

PARTIAL DIVERSION OF THE SAULT AUX COCHONS RIVER

CANADIAN ENVIRONMENTAL ASSESSMENT ACT

COMPREHENSIVE STUDY REPORT

PREPARED BY

**FISHERIES AND OCEANS CANADA
QUEBEC REGION**

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**Fisheries and Oceans
Canada**

**Pêches et Océans
Canada**

Canada

General Information

Date: April 23, 2002

Project proponent: Hydro-Québec

Type of project: Partial diversion of a river

Triggers: *Fisheries Act*, subsection 35(2)

 Navigable Waters Protection Act, subsection 5(1)

Responsible Authority: Fisheries and Oceans Canada

Type of study: Comprehensive Study in compliance with the Comprehensive *Study List Regulations*, section 9.

Summary

Hydro-Québec intends to proceed with the partial diversion of the Sault aux Cochons River to the Bersimis complex, which includes the Pipmuacan Reservoir and the Bersimis 1 and Bersimis 2 power stations. The mean annual flow from the Sault aux Cochons River would decrease from 7.5 m³/s to 1 m³/s at the cut-off point which would result in an 87% reduction in the mean annual flow at the cut-off point and an 18% reduction at the mouth. This project involves, among other things, the construction of a diversion canal and renovations to the existing dyke and the Sault aux Cochons Reservoir dam. The redevelopment of an existing road and the replacement of culverts by a bridge would also be required.

The water diverted to the Pipmuacan Reservoir would produce more electricity when generated in the two power stations at the Bersimis complex, than it does in the three power stations of the Sault aux Cochons River where it is currently generated. The average annual generation of the Bersimis complex would increase by 157 GWh, whereas generation from the Sault aux Cochons River power stations would decrease by approximately 8 GWh.

The project's primary impacts on fish habitat productivity would be caused by changes in hydrological conditions, that is, a drop in water levels and a decrease in the waterflow rate. To reduce these impacts, specific mitigation measures would be implemented. They include the maintenance of a minimum flow of 1 m³/s, and the installation of spurs at the lake outlet to prevent a drop in water levels, and at certain points in the river to maintain adequate levels. As such, the total amount of de-watered areas would rise to almost 11 ha depending on the minimum summer flow, of which more than 9 ha would be downstream from km 94. In addition to causing further navigational constraints in certain sections of the river, this loss in aquatic areas would result in a loss of brook trout habitats, which is the most highly valued species by users of the area. Furthermore, a loss in fish production would occur due to a decline in the quality of rearing habitats and increased competition with suckers. The resulting loss in fish production caused by this project is therefore estimated at 215 kg of brook trout per year.

Formal approval is required for the project in accordance with Part I of the *Navigable Waters Protection Act* (NWPA), and authorization must be granted in compliance with subsection 35(2) of the *Fisheries Act* (FA), due to the loss of productive capacity of fish habitat caused by the project. These approvals constitute triggers for the *Canadian Environmental Assessment Act* (CEAA) under the *Law List Regulations* which require an environmental assessment of the project in accordance with CEAA.

This report fulfills the Fisheries and Oceans Canada's (DFO) obligation, as the Responsible Authority established under CEAA, to carry out an assessment of the project's environmental effects in consultation with other appropriate expert Federal Authorities.

In the light of the mitigation and compensation measures, the proposed follow-up program, and the proponent's commitments, DFO has determined that the proposed project, as defined by the scope of the study, is not likely to lead to significant adverse environmental effects.

This is a preliminary conclusion which will be reconsidered following an evaluation of comments received during public consultations, to be held by the Canadian Environmental Assessment Agency following the presentation of this report.

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1. Introduction

The Fisheries and Oceans Canada (DFO) has prepared this Comprehensive Study Report on the partial diversion of the Sault aux Cochons River proposed by the project proponent, Hydro-Québec. This report fulfills DFO's obligation, as the Responsible Authority under the *Canadian Environmental Assessment Act* (CEAA), to carry out an assessment of the project's environmental effects in consultation with other appropriate expert Federal Authorities.

This document includes a summary description of the project and the area in which it will be carried out; the results of public consultations conducted by the proponent and of those held by the Bureau d'audiences publiques sur l'environnement (BAPE); a summary of the main environmental effects, including the cumulative effects and the effects caused by accidents and malfunctions, that may occur; the terms and conditions of mitigation measures and follow-up programs; the determination of the significance of the environmental effects; the conditions of approval; and the preliminary findings on the significance of the adverse environmental effects of the project as a whole.

The documents listed below also make up part of the comprehensive study report and have been used as reference material for this document. In addition to providing more detailed information regarding the various elements mentioned above, these documents contain the proponent's responses to questions raised during the assessment of the project under the provincial environmental review process, as well as additional elements necessary to fulfill the requirements of an environmental assessment under CEAA.

- Hydro-Québec. 1999. Dérivation partielle de la rivière du Sault aux Cochons. Rapport d'avant-projet. [Partial Diversion of the Sault aux Cochons River. Preliminary project report.] August 1999. Volume 1. 344 pp.
- Hydro-Québec. 1999. Dérivation partielle de la rivière du Sault aux Cochons. Rapport d'avant-projet. [Partial Diversion of the Sault aux Cochons River. Preliminary project report.] August 1999. Volume 2. Appendices.
- Hydro-Québec. 2000. Dérivation partielle de la rivière du Sault aux Cochons. Résumé du rapport d'avant-projet. [Partial Diversion of the Sault aux Cochons River. Summary of the preliminary project report.] January 2000. 40 pp.
- Hydro-Québec. 2000. Dérivation partielle de la rivière du Sault aux Cochons. Complément du rapport d'avant-projet. Réponses aux questions et aux commentaires du ministère de l'Environnement du Québec. [Partial Diversion of the Sault aux Cochons River. Supplement to the preliminary project report. Responses to the questions and comments of the Ministère de l'Environnement du Québec.] January 2000. 138 pp. + appendices.
- Hydro-Québec. 2000. Dérivation partielle de la rivière du Sault aux Cochons. Réponses aux questions et aux commentaires des autorités fédérales concernant le rapport d'avant-projet. [Partial Diversion of the Sault aux Cochons River. Responses to questions and comments of the Federal Authorities concerning the preliminary project report.] February 2000. 142 pp. + appendix.
- Hydro-Québec. 2000. Dérivation partielle de la rivière du Sault aux Cochons. Réponses aux questions et aux commentaires des autorités fédérales concernant le rapport d'avant-projet. Deuxième série. [Partial Diversion of the Sault aux Cochons River. Responses to

the questions and comments of the Federal Authorities concerning the preliminary project report. Second series.] October 2000. 51 pp.

- Hydro-Québec. 2000. Dérivation partielle de la rivière du Sault aux Cochons. Complément du rapport d'avant-projet. Réponses aux questions et aux commentaires du ministère de l'Environnement du Québec. Deuxième série. [Partial Diversion of the Sault aux Cochons River. Supplement to the preliminary project report. Answers to the questions and comments of the Ministère de l'Environnement du Québec. Second series.] November 2000. 23 pp.
- Hydro-Québec and Alliance Environnement. 2000. Dérivation partielle de la rivière du Sault aux Cochons. Évaluation des répercussions environnementales. Modifications du projet. [Partial Diversion of the Sault aux Cochons River. Assessment of environmental impact. Project modifications.] August 2000. 19 pp.
- Alliance Environnement Inc. 2000. Dérivation partielle de la rivière du Sault aux Cochons. Révision des pertes de production piscicole. Document de travail. [Partial Diversion of the Sault aux Cochons River. Review of fish production losses. Working document.] November 2000. 19 pp.
- Hydro-Québec. 2001. Dérivation partielle de la rivière du Sault aux Cochons. Réponses aux questions complémentaires formulées par Pêches et Océans Canada. [Partial Diversion of the Sault aux Cochons River. Answers to additional questions by Fisheries and Oceans Canada.] February 2001. 16 pp.
- Alliance Environnement Inc. 2001. Dérivation partielle de la rivière du Sault aux Cochons. Suivi environnemental 2000-2001. Réévaluation des pertes de production pour l'omble de fontaine à partir de la méthode POTSAFO 2.0. Document de travail. [Partial Diversion of the Sault aux Cochons River. Environmental follow-up 2000-2001. Re-evaluation of brook trout production losses using the POTSAFO 2.0 method. Working document.] December 2001. 12 pp.
- Fisheries and Oceans Canada, March 2002. Programme de compensation d'habitat du poisson pour le projet de dérivation partielle de la rivière du Sault aux Cochons. [Fish habitat compensation program for the partial diversion of the Sault aux Cochons River.] 6 pp.

2. Project Description

This section is a summary of the information regarding the project's context and justification, proposed alternatives and a description of the development plan that has been retained. These elements can be found in Chapter 2 of Volume 1 of the preliminary project report¹, as well as in the supplements to the preliminary project report of January 2000² and August 2000.⁶

2.1. Project Context and Justification

The project consists in diverting the waters of the Sault aux Cochons River to the Pipmuacan Reservoir. The completion of this project will increase the inflow of the Pipmuacan Reservoir, which is the main reservoir of the Bersimis complex on the Betsiamites River.

The water diverted to the Pipmuacan Reservoir will produce more electricity when it is generated in the two power stations at the Bersimis complex than it does in the three power stations of the Sault aux Cochons River where it is currently generated. The average annual

generation of the Bersimis complex will increase by 157 GWh, whereas generation from the Sault aux Cochons River power stations will decrease by approximately 8 GWh.¹

Justification for the partial diversion of the Sault aux Cochons River project is based on Hydro-Québec's *Strategic Plan 2000-2004*. According to this plan, growth in electricity demand for the province of Quebec will reach 17.4 TWh in additional sales by 2004, compared to 1999. The energy required to meet these additional sales will come from new water supply sources and a reduction in net sales on the external market.²

The proponent believes that this project ranks among others that are capable of meeting the three basic conditions cited in Hydro-Québec's *Strategic Plan 2000-2004*. These three conditions are: profitability, environmental acceptability and approval by local communities.

The proponent has not proposed any alternatives. According to the proponent, if the project is not carried out, a profitable project will be lost and replaced by a less economical project, which will eventually result in an increase in the costs of supplying electricity.²

2.2. Development Alternatives

The proponent assessed three alternatives. These three alternatives are described in detail in Volume 1 of the preliminary project report (pp. 27 to 29), and differ principally in terms of the location of the dam and the diversion canal. According to the proponent, the alternative that has been retained is the most advantageous from an environmental point of view. In fact, the selected alternative maximizes the use of structures which are already in place and limits intrusion into areas which are not currently affected.¹ Consequently, DFO believes that there are no major discrepancies between the alternatives and agrees with the one which has been chosen.

