TOULNUSTOUC HYDROELECTRIC FACILITY
PROPOSED BY HYDRO-QUÉBEC

CANADIAN ENVIRONMENTAL ASSESSMENT ACT

COMPREHENSIVE STUDY REPORT

PREPARED BY

DEPARTMENT OF FISHERIES AND OCEANS CANADA
LAURENTIAN REGION

SEPTEMBER 2001

Fisheries and Oceans Canada | Pêches et Océans Canada

Canada

GENERAL INFORMATION

Date:	September 28, 2001
Proponent:	Hydro-Québec
Project Type:	Construction and operation of a dam and hydroelectric generating station
Trigger:	*Fisheries Act*, subsection 35(2) *Navigable Waters Protection Act*, section 5.1
Responsible Authority:	Department of Fisheries and Oceans Canada
Study Type:	Comprehensive study under the "Comprehensive Study List Regulations", subsection 4(b)

SUMMARY

Hydro-Québec intends to construct a new generating station, with an estimated generating capacity of 526 MW, on the Toulnustouc River.

Construction of the Toulnustouc hydroelectric station springs from Hydro-Québec's sustained growth and cost-effectiveness initiatives adopted as part of the 2000–2004 strategic plan. In addition, it is also part of the completion of the hydroelectric development of the Manicouagan and Toulnustouc basins.

Of the various options examined (nine variations and combinations), it was determined that option number five would prove to be the most acceptable with respect to cost-effectiveness, as well as the most environmentally and socially acceptable.

The project involves exploiting the hydroelectric potential of the Toulnustouc River north of the Manic 2 dam. In order to do this, the following installations are required: damming of the Toulnustouc River (including the upstream and downstream cofferdams), temporary diversion (including intake and tailrace canals), the south dike, spillway (including the intake and tailrace canals), the generating station intake (including the intake canal), the 526 MW generating station, the generating station intake (including the power tunnel) and the generating station tailrace canal. The project also includes modification and reconstruction of existing installations, including the southeast dike, the Sainte Anne dam, the various access routes including the water-crossing installation and the bridge at kilometre 92 of the Sainte Anne road. Other installations are required, such as construction of a 69 kV transmission line between the Micoua and Pesamit stations.

The main changes to the physical environment will result from the presence and operation of the new portion of Lake Sainte Anne, from flow reduction in a segment of the river, from flood management and from the operation of the generating station. Enlargement of Lake Sainte Anne will result in the creation of 22 km² of lacustrine environment and the loss by submergence of a 14 km segment of the river. The highest operating water level on Lake Sainte Anne will be 301.75 m. The reservoir will hold the spring freshet in May and June, at which point its average operating level will increase to 299 m, from 290 m. From December to April, the reservoir level will gradually decrease to 290 m. The annual drawdown will thus be 11.75 m compared to the actual 26 m. Downstream from the proposed dam, the mean annual discharge will decrease from the actual 212 m³/s to 5 m³/s over 14 km of river. Finally, in the altered flow sector the impact will mainly be associated with the operation of the hydroelectric facility.

Under the *Canadian Environmental Assessment Act* (CEAA), an environmental assessment of the project must be conducted, since the project will incur the loss of fish habitat which requires authorization under subsection 35(2) of the *Fisheries Act* (FA). Some of the installations proposed within this project are also subject to formal approval under section 5.1 of the *Navigable Waters Protection Act* (NWPA), which is also a trigger of the CEAA under the Law List Regulations.

This report fulfills the Department of Fisheries and Oceans' (DFO) obligation as a responsible authority established under the CEAA, to conduct an assessment of the project's

environmental effects, in consultation with other federal authorities who have the appropriate expertise.

Taking into account the proposed mitigation and compensation measures, the follow-up programs, and the proponent's commitments, DFO has determined that the proposed project, as defined by the scope of the assessment, is not likely to have a significant negative effect on the environment.

This is a preliminary conclusion that will be reconsidered following the analysis of the comments received during the public consultation period.

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1 Introduction

The Department of Fisheries and Oceans (DFO) prepared this comprehensive study report for the new Toulnustouc hydroelectric facility proposed by Hydro-Québec, the project proponent. This report fulfills DFO's obligation, as responsible authority under the *Canadian Environmental Assessment Act* (CEAA), to conduct an environmental impact assessment of the project, in consultation with other federal authorities who have the appropriate expertise.

This document includes a summary of the project and the environment in which it will be conducted, the results of public consultations conducted by the proponent, a summary of the main environmental effects, the cumulative effects and the effects caused by accidents or malfunctions that might occur, an outline of the associated mitigation and monitoring measures, determination of the significance of the effects, approval conditions and a preliminary conclusion on the environmental acceptability of the project.

The documents used and that are also part of the comprehensive study report:

- Hydro-Québec (June 2000). Aménagement hydroélectrique de la Toulnustouc. Rapport d'avant-projet [Toulnustouc hydroelectric facility. Preliminary project report.], volume 1, various pagings
- Hydro-Québec (June 2000). Aménagement hydroélectrique de la Toulnustouc. Rapport d'avant-projet [Toulnustouc hydroelectric facility. Preliminary project report.], volume 2, appendices
- Hydro-Québec (October 2000). Aménagement hydroélectrique de la Toulnustouc. Complément au rapport d'avant-projet, Réponses aux questions et aux commentaires du ministère de l'Environnement du Québec, [Toulnustouc hydroelectric facility. Supplement to preliminary project report, responses to questions and comments from the ministère de l'Environnement du Québec.] vi + 107 pp. and appendices
- Roche ltée (November 2000). Évaluation des effets cumulatifs. Préparé pour Hydro-Québec. 37 pp.
- Hydro-Québec (November 2000). Aménagement hydroélectrique de la Toulnustouc. Études complémentaires. Mesures d'atténuation et de compensation pour l'omble de fontaine. [Toulnustouc hydroelectric facility. Supplementary studies. Mitigation measures and compensation for brook trout.] 65 pp. + appendices
- Hydro-Québec (January 2001). Aménagement hydroélectrique de la Toulnustouc. Réponses aux questions et aux commentaires des autorités fédérales concernant le rapport d'avant projet. [Toulnustouc hydroelectric facility. Responses to questions and comments from federal authorities on the preliminary project report.] 103 pp. + appendices
- Hydro-Québec (January 2001). Aménagement hydroélectrique de la Toulnustouc. Informations complémentaires demandées dans l'avis du ministère de l'Environnement du Québec sur la recevabilité de l'étude d'impact. [Toulnustouc hydroelectric facility. Supplementary information requested by the ministère de l'Environnement du Québec on the admissibility of the impact assessment.] 21 pp. + appendices
- Poly-Géo inc. (January 2001). Alimentation à 69 kV de la future centrale de la Toulnustouc. Photo-interprétation et cartographie des éléments environnementaux. [Supplying 69 kV for the future Toulnustouc Facility. Photos and maps of the environmental elements.] Prepared for Hydro-Québec, Engineering department, 47 pp. and field guide

- DFO-CEAA-HQ (4 May 2001). Compte rendu de la réunion tenue à Québec relativement à l'évaluation des effets cumulatifs dans le cadre du projet d'aménagement hydroélectrique de la Toulnustouc. [Minutes of a meeting held in Quebec concerning the cumulative effects assessment of the Toulnustouc hydroelectric facility.] 22 pp.
- Hydro-Québec (May 2001). Aménagement hydroélectrique de la Toulnustouc. Réponses aux questions et aux commentaires des autorités fédérales concernant le rapport d'avant-projet, deuxième série. [Toulnustouc hydroelectric power project. Responses to questions and comments from federal authorities on the preliminary project report. Second edition.] 38 pp. + appendices

2 Project description

2.1 Project context and rationale

The Toulnustouc River is a tributary of the Manicouagan. A single hydroelectric installation, the Sainte Anne dam, currently exists on this watercourse. This dam was constructed to create the Lake Sainte Anne reservoir, first filled in 1957, which makes it possible to regulate the flow which feeds the downstream hydroelectric plants (Manic 2, Manic 1 and McCormick).

Hydro-Québec plans to build a hydroelectric generating station between the Sainte Anne dam and the Manic 2 reservoir in order to exploit the unused potential of the Toulnustouc River, 190 m of gross falls. This project is part of the completion of the hydroelectric development of the Manicouagan and Toulnustouc basins.

Rationale for this project is based on Hydro-Québec's sustained growth and cost-effectiveness initiatives adopted as part of the *2000–2004 Strategic Plan*. According to the proponent's forecast, an increased demand for electricity in Quebec will result in additional sales of 17.4 TWH by 2004, compared to 1999. These additional sales will mainly be to meet the needs of large-scale organizations and industrial growth. The energy required for these additional sales will come from new energy supply sources and a reduction in net sales to external markets (expiry of long-term contracts). The new installations will provide 20% of the energy required to meet this extra demand. Although reduced, net sales to external markets will represent 80% of forecast additional sales (new contracts).

2.2 Hydroelectric facility alternatives

As a result of summary studies to assess the unused potential of the Manicouagan and Outardes rivers, Hydro-Québec undertook a preliminary project study on the Toulnustouc hydroelectric facility in 1997.

Nine technically feasible alternatives were the subject of a comparative analysis of generating stations with an equipment speed of 300 m^3/s (Table 1). Option 5 was retained by the proponent since it represents the most economically interesting option (cost/power ratio of 26% to 84% less than the other options and cost-effective according to market conditions) and since it allows exploitation of 175 of the 190 m of gross head between Lake Sainte Anne and the Manic 2 reservoir, which is almost the river's full potential.

The proponent conducted optimization and environmental impact studies for option five only, since it was the only option that offered optimization potential sufficient for the project to meet the three conditions set by Hydro-Québec:

- Cost-effectiveness (generating station production cost of 3¢/kWh);
- Environmental acceptability; and
- Favourable reception by the local communities.

Table 1 : Comparison of the technical and economic aspects of the alternatives for the development of the Toulnustouc River hydroelectric facility between Lake Sainte Anne and the Manic 2 reservoir (ref. 1, 3)

	Generating capacity (MW)	**Dam location (kilometre of the river)**	**Area of the new body of water (km^2)**	**Maximum operating level (m)**	**Basic cost[A] (millions of 1997 dollars)**	**Cost / power ratio (million $/ MW)**
Options						
1	92	81.2	-	301.75	252	2.7
2	145	67.5	7.8	267	373	2.6
3	240	67.5	22.0	301.75	448	1.9
4	120	60	0.6	205	245	2.0
$4^{modifiied}$	178	60	0.6	205	367	2.1
5	425	67.5	22.0	301.75	632	1.5
Combined options						
1, 2 and 4	357	81.2	-	301.75	870	2.4
3 and 4	360	67.5	22.0	301.75	693	1.9
1 and $4^{modifed}$	270	81.2	-	301.75	619	2.3

[A] Excludes interest and inflation.

2.3 Project definition

2.3.1 Infrastructures

The project requires the construction of retaining structures (Toulnustouc dam and south dike), the levelling of the Sainte Anne dam and repair of the southeast dike. Lake Sainte Anne, which currently covers 213 km^2, will thereby be enlarged by 22 km^2. Construction of the Toulnustouc dam requires the diversion of the watercourse for a year and a half. The diversion tunnel located on the left bank will be designed to allow a flow of 350 m^3/s.

The new generating station, located at kilometre 53.8 of the river, will be equipped with two Francis-type turbine generator units for an equipment speed of 330 m^3/s and an estimated generating capacity of 526 MW. The equipment speed will be greater than 300 m^3/s (value used for the comparative analysis) following the modifications to the design of the intake channel to

reduce pressure loss and, as a result, gain additional power. The Toulnustouc generating station's average annual production will be approximately 2660 GWh.

The generating station will be fed by a 9.8 km intake channel and single water intake barrage bay located approximately 2 km east of the Toulnustouc dam, in a bay created by submergence of the Rooney stream valley. A 1.2 km tailrace canal (0.45 km to the river and 0.8 km of excavation in the river) will return the turbine water to the Toulnustouc River.

A flood spillway with a 3500 m^3/s capacity will be built near the south dike to protect this structure and the Toulnustouc dam from high water. This spillway will have 3 outlets. Two of these outlets will be equipped with openings to ensure minimum flow at all times (e.g., maintenance on one of these outlets) in the 14 km segment between the dam and the generating station.

The generating station will be connected to the Micoua station by a 315 kV transmission line approximately 55 km long. On the roof of the generating station will be transformers to raise the voltage to 315 kV along with some of the switching yard equipment. The rest of the switching yard equipment will be in a switch room located about 165 m from the generating station. A temporary 69 kV line from the Micoua station will power the work site. This distribution line will be made permanent when the construction site is dismantled; it will be used as an additional energy source for the facility's auxiliary services, water inlet and flood spillway.

The access road to the Toulnustouc generating station will require the construction of 12 km of road and the improvement of the Lake Sainte Anne road (an existing earth road) over a distance of 90 km, replacing or repairing bridges and lengthening culverts. Access to the Sainte Anne dam will be provided by the road to lakes Fléché and Provencher, requiring repairs to the road over a distance of 57.7 km and the replacement of small bridges. The Lake Amariton work camp, water intake, reservoir structure, discharge and diversion structures and the southeast dike will be accessible via the Lake Sainte Anne road, existing minor roads and the construction of a new segment approximately 9 km long past Lake Goujon (access to the southeast dike).

Construction of the new Toulnustouc hydroelectric facility will require excavations that will generate large quantities of blasted rock and overburden. Some of the excavated material may be used by the contractor. The excess, about 2 098 100 m^3 of rock and 1 050 150 m^3 of overburden, will be dumped in four disposal areas close to the intake channel. For construction purposes, six potential borrow sites (granular materiel and till) have also been located in the work area.

2.3.1.1 Alternatives considered for the installation of the 69 kV line

The 69 kV transmission line for the Toulnustouc site has prompted an inventory of the elements of the physical environment that would affect the installation of a line (escarpments, rock falls, peat bogs, flood-risk areas, etc.) as well as aspects of the human and biological environment likely to be affected by the project (recreational facilities, canoe-camping routes, trap lines, plant communities, potential wildlife habitats, etc.) (ref. 6).

A comparative study of the elements of the physical environment and the issues with regard to access was conducted for each proposed alternative in order to choose a preferable route (ref. 8).

Comparison of the two routes retained shows that the northern route seems preferable to the southern route, mainly for the following reasons:

- the northern route is shorter by slightly more than 4 km;
- access to both banks of the Toulnustouc River is less of a problem for the northern than for the southern route;
- the number of watercourses intersected is similar for both routes except that the northern route crosses fewer permanent streams narrower than 3 m (16 compared to 22 for the southern route);
- the northern route crosses an area that is generally less prized by local users than the southern route and has a lesser impact on tourist activities (recreational facilities, canoe-camping routes, campsites, fishing, etc.), landscape quality and the activities carried on by the Aboriginals (trapping, fishing, campsites) (ref. 8).

2.3.2 Management of the facility

The maximum operating level of Lake Sainte Anne will again be 301.75 m. The reservoir will store the spring freshet in May and June (ref. 1). Its average operating level will then go from 290 m to 299 m (ref. 3). From July to December, the station will produce an outflow roughly equal to the natural flow and the reservoir level will remain relatively stable at around 299 m. From December to April, the reservoir level will fall gradually to its minimal operating level of 290 m. Accordingly, the year-to-year drawdown in the Lake Sainte Anne reservoir will be 11.75 m after the construction work compared to 26 m at the present time.

The operating mode of the generating station will be determined by the level of Lake Sainte Anne, production requirements and the fact that it has two Francis-type turbine generator units (ref. 1). Daily turbinated flow will generally range from 100 to 300 m^3/s from May to November and 200 to 300 m^3/s from December to February. For March and April, average turbine outflow will be about 120 m^3/s due to the fall in energy demand and water reserves.

