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Report 256

Joint Review Panel

Romaine Hydroelectric Complex Project

Investigation and Public Hearing Report

February 2009

Canada

Québec

The concept of the environment

The commissions of the Bureau d'audiences publiques sur l'environnement examine the projects submitted to them from a sustainable development perspective, applying the concept of the environment used by higher courts, a concept that encompasses biophysical, social, economic and cultural aspects.

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February 27, 2009

Line Beauchamp
Minister of Sustainable Development,
Environment and Parks
Édifice Marie-Guyart, 30th Floor
675 René Lévesque Blvd East
Quebec City, Quebec G1R 5V7

Minister:

It is with great pleasure that I submit the report on Hydro-Québec's proposed project to develop a hydroelectric complex on the Romaine River by the Bureau d'audiences publiques sur l'environnement. The Commission was chaired by Michel Germain, with the participation of commissioner Louis Dériger, and began its investigative work and public hearings on October 27, 2008.

On completion of its analysis, the Commission concluded that the project fulfilled three of the objectives of the Quebec Energy Strategy, namely to enhance security of energy supply, to make better use of energy as a lever of economic development, and to give more say to local and regional communities and First Nations.

In this regard, the Commission submits to the attention of the decision-making authorities concerned various matters that require commitments, amendments or clarification before any government authorizations may be issued.

Yours truly,

Pierre Renaud
President

Bureau
d'audiences publiques
sur l'environnement
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February 25, 2009

Pierre Renaud
President
Bureau d'audiences publiques sur l'environnement
Édifice Lomer-Gouin
575 Saint-Amable Street, Office 2.10
Quebec City, Quebec G1R 6A6

Dear Sir:

I am pleased to submit the report by the Commission responsible for the investigation and public hearings into the Romaine Hydroelectric Complex project by Hydro-Québec.

The Commission's analysis and findings are based on the file forwarded by the Minister of Sustainable Development, Environment and Parks as well as on documentation and additional information added to the file by the Commission in the course of its investigation. The analysis primarily focused on the concerns, opinions and suggestions of the participants in the public hearings.

I would like to thank everyone who showed an interest in the Commission's work by asking questions or submitting briefs. I would also like to acknowledge the resource persons for their collaboration in this public process. Lastly, I would like to give thanks to my colleague Louis Dériger and the team members who assisted us throughout the process.

Yours truly,

Michel Germain
Commission Chair

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Canada Québec

February 27, 2009

The Honourable Jim Prentice
Minister of the Environment
House of Commons
Ottawa, Ontario K1A 0A6

Line Beauchamp
Minister of Sustainable Development,
Environment and Parks
Édifice Marie-Guyart, 30th Floor
675 René Lévesque Blvd East
Quebec City, Quebec G1R 5V7

Mr Minister,
Madam Minister:

The Joint Review Panel for Hydro-Québec's Romaine Hydroelectric Complex Project has completed the mandate it received on September 5, 2008. As Chairman of the Panel, I am pleased to submit our report to you. In this instance, the BAPE Commission and the Joint Review Panel agreed to draft a joint report.

The Commission reviewed the project from a sustainable development perspective, applying the concept of environment defined by the higher courts of the country, a concept that encompasses the biophysical, social, economic and cultural aspects of development. It also meets the requirements of the *Canadian Environmental Assessment Act* and the Quebec *Environment Quality Act,* as stipulated in the Canada-Quebec Agreement on Environmental Assessment Co-operation.

I would like to express my gratitude to my colleagues Jean-Guy Beaudoin and Louis Dériger as well as to the members of the team that worked with us. I would also like to underscore the essential input of the members of the public who participated in the hearings.

Yours truly,

Michel Germain
Chairman,
Joint Review Panel

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Introduction

The process

The Hydro-Québec Romaine River Hydroelectric Complex Project is subject to the Quebec environmental impact assessment and review process as set out in section 31.1 et seq. of the *Loi sur la qualité de l'environnement* (L.R.Q., c. Q-2) [the Quebec *Environment Quality Act* (R.S.Q., c. Q-2)], which provides for public participation. It is also subject to a federal environmental assessment under the *Canadian Environmental Assessment Act* (S.C. 1992, c. 37), which also includes a mechanism for public consultation. The project is therefore subject to a cooperative environmental assessment under the *Canada-Quebec Agreement on Environmental Assessment Cooperation* of May 2004, hereinafter called the Agreement, which provides for, among other provisions, the possibility of establishing a joint review panel for a project when the federal and provincial authorities require review by an independent panel.

Following the recommendation of Fisheries and Oceans Canada and Transport Canada, the two federal authorities responsible for issuing a permit and an authorization for the project, the then federal Environment Minister, the Honourable Stéphane Dion, decided on February 10, 2005, to refer the project to a federal panel under the *Canadian Environmental Assessment Act*. On September 4, 2008, Ms. Line Beauchamp, Minister of Sustainable Development, Environment and Parks, mandated the Bureau d'audiences publiques sur l'environnement (BAPE) to hold a public hearing on the project under section 31.3 of the Quebec *Environment Quality Act.* The Minister also asked BAPE to establish a joint review panel, if appropriate, pursuant to the Agreement.

On September 4, 2008, in accordance with the provisions regarding the establishment of a joint review panel as stated in the Agreement, the president of BAPE, Mr. Pierre Renaud, established the BAPE Review Panel and appointed its two members to the Joint Review Panel. The appointment of these two members was approved by the then federal Environment Minister, the Honourable John Baird. The federal panel member who joined the BAPE members on the Joint Review Panel was appointed by Minister Baird and by the President of BAPE on September 5, 2008. Upon completion of this process, the Quebec Minister of Sustainable Development, Environment and Parks approved the appointment of the three members of the Joint Review Panel.

The Joint Review Panel completed its work concurrently with the BAPE Review Panel in accordance with BAPE's rules as specified in the *Règles de procédures relatives au déroulement des audiences publiques* (Q-2, r. 19) [Rules of procedure relating to the conduct of public hearings (Q-2, r. 19)]. The two panels began work on October 27,

2008 for a maximum duration of four months. As allowed under the Agreement, it was decided to produce a joint report.

On March 31, 2004, Transport Canada and Fisheries and Oceans Canada received a project notice from Hydro-Québec Équipement, followed on April 4, 2004, by a similar notice sent by Hydro-Québec Production to the Quebec Environment Minister, Thomas J. Mulcair (now the Department of Sustainable Development, Environment and Parks (MDDEP)). After finding the environmental impact study admissible, the Quebec Minister of Sustainable Development, Environment and Parks mandated BAPE to make the environmental impact statement public and to hold a public information and consultation period from September 4 to October 19, 2008. During that period, the Minister received four requests for public hearings.

The first part of the public hearings was held in Havre-Saint-Pierre from October 27 to 30, 2008. A total of 57 submissions were presented at the second part of the public hearings, held from December 1 to 11, 2008, in Ekuanitshit (Mingan), Havre-Saint-Pierre and Sept-Îles. In addition, 59 submissions were tabled but not presented, and 4 oral presentations were made.

The project

Hydro-Québec, a provincial government corporation, proposes to build a hydroelectric complex on the Romaine River north of the municipality of Havre-Saint-Pierre. With an installed capacity of 1,550 MW, the complex would have an average annual production capacity of 8.0 TWh. It would consist of four hydroelectric power plants located close to kilometre markers[1] 53, 90, 158 and 192 on the river (Table 1). Each one would include a rockfill dam, a flood spillway, a supply main, a power plant with two turbine-alternator sets, and a temporary by-pass structure. The four reservoirs would cover a total area of 279 km².

[1] In the environmental impact study, the kilometre markers are shown as PK.

Table 1 Main features of hydroelectric complex reservoirs and generating stations

	Romaine-4	Romaine-3	Romaine-2		Romaine-1	Total
RESERVOIRS			2014–2020	after 2020		
Area (km²)						
• at maximum water level	142.2	38.6	85.8		12.6	**279**
• at minimum water level	77.4	34.5	68.3	81.0	11.2	**204**
Operating water level (m)						
• critical	459.6	366.8	244.1		83.3	
• maximum	458.6	365.8	243.8		82.3	
• minimum	442.1	352.8	224.8	238.8	80.8	
• summer mean	455.8	364.2	not indicated	243.4	82.2	
Drawdown (m)	16.5	13.0	19.0	5.0	1.5	
Upstream limit (PK)						
• at minimum level	265.5	189.3	152.0	153.3	80.8	
• at maximum level	289.2	190.7	155.0		81.8	
Downstream limit (PK)	191.9	158.4	90.3		52.5	
Length of river flooded (km)	97.3	32.3	64.7		29.3	**223.6**
Dam height (m)	87.3	92.0	121.0		37.6	
Stored water volume (hm³)						
• total	2,710	1,878	3,720		147	**8,455**
• effective	1,762	475	1,460	419	18	**2,674**
Duration of impoundment (days)						
• start date	September 2019	October 2016	April 2014		July 2016	
• low flow (5th percentile)	314	229	406		44	
• medium flow (50th percentile)	276	215	98		17	
• high flow (95th percentile)	260	197	77		7	
GENERATING STATIONS						
Generating units	2	2	2		2	**8**
Flows (m³/s)						
• design flow	307	372	453		485	
• mean turbine flow	179	217	264		284	
• mean spill flow	6	7	9		7	
Planned commissioning date						
• 1st group	August 2020	August 2017	September 2014		October 2016	
• 2nd group	October 2020	December 2017	December 2014		December 2016	
Installed capacity (MW)	245	395	640		270	**1,550**
Average annual production (TWh)	1.3	2.0	3.3		1.4	**8.0**
Average use factor	0.58	0.58	0.58		0.59	

Sources: Adapted from PR3.1 (chapters 1 and 9 to 12) and PR5.1 (tables QC-61-1 and QC-89-1).

The hydroelectric complex would be connected to Highway 138 by a 150-km permanent, paved access road. Two temporary work camps would be built on the right bank of the river. The Murailles camp, at kilometre 35.7 on the access road near the site of the Romaine-2 power plant, would be occupied between 2009 and 2016. As for the Mista camp, it would be at kilometre 118 near the site of the Romaine-3 power plant, and would be occupied from 2012 to 2020.

To connect the four power plants to the electricity grid, Hydro-Québec plans to build approximately 28 km of 315 kV lines and 470 km of 735 kV lines, all of which would operate at 315 kV and four substations. These lines and substations were not analysed in the environmental impact study. They were described in a project notice in 2005 and are undergoing a separate environmental assessment. Moreover, to supply the worksites and the future Romaine-1 power plant, a 13-km 161 kV line would be installed and connected to the existing power line along Highway 138. Near the Romaine-1 power plant, a temporary transformer station producing 161 to 34.5 kV would feed a 152-km temporary line serving the camps and worksites of the other three planned power plants.

The proponent would like to start construction by mid-2009 in order to phase in the commissioning of the power plants between 2014 and 2020 (Table 1). The estimated cost of the project is $6.5 billion, excluding the costs of the transmission lines, post-construction environmental monitoring or agreements with the community.

Hydro-Quebec estimates that development of this hydroelectric complex will generate $3.5 billion in economic benefits in Quebec and will create direct employment of 18 553 person-years and indirect employment of 14 877 person-years.

The review framework

The BAPE Review Panel focused particular attention on the integration of the project into the natural and human environments. To this effect, the principles of sustainable development set out and defined in section 6 of the *Loi sur le développement durable* (L.R.Q., c. D-8.1.1) [the Quebec *Sustainable Development Act* (R.S.Q., c. D-8.1.1)], which must guide the actions of the Quebec government, were taken into account in the project analysis.

In addition, the Joint Review Panel reviewed the project in accordance with the requirements of the *Canadian Environmental Assessment Act* and the Quebec *Environment Quality Act*, as stipulated in the Agreement. It reviewed the environmental effects of the project and their significance, including the environmental effects of malfunctions or, accidents and the cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out, taking into account any measures that could mitigate these

effects. Finally, the purpose of the project, the alternative means of carrying out the project that are technically and economically feasible, and the content of the follow-up program were also reviewed, as well as the capacity of renewable resources that are likely to be significantly affected by the project to meet the needs of the present and those of the future.

The review panel[2] reviewed the project using the information in the file created by the Department of Sustainable Development, Environment and Parks and by the Canadian Environmental Assessment Agency. The panel did not request additional information from the proponent or resource persons after the public part of its mandate, which ended on December 10, 2008 with the conclusion of the second part of public hearings. The panel also based its review on information and documentation tabled during the public hearings and on its own research. It evaluated the environmental impacts of the project with reference only to the 1927 Privy Council boundary and makes no pronouncement of any kind on the validity of the border between Quebec and Newfoundland and Labrador.

A review panel is not a court and does not make rulings. Its mandate is to review and analyse the environmental impacts of a project. Its role is to provide opinions to the Minister of Sustainable Development, Environment and Parks to help inform its recommendations, as well as to make recommendations to the federal responsible authorities, for their decision.