2.3. Project Definition

The Sault aux Cochons Reservoir is currently comprised of a dam at its outlet and a dyke in its northeast section. The dam is composed of an embankment measuring approximately 110 m in length and a maximum of 15 metres in height. The dyke is an earth dyke measuring approximately 300 m in length and 5 m in height.

The current dam is used for hydroelectric purposes in order to supply three private power stations located downstream on the Sault aux Cochons River.

The project involves the building of a diversion canal next to the current dyke to bring water from the Sault aux Cochons River to the Pipmuacan Reservoir and the Betsiamites River via the Lionnet River. As such, a mean annual flow of 6.5 m³/s will be diverted from the Sault aux Cochons River to the Lionnet River. A minimum flow of 1 m³/s is anticipated.

The diversion structure will be excavated in rock at a 426.6 m elevation level and will have a maximum width of 46 m. It will include a channel of approach of approximately 30 m in length and a 61 metre-long tailrace. This structure will be designed for a flow of 111 cubic metres per second.⁶ The waste pile will be disposed of on a stable embankment on either side of the excavation and be transported to an appropriate site. The excavated rock will be used for the dyke repairs and for the creation of a riprap in the downstream section of the tailrace.⁶

Repairs will be carried out on the existing dyke to stop leaks, ensure its stability and protect its upstream face from wave action.¹

The access road to the dyke will be rebuilt on a 16 km stretch. Anticipated activities include clearing, drainage work such as ditch cleaning or the addition of culverts, and the addition of granule materials on the road surface finish. Construction of a new bridge over the planned diversion canal is also anticipated in order to replace the existing culvert.

2.4. Work Schedule

The work will take about 4 months and is planned to start as soon as provincial and federal government permits are granted.

3. Environmental Assessment and Applicable Regulations

Formal approval is required for the project in accordance with Part I of the *Navigable Waters Protection Act* (NWPA), and authorization must be granted in compliance with subsection 35(2) of the *Fisheries Act* (FA), due to the loss of productive capacity of fish habitat caused by the project. These approvals constitute triggers for the *Canadian Environmental Assessment Act* (CEAA) under the *Law List Regulations* which require an environmental assessment of the project in accordance with CEAA.

The proponent must propose compensation measures which adhere to the principle of no net loss of productive capacity of fish habitat as described in DFO's *Policy for the Management of Fish Habitat* before an Authorization can be granted under subsection 35(2) of the FA. These compensation measures must be carried out to the satisfaction of DFO and is an integral part of the Authorization required under the FA.

As specified in section 9 of the *Comprehensive Study List Regulations*, a proposal for the construction, decommissioning or abandonment of a structure for the diversion of 10,000,000 m³/year or more of water from a natural water body into another natural water body or an expansion of such a structure that would result in an increase in diversion capacity of more than 35 percent, requires that an environmental assessment be performed in the form of a Comprehensive Study.

A Comprehensive Study carried out under CEAA is a method of self-assessment which the Responsible Federal Authority uses as a basis to examine the environmental effects of a project before it makes any irrevocable decisions.

As stipulated by CEAA, through the administration of the habitat provisions of the *Fisheries Act* and of the *Navigable Waters Protection Act*, DFO is the only Responsible Federal Authority for this project. DFO oversees that the environmental assessment process as well as the comprehensive study comply with the requirements of CEAA.

Other federal departments such as the Indian and Northern Affairs Canada (INAC), Environment Canada (EC), Natural Resources Canada (NRCan) and the Health Canada (HC), were also consulted to determine their legislative responsibilities and requirements in relation to the project, as well as to obtain their comments with respect to the CEAA assessment. The Canadian Environmental Assessment Agency also collaborated on this file by providing interpretation of CEAA and input on the CEAA process.

4. Scope of the Environmental Assessment

The scope of the project includes the construction of the diversion structures, rehabilitation of existing structures including the access road, and the diversion of waters from the Sault aux Cochons River to the Sault aux Cochons, Lionnet and Betsiamites Rivers and to the Sault aux Cochons and Pipmuacan reservoirs.

The environmental assessment includes the study of the project's environmental effects, including those caused by any malfunctions or accidents that may occur in connection with the project, and the cumulative effects that, in combination with the effects of other structures, projects or activities, the project is likely to have on the environment.

The environmental effects, as defined in subsection 2(1) of CEAA, represent any changes caused by the project to the natural environment and any effects resulting directly from these changes on human health, socio-economic conditions and natural and cultural heritage (historical, archaeological, paleontological, architectural), in addition to any current use of the land and natural resources by Aboriginal peoples for traditional purposes.

The study also addresses the following issues:

- the purpose of the project;
- development alternatives;
- the significance of the environmental effects;
- the effects of the environment on the project;
- public comments;
- mitigation measures;
- the need for a follow-up program and its terms and conditions; and
- an assessment of the capacity of renewable resources that are likely to be significantly affected by the project, to meet needs of present and future generations.

5. Public Consultation Program

5.1. Hydro-Québec's Communications Program and Provincial Public Hearings

5.1.1. Hydro-Québec's Communications Program

Hydro-Québec has set up a communications and community relations program in order to ensure the widest possible dissemination of information on the Sault aux Cochons project, to become acquainted with the concerns and expectations of the communities who will be directly affected and to respond to questions and comments from the various participants. This program is described in Chapter 15 of the preliminary project report.¹

The diversion projects for the Sault aux Cochons River and Portneuf River were addressed in the same communications program since these projects essentially involve the same participants.

The program was conducted in three main stages, as follows: 1) general information meetings (June and July 1997); 2) roundtable discussions, workshops on the project, science committee meetings and information and consultation meetings (July 1997 to May 1998); and 3) a follow-up of community relations (May 1998 to June 1999).

The first stage comprised seven meetings with 33 different organizations including municipal, provincial and federal governments, the media, and recreational and tourism groups. During the second stage, there were 24 meetings including four roundtable sessions, one meeting with the government agencies, four workshops devoted to the Sault aux Cochons project and 15 information meetings. The third stage consisted of three meetings with the regional county municipalities (MRCs) and the municipality of Forestville.¹

5.1.2. Provincial Public Hearings

Within the framework of the Ministère de l'Environnement du Québec's environmental assessment process, the project was submitted to the Bureau d'audiences publiques sur l'environnement (BAPE) for examination by and consultation with the public. The fact-finding committee, which sat from September 18, 2000 to January 18, 2001, looked into the diversion projects for both the Portneuf River and the Sault aux Cochons River. Hearings were held at Sainte-Anne-de-Portneuf, Forestville and Betsiamites. In all, 23 briefs were filed by the public. The BAPE made public its enquiry report and the proceedings of its public hearings on February 8, 2001.

5.1.3. Issues of Concern to the Community

Public consultations enabled the proponent and the BAPE to identify several issues of concern regarding the various organizations consulted, such as partnership agreements, ligneous residue in the river, the impact of the project on the activities of outfitters and resort vacationers, the drying up of segments of the river, navigation, the cumulative effects on the Betsiamites River, regional economic benefits and compensation.

As part of hereby environmental assessment, some public concerns were retained on the basis of Valued Environmental Components (VEC) and are discussed into the different sections of this report.

Log floating on the Sault aux Cochons River, which ended in 1992, left a huge amount of logs on the river bed. The public was concerned with the consequences of the partial diversion of upstream reaches of the watershed on the remobilization of a huge amount of those logs, that would then be floating. The downstream progression could, among others, have an effect on riparian areas and sensitive habitats, give rise to eyesore, impair landscape and interfere with nautical and tourism activities.

Consultation conducted by the proponent showed that many groups were concerned with the consequences of the drying up of segments of the Sault aux Cochons River. Those groups represented outfitters and resort vacationers that have the mandate to develop the Sault aux Cochons River and groups that develop canoe activities. Furthermore, some sectors would have their water level enhanced, this being a concern for some organisms, because of the impact of this rising on spawning grounds in the Lionnet River. In the same way, project impact on outfitters and resort vacationers activities were raised by those organisms: among others, project impact on brook trout and lake trout fishing were raised.

Some concerns were raised concerning navigability on the Sault aux Cochons River following flow reduction. Some stakeholders pled that even with the maintenance of a minimum flow, the upstream part of the river may come impassable.

Some concerns on the cumulative effects of the project on Betsiamites River were raised by the Aboriginal community of Betsiamites, primarily regarding the effect of rising water flow downstream of Bersimis-2 hydroelectric power plant on the Atlantic salmon population.

Finally, concerns about compensation measures for fish addressed primarily by resort vacationers were raised during the public consultation conducted by the proponent.

5.2. Public Consultation Under CEAA

A period of public consultation is anticipated following the presentation of the comprehensive study report to the Canadian Environmental Assessment Agency (CEAA). During this period, the public may consult the documents and voice any opinions or concerns regarding the environmental effects of the project. In addition, 13 requests for documents have been filed with the Public Registry and under the *Access to Information Act*, between 1998 and 2002.

5.3. Public Consultation Under the Navigable Waters Protection Act

Within the framework of the *Navigable Waters Protection Act*, the proponent has to issue an announcement in the Canada Gazette and in two local newspapers to notify the community of the project and to encourage the members of the community to voice their concerns with respect to navigation. For the purposes of this assessment, the public consultation period provided for in the NWPA will coincide with the public consultation period provided for in CEAA. The consultation period will be held by the Canadian Environmental Assessment Agency following the submission of this report.

6. Description of Existing Environmental Conditions

Chapters 4, 5, 6 and 7 of the preliminary project report provide a detailed description of the general aspects and environmental issues with respect to the natural and social environments. Furthermore, the documents referred to in Section 1 may provide additional information. The following sections address the main points relative to the existing environmental conditions.

6.1. Physical Environment

6.1.1. Hydrography

6.1.1.1. The Sault aux Cochons River

The Sault aux Cochons River basin has a total surface area of 1,946 km². The source of the Sault aux Cochons River is in the northwestern area of the Sault aux Cochons Reservoir. This reservoir was created following an increase in the level of the Sault aux Cochons Lake, which, as a result, merged with the Cacuscanus Lake. The river, which has a mean annual flow of 7.5 m³/s, flows into the St Lawrence estuary, 128 km downstream.¹ In addition to three hydroelectric power stations run by RSP Hydro, there are three dams along the river: the Sault aux Cochons Reservoir dam, the Grand Portage Lake dam and the de l'Île Lake dam.