In periods of heavy demand for power (from winter to spring freshet), the operating mode can be based on two daily peaks. The flow could reach 360 m^3/s at these peaks (from 6 to 9 a.m. and 5 to 9 p.m.) whereas in off-peak periods it would be around 120 to 140 m^3/s. In winter, heavy demand periods correspond to periods of deep cold and may last from a few days to a few weeks.

It is also possible that the generating station may be used to handle daily peak periods during the summer (from June to October) with flow ranges similar to those in wintertime. According to the proponent, summer peak management of the Toulnustouc generating station reflects a reduction of the equipment pool by maintenance carried out on units in some generating stations and the fact that maintenance on both units in the Toulnustouc generating station could easily be done in late winter before the major spring freshet flows (ref. 3). The Toulnustouc generating station will thus be available to meet the summer demand, when the major peaks should occur with comparable frequency to the ones in the winter.

2.4 Construction cost and schedule

The cost of the new hydroelectric facility on the Toulnustouc is estimated at $632 million and meets the proponent's profitability requirement (production cost at the station in the order of 3 ¢/kWh) (ref. 6, 7). However, this cost excludes any payments to Aboriginal communities or to municipalities for work and corrective programs. Based on the assumption that government

permits are obtained in June 2001, the proponent had planned to start work in July 2001 and get the generating station into service during October 2005 (ref. 1).

3 Environmental assessment and applicable regulations

The project requires an environmental assessment under the *Canadian Environmental Assessment Act* (CEAA) since it will cause a loss of fish habitat, which requires a permit issued under subsection 35(2) of the *Fisheries Act* (FA). This permit triggers the CEAA under the Law List Regulations. Some of the structures proposed in this project are also subject to formal approval under section 5.1 of the *Navigable Waters Protection Act* (NWPA), which is also triggered under the Law List Regulations.

Before a permit under subsection 35(2) of the FA is issued, the proponent has to propose a compensation plan in compliance with the principle of no net loss in fish habitat production capacity as set out in the Policy for the Management of Fish Habitat of the Department of Fisheries and Oceans (DFO). Before formal approval under section 5.1 of the NWPA can be granted, the proponent has to submit a formal application to the Coast Guard Navigable Waters Protection (DFO) and then file all documents concerning the structures with the registry office and place a one month's notice in the *Canada Gazette* and two local newspapers.

As specified by subsection 4(b) of the Comprehensive Study List Regulations, a project to build, decommission or shut down a hydroelectric plant with a production capacity of 200 MW or more requires a comprehensive study-type environmental assessment.

A comprehensive study conducted under the CEAA is a self-assessment approach in which the responsible federal authority looks at a project’s environmental effects before making any irrevocable decisions.

Within the meaning of the CEAA, DFO, through the Fish Habitat Management Division (FHMD) and Navigable Waters Protection (NWP), is the only responsible federal authority for this project. DFO has ensured that the environmental assessment process and the comprehensive study are in compliance with CEAA requirements.

Other federal departments have also been consulted to determine whether they have trusts with regard to this project, whether connected with section 5 of the CEAA or not, and to obtain their respective comments and requirements for their areas of jurisdiction concerning the environmental assessment under the CEAA. These are the Department of Indian and Northern Affairs Canada(DINAC), Environment Canada (EC), Natural Resources Canada (NRCan) and Health and Welfare Canada (HWC). The Canadian Environmental Assessment Agency (CEAA) has also worked on this file on matters of interpretation of the CEAA and methodology.

In terms of provincial procedure, this project was subject to section 31.1 of Quebec’s *Environmental Quality Act*, which requires an environmental impact assessment and study. The Department of Fisheries and Oceans (DFO) and Environment Canada (EC) took part in reviewing the validity of the project study carried out as part of this procedure. Comments were forwarded to the proponent by the Quebec department of the environment under the same cover as those from the various other Quebec departments and agencies involved. The comments of the two federal agencies involved were the same as those produced for the procedure under the CEAA.

4 Scope of the project and of the environmental assessment

The scope of the project includes the construction and operation of the hydroelectric facility on the Toulnustouc River and its area of influence, the enlargement of the existing reservoir, repairs to the dike located in the southeastern sector of the existing reservoir at the Godbout River and the various water crossings necessary for the construction or repair of the access roads and the 69 kV line that will be used to get power to the site. The 315 kV transmission line is not included in the scope of the project since it will undergo a separate environmental assessment by the province in 2001 under section 31.1 of the Quebec *Environmental Quality Act* and in an attempt to co-ordinate the federal and provincial procedures.

The environmental assessment includes study of the project's environmental effects including those caused by potential accidents or malfunctions and the cumulative effects that the project, combined with the existence of other structures or other projects or activities, is likely to cause to the environment.

Environmental impacts as defined by subsection 2(1) of the CEAA are the changes caused by the project to the biophysical environment and the direct effects of these changes on human health, socio-economic conditions, natural and cultural heritage (historical, archaeological, paleontological and architectural) as well as the current use of lands and natural resources for traditional purposes by Aboriginals.

The study also deals with the following:

- the project rationale;
- practicable alternatives or alternative means of carrying out the project;
- the significance of the environmental effects;
- the effects of the environment on the project;
- public comments;
- mitigation and compensatory measures;
- the need for a follow-up program and its requirements; and
- assessment of the capacity of renewable resources that may be significantly affected by the project to meet the needs of present and future generations.

The environmental assessment of the project is also based on the Quebec department of the environment and wildlife guidelines, issued in December 1997, specifying the nature, scope and extent of the environmental impact study, along with specific requirements set forth by federal authorities, such as DFO's Policy for the Management of Fish Habitat concerning compliance of the no net loss principle for fish habitat and the Federal Policy on Wetland Conservation.

5 Public consultation program

5.1 Hydro-Québec communications program and provincial public hearings

5.1.1 Hydro-Québec communications program

This section summarizes the main information found in Chapter 5 of Volume 1 of the preliminary project report produced by the proponent and entitled *Relations with the host*

community. This contains a list of the various organizations contacted and a sub-chapter on the concerns voiced by people consulted.

Since the start of the project in 1999 there have been two public information and consultation tours. An initial general information tour was conducted from June to November 1999. This tour was to facilitate the introduction of the project in its preliminary phase and the compilation of relevant comments and concerns for later study. During this stage, Hydro-Québec held 16 meetings: 12 with 138 individuals and representatives of 35 citizen groups, organizations and associations; one with nine representatives of six Quebec government departments; one with four elected representatives of the county regional municipality (MRC) of Manicouagan; one with some fifty members of the Sept-Îles Chamber of Commerce; one with five representatives of the regional media.

Hydro-Québec also used an organizational participation approach based on the creation of an information and exchange table (IET). The IET for the project included elected representatives of the Manicouagan MRC and the Betsiamites Band Council. It also included environmental, tourism and socio-economic groups such as regional development, tourism, fish and game, snowmobiling and recreational associations. Along with the IET sessions, working and information sessions were also organized to meet specific needs.

Hydro-Québec finally issued a press release concerning the creation of the IET on December 9, 1999. The company also placed two advertising inserts in the regional newspaper to explain the project's latest developments.

5.1.2 Public hearings

In all, 398 people took part in the first round of BAPE public hearings held in Baie-Comeau from January 29 to February 1, 2001. In Betsiamites, 121 people came to the initial round of hearings held on February 5 and 6, 2001. In the second round held in Baie-Comeau on March 12 and 13, 2001, more than 100 people participated. A total of thirty-one (31) briefs were presented by various individuals, groups and organizations.

5.1.3 Concerns and issues raised by the community

The main concerns raised with regard to this project concern:

- local economic spin-offs;
- seemingly incomplete aspects of the study;
- habitat loss;
- Aboriginal trapping lands;
- mercury;
- recreational facilities and access roads.

Some people have also raised concerns about potential erosion problems and the matter of minimum flow which they felt might seriously interfere with habitat and the survival of the brook trout in the part of the river where water will be regulated at 3 m^3/s (citizen’s brief filed with the BAPE on March 13, 2001).

The vast majority of presentations in the BAPE public hearings offered virtually unconditional support for the project, which is perceived as essential to stimulate the regional economy. The

municipalities of Baie-Comeau and Sept-Îles, the county regional municipality and various business and worker associations came to declare their support for the project. However, some citizens stated their concerns with regard to the project's environmental effects and questioned the proponent's assessment.

The concerns raised in the brief filed at BAPE public hearings by the Betsiamites Band Council (mercury in fish flesh, erosion of banks downstream from the future generating station, effectiveness of the fish management measures, access to the territory, cumulative effects, follow-up program) as well as in the brief filed by the Uashat Mak Mani-Utenam Band Council and in the correspondence addressed to DFO (Bicknell's thrush, Lake Sainte Anne bank erosion and contamination of the water and fish flesh) are addressed in the analysis of the project's environmental effects within the project study area.

5.1.4 Hydro-Québec commitments

In some cases, the information provided by the proponent helped to alleviate concerns and satisfy community expectations. Negotiations between the Betsiamites Band Council and Hydro-Québec led to a partnership agreement called the 1999 Pesamite Agreement. This agreement will only come into effect and be implemented if and when Hydro-Québec obtains all the governmental authorizations required for each of its various projects. This agreement deals with the Toulnustouc development and partial diversion of the Portneuf, Sault-aux-Cochons and Manouane rivers projects. A ratification vote was held and the partnership agreement was accepted, with 79.5% of the members who voted doing so in favour of said agreement (ref. 1,). Furthermore, the *Toulnustouc* agreement, signed by the Manicouagan MRC and Hydro-Québec in October 1999, will allow for the creation of a regional development fund.

All of the environmental concerns addressed with regard to this project were dealt with in the various sections of this comprehensive study.

5.2 Public consultations under the CEAA

A period for public comment is provided when the comprehensive study report is filed with the Canadian Environmental Assessment Agency (CEAA). During this period the public will be able to review the document and express their opinions and concerns about the project's environmental effects. In addition, there were 15 requests for documents from the public registry and under the *Access to Information Act* from 1999 to 2001.

5.3 Public consultations under the *Navigable Waters Protection Act*

As required by the *Navigable Waters Protection Act* (NWPA), the proponent places a notice in the *Canada Gazette* and two local newspapers to apprise the public of its project and invite people to share their concerns about navigation.

During the public notice period ending September 11, 2001, DFO did not receive any comments or concerns from the public about the impacts of this project on navigation.

6 Current state of the environment

Chapters 7 through 18 and appendices A through X of the preliminary project report provide a detailed description of the general components and environmental issues involving natural and human environments. The following sections summarize this information.

Four areas were defined to facilitate the description of the host community and environmental effects, namely:

- the present Lake Sainte Anne reservoir;
- the future reservoir area (between the Sainte Anne dam and kilometre 67.5 of the Toulnustouc River);
- the reduced flow area (between kilometres 67.5 and 53.8);
- the altered flow area (from kilometre 53.8 to the Manic 2 reservoir).

6.1 Physical environment

6.1.1 Hydraulics and hydrology

The Toulnustouc River comes into being at the foot of Mont Groulx and covers more than 200 km before flowing into the Manic 2 reservoir, thus draining a watershed of more than 11,000 km^2. This river is a tributary of the Manicouagan and Lake Sainte Anne is actually a reservoir formed by the construction of a dam on the Toulnustouc River. With a total area of 213 km^2, it was developed to regulate the flow into the hydroelectric generating stations downstream: Manic 2, Manic 1 and McCormick. The Sainte Anne dam is the only hydroelectric structure on the Toulnustouc River (ref. 1).

The flow from the Toulnustouc River watershed into Lake Sainte Anne was reconstructed for the period between 1979 and 1998. The daily maximum was 1590 m^3/s and the winter minimum about 10 m^3/s (ref. 1). The hydraulic regime is nivopluvial with a control flow of 212 m^3/s, relatively sustained summer flows for an average of 215 m^3/s and very distinct winter minimums (ref. 1).

The hydrological regime of the Toulnustouc River below Lake Sainte Anne is influenced by the management of the lake/reservoir. This hydrological regime is progressively modified by the flow from downstream tributaries that partly restore a natural hydrological regime to this river. (ref. 1).

6.1.2 Thermal regime and ice regime

Current conditions are outlined in section 9.1 and Appendix C of the preliminary project report (ref. 1, 2). The thermal regime described is based on series of observational data from the Toulnustouc River, series of regional data and calculations of the thermal regime using specialized software.

According to calculations made for the outflow from Lake Sainte Anne, the water temperature reaches 16°C in summer (between mid-July and mid-August) and drops quickly from 12 to 2°C in the fall (October and November). In the winter (December to March), the temperature ranges from 0.7-1.5°C in December, to 0.5-1.0°C in March. In the spring, the water heats up quickly

from April to May. In the Lake Sainte Anne reservoir, freeze-up occurs around the end of November and break-up comes in mid-May.

In the summer, the water temperature below the Sainte Anne dam rises progressively from 1 to 2 °C while flowing towards the Manic 2 reservoir, while in winter it falls to 0°C between kilometres 60 and 70. The river is therefore completely ice-free between the Sainte Anne dam and Caribou Bay (kilometre 72) and partly free as far as kilometre 52.5. The ice cover then forms shore to shore, up to the Manic 2 reservoir, except in the rapids at kilometres 48.3 and 47.

6.1.3 Water quality

Current conditions are outlined in section 10.1 and Appendix D of the preliminary project report (ref. 1, 2). The area studied is relatively unpopulated and free of pollution from municipal, mining or industrial sources. The various uses likely to affect water quality are recreational facilities, forestry and water catchment by the Sainte Anne dam.

Generally speaking, the physicochemical characteristics of the water in the areas studied are typical of major North Shore rivers. The properties of the Toulnustouc River waters are largely determined by those of Lake Sainte Anne, since inflows from tributaries along the river are low, especially in lower-water seasons.

On the whole the water is clear, low in major ions and nutrients and have a low buffering capacity (ability to neutralize acidity). Despite exceeding certain quality criteria set by the Quebec department of the environment (MENV), the proponent feels that the water analysed is of excellent quality.

6.1.4 Banks' sensitivity to erosion

Current conditions are outlined in section 8.1 and Appendix B of the preliminary project report (ref. 1, 2).

In the area of the future reservoir, about 40% of the banks of the Toulnustouc River show low erosion sensitivity while 50% have a strong sensitivity to erosion. On the right bank, only segments that rise sharply or are made up of sandy deposits are erosion-sensitive, while on the left bank most segments recorded are eroding, especially the talus bases made up of sandy deposits.

In the area of reduced flow, about 78% of banks have low erosion sensitivity. Most banks in this area are made up of rocks, blocks, cobble and pebbles. Part of the right bank located close to the planned flood spillway exit, made up of sand and gravel, is seen as moderately sensitive to erosion (ref. 7).

In the altered flow area, most banks are highly erosion-sensitive (76.7%). This area consists of a valley filled largely with glaciofluvial deposits (sand and stratified sand and gravel). Regardless of their height, bank segments made up of these types of deposits are highly unstable and very sensitive.

6.2 Biological environment

6.2.1 Ichthyological fauna and fish habitat

Ichthyological fauna and fish habitat are described in Chapter 12 and in Appendices H, I, J and K of the preliminary project report.

In the segment of the Toulnustouc River between the current Sainte Anne dam and the top of Crans Serrés rapids (kilometre 58), only three species have been recorded: northern sucker, brook trout and burbot. These species are also the only ones known in Lake Sainte Anne. We find five other species below kilometre 54: northern pike, whitefish, pearl dace, round whitefish and white sucker (ref. 1).