Finally, the review panel includes in its report findings, opinions and recommendations. A finding is a fact, an opinion is a view held by the panel, and a recommendation is an action proposed by the panel to a federal responsible authority.

[2]. In what follows, for economy of expression, "review panel" will refer both to the BAPE Review Panel and to the Joint Review Panel.

Figure 1 Project location

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Figure 2 Reservoirs and generating stations of the hydroelectric complex

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Figure 3 Development diagrams

Insert 11″ × 17″ colour figure

Figure 4 Cross-section of the Romaine River after development

Chapter 1 Participants' Concerns and Opinions

The public hearing for the Romaine River Hydroelectric Complex Project involved the participation of individuals; environmental, social and economic groups; and elected officials from the North Shore. This summary takes into account the various concerns, analyses and opinions expressed in written and oral submissions.

Need for the project

Many of the participants were in favour of the project, owing to the significant economic spinoffs forecast for the North Shore and Quebec as a whole. Others questioned its rationale.

Elected officials of various municipalities, including Havre-Saint-Pierre, expressed their interest in proceeding with the project and the resulting benefits: "[Translation] We cannot afford to pass up an opportunity to create thousands of jobs and we cannot be in favour of curbing the advancement and development of our municipality" (DM17, p. 5). Other regional social and economic players shared this viewpoint, including the Société d'aide au développement économique de la Côte-Nord (SADC): "[Translation] In light of the situations specific to its territory […] the Côte-Nord SADC considers the project to be not only acceptable, but also desirable for the region" (DM24, p. 11). The Centre local de développement (CLD) de la Minganie stated that "[Translation] in order to revitalize our communities and stem the exodus, this timely project […] will help curb the devitalization of our municipalities" (DM54, p. 6).

The CLD of the Sept-Rivières Regional County Municipality (RCM) described the project as a keystone project for the entire North Shore (DM64, p. 9), and some, including the Jeune chambre de Manicouagan [Junior Chamber of Commerce of Manicouagan], consider the project to be a major economic lever (DM57, p. 9).

With a view to furthering the competitive positions of their respective industries, Quebec manufacturers and exporters, and the Aluminum Association of Canada feel that the project is justified in that it would ensure a reliable energy supply at a competitive price (DM60, p. 4; DM14, p. 16). The Fédération des chambres de commerce du Québec [Quebec Federation of Chambers of Commerce] believes that the project would give Hydro-Québec the flexibility to meet future domestic market growth, thereby guaranteeing energy security and capitalizing on short-, medium- and long-term business opportunities (DM25, p. 2). The project would also be beneficial to the Association de l'industrie électrique du Québec:

> [Translation] The development of major hydroelectric projects is key to continuing to maintain and develop the know-how of Quebec's electrical industry and to staying at the forefront of technology to improve the industry's competitiveness.
> (DM63, p. 34)

In contrast, the environmental groups Rivers Foundation and Nature Québec are troubled by Hydro-Québec's desire to continuously increase its power production, particularly by carrying out major hydroelectricity projects, with a view to giving itself greater room to manoeuvre (DM101, pp. 7, 10 and 27; DM111, pp. 8 and 10). One individual stated that Quebec should focus on reducing energy needs and consumption, rather than carrying out new projects: "[Translation] As a member of society, I question the real issues at hand: should we continue to indulge in excessive energy consumption or simply reposition ourselves as a society that values the environment?" (Pierre Lévesque, DM84, p. 3).

Along the same lines, Les AmiEs de la Terre de Québec added that

> [Translation] wanting to meet the ever-growing demand for electricity through hydroelectric development on the Romaine River is promoting a lifestyle that jeopardizes the ability of current and future generations to meet their essential needs.
> (DM91, p. 2)

The Association Québec solidaire Duplessis, Rivers Foundation and Nature Québec want the Crown corporation's planning to include the promotion of energy supply diversification. Other types of energy, such as wind, solar and geothermal energy, are preferable alternatives or complements to hydroelectricity (DM59, p. 6; DM101, pp. 27–47; DM111, pp. 27–30). In this regard, the Rivers Foundation feels that

> [Translation] […] when it comes to ensuring supply reliability and stability, it would be more responsible to increase the proportion of wind power in Hydro-Québec's network at the same time as increasing the capacity of some hydroelectric generating stations, rather than develop the Romaine River.
> (DM101, p. 47)

Some participants advocated the optimization of the existing hydroelectricity generating fleet so as to preserve major rivers for the benefit of future generations, while maintaining the feasibility of complementary projects (F. Pierre Gingras and Roger F. Larivière, DM23, p. 5).

Some questioned the need to develop such a large hydroelectric complex and did not believe that the generation of power for export purposes justified the resulting impacts on the environment (Alliance Romaine, DM43, p. 20; Green Party of Canada and Green Party of Quebec, DM70, p. 1; Étienne d'Hauterive, DM92, p. 2; Rivers Foundation, DM101, p. 29; Nature Québec, DM111, p. 20).

Minganie residents expressed concern about the rivers.

> [Translation] Although hydroelectricity can be considered a renewable energy, the rivers themselves are not: once dams have been built on them, there is no going back! Sooner or later, the dam construction industry will be faced with a shortage of the resource it depends on most, namely the rivers themselves.
> (Ilya Klvana and Amélie Robillard, DM97, p. 4)

The Regroupement national des conseils régionaux de l'environnement du Québec [Quebec association of regional environmental boards] and the Conseil régional de l'environnement de la Côte-Nord [Côte-Nord regional environmental board] would be in favour of the project if it reduced the population's dependence on oil:

> [Translation] The power to be generated by the La Romaine project appears key to me if we are to end our dependence on oil by 2030. […] If the La Romaine Complex is not built, the equivalent of approximately 5500 MW of hydroelectric power will need to be generated otherwise by 2030 […] to make up for a portion of current needs that are currently met by oil. […] Not proceeding with a project like La Romaine now could be risky, considering that the availability of fossil fuels is expected to decrease in the near future. […] These new sources [of energy] will account for only a small portion of Quebec's energy balance in 2030, despite strong growth.
> (DM65, pp. 16 and 21)

A group of political and economic stakeholders of Sept-Îles consider hydroelectricity to be a natural choice for the North Shore and wind energy to be a complementary source (Chambre de commerce de Sept-Îles Inc., City of Sept-Îles, Corporation de promotion industrielle et commerciale de Sept-Îles Inc., DM69, p. 6). A number of other participants that support the project share that opinion, including the Conférence régionale des élus de la Côte-Nord:

> [Translation] […] The North Shore's wind resources are very impressive. They, along with existing and potential hydroelectric facilities, give the region an advantage in testing wind/hydro coupling.
> (DM51, p. 19)

In this respect, the Association de l'industrie électrique du Québec is of the opinion that the project would facilitate the integration of other intermittent renewable sources of energy, such as wind power (DM63, p. 29).

In addition, the social and economic partners of the Manicouagan RCM and the Conférence régionale des élus de la Côte-Nord expressed an interest in developing energy expertise in Quebec. They would like Hydro-Québec to be involved in developing this research niche (CLD de Manicouagan, Service d'actions entrepreneuriales Manicouagan and the Manicouagan Community Futures Development Corporation, DM36, pp. 6–7; DM51, p. 41).

Economic rationale for the project

The Association de l'industrie électrique du Québec is of the opinion that beginning in 2014, the project would generate an energy reserve for neighbouring markets, without compromising Quebec's energy security (DM63, p. 18). The Conférence régionale des élus de la Côte-Nord feels that the power generated could benefit Quebec society and be used to meet the needs of Quebec businesses (DM51, p. 21). For its part, the Chambre de commerce de Port-Cartier and the Corporation de développement économique de la région de Port-Cartier see the possibility of using the energy surpluses generated by the project to meet demand for electricity, which could increase with the electrification of transportation (DM40, p. 8).

Some participants noted the importance of hydroelectric power royalties to Generations Fund contributions. They are of the opinion that Quebec society would benefit from the fund's spinoffs, which would help reduce the province's debt and be invested in various social programs (Association de l'industrie électrique du Québec, DM63, p. 8; Regroupement des jeunes chambres de commerce du Québec, DM85, p. 9).

However, others feel that energy would be exported at the expense of Quebec's needs. One individual wrote: "[Translation] Our country and our resources are made available to the highest bidder, at the expense of our priceless environmental and cultural heritage" (Simon d'Hauterive, DM99, p. 1). Another person said she was uncomfortable with the idea of increasing power generation, when no agreement has been entered into for the sale and export of the electricity (Guylaine Côté, DM115, p. 6).

Nature Québec stated the following: "[Translation] Evidence is far from conclusive that the development of the Romaine River is the preferred option based on the respective costs of the other options available" (DM111, p. 7). Furthermore, "Hydro-Québec's estimated project costs have likely been underestimated by approximately 15%" (ibid., p. 6).

In this regard, the Groupe de recherche appliquée en macroécologie is of the opinion that, in order to properly assess the economic impact of a power generating system, the amortization of construction costs has to be taken into account and, in this respect, "[Translation] hydroelectricity is in a unique position" (DM56, p. 48).

However, the Conseil régional de l'environnement de la Côte-Nord, the Regroupement national des conseils régionaux de l'environnement du Québec and the Rivers Foundation feel that the cost of importing fossil fuels is far from being covered by the income generated by the export of electricity in Quebec's energy balance (DM65, p. 12; DM101, p. 30).

Greenhouse gases

Many support the development of a renewable energy source with low greenhouse gas (GHG) emissions (Association des ingénieurs-conseils du Québec, DM55, p. 5; Conseil central Côte-Nord, DM80, p. 9; Conférence régionale des élus de la Côte-Nord, DM51, p. 27; Regroupement des jeunes chambres de commerce du Québec, DM85, p. 4). A number of participants, including the Canadian Hydropower Association, emphasized the potential reduction in GHGs resulting from the export of hydroelectricity to neighbouring markets that use sources of energy that produce high GHG emissions:

> [Translation] By replacing power generating sources that produce air pollutants and greenhouse gas emissions, hydroelectricity is a concrete means for reducing air pollution and tackling climate change.
> (DM29, p. 5)

Others, such as Alliance Romaine, the Green Party of Canada and the Green Party of Quebec, argue that the project's GHG balance sheets are incomplete. The proponent failed to take certain sources into account, such as indirect emissions resulting from changes to the natural environment (e.g. wide-scale deforestation with the filling of reservoirs, construction of roads) and did not consider the specific characteristics of the ecosystem of the river's watershed (DM43, p. 7; DM70, p. 1).

Sustainable development

Many, including the Conseil provincial du Québec des métiers de la construction (international), find that the project is in line with sustainable development principles, such as environmental protection, equity, social solidarity and cost-effectiveness (DM66, p. 3). The Groupe de recherche appliquée en macroécologie is of the opinion that "[Translation] hydroelectricity is also the only option enabling us to leave future generations with a rich supply of clean energy at an extremely low cost, with generating stations often operating well beyond the amortization period of their investments" (DM56, p. 53).

For its part, the Jeune chambre de commerce de Sept-Îles pointed out that the positive spinoffs and opportunities for social and economic development would outweigh the anticipated impacts (DM27, p. 2).

However, Nature Québec questions the project's sustainability; in order for a project to be categorized as sustainable, it must ensure that future generations have the same opportunities as current generations with respect to environmental integrity (DM111, p. 44). Minganie residents do not find that the project constitutes sustainable development in the long term. Instead, they suggest that investments be made in the area's economic diversification (Ilya Klvana and Amélie Robillard, DM97, p. 4). Like many Minganie residents, one participant expressed concern for rivers on the North Shore: "[Translation] Is it not high

time that we truly start thinking about future generations by leaving them an untouched part of their natural heritage?" (Sylvie Angel, DM82, p. 8).

A member of the Nutashkuan community expressed concern about the impact that the project would have on forest resources and their potential use by future generations (Joël Malec, DT4, p. 100).

Impacts on the natural environment

Woodland caribou

For the four Innu communities that participated in the hearings, increased traffic in the territory is likely to impact the woodland caribou population and its territory, which could adversely affect the practice of some traditional activities (Corporation Nishipiminan, DM75, p. 2; the Pakua Shipi and Unamen Shipu Innu Councils and their representatives, DM94, p. 13; Nutashkuan Montagnais Council, DM74, p. 12). The Government of Newfoundland and Labrador shares this concern and expects Labrador's caribou population to be affected (DM62, p. 4).

Other participants made similar observations, feeling that woodland caribou could be subject to habitat changes as a result of the new reservoirs and logging, which could adversely affect the populations (Alliance Romaine, DM43, p. 22; the Green Party of Canada and the Green Party of Quebec, DM70, p. 3; Ed Labenski, DM68, p. 1).