6.1.1.2. The Sault aux Cochons Reservoir

Composed of the Sault aux Cochons and Cacuscanus lakes, the Sault aux Cochons Reservoir has operating levels between 424.8 m and 429.1 m. However, it is generally operated with a water-level fluctuation range of 3.1 m, rarely falling below the 426 m elevation level.⁴ The opening and closing times of the Sault aux Cochons Reservoir dam are not fixed. The dam is generally closed from the end of April to mid-June and then again from the end of October to the end of November. When the dam is closed, about 1 m³/s drains into the Sault aux Cochons River due to seepage in the stop logs.¹

6.1.1.3. The Lionnet River

The Lionnet river drains a basin of 168 km² and has a mean annual flow of 3.6 m³/s. Its minimum annual winter flow is estimated at 0.5 m³/s.

6.1.1.4. The Betsiamites River

The Pipmuacan Reservoir has an available water supply of 725,200 m³ and its elevation levels vary between 388.62 m and 398.60 m.³ The Betsiamites River is characterized by the presence of two reservoirs, the Pipmuacan and Bersimis-2, which supply two hydroelectric power stations, Bersimis-1 and Bersimis-2. The mean annual flow of the river is 289 m³/s at Bersimis-1, 324 m³/s at Bersimis-2 and 402 m³/s at the mouth where it flows into the St Lawrence River. The Bersimis-2 power station is located 72 km from the mouth. Due to the operation of the Bersimis-2 power station, the flow of the river downstream from it is characterized by abrupt and frequent changes.¹ On a daily basis, the flow may vary by 150 m³/s above or below the average. During normal operation, the flow fluctuates between 600 and 130 m³/s, the latter limit established as the protective criterion for biological and human use.¹

The estuary of the Betsiamites River extends up to the first rock sill, 25 km from the mouth. Saltwater does not penetrate upstream any further than the farthest reversing current near the bridge on Highway 138, 8.5 km from the mouth.³

6.1.2. Thermal Regime and Ice Cover

6.1.2.1. The Sault aux Cochons River

The temperature data for the Sault aux Cochons River are recorded on two thermographs installed by the proponent at km 0.4 and km 128 in July of 1999.⁴ In the summer, the average temperature at the dam toe generally varies between 18°C to 20°C with peaks reaching as high as 21.1°C. In the winter, the temperature sits at about 2°C at the dam toe of the Sault aux Cochons Reservoir.

In the Sault aux Cochons River, the freeze-up usually occurs around the end of November and the break-up begins around the end of April. The ice cover forms downstream from the Sault aux Cochons Reservoir dam over the entirety of the lakes, except at their outlets, where the water runs with an open surface, at times over a long distance.¹

6.1.2.2. The Sault aux Cochons Reservoir

The Sault aux Cochons Reservoir has a thermal regime similar to that of other deep lakes in the region. At depth the water temperature remains between 3°C and 5°C throughout the

year, whereas the surface water reaches temperatures between 20°C and 22°C in the summer and drops to between 0°C and 1°C under the ice cover in the winter. The ice cover forms around the beginning of December and lasts until mid-May.¹ A thermograph installed in the reservoir by the proponent at km 128.4 in July of 1999 supports these data.⁴

6.1.3. Water Quality

In general, the geographic area examined in this study does not include sources of polluting waste that would contribute to a reduction in water quality.

6.1.3.1. The Sault aux Cochons River

The data regarding the Sault aux Cochons River show relatively low dissolved oxygen values. These values may be attributable to the presence of float logs which have accumulated at the bottom as a result of the log floating which took place on the river up until the beginning of the 1990s.

6.1.3.2. The Sault aux Cochons Reservoir

The quality of the reservoir water is comparable to that of the surrounding lakes in the North Shore area. The pH levels tend to be acidic (5.4 to 5.9) and aluminium values are slightly elevated.

6.1.3.3. The Betsiamites River

In September 1985, basic water quality sampling was conducted in the Bersimis-2 Reservoir.³ The pH level varied between 5.7 and 6.1, and overall, the values measured were similar to those of other reservoirs in nearby areas such as Manic 2, Manic 3, Outardes 4 and Pipmuacan.

With respect to the Pipmuacan Reservoir, the water is characterized by an average acidity (pH between 5.5 and 6.0) and by low conductivity. At greater proximity to the river, the acidity is lower, the total alkalinity is relatively elevated and there is higher conductivity.¹

6.2. Biological Environment

6.2.1. Ichthyofauna and Fish Habitat

6.2.1.1. Sault aux Cochons River

The main species found in the Sault aux Cochons river are brook trout (*Salvelinus fontinalis*), lake trout (*Salvelinus namaycush*), lake whitefish (*Coregonus clupeaformis*), round whitefish (*Prosopium cylindraceum*), white sucker (*Catostomus commersoni*), longnose sucker (*Catostomus catostomus*), longnose dace (*Rhinichthys cataractae*) and threespine stickleback (*Gasterosteus aculeatus*). Anadromous brook trout also visits the river's estuary. Impassable obstacles at the mouth of the river block access to the river for migrating species, however.

Purportedly, there are 19 recognized brook trout spawning grounds in the lower part of the river (km 0-94), 5 of which are located in tributaries. The proponent has no information regarding the size of these sites. However, the average area of each spawning ground is estimated at 4,000 m², based on data collected in the upper reach as well as in the Portneuf river.³

There are 27 potential or recognized spawning grounds in the upper reach of the Sault aux Cochons river, of which 4 are in tributaries and 4 are in lakes. 24 of these sites have been counted by the proponent, with an average area of 40 m².

Rearing habitats were classified in three categories, namely, excellent, average and poor, according to their potential for the development of the brook trout.

Table 1. Area of brook trout rearing habitats in the Sault aux Cochons River

Segment	Rearing habitats (ha)			
	Excellent	Average	Poor	Total
Lower reach (km 0-94)	28	337	43	409
Upper reach (km 94-128)	8	93	1	102

Firstly, the proponent estimated the potential production of the rearing habitats (yearly harvestable biomass) by using theoretical values of biological data, as no other values regarding the Sault aux Cochons River were available. These values were then validated with the biological data regarding brook trout populations in the Montmorency River, which is comparable to the Sault aux Cochons River. It was thus estimated that the biomass which could be harvested annually was 4,069 kg/year in the lower part of the river and 1,636 kg/year in the upper reach.³

The proponent adjusted potential production values by using biological data collected in the Sault aux Cochons River after experimental fishing had been carried out in summer 2000.⁷ It was then estimated that the biomass which could be harvested annually was 1,868 kg/year in the lower part of the river and 290 kg/year in the upper reach. A second year of experimental fishing in 2001 allowed the proponent to specify the biomass harvesting estimations at 1,764 kg/year.¹³

Furthermore, the experimental fishing results obtained in summer 2000 show that the lakes sampled, i.e. Casgrain, de l'Île and Grand Portage Lakes, contain substantial lake trout populations. In de l'Île Lake, habitat conditions are particularly favourable for lake trout, as the lake is deep and its thermal stratification is well-defined.⁷

Moreover, lake trout are found in the upper reach of the Sault aux Cochons River, which they use for feeding and for moving between different lakes.

6.2.1.2. Sault aux Cochons Réservoir

Among the species found in the Sault aux Cochons reservoir are lake trout, brook trout, longnose sucker, white sucker, round whitefish and various minnow species.

There are a relatively large number of lake trout spawning sites in the Sault aux Cochons reservoir, and high-quality sites make up 4% of the reservoir's perimeter. The data contained in the preliminary project report show a recognised spawning ground located between the

425.8 and 424.1 m elevation levels. Furthermore, conditions in the reservoir are conducive to rearing, feeding and shelter for lake trout.

6.2.1.3. Lionnet River

According to sampling conducted by the proponent, the species present in the Lionnet River are the mottled sculpin (*Cottus bairdi*), longnose dace, burbot (*Lota lota*), northern pike (*Esox lucius*), white sucker⁴ and lake chub (*Couesius plumbeus*).⁷ Species found in the Pipmuacan reservoir such as the lake whitefish, longnose sucker and brook trout¹ are also likely to be found in the Lionnet River.

There seem to be rather scarce populations of brook trout in the Lionnet River, which may be explained partly by the presence of predators and competing species such as the northern pike and lake chub.⁷

According to the inventory of river sections⁹, there are large areas of potential brook trout spawning grounds in the Lionnet River. The proponent confirmed the presence of these potential spawning grounds during a field visit in September 2000.⁴

The entire section of the Lionnet River affected by increased flow represents excellent and average-quality brook trout rearing habitats (1 ha and 8 ha, respectively).¹

6.2.1.4. Betsiamites River

A total of 17 species are found in the Betsiamites River, downstream from the Bersimis-2 power station. Of these, Atlantic salmon (*Salmos salar*), whose population is considered endangered, is one of the species harvested most by the Aboriginal community of Betsiamites, which is located at the mouth of the river. It is currently estimated that between 100 and 500 adult salmon swim up the river each year. The salmon population is mostly made up of salmon of one and two sea years.¹ Moreover, historical fishing data show that approximately 4,000 salmon were fished in the early 20th century. This roughly corresponds to a population of 7,500 salmon, considering that approximately 2,700 spawners are necessary to ensure recruitment.¹²

The main spawning grounds used are located in the upstream part of the river at kilometres 67, 65, 52 and 42. Spawning seems to occur only marginally in tributaries (redds were found only in the Boucher River).¹

Among other species present in the Betsiamites River are brook trout, American eel (*Anguilla rostrata*) and rainbow smelt (*Osmerus mordax*). Generally speaking, eel populations seem relatively scarce in the Betsiamites River. There are no favourable habitats for the feeding and reproduction of eels (lakes) in the easily-accessible section of the Betsiamites basin. Finally, it is possible that eels feed in the estuary of the Betsiamites River during the summer and swim upstream in autumn to hibernate.⁴

Saltwater can penetrate through the bottom of the estuary for as far as 10 km from the mouth of the Betsiamites River. According to substrate characteristics, rainbow smelt could spawn upstream from the maximum area of influence of saltwater penetration, to the Bersimis-2 power dam. There seem to be many potential rainbow smelt spawning grounds beyond the limit of saltwater intrusion, and they do not represent a limiting factor for this species in the Betsiamites River.⁴

Brook trout populations, in particular juvenile populations, seem very small in the Betsiamites and its tributaries. This scarceness may be explained in part by the sudden and frequent variations in the flow as well as by the presence of several competing species and predators.