Brook trout

Below the Sainte Anne dam, brook trout are present in the upper part of the Toulnustouc River above kilometre 48.

Characterization of potential fry rearing and spawning sites (photo interpretation, aerial view and *in situ* inventories) has identified one potential rearing site in the main channel of the Toulnustouc River and two potential spawning sites (ref. 1, 2). The rearing site found on the river's main channel is located around kilometre 64 in the reduced flow area. No fry have been captured at this site.

The spawning sites are located at kilometre 76 in the area of the future reservoir and in the reduced flow area immediately below tributary T13. According to results presented by the proponent, only four adults were sighted on an initial visit to the site located in the reduced flow area, but no spawners or signs of spawn were seen afterwards (ref. 2).

Generally speaking, the potential fry-rearing sites located in tributaries have an average depth of between 0.1 and 0.7 m and a flow speed ranging from slow to moderate (1 to 50 cm/s) (ref. 1). Brook trout spawning could be confirmed in a single tributary, the one (T28) flowing into the Toulnustouc River just upstream from the airport (future reservoir area).

Densities of young of the year in the river's most suitable sites turned out to be sharply lower than those found in a number of its tributaries (ref. 1). However the abundance of fry in the river proper could not be defined since strong flows made it impossible to do much electrical fishing there (ref. 6). The fishing results therefore do not enable us to state that there are no fry in the Toulnustouc River (ref. 6). However the fry densities in tributaries T5 and T14 (33.3 and 42.5 ind./100 m^2: ref. 5), in the reduced flow area, seem to show that areas conducive to fry development in the Toulnustouc River might be limited and the small average size of these fry indicates that fry habitats in the Toulnustouc River are filled up by the first comers and some fry have to use more marginal habitats where growing conditions are lower.

In short, the accessible fry rearing and breeding habitat on the Toulnustouc River is sparse and probably limited. The inventory results suggest that most of the brook trout in the Toulnustouc River are produced in Lake Sainte Anne and some tributaries of the Toulnustouc, especially tributaries T13 and T28 (ref. 1).

The fishing potential of Lake Sainte Anne has been assessed in a 1990 study (Profaune, 1991). The maximum sustainable yield (MSY), or the quantity of fish that can be taken on a sustained basis by a fishery, has been evaluated from the morphoedaphic index for the brook trout. The

MSY was estimated at 0.34 kg/ha/yr or 2,380 kg for the lake as a whole (ref. 3). Seven of the 10 Lake Sainte Anne tributaries characterized in this study showed, respectively, very good potential for brook trout spawning (three tributaries, including the Fontmarais and Régis rivers), good potential (two tributaries) or poor potential (two tributaries).

Northern pike

Northern pike distribution ranges from kilometre 48 of the Toulnustouc River to the Manic 2 reservoir. Based on the characteristics of the spawning habitat for this species, 11 sites were chosen for fishing and observation (ref. 1).

High quality sites for this species to spawn, like aquatic-grass beds flooded in springtime, are relatively rare. The fairly small flow released from the Sainte Anne dam in the spring somewhat discourages spawning (ref. 1).

Due to the relatively poor quality of characterized sites and the fact that no northern pike eggs were collected or observed, we cannot confirm the existence of spawning sites in the river segment studied. However, given the bigger catches made and the maturity of the gonads noted on specimens harvested, it appears that sites F40 and F41 (kilometres 29.5 and 30) are the most likely to be used for spawning by the northern pike (ref. 1).

6.2.2 Avian fauna

Birds are described in Chapter 14 and Appendix Q of the preliminary project report (ref. 1).

At least 341 bird species have already been reported in the North Shore region and 174 of this number nest there. In and around the project's area of influence, 103 species have already been observed in the mating season, 42 of them associated with wetlands (ref. 3).

Regarding waterfowl, 8 anatidae species were observed in the area of influence in 1999 and 111 individuals counted in the spring, including 36 nesting pairs. Five areas represent potential breeding habitat for waterfowl due to their configuration and the presence of riparian habitat: 1) Caribou Bay and the adjacent network of lakes and streams (km 72); 2) Anctil brook lake north of the Toulnustouc River (km 67); 3) the network of bays and brooks including Rooney brook (km 66); 4) all the islands, shoals and bays located immediately downstream from the site of the future Toulnustouc generating station (km 52); 5) the area on the Isoukustouc River where a number of small bays, aquatic-grass beds and islands can be found approximately 25 km from its mouth.

Six species of raptors and 4 other water bird species were also observed in the area of influence during 1999. However, no raptor nests were found on the cliffs or riverbanks.

Three species likely to be designated as threatened or vulnerable under Quebec's *Act respecting threatened or vulnerable species*—the bald eagle, golden eagle and Barrow's goldeneye—might frequent the area of influence. The presence of the bald eagle was confirmed by the 1999 inventories at Lake Sainte Anne. The golden eagle and Barrow's goldeneye have never been observed in the area of influence. However the latter has been reported several times in the years of monitoring black ducks in lots bordering the area of influence. The horned grebe, a threatened species in Quebec and legally so designated under the *Act respecting threatened or vulnerable species*, was mentioned in August 1959, at Lake Sainte Anne (ref. 3). However, recent

inventories (the *Quebec Breeding Bird Atlas* and the aerial inventories of 1999) did not confirm the presence of the horned grebe in the area under study.

Bicknell's thrush, recently classified as a concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), was documented near the Manic 2 reservoir during the preparation of the *Quebec Breeding Bird Atlas*. Bicknell's thrush is highly selective in its choice of habitat: it prefers conifer stands dominated by balsam fir and white spruce at an altitude above 200 m. It is found in new growth areas following forest fires or logging with a stem density exceeding 17,600 per hectare.

6.2.3 Riparian and aquatic vegetation

Riparian and aquatic plant life is described in section 11.1.2 and in Appendix F of the preliminary project report (ref. 1, 2).

The riparian habitat is limited due to steep, rocky banks and flow velocity. In the Toulnustouc River, riparian habitat occurs on fine or organic deposits as in Caribou Bay and the confluence of Rooney brook and the Toulnustouc. Most of the riparian habitat area borders brooks flowing along valley floors towards the Toulnustouc River or the district's many small lakes.

Within the boundaries of the future reservoir, riparian habitat (the Toulnustouc River, streams and other lakes) covers an area equal to 94.8 ha. In the reduced flow area, there is a major difference in height and the riparian habitat is narrow, covering an area equal to 11.4 ha.

The altered flow area has a smaller drop but riparian habitat is still rare and undeveloped, covering an area equal to 39.5 ha. Two richer areas have been observed in this sector below the future generating station and slightly upstream from the Manic 2 reservoir at the confluence of the Pistuacanis and Isoukustouc rivers.

6.2.3.1 Wetlands

According to Canada's wetlands classification system, there are 3 types of wetlands in the area that will be affected by the enlargement of Lake Sainte Anne: bogs (29.9 ha), kettle marshes (1.5 ha) and floodplain marshes (74.1 ha, corresponding to riparian habitats more than 10 m wide) (ref. 6).

The kettle and floodplain marshes noted in the area of the future reservoir promote sedimentation and are confirmed wildlife habitats (moose, beaver, etc.). The kettle marshes also display great floristic diversity, whereas some areas of the floodplain marshes form part of a major drainage network. The wetlands recorded in the area of the future reservoir also represent potential habitats for rare wildlife species.

No wetlands were recorded in the reduced flow area, whereas the altered flow sector contains 9.8 ha of wetlands, including 1.6 ha of kettle marsh and 8.2 ha of riparian habitat more than 10 m wide (ref. 6).

In the altered flow sector, the kettle and floodplain marshes perform appreciably the same functions as in the area of the future reservoir (sedimentation, potential wildlife habitat, potential rare wildlife habitat). The kettle marshes also display great floristic diversity, while one section of the floodplain marsh is an important example of this category.

6.3 Human environment

6.3.1 Socio-economic and socio-demographic profile

The area under study basically coincides with the North Shore administrative region and the county regional municipality (MRC) of Manicouagan. This MRC covers a total area of 39,462 km^2 and extends west to east from the Betsiamites River to the northeast boundary of Baie-Trinité. It is made up of the following municipalities: Ragueneau, Chute-aux-Outardes, Pointe-aux-Outardes, Pointe-Lebel, Baie-Comeau, Franquelin, Godbout and Baie-Trinité. In 1996, the population of this MRC was 36,271. To the north lies the unorganized territory of Rivière-aux-Outardes, which covers 37,000 km^2 on its own. The manufacturing sector is distinctly more important here than in the North Shore region or in Quebec as a whole. Construction encompasses more than 900 workers in about one hundred businesses. The primary sector employs nearly 740 people, more than 600 of them in the forest industry. Lastly, with 65% of the jobs, the tertiary sector is less significant here than elsewhere in Quebec (ref. 1).

Approximately fifty kilometres west of Baie-Comeau lies the Montagnais Reserve of Betsiamites. In 1998, this community had 3,055 people. The reserve occupies 255 km^2. Beyond the public service sector that accounts for almost all of the permanent full-time jobs, four areas comprise the basic economic activities: forestry, construction, petty trade and traditional activities (ref. 1).

6.3.2 Land use

From the economic standpoint, the Manicouagan MRC represents a resource region where the land is used mainly for its forests, hydroelectric potential and tourist attractions.

Land use by non-Aboriginals is essentially geared to recreation, fishing and hunting. These activities are pursued on free territory. Hunting and fishing can also be practised on properties where outfitters have exclusive rights (ref. 1).

6.3.2.1 Recreation

Recreational activities represent one of the main activities of users within the boundaries of the area of influence. There is a total of nearly 140 cottages, which is relatively dense for a scattered recreation type of use. These cottages are basically found near lakes and streams. Nearly thirty of them are right next to the Lake Sainte Anne road between kilometres 0 and 93. Just over a dozen cottages are within the boundaries of the future reservoir area.

In the area of influence, more than 44% of respondents have owned their cottages for more than 11 years and in 13% of cases the cottages have been standing for over 20 years. This situation accounts for the profound attachment to the area and the settlement sites voiced by vacationers attending the information and consultation sessions organized by Hydro-Québec (ref. 1).

6.3.2.2 Hunting and fishing on free access territory

Fishing is the preferred activity of the cottage owners and casual users consulted. Virtually all of them say that fishing is the only pursuit they practise regularly year after year. Although fishing is also done on Lake Sainte Anne and the Toulnustouc River, the main fishing contingent is found

on the lakes of adjacent territories. The biggest influx on the Toulnustouc comes when the fishing season opens (late May, early June). Brook trout is the main species sought by most fishers (ref. 1).

Fishers, whether they are cottage owners or excursionists, are regular users of the area under study. Almost 60% of them have been fishing for over 10 years. And almost one quarter of the fishers have been going there for more than 20 years. These fishers are especially loyal to the area of influence (ref. 1).

Hunting, though less popular than fishing, is still pursued by a number of vacationers. More than half of respondents have been hunting for more than 10 years. Slightly more than one in five have been hunting for over 20 years. In each of these groups, about 10% more hunters are after small game than after big game (ref. 1).

6.3.2.3 Wilderness travel

Since 1992, a wilderness travel outfit has been offering rabascaw canoe expeditions on Lake Sainte Anne and the Toulnustouc River. These expeditions usually take place in July and August. The routes enable adventurers to cover the northern part of the Toulnustouc as far as Lake Sainte Anne. Another expedition starts on the Toulnustouc at the Sainte Anne road bridge at kilometre 92 and goes as far as the Manic 2 reservoir. They both last 6 days and have attracted some 450 clients over the seasons.

When it comes to snowmobiling, casual users of the area are, with 59% of respondents, proportionally more likely than cottage owners to engage in this activity. The loop trail of the Manicouagan Snowmobilers Association (AMMI) uses the Lake Sainte Anne road since there is no regular winter maintenance of that road. The first 45-km segment then becomes an integral part of Trans-Quebec Trail No. 3 allowing access to the whole North Shore area farther east. AMMI leaders reckon this trail draws between 500 and 1,000 users per weekend day (ref. 1).

6.3.3 Archaeology and heritage

The Toulnustouc River is a major travel route that enabled communities to reach the banks of the St. Lawrence while also affording access to the interior and its wildlife.

In the area of influence, the banks of the Toulnustouc were likely to see two types of human encampments, bivouacs used as trappers, fishers and hunters made their rounds and campsites associated with overland travel, generally for a short-term stay. Sites EaDx-1, EaDx-2 and EaEa-1 (area of the future reservoir) support the theory that the river was used as a travel artery (ref. 1).

6.4 Current use of lands and resources for traditional purposes by Aboriginals

The planned structures will fall within the Bersimis beaver reserve. With an area of 82,600 km^2, this reserve includes the watersheds of the Manicouagan, Outardes and Bersimis rivers. It is subdivided into 87 trapping grounds, divided among the families of the Betsiamites community. On these grounds, the Montagnais devote themselves exclusively to trapping, while fishing and hunting remain accessible to non-Aboriginals.

The present method of dividing land is based on the trapping grounds system set up by government authorities and the family hunting grounds system that reflects an older management model.

The area of influence cuts across four trapping grounds:

- lot 136 covers the upper watershed of the Toulnustouc River, bordering the west bank from Crans Serrés rapids to the mouth of the Pistuacanis River;
- lot 148 is bounded on the south by the Manic 2 reservoir, on the west by the Manic 3 reservoir, on the north by Lake Smith (lot 136) and on the east by the Toulnustouc River;
- lots 149 and 150 include the lower watershed of the Toulnustouc River (ref. 1).

The route of the temporary 69 kV line will cut across two other lots, 135 and 147, while the Lake Sainte Anne road, which will require some repair work, crosses lot 157 between kilometre points 12 and 50 (Betsiamites Band Council brief filed with the BAPE, March 2001).

7 Anticipated effects, their significance and mitigating measures

The method of assessing impacts is described in Chapter 6 of Volume 1 of the preliminary project report, while Chapter 19 summarizes the project's impacts on the main elements of the physical, biological and human environments along with specific mitigation measures (Appendix 1 of this document). The mitigation measures that are integrated into the project design are described in Chapter 4.

The following section summarizes the main environmental effects caused by the project, including those caused by accidents and malfunctions as well as cumulative effects. Mention is also made of the major mitigation measures. For the sake of conciseness, only the main concerns are outlined here.

7.1 Impact assessment methodology

The proponent assessed the impacts before and after mitigation measures were put in place for each component of the natural and human environments. For the physical environment, mention is made of changing elements rather than impacts. The impact assessment approach involves defining project components and the sensitive aspects of the environment and then determining potential interconnections, pinpointing project impacts and establishing their significance.

The significance of impacts, rated as major, moderate or minor, is determined on the basis of four criteria: the value of the affected component, the intensity of the disturbance, the spatial scope of the impact and its duration.

This classification differs from the one used to define the environmental effects of projects under the *Canadian Environmental Assessment Act* (CEAA), where a negative impact has to be defined as significant, not significant or uncertain.

The Department of Fisheries and Oceans (DFO) feels that a major impact corresponds to a significant effect as defined in the language of the CEAA, while a moderate or minor impact corresponds to an non-significant effect.

7.2 Changes in the physical environment caused by the project

7.2.1 Changes in the characteristics of the Toulnustouc River

The key changes in the physical environment would result from the presence and operation of the new portion of Lake Sainte Anne, from the reduction of the flow rate in a section of the river, from flood management and from the management of the generating station.