Birdlife

The Club d'ornithologie de la Côte-Nord reviewed the impacts on birdlife affected by the project that are anticipated by the proponent. The birdwatching club recommends that additional surveys be conducted for various species, including Barrow's Goldeneye and the Red Knot. However, it expressed a number of concerns about the cumulative impacts of regional industrialization, particularly the loss of old-growth forests. The club pointed out that the North Shore is a base for major waterfowl groups and has sites that lend themselves to shorebird conservation and that are migration corridors for birds of prey and forest birds (DM22, pp. 1–5). The club is also concerned about transmission lines:

> [Translation] The energy industry is increasingly erecting structures (towers, transmission lines, wind turbines) that birds can collide into. […] [Migration] corridors need to be characterized in order to minimize the energy industry's impacts on migratory birds. (ibid., p. 5)

Nature Québec stated that species whose populations are in decline and that were not taken into account by the proponent (e.g. Boreal Pewee, Rusty Blackbird and Kirtland's Warbler) could see their numbers fall (DM111, p. 43). Parks Canada maintained that "[Translation] the populations of terns in the Mingan Archipelago are among the largest in Quebec," and the river mouth area is an important nesting site:

> [Translation] Parks Canada wants further preliminary studies to be conducted on the feeding behaviour of terns in the river mouth area […]. Parks Canada is also of the opinion that the feeding conditions of birds, and of terns in particular, should be monitored in the mouth of the Romaine River in order to determine whether the impacts are greater than expected and to implement any necessary mitigation or compensatory measures. (Yann Troutet, DT12, p. 3)

Aquatic fauna

Many participants expressed concern about the project's impacts on the Romaine River's fish population. Lengthy flow interruptions during filling periods and the management of instream flows would have impacts that, some believe, could not be offset by the introduction of farmed salmon or species tolerant of the new conditions. This measure raises questions about the potential impacts on the genetics of the salmon population and on biodiversity (Atlantic Salmon Federation and the Fédération québécoise pour le Saumon atlantique, DM104, p. 18; Nature Québec, DM111, p. 59; Guylaine Côté, DM115, p. 3; Groupe de recherche en macroécologie, DM56, pp. 74–77).

Heritage

Some of the participants believed that Quebec should grant permanent protective status to all of its wild rivers (Ilya Klvana and Amélie Robillard, DM97, p. 6). The Association de Québec solidaire Duplessis candidate asked that the Moisie River be protected to compensate for hydroelectric development on the Romaine River, with only ecotourism to be permitted there (Olivier Noël, DM59, p. 8).

According to some, the Quebec Strategy for Protected Areas needs to be reviewed in terms of both the objectives and variables selected to determine the value of the river ecosystems to be protected (Philippe Bourdon and Thomas Buffin-Bélanger, DM114, p. 10).

According to the Government of Newfoundland and Labrador, Innu archaeological sites could be affected by the flooding of the land. It asked that the sites in Labrador near Banane Lake and Theta Lake be documented further (DM62, p. 5).

Integrity of the Mingan Archipelago National Park Reserve of Canada

Nature Québec raised the issue of reconciling the project's objectives with those of a national park. The organization is specifically concerned about the impacts on the natural ecosystem in the river mouth area (DM111, p. 57). Others are of the opinion that the reduction in nutrients, changes in flow and the decreased volume of sediment in transition would affect coastal productivity and benthic and aquaculture species. They fear the disappearance of capelin spawning grounds (Carle Bélanger, DM100, p. 1; Alliance Romaine, DM43, p. 14; Groupe de recherche en macroécologie, DM56, p. 76).

A Mingan resident suggested that the possibility of creating a marine area (similar to the Saguenay−St. Lawrence Marine Park) in the northern Gulf of St. Lawrence be looked into with a view to enhancing the marine environment heritage in the Mingan Archipelago and on Anticosti Island (Lionel Cormier, DM81, p. 1).

Coastal erosion

The Corporation des services universitaires du secteur ouest de la Côte-Nord expressed concern about potential shoreline erosion downstream from the hydroelectric complex: "[Translation] The combination of factors related to climate change and the presence of hydroelectric facilities in our region appear likely to increase shoreline erosion" (DM41, p. 5). In this respect, the organization asked that the economic spinoffs be used to support initiatives for mitigating shoreline erosion on the North Shore and submitted a concrete proposal to that effect (DM41.1, pp. 8–9).

A resident of Val-Marguerite suggested "[Translation] that environmental monitoring automatically include a comprehensive and integrated assessment of changes in the estuary with respect to shoreline erosion, in cases where a community is located near the mouth of the estuary" (Serge Marchand, DM37, p. 5).

Human environment

Although many view the project as an opportunity to improve living conditions in the region, fears remain with respect to the project's impact on quality of life and on the health and safety of local and regional communities.

Quality of life

The Conseil des maires de la Basse-Côte-Nord stated that "[Translation] the project will have a positive impact on the quality of life of North Shore residents" (DM48, p. 2). In addition, the CLD de la Minganie specified that "[Translation] considering the forecast population declines, we believe that an influx of people will help us improve our standard of living and have a positive impact on our environment" and that the project "[Translation] will enhance our community and the lives of families who live here, while improving quality of life from a social, cultural and economic standpoint" (DM54, pp. 6 and 8).

Many of the participants expressed concern about the changes that could compromise their quality of life. Two Mingan residents explained that the project would disrupt their current way of life: "[Translation] Minganie is a region known for nature, which is the reason we all live there—for the tranquility and vastness of the land" (Sophie England and Martin Desrosiers, Julie Lanthier and Christophe Rolland, and Christian Morissette, DM112, p. 2). One resident is of the opinion that "[Translation] people's quality of life should be the priority" (Étienne d'Hauterive, DM92, p. 2).

Others are worried about the level of noise caused by road and air traffic during the construction and operation of the complex. A group of Magpie village residents stated that "[Translation] […] it is obvious that the situation will change from one of peace and quiet to one in which we will have to endure the road traffic noise for the greater part of the day and week" (DM103, p. 3).

Road safety

The Municipality of Rivière-au-Tonnerre would like Hydro-Québec to consider the increased traffic on Highway 138, especially in summer (DM16, p. 1).

Some participants were unhappy with the measures proposed by the proponent for maintaining an appropriate level of safety for users of Highway 138. The governing council of Saint-François-d'Assise school in Longue-Pointe-de-Mingan fears that the increased traffic will jeopardize the safety of children, who need to cross the road regularly (DM108, p. 2). Residents explained the importance of Highway 138, which runs through the communities of Longue-Pointe-de-Mingan and Ekuanitshit (Mingan) and which residents travel daily on foot, by bicycle or by vehicle. They suggested that Highway 138 be rerouted around the villages affected (Pauline Vachon, DM95, pp. 4–5; Group of Mingan residents, DM93, p. 2).

Two Havre-Saint-Pierre residents suggested that the design of the access road leading to the hydroelectric complex be changed so as to make the road safer for all users (Jean-Guy Fortin and André Vigneault, DM21, pp. 2–7).

Some participants, including the Corporation de développement et de gestion du port de Havre-Saint-Pierre, suggested that the seaway be used to transport materials and goods during construction. This solution would mitigate the expected impact on Highway 138 and would make Havre-Saint-Pierre's port infrastructure economically viable again (DM98, p. 3). The MNA for Duplessis stated that

> [Translation] the construction phase is to be carried out over many years and will result in increased use of the road network. Despite the proponent's decision in favour of this option, I would still like the seaway to be considered if only for the sake of the environment, safety and peaceful setting for residents living next to Highway 138.
> (Lorraine Richard, DT14, p. 3)

Quality of services

Some groups expressed concern about the increase in demand for social services. The Centre de santé et de services sociaux de la Minganie is mainly worried about the increase in the number of families, the shortage of human resources in the field of essential services and the anticipated increase in housing costs (DM33, p. 2). The Corporation de développement économique de Havre-Saint-Pierre recognizes that the project would generate significant beneficial spinoffs and wants the spinoffs to translate into investments in infrastructure and better extracurricular activities (DM53, p. 2).

According to some residents, the influx of workers and the creation of a large-scale jobsite raise questions as to the region's capacity to manage growing needs for public services, such as waste management, wastewater treatment and drinking water supply (Carle Bélanger, DM100, pp. 2–3; Guylaine Côté, DM115, pp. 2–3).

Others feel that the project is an opportunity to improve the level of service offered. The Centre de la petite enfance Picassou plans to take advantage of the project to expand its premises, and the Municipality of Île-d'Anticosti sees it as a chance for the community to take control (DM71, pp. 1–2; DM30, p. 3). The Fédération des chambres de commerce du Québec stated that "[Translation] some of its member firms are interested in diversifying their offerings, which would in turn improve services for the local population" (DM25, p. 12). The political and economic stakeholders of Sept-Îles recommended that Hydro-Québec monitor impacts on public services and housing (DM69, p. 14).

Social impact

The changes affecting local communities concerned many participants, who felt that the current resources and existing infrastructure would be insufficient to meet needs. The Regroupement Mamit Innuat is concerned about the social and psychosocial impacts on the communities during construction, as a result of the massive influx of workers, the rise in the housing market and the favourable, yet temporary, economic conditions (DM50, p. 5). The Pakua Shipi and Unamen Shipu (La Romaine) Innu Councils are of the opinion that the measures proposed by Hydro-Québec are insufficient to offset the problems expected to arise in the two communities (DM94, p. 1).

The Agence de la santé et des services sociaux de la Côte-Nord [Côte-Nord health and social services agency] reiterated those concerns and felt that the proponent addressed social and psychosocial impacts only minimally. Although it acknowledged the significant beneficial social impacts of the project, the agency is of the opinion that "[Translation] the social and economic aspects of the study were limited to the economic aspect, which appears to be positive for the host community." The Agency would like the proponent to implement "[Translation] a process for monitoring social changes in its environmental monitoring program." (DM38, pp. 5 and 11).

Some participants are of the opinion that the project would improve the living conditions of North Shore residents. The Association des commissions scolaires de la Côte-Nord [Côte-Nord school board association] views the project as an opportunity to make education services more widely available: "[Translation] We believe that gainful employment opportunities encourage many young people to stay in school and graduate" (DM39, p. 8). The Club optimiste de Havre-Saint-Pierre is of the opinion that the project would motivate young people to find employment in their area (DM9, p. 1). The CLD de la Basse-Côte-Nord and the Conseil central de la Côte-Nord both believe that the project would create employment and business opportunities for residents and would give many people the chance to return to and settle in the region (DM47, p. 5; DM80, p. 6).

For its part, the Minganie RCM feels that

> [Translation] the dynamics and momentum generated by the project will have a positive impact, especially in terms of the diversification of recreational, cultural and sports services […] We firmly believe that the project will enable Minganie to offer an exceptional quality of life to those who have chosen to contribute to the region's development.
> (DM52, p. 12)

Lastly, the Volet des femmes women's centre believes that the project could have a positive impact on women in Minganie (DM1, p. 1). The Jeune chambre de commerce de Manicouagan observed that

> [Translation] […] this excellent news will have a positive effect on the social fabric and will, for example, help strengthen and lead to the development of new services and businesses. (DM57, p. 7)

Health and mercury

Concerns remain about the consequences of increasing mercury levels in fish and shellfish. Residents fear for the health of people living in Minganie, who are avid consumers of fish and shellfish (Claude Lussier, DM113, p. 3; Guylaine Côté, DM115, p. 2). The Corporation Nishipiminan expressed concern about the presence of mercury in the fish of future reservoirs (DM75, p. 2). The Government of Newfoundland and Labrador asked whether fish that contain high levels of methylmercury could migrate to Labrador streams and be consumed by the public (DM62, p. 5). The Société pour vaincre la pollution, an environmental group, also questioned the data on the presence of mercury and on safe levels provided by Hydro-Québec (DM106).

In order to ensure effective mitigation measures, the Conférence régionale des élus de la Côte-Nord suggested

> [Translation] […] that the information program adopt communication and dissemination means that are tailored to the targeted community and groups (groups at risk), […] use community print and non-print media for its information and awareness campaigns. […] Direct contact with the public during information sessions, for example, should also be prioritized.
> (DM51, p. 29)

Commercial and subsistence fisheries

North Shore fishers worry about the impact on the commercial fishery. The Association des pêcheurs de Havre-Saint-Pierre expressed concern about the impact on scallop: "[Translation] The unstable situation of our sector is of great concern to us" (DM6, p. 1). According to some, the development of the hydroelectric complex "[Translation] could result in a decrease in population density and changes to community composition, with some

species becoming more abundant than others" (Pierre Barriault and Raynald Thériault, DM109, p. 1). Concerns are also related to potential mercury levels in certain species that are harvested at the river's mouth (Laurent Jomphe and Joël Landry, DM88, p. 1; Pierre Barriault and Raynald Thériault, DM109, p. 2). In light of the uncertainty related to the potential impacts on the industry, the fishers asked Hydro-Québec

> [Translation] […] to provide for financial compensation in the event that the resources available and the quality of the species are affected in any way whatsoever […] The fishers would like to meet with Hydro-Québec to obtain more information regarding their concerns […].
> (Ibid., DM109, p. 3)

The Corporation Nishipiminan fears that the Innu will be unable to continue to practise their traditional activities, especially fishing, because of the impact on fish, particularly salmon, and fish habitat. It also had reservations about the proposed management of instream flows (DM75, p. 2).

