by or under regulations made pursuant to subsection (5) shall, when directed in writing by the Minister, notwithstanding any regulations made pursuant to paragraph (5)(e) or any conditions set out in an authorization made pursuant to paragraph (5)(f), conduct such sampling, analyses, tests, measurements or monitoring, install or operate such equipment or comply with such procedures, and report such information, as may be required by the Minister in order to determine whether the person is depositing the deleterious substance in the manner authorized. R.S., c. F-14, s. 33; R.S., c. 17(1<sup>st</sup> Supp.), s. 3; 1976-77, c. 35, s. 7; 1984, c. 40, s. 29.

**Minister may  
require plans  
and specifica-  
tions**

37. (1) Where a person carries on or proposes to carry on any work or undertaking that results or is likely to result in the alteration, disruption or destruction of fish habitat, or in the deposit of a deleterious substance in water frequented by fish or in any place under any conditions where that deleterious substance or any other deleterious substance that results from the deposit of that deleterious substance may enter any such waters, the person shall, on the request of the Minister or without request in the manner and circumstances prescribed by regulations made under paragraph (3)(a), provide the Minister with such plans, specifications, studies, procedures, schedules, analyses, samples or other information relating to the work or undertaking and with such analyses, samples, evaluations, studies or other information relating to the water, place or fish habitat that is or is likely to be affected by the work or undertaking as will enable the Minister to determine

e) les conditions, les quantités, les exigences préalables et les degrés de concentration autorisés pour l'immersion ou le rejet des substances ou catégories de substances visées à l'alinéa a) dans les eaux et les lieux visés à l'alinéa b) ou dans le cadre des ouvrages ou entreprises visés à l'alinéa c);

f) les personnes habilitées à autoriser l'immersion ou le rejet de substances ou de catégories de substances nocives en l'absence de toute autre autorité et les conditions et exigences attachées à l'exercice de ce pouvoir.

(6) Malgré les règlements d'application de l'alinéa (5)e) ou les conditions dont sont assorties les autorisations prévues à l'alinéa (5)f), les personnes autorisées à immerger ou à rejeter des substances nocives en vertu des règlements d'application du paragraphe (5) doivent, à la demande écrite du ministre, prélever les échantillons, faire les analyses, tests, mesures ou contrôles, installer ou utiliser les appareils ou se conformer aux procédures, et fournir les renseignements que celui-ci juge nécessaires pour déterminer si les conditions de l'autorisation ont été respectées. S.R., ch. F-14, art. 33; S.R., ch. 17(1<sup>st</sup> suppl.), art. 3; 1976-77, ch. 35, art. 7 et 20; 1984, ch. 40, art. 29.

**Instructions  
ministérielles**

37. (1) Les personnes qui exploitent ou se proposent d'exploiter des ouvrages ou entreprises de nature à entraîner soit l'immersion de substances nocives dans des eaux où vivent des poissons ou leur rejet en quelque autre lieu si le risque existe que la substance nocive en cause, ou toute autre substance nocive provenant de son rejet, pénètre dans ces eaux, soit la détérioration, la perturbation ou la destruction de l'habitat du poisson, doivent, à la demande du ministre — ou de leur propre initiative, dans les cas et de la manière prévus par les règlements d'application pris aux termes de l'alinéa (3)a) —, lui fournir les documents — plans, devis, études, pièces, annexes, programmes, analyses, échantillons — et autres renseignements pertinents, concernant l'ouvrage ou l'entreprise ainsi que les eaux, lieux ou habitats du poisson menacés, qui lui permettront de déterminer, selon le cas :

**Obligation de  
fournir des  
plans et devis**

## Powers of Minister

- (a) whether the work or undertaking results or is likely to result in any alteration, disruption or destruction of fish habitat that constitutes or would constitute an offence under subsection 40(1) and what measures, if any, would prevent that result or mitigate the effects thereof; or
- (b) whether there is or is likely to be a deposit of a deleterious substance by reason of the work or undertaking that constitutes or would constitute an offence under subsection 40(2) and what measures, if any, would prevent that deposit or mitigate the effects thereof.

(2) If, after reviewing any material or information provided under subsection (1) and affording the persons who provided it a reasonable opportunity to make representations, the Minister or a person designated by the Minister is of the opinion that an offence under subsection 40(1) or (2) is being or is likely to be committed, the Minister or a person designated by the Minister may, by order, subject to regulations made pursuant to paragraph (3)(b), or, if there are no such regulations in force, with the approval of the Governor in Council,

- (a) require such modifications or additions to the work or undertaking or such modifications to any plans, specifications, procedures or schedules relating thereto as the Minister or a person designated by the Minister considers necessary in the circumstances, or
- (b) restrict the operation of the work or undertaking,

and, with the approval of the Governor in Council in any case, direct the closing of the work or undertaking for such period as the Minister or a person designated by the Minister considers necessary in the circumstances.

## Regulations

- (3) The Governor in Council may make regulations
- (a) prescribing the manner and circumstances in which any information or material shall be provided to the Minister without request under subsection (1); and
  - (b) prescribing the manner and circumstances in which the Minister or a person designated by the Minister may make orders under subsection (2) and the terms of the orders.