The reservoir structures would lead to a change in the flow conditions of a 14-km section of the river that would change from a lotic ecosystem to a lacustrine ecosystem. The rebuilding of the southeast dike would also allow the reservoir levels to be raised to its initial maximum operating level of 301.75 m, while the management of the generating station would result in a year-to-year drawdown of 11.75 m as opposed to 26 m at the present time. The 13.7 km with minimum flow would see a 97.6% reduction in the annual flow rate that would drop from 212 m^3/s to about 5 m^3/s, which would result in a reduction in water levels and wet areas as well as a decrease in the currents. For example, the minimum 3 m^3/s flow that would prevail during 2/3 of the year represents a decrease of 1.8 m in the level of the rapids and 3 m in the level of the water bodies in comparison with a 212 m^3/s rate of flow (ref. 1).

The altered flow segment would undergo some significant changes associated with the intensification of the flow rate during peak management periods (deepening of the main channel, downstream displacement of large quantities of sand and gravel, lateral displacements of the main riverbed or channel, erosion of the convex banks and expansion of the concave banks) (ref. 1, 3).

Section 7.3 of this report will deal with the effects of these modifications on the environmental components, particularly the effects of the project on fish habitat.

7.2.2 Bank erosion

The proposed hydroelectric facility on the Toulnustouc River would cause some changes in the drawdown of the water or the hydrologic regime that are likely to increase erosion in various parts of the river.

In the current reservoir, the drawdown would be reduced from 26 m to 11.75 m while the maximum operating level would remain the same. Hence, the water level would remain higher longer and intensified wave-induced riparian erosion is to be expected. According to the proponent, intensified erosion at the new minimum operating level and reactivation of the phenomenon in the already-eroding slopes might occur. The expansion of the reservoir in the flooded section of the Toulnustouc River would create 69.7 km of new banks. Part of them, newly exposed and made vulnerable by the loss or degradation of the current vegetation cover, risk undergoing significant erosion and slope alterations.

Between the dam and the generating station, the flow would be reduced considerably, but the section could occasionally receive the overflow from the spillway that could result in substantially higher flow rates, up to 500 m^3/s. On the other hand, 80% of the banks are relatively safe from erosion and only the part of the river right at the spillway outlet might be disturbed. The proponent is planning to protect the right bank facing the floodway, by placing a riprap there.

In the altered flow segment, the proponent's surveys revealed this section's great sensitivity to erosion. Even though high flow rates should occur less frequently with the operation of the proposed generating station, the proponent expects heightened and accelerated erosion in this trunk attributable primarily to the rapid daily variations associated with the hourly management of peak flows. The proponent anticipates some major changes in the environment, including shrinkage of the banks, deepened areas in the channel, a downstream displacement of sand banks, the filling of some basins, the erosion of certain islands and the lateral displacement of the riverbed (ref. 1, 3). The proponent proposes stabilizing two areas (between kilometres 53.8 and 48.3) by building riprap at the most exposed locations and has studied several stabilization options based on the various scenarios that will appear again during the operating phase. The proponent has come to the conclusion that despite the presence of several areas sensitive to erosion, no infrastructure and no cottage, campsite or building would be affected by the erosion of riverbanks in the altered flow area.

DFO considers, taking into account the implementation of the different mitigation measures anticipated by the proponent as well as by setting up a bank erosion monitoring program in all the areas affected by the project, namely the reservoir (current and new portion) and the reduced and altered flow areas, and taking into account the corrective measures taken in the locations targeted by the follow-up program, that the project is not likely to result in significant adverse effects on bank erosion.

7.3 Project's effects on the environmental components

7.3.1 Ichthyological fauna and fish habitat

The main impacts of the project with respect to the productivity of fish habitats in the targeted area are associated with the construction phase, the filling of the reservoir and the operation of the hydroelectric facility.

7.3.1.1 Construction of infrastructures

In order to exploit the hydroelectric potential of the Toulnustouc River between the Sainte Anne dam and the Manic 2 reservoir, the construction of the following structures is proposed: the Toulnustouc dam (including the upstream and downstream cofferdams), the temporary bypass (including the intake and tailrace canals), the south dike, spillway (including the intake and tailrace canals), the generating station, the facility's water inlet (including the power tunnel), the generating station's tailrace canal as well as the installation of a 69 kV transmission line. The project also includes the modification and rebuilding of existing structures including the southeast dike, the Sainte Anne dam and the access roads.

Some of this work would cause losses by encroaching on or altering the fish habitat. (Table 2)

Table 2 : Area of affected fish habitat and nature of the impacts caused by various components of the Toulnustouc River hydroelectric facility

Structure	Watercourse	Area on the bed of the watercourse (m^2)	Impact on fish habitat
Toulnustouc dam	Toulnustouc Riv.	13,000	Permanent encroachment
Upstream cofferdam	Toulnustouc Riv.	5,900	Temporary encroachment
Southeast dike			
Impermeable upstream blanket	Lake Sainte Anne	35,000	Modification of substratum
Downstream berm	Godbout-East Riv.	5,000	Permanent encroachment
Tailrace channel	Toulnustouc Riv.	24,000	Modification of the bed (substratum, depth, flow concentration)
Cofferdam (dry excavation)	Toulnustouc Riv.	-	Temporary encroachment

7.3.1.2 Area of the future reservoir

The construction of a new dam downstream from the current dam and the levelling of the current dam (Sainte Anne dam) would expand the area of the Lake Sainte Anne reservoir from 213 km^2 to 235 km^2. The expansion of Lake Sainte Anne would result in the creation of a 22 km^2 lacustrine environment and the loss through submergence of a 14 km section of the Toulnustouc River (279 ha) between the current dam and the proposed dam, tributaries (14 ha) and small lakes (32 ha), which in turn would result in the loss of actual and potential spawning grounds as well as brook trout rearing and feeding areas.

In its documentation, the proponent estimates the current brook trout productivity in the watercourses at 72 kg/year, which would be affected by the expansion of the reservoir and the brook trout productivity of the future reservoir at 220 kg/year. These estimates lead to the conclusion that the creation of the new portion of reservoir would result in a positive brook trout production. However, without considering the potential spawning grounds, the proponent also concludes that the submergence would cause the loss of two spawning areas. He therefore proposes to develop two tributaries in the future reservoir area to offset this spawning ground loss and to enhance the productivity in this area. The 320 m^2 spawning area to be managed was calculated to allow a productivity equivalent to 72 kg/year.

The Department of Fisheries and Oceans (DFO) points out that the creation of the reservoir cannot immediately compensate for the loss of a lotic habitat even if it contained the same species. The functions provided by the lotic environment (reproduction, rearing, feeding, shelter) are not all found in a reservoir. Although the brook trout can reproduce in lakes (reappearance areas, clean substratum, etc.), it cannot successfully reproduce in reservoirs because of the drawdown. The proponent will therefore have to ensure that the brook trout will have access to some tributaries in order to reproduce successfully. It must also be noted that the reservoir

constitutes an outcome of the development project and cannot be considered an acceptable compensation measure.

Furthermore, the reference values selected by the proponent to estimate the actual productivity of the future reservoir area came from biological data pertaining to the James Bay populations (Lévesque *et al*., 1996). In the multispecific James Bay situations (presence of yellow walleye, northern pike and sometimes lake char), the brook trout production would be 95% lower. The multispecific communities of James Bay, however, include some piscivorous species, which is not the case of the Toulnustouc fish community in the area of the future reservoir. DFO therefore recalculated the figures used by the proponent in its preliminary project report by considering a 50% reduction rate to better take into account the interspecific competition for the species present in this area of the Toulnustouc. According to these calculations, the current brook trout production would be 579 kg/year in the area of the future reservoir, which includes all the watercourses affected by filling the reservoir (river, tributaries, lakes). By using the ratios presented by the proponent in its preliminary project report, the area of spawning grounds allowing for an equivalent productivity would be 2,573 m^2.

7.3.1.3 Reduced flow area

Downstream from the Toulnustouc dam, the mean annual discharge (MAD) would drop from 212 m^3/s to about 5 m^3/s over 14 km of the river, as authorized by provincial authorities. Such a change in the river's hydraulic conditions would result in many complex and interrelated impacts on the fish habitat, including a reduction in wet area, a reduction in currents and water levels, reaching suboptimal temperatures for brook trout growth during heat waves and the reduction of the wintering habitat by promoting the icing cover of sections in this area. The proponent concludes that the flow reduction would not result in altering access conditions to the tributaries or the creation of new obstacles to fish movement in the river. Filling the reservoir would also result in a temporary but significant reduction in the river's wet area. In fact, the water would be accumulated in the reservoir without any discharge of the operating flow until the level of the reservoir reaches 286 m. To mitigate the project's impacts on the wintering habitat, the proponent proposes to install a spillway sill at kilometre 60.5, which would raise the water level by about 1.1 m at this location and create a water body about 2 km in length. This sill would mitigate the impacts of filling the reservoir by providing an additional refuge for the fish. It would, however, constitute a new obstacle to the movement of fish.

In its arguments for justifying the proposed minimum flow, the proponent indicates that a minimum flow of 3 m^3/s would preserve a weighted physical habitat area (virtual area affected by a value relating to water speeds and levels) equivalent to the weighted physical habitat at the mean annual discharge (MAD) of 212 m^3/s and that the completion of the project would therefore not result in any loss of fish habitat. The analysis of all the available information led DFO to conclude that significant deficiencies in the minimum flow assessment performed by the proponent, especially in the application of the Physical Habitat Simulation Method (PHABSIM), led to exceedingly low results and that a minimum flow of 3 m^3/s, which reflects a 98.6% decline in the river's mean annual discharge over a section of about 14 km, is insufficient.

Under such circumstances, the Department of Fisheries and Oceans (DFO) is responsible for taking a cautious approach and conducted another assessment of the minimum flow. To do this, DFO applied the wetted perimeter method based on the characteristics of the cross sections of the

Toulnustouc River supplied by the proponent. The results obtained were also validated using other methods, including Tennant's method. The findings converged to show that a flow of 30 m^3/s (annual average) reflects the minimum flow value to be maintained in the reduced flow area of the Toulnustouc River and that the instantaneous flow rate should never drop below 10% of the mean annual discharge to prevent severe deterioration of the habitat. A mean annual discharge in the range of 5 m^3/s would prevent the complete drying of the river section located between the proposed dam and the generating station, but would still be far from an ecological minimum flow.

DFO also considers that the general reduction in the flow would result in losses through drying, primarily associated with feeding and growth habitats, which will have to be the object of adequate compensation.

During meetings with DFO staff, the proponent mentioned that the maintenance of a minimum flow as recommended by DFO, i.e. an mean annual discharge of 30 m^3/s and an instantaneous flow that should never drop below 10% of the current mean annual discharge, would have a significant impact on the cost-effectiveness of the project.

In order to make its decision pursuant to the Policy for the Management of Fish Habitat, DFO had to consider different factors on the minimum flow issue in the reduced flow area of the Toulnustouc River. DFO took into account the current state of the river, which is subject to a flow system controlled by management requirements of the Manicouagan hydroelectric generating station. DFO also took into consideration the possibility of increasing the minimum flow depending on follow-up results on the brook trout population, in an adaptive management approach, as authorized by provincial authorities. Lastly, DFO considered the proponent's commitment to follow the no net loss principle of habitat productive capacity, including an eventual increase in minimum flow as an additional mitigation measure. DFO therefore believes that the project complies with the sustainable development requirements of the Policy for the Management of Fish Habitat. However, in keeping with the precautionary approach and to ensure compliance with this policy, DFO requires that anticipated losses of habitat productivity based on a proposed mean annual discharge of $5m^3/s$, during the first five years of operation, be compensated by adequate measures, carried out prior to the start of the operational phase.

Downstream migration at the proposed dam

The preliminary project study indicates that the fish that currently colonize the future reduced flow area would mostly come from Lake Sainte Anne and from some Toulnustouc tributaries. No study was conducted to characterize the fish downstream migration but the hypothesis is based on indirect evidence such as little reproduction in the river (or reproduction with little success) and the low flows from the tributaries that would contribute less to the fish downstream migration than the 212 m^3/s mean annual discharge from Lake Sainte Anne, which is likely to result in a good quantity of brook trout and longnose suckers. The presence of impassable falls also prevents brook trout colonization of this section from downstream. The proponent agrees that it is necessary to maintain a local population of brook trout downstream from the future Toulnustouc dam and proposes to set up a 180 m^2 spawning ground in a tributary located in the upstream part of the reduced flow area to allow a production of about 40 kg/year.

According to the DFO estimate, the actual productivity of the future reduced flow area would instead be 394 kg/year and the spawning area that would allow equivalent productivity will be 1 751 m^2.

In light of the available information, DFO is of the opinion that maintaining downstream migration represents an important mitigation measure for reducing the project's impacts and should be encouraged. However, given the financial and the technical difficulties (difference in elevation, drawdown, etc.) specific to the Toulnustouc project of creating an effective downstream migration structure, DFO deems it acceptable that the maintenance of a self-sustaining brook trout population downstream from the proposed dam, be ensured by fish management measures.

7.3.1.4 Altered flow area

In the altered flow area, the impacts would be associated primarily with the operation of the hydroelectric facility. Besides resulting in the modification of the river's physical characteristics (deepening of the main channel, downstream displacement of large quantities of sand and gravel, lateral displacement of the riverbed or the river's main channel, erosion of the convex banks and expansion of the concave banks), winter and summer peak management would result in rapid habitat changes linked to the flow rate and the water level.

Concerning the brook trout present upstream of kilometre 48, the proponent feels that peak management could influence their distribution on a small scale, without resulting in any predictable impact on their feefing. Downstream of kilometre 48, brook trout are absent and the main species are northern pike and white sucker. The proponent concludes that completing the project would affect the northern pike's general feeding and shelter habitat.

The effects of the generating station's operational mode, however, will be especially marked upstream of kilometre 48, where there is no northern pike, and will gradually drop as one goes downstream. There would also be little change in the section that is currently showing a certain potential for the reproduction of northern pike (downstream from kilometre 30), since the water level is relatively unaffected by the flow of the Toulnustouc River (ref. 1, 6). Changes in the habitat are therefore considered low and will not affect the northern pike's habitat production capacity.

7.3.1.5 Other structures

Other activities, like the construction or repair of access roads and installing a 69 kV power line for the construction site, could have some impacts on the fish habitat.

Opening access roads involves replacing or repairing 11 bridges as well as repairing and lengthening about 300 culverts. In light of the information received and considering the guidelines presented in the *Modalités d'intervention dans le milieu forestier [Forest intervention methods]* (MRN, 2000) methods that will in all likelihood make it possible to limit the impacts of the work on the fish habitat, DFO does not anticipate habitat losses ensuing from the 11 bridges needing to be replaced or repaired or during the repair of the culverts. In the absence of specific data concerning the species present in each of the watercourses crossed, DFO must, however, assume that brook trout are present in each of these watercourses except in the Toulnustouc River, where we find, in the crossing point area (kilometre 92 bridge on the Lake Sainte Anne road), northern pike, lake whitefish, white sucker and longnose sucker. In order to mitigate the impacts of the watercourse crossings on the fish and their habitat, the Department of Fisheries and Oceans (DFO) recommends performing the work outside the existing species' vulnerable periods.

With respect to the work site power line, the proponent provides little information concerning the fish habitat in the watercourses that would be crossed by the 69 kV line. However, considering the nature of the anticipated work, the mitigation measures presented by the proponent are deemed adequate. DFO considers that special attention shall be paid to complying with the following mitigation measures:

- Not to allow any fords;
- Encourage the use of prefabricated bridges (deck laid from one bank to the other) to limit the direct interventions on the approaches and in the watercourses.
- When the installation of culverts is unavoidable:
  - ✓ Install and remove temporary culverts outside the spawning periods of the species of fish likely to be found in the watercourse;
  - ✓ Ensure that no culvert is installed at or less than 200 m upstream of a potential or actual spawning site;
- Ensure that the work performed does not interfere with the movement of fish (upstream migration or downstream migration);
- Perform the work on approaches to the most sensitive watercourses outside the spawning periods of the species of fish likely to be found in the watercourse.