Recreation

Individuals and interest groups are aware of the repercussions that would affect the practice of recreational activities.

Many outdoor enthusiasts consider the Romaine River to be "[Translation] one of Quebec's last wild rivers" (Mathieu Bourdon, DM61, p. 2). Some residents feel that "[Translation] a change in the river's water temperature would have an impact on swimming and family activities" and that "the Romaine River's current attractions will be lost" (Chantal Guillemette, DM105, p. 2). Kayakers expressed their disappointment at losing the rapids and whitewater sections. According to them, "[Translation] there is no readily accessible site in Minganie that is equivalent to the rapids at the Romaine River bridge" (André Charest and Yann Troutet, DM58, p. 7).

Many deem the Romaine River to be one of the biggest rivers on the North Shore that offers exceptional conditions for outdoor and aquatic sports (Chantal Guillemette, DM105, p. 1; Mathieu Bourdon, DM61, pp. 2–3). In exchange for the river's loss, they asked that the Magpie River be completely protected and that a permanent protected area be created in its watershed (André Charest and Yann Troutet, DM58, p. 11; Pierre Lévesque, DM84, p. 4; Patrick Vibert, DM86, p. 1; Chantal Guillemette, DM105, p. 3).

A Havre-Saint-Pierre resident expressed concern about the impacts on salmon fishing following the change in flow between June 15 and July 15 (Gaétan Cassivy, DM28, p. 1). Although the Association de chasse et pêche de Havre-Saint-Pierre is also concerned about the impact on fish behaviour, it acknowledged that the Atlantic salmon enhancement program is grounds for hope for its members and would like to help implement it (DM26, pp. 5–6).

The Atlantic Salmon Federation and the Fédération québécoise pour le Saumon atlantique expressed reservations about some of the impacts on the salmon population anticipated by

the proponent and questioned the effectiveness of a few of the measures proposed. In their opinion, the daily fluctuations of instream flow would change fishing conditions and require local fishers to adapt (DM104, pp. 12–18). They made several requests aimed at ensuring compatibility between hydroelectric development and resource conservation:

> [Translation] Establish a multipartite management agency for the Romaine River, including a scientific committee […] develop a fishery plan, a protection plan and a resource improvement plan, and promote co-operation between the various stakeholders. (DM104, pp. 20–21)

Lastly, the Fédération des chasseurs et pêcheurs de la Côte-Nord is of the opinion that the compensatory measures planned for the various aquaculture species targeted have to be assessed in light of Quebec regulations (DM116, pp. 2–3).

The Association chasse et pêche de Havre-Saint-Pierre believes that the project will have greater impacts than those anticipated by Hydro-Québec, including the loss of vacation homes as a result of the flooding of lands, and that moose hunting would be compromised during construction. It suggested that a standing committee be created to monitor impacts, among other measures (DM26, p. 6).

A Havre-Saint-Pierre resident drew attention to the shortening of the snowmobile river crossing season stemming from changes in the ice regime (Yves Thériault, DT11, p. 33). The Le Blizzard de Havre-Saint-Pierre snowmobile club is also concerned about the safety of its members when crossing the river and when travelling on trails subject to higher traffic. To that end, it asked for a financial contribution to implement measures for making the crossing safer (DM35, p. 4).

Increased access to the territory

The road leading to the hydroelectric complex from Highway 138 would give access to a territory that has undergone little development to date.

For some, greater access to the territory means economic development opportunities, as natural resources exploration and development becomes easier (Jeune chambre de commerce de Sept-Îles, DM27, p. 2; Construction Leclerc et Pelletier, DM18, p. 1). Increased access to the territory could be beneficial for the region: “[Translation] New horizons will open up [for Minganois], including opportunities for recreational and tourism business start-ups or simply the chance to take in the gifts of nature” (Quincaillerie Vigneault, DM89, p. 1).

However, increased land use could have adverse effects, with the natural environment and wildlife being subjected to greater pressure (Guylaine Côté, DM115, p. 2). The social and economic partners of the Manicouagan RCM and the Conférence régionale des élus de la Côte-Nord anticipate that the presence of construction workers could result in the overharvesting of wildlife resources. They proposed that monitoring and control measures be put in place during construction and the first few years of operation (DM36, p. 13; DM51, p. 33).

The Ekuanitshit Innu Council and the Corporation Nishipiminan expressed concern about the pressure exerted on wildlife resources by future forestry, mining and tourism development projects, combined with the increased presence of hunters and fishers. They foresee these conditions having an impact on their traditional hunting and fishing activities and sparking potential usage conflicts (DM74, p. 18; DM75, p. 4).

Innu communities and the territory

Five North Shore Innu communities are concerned about the project's impact on their way of life and the practice of traditional activities. They feel that their rights have not been respected in the development of the project, which is to be carried out on territory that is the subject of land claims by the communities. The transmission lines would be erected partly on the traditional territory of the Uashaunnuat, Innu families and members of the Innu Takuaikan Uashat Mak Mani-Utenam (DM44, p. 1). Some of the communities do not consider that they have given their consent to the project (Innu Takuaikan Uashat Mak Mani-Utenam Council, DM44, pp. 1, 3 and 10; Ekuanitshit Innu Council, DM74, pp. 6 and 18; Pakua Shipi and Unamen Shipu Innu Councils and their representatives, DM94, pp. 5−6 and 15).

Members of the Ekuanitshit community, including one elder, expressed their sense of belonging to the land:

> [Translation] If the hydroelectric development project goes ahead today, the territory that was our beautiful land will be flooded. It is also there that I was born. It is therefore obvious that that is what we will lose, those rights—our land will be flooded. Things will never be the same because the land is our identity.
> (Raphaël Mollen, DT8, p. 9)

> [Translation] […] The Innu of Ekuanitshit regularly eat caribou, Canada goose, beaver, partridge, hare, salmon, trout, capelin and cod. […] A large part of our history, of our culture, will be flooded and lost forever with the creation of the four reservoirs.
> (Innu of Ekuanitshit, DM77, p. 2)

For others, "[Translation] the project will have irreversible effects on the intrinsic ties that bind us to Nitassinan Mamit and everything that might affect it" (the Pakua Shipi and Unamen Shipu Innu Councils and their representatives, DM94, p. 15).

The Nutashkuan Montagnais Council explained the importance of measures for permanently maintaining access to traditional hunting grounds (DM45, p. 10).

The Innu communities deplore the fact that the Government of Quebec supported the project without Hydro-Québec having held any real consultations or made any effort to accommodate Innu rights and interests (Vincent Napish, DT8, p. 7; the Pakua Shipi and Unamen Shipu Innu Councils and their representatives, DM94, pp. 6–7). Some of the communities said that no final land claim agreement had been signed between the federal and provincial governments

and North Shore communities (ibid., p. 5; Ekuanitshit Innu Council, DM74, pp. 3–4). Only the Nutashkuan community is in talks to sign a final agreement (DM45, p. 12).

Tourism

Opinions varied with respect to the tourism industry. Many Minganie residents anticipate a decline in the region's attractiveness as a result of the planned changes to the Romaine River's natural flow and landscape. One individual believed "[Translation] that the Romaine River's priceless recreational and tourism potential will be largely compromised if the project to harness its power and construct the dam goes ahead" (Jean-François Bourdon, DM102, p. 2). Others fear that accommodations will become insufficient, which would lead to a drop in tourism (Ilya Klvana and Amélie Robillard, DM97, p. 3).

The regional tourism associations of Manicouagan and Duplessis feel that the project should be carried out in an environmentally responsible manner so as to preserve eco-tourism potential. They hope that tourism in Minganie will be developed further and call upon Hydro-Québec to establish a partnership for promotional activities and infrastructure investments (DM79, pp. 3–5).

According to the Conférence régionale des élus de la Côte-Nord, the hydroelectric complex could become a tourist attraction and be an asset when it comes to developing the region's cruise ship industry (DM51, p. 34).

Economic spinoffs

Regional spinoffs

The anticipated economic spinoffs are a unique opportunity for many participants in the region. The Chambre de commerce de Manicouagan stated that "[Translation] the anticipated spinoffs are significant and unmatched by any alternative solution" (DM42, p. 4). Marché Vigneault maintained that "[Translation] Hydro-Québec brings us money and gives us hope for a better quality of life" (DM19, p. 1).

Many commented on the economic downturn in the region, whose economy is largely based on natural resources and whose businesses are subject to fluctuations in the global market. The Chambre de commerce de Havre-Saint-Pierre expects "[Translation] that Hydro-Québec will be a driving force for our businesses and we believe that the project will be the beginning of new long-term development in our region" (DM73, p. 1). The Municipality of Rivière-Saint-Jean feels that the project would generate "[Translation] direct spinoffs for the reopening of the sawmill, which has been closed for five years" (DM87, p. 1). For some, the project is a beacon of hope and the opportunity to foster a sense of belonging and pride (Héli-Excel Inc., DM10, p. 1; Express Havre-Saint-Pierre, DM20, p. 1).

The Fédération des travailleurs et travailleuses du Québec pointed out that approximately 1100 high-quality, well-paying jobs would be maintained during the construction phase and

that over 100 jobs would subsequently be available for the operation of the hydroelectric complex (DM72, p. 15). The Conseil central de la Côte-Nord stated that that translates into "[Translation] nearly a generation's worth of healthy prospects for our region" (DM80, p. 6). The Association des constructeurs de routes et grands travaux du Québec feels that the project is important for the region because "most of the workers would be from the North Shore" (DM32, p. 10).

Indirect spinoffs are also anticipated. The Jeune chambre de commerce de Manicouagan remarked that there would be "[Translation] a direct impact on businesses that would be awarded contracts directly related to the project, while there would be an indirect impact on all of their suppliers of goods and services in the region" (DM57, p. 9). Air Labrador feels that "[Translation] the contributions of travellers to those destinations will benefit the entire local population, as the frequency of flights will need to be increased" (DM3, p. 1). The political and economic stakeholders of Sept-Îles added that

> [Translation] development in Minganie spurred by the project is good news for Sept-Îles, as it will enable our region to maintain and enhance services offered to our local population—proof that our excellent quality of life will be maintained. (DM69, p. 15)

Some see the project as an opportunity for training the next generation of workers and developing workforce skills (Porlier Express Inc., DM2, p. 1; Nemetau, DM15, p. 1; Vitrerie Norcristal, DM5, p. 1). For Tecsult, "the project paves the way to great opportunities and the chance to develop diverse and exportable skills and expertise in the region" (DM46, p. 5). For its part, the Chambre de commerce de Manicouagan affirmed that "the project's go-ahead would also help maintain an active workforce in the construction industry" (DM42, p. 3).

Some pointed out the importance of focusing on the development of regional skills to better meet needs (Regroupement des jeunes chambres de commerce du Québec, DM85, p. 8; Conférence régionale des élus de la Côte-Nord, DM51, p. 36). To that end, the CLD de la Basse-Côte-Nord has had a vocational training program for hydroelectric projects on the Romaine River and the Petit Mécatina River since 2003 (DM47, p. 4).

Others fear a labour shortage following the transfer of employees to jobsites, coupled with an increase in demand for services. The Corporation de développement économique Ekuanitshinnuat and the Société de gestion Ekuanitshinnuat want Hydro-Québec to invest in innovative solutions to facilitate regional recruitment and want "to be involved, as a priority, in initiatives and work aimed at mitigating the project's negative impacts" (DM76, p. 6). A local business added that, "in order to ensure our business's excellence, we would like the government corporation to help us find workers needed to expand our services to the public" (Multi-Meubles, DM110, p. 2).

However, some expressed concern that the economic spinoffs would be too short-lived and disappear once construction was completed. The Alliance Romaine and Association de Québec solidaire Duplessis feel that the project would generate only short-term jobs for

workers from across the province (DM43, p. 24 ; DM59, p. 3). In this regard, the Partenaires socioéconomiques de la MRC de Manicouagan remarked that

> [Translation] the advent of a hydroelectric project must no longer maintain the industrial structure in a construction-based economy, but rather move toward a sustainable innovation- and knowledge-based economy. Any spinoffs must therefore have medium- and long-term impacts. (DM36, p. 7)

Similarly, the Corporation de développement économique de Havre-Saint-Pierre maintained that the project must generate long-term regional spinoffs:

> [Translation] We want economic and environmental monitoring mechanisms to be assured by the Comité de maximisation des retombées économiques (COMAX), an organization with roots in our community. We also want Hydro-Québec to, like us, listen to the community not only before the project, but also during and after the project. (DM53, p. 3)

The CLD of the Caniapiscau RCM said that a large-scale project also brings with it its share of problems and observed that the public has to be a stakeholder in the project in order for communities to be at peace with the project once it is completed (DM96, p. 2).