Various species are present at the mouth of the river and nearby coastal area. Capelin (*Mallotus villosus*) use the beaches of the estuary up to km 5, as well as the beaches of Pointe à Michel and of the of Betsiamites spit. Plaice are found in the channel up to the bridge of Highway 138 (km 8.5). Black sturgeon (*Acipenser oxyrinchus*) have been seen along the coast between Pointe à Michel and the Jérémie Islets to the west. Atlantic cod (*Gadus orgac*) and Atlantic halibut (*Hippoglossus hippoglossus*) are found further offshore. A seal haul-out has been located less than 1 km offshore from Pointe à Michel.³ Large concentrations of soft-shell clams (*Mya arenaria*) are found in the shoals of the estuary, on the banks facing the village of Betsiamites and off all the beaches between Pointe à Michel and the Jérémie Islets.³

6.2.2. Avifauna

According to the *Atlas des oiseaux nicheurs du Québec méridional*, 125 species have been identified in the basin of the Sault aux Cochons River. The greatest diversity within the study area was found in the 100 km² area delineated in the Atlas which covers the St. Lawrence River, the estuary of the Sault aux Cochons River and the first ten kilometres of the river. Ninety-six species have been identified there, including species which are usually associated with the St Lawrence River, such as the common eider (*Somateria mollissima*) and the black guillemot (*Cephus grylle*). Avian diversity is at its weakest in the upper section of the Sault aux Cochon River's tributary basin, where less than 60 species have been identified in a balsam fir-white birch stand.¹

On May 26, 1999, an aerial survey conducted by helicopter allowed the identification of 12 species of water birds between the mouth of the Sault aux Cochons River and the Lionnet River, including the Sault aux Cochons Reservoir. Anatidae were the most common with 9 species, and the most populous with 111 individuals. Among other water bird species counted were the common loon (*Gaviar immer*), the American bittern (*Botaurus lentiginosus*) and the spotted sandpiper (*Tringa macularia*). Common mergansers (*Mergus merganser*), American black ducks (*Anas rubripes*) and spotted sandpipers are the species most often encountered on the Sault aux Cochons River.³

Sault aux Cochons Reservoir is essentially visited by the common loon and common merganser³, whereas the spotted sandpiper, common merganser and red-breasted merganser (*Mergus serrator*) are seen on the Lionnet River.³

6.2.3. Riparian and Aquatic Vegetation

Riparian and aquatic vegetation covers an area of approximately 63 ha of the Sault aux Cochons River. Brise-Culotte marsh, which covers an area of 25 ha, is located near kilometres 45 and 50, at the mouth of Brise-Culotte brook.

This vegetation covers an area of 7.6 ha in the Sault aux Cochons Reservoir. Factors such as the rise and fall of tide and the action of waves limit the spread of riparian vegetation and aquatic-grass beds.

In the Lionnet river, riparian scrublands are 5 m wide on average and cover an area of 2 ha. They are made up of alder, willow and sweet gale.

Riparian habitats along the Betsiamites are scarcely documented. In 1997, Hydro-Québec conducted a survey around the Bersimis-2 reservoir which revealed that the shrub stratum is weakly developed on approximately 4% of the banks. It is essentially made up of green alder and sweet gale.

6.3. Human Environment

6.3.1. Socio-economic and Socio-demographic Profile

The study area consists mostly of public land under the jurisdiction of the Ministère des Ressources Naturelles (MRN). It overlaps the administrative region of Saguenay-Lac-Saint-Jean to the west, which includes an Indian reserve and four regional municipalities (MRCs), and the North Shore administrative region to the east, which includes 9 Indian reserves and 5 MRCs. The limit between these two regions is situated at Cacuscanus Lake. The Sault aux Cochons River, which is located in the Haute-Côte-Nord MRC, crosses the town of Forestville for approximately 27 km before it flows into the St Lawrence River.

The regional economy of the North Shore is essentially based on the development and transformation of resources. Mining, forestry, hydroelectric power production and fishing are the main economic activities in the region. The unemployment rate is relatively high at 17.3%. The project will affect two Indian communities, those of Essipit and Betsiamites.

The economy of the Saguenay-Lac-Saint-Jean region is also based on natural resources. The development of its considerable hydroelectric potential gives the region a comparative advantage in the aluminium and pulp and paper industries. The unemployment level reaches 15.5% and 14%, specifically in the Fjord-du-Saguenay RCM. Mashteuiatsh, the only Aboriginal community in the region, will not be affected by the project.

The Betsiamites community, which covers 255 km², is Southern Québec's largest Indian reserve. Its population, which numbered 3055 people in 1998, is considered young, with 48% of inhabitants under the age of 25. The Band Council alone provides full-time employment to nearly 200 people, which represents two thirds of the jobs in the community. Forestry, construction, petty trade and traditional activities are the other types of economic activity.

6.3.2. Tourism

Outfitting camps and controlled harvesting zones (ZECs) are the main tourist attractions in the project's area of influence. Four outfitting camps and two ZECs are located in this area. Of these outfitting camps, three are situated along the river and have exclusive rights, namely Le Chenail du Nord, Domaine du Canyon and Domaine Orégnac, whereas the Lac Kakuskanus outfitting camp, located on Sault aux Cochons Reservoir, does not have exclusive rights. In 1996, there were a total of 3,000 person-day visits to the three outfitting camps. The main activities related to wildlife harvest are fishing (90% of activity) and hunting. In addition to these activities, certain outfitting camps offer activities such as canoeing, hiking, and nature tips.

These activities also take place in the two ZECs of the study area, namely the Forestville ZEC and the Labrieville ZEC. In 1996, there were 37,821 person-day visits in total to the Forestville ZEC, which is situated approximately 10 kilometres from the town of Forestville. Fishing activities accounted for 44% of these visits, hunting for 28% and vacationing for 25%. In total, there were 15,573 person-day visits in the Labrieville ZEC in 1996, the great majority of which involved fishing (89%).

Some of the tourism sites and recreational facilities in the project's area of influence are located in the municipality of Forestville, more specifically between the mouth of the Sault aux Cochons River and the municipal wharf. This area is used for bathing, picnics, fishing, camping, etc. Furthermore, the municipality of Forestville and the Corporation de développement de la Baie Verte have developed a plan for improving infrastructure and promoting tourism in Baie Verte.

Use of the Sault aux Cochons River for navigation is described in detail in Volume 1 of the preliminary project report (pp. 116 to 118).¹ Obstacles to navigation include hydro-electric power stations in the lower reaches of the river, and whitewater rapids and shallow bays in the upper reaches. However, despite the fact that the Sault aux Cochons River is not recognized as useable by the Fédération québécoise du canot et du kayak, more and more canoers have started using the river since the end of log floating activities.

6.3.3. Use of Land

Forest covers most of the project's area of influence. At present, there is one Timber Supply and Forest Management Agreement contract for the area with Produits forestiers Labrieville.

The area of influence is not very built up or industrialized – there is only the municipality of Forestville and its industries – and farming activity does not exist in the area.

6.3.4. Current use of Land and Ressources for Traditionnal Purposes by Aboriginal People

The current use of land and ressources for traditionnal purposes by Aboriginal people is described in detail in Volume 1 of the preliminary project report (pp. 280-281).¹ The project's area of influence covers land and resources exploited by the Montagnais community of Betsiamites. It overlaps the Bersimis beaver reserve where the Montagnais have exclusive trapping rights for fur-bearing animals. Furthermore, the Montagnais alone are granted permission for salmon fishing in the Betsiamites River.¹

7. Anticipated Effects, their Significance and Mitigation Measures

Chapter 10 of Volume 1 of the preliminary project report describes in a general way the impacts of the project on the natural and human environments. Chapter 11 presents more specific impacts on environmental components such as fish, the use of resources by Aboriginal and non-Aboriginal communities, as well as recreation, leisure and tourism activities and related infrastructure. The method of impact assessment used by the proponent is presented in Chapter 8. In addition, all documents mentioned in Section 1 provide additional information on the environmental effects of the project.

The following sections present a summary of the cumulative effects and the main environmental effects of the project, including those caused by accidents and malfunctions. The main mitigation measures are also mentioned.

It is important to note that only the main concerns are described in this report. For more details and a complete evaluation of impacts, refer to the documents mentioned in Section 1.

7.1. Effects Assessment Methodology

The assessment method used by the Responsible Authority consists in identifying the effects of the project on the different Valued Environmental Components (VECs) and in determining their significance. The identification of the effects of the project and the determination of their significance is based on information provided by the proponent and the expertise of various Federal Authorities. It also takes into account the application of mitigation measures proposed by the proponent or recommended by Federal Authorities as well as the implementation of a follow-up program.

The selection of Valued Environmental Components (VECs) takes into account the mandates and fields of expertise of the different federal experts, scientific knowledge, and concerns expressed by the public directly to the proponent or to the provincial or federal government.

The VECs for the present project are the following:

- ichthyofauna and fish habitat;
- avifauna;
- riparian and aquatic vegetation;
- socio-economic situation;
 - tourism (navigation);
 - use of resources (fisheries);
- current use of land and resources for traditional purposes by Aboriginals.

Physical and cultural heritage and human health were addressed by the proponent¹ in a satisfactory manner and are not, as part of the hereby project environmental assessment, Valued Environmental Components.

7.1.1. The Significance of Effects

The assessment method used by the proponent consists in identifying the impacts of the project and in determining their significance. The identification of the project's impacts is based on information gathered concerning the technical characteristics of the project, the basic data regarding the receiving environment, scientific literature and the lessons learned from similar projects. The analysis of this information allows the identification of the project's impacts by specifying the interrelations between the different physical, biological and human components of the project's environment. This analysis takes into account all physical works and the different phases of the project, i.e. from construction to operation. The assessment of impacts takes into account the implementation of up-to-date mitigation measures. Furthermore, certain mitigation measures have been integrated into the project's design (minimum flow and spurs) and are also taken into account during the assessment.

The proponent determines the extent of impacts which can be qualified as high, medium or low, based on four criteria: the value of the affected component, the intensity of the disruption, and the spatial and temporal extent of the impact.