## Pouvoirs du ministre

- a) si l'ouvrage ou l'entreprise est de nature à faire détériorer, perturber ou détruire l'habitat du poisson en contravention avec le paragraphe 35(1) et quelles sont les mesures éventuelles à prendre pour prévenir ou limiter les dommages;
- b) si l'ouvrage ou l'entreprise est ou non susceptible d'entraîner l'immersion ou le rejet d'une substance en contravention avec l'article 36 et quelles sont les mesures éventuelles à prendre pour prévenir ou limiter les dommages.

(2) Si, après examen des documents et des renseignements reçus et après avoir accordé aux personnes qui les lui ont fournis la possibilité de lui présenter leurs observations, il est d'avis qu'il y a infraction ou risque d'infraction au paragraphe 35(1) ou à l'article 36, le ministre ou son délégué peut, par arrêté et sous réserve des règlements d'application de l'alinéa (3)b) ou, à défaut, avec l'approbation du gouverneur en conseil :

- a) soit exiger que soient apportées les modifications et adjonctions aux ouvrages ou entreprises, ou aux documents s'y rapportant, qu'il estime nécessaires dans les circonstances;
- b) soit restreindre l'exploitation de l'ouvrage ou de l'entreprise.

Il peut en outre, avec l'approbation du gouverneur en conseil dans tous les cas, ordonner la fermeture de l'ouvrage ou de l'entreprise pour la période qu'il juge nécessaire en l'occurrence.

## (3) Le gouverneur en conseil peut, par règlement, fixer : Règlements

- a) les cas où des documents et des renseignements doivent être fournis dans le cadre du paragraphe (1) au ministre sans qu'il en fasse la demande, ainsi que le mode de communication;
- b) les cas où le ministre ou son délégué peut prendre l'arrêté visé au paragraphe (2), ainsi que les modalités de fond et de forme applicables.

**Appendix 2**  
**Policy for the Management of Fish Habitat**

A copy of the Policy for the Management of Fish Habitat  
may be obtained through any  
Department of Fisheries and Oceans branch.

**Appendix 3**  
**Example of a Compensation Agreement**

Serge Ag  
Jan 19/90

**FISH HABITAT COMPENSATION AGREEMENT**

In accordance with the Department of Fisheries and Oceans, "Policy for the Management of Fish Habitat", and with particular reference to the principle of "No Net Loss of the Productive Capacity of Habitats":

The South Nation River Conservation Authority hereby agrees to undertake the following program to compensate for fish habitat which has been and will be lost as a result of the construction of the Seguinbourg Slope Stabilization Project.

The South Nation Conservation Authority will:

1. Incorporate in the Phase 3 part of the project a habitat reconstruction component consisting of a series of boulder clusters with upstream and downstream substrate placement as agreed to by the signatory parties.
2. Implement the habitat reconstruction project as part of the Phase 3 berm construction or undertake it as a separate project to be completed prior to October 1st, 1990, as agreed to by the S.N.R.C.A., M.N.R. (Cornwall) and Fisheries and Oceans (Canada).
3. Place the boulder clusters and associated substrate at the base of the berm every 20-25 m along the entire length of the Phase 3 project.
4. Consult the local M.N.R. Fish and Wildlife staff regarding specific details of the project (i.e. substrate size, etc.) prior to construction.
5. Following implementation, periodically maintain the fish habitat constructed as part of their berm maintenance program, and any major repairs to the berm due to natural factors (i.e. ice) will include any appropriate reconstruction of the fish habitat which had been restored.
6. Implement the fish habitat restoration program for the area altered by Phases 1 and 2 of the project as agreed to by the S.N.R.C.A., M.N.R. (Cornwall) and Fisheries and Oceans Canada. Implementation is to be finished by Oct. 1st, 1990.
7. Ensure that the proposed program meets and complies with the requirements defined under Ontario's environmental legislation and regulations.

The Ministry of Natural Resources (Cornwall) will:

1. Provide design assistance as required for the Phase 3 project including review of the project details and on-site guidance to the level deemed necessary by M.N.R. (Cornwall) staff. This advice will be limited to the project components related to the fish habitat restoration only.
2. Be responsible for approving any modifications or deviations from the agreed-to Phases 1 and 2 and Phase 3 fish habitat construction projects.
3. Undertake post-construction monitoring to the degree deemed necessary by M.N.R. (Cornwall) to determine the success of the Phases 1 and 2 and Phase 3 fish habitat reconstruction projects. This monitoring will consist of an objective determination of the habitat suitability of the habitat restored by the projects.

The Department of Fisheries and Oceans, Ontario will:

1. Provide advice regarding the proposed program, and offer assistance regarding the interpretation of any aspects of the "Policy for the Management of Fish Habitat" which require clarification.

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South Nation River Conservation Authority

12 Dec /89

Date

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Ministry of Natural Resources

12 Dec 1989

Date

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H. Shear  
Area - Manager, Ontario Department  
of Fisheries And Oceans

89-11-20

Date