Québec Labradorite indicated that the creation of reservoirs would infringe on its mining rights and it feared that it would end up closing as a result. It would like to enter into an agreement with Hydro-Québec before the project is authorized (DM49, pp. 1–2).

A resident of the Val-Marguerite district of Sept-Îles testified about his community's experience with the Sainte-Marguerite Hydroelectric Project. He said that, despite the impacts such a project has on the area at the mouth of the river, the region benefited from spinoffs generated by the project. In this respect, he suggested that each of the local communities affected by the project be allowed to benefit from it in an equitable manner (Serge Marchand, DM37, p. 5).

Maximizing regional spinoffs

Numerous participants noted the importance of maximizing economic spinoffs in the region. Economic services corporations suggested that Hydro-Québec give preference to young businesses in the region in terms of contracts. Many mentioned contracts by mutual agreement, calls for tender restricted to the region, contract splitting and a clause giving preference to local subcontracting (Chambre de commerce de Manicouagan, DM42, p. 6; Les partenaires socioéconomiques de la MRC de Manicouagan, DM36, p. 5; Conférence régionale des élus de la Côte-Nord, DM51, p. 35). The Minganie RCM asked the proponent "that Minganois be given hiring preference and that businesses operating in the RCM be given priority for contract awards" (DM52, p. 9). The Chambre de commerce de Manicouagan suggested that,

> [Translation] […] together with the regional committee on economic spinoff maximization, [Hydro-Québec] invest the resources needed to obtain an accurate assessment of the variables at play, including the North Shore's potential to meet it, and that it promote the maximum use of regional resources. (DM42, p. 6)

The Conférence régionale des élus du Saguenay–Lac-Saint-Jean and the Conseil des Montagnais du Lac-Saint-Jean stated the following: "[Translation] We nevertheless feel it is fundamental for the host populations, including the First Nations, to, first and foremost, benefit from the economic spinoffs generated by the project" (DM67, p. 6). They also offered to share their experience (ibid., p. 10).

The Corporation de développement économique Ekuanitshinnuat and the Société de gestion Ekuanitshinnuat want to forge business partnerships with firms that have the financial and technical capacity to carry out projects of this scale. They aim to "promote access to stable, well-paid employment corresponding to the interests and abilities of the members" of their communities and "skill development" (DM76, p. 4) for members of their communities.

Like many, the Conférence régionale des élus de la Côte-Nord stated that "[Translation] practices must be selected in keeping with the idea of making the most of regional skills and developing expertise" (DM51, p. 35). Groupe-conseil TDA would like Hydro-Québec to establish a regional policy advocating the hiring of regional firms (DM78, p. 5).

Some firms feel that the project would help them boost employment in the region (Location d'autos b.c. Inc., DM4, p. 1). Others welcome the project owing to the anticipated spinoffs that would contribute to economic recovery (Caisse populaire Desjardins de Sept-Îles, DM11, p. 1; Distributions J.R.V. inc., DM12, p. 1; Entreprise Simco, DM7, p. 1). The Centre local de développement of the Sept-Rivières RCM is banking on synergy among North Shore businesses, in partnership with other economic development agencies in the region (DM64, p. 7).

In this respect, the Association des ingénieurs-conseils du Québec believes that the project would give rise to development opportunities:

> [Translation] The firms involved in subsequent work will continue to hire local workers, as was the case during the preliminary phase. Be they Innu or Minganois, individuals will be trained to help conduct inventories, surveys and other investigations involved in environmental monitoring. In addition to the training and employment opportunities offered by the proponent, local community members will also have greater opportunity to develop their environmental expertise (DM55, pp. 12−13).

Some participants asked that a portion of the power generated be reserved to meet the region's future needs (Lorraine Richard, DT14, p. 3). Organizations would like to have the opportunity to benefit from investments or project spinoffs. The Société historique de Havre-Saint-Pierre is of the opinion that a portion of the project spinoffs should be allocated to social and cultural organizations, so that they can invest in infrastructure and carry out concrete

activities benefiting the local population (DM8, p. 3). The Comité de spectacles de Havre-Saint-Pierre feels that a cultural, multi-purpose room devoted to performing and visual arts is needed, as it would enhance quality of life in the region from a cultural perspective (DM13, pp. 1–2).

Agreements

Agreements entered into between Hydro-Québec and various communities in the region were the subject of numerous discussions during the public hearing.

Many, including the Green Party of Canada and the Green Party of Quebec, expressed their disappointment with the negotiation process for the partnership agreements between Hydro-Québec and local communities. They are of the opinion that the agreements should be signed only once the impact assessment process is completed. According to them, the secret nature of the agreements prevents the equitable allocation of spinoffs (DM70, pp. 6−7 and 9). One individual stated, "[Translation] We are, in fact, led to believe that some steps in the debate process were skipped following the compensation of elected Minganie RCM officials by the Crown corporation, Hydro-Québec" (Jean-François Bourdon, DM102, p. 2). One Mingan resident expressed concern about the context of the agreements:

> [Translation] I question how Minganie residents were represented by the RCM's elected officials, knowing that the latter received $12 million for ensuring that the project is accepted by the community. This procedure is not in line with democratic principles and is dangerously close to propaganda. (Sylvie Angel, DM82, p. 1)

However, the Minganie RCM is of the opinion that the elected officials would have no bargaining power with project contractors if the talks had begun after all authorizations had been issued (DM52, p. 11).

Many view the agreements as beneficial. Political and economic stakeholders in Sept-Îles and the Fédération des chambres de commerce de Québec pointed out that the agreements provide for various funds to be established for carrying out economic, environmental, social and cultural projects (DM69, p. 9; DM25, p. 14). The Jeune chambre de Manicouagan commented that the agreements would provide for investments in certain infrastructure and would even help develop services (DM57, p. 7).

The Nutashkuan Montagnais Council entered into an impact and benefit agreement with the proponent providing for the setting up of funds for various initiatives. It believes that it is fundamental that the agreement enable the community to develop skills, especially in the forestry sector, so that its members can gradually contribute to the North Shore's economy (DM45, pp. 2−3).

The Pakua Shipi and Unamen Shipu Innu Councils also entered into an impact and benefit agreement that provided for significant funding in support of economic and social

development initiatives and training programs. They nevertheless feel that their concerns were not adequately addressed and that the proponent's responses were unsatisfactory during the negotiation process (DM94, pp. 6−7).

The Ekuanitshit Innu Council stated that, although it had signed an agreement in principle with Hydro-Québec, the agreement hinged on the community members' approval in a referendum (DM74, p. 7).

Transmission lines

Although the construction project for the hydroelectric complex's transmission lines is not part of the panel's mandate, it was the subject of many discussions at the public hearings. Numerous participants expressed their disappointment with respect to the separate impact assessment process for the project, including the Corporation Nishipiminan:

> [Translation] The transmission lines are an essential component of the hydroelectric complex, but are in no way included in the assessment process […] this is completely unacceptable to us. (DM75, p. 4)

One individual stated that "[Translation] assessing the transmission line separately gets around the cumulative impacts of the two projects" (Sylvie Angel, DM82, p. 7). For their part, the Pakua Shipi and Unamen Shipu Innu Councils question whether the anticipated 735-kV transmission lines were not also intended to meet the needs of the hydroelectric project on the Petit Mécatina River (DM94, p. 13).

Criticism was also directed at the planned alignment. The Association communautaire du lac Daigle is concerned about the impacts that the transmission line at the proposed site could have on the natural environment and the health of local residents (DM31). Other participants commented on the impact on the Mingan landscape and recreational activities. The Centre de plein air de la Minganie stated that "[Translation] the transmission line will be visible from the cross-country ski trail and the noise will disrupt the peaceful setting for the skiers […] and want Hydro-Québec to align the transmission line in a way so that it is not visible or audible" (DM90, pp. 1−2).

One resident expressed concern about the use of herbicides for maintaining vegetation under the transmission lines, an area where small fruits grow and are harvested, and asked that the use of herbicides be prohibited (Guylaine Côté, DM115, p. 4).

Cumulative and transboundary effects

Some criticized the proponent's method for assessing the cumulative impacts. The members of the Ekuanitshit Innu community disagreed with the proponent that the cumulative impacts of mining, logging, landfills and the hydroelectric complex project on the Romaine River and of other hydroelectric dams in the area are negligible or isolated (Corporation Nishipiminan,

DM75, p. 4; Uashaunnuat, Takuaikan Uashat mak Mani-Utenam Innu Council and some Innu families in the community, DM44, p. 4). Alliance Romaine raised the following question: "What will be the cumulative impacts on woodland caribou populations of further habitat loss and fragmentation if the Romaine and Lower Churchill megaprojects are carried out?" (DM43.1, p. 2). Individuals added: "[Translation] Would an overall vision for the region be possible, and not just one that considers projects on a river-by-river basis?" (Sophie England and Martin Desrosiers, Julie Lanthier and Christophe Rolland, and Christian Morissette, DM112, p. 3).

The Government of Newfoundland and Labrador expressed concerns about the project's potential impacts on Labrador and asked Quebec to recognize the official political boundary between Quebec and Labrador (DM62, p. 2). Lastly, one participant asked that Labrador rejoin Quebec, pure and simple (Paul de Bané, DM34).

Public participation

Many people expressed an interest in participating in various monitoring and follow-up programs related to the project. This is seen as an opportunity not only to maximize economic spinoffs, but also to promote the development of regional expertise. The Corporation Nishipiminan stated that "[Translation] our duty is to ensure maximum benefits for our community and its full participation in managing mitigation and environmental monitoring measures" (DM75, p. 5). Representatives of the Ekuanitshit community would like to share their traditional knowledge of the land with a view to ensuring its protection (Innu of Ekuanitshit, DM77, p. 2).

Environmental assessment process

Some participants contested how the environmental assessment process was conducted, while others denounced what they believed to be a project that has already been sanctioned by the government, regardless of the findings of the review process and the public hearings. They questioned the impartiality of the government and the panel (Rivers Foundation, DM101, pp. 5–6; Sylvain Roy, DM83, p. 2; Carle Bélanger, DM100, p. 1). Others were of the opinion that the public hearings should also have been held elsewhere in the province, rather than just solely on the North Shore (Sylvain Roy, DM83, p. 2).

Some of the participants found that the volume of documentation on the project made consultation difficult, while others would have appreciated an English version. Some felt that they had not been sufficiently consulted (David Basile and Rita Mestokosho, DT8, p. 22; Ed Labenski, DM68, p. 1; Government of Newfoundland and Labrador, DM62, p. 6).

Lastly, the Groupe de recherche en macroécologie noted that the Métis community of Domaine du Roy and La Seigneurie de Mingan had not been taken into account in the project's impact assessment. It is of the opinion that the community must be consulted as it

practises traditional hunting and fishing activities on the land targeted by the project (DM56, p. 84).

Chapter 2 Project Rationale

This chapter covers the project background and its usefulness in terms of energy and economy. The panel has examined the project rationale from the perspectives of regulatory context and government directions, the Quebec and northeast U.S. energy balance, project profitability objectives and alternatives.

Government directions

Hydro-Québec's activities are governed by the *Quebec Energy Strategy 2006-2015*, which has six objectives; three of them specifically concern the project. The strategy is the result of a public consultation held in 2004 and 2005. The first objective is to strengthen energy supply security, in terms of both physical reliability and prices. The second is to make better use of energy as a lever for economic development, given that Quebec has some of the cheapest electricity in North America. The third is to give more say in energy development to local communities and First Nations. For the achievement of these objectives, the Strategy depends on the resumption and acceleration of hydroelectric development with the implementation of major projects. Hydro-Québec's production capacity would thereby heighten, allowing for an increase in electricity exports and support of industrial development (Quebec Department of Natural Resources and Wildlife, 2006, p. 4, 10, 14 and 20–22).

The 1996 adoption of the *Act respecting the Régie de l'énergie* (R.S.Q. c. R-6.01) changed the legal framework of the Quebec energy sector by establishing that the production, transmission and distribution of electric power were regulated activities. In June 2000, the government of Quebec adopted the *Act to amend the Act respecting the Régie de l'énergie and other legislative provisions* (S.Q. 2000, c. 22), which deregulated electric generation in Quebec and introduced competition. In this environment, Hydro-Québec divided its activities into four administrative divisions: production, distribution, transmission and equipment.

Hydro-Québec Production develops and operates the Hydro-Québec generating facility, and markets the electricity that it produces on wholesale markets[3] in Quebec and surrounding areas. Most of its production goes to Hydro-Québec Distribution, which is responsible for supplying Quebec residents with electricity and ensuring that the distribution network is reliable. Hydro-Québec TransÉnergie operates the Quebec electricity transmission network, and Hydro-Québec Équipement conducts all hydroelectric and transmission line projects (PR3.1, p. 1-1).