7.3.1.6 Project effects follow-up program

The proponent will set up an environmental follow-up program for monitoring the changes in the environment during and after the construction. This follow-up, whose key components are described in Chapter 21 of the preliminary project report (Appendix 2 of this document), will also make it possible to verify the effectiveness of the mitigation measures and to define the necessary adjustments.

The elements included in the follow-up program seem adequate. The proponent does, however, limit the follow-up of the thermal regime to the reservoir, to the body of water upstream from the Crans Serrés rapids and to the generating station outlet.

Considering that the flow reduction between the proposed dam and the generating station could result in reaching suboptimal temperatures for brook trout growth (> 20ºC), mainly downstream from the Crans Serrés rapids during heat waves, DFO is of the opinion that water temperature monitoring should also cover the area located between the foot of the Crans Serrés rapids and the generating station.

The proponent also concludes that the flow reduction would result neither in the modification of conditions for access to the tributaries nor in the creation of new obstacles to fish movement in the river. DFO will ensure that this element is included in the follow-up to validate the assessment of the anticipated impacts on the movement of fish and to put the necessary corrective measures in place if need be.

7.3.1.7 Fish habitat compensation program

The anticipated impacts of the project's construction and operation on the fish habitat requires authorization issued under subsection 35(2) of the *Fisheries Act* (FA). Pursuant to the no net loss principle advocated by the DFO Policy for the Management of Fish Habitat, such authorization may only be issued if the habitat losses are adequately compensated.

The compensatory measures proposed by the proponent consist in implementing fish management measures in all the appropriate sites of the tributaries or right in the Toulnustouc River in the reservoir area (new portion) and the reduced flow area as well as in the upstream portion of the altered flow area so as to develop the maximum brook trout production capacity of all the targeted sites. The objectives set out in the compensation program are as follows:

- Reach a productivity level of brook trout in the new portion of the reservoir that is equal to or higher than productivity in areas that will be affected by submergence, namely the Toulnustouc River, its tributaries or lakes;
- Maintain the productivity of brook trout in the reduced flow area at a level that is equal to or higher than the productivity corresponding to prevailing environmental conditions before the implementation of the hydroelectric facility project and specified at the establishment of the reference state;
- Maintain the productivity of brook trout in the altered flow area at a level that is equal or higher than the productivity corresponding to prevailing environmental conditions before the implementation of the hydroelectric facility project and specified at the establishment of the reference state;
- Ensure the maintenance of a self-sufficient brook trout population downstream from the future dam up until kilometre 48 after the downstream migration cut.

The effectiveness of the compensation program will be measured through a multi-year follow-up program that will focus on the integrity and the use of the fish management measures as well as on the brook trout productivity and the fish population's dynamics in the reservoir (current and new portion), the reduced flow area and the altered flow area. Beforehand, the proponent will have to establish a reference state of fish productivity covering a three-year period prior to the filling of the reservoir in order to determine the actual production of the different areas affected by the project. The follow-up program, whose evaluation method and sampling procedures will be developed jointly with DFO, the proponent and provincial authorities, will attempt to verify predictions of the maintenance of production capacity, while taking into account the effectiveness of compensatory measures and potential increases of minimum flow in the reduced flow area.

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

7.3.2 Avian fauna

The anticipated impacts on avian fauna are described in section 14.2 of the preliminary project report (ref. 1).

During the construction phase, the impacts on the avian fauna would be associated primarily with the building of the infrastructures and the structures as well as the filling of the new portion of Lake Sainte Anne. Waterfowl and raptors would suffer disruptions caused by the work itself as well as a loss of habitat caused by the clearing and the stripping necessary for the construction of

the infrastructures and the structures (work site facilities and camp, granular borrow pits and excavated material disposal sites, right-of-way for the 69 kV line, area of the future reservoir).

However, in order to reduce part of the impacts of the construction of infrastructures and filling of the new portion of the Sainte Anne reservoir, Environment Canada (EC) recommends proceeding with the clearing, vegetation removal and the filling of the reservoir outside bird nesting season.

Depending on the bird species, the reproduction season can began very early in the spring with nest-building and go right to the end of summer for species with two or three broods. All these factors have to be taken into account then in order to set a time during which the clearing and vegetation control work will be least disruptive for birds.

Pursuant to section 6a of the Migratory Birds Regulations: *"no person shall disturb, destroy or take a nest, egg, nest shelter, eider duck shelter or duck box of a migratory bird…"* The proponent must therefore comply with these regulations and forego work that could bring harm to birds during their reproduction season.

The construction of the infrastructures and the filling of the new portion of the Sainte Anne reservoir would cause the loss of 1,770 ha of terrestrial habitat and 95 ha of aquatic habitat. The proponent proposes installing a few nesting boxes to compensate the loss of hollow trees used by waterfowl for nesting.

The effectiveness of this mitigation measure is closely linked to the follow-up and maintenance program that is usually linked to the installation of waterfowl nesting boxes. After a few years without maintenance, the nesting boxes fill up and become unusable and useless for the waterfowl. For this reason, EC recommends that the installation of the nesting boxes be accompanied by a 15-year follow-up and maintenance program.

Among the species at risk likely to frequent the study area, only one immature bald eagle was seen during the 1999 inventories but no nest was seen. Since the new portion of the Sainte Anne reservoir does not shelter species at risk during the nesting period, EC concludes that the impacts on avifauna will not be significant.

7.3.2.1 Bicknell's thrush

In September 2000, specialists from the Canadian Wildlife Service (CWS) indicated the absence of Bicknell's thrush from the list of species at risk likely to frequent the study area. This species had been seen in the Manicouagan River watershed at the time of the work on the *Quebec Breeding Bird Atlas*.

Bicknell's thrush is very selective in its choice of habitat: it frequents conifer stands dominated by balsam fir or white spruce located at altitudes of more than 200 m. It is found in new growth areas following forest fires or logging operations, and where stem density is greater than 17,600 per hectare.

The expansion of the Sainte Anne reservoir would cause the loss of five fir forest stands totalling 10.04 ha (ref. 10: Table 11 and Appendix D). Analysis of the forest data revealed that the highest stem density per hectare was seen in stand No. 528 with 3,800 fir stems. This value is lower than the minimum stem density found in habitats frequented by Bicknell's thrush (Yves Aubry, CWS).

Consequently, EC is of the opinion that the probability of finding Bicknell's thrushes in the study area is low and that carrying out the project should not cause a significant impact on this species.

7.3.2.2 Route of the 69 kV Micoua-Toulnustouc electrical transmission line

EC also studied the route proposed by Hydro-Québec for the 69 kV Micoua-Toulnustouc line that would power the work site and would subsequently serve as an additional power source for the generating station's auxiliary services, the water inlet and the spillway (ref. 10: forest maps). The preparation of the right-of-way would cause the clearing of 28.4 ha of fir forests (ref. 10: Table 12 and Appendix D). Once again, the fir stem density per hectare is lower than the minimum fir stem density found in the habitats frequented by Bicknell's thrush. Consequently, EC is of the opinion that probabilities of finding Bicknell's thrushes in the study corridor are low.

The preparation of the right-of-way would cause a temporary loss of habitat. EC is of the opinion that the impacts of preparing the right-of-way on the avifauna will not be significant. However, EC recommends maintaining the right-of-way mechanically.

The Department of Fisheries and Oceans (DFO) is of the opinion that the project's effect on the avifauna may be deemed not significant to the extent that the proponent complies with the above-mentioned mitigation measures.

7.3.3 Riparian and aquatic vegetation

The project's impacts on the riparian and aquatic vegetation are described in section 11.2 of the preliminary project report (ref. 1).

The construction and repair of access roads would result in the loss of small riparian habitat areas associated with the watercourse crossings. The largest losses, however, would be linked to filling the new portion of Lake Sainte Anne, which would result in the submergence of 94.8 ha of riparian habitats. The banks of the new body of water would support the development of relatively poor riparian vegetation because of the erosion of the banks, the inadequacy of the substratum and the year-to-year drawdown. Some riparian habitats could, however, develop at certain sites, such as the mouth of the tributaries where the effect of the drawdown would be lessened.

In the reduced flow area, controlling and reducing the flow would, in the long term, result in an 11 ha decrease in the riparian habitat area in this sector. In the altered flow area, the hourly peak management would result in the general depletion of the riparian habitat up to about kilometre 40 and the loss of riparian habitat, especially in the richest areas located immediately downstream from the site of the future generating station.

The project's impact on riparian and aquatic vegetation is deemed medium by the proponent (ref. 1).

7.3.3.1 Federal Policy on Wetland Conservation

The primary objective of the Federal Policy on Wetland Conservation (FPWC) is to promote the conservation of Canada’s wetlands to sustain their ecological and socio-economic functions, now and in the future (Government of Canada, 1991). The policy intends that there be no net loss of wetland functions: 1) on federal lands and waters; 2) in areas affected by the implementation of

federal programs where wetland loss or degradation has reached critical proportions; and 3) in areas where federal activities affect wetlands designated as ecologically or socio-economically important for a region.

The wetlands affected by the Toulnustouc hydroelectric facility project meet none of the above-mentioned conditions. At the request of the Department of Fisheries and Oceans, the proponent has, however, considered the Policy and assessed the functions of the wetlands that would be affected by the project and the losses (areas, functions) or alteration in the functions stemming from carrying out the project.

To comply with this principle of no net loss of functions, the recommended approach contains three steps that consist of:

- avoiding the wetlands;
- reducing as much as possible the inevitable encroachments into the wetlands;
- mitigating and compensating the wetland functions that will be affected by the project.

However, since this is a policy, its enforcement is not rigid and its objectives can be reached in several ways. For example, some of the projects that might be proposed as part of a program to compensate the fish habitat losses might also meet the FPWC objectives.

The expansion of the Lake Sainte Anne reservoir would result in submerging lowlands, which would result in the inevitable loss of 105.5 ha of wetlands, 74.1 ha of which reflect riparian habitats wider than 10 m.

To compensate the wetland area losses, the proponent proposes to enhance certain wetlands situated on the periphery of the proposed reservoir or to create new wetlands in this area by diking bays, placing a sill in a tributary or diking a stream.

Currently, seven sites have been selected to receive such treatments. If they are not planned with care, these treatments could turn out to be ineffective or cause adverse impacts on the fish habitat. Certain structures could, for example, constitute obstacles to the movement of fish.

The project's effect on the riparian vegetation and the wetlands is deemed not significant to the extent that the proponent complies with the above-mentioned compensation measures. However, the plans and a detailed description of the proposed mitigation measures will have to be presented to Environment Canada (EC) and Fisheries and Oceans Canada beforehand for evaluation and approval.

7.4 Effects of the environmental changes on the physical and cultural heritage

The construction of the infrastructures and the structures, as well as the filling of the new portion of Lake Sainte Anne, constitute the main sources of impact on the archaeological resources in the area of influence (ref. 1).

To avoid any impact associated with the construction phase, the proponent will conduct a supplementary archaeological potential assessment (ref. 1). The sites identified in the areas of the future reservoir will also undergo full archaeological excavation, prior to any intervention anticipated during the construction phase, to recover all the relevant data since filling the reservoir will result in submerging these sites.

Considering the measures that will be taken, the effects of the project on the physical and cultural heritage is deemed not significant.

7.5 Effects of the environmental changes on human health

The creation of a new body of water usually results in the release into the water of easily assimilated organic mercury (methyl mercury) whose concentration rises with each trophic level in the aquatic food chain. We usually witness a rapid rise in the level of mercury over the course of the first years following the filling and then a return to initial levels within the next fifteen to twenty years.

An analysis of the current mercury level in fish flesh was done for the main species in the Toulnustouc River and Lake Sainte Anne: brook trout, northern pike, northern sucker and lake whitefish; the change in mercury concentrations in fish flesh after the filling was estimated using a semi-empirical simulation model (Table 3).

Table 3 : Current and future mercury concentrations in fish flesh and consumption frequency suggested according to the Guide to eating freshwater sport fish (ref. 1: Table 12-9)

Species	Current Hg concentration (mg/kg)	Current number of meals per month**	Future maximum Hg concentration (mg/kg)	Future number of meals per month
Area of the future reservoir				
Brook trout (300 mm)	0.21	8	0.31	8
Brook trout (400 mm)	0.31	8	0.45	8
Northern sucker or lake whitefish (400 mm)	0.25	8	0.36	8
Reduced flow and altered flow area				
Brook trout (300 mm)	0.11	8	0.21	8
Brook trout (400 mm)	0.17	8	0.31	8
Northern sucker or lake whitefish (400 mm)	0.14	8	0.25	8
Northern pike (700 mm)*	0.94	4	1.24	3

* Altered flow area only

** Considering a permissible exposure of 0.47 µg of mercury/day/kg of body weight, a adult with a body weight of 60 kg and a portion of 230 g (8 ounces) per meal.

The maximum anticipated increases in fish flesh mercury levels should not result in a decrease in the consumption frequency currently recommended for adults in general. On the other hand, the concentrations anticipated in northern pike and brook trout immediately downstream from the generating station could reach similar concentrations if they feed on the small fish coming from

the new portion of the reservoir, which, injured by going through the turbines, would become easy prey. A consumption frequency higher than that recommended could therefore result in mercury exposure levels higher than those deemed safe (ref. 1).

To minimize the human health risks, the proponent will monitor mercury levels in fish flesh and also produce, in collaboration with regional public health stakeholders, an information leaflet on the mercury issue in this region. This leaflet will contain, among other things, information on the eating habits that should be adopted by pregnant women, or those planning to be, as well as those who are breastfeeding (ref. 6).

These measures adequately satisfy Health Canada's questions and recommendations.

The earth sciences sector of Natural Resources Canada (NRCan) reviewed the documents received and conducted a more thorough review of a few documents pertaining to the release of mercury in reservoirs. This review confirms the effectiveness of the empirical model used by Hydro-Québec to predict the temporal evolution of the mercury levels in fish flesh. On the other hand, the great variability of the mercury levels in the boreal environments of Quebec and the eastern continent remains to a great extent unexplained. In the opinion of NRCan, the characterization of the geochemical composition of the land that will be affected by filling the new portion of the reservoir would have allowed a better assessment of the potential heavy metal remobilization and the environmental repercussions associated with this problem. In the absence of this information, NRCan recommends that the remobilization of mercury be conducted within the follow-up program prescribed by the proponent on the water quality of the future reservoir and that NRCan be consulted during the development of the follow-up program.

The effect of the project on human health, in terms of risks associated with mercury, is deemed not significant considering the preventive and follow-up measures put in place.

7.6 Effects of the environmental changes on the socio-economic situation

7.6.1 Economy and employment

The construction work for the new facility would create economic benefits estimated at $211,200,000 for the North Shore region. The aggregate spending linked to the project would generate, over a 5-year period, about 1,000 person-years of employment, or an average of 222 person-years. This is a significant positive impact (ref. 1).

7.6.2 Land use

The types of land use that would be affected during the construction and operating phases would include the submergence of certain recreational areas, the loss of fishing sites on the Toulnustouc River, large and small game hunting, rabascaw canoe and snowmobile excursions (ref. 1).

7.6.2.1 Fishing

The transition from a lotic to a lacustrine environment in the area of the future reservoir would cause the loss of a whitewater fishing area comprising the major portion of the fishing sites on the Toulnustouc River. These sites are of special interest because of their location on a river

rather than on a body of water. Sites that are conducive to this type of fishing are relatively rare in the area of influence as elsewhere in the regional area.

The changes made by the project in the reduced flow and altered flow areas would also result in a decline in the quality of fishing on the Toulnustouc River. The new portion of the reservoir would, however, offer new opportunities for lacustrine fishing.