This list is different from the one used to define the environmental effects of a project in accordance with the *Canadian Environmental Assessment Act*, in which a negative effect must be defined as significant, not significant or uncertain.

The Department of Fisheries and Oceans (DFO) believes that a strong impact corresponds to a significant effect as defined according to the terminology of CEAA, and that a medium or low impact corresponds to an not significant effect.

However, in accordance with the *Canadian Environmental Assessment Act*, the Responsible Authority is not bound by the conclusions drawn by the proponent concerning the extent of the effects, and is required to draw its own conclusions, which will take into account the proponent's opinions as well as its own expertise and that of other Federal Authorities, along with all other information at its disposal.

In the process of environmental assessment, the Responsible Authority consults other federal authorities by requesting their collaboration for the assessment of the project. Each consulted Federal Authority indicates, at the best of their knowledge and in their competence sphere, if the submitted environmental assessment is appropriate regarding their concerns and in the respect of the requirements of CEAA for a comprehensive study. The different consulted Federal Authorities must come down with a statement on the proponent conclusions and set out recommendations to the Responsible Authority on the different aspects in relation with their competence sphere.

7.2. Effects of the Project on Environmental Components

7.2.1. Ichthyofauna and Fish Habitat

The analysis of the effects of the project on ichthyofauna and fish habitat is based on information provided by the proponent and is supported by the *Policy for the Management of Fish Habitat* (PMFH), the *Decision Framework for the Determination and Authorization of Harmful Alteration, Disruption or Destruction of Fish Habitat* and the *Habitat Conservation and Protection Guidelines* of Fisheries and Oceans Canada (DFO).

Under the subsection 35(2) of the *Fisheries Act*, DFO may authorize the harmful alteration, disruption or destruction of the fish habitat.. However, residual losses of fish habitat following the application of adequate mitigation measures must be acceptable. Furthermore, in accordance with the principle of no net loss of the PMFH, the aforementioned authorization cannot be granted unless the habitat losses are adequately compensated for.

When determining the significance of the project's impact on fish habitat, the proposed mitigation and compensation measures as well as the follow-up program will be considered.

Therefore, an important effect on fish habitat may arise in the case where fish habitat loss would be judged non acceptable or if residual fish habitat loss judged acceptable, would not be compensated.

7.2.1.1. Sault aux Cochons River

The main impacts of the project on fish habitat productivity are said to be caused by modifications to hydrological conditions, i.e. mainly the decrease in water levels and flow velocity. At the point of diversion, the mean annual flow of the Sault aux Cochons River would decrease from 7.5 m³/s to the maintenance flow rate of 1 m³/s. This would result in an 87% reduction in the flow at the cut-off point and an 18% reduction at the mouth of the River. This decrease in the flow would lead to drops in the water level and dewatering of the river bed. The dewatered areas cover a total of almost 11 ha in minimum summer flow conditions with more than 9 ha downstream from km 94.³ The main mitigation measures which would allow the lessening of impacts are the establishment of a minimum flow of 1 m³/s and the installation of spurs at lake outlets in order to prevent a drop in their water levels, and at certain points in the river in order to maintain an adequate level.

Brook Trout

In the assessment of impacts on the piscifauna, the proponent considered different parameters which could become limiting for brook trout following the completion of the project. Among these, it would appear that the quality and availability of rearing habitats as well as increased competition with suckers would lead to losses in fish production following the application of a minimum flow of 1 cubic metre per second.¹

The proponent estimated that the dewatering of rearing habitats would be between 1 and 3% following the maintenance of a minimum flow of 1 m³/s, according to the segments. Therefore, a dewatering of 9.6 ha is expected in the lower part of the river (km 0-94) and 1.2 ha in the upper part (km 94-128).³ These values are calculated based on the minimum summer flow.

Due to the reduction of flow velocities, a decrease in the quality of rearing habitats is expected. Therefore, most habitats considered to be of excellent quality would become habitats of average quality. However, habitats considered to be of average or low quality would remain so. The proponent estimated that this impact would translate into a loss in potential production from 15 to 25% following the application of mitigation measures, for the upper reach of the river.¹ In the lower part of the river, the proponent estimated that the reduction of flow velocities would not be very noticeable following the application of mitigation measures except in the segment between km 90-94, where a 15% decrease in the quality of rearing habitats would be expected.³ In the first draft document on the revision of fish production losses⁷, the proponent made an upward adjustment in the percentages for the decrease in the quality of rearing habitats. The proponent now estimates that the reduction in flow velocities would lead to losses in potential production in rearing habitats which are considered excellent, from 25 to 50% in the upper reaches and from 5 to 25% in the lower reaches of the river. The proponent did not justify these modifications.

The reduction in the flow would also favour the suckers to the detriment of the brook trout. The proponent estimated that a growth in the sucker population should occur especially in the upper reaches and that this should translate into a loss in potential production of 10% (km 94-177) to 20% (km 117-128) following the maintenance of a minimum flow of 1 m³/s.¹ In the lower reaches of the river, the proponent estimated that the growth of the sucker population would hardly change following the completion of the project as they are already abundant, and that the speed of the flow would hardly change except in the part between km 90-94

where a 10% loss in production is expected. Based on fish inventories completed by the proponent in August and September 2000, however, competing species such as the white sucker, longnose sucker, lake chub and the lake trout, are more abundant in the upper reach than was originally estimated. The present decrease effect on brook trout production is therefore more significant and could reach close to 90% according to the proponent. It is therefore unlikely that the growth in the sucker population following the realization of the project would have an effect of 10 to 20%. Therefore, the proponent reduced the potential production loss for the brook trout due to the growth of the sucker population following the project to 5% for the whole river, except between km 0 and 24 where it would remain at 0%.⁷ However, in the second draft document on the revision of fish production losses¹³, the percentage of losses connected to the growth of the sucker population was revised a second time in order to consider lotic and lentic habitats. The proponent estimates that this impact would be greater in a lotic environment than in a lentic environment, with a 10% and 5% loss respectively.

All of the percentages for fish production losses associated with the three main impacts, i.e. the decrease in the quality and availability of rearing habitats as well as increased competition with suckers, were applied in the assessment of the present production potential of the river using the POTSAFO 2.0 method.¹³ DFO believes this method to be the most acceptable of the three evaluations conducted by the proponent^{3, 7, 13} because it takes into account two years of experimental fishing in the Sault aux Cochons River. The proponent estimates that there would be fish production losses of 195 kg/year of brook trout.

However, DFO estimates that certain factors were not considered in the evaluation of fish production losses. DFO feels that the proponent must consider the loss in the riparian ecotone. Indeed, the reduction in floods would limit the extent and length of spring overflowing which supplies a significant amount of organic matter and food for the fish. As a precautionary measure and in order to consider the impact on fish production, DFO increased the losses calculated by the proponent by 10%. DFO estimates that the potential production losses for brook trout in the Sault aux Cochons River would therefore reach 215 kg/year. Furthermore, 1,500 m² of brook trout spawning grounds which would be dewatered following the completion of the project would be added to the total losses.

Maintaining the accessibility of certain tributaries appears uncertain. The proponent mentions that between km 0 and 93 the tributaries should be downcut in loose sediment, and that between km 93 and 128, the overdeepening of tributaries would be reduced considerably, given that the bed and banks are composed of rocks and boulders in certain places and that there is a presence of rocky ridges.¹ Furthermore, the proponent estimates that the downcutting of tributaries should not be very significant, given the presence of rock sills near the mouths of the tributaries, but that the tributaries would have to clear a new channel in the loose material of the Sault aux Cochons River.³

DFO feels that the access to tributaries which contain recognized or potential spawning grounds must be maintained. The proponent will therefore have to verify accessibility in the follow-up program and provide remedial measures when necessary in order to ensure that access to tributaries is not impeded by the project.

The proponent estimates that the reduction in the flow of the Sault aux Cochons River should cause a 1.5 to 2°C temperature increase in the upper reaches.³ Directly downstream from the

dam, this increase would be smaller due to the fact that the water which makes up the minimum flow would be colder than it is at present, because most of it would come from a deeper part of the reservoir. Therefore, the proponent expects average daily summer temperatures to vary between 19 and 21°C with peaks reaching 22°C between km 128 and 80, and between 19 and 22°C with peaks reaching 23°C downstream from km 80.⁴ The proponent estimates that the increase in summer temperatures would not have a significant impact on brook trout production because most of the time the temperatures would remain under the optimal maximum value of 20°C, and the maximum tolerated value of 24°C would not be reached more frequently.

Following the completion of the project, the proponent intends to leave three thermographs on the site, one of which would be located near kilometre 113.6, in order to continue gathering temperature data and thus make sure of the accuracy of predictions.

Lake Trout

Despite a request from DFO, the proponent did not find it justifiable to assess the impacts on lake trout habitats because, according to the proponent, these habitats would not support a natural population of this species in the upper reaches of the Sault aux Cochons River.³ Fish inventories have shown that lake trout are relatively abundant in this section of the River.⁷ The proponent now believes that the project would not have an impact on lake trout because the installation of spurs at lake outlets would prevent levels from dropping. However, despite the fact that lake trout are considered to be essentially a lacustrine species, the fishing data show that they use the upstream part of the river as a feeding habitat and as a means of moving between the different lakes.⁷ Therefore, DFO believes that a loss in wet areas in the upper reaches of the river would reduce the size of Lake Trout feeding areas. This loss would have to be compensated for.

Furthermore, drops in water levels could make it more difficult for the fish to move between lakes. DFO believes that in the environmental follow-up, the proponent will have to make sure that the lake trout remain present in all water bodies where they are presently found, and that the free movement of the fish between these water bodies remains possible at all times, despite the drops in water levels.

7.2.1.2. Sault aux Cochons Reservoir

In the Sault aux Cochons Reservoir, the main impact would result from the introduction of new species. However, an impassable obstacle, that is to say a vertical waterfall of a net height of at least 3 metres, would be made downstream from the future falling crest.⁸ This would prevent the introduction of non-indigenous species into the basin. The annual rise and fall of the reservoir would be reduced from 4.3 m to 1.4 m following the project's completion. Therefore, the reservoir would have a maximum elevation level of 428 m and a minimum elevation level of 426.6 m. There would be no reservoir management, as the hydrological conditions would be the same as those in a natural lake.⁸ This decrease in the rise and fall of the reservoir represents a positive impact for lake trout.