The Hydro-Québec *Energy Strategy 2006-2010* was approved by the Quebec government in 2007. The strategy includes three directions that concern Hydro-Québec Production: increase hydroelectric production capacity by accelerating project completion, facilitate the integration of wind power, and ensure that the generating facility is efficient and reliable. The strategy

[3]. Transactions on wholesale markets are completed between various producers or merchants through energy exchange or direct sale to electricity distributors. Retail sales are conducted between electricity distributors and consumers.

includes the quick commissioning of current projects and the creation of a project portfolio totalling 4,500 MW of power, which would be implemented beyond 2010. The current project belongs to this portfolio. The strategy also aims to optimize buying and selling on export markets to increase the company's revenue (Hydro-Québec, 2006, p. 17–22 and 24).

- *The panel notes that the proposal to develop a hydroelectric complex on the Romaine River is in line with the directions set out in the* Quebec Energy Strategy 2006-2015*, which sets out the Quebec government's desire to tap into the province's hydroelectric potential.*

Available resources

In 2007, the capacity of the Hydro-Québec Production generating facility consisted of 57 hydroelectric plants, one nuclear plant, 28 thermal plants and one wind farm. Other supply sources were at its disposal, including almost all the production of the Churchill Falls plant, the production of seven wind farms owned by private producers, and the production of other private suppliers (Hydro-Québec, 2007b, p. 122). In the same year, the Hydro-Québec Production energy resources were at 195.9 TWh, and it had 40,096 MW of power available in 2007-2008 (tables 2 and 3).

Table 2 Hydro-Québec energy resources from 2007 to 2021

Energy in TWh	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Current resources	195.9	198.1	198.1	198.7	194.5	194.1	198.7	198.5	198.5	198.5	198.5	198.5	198.5	198.5	198.5
Total commitments	190.7	190.8	190.9	190.9	190.9	190.9	190.5	190.5	190.2	188.9	188.8	188.8	188.8	188.5	188.5
Difference between resources/commitments	5.2	7.3	7.2	7.8	3.6	3.2	8.2	8.0	8.3	9.6	9.8	9.8	9.8	10.0	10.0
+ Management of hydraulicity and available equipment, and current project contributions	1.8	7.9	7.8	7.2	11.3	11.8	13.4	14.1	11.8	11.7	11.7	11.7	11.7	11.7	11.7
+ Romaine River Complex	–	–	–	–	–	–	–	0.7	3.0	3.0	3.6	6.0	5.3	5.4	8.0
- Margin of flexibility for managing hydraulicity risk (or short-term sales)	6.9	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
= Long-term sale resource	0.0	0.0	0.0	0.0	0.0	0.0	6.6	7.8	8.0	9.3	10.0	12.5	11.8	12.1	14.7

Source: adapted from PR9.3, p. 63.

Table 3 Hydro-Québec power resources from 2007 to 2021

Energy in TWh	2007 2008	2008 2009	2009 2010	2010 2011	2011 2012	2012 2013	2013 2014	2014 2015	2015 2016	2016 2017	2017 2018	2018 2019	2019 2020	2020 2021
Current resources	40,096	40,078	40,104	40,097	39,242	39,917	39,917	39,667	39,667	39,667	39,587	39,417	39,417	39,417
Total commitments	39,145	39,183	39,326	39,519	39,732	39,883	40,055	40,055	39,810	39,784	39,784	39,784	39,784	39,729
Difference between resources/commitments	951	895	778	578	-490	34	-138	-388	-143	-117	-197	-367	-367	-312
+ Purchase of private production and current or past project contribution	194	578	632	647	1,257	1,515	1,515	1,575	1,575	1,575	1,585	1,625	1,625	1,615
+ Romaine River Complex	–	–	–	–	–	–	–	640	640	910	1,305	1,305	1,305	1,550
= Long-term sale resource	1,145	1,472	1,409	1,224	766	1,548	1,376	1,826	2,072	2,368	2,693	2,563	2,563	2,852

Source: adapted from PR9.3, p. 64.

Hydro-Québec Production has various electricity supply commitments. Its main obligation is to deliver an annual heritage pool energy block of 165 TWh to Hydro-Québec Distribution, at a fixed price of 2.79¢/kWh, to which 13.9 TWh are added for distribution and transmission losses. 32,342 MW of power are also associated with heritage pool energy. Hydro-Québec Production also has other commitments, including providing 600 MW to Hydro-Québec Distribution in accordance with two 20-year contracts, in effect since 2007. It is also required to provide power balancing services to facilitate integration of wind farm production into the network, and deliver electricity in accordance with two long-term contracts with Vermont Joint Owners and Cornwall Electric (Hydro-Québec, 2007a, p. 22).

Hydro-Québec Production would run an energy surplus from 2007 to 2021. This surplus would correspond to the difference between resources and commitments, adjusted based on hydraulicity management and current and past project contribution. There are two types of surplus: a margin of flexibility for managing hydraulicity on an annual basis or for short-term sales, and resources for long-term sales. The flexibility margin was 15 TWh in 2008, and it is expected to remain at that level until 2021. Available resources for making long-term sales would be nonexistent between 2007 and 2012, but would gradually grow from then on to reach 14.7 TWh in 2021. The four power plants involved in the project, which would be put into operation between 2014 and 2021, would contribute steadily to increasing these resources from 0.7 TWh in 2014 to 8 TWh in 2021 (table 2).

With regard to power, Hydro-Québec Production had 1,145 MW of uncommitted resources available for long-term sale in 2007-2008, which would increase to 2,852 MW in 2020-2021. The project contribution to that number would be 640 MW in 2014-2015, and would increase to 1,550 MW in 2020-2021 (table 3).

- *The panel notes that the project would increase Hydro-Québec's energy and power resources when the Romaine-2 power plant is commissioned in 2014, which would help to gradually increase its supply of electricity to the market.*

Project objectives

The electricity produced by the project would enable the proponent to make energy and power sales on markets inside and outside Quebec. For the period between 2014 and 2020, Hydro-Québec Production expects that all energy would go to export markets. Then, between 2020 and 2036, it would gradually be provided for the purpose of meeting Quebec's needs, with an increase of 0.5 TWh per year, reaching 8 TWh in 2036. As of 2036, all energy produced by the project would go to the Quebec market (PR3.1, p. 2-13–2-14).

Furthermore, the proponent considers that power sales would be made on New England and Quebec markets starting in 2015, because increased energy demand on these markets would be accompanied by increased peak power demand. When analyzing the financial performance of the project, the proponent concluded that the revenue generated by power sales between 2015 and 2026 would account for 15% to 22% of revenue, depending on the year (ibid., p. 2-18).

The Quebec market

Hydro-Québec Distribution is responsible for supplying Quebec residents with electricity, and is required to submit a supply plan to the Régie de l'énergie.[4] The *Regulation respecting the tenor of a supply plan and the intervals at which it is to be submitted* states that a plan must be submitted every three years, and must cover a period of at least ten years. It must contain Quebec's anticipated energy and power demand based on weak, average and strong scenarios, as well as the Hydro-Québec Distribution supply strategy.

The supply plan covering 2008-2017 was submitted to the Régie on November 1, 2007, and was approved on October 20, 2008 (Decision D-2008-133). On October 31, 2008, Hydro-Québec Distribution submitted to the Régie a progress report on the supply plan for 2008-2017. Hydro-Québec Distribution is required to submit to the Régie a progress report on its supply plans on November 1 of the first and second years following submission of the plans. In this section, the panel has reviewed the data on Quebec demand forecasts based on the plan's average scenario (table 4). It would like to point out that no demand forecasts for 2017 to 2036 are yet available, though the proponent has extrapolated project contributions to the Quebec market up to that point.

Table 4 Quebec electricity demand

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Energy (TWh)[1]	185.3	183.9	183.7	187.7	189.5	193.9	197.4	198.9	200.8	203.2	204.3
	2006 2007	**2007 2008**	**2008 2009**	**2009 2010**	**2010 2011**	**2011 2012**	**2012 2013**	**2013 2014**	**2014 2015**	**2015 2016**	**2016 2017**
Power (MW)[2]	35,100	35,780	36,040	36,781	37,291	37,688	38,597	38,948	39,305	39,617	39,958

1. Actual values are 186.3 TWh for 2007 and 183.4 TWh for 2008, the effect of climatic conditions having increased 2007 demand by 1 TWh and decreased 2008 demand by 0.5 TWh (Hydro-Québec Distribution, 2008, p. 12).

2. Actual values are 35,596 MW for 2006-2007 and 34,902 MW for 2007-2008, climatic conditions having increased 2006-2007 demand by 496 MW and decreased 2007-2008 demand by 878 MW (Hydro-Québec Distribution, 2008, p. 13).

Sources: DQ20.1, p. 5; Hydro-Québec Distribution, 2008, p. 12–13.

Annual electricity demand corresponds to the value of total regular sales, to which are added losses related to transmission and distribution, requirements for additional power plant services and consumption by Hydro-Québec buildings. Demand forecasts take into account demand history, predicted population growth and planned construction of new buildings. They also consider planned energy savings in the overall energy efficiency plan prepared by Hydro-Québec Distribution (Régie de l'énergie, 2008, p. 48).

4. Under section 72 of the *Act respecting the Régie de l'énergie.*

Quebec's energy demand would increase by 19 TWh between 2007 and 2017, a rate of 1.9 TWh or 1% per year. Winter peak power demand would increase by 4,858 MW between reference periods 2006-2007 and 2016-2017, an annual rate of 1.3% (Hydro-Québec Distribution, 2008, p. 12–13). After 2017, the proponent considers that it is reasonable to believe that energy demand will continue to increase in Quebec (PR3.1, p. 2-6).

With regard to the supply plan for 2008-2017, the demand forecast presented in the progress report sets out a 3.5 TWh increase in energy demand and a 1,200 MW increase in power demand by 2017. According to Hydro-Québec Distribution, this increase is due in part to higher fuel prices, which will cause a greater transition to electric heating and an increase in consumption by the industrial sector beginning in 2010, due to new industry requirements for aluminum, iron and steel (Hydro-Québec Distribution, 2008, p. 7 and 12).

- *The panel notes that, according to the latest progress report of Hydro-Québec Distribution's 2008-2017 Electricity Supply Plan, Quebec's energy and power needs are set to increase steadily until 2017.*

The progress report on the supply plan for 2008-2017 presents the Hydro-Québec Distribution strategy for meeting Quebec's needs in that period. Heritage pool electricity would cover the majority of those needs, but non-heritage energy and power supplies would also have to be used (table 5, line 1 and table 6, line 1) (DQ20.1, p. 6–7; Hydro-Québec Distribution, 2008, p. 26 and 29).

Table 5 Additional energy demand (TWh)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Energy required in addition to heritage pool electricity	4.7	4.8	8.8	10.6	15.1	18.5	20.1	22.0	24.4	25.5
Additional supply required (surplus)	(1.5)	(1.8)	(2.8)	(1.3)	1.0	0.7	0.0	0.3	1.8	2.9

Sources: adapted from DQ20.1, p. 6; Hydro-Québec Distribution, 2008, p. 26.

Table 6 Additional power demand (MW)

	2008 2009	2009 2010	2010 2011	2011 2012	2012 2013	2013 2014	2014 2015	2015 2016	2016 2017
Power required in addition to heritage pool electricity	2,083	3,055	3,790	4,412	5,421	5,811	6,208	6,554	6,933
- Non-heritage supply	1,741	2,658	2,693	2,940	3,368	3,636	3,844	3,940	3,940
= Additional power required (rounded to 10 MW)	340	400	1,100	1,470	2,050	2,180	2,360	2,610	2,990

- Contribution by short-term markets	340	400	1,000	1,000	1,000	1,000	1,000	1,000	1,000
= Additional supply required	0	0	100	470	1,050	1,180	1,360	1,610	1,990

Sources: adapted from DQ20.1, p. 7; Hydro-Québec Distribution, 2008, p. 29.

On October 31, 2008, Hydro-Québec Distribution had 29 long-term non-heritage supply contracts. Fifteen were entered into in its last call for tenders for 2,000 MW of wind energy produced in Quebec; contribution to its resources should begin in 2011 (Hydro-Québec Distribution, 2008, p. 20). Other calls for tenders are planned for the short term: 125 MW of biomass cogeneration, two blocks of wind energy of 250 MW each -- one for Quebec First Nations communities and one for the municipalities – and small hydroelectric projects totalling 150 MW of power. The projects resulting from these calls for tenders would contribute to Hydro-Québec Distribution resources beginning in 2012 (ibid., p. 25).