Close to half of the fishing sites identified on the Toulnustouc River are located in the future reservoir area. Whitewater fishing constitutes the primary interest for vacationers located close to the landing strip. The latter, however, would be located further downstream (ref. 9). The Toulnustouc reservoir would also offer new opportunities for lacustrine fishing, which should translate into more visits in the area of the future reservoir (ref. 4). Furthermore, close to 80% of respondents said they fished on lakes of adjacent lands.

According to the proponent, the impact of the project on land use, including use of the Toulnustouc River for sport fishing, would appear to be negative overall yet of little significance. Considering that the vast majority of fishers are found mostly on the lakes of adjacent lands, as well as new opportunities associated with the new body of water, the impact of the project on sport fishing is deemed not significant.

7.6.2.2 Recreational facilities

The expansion of Lake Sainte Anne should provide new opportunities for establishing camps or cottages. Permanent access to the facility, the repair of the forest roads and the maintenance of an inter-shore link via the bridge at kilometre 92 would enhance the territory's accessibility to the land for recreational facilities (ref. 1). It is also anticipated that just over a dozen cottages and an in-service landing strip would be affected by the submergence of the new reservoir. The proponent proposed to lease holders of the recreational facilities compensation or the possibility of relocating them on the land, following discussions with each recreational facility concerned and the lands branch of Quebec's ministère des Ressources naturelles (ref. 1).

7.6.2.3 Navigation

Raising the Lake Sainte Anne water levels should have a positive impact on the development of canoeing along the Sainte Anne, Bouffard, Fortin and Caron lakes. The new navigability conditions on Lake Sainte Anne, including the improvement of its road accessibility, should also have a positive impact on the development or maintenance of navigation activities on the Toulnustouc River. (ref. 1)

In the reduced flow area, navigation may not be practicable, as is already the case now, where the many falls and high flow rates make navigation perilous over most of this section.

In the altered flow area, the rise in the level associated with peak periods would be felt mostly up to the level of the bridge at kilometre 92, lessening rapidly thereafter further downstream. According to the proponent (ref. 6), the flow modifications would result in a gradual alteration of the level that would not endanger the safety of the users and would not prevent the practice of downstream activities.

Experts from the Coast Guard Navigation Protection Program (Fisheries and Oceans Canada) are of the opinion that these different conclusions and compliance with the conditions associated

with the formal approval to be issued under the *Navigable Waters Protection Act* (NWPA) will ensure navigation safety in the area and that the project will not cause a significant adverse effect on navigation.

7.6.2.4 Snowmobiling

The winter maintenance of the Lake Sainte Anne road between Baie-Comeau and the Toulnustouc generating station would result in the disappearance of a portion of the trails presently used by the region's snowmobilers and the snowmobilers travelling east or west (ref. 1).

To mitigate the anticipated effects on the local and regional infrastructures, the proponent identified, in collaboration with representatives of the Quebec Federation of Snowmobile Clubs (FCMQ) and the AMMI, some alternative routes for both the No. 3 Trans-Quebec trail and the loop trail. In the case of the No. 3 Trans-Québec trail, the new route is located closer to highway 138 thereby facilitating refuelling and providing greater safety for snowmobilers. The FCMQ and the AMMI deemed these measures appropriate and adequate (ref. 4).

The trail relocation project presented by the AMMI snowmobile club is currently being studied by the Department of Fisheries and Oceans (DFO) and will be handled separately from the present project.

In light of sections 7.6.1 to 7.6.4, DFO is of the opinion that the effect of the project on land use are deemed not significant.

7.7 Effects of the environmental changes on the current traditional use of the land and resources by Aboriginals

During the construction phase, the impacts on land use would arise from the construction of infrastructures and structures, the presence of workers as well as from filling the new portion of Lake Sainte Anne. During the operating phase, the impacts on the Aboriginal community's activities would arise from the presence of the new portion of Lake Sainte Anne, the management of the generating station, navigability in the section of the river downstream of the km 92 bridge, trapping in the altered flow area and from the presence of the access road.

Despite recent data, it is too early to confirm that the downward trend of traditional activities will continue in future years. The Betsiamites Band Council signed an agreement with Hydro-Québec, containing measures that would sustain traditional activities. It is possible that there may be a significant increase in activity just like in the Montagnais territory of the Saint-Marguerite basin (ref. 4).

With regard to lot 157, an area of this lot would intersect with the Sainte Anne road. For both construction and operation phases, the flux of traffic on the road should be higher than it is at the present time. These repairs would entail slightly negative effects on land use by the Montagnais. During operation phase, it is expected that the increased land use could be a minor source of disturbance for the Montagnais users yet provide easier access to their trapping line (ref. 9).

A study on the 69 kV line assessed the probable direct impacts of setting up such a facility on land use by the Montagnais, which were estimated as being slightly negative in the short or

medium term. Users of the northeast portion of lot 147 hunt grouse, hazel grouse and ptarmigan within the right-of-way that they use to get to their operating areas. The works (clearing of right-of-way, development of access ways and watercourse crossings, vehicle traffic, presence of the transmission line) would also have low impacts in the short and medium terms on places that are conducive to hunting, fishing and trapping located on the banks of watercourses (Vallant, Manicouagan, Landry, Isoukustouc, Jourdain and Toulnustouc rivers). However, impacts related to the development and the use of access ways should be restricted to the construction period (ref. 9). The construction and the presence of the 69 kV line would not, however, be such as to significantly modify known activities. Expected effects are deemed negligible to low (ref. 9).

The expansion of Lake Sainte Anne would result in the loss of or make inaccessible an area located on the river's left bank between the Sainte Anne dam and the Toulnustouc dam, which would have the following consequences (ref. 1):

- the submergence of the camp located in close proximity to the Sainte Anne dam;
- the partial submergence and inaccessibility of the small game hunting ground located in close proximity;
- the loss of the whitewater fishing area located at the foot of the Sainte Anne dam; and
- the inaccessibility of the moose hunting area currently located at the approaches to the Lake Sainte Anne road (kilometres 124 to 137).

The new portion of the reservoir would, however, provide new opportunities for lacustrine fishing while the land adjacent to the new road on the right bank would in all probability offer a good small game potential.

The construction of the infrastructures and the structures should not have a significant effect on the Montagnais' land use since they do not make use of the areas neighbouring the sites involved. On the other hand, access to certain areas may be more difficult because of the security measures surrounding the work zones and the presence of the workers would substantially increase the traffic on the Lake Sainte Anne road for the duration of the construction period.

After the road repair work, the territory's increased accessibility would encourage visits to the Toulnustouc River basin by non-Aboriginals, which may cause certain Aboriginal users to move their facilities in order to go about their activities more peacefully.

Overall, the project's negative impact on land use by the Aboriginal community is deemed moderate by the proponent.

To limit the impacts on traditional activities, the Department of Indian and Northern Affairs Canada(DINAC) specifically recommends that the mitigation measures pertaining to terrestrial fauna proposed in the BAPE report be put in place: the modification of the reservoir's filling in order to lengthen the filling time and reduce the risk of mortality among certain mammals; the environmental follow-up of this activity; as well as moving the beaver colonies present on the part of the Toulnustouc River that will be submerged as a result of carrying out the project.

DFO is of the opinion that the impact of the project on Aboriginal traditional activities will not be significant. The method for filling the new portion of the reservoir will have to be developed so as to minimize the impacts on small mammals, ichthyological fauna and avifauna.

7.8 Effect of the environment on the project

Natural events such as floods and earthquakes were taken into consideration by the proponent. The study of reservoir structure failures focused on the Toulnustouc dam and on the southeast dike. Because of its nature, the failure of the Toulnustouc dam structure would have the most effects (ref. 3).

The Toulnustouc development also involves rebuilding the southeast dike located upstream from the Godbout River watershed. The failure of this dike has already been studied (Hydro-Québec, 1986). Since Lake Sainte Anne would be somewhat enlarged, this study's findings appear in Appendix A of the supplement to the preliminary project report (ref. 3).

Since the Toulnustouc dam is a rough fill structure with an upstream concrete apron, the hypothesis suggests a gradual failure lasting 30 minutes. Given the size of the wave front that would result from the failure of the Toulnustouc dam, subsequent failures of the Manic 2, Manic 1 and McCormick reservoir structures must be considered. Such failures would occur as a result of an up-swash cresting at 1.5 m higher than the structures (ref. 3).

The failure study, which takes into consideration the propagation of the wave front, was conducted between the Toulnustouc dam and the mouth of the Manicouagan River. The main findings that emerged are the following:

- At the height of the Toulnustouc dam breach, the maximum flow would be 87,700 m^3/s (in the range of 1,000 m^3/s three days after the failure);
- At the Manic 2 dam, the maximum flow would be greater than 57,000 m^3/s, reached 5.4 hours after the beginning of the Toulnustouc dam failure;
- At the Manic 1 dam, the maximum flow would be greater than 55,000 m^3/s, reached 14.8 hours after the beginning of the Toulnustouc dam failure;
- The area that presents the greatest risk for flooding is located downstream from the Manic 1 dam, first on the left bank, flooding part of the Mingan sector of the city of Baie-Comeau and then on the right bank, flooding of part of the Pointe-Lebel sector situated close to the Baie-Comeau airport. The section of Highway 138 located downstream from the Manic 1 structures would also be affected, with a maximum rise in level in the range of 11 m occurring about 15 hours after the beginning of the Toulnustouc dam failure (ref. 3).

A failure study on the southeast dike has already been done in 1986 (Hydro-Québec, 1986) and its main findings are still valid because Lake Sainte Anne's maximum operating level will remain the same, at 301.75 m. The only notable difference is related to the fact that the volume of retained water would be about 18% greater. It appears that this difference would have little impact, only the spillover time would be prolonged (ref. 3).

7.9 Impacts caused by accidents or malfunctions

Hydro-Québec has a monitoring program that provides for periodic inspections and behaviour studies on its structures. They are, moreover, equipped with the auscultation instruments necessary for monitoring and analyzing the behaviour of the structures, which would also be the case for the new structures. The maintenance program consists of preventive and curative maintenance for the structures, based on the findings of the behaviour studies (ref. 3).

The proponent describes its emergency measures plan in Chapter 4 of Appendix A in the supplement to the preliminary project report (ref. 3). It contains the logic diagram for the dam

emergency actions, the diagrams on the communication processes in the event of various emergency situations. In the construction phase, a temporary emergency plan is anticipated. This plan takes into account the dangers with effects on personal and property safety, describes the measures anticipated for protecting the population and the environment should an accident occur and provides the coordinates of the people in charge on the premises (ref. 3).

In light of the information in sections 7.8 and 7.9, DFO deems the identification of impacts concerning this matter as satisfactory, as well as proposed prevention measures, intervention measures and emergency plans.

7.10 Effects of the project on renewable resources

Renewable resources such as the forest and fisheries have been identified as elements requiring analysis with respect to the effects brought on by the proposed project.

The clearing and stripping work as well as the filling of the new portion of the reservoir would affect a forest that has already been logged and is primarily composed of resinous new growth softwood stands and mixed new growth stands. In addition, the volume of lost allowable cut is less than 1% of the annual allowable cut of the common area that would be affected by the project (ref. 1). Beyond the mitigation measures associated with the restoration (reforestation) of disturbed environments proposed by the proponent, no measure can compensate the losses that will result from filling the reservoir. Impacts on the forest will, however, be limited to the project's construction phase.

Fisheries should not be affected since the lost habitats will be compensated by some measures intended to maintain brook trout productivity in the areas affected by the project.

DFO believes that the project is not likely to cause significant effects on renewable resources making up the forest and the fisheries.

7.11 Cumulative effects

This section serves as a summary of the different sections dealing with the subject, as well as of the meeting held between federal authorities and the proponent to clarify the assessment of this development project's cumulative effects. The method used and the handling of these effects are in accordance with the requirements of the *Canadian Environmental Assessment Act* (CEAA) in this matter.

The method used is very broadly drawn from that advocated in the Canadian Environmental Assessment Agency's document. The major steps in this approach are briefly described. Step 1 consists of determining the importance of the problems and the priorities by identifying the issues and the related valued ecosystem components (VECs), by establishing the spatial and temporal boundaries and by determining the other projects or activities whose negative effects could add to those of the project. The second step consists of analyzing the effects by describing the reference status and by assessing the cumulative effects. The third step consists of defining the mitigation measures while the fourth step permits the assessment of the significance of the residual effects. Lastly, the fifth step identifies the follow-up required (ref. 4).

The valued ecosystem or environmental components (VECs) represent elements of the natural and human environment with a special value in the project region. VECs were identified in

consideration of the regional stakeholders met by the proponent as well as the knowledge of specialists who studied the land (ref. 4). Environmental issues as well as related VECs are presented in the following table.

Table 4 : Environmental issues, valued environmental components and indicators retained for the purpose of cumulative effects assessment (ref. 4: Table 2)

Environmental Issues	Valued Components	Indicators
Fish resources	– Brook trout	– Available habitats – Interspecies competition – Production
Land use for recreotourism purposes	– Sport fishing	– Visits to land – Success of fishing
	– Recreational facilities	– Number of cottages
	– Wilderness travel	– Land accessibility – Km of trails – Navigability
Land use by the Montagnais of Betsiamites	– Camping sites – Trapping activities	– Number and quantity of sites – Accessibility to resources – Number of Aboriginal cottages – Abundance of resource (beaver)

The spatial boundaries for assessing the cumulative effects of the Toulnustouc project were adjusted according to the three major issues considered. Hence, for the fish resources, the spatial boundaries cover Lake Sainte Anne and the Toulnustouc River up to the Manic 2 reservoir, as well as the sub-watersheds draining into them (ref .). The potential effects beyond these boundaries can be considered negligible (ref. 9).

With respect to land use by Aboriginals, the area considered also covers the following seven trap lines: 135, 136, 147, 148, 149, 150 and 157. The study area covers the project's entire area of influence, considering that the 69 kV line and the repair of the Lake Sainte Anne road are integral parts of the project (ref. 9).

Finally, in terms of land use for recreotourism purposes, the spatial boundaries extend to the Manicouagan RCM. This territory covers a total area of 39,462 km^2 (ref. 9).

The temporal bounds of the study were set at ± 10 years from 2000, or from 1990 to 2010. The ten-year limit for past projects is intended to take into consideration changes in the environment without necessarily covering the entire history of the development of the dam and the creation of Lake Saint-Anne (ref. 4). Beyond these limits, Hydro-Québec considers that the possible effects will not be significant.

The following list presents other projects or activities that may (or have had) effects that are likely to add to those of the Toulnustouc project during the period from 1990 to 2010:

- reduction of the maximum operating level of Lake Sainte Anne (as of 1996);

- construction of the 315 kV line;
- logging (including the road network);
- Parc Boréal du Saint-Laurent.

No mining operation project has been identified in the project's area of influence and there is no claim (mining claim) or surface mineral prospecting licence in the area of the future reservoir (ref. 4). The projects and initiatives of the Montagnaise community of Betsiamites, which deal primarily with reserve land development, were not considered because they did not intersect with the study area of the Toulnustouc hydroelectric facility and will be carried out outside of defined spatial boundaries for the assessment of cumulative effects on land use by the Montagnais (ref. 4, 9).

7.11.1 Fish habitat

Different types of projects (filling, hydrodynamic modification, dredging, etc.) are likely to cause a loss of fish habitat and thereby must be compensated in order to comply with the principle of no net habitat loss as set out in the Policy for the Management of Fish Habitat of the Department of Fisheries and Oceans (DFO).

In its assessment of the cumulative effects on fish habitat, the proponent retained two human activities besides the Toulnustouc project that are likely to create a fluctuation in the brook trout resources and its habitat in the project's area of influence, namely logging and the reservoir's management. In addition to this, there is the construction of the 315 kV line.