7.2.1.3. Lionnet River

The mean annual flow of the Lionnet River would rise from 3.6 m³/s to 10.1 m³/s, increasing by 208%. With a maximum diversion flow of 110 m³/s, the submerged area could cover 42 hectares.⁶ The rise in flows and water levels in the Lionnet River would favour the northern

pike to the detriment of the brook trout. According to the proponent, the flooding of lands and the resulting hydrological conditions might lead to the development of grass beds which are favourable to the reproduction of northern pike in certain areas.¹ Furthermore, an increase in the number of northern pike would increase the predation pressure on the brook trout. Therefore, the proponent expects a loss of 4 kg/year in the potential production of brook trout, which corresponds to the potential production of the section of the Lionnet River with a modified flow.⁷

The increased flow in the Lionnet River would translate into a significant increase in erosion and in the volume of sediment carried towards the Pipmuacan Reservoir. Overall, there would be a widening and an overdeepening of the river bed. The proponent believes that the levels of suspended matter in the water would not be harmful to aquatic life.¹ The proponent would clear the land and remove the overburden in part of the submerged area in order to limit the amount of eroded sediment. Furthermore, in order to limit the amount of sediment carried in the water, the proponent would install a sediment trap in the Lionnet River.¹ The proponent would ensure a follow-up program to ensure the development of the diversion channel and to identify problem areas. A mobile intervention team would take the necessary corrective actions and ensure that the impacts remain as small as possible.⁷ Overall, the mitigation measures and the follow-up program mentioned above would reduce erosion and sedimentation impacts.

7.2.1.4. Betsiamites River

Following the completion of the diversion projects for the Portneuf and Sault aux Cochons rivers, the mean annual flow of the Betsiamites River would increase from 341 m³/s to 358 m³/s at Bersimis-2, and from 402 m³/s to 419 m³/s at the mouth. The level of the Pipmuacan Reservoir would decrease by 1 m compared to the present winter conditions. However, the elevation levels of the reservoir during operation would not change and the minimum and maximum levels would remain at 388.62 and 398.98 m respectively.³ Therefore, these two diversion projects would have little impact on the fish habitat and resources of the Betsiamites River. Indeed, considering that the present hydrological management of the river is based on peak demand management, involving rapid and frequent variations in flow, and that the minimum and maximum flows would not be modified, the expected small increase in the flow would have few negative effects.

7.2.1.5. Compensation Program

The impact of the diversion of the Sault aux Cochons River on the fish habitat is considered to be significant and requires authorization in accordance with subsection 35(2) under the *Fisheries Act* (FA). In accordance with the principle of no net loss set out by DFO's Policy for the Management of Fish Habitat, the authorization cannot be granted unless the habitat losses are compensated for.

The compensation program proposed by the proponent aims essentially at increasing the production of brook trout in certain lakes by the creation of spawning grounds and rearing areas in lakes and streams located in the Chenail du Nord outfitting camp, as well as by the establishment of populations of brook trout in virgin lakes in the Forestville ZEC.¹¹ These developments should allow the productive capacity of the receiving environment to increase by a minimum of 268 kg/year for brook trout, expressed in harvestable biomass.

In short, the compensation program would include the following elements:

- the implementation of fish habitat management measures at the sites aimed at the creation or improvement of brook trout habitat in the Sault aux Cochons River basin or in a second basin. The proposed management measures in lakes and their tributaries will aim at creating allopatric populations of brook trout which are self-sustaining and viable in lakes which have undergone fish stocking in the past with no long-term success, as well as in virgin lakes;
- the creation of a brook trout spawning ground covering 1,500 m² in the main reach of the Sault aux Cochons River; and
- the creation of a lake trout spawning ground covering 100 m² in de l'Île Lake.

The proponent's compensation proposal, which aims at compensating for fish production losses, includes brook trout stocking in certain lakes without fish, as well as the management of these lakes in order for the stocked trout populations to live naturally. According to experts from the Canadian Wildlife Service (CWS) of Environment Canada, this part of the project may have an impact on the preferred nesting habitat of the Barrow's goldeneye, a species of migrating duck whose status is a cause for concern, and for which the CWS has a management mandate.

Two virgin lakes which do not represent ideal or preferred habitat for this bird species were retained for the program of fish stocking and management, with the condition that the benthic, planktonic, avian and amphibian communities must be studied before and after the introduction of fish. The purpose of this is to document the effects of the introduction of new predators (fish) on the benthic and planktonic communities in virgin lakes, which are necessary for rearing immature Barrow's goldeneye and golden-eye ducks as well as for amphibians and all other animal species, since virgin lakes represent important ecosystems in terms of biodiversity.

The effectiveness of the compensation program will be monitored over 10 years to examine the wildlife management measures and their effects on fish, as well as to examine brook trout production in managed water bodies.

7.2.1.6. Conclusion

Due to the proposed and recommended mitigation measures and the compensation program for residual impacts on fish habitat productivity, as well as the proponent's commitment to implement an adequate follow-up program, DFO believes that the effects of the project on the fish habitat are not significant.

7.2.2. Avifauna

The proponent believes that, considering the impacts related to the construction and operation phases, the establishment of mitigation measures and suitable habitat gains in areas of Sault aux Cochons reservoir and at the new outfall, the residual impact of the project on avifauna will be negligible.¹

7.2.2.1. Sault aux Cochons River

The construction and clearing work on the 15 ha at the site of the dyke would disturb the area's avian fauna. However, the proponent estimates that the effects of disruption and loss

of habitat caused by clearing would be negligible, since the coniferous tree populations to be cut are particularly abundant in the area. Environment Canada recommends that clearing should take place outside the nesting period. Moreover, the proponent estimates that the reduced rise and fall of water levels would facilitate the development of a riparian ecotone, a more favourable habitat for the avian fauna.

Following the reduction of the flow of the Sault aux Cochons River, as described in detail in section 7.2.1.1., the proponent estimates that displacing the ecotone towards the new waterline would entail no adverse effects for the avian fauna. The proponent believes that the dewatered terrace located in the most favourable habitats, essentially in the sector of Brise-Culotte Brook, would attract shore and aquatic birds over the short term.¹ Over the longer term, the extension of the shrub stratum would provide shelter and nesting cover for riparian birds.

The impact on avian fauna in the sector of the Sault aux Cochons River is not considered to be significant. The use that waterfowl make of dewatered areas of the river is an element to be assessed through environmental follow-up.³

7.2.2.2. Lionnet River

An increased water level in the Lionnet River, as described in detail in section 7.2.1.3, would cause the area's nesting birds to leave. Forest-dwelling species would be replaced by species associated with fluvial environments. The proponent believes that these changes would not threaten the habits of local bird species. Waterlogged shrubland could provide shelter during the rearing period of immature ducks, while the flooding of herbaceous crops due to increased water levels could periodically improve food supplies on the shores for waterfowl.

7.2.2.3. Conclusion

According to Environment Canada specialists, the impacts of the partial diversion of the Sault aux Cochons River on the avifauna are not considered to be significant, providing that the proponent respects the suggested mitigation measures.

7.2.3. Riparian and Aquatic Vegetation

The proponent believes that, considering the impact related to the construction and exploitation phases and the establishment of mitigation measures, the residual impact of the project on riparian and aquatic vegetation will be negligible.¹

Generally speaking, the reduction of the flow of the Sault aux Cochons River, as described in detail in section 7.2.1.1, would cause the displacement of the riparian ecotone towards the new waterline. The dewatered terrace would therefore be recolonized by herbaceous plants, and by shrub vegetation over the longer term.¹ The Brise-Culotte marsh would not be affected by the river's reduced flow, as it is supplied by the Brise-Culotte brook.³

The reduction in the maximum spring water level of the Sault aux Cochons Reservoir, as described in detail in section 7.2.1.2, would cause changes in riparian ecotones. Therefore, approximately 7.6 hectares of riparian ecotone would be temporarily lost while vegetation would recolonize the area along the new maximum water level (428 m).⁸

The increase of the water level in the Lionnet River, as described in detail in section 7.2.1.3, would cause the drowning of 7.6 ha of alder stands and 1.8 ha of aquatic and riparian vegetation.

7.2.3.1. Federal Policy on Wetland Conservation

The main objective of the Federal Policy on Wetland Conservation is to promote the conservation of wetlands so as to maintain their present and future ecological and socio-economic functions. The policy aims at ensuring that there are no net losses of wetland functions: 1) on federal land and in federal waters, 2) in sectors which are influenced by the implementation of federal programs where loss or degradation of wetlands has reached critical proportions; and 3) in sectors where federal activities influence wetlands which have been designated as being ecologically significant for a region.

Wetlands affected by the partial diversion of the Sault aux Cochons River project meet none of the above-mentioned conditions. However, the proponent respects the general spirit of the policy, since the mitigation measures which could be applied in order to prevent or limit the loss of habitat for the aquatic fauna would also help to prevent the loss of riparian habitats and wetland in the entire area of influence. Moreover, the riparian ecotone follow-up program for the Lionnet River would ensure that the effects of the project on important ecological environments are assessed, and would allow the situation to be adjusted if necessary.

7.2.3.2. Conclusion

Due to the project's relatively limited impact on aquatic and riparian vegetation in the area of influence and the adequate follow-up measures adopted, DFO believes that the impact of the project on riparian and aquatic vegetation is not significant.

7.2.4. Socio-economic Situation

7.2.4.1. Tourism

The elements mentioned in this section are all related to boating activities, which is the main concern with respect to tourism. In fact, in the course of public consultations, many groups indicated their concern about flow reduction on the river and its effect on navigation activities, specifically for the upstream reaches of the Sault aux Cochons River. The reader will find information pertaining to other aspects in Volume 1 of the preliminary project report (pp. 282-290).¹

The proponent believes that, considering the impact related to the construction and exploitation phases and the establishment of mitigation and follow-up measures, the residual impact of the project on navigation will be low. In addition to maintaining a minimum flow in the Sault aux Cochons River (as described in detail in section 7.2.1.1), the proponent intends to build spurs at the outlets of Lake Casgrain and Lake Anonyme, and at certain points along the river in order to alleviate impacts on navigation. In addition, the proponent will confirm navigability between km 114 and 115 and between km 122 and 128 before and after the diversion, and will take the necessary corrective action to resolve any problems. The proponent believes that with these measures, proper boating conditions and access to boathouses would be ensured.¹

Furthermore, the public was concerned with the possibility that a lower water level could cause debris from wood floating to emerge, thus impeding navigation. In addition, it is possible that a drop in the water level would cause logs to emerge and dry out, and to float during floods. In order to help resolve the problem of remobilization of floating logs, a committee was formed with the mandate to describe the problematic and propose concrete intervention actions. The proponent participated to a technical subcommittee and a pilot project set-up in 1999 and afterwards a conveyor was installed in the downstream part of the Sault aux Cochons River.¹

The reduced rise and fall of the water level in the Sault aux Cochons Reservoir (as described in detail in section 7.2.1.2) could change conditions of access to certain structures such as launching ramps and docks. Once the project has been completed, the proponent will ensure that these installations remain useable, and will take the necessary corrective measures if this is not the case.