Hydro-Québec Distribution would run an energy surplus from 2008 to 2011, and would be balanced or running a slight deficit from 2012 to 2015. In 2016 and 2017, the additional supply required would be slightly more than in previous years: 1.8 TWh and 2.9 TWh[5] respectively (table 5). The proponent expects that the project would not meet Quebec's energy demand before 2020. Hydro-Québec Distribution predicts that there would be needs to be addressed in 2016 and 2017. However, these may change according to updated supply plans and progress reports by Hydro-Québec Distribution.

With regard to power, Hydro-Québec Distribution would have needs exceeding its supply as of 2008-2009 (table 6). It would call on short-term markets to address those needs. However, despite market contributions, it would have a demand of 100 MW as of 2010-2011, which would increase to 1,990 MW in 2016-2017.[6] To meet part of this demand in the long term, Hydro-Québec Distribution plans to issue calls for tenders in spring 2009. It plans to adjust the calls for tenders based on demand that may be generated by planned industrial projects that are not yet confirmed (ibid., p. 29). Furthermore, Hydro-Québec Production may participate in possible short- and long-term calls for tenders by Hydro-Québec Distribution, depending on the availability of its resources. The implementation of the project would be necessary for it to make a commitment for 1,990 MW of power, which would extend beyond 2013-2014 (DA67, p. 11).

However, the use of electricity produced by this project depends on that which Hydro-Québec Production takes away from possible calls for tenders by Hydro-Québec Distribution. The Régie de l'énergie process for tendering and contracting for electricity purchases stipulates that no electricity supplier, including Hydro-Québec Production, may have any advantage

5. In the supply plan for 2008-2017, the additional supplies required for 2016 and 2017 were 0.9 TWh and 2 TWh respectively.

6. The additional supply required in the progress report on the supply plan for 2008-2017 is greater than that presented in the supply plan for 2008-2017 as of 2012-2013, despite increased short-term market contributions of 500 MW to 1,000 MW as of 2010-2011.

over another. Price is the only selection criterion for bids on short-term calls for tenders. For long-term calls for tenders, price is a major factor, but other criteria are taken into account, such as the feasibility of the project, financial soundness, bidder experience and sustainable development. A call for tenders may also result from an energy block determined by government regulation. In that case, social, economic and environmental concerns are also taken into account (DQ9.1, p. 44).

- *The panel notes that in the short term, Hydro-Québec's energy supply is forecast to exceed the province's needs, but additional supply would be required between 2012 and 2017. As well, calls for tenders are planned in 2009 to meet power needs from 2010-2011 to 2016-2017.*

Electricity markets outside Quebec

For Hydro-Québec, "Electricity sales on markets outside Quebec represent a strategic activity and an important source of revenue" (Hydro-Québec, 2007a, p. 22). In its *Financial Profile 2007-2008,* Hydro-Québec describes its main activities on markets outside Quebec. They are based mainly on the competitive advantage of hydroelectric production that results from the ability to store water in reservoirs, which offers a great deal of flexibility for adapting the supply to daily, seasonal and annual fluctuations in demand:

> We established an energy trading floor in 2000 enabling us to sell our surplus electricity and carry out purchase/resale operations. […]One of our strategies involves purchasing electricity at a given point in time at a low price on a market where demand is weak, and reselling it at the same point in time at a higher price on a market where demand is strong (real-time arbitrage). Another strategy entails purchasing electricity on a neighboring market, when consumption is low and prices fall, and importing it to Quebec (day/night and seasonal arbitrage). This allows Hydro-Québec Production to cut back night-time production at its generating stations and use this electricity to supply Québec customers. Hydro-Québec Production can then generate electricity and export it to neighboring markets for a profit margin.
> (Ibid.)

For example, in 2007, electricity exports from turbined water – that is, the net outflow from reservoirs – reached 1,104 million dollars for 10.7 TWh of energy, at an average price of 10.3¢/kWh. In the same year, revenues from the sale and purchase of electricity outside Quebec reached 1,483 million dollars for a total of 17.5 TWh of energy sold. Hydro-Québec Production's net exports accounted for only 5.6% of the volume of sales, but they generated 25% of the income (ibid.; Hydro-Québec, 2007b, p. 10).

- *The panel notes that Hydro-Québec has a competitive advantage for capitalizing on business opportunities in export markets because of hydroelectricity.*

The proponent has defined various export markets for the sale of electricity produced by the four projected generating stations. The first is the New England market,[7] followed by New York State and Ontario (Mr. Benoît Gagnon, DT1, p. 16). Sales on short-term markets are the main goal, but there is potential for long-term sales contracts, particularly with the New England states (Mr. Christian Brosseau, DT2, p. 37–38).

Electricity demand forecasts for these markets report an increase in demand. In New England, peak power demand would go from 27,360 MW in 2007 to 31,510 MW in 2015 – an increase of 4,150 MW and an average annual growth rate of 1.8%. In the same time frame, energy demand would increase from 132.6 TWh to 145.6 TWh, for an average annual growth rate of 1.2 %. In New York State, 2,549 MW of additional power would be required between 2007 and 2015, due to a forecasted growth in peak demand from 33,831 MW to 36,380 MW, for an average annual growth rate of 0.9%. The state's energy demand would increase from 170.1 TWh to 182.6 TWh, an average annual growth rate of 0.9% (PR3.1, p. 2-8; PR5.1, p. 6). New plants would probably be required because, according to the proponent, the generating facilities in New England and New York State may need to be replaced (Mr. Christian Brosseau, DT2, p. 39).

On June 2, 2008, a memorandum of understanding on energy was made between the Ontario and Quebec governments, who agreed to strengthen interconnections to increase renewable energy exchange between the two provinces.[8] According to the Ontario Power Authority,[9] Ontario's energy demand would go from 157 TWh in 2007 to 195 TWh in 2027, an increase of 38 TWh and an average annual growth rate of 1.1%. The power demand would increase from 26,282 MW to 33,677 MW in the same period, a difference of 6,395 MW and an average annual growth rate of 1.2%. With regard to the province's production capacity, the same organization predicts the following:

> [TRANSLATION] production of 6,500 MW by coal plants will stop by 2014, and three existing nuclear plants will have reached the end of their useful life in 2020. By 2020, approximately two thirds of current electric generation equipment will have reached the end of its useful life. Projections show that, starting in 2013, demand will exceed the combined capacity of the current resources that will still be in service and new confirmed resources. The situation will continue to become more acute.
> (PR3.1, p. 2-8)

The proponent has stated that the interconnection capacity between Quebec and the markets targeted for export was 4,945 MW in 2008, and that an additional exchange capacity of 1,250 MW with Ontario would be added by 2010, for a total capacity of 6,295 MW[10] (DA11,

7. New England, located in the northeastern United States, is made up of six states: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont.

8. [Accessed on (December 10, 2008): www.premier-ministre.gouv.qc.ca/salle-de-presse/communiques/2008/juin/entente-energie%20.pdf].

9. [Accessed on (December 9, 2008): www.powerauthority.on.ca/Storage/53/4861_D-1-1_corrected_071019.pdf].

10. This is actual transmission capacity, which takes into account various limitations, as opposed to nominal capacity, which is greater.

p. 13). The proponent considers that this capacity would be sufficient to allow for the export of electricity produced by the projected power plants (PR5.1, p. 17; Mr. Henri-Paul Dionne, DT2, p. 20). After the second part of the public hearing, Hydro-Québec announced that an agreement had been signed with partners in the United States for the construction of a power transmission line with a capacity of 1,200 MW between the Des Cantons station near Sherbrooke and the New Hampshire station.[11]

- *The panel notes that energy and power demand in the export markets targeted by Hydro-Québec can be expected to increase continuously and that these needs may be satisfied, in whole or in part, through the construction of new facilities or by means of trading among the different markets.*

- ***Opinion —*** *The panel agrees that the energy and power surpluses made available by the project could meet demand in markets bordering Quebec for a few years, and then its internal needs.*

Project profitability

Hydro-Québec Production would market the electricity produced by the projected complex based on market conditions inside and outside Quebec (PR3.1, p. 2-1). The profitability of sales would be determined by the price obtained, from which would be subtracted the cost of production and delivery. The proponent has estimated that the project cost would be 9.2¢/kWh Canadian in 2015.[12] Of this amount, 7.3¢/kWh would cover building and operating the power plants, and network connection fees would account for the other 1.9¢/kWh (Mr. Benoît Gagnon, DT2, p. 17 and 19).

According to Hydro-Québec Distribution, electricity prices in the north-eastern United States are extremely volatile (PR3.8, appendix A, p. A-58). Hydro-Québec Production considers that natural gas electricity production determines price during peak times (PR5.1, p. 6). According to the U.S. Department of Energy, over 90% of thermal plants built in the United States in the next twenty years would run on natural gas.[13] In the words of the National Energy Board, "with the increased use of natural gas for electric generation, short term upward pressure on electricity prices will result from a tight supply and demand balance in the natural gas market over the longer-term."[14] With regard to the future evolution of prices, the National Energy Board believes that they will "continue to be affected by fuel prices, changes in operating costs and the impact of adding new infrastructure. Short-term price fluctuations in competitive wholesale markets will be influenced by weather and the occurrence of temporary tight supply situations."[15]

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11. [Accessed on (January 6, 2009): www.cyberpresse.ca/le-soleil/affaires/actualite-economique/200812/18/01-811738-hydro-quebec-fonce-vers-les-etats-unis.php].
12. This cost is equivalent to 8¢/kWh in 2008 dollars (DA18, p. 1).
13. [Accessed on (January 2, 2009): www.energy.gov/energysources/electricpower.htm].
14. [Accessed on (January 2, 2009): http://www.neb.gc.ca/clf-nsi/rnrgynfmtn/prcng/lctrct/frqntlskdqstn-eng.html.
15. NATIONAL ENERGY BOARD (2007). *Canadian Energy Overview 2007*, p. 43, [Accessed on (January 21, 2009): www.neb.gc.ca/clf-nsi/rnrgynfmtn/nrgyrprt/nrgyvrvw/cndnnrgyvrvw2007/cndnnrgyvrvw2007-eng.pdf].

There is uncertainty regarding the evolution of electricity costs on export markets that is partially linked to the future price of hydrocarbons. The proponent has stated that they would assume all liability for the Romaine complex project, including market prices inside and outside Quebec (PR3.1, p. 2-16).

Use of electricity generated

Participants in the public hearing have proposed that the electricity generated by the project be used, wholly or in part, for other purposes than sales on markets outside Quebec. Socio-economic North Shore stakeholders have requested that measures be implemented to promote the development of companies that are major energy consumers near generating facilities, to ensure the sustainability of the local economy. Other stakeholders consider that the project would be justified if its objectives involved using the energy generated to reduce dependency on petroleum.

In 2006, petroleum accounted for 36.79% of total energy consumption in Quebec, while electricity was the most-used form of energy, at 40.4% of total consumption.[16] The transport sector consumed the most petroleum products, with 66% of the total.[17] Electrifying transport could help reduce the percentage of petroleum in Quebec's total energy consumption.

During the public hearing, the proponent stated that the energy required to electrify transport in Quebec was not part of the demand forecast (Mr. Benoît Gagnon, DT1, p. 91–92). Nevertheless, to manage demand on its network in an optimal manner, Hydro-Québec is working on various aspects of this possibility, including fine-tuning electric motorization systems and vehicle charging infrastructures, since recent technology breakthroughs herald the advent of rechargeable electric automobiles (DQ18.1, p. 1).

The objectives and directions concerning energy use in Quebec are largely the result of government decisions listed as priorities for action in various energy strategies and policies. The first Romaine River generating station would be commissioned one year before the current Quebec energy strategy expires: the strategy covers the period between 2006 and 2015. Consequently, future use of energy surpluses generated by the project and other sources would have to be re-evaluated by policy makers, who will be responsible for setting objectives, directions and priorities for action as part of the next energy strategy, based on demand on markets inside and outside Quebec, economic and technological conditions, and social priorities. Electrifying transport may become one of those priorities. However, the panel stresses that its mandate is not to order or decide on future energy use.

16. [Accessed on (January 7, 2009): www.mrnf.gouv.qc.ca/energie/statistiques/statistiques-consommation-forme.jsp].

17. [Accessed on (January 7, 2009): www.mrnf.gouv.qc.ca/energie/statistiques/statistiques-consommation-petroliers.jsp].

- ***Opinion —*** *The panel is of the opinion that the electricity made available by operating the project's power plants would provide for flexibility in developing a future energy strategy for Quebec.*

Alternatives

Under the *Canadian Environmental Assessment Act* (paragraph 16 (1) (e)) and the directives from the Quebec Department of Sustainable Development, Environment and Parks regarding impact assessments, the proponent is required to present alternatives to the project. According to the Canadian Environmental Assessment Agency, "alternatives to" a project are "the functionally different ways to meet the project need and achieve the project purpose."[18] For the proponent, the project is justified by two main purposes: increasing Quebec's wealth through exports when the Romaine-2 power plant is commissioned in 2014, and ensuring that Quebec's electricity demand is met in the long term. The proponent maintains that no alternative to the project would achieve those objectives (Mr. Benoît Gagnon, DT5, p. 78).