Logging could have significant effects on the fish resources. The clearing of extensive areas accelerates and increases drainage and the flow rate in watercourses. It promotes surface and bank erosion (ref. 4). According to available information, interventions intersecting with defined spatial boundaries for the evaluation of cumulative effects on fish resources are primarily silvicultural works (plantation and thinning), which were conducted or will be conducted between 1997 and 2001, while as of 1990, there was no forest harvest in areas likely to affect brook trout populations of Lake Sainte Anne and of Toulnustouc River (ref. 4). Completed silvicultural work could potentially give rise to habitat changes in tributaries associated with the slowdown of drainage water and surface erosion. For the next 10 years, most of the targeted operating areas are located outside the basin flowing into the Toulnustouc and already have a network of bush roads (ref. 9). Considering the territories affected by the known and anticipated interventions within the temporal bounds, the residual effects of the logging industry are in all probability not significant (ref. 9).

The maximum operating level of the Lake Sainte Anne reservoir went from 301.75 m to 296 m in 1996 because of problems with infiltration in the foundation at the downstream toe of the southeast dike. According to a spawning potential study of 10 tributaries of Lake Sainte Anne (Profaune, 1991), the water level drop to 290 m would not prevent access or the reproduction of brook trout in these tributaries (ref. 1). The average level observed in Lake Sainte Anne for the 1996–1998 period was higher than the 290 m level between August and November, which includes the migration of the brook trout to the spawning sites and reproduction period. In Lake Sainte Anne, the changes anticipated in the Toulnustouc project reflect a return to the former maximum operating elevation (301.75 m) along with a significant decrease in the year-to-year drawdown, which will drop from 26 m to 11.75 m. These changes should facilitate access to the tributaries during the brook trout spawning run and breeding period (ref. 4). Owing to the

reduced drawdown, the water level will remain high for a longer period of time and intensified riparian erosion from waves is to be expected. According to the proponent, intensified erosion at the new minimum operating level and a reactivation of the phenomenon in the already eroding taluses could take place. The set-up of a bank erosion follow-up program and implementation of corrective measures required in areas targeted by it will minimize the effects of bank erosion on fish habitat. The effects of reservoir management are not likely to be significant.

The transmission route of the 315 kV line that will be retained to link the generating station substation to the Micoua substation will cross over several watercourses, including the Toulnustouc River and some of its tributaries. Possible repercussions of setting up transmission lines over fish habitat are especially associated with shore clearing and the set-up of temporary bridge structures. Many mitigation measures, e.g. the use of prefabricated bridges and a clearing method adapted to the sensitivity of watercourses minimize the impacts on fish habitat. Considering the applicable mitigation measures, the effects of the watercourse crossings necessary to set up the 315 kV line will not likely be significant.

Given that the habitat losses attributable to the project will be compensated by some fish management measures intended to maintain brook trout productivity of the affected areas and that a program to monitor the movement of fish, as well as the thermal regime and the ice regime, will permit verification of the accuracy of the predictions (i.e. impact on fish habitat considered low), the project should not cause significant cumulative effects on the fish habitat.

7.11.2 Use of the land for recreational and tourism purposes

Fishing

With the exception of the Toulnustouc project, no other planned project or activity in the next 10 years is likely to give way to an appreciable modification of sport fishing activities on the Toulnustouc River.

The management of Lake Sainte Anne at its maximum level and the drop of the year-to-year drawdown will facilitate navigation, which could promote sport fishing on the reservoir.

New means of access will likely have an impact on the sport fishing sector. Permanent access to the generating station, the relocated forest access road along the right shore and the maintenance of an inter-shore link will provide easier access to the land for sport fishing, which is a positive effect. However, it is difficult to assess the possible increase of land use by sport fishers and, consequently, the possibilities of overharvesting the resource. In fact, there is very little data on land use since the Société de la faune et des parcs du Québec does not gather data on land use in the case of free territory (ref. 9). The total number of fishing licences sold on the North Shore, however, has been steadily dropping since 1994 (ref. 4), which suggests that improved access to the land should not lead to a drastic increase in the use of the land for sport fishing.

With the Toulnustouc Project, the transition from a fluvial environment to a lacustrine environment between the current Lake Sainte Anne dam and the future dam would cause the loss of a white-water fishing area, making up the major part of fishing sites on the Toulnustouc River (ref. 4). The Toulnustouc reservoir would also offer new possibilities for lacustrine fishing, which could mean a greater number of visits to the future reservoir area (ref. 4). Considering that the vast majority of fishers are found on lakes of adjacent lands, approximately 80% of survey respondents, as well as new possibilities associated with the new body of water, the direct effect

of the project on sport fishing is deemed not significant as well as the project's cumulative effects on sport fishing.

Recreational facilities

Recreational development in the area concerned by the project is closely linked to the territory's accessibility. New access would therefore have some effects on the recreational facilities. The permanent access to the generating station, the forest road relocated to the right bank and the maintaining of an inter-shore link would enhance the territory's accessibility for current or future recreational facilities (ref. 4).

The presence of the Toulnustouc reservoir should provide new opportunities for establishing camps or cottages. The area of the future reservoir is located in a territory conducive to the development of widespread recreational facilities.

Considering these facts, the Toulnustouc project will have a positive effect on recreational facilities around Lake Sainte Anne and in the area affected by the new access roads and no cumulative effect is expected.

Navigation

Raising the Lake Sainte Anne water levels should have a positive impact on the development of canoeing along the Sainte Anne, Bouffard, Fortin and Caron lakes. New navigability conditions on Lake Sainte Anne, including the improvement of its road accessibility, should also have a positive impact on the development or maintenance of navigation activities on the Toulnustouc River.

The information gathered from the "Expéditions Canots Rabaskas Sorel/Sept-Îles inc." proponent did not foresee any specific alteration to the continuation of canoeing activities on the Toulnustouc River.

The only change brought up consists of the change in the access point for the "Expédition Toulnustouc" product. The company expects to use the access road to the SM-3 generating station and the Uniforêt forest roads rather than highway 389.

However, considering the current low water levels in Lake Sainte Anne, it is possible that some lakes located upstream from this potential new access point would no longer be used. It would then be necessary to use portage rather than "cord" techniques, which might be more difficult for the usual clientele. For the "Expédition Manicouagan" product, the contractor still expects to use the Lake Sainte Anne access road, although it deplores the increasingly obvious deterioration of this access road.

Since it is expected that the project will have positive or no effects on the development or maintenance of navigational activities on the Toulnustouc, no cumulative effect is expected.

Snowmobiling

No other planned project or activity in the next 10 years is likely to give way to an appreciable modification of snowmobiling activities in the project's area of influence.

The winter maintenance of the Lake Sainte Anne road between Baie-Comeau and the Toulnustouc generating station would lead to the disappearance of a portion of the trails currently used by snowmobilers of the region and snowmobilers travelling east and west (ref. 1). In order to mitigate the expected repercussions on the local and regional infrastructures, the proponent

identified, in collaboration with representatives of the Quebec Federation of Snowmobile Clubs (FCMQ) and of AMMI, alternative routes for both the No. 3 Trans-Quebec trail as well as for the loop trail. Considering the relocalization of snowmobile trails, the effects of the project on snowmobiling activities will likely be nil.

Because it is expected that the project will have nil effects on the development or maintenance of snowmobiling activities in the study area, no cumulative effect is expected.

7.11.3 Use of the land by the Betsiamite Montagnais

Concerning the territory's use by the Betsiamite Montagnais, only the construction of the 315 kV line and new access ways could have an impact. No project deemed a priority by the Betsiamite community cuts across the study area of the Toulnustouc hydroelectric facility (ref. 9). These projects, which deal primarily with reserve land development, will also be conducted outside of defined spatial boundaries for the assessment of cumulative effects on land use by the Montagnais. With regard to the logging industry, the targeted operating areas for the next 10 years are located outside of defined spatial boundaries for the assessment of cumulative effects on land use by the Montagnais. The logging industry will only potentially reach the areas used by the Montagnais community during the five-year period of 2015–2019, which is too far in time and too hypothetical to be kept within temporal boundaries (ref. 9).

Work on the 315 kV line (clearing of right-of-way, development of access ways and watercourse crossings, vehicle traffic, presence of the line) will also have low impacts in the short and medium terms on places that are conducive to hunting, fishing and trapping. Impacts related to the development and the use of access ways should be restricted to the construction period. The construction and the presence of the 315 kV line are not, however, such as to significantly modify known activities. The presence of a transmission line makes it easier for Aboriginals to access their land. Some users also hunt small and large game within these right-of-ways.

The land's increased accessibility could encourage more visits to the territory and constitute at the same time a source of minor disturbance for Montagnais users, while giving them easier access to their trapping line. Certain Aboriginal users, however, may move their facilities in order to go about their activities more peacefully.

The impacts of the Toulnustouc generating station would arise mostly during the construction phase and the filling of the new portion of the reservoir.

The expansion of Lake Sainte Anne would result in the loss of or make inaccessible an area located on the river's left bank between the Sainte Anne dam and the Toulnustouc dam. The new portion of the reservoir would, however, provide new opportunities for lacustrine fishing while the land adjacent to the new road on the right bank would in all probability offer a good small game potential. The construction of the infrastructures and the structures should not have a significant effect on the Montagnais' land use since they do not make use of the areas neighbouring the sites involved. On the other hand, access to certain areas may be more difficult because of the security measures surrounding the work zones and the presence of the workers would substantially increase the traffic on the Lake Sainte Anne road for the duration of the work. Considering the planned mitigation measures, DFO is of the opinion that the effects of the project on traditional activities by Aboriginals will be not significant.

The project's cumulative effect on the traditional practices of the Montagnais is deemed minor and it does not seem necessary to propose other mitigation measures or follow-up programs than are planned by the proponent as well as additional recommendations of the Department of Indian and Northern Affairs Canada(DINAC) contained in this report. DFO believes that the project should not cause major cumulative effects on land use by the Montagnais of Betsiamites.

8 Follow-up program

Chapter 21 of Volume 1 of the preliminary project report describes the monitoring and follow-up program proposed by the proponent (presented in Appendix 2 of this document). These measures will make it possible to verify the effectiveness of the proposed mitigation measures and determine the necessary readjustments. Some additional clarifications are also found in certain supplementary documents. The proponent committed, following the project's approval by the government authorities, to prepare a detailed environmental follow-up program in keeping with its commitments, which will be submitted to the Department of Fisheries and Oceans (DFO) (ref. 6).

Basically, the follow-up program comprises three parts involving the physical environment (bank stability and evolution, thermal and icing regimes, water quality), the biological environment (aquatic and riparian vegetation, ichthyological fauna, terrestrial and semi-aquatic fauna, avifauna) and the human environment (economic benefits, land use by the Betsiamite Montagnais and land use by non-Aboriginals). The proponent will be responsible for implementing these different follow-up measures.

DFO deems that the latter will make it possible to achieve the major objectives targeted by these programs. However, some of these follow-up procedures may be modified to allow a better assessment of the anticipated environmental effects. The following elements will have to be considered:

- Considering that the flow reduction between the proposed dam and the generating station could result in suboptimal temperatures for brook trout growth (> 20ºC), primarily downstream from the Crans Serrés rapids during heat waves, DFO is of the opinion that the follow-up on the water temperature should also cover the area located between the foot of the Crans Serrés rapids and the generating station.
- The Department of Natural Resources Canada (NRCan) recommends that the remobilization of mercury in the submerged area be an integral part of the water quality follow-up and it should be consulted by DFO and the proponent during the set-up of the follow-up program.
- The proponent concludes that the flow reduction will result neither in modifying access conditions to the tributaries nor in creating new obstacles to the movement of the fish in the river. DFO is of the opinion that this element should be included in the follow-up to validate the assessment of the anticipated impacts on the movement of fish and to put the necessary corrective measures in place if needed.
- DFO is of the opinion that a follow-up program on bank erosion in all the areas affected by the project, namely the reservoir (current and new portion) and the reduced and altered flow areas, should be put in place.
- Environment Canada (EC) recommends that the installation of nesting boxes be accompanied by a follow-up and maintenance program for a period of 15 years.

- The Department of Indian and Northern Affairs Canada (DINAC) recommends that the proponent consider involving the Montagnais more closely in the follow-up activities.

The follow-up findings will have to be forwarded to DFO, which may, where appropriate, request some changes in light of the results obtained.

9 Terms of approval

The terms of approval of the comprehensive study report are:

- that the proponent implement the mitigation and compensation measures, as well as the follow-up programs that are mentioned in the different documents produced by it and in the present document;
- that the proponent present beforehand to Environment Canada and Fisheries and Oceans Canada for evaluation, the plans for and a detailed description of the proposed measures, prior to carrying them out, that may be taken to compensate the loss of wetlands.

10 Conclusion

Following the analysis of the nature of the project, the description of the work, the infrastructures and the proposed modifications to the hydraulic management regime, the Department of Fisheries and Oceans, as responsible authority as defined in the *Canadian Environmental Assessment Act* (CEAA), has assessed the potential impacts that the hydroelectric facility project on the Toulnustouc River would be likely to have on the environment.

This review was completed on the basis of the information provided by the proponent and the opinions of the different federal departments that have an interest in the project's construction.

Taking into account the proposed mitigation measures, compensation and follow-up programs, as well as the proponent's commitments, DFO determined that the proposed project, as so defined in the scope of the study, is not likely to cause significant negative environmental effects.

In light of the information contained in the present document, Fisheries and Oceans Canada makes the decision, pursuant to subsection 20(1)a of the CEAA, to exercise its powers to allow the implementation of the project. This decision is also conditional on the application of all the mitigation and compensation measures and conditions stipulated in the present document.

This is a preliminary conclusion that will be reconsidered following the review of the comments received at the time of the public consultation.