Conditions associated with the formal approval to be granted under the *Navigable Waters Protection Act*, would include:

- the positioning of warning signs upstream of the diversion canal and fish barrier on the Lionnet Brook;
- the clearing and maintenance of portage paths could be required;
- conditions of approval would also state that other conditions could be recommended by a follow-up committee.

Moreover, it should be expected that additional conditions or changes could be added following the posting required by public consultation procedures under the *Navigable Waters Protection Act*.

7.2.4.1.1 Conclusion

Experts of the Canadian Coast Guard Navigation Protection Program (Fisheries and Oceans Canada) believe that these different conclusions and the compliance with the conditions associated with the formal approval to be granted under the *Navigable Waters Protection Act* will ensure boating safety in the area and will have no significant adverse effects on navigation.

7.2.4.2. Use of Resources

The elements analyzed in this section are all related to fisheries, which are the main issue regarding the use of resources. On the course of consultations made by the proponent, the project impact on outfitters and resort vacationers activities were raised by these organisms who were concerned about the consequences of the drying up of segments of the Sault aux Cochons River and of the rising of water level in the Lionnet River, among others on brook trout and lake trout fishing. For other aspects, the reader may consult Volume 1 of the preliminary project report (pp. 233-236).¹

The proponent believes that, considering the impact related to construction and operation phases for the three affected sectors (Sault aux Cochons River, Sault aux Cochons Reservoir and Lionnet River) and the establishment of mitigation and compensation measures, the residual impact on the use of resources will be low for Sault aux Cochons River and positive for Sault aux Cochons reservoir and Lionnet river. The reduction of potential brook trout

production in the Sault aux Cochons River would cause an equal reduction of potential visits related to brook trout fishing. The preliminary project report¹ mentions that following the application of mitigation measures, the reduction of potential visits upstream from km 94 is estimated at 94 and 109 fishing-days per year, that is to say in the order of 11% to 16%. In the lower part of the river, downstream from km 94, the reduction of potential visits is estimated at 6%.

However, revised fish production figures⁷ have changed the proportion of losses for the entire river. Therefore, losses are now estimated at 7% in the upper and lower parts of the river, which should cause a proportional reduction of the potential number of visits. The impact on the use of resources would be felt most in the Forestville ZEC, where the reduction of potential visits related to brook trout fishing is estimated at nearly 10%.

Nonetheless, the proponent will need to compensate for fish production losses entirely. The proponent will be required to create fish habitat, with a productive capacity which is equal to losses incurred. Therefore, DFO believes that the residual effect on resource use is not significant.

Dyke repair works in the Sault aux Cochons Reservoir would slightly disrupt fishing activities during the construction phase. Generally speaking, the reduced rise and fall of the water level (as described in detail in section 7.2.1.2) would have a positive impact on navigation conditions, and therefore on fishing.

In the Lionnet River, the increase in northern pike populations to the detriment of brook trout would cause the latter to be no longer suited for harvest. The proponent had initially estimated the annual number of lost fishing-days at 25 for this area.¹ However, the proponent has re-evaluated the brook trout's potential at 4 kg/year for the entire affected area, which is unlikely to represent 25 fishing-days.

7.2.4.2.1 Conclusion

DFO believes that the project will have no significant effects on resource use.

7.2.5. Current Use of Land and Ressources for Traditionnal Purposes by Aboriginals

The project will not affect the basin of the Sault aux Cochons River, and therefore will have no impact on hunting operations of Aboriginal people, as they make little use of the area under study.³

The Montagnais of Betsiamites practice exclusive fishing for the Betsiamites River. Subsistence fishing is practiced during the summer, particularly in July during the most intense salmon migration period, and use nets. The proponent believes that since the diversion projects of the Portneuf and Sault aux Cochons rivers would have no impact on the Betsiamites salmon, there would be no adverse effect on salmon harvesting by Aboriginal people.¹

The Montagnais of Betsiamites expressed their concerns regarding snowmobile circulation on the Pipmuacan Reservoir and on Dubuc Lake, at the mouth of the Lionnet River. Results of observations from the winter of 1997-98 as part of a study of the ice regime in the area, showed that the project would not affect ice conditions. In order to verify this prediction, Indian and Northern Affairs Canada (INAC) recommends a follow-up in this matter.

7.2.5.1. Conclusion

The proponent believes that no impact will arise at the time of project construction and operation phases. Thus the project will not have residual impact on current use of land and resources for traditional purposes by Aboriginals in the opinion of the proponent. In order to limit impacts on traditional activities, INAC recommends that the mitigation measures suggested in the report of the BAPE should be implemented, and specifically believes that flow management of the Betsiamites River as well as monitoring of water levels at salmon spawning grounds to ensure population development, should ensure that the project will not have a significant effect on the use of resources by Aboriginal people.

DFO believes that the project will have no significant effect on the traditional activities of Aboriginals.

7.3. Effects of the Environment on the Project

The increase of the dyke's height and the rehabilitation of the dam will be carried out so as to allow the discharge of the maximum probable flood, i.e. a flow of 260 m³/s, respecting a freeback of 1.5 m.

7.4. Impacts Caused by Accidents and Failures

Breach of the dyke near the point of diversion and rupture of the Sault aux Cochons dam are the two main accidents or malfunctions associated with the project.

The proponent has estimated the consequences of a breached dyke between the Sault aux Cochons Reservoir and the Pipmuacan Reservoir, by supposing that the entire volume of the first reservoir, i.e. 260 hm³ at elevation level 430 m, would flow into the second. According to this evaluation, it appears that the level of the Pipmuacan reservoir would increase by 0.3 m, compared to its maximum level of operation. This corresponds to the level of the falling crest. The proponent estimates that in fact, the increase would be lower, as the evaluation of the volume of the Sault aux Cochons Reservoir was based on elevation level 430 m, whereas the maximum level of operation will be 429 m. It therefore seems that a ruptured dyke would not threaten the Bersimis-1 structures.¹

The proponent has also assessed the consequences of a breach in the Sault aux Cochons Reservoir dam by supposing that a gap could appear in the embankment. The proponent has estimated that the flow associated with a breach would be 1,584 m³/s and that the flood wave would be 4 m high just downstream from the dam.¹

The proponent has designed an emergency plan to be implemented at any time during construction works. The Manicouagan emergency plan will be in force and will allow the communications scheme to be updated in case of an emergency and the coordination of the various parties involved in emergency operations.¹

7.4.1. Conclusion

In light of the information contained in sections 7.3 and 7.4, DFO believes that impacts due to accidents or malfunctions, as well as the proposed prevention and intervention measures, have been satisfactorily identified.

7.5. Effects of the Project on Renewable Resources

Among the renewable resources to be analyzed, fisheries have been identified as the main element to be evaluated with regard to the impacts of the proposed project. On the whole, fisheries should not be affected, as losses in fish productivity would be entirely compensated for by wildlife management.

7.5.1. Conclusion

DFO believes that the project is not likely to have a significant effect on the renewable resources of fisheries.

7.6. Cumulative Effects

The assessment of the cumulative effects is described in the documents “Réponses aux questions et aux commentaires des autorités fédérales” (Responses to the Questions and Comments of the Federal Authorities) from February 2000³ and October 2000⁴, as well as in the December 2000¹⁰ document on the partial diversion project of the Manouane River concerning cumulative effects on the Betsiamites River. It is important to note that only the main concerns are discussed in the present document. The reader will need to refer to the above-mentioned documents for the complete evaluation of cumulative effects.

The method used is based on the method promoted in the Canadian Environmental Assessment Agency’s document. The main steps of this process are briefly described. Step 1 consists of determining the importance of problems and priorities by identifying the related issues and Valued Environmental Components (VECs), by setting limits in space and time and by determining the other projects or activities whose negative effects could be added to those of the proposed project. The second step consists of analyzing effects by describing the reference state and evaluating cumulative effects. The third step consists of determining mitigation measures, whereas the fourth step allows the significance of residual effects to be determined. Finally, the fifth step consists of assessing the required follow-up.

Valued Environmental Components are elements of the natural and human environment of particular importance in the project’s vicinity. VECs are identified by taking into account the concerns of parties in the region of the project, whom the proponent has met, as well as the information gathered in the territory by specialists. The environmental issues posed by the Sault aux Cochons River project and its related VECs are:

- fish communities and habitats (brook trout, lake trout, Atlantic salmon);
- use of resources by non-aboriginal people (brook trout and lake trout fishing);
- use of resources by aboriginal people (use of wildlife resource for subsistence purposes, access to harvesting areas); and
- recreation, leisure and tourism (boating, landscape).³

Time limits were set at ± 10 years, with the period being considered covering 20 years, from 1989 to 2009. The ten-year limit for past projects aims at taking environmental changes into account without, however, covering the entire history of the harnessing of the Sault aux Cochons River, since Hydro-Québec believes that beyond this limit, information is not readily available and predictions become increasingly uncertain.³

Spatial limits include the entire area of the Betsiamites River basin and Sault aux Cochons River basin.

The following activities have been taken into account by the proponent to assess cumulative effects:

- operation of the three hydro-electric power stations along the Sault aux Cochons River;
- the other partial diversion projects of Hydro-Québec, i.e. the Portneuf, Manouane and Boucher projects;
- forest harvesting in the basins of the rivers in the study area;
- log floating;
- fishing pressure on fish stocks by sport fishers and Aboriginal fishers;
- recreation;
- the forest fires of 1991;
- the flood event of July 1996.

7.6.1. Ichthyofauna and Fish Habitats

7.6.1.1. Sault aux Cochons River

Past and present activities on the river, such as log floating and the operation of three mini power stations, have had detrimental effects on fish habitat and fish communities. For example, the quality of spawning grounds has declined due to the accumulation of fine sediments and bark resulting from log floating.

The partial diversion of the Sault aux Cochons River project would entail fish production losses that would be compensated for by wildlife management. Residual impacts on fish communities are therefore considered negligible.