Revised for the implications of the *Navigable Waters Protection Act* by:

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26 Septembre 2001
Date

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27 September 2001
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27 septembre 2001
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APPENDIX 1: SUMMARY SHEET OF THE IMPACT AND MITIGATION MEASURES PRESENTED BY THE PROPONENT

Environmental component	Source of effect	Description of the effect	Specific mitigation measure	Residual effect
Hydraulics and hydrology	**Construction phase**			
	Construction of the infrastructures and structures; filling of the new portion of Lake Sainte Anne	Localized changes in the flow conditions attributable to various river interventions In the area of the future reservoir, average rise of 2.5 metres per day of the water level during filling (two to three weeks)	None	Negative – Low
	Operating phase			
	Presence and use of the new portion of Lake Sainte Anne; flow reduction and flood management; management of the generating station	Creation of a 22 km^2 body of water, including 17.8 km^2 of submerged land area Alteration of the flow conditions (transformation of a lotic ecosystem into a lentic ecosystem) Decline in the year-to-year drawdown of Lake Sainte Anne, which will drop from 26 m to 11.75 m In the reduced flow area, reduction and stabilization of the flow to approximately 3 m^3/s (minimum flow value) In the altered flow area, transient regime resulting in sudden, large fluctuations	None	Negative – High

Environmental component	Source of effect	Description of the effect	Specific mitigation measure	Residual effect
Bank sensitivity to erosion	**Construction phase**			
	Construction of the infrastructures and structures; filling of the new portion of Lake Sainte Anne	In the area of the future reservoir, erosion of highly sensitive banks Destabilization and erosion of some highly sensitive banks at the outlet of the diversion tunnel	Protection of the banks located at the outlet of the diversion tunnel, the spillway and the tailrace canal by installing protective structures (ripraps) adapted to the agents and processes at issue	Negative – Low
	Operating phase			
	Presence and use of the new portion of Lake Sainte Anne; flow reduction and flood management; management of the generating station	Variable bank erosion depending on the areas, their characteristics and flow conditions Erosion of the new banks (65% of them of high and average sensitivity, for a total of 45 km of banks) In the altered flow area, intensification and acceleration of the extent and speed of erosion; deepening of the channel; displacement of a large volume of sand downstream; lateral displacement of the riverbed	Installation of linear stabilization structures (riprap blankets) and ad hoc structures; appropriate design of the tailrace canal	Negative – High
Thermal regime and ice regime	**Construction phase**			
		No effect anticipated	—	—
	Operating phase			
	Presence and use of the new portion of Lake Sainte Anne; flow reduction and flood management; management of the generating station	In the area of the future reservoir, colder water in summer and warmer in winter; stronger stratification in the deep layers of the new body of water; thermal stratification in all seasons; surface thermocline sensitive to wind; thermocline at 20 m below the surface In the reduced flow area, 6°C warming of the water between the spillway and the Crans Serrés rapids; formation of an ice cover Altered flow area: 3 to 5°C drop in water temperature in the summer; loss of ice cover in the winter	None	Negative – High

Environmental component	**Source of effect**	**Description of the effect**	**Specific mitigation measure**	**Residual effect**
Water quality	**Construction phase**			
	Construction of the infrastructures and structures; filling of the new portion of Lake Sainte Anne	Decomposition of the vegetation and organic matter Increased concentration of suspended solids (increased primary production)	None	Negative – Medium
	Operating phase			
	Presence and use of the new portion of Lake Sainte Anne; reduction of the flow; management of the generating station	Modification of water characteristics (particularly the pH) downstream from the generating station High renewal rate (11 times per year) enhancing the water quality of the future body of water	None	Negative – Medium
Land vegetation	**Construction phase**			
	Construction of the infrastructures and structures; filling of the new portion of Lake Sainte Anne	Clearing and stripping of nearly 500 ha of forest (resinous new growth and mixed new growth stands) Submergence of 1,770 ha of land vegetation (young regenerating forests)	None	Negative – Medium
	Operating phase			
		No effect anticipated	—	—

Environmental component	**Source of effect**	**Description of the effect**	**Specific mitigation measure**	**Residual effect**
Riparian and aquatic vegetation	**Construction phase**			
	Construction of the infrastructures and structures; filling of the new portion of Lake Sainte Anne	Loss of small riparian habitat areas at watercourse crossing points Loss of nearly 95 ha of riparian habitat associated with filling the reservoir	Enhancement of the wetlands located on the periphery or creation of wetlands by diking streams	Negative – Low
	Operating phase			
	Presence and use of the reservoir; flow reduction and flood management; management of the generating station	In the area of the future reservoir, poor development of riparian vegetation, limited to the banks offering favourable conditions for its establishment (in the long term) In the reduced flow area, decline in the riparian habitat areas (in the long term) In the altered flow area, loss of riparian habitat areas, particularly in one of the richest sites just downstream from the generating station (in the long term)	Enhancement of the wetlands located on the periphery or creation of wetlands by diking streams	Negative – Low

Environmental component	Source of effect	Description of the effect	Specific mitigation measure	Residual effect
Brook trout habitat	**Construction phase**			
	Construction of the infrastructures and structures; filling of the new portion of Lake Sainte Anne	Erosion and sedimentation attributable to direct interventions on the banks and the beds of watercourses Transformation of one 13.7 km segment of the Toulnustouc River into a lacustrine-type habitat Increased turbidity Temporary interruption of the flow during the filling of the reservoir (particularly in the segment located upstream from the Crans Serrés rapids)	None	Negative – Low
	Operating phase			
	Presence and use of the new portion of Lake Sainte Anne; flow reduction and flood management; management of the generating station	Net loss of 8 linear km of tributaries Net gain of lentic habitat (1 800 ha) and net loss of lotic habitat (14 ha) Loss of two spawning grounds In the reduced flow area, modification of the temperature regime End of the addition of brook trout migrating out of Lake Sainte Anne	Development of a spawning bed in the area of the future reservoir; installation of a sill at kilometre 60.5; development of a spawning bed in the reduced flow area	Negative – Low
Northern pike habitat	**Construction phase**			
	Filling of the new portion of Lake Sainte Anne	Temporary interruption of the flow and narrowing of the aquatic habitat (particularly upstream of kilometre 40) during the filling (two to three weeks)	None	Negative – Low
	Operating phase			
	Management of the generating station	Significant increase in flow at the time of spawning Change in the habitat conditions in the river Slowdown in the pikes' growth in the altered flow area	None	Negative – Medium

Environmental component	Source of effect	Description of the effect	Specific mitigation measure	Residual effect
Fish population	**Operating phase**			
	Presence and use of the new portion of Lake Sainte Anne; flow reduction and flood management; management of the generating station	Increased production after a few years Possible dominance of the sucker to the detriment of the brook trout Increased mercury levels in fish flesh	Implementation of a mercury risk management program Monitoring of mercury levels in fish flesh	Negative – Low
Large fauna	**Construction phase**			
	Construction of the infrastructures and structures; filling of the new portion of Lake Sainte Anne	Loss of more or less good quality habitat Risk of death for a few individuals	None	Negative – Low
	Operating phase			
	Presence and use of the new portion of Lake Sainte Anne; flow reduction and flood management; management of the generating station	Loss of 17.8 km^2 of terrestrial habitat that is more or less attractive to moose (in the medium term, this loss will be compensated by the reforestation or new plant growth on the exposed banks in the reduced flow area) Slight decline in the environment's ability to support moose	None	Negative – Medium
Small fauna	**Construction phase**			
	Construction of the infrastructures and structures; filling of the new portion of Lake Sainte Anne	Habitat loss Submergence of less mobile individuals Displacement of certain species such as the American mink and the river otter	None	Negative – Low
	Operating phase			
	Presence and use of the new portion of Lake Sainte Anne; flow reduction and flood management; management of the generating station	Submergence of 17.8 km^2 of land environment that is more or less attractive to the main species present (in the medium term, this loss will be partially compensated by the reforestation or new plant growth on the exposed banks in the reduced flow area)	None	Negative – Medium

Environmental component	Source of effect	Description of the effect	Specific mitigation measure	Residual effect
Beaver	**Construction phase**			
	Construction of the infrastructures and structures; filling of the new portion of Lake Sainte Anne	Displacement of the beaver colonies Increase in predation risks Risk of death among young beavers	Logging to enhance the new growth of deciduous species on certain tributaries of the new body of water	Negative – Low
	Operating phase			
	Presence and use of the reservoir; flow reduction and flood management; management of the generating station	Displacement of the beaver colonies to more conducive locations (particularly those located on the river between kilometres 53.8 and 41.8) Rise in mortality rate due to increased predation	None	Negative – Low
Rare wildlife species	**Construction phase**			
	Construction of the infrastructures and structures; filling of the new portion of Lake Sainte Anne	Displacement of individuals outside the affected areas In the area of the future reservoir, probable mortality – by predation or interspecies competition – of a significant number of smaller individuals Loss of nearly 500 ha of habitat (resinous new growth and mixed new growth stands)	None	Negative – Medium
	Operating phase			
	Presence of the reservoir; presence of the access road	Loss of habitat Increase in trapping pressure (lynx)	None	Negative – Medium

Environmental component	Source of effect	Description of the effect	Specific mitigation measure	Residual effect
Waterfowl	**Construction phase**			
	Construction of the infrastructures and structures; filling of the new portion of Lake Sainte Anne	Loss of habitat, particularly for diving ducks nesting in forest environments Submergence of ground nests (river, streams and lakes)	None	Negative – Low
	Operating phase			
	Presence and use of the new portion of Lake Sainte Anne; flow reduction and flood management; management of the generating station	Destruction of 95 ha of riparian habitat used for breeding by waterfowl and other aquatic bird species In the reduced flow area, displacement of the riparian transition zone toward the new water line; colonization of the top-bed by herbaceous species, exposed flats and spits; extension of shrub expanses into the better drained environments In the altered flow area, depletion of the riparian habitats up to kilometre 40	Installation of nesting boxes; enhancement of the surrounding wetlands	Negative – Low
Raptors	**Construction phase**			
	Construction of the infrastructures and structures; filling of the new portion of Lake Sainte Anne	Disturbance and loss of habitat, particularly for species nesting in forest environments	None	Negative – Low

Environmental component	**Source of effect**	**Description of the effect**	**Specific mitigation measure**	**Residual effect**
Economy	**Construction phase**			
	Presence of workers; purchase of goods and services	Economic benefits in the range of $211.2 M for the North Shore Job creation (1 000 person-years)	Formation of an economic benefits committee Inclusion of contractual clauses favouring regional subcontracting	Positive – High
	Operating phase			
	Presence and use of the new portion of Lake Sainte Anne; management of the generating station; presence of the access road	Nine jobs required to maintain structures and equipment Stimulation of the territory's development due to the presence of new transportation infrastructures	None	Positive – Medium
Land use by the Betsiamite Montagnais	**Construction phase**			
	Construction of the infrastructures and structures; presence of the workers; filling of the new portion of Lake Sainte Anne	Disincentive to use the territory Territory made less attractive because of the traffic and noise Disappearance of one camp site and one brook trout fishing site at the foot of the Lake Sainte Anne dam	None	Negative – Medium
	Operating phase			
	Presence and use of the new portion of Lake Sainte Anne; management of the generating station; presence of the access road	In the altered flow area, change in the conditions for the Montagnais users' navigation conditions and activities (pike fishing, beaver and mink trapping) Easier access to the territory Potential conflicts of use due to non-Aboriginal visits to the Toulnustouc River basin	None	Negative – Medium

Environmental component	**Source of effect**	**Description of the effect**	**Specific mitigation measure**	**Residual effect**
Use by non-Aboriginal populations	**Construction phase**			
	Construction of the infrastructures and structures; presence of the workers; filling of the new portion of Lake Sainte Anne	Submergence of a dozen cottages and an airfield Loss of a fishing area on the Toulnustouc River Difficulty in freely accessing some parts of the territory Possible drop in the number of AMMI members Snow removal on the generating station access road Significant increase in traffic on the Lake Sainte Anne road	Compensation for the acquisition or moving of the cottages located in the area of the future reservoir and along the access road; moving of the No. 3 Trans-Quebec Trail; moving of the AMMI loop trail	Negative – Low
	Operating phase			
	Presence and use of the new portion of Lake Sainte Anne; management of the generating station; presence of the access road	In the reduced flow and altered flow areas, decline in the quality of fishing Positive repercussions on the development of recreational facilities as well as on the navigation conditions farther upstream in Lake Sainte Anne Easier access to the territory	Construction of a launching ramp upstream from the Toulnustouc dam	Positive – Low

Environmental component	Source of effect	Description of the effect	Specific mitigation measure	Residual effect
Logging	**Construction phase**			
	Presence and use of the new portion of Lake Sainte Anne	Loss of 24 km of bush roads Loss of logging potential (3285 m^3/year)	Recovery of 4240 m^3 of merchantable timber; planting in an area of 1750 ha; moving of the road leading to the southeast dike and repair of the bush roads located on the right bank between the Lake Sainte Anne dam and the bridge at kilometre 92; compensation for the lost forest plantations; compensation for the displacement of the permanent sample plots	None
	Operating phase			
		No effect anticipated	—	—
Archaeology	**Construction phase**			
	Construction of the infrastructures and structures; filling of the new portion of Lake Sainte Anne	Submergence and destruction of archaeological sites	Inventories and archaeological excavations	None
	Operating phase			
		No effect anticipated	—	—
Landscape	**Construction phase**			
	Construction of the infrastructures and structures; filling of the new portion of Lake Sainte Anne	Transformation of the natural landscape, particularly because of the clearing and unloading of the excavated materials	None	Negative – Medium
	Operating phase			
	Presence and use of the new portion of Lake Sainte Anne; management of the generating station; presence of the access road	Transformation of a river landscape into a lacustrine landscape Introduction of anthropogenic elements into the composition of the landscape Significant transformation in the reduced flow area (particularly between kilometres 67.5 and 58)	Use of natural shades harmonizing with the landscape for the generating station and associated equipment Installation of observation points to promote the hydroelectric infrastructures	Negative – Low

APPENDIX 2: ENVIRONMENTAL FOLLOW-UP PROGRAM PRESENTED BY THE PROPONENT

Measures to be taken	**Effect or parameter measured**	**Measurement frequency (years)**					
		Reference	**Commissioning**	**Yr 2**	**Yr 3**	**Yr 4**	**Yr 5**
Physical environment							
Stability and evolution of the banks and the riverbed							
Monitor the changes in the areas of erosion in the altered flow segment and at the mouth of the Caribou River as well as a few kilometres upstream of it	Longitudinal section, cross profiles, morphological (shape) and physical (granulometry, stratigraphy) characteristics of the banks and the riverbed*	√	√		√		√
Perform some drillings at specific locations (high flow velocity and shear force) of the riverbed		√					
Thermal regime and ice regime							
Perform continuous thermographic recordings in the body of water upstream from the Crans Serrés rapids and at the generating station's outlet	Temperature	√	√	√	√		
Measure some cross profiles in the expanded reservoir in different seasons	Temperature	√		√			√
Monitor the ice cover in the reduced and altered flow areas	Ice behaviour	√		√			√
Water quality							
Measure the main physicochemical components and establish water quality from the perspective of aquatic organism requirements in the new body of water, the Toulnustouc River and Lake Amariton	"Regular" group parameters: pH, dissolved oxygen, conductivity (Hydrolab), SS, etc.*	√			√		√
Measure the parameters in Lake Amariton allowing the water to be qualified fit for consumption according to MENV and Environment Canada criteria	"Potable water" group parameters: main major families of pesticides and metals	√			√		√
* Where necessary, other parameters may be added to the follow-up program.							

Measurement to be taken	Effect or parameter measured	Measurement frequency (years)					
		Reference	Commissioning	Yr 2	Yr 3	Yr 4	Yr 5
Natural environment							
Riparian and aquatic vegetation							
Follow-up on the effectiveness of the mitigation measures	Cross-sampling of the vegetation in control sites determined at the implementation of the mitigation measures	√			√		√
Ichthyological fauna							
Characterize the fish communities in the submerged area as well as in the reduced flow and altered flow areas	Size, age and growth	√			√		√
Assess the performance and dynamics of the fish populations	Fish productivity losses and gains determined through experimental fishing	√			√		√
Follow-up on brook trout usage of the installed spawning beds	Counts of spawning runs, number of nests, number of brook trout hatchlings	√			√		√
Measure mercury levels in fish flesh	Population information program	√			√		√
Terrestrial and semi-aquatic fauna							
Monitor at the time of the filling to detect any concentration of wildlife on the islands	Observation performed by flying over the periphery of the body of water and the new islands	√					
Take an inventory of the beavers in the submerged area as well as in the reduced flow and altered flow areas	Number of colonies determined by an aerial fly-over	√				√	
Avian fauna							
Take inventories of the waterfowl and use of the sites prepared for the waterfowl	Number of nesting pairs and broods ascertained by an aerial fly-over and by ground-based observation	√			√		√
Human environment							
Economic benefits							
Follow-up the annual economic effects during the construction phase							
Land use by the Betsiamite Montagnais							
Establish the number of visits to the Toulnustouc River basin by the Montagnais community	Change in practices (hunting, trapping and fishing) in the Toulnustouc River basin	√			√		√
	Changes in the number of camp sites in the Toulnustouc River basin	√		√			
Land use by non-Aboriginal populations							
Measure the quality of wildlife resources harvest practices	Change in practices (hunting, trapping and fishing) in the Toulnustouc River basin	√			√		√
Measure the project's effects on recreational practices and navigation conditions		√			√		√