However, the present project would bring changes to the environment that may exacerbate other past and future activities, such as wood harvesting and forest fires. The main changes would affect the river's flow, temperature and turbidity.

Generally speaking, wood harvesting would cause increased flow, whereas the present project would cause the flow to diminish. Therefore, the cumulative effects on the river's flow could mitigate each other instead of aggravating each other.

The effects of the project on temperature would be a 1 to 2°C rise in the maximum summer temperature. This rise could be added to the possible temperature rise resulting from wood harvesting. However, these cumulative effects are considered weak, since no wood harvesting is expected to take place in the sector of the Sault aux Cochons River over the next 25 years, and little forestry-related activity has occurred there over the past 10 years.^{3,4}

According to the proponent, the project would cause reduced turbidity, due to lower sediment charge associated with a reduced flood flow, and the stabilization of active taluses.⁴ Activities related to wood harvesting or forest road systems would instead cause increased turbidity. Therefore, the cumulative effects on the river's turbidity would mitigate each other instead of aggravating each other.

7.6.1.2. Betsiamites River

The main activities with an impact on communities are hydro-electric operations and fishing.

The diversion projects of the Sault aux Cochons and Portneuf rivers would cause an increase of 18 m³/s in the mean annual flow. The main future project which would have a similar impact is the diversion of the Manouane River, which would cause a flow increase of 30 m³/s. The main impact of these three projects on the Betsiamites River is the reduced quality of fish habitats. In order to answer concerns of the Aboriginal community of Betsiamites related to the Atlantic salmon population downstream of Bersimis-2 hydroelectric power plant and in accordance with an agreement signed by the proponent and the Betsiamites band in 1999, the proponent has changed the management of the flow of the Betsiamites River in order to promote salmon production, notably by limiting the maximum hourly flow variation downstream from the Bersimis-2 power station.¹⁴ By limiting the variation of the power station's production to one unit per hour, the maximum hourly flow variation would be approximately 110 m³/s to 140 m³/s from 15 June to 30 November of each year, from 1999 to 2004. The proponent is also committed to ensuring a minimum flow of 1 unit (approximately 110 to 140 m³/s) throughout the entire year, up to 4 June 2005. Moreover, in order to avoid the dewatering of redds and hatchlings before the emergence period, the proponent is committed to increasing the minimum flow of one unit (approximately 130 m³/s) to that of two units (approximately 260 m³/s) from 15 November 2000 to 30 June 2001. DFO believes that the above-described modifications to the flow management of the Betsiamites River would increase its present productive capacity.

At the mouth of the Betsiamites River, the arrival of greater quantities of freshwater would alter the penetration of the salt-water wedge. These modifications are greater during low spring tide and when the river flows are greater. The proponent believes that expected flow variations are too weak to influence habitats, and marine resources and their harvesting, considering the natural variability due to tides and climatic influence, and the variability introduced by management methods of the Bersimis-2 power plant. DFO has certain reservations regarding these conclusions and asks the proponent to implement a follow-up program for the Manouane project, in order to specify present and future conditions in the estuary of the Betsiamites River.

7.6.1.3. Conclusion

Since the loss of habitats caused by the Sault aux Cochons River project would be compensated for by fish management in order to maintain brook trout productivity in affected areas, and since changes brought to the management of the Betsiamites River should improve its present productivity, the project should not have significant cumulative effects on fish habitats.

7.6.2. Use of Resources by Non-Aboriginal People

The reduction of potential brook trout production in the Sault aux Cochons River would cause an equal reduction of potential visits to the area for brook trout fishing. This reduction of visits related to fishing is estimated at approximately 7% for the entire Sault aux Cochons River (see section 7.2.4.2). Whitewater fishing sites would mostly be lost. The project could also cause navigation constraints and change berthing, mooring and boat launching conditions. These impacts would be added to negative effects caused by forest fires and hydro-electric station operations.³

7.6.2.1. Conclusion

Considering the compensation for the losses in fish production, as well as the mitigation and follow-up measures, DFO believes that there are no significant cumulative effects on the use of resources by non-aboriginal people.

7.6.3. Use of Resources by Aboriginal People

In the basin of the Sault aux Cochons River, the project would have relatively limited negative impacts on the territory and resources used by Aboriginal people. Their traditional activities in the area of the works will not be significantly affected by the project. Therefore, no cumulative negative impact is expected to this effect.³

Furthermore, in accordance with an agreement between Hydro-Québec and the Betsiamites band council, Hydro-Québec has agreed to respect certain management constraints in order to favour Atlantic salmon in the Betsiamites River. These new management policies should help improve habitat conditions not only for salmon, but for all the aquatic species present in the river.¹⁰ Cumulative impacts of the project on fish resources are described in section 7.6.1.

7.6.3.1. Conclusion

The cumulative effects of the project on the use of resources by Aboriginal people are considered to be weak, and it does not appear that mitigation measures or follow-up programs need to be implemented, other than the ones designed by the proponent as well as the additional recommendations of Indian and Northern Affairs Canada (INAC) in the present report. DFO believes that the project would have no significant cumulative effects on the use of resources by Aboriginal people.

7.6.4. Recreation, Leisure and Tourism

In the past, various activities or projects, such as log floating or hydro-electric station operations, have affected the navigability of the Sault aux Cochons River. The drop in the water level caused by the present project would not prevent boating on the river but could make conditions worse in certain areas. This impact would be added to previous impacts and could be considered, according to the proponent, as a cumulative impact whose nature and scope remain to be determined. Therefore, the application of various mitigation and follow-up measures (spurs, follow-up on navigation conditions, etc.) as well as the reduction of the rise and fall of water levels in the Sault aux Cochons Reservoir, would ensure safe navigation conditions.

7.6.4.1. Conclusion

Experts of the Canadian Coast Guard Navigation Protection Program (Fisheries and Oceans Canada) believe that these different conclusions and the compliance with the conditions (described in section 7.2.4.1), along with the formal approval to be granted under the Navigable Waters Protection Act, will ensure safe navigation in the area and will also ensure that the project will have no significant adverse effect on boating.

8. Follow-up Program

The follow-up program is described in Chapter 14 of the preliminary project report.¹ Additional specifications can also be found in certain secondary documents containing answers to questions from the Federal Authorities.^{4, 8, 10} Following the approval of the project by government authorities, the proponent will prepare a detailed environmental follow-up program, which will be submitted to DFO, in accordance with the proponent's commitments.

The follow-up program would be carried out over a 10-year period and would allow the accuracy of the project's predicted impacts to be validated, as well as ensuring the effectiveness of mitigation measures. The main elements to be validated are identified in table 40 of the preliminary project report¹, to which the following elements are added, as requested by Federal Authorities:

- Verify that the installation of spurs as a mitigation measure does not prevent the passage of fish;
- Ensure that brook trout freely access tributaries, following flow modifications;
- Ensure future access to presently accessible water expanses for lake trout;
- Ensure that lake trout remain in all parts of the Sault aux Cochons River where they are presently found;
- Wood clearing work should not be carried out during nesting periods.

Indian Northern Affairs Canada (INAC) recommends that the proponent should consider collaborating closely with the Montagnais on follow-up activities, particularly with regard to the following element: follow-up on the condition of the ice cover on the Pipmuacan Reservoir in the area of influence of the Lionnet River.

Moreover, a ten-year follow-up which specifically focuses on compensation measures will need to be carried out in order to validate the effectiveness of compensation and to implement corrective measures if necessary, as described in the compensation program.¹⁵

Results of the follow-up will need to be forwarded to DFO, which will, if necessary, request modifications in light of results obtained.

9. Conclusion

Following the analysis of the project design and the description of proposed works, infrastructure and modifications to the hydrological regime, Fisheries and Oceans Canada, the Responsible Authority as defined by the *Canadian Environmental Assessment Act*, has evaluated the potential environmental impacts of the Sault aux Cochons River diversion project.

This study has been conducted based on information provided by the proponent and on the opinions of different federal departments concerned with the implementation of the project.

Considering the mitigation and compensation measures and follow-up program which have been proposed, as well as the proponent's commitments, DFO has determined that the proposed project as defined in the study is not likely to have significant adverse environmental effects.

This is a preliminary conclusion that will be reassessed once the comments gathered during public consultation period have been reviewed.

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Date

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APPENDIX 1 : List of Mitigation Measures

Partial Diversion of the Sault aux Cochons River

List of Mitigation Measures

Sault aux Cochons River

- A minimum flow of 1 m³/s at the Sault-aux-Cochons Reservoir dam will be maintained.
- Navigation conditions between km 114 and 115 and between km122 and 128.5 as well as the condition of access to the shoreline and docks will be confirmed before and after the implementation of the diversion. Corrective measures will be taken if obstruction to navigation are identified.

Sault aux Cochons Reservoir

- The reservoir will be maintained above an elevation level of 425 m if construction works are carried out during the spawning season (October) or if they must continue during the critical periods of egg incubation and fry emergence (October to May).
- An impassable obstacle (vertical waterfall) measuring at least 3 m (2 m net) will be built downstream from the diversion channel in order to prevent species present in the Lionnet River and Pipmuacan Reservoir from accessing the basin of the Sault aux Cochons River.
- Montagnais resource users will be informed of the nature and schedule of the works.
- Workers will be informed of local rules concerning wildlife harvesting.
- Riparian structures will be inspected before and after the works, and corrective measures will be taken if required.

Lionnet River

- Riparian structures will be inspected before and after the works, and corrective measures will be taken if required.
- A road stabilization program will be implemented at Catherine Lake, near the future diversion channel.
- A preliminary archaeological inventory will be taken along the banks of the Lionnet River.
- The off-road vehicle trail leading to the cottage will be moved.
- The corridor (25.3 ha) used by the diverted waters will be cleared, in accordance with the MRNQ's specifications.
- Follow-up will be ensured regarding the channelization and erosion during the priming of the runoff corridor in order to detect possible problem areas
- Areas where plant debris accumulates, such as the part upstream from the new bridge, will be cleared.

Recreation

- A graduated rule will be placed near the bridge at km 24.5 .

- Warning signs will be positioned upstream from the diversion channel and fish obstacle of the Lionnet brook;
- The clearing and maintenance of portage paths could be requested;
- Conditions of approval would also indicate that other conditions could be required, if recommended by the follow-up committee.

Avifauna

- Environment Canada recommends that clearing should not take place during the nesting season.