The proponent's conclusion that there are no satisfactory alternatives to the project rests on a comparison of services provided by various accessible electricity generation channels (ibid., p. 75). The proponent considers that hydroelectric plants with reservoirs have several advantages due to the ability to store water and the speed at which turbines can be put into service, providing flexibility for dealing with demand fluctuations on various markets, particularly within the proponent's activities on export markets. Hydroelectric plants help address hourly, seasonal and annual fluctuations in electricity demand. Hydroelectricity also helps stabilize the electrical load on a network by compensating for fluctuations in production by energy sources that produce intermittently, such as wind energy plants (DQ16.1, p. 1).

When analyzing alternatives, the proponent immediately rejected thermal energy, meaning nuclear generating plants as well as plants powered by natural gas or fuel oil, because the company is basing its development on renewable energy, and it considers that these production methods are not socially acceptable in Quebec (DA34, p. 1). The Quebec energy strategy does not set out any recourse to these production methods. As a result, the proponent considers that the only conceivable alternative would be another major hydroelectric project, and therefore that the current project is the best option from an economic, environmental and social perspective.

Geothermal, solar and wind power

The proponent maintains that, from a technical and economical viewpoint, geothermal and solar energy are not currently competitive with hydroelectricity or wind power. The large-scale development of these methods depends on technological development (ibid., p. 2). However, the proponent recognizes that geothermal energy is being used increasingly for heating and air conditioning in the residential and industrial sectors (Mr. Benoît Gagnon, DT5, p. 76).

[18]. Operational Policy Statement OPS-EPO/2-1998,
[Accessed on (November 17, 2008): http://www.ceaa-acee.gc.ca/013/0002/addressing_e.htm].

Participants in the public hearing advocated the development of wind energy as an alternative to the project or as a complement to it. The proponent considers that wind energy could not provide the same service as the project because of the intermittent nature of its production. The proponent believes that the inconsistent availability of the electricity produced by wind turbines demands that it be paired with an additional production method to provide set, guaranteed power and energy when wind power is lacking (PR3.1, p. 2-20).

The *Quebec Energy Strategy 2006-2015* anticipates the development of the existing potential of wind energy, which can be integrated into the Hydro-Québec network (Quebec Department of Natural Resources and Wildlife, 2006, p. 31). Total wind power development in Quebec should reach 4,000 MW of installed capacity by 2015, approximately 10% of peak demand (ibid., p. 38). During the public hearing, participants discussed the possibility of developing wind energy beyond the 10% mark. According to the proponent, exceeding the 10% mark depends on evaluating needs to balance out fluctuations in wind energy production. However, there would still be uncertainty, because the necessary balance depends on the long-term performance of wind power, which is yet to be evaluated (Mr. Henri-Paul Dionne, DT5, p. 87–88). In addition, the proponent maintains that the cost of an alternative wind power project would be 11.5¢/kWh in 2015 dollars – higher than the anticipated 9.2¢/kWh cost of the project (id., DT2, p. 96).

The Rivers Foundation submitted a wind power project scenario that it feels would be a good replacement for the Hydro-Québec project. The installed capacity of 2,205 MW would mean 8 TWh of energy per year at a cost of 7.04¢/kWh in 2008 dollars (DM101, p. 56–66). The proponent disagrees with several parameters used in the scenario. The proponent considers that 2,836 MW of power would be required to provide the same amount of energy. The 43.6% load factor for wind turbines used by the Rivers Foundation is greater than the average factors set out for the wind power projects in the first two calls for tenders by Hydro-Québec Distribution, which were 36.6% and 35%. In addition, the proponent considers that the cost has been underestimated, particularly in comparison to the 10.5¢/kWh cost (in 2007 dollars) obtained in the second call for tenders by Hydro-Québec Distribution (DA67, p. 13).

Furthermore, the panel emphasizes that the proposed wind power project may have significant impacts on the biophysical environment of Minganie, particularly in terms of wildlife. A serious comparison of the Hydro-Québec and Rivers Foundation projects cannot be made without a detailed evaluation of the environmental impacts of the wind power project. However, this information is not available, and the proponent is not required to produce a comparative impact study within the provincial and federal procedures for environmental assessment.

Energy efficiency and energy conservation

Some participants in the public hearing suggested increasing efforts in energy efficiency and conservation. Since the adoption of the *Act respecting the implementation of the Quebec Energy Strategy and amending various legislative provisions* (S.Q. 2006, c. 46) on December

13, 2006, the Quebec Energy Efficiency Agency has had a mandate to develop an overall plan for energy efficiency and new technologies and to take responsibility for implementation and follow-up. The 2007-2010 plan was filed with the Régie de l'énergie on July 31, 2008 (R-3671-2008). A public hearing regarding the plan began on January 7, 2009, before the Régie de l'énergie.

In the plan, Hydro-Québec Distribution was required to submit an overall plan for energy efficiency to the Régie de l'énergie. The objective for energy conservation in 2008 was set at 0.75 TWh, a 16% increase from the objective set out in 2007. Hydro-Québec kept its energy conservation objective at 4.7 TWh by 2010, and planned to invest nearly 1.3 billion dollars.[19] According to the Quebec Department of Natural Resources and Wildlife, the least costly measures for reducing energy consumption, such as changing individual behaviour, have already been implemented. Additional conservation is therefore becoming increasingly expensive, because major work is required (Mr. Taoufik Sassi, DT5, p. 83).

- *The panel notes that the proponent has considered the options that are available as alternatives to the project and has concluded that none of them, apart from a similar hydroelectric project, would permit it to meet its objectives economically or technically.*

- ***Opinion —** The panel is of the opinion that in accordance with the requirements of federal and Quebec directives, the proponent has demonstrated that it has no satisfactory alternative to the project.*

Finally, as part of the impact assessment, the proponent presented a project variation. This variation, with no bypassed portion, would aim to reduce environmental impacts (PR3.1, p. 8-1 to 8-36). Though the variation would be better than the original project with regard to the environment, the proponent rejected it because the cost of the energy generated would be greater than 34%. There were no concerns raised about the variation at the public hearing.

[19]. [Accessed on (January 5, 2009): http://communiques.gouv.qc.ca/gouvqc/communiques/GPQF/Fevrier2008/26/c6236.html].

Chapter 3 Natural environment

This chapter discusses the impacts of the project on the natural environment of the Romaine River watershed, as well as the impacts on the marine environment, in terms of its physical aspects and flora and fauna. In this chapter, the panel also discusses the cumulative effects on one element or component of the natural environment for project impacts that are considered significant or substantial. The analysis of cumulative effects is not a substitute for the analysis conducted by the proponent in the impact study. Rather, it is the product of the panel's analysis of the issue, conducted in response to concerns raised by participants at public hearing.

The panel finds three principles from the Quebec *Sustainable Development Act* particularly applicable to this chapter. The first is the principle that states that "to achieve sustainable development, environmental protection must constitute an integral part of the development process." In this context, "environmental protection" refers to the protection of the biophysical environment.

The second principle is biodiversity preservation, which states that "biological diversity offers incalculable advantages and must be preserved for the benefit of present and future generations. The protection of species, ecosystems and the natural processes that maintain life is essential if quality of human life is to be maintained."

The third applicable principle is prevention, because "in the presence of a known risk, preventive, mitigating and corrective actions must be taken, with priority given to actions at the source."

Terrestrial environment

Flora

The implementation of the project would result in the loss of 10 vascular plant species in the study area identified by the proponent. This represents 2% of the plant species found in that area. However, in the opinion of the proponent, seven of these 10 species are scarce because they are naturally sporadic or are found at the limit of their range, and the other three species are infrequent because of the lack of suitable habitat (PR3.11, p. 89).

Three native vascular plant species with special status under the Quebec *Act Respecting Threatened or Vulnerable Species* (R.S.Q., c. E-12.01) would be affected by the project: 1) dragon's mouth (likely to be designated threatened or vulnerable), 2) ostrich fern (vulnerable) and 3) poverty grass (likely to be designated threatened or vulnerable) (ibid.).

The proponent expects the project to have little effect on the dragon's mouth present in the region, since less than 1% of the known populations may be affected by the presence of the Romaine 1 reservoir. It also expects the project to have little effect on the ostrich fern. The presence of the Romaine 2 reservoir would result in the loss of two ostrich fern populations, but the species could be retained in the area through a transplant program. Because it is easy to transplant and cultivate this plant, the proponent is of the opinion that four years after the transplants, the number of individuals should be the same as it was originally (ibid.).

The number of known poverty grass individuals is expected to be reduced by 80% at the site of the Romaine 4 reservoir. However, a program for mature plant transplant and germination in a controlled environment could mitigate the impact (ibid.). In the impact study admissibility analysis, the Quebec Department of Sustainable Development, Environment and Parks expressed reservations about the efficiency of this program and suggested that the proponent should instead focus on protecting one threatened or vulnerable population or species. The proponent nevertheless wishes to continue with the proposed program and considers the program to be in line with poverty grass conservation efforts, for which there is limited applied knowledge of protection measures. The proponent believes that its program would help acquire new knowledge that could be applicable to other species conservation or recovery projects. The Quebec Department of Sustainable Development, Environment and Parks accepted the proponent's proposal, stating that the program was satisfactory and that the monitoring, to be carried out over five years, would make it possible to evaluate its success before the filling of the Romaine 4 reservoir in 2019. If MDDEP is not satisfied with the results, it would then be able to require other measures, since the proponent would be bound by an obligation of result (PR5.1, p. 201; DQ6.1, pp. 5–6).

- ***Note —*** *The panel deems the mitigation and compensation measures planned by the proponent for the special-status vascular plants that would be affected by the project to be satisfactory. The panel is of the opinion that the proposed monitoring would make it possible to verify whether these measures are producing the desired results and whether additional measures should be undertaken.*

Wetlands

Hydro-Québec estimates the wetland loss caused by the project to be 1,359 ha, of which 649 ha are peatlands and 710 ha are riparian wetlands. Because the proponent believes that 733 ha of the wetlands, mainly swamps, would regenerate without intervention, particularly along the Romaine 4 reservoir, it calculates that the net wetland loss in the four planned reservoirs would be 626 ha, primarily peatlands (PR9.3, pp. 46–49 and appendix).

The proponent also prepared inventories of wetland losses and gains for each reservoir. The inventory for the Romaine 4 reservoir shows a gain of 218 ha in riparian environments that the proponent believes would regenerate by themselves. Wetland losses of approximately 117 ha and 40 ha are anticipated in the Romaine 2 and Romaine 3 reservoirs respectively. For the Romaine 1 reservoir, the inventory shows no wetland loss.

The proponent suggests various measures for mitigating wetland loss, primarily aimed at preserving habitat function by creating areas suitable for flora and fauna. The planned measures are the clearing of a 3-m strip, mainly around the Romaine 1 reservoir, in order to encourage the recolonization of the sector by shrub species to serve as a riparian habitat, and the creation of two or three bays with a total surface area of 15 ha, also in the Romaine 1 reservoir.

The proponent believes that the terrestrial and aquatic habitat functions of the wetlands would be the most severely affected by the project, particularly for species associated with peatlands. It plans to compensate by creating wetlands in borrow pits located near the Romaine 2 and Romaine 3 reservoirs. The proponent has identified approximately 10 borrow pits that would be suitable for development. The total surface area of the developments could reach 100 ha. The proponent has stated that it is proposing this measure not to compensate for an overall negative wetland inventory, but because the inventories for the Romaine 2 and Romaine 3 reservoirs are negative. The proponent attributes recreational and education value to these developments, in addition to their value as wildlife habitat.

The proponent believes that the wildlife habitat function of the wetlands along the Romaine River will not be at risk after the project is completed. It calculates that the surface area of the wetlands would decrease only slightly once the mitigation and compensation measures have been applied. It also points out that these measures have been designed taking into account the functions and values of the wetlands that would be affected, in order to adhere to the principle of no net loss of wetland functions recommended by *The Federal Policy on Wetland Conservation* (Government of Canada, 1991). It believes that the new swamps, marshes and aquatic plant beds would offer a better wildlife habitat function than peatlands. It states that follow-up studies on the newly created riparian wetlands would be useful for better understanding their development and for refining the proponent's method. These studies could be considered research, as suggested by the Quebec Department of Sustainable Development, Environment and Parks (PR9.4, pp. 35–39; DA65, p. 2).

The Quebec Department of Sustainable Development, Environment and Parks counters that although the riparian wetlands may regenerate, it is difficult to predict their quality and quantity with certainty. MDDEP believes that these newly created environments are unlikely to have "[translation] habitats as rich and diverse as in natural environments, where there is a plant succession on the banks, reflecting an established slope gradient and a natural, seasonal water regime" (DQ6.3, pp. 8 and 9; DQ6.3.1). In the view of MDDEP, it is possible that the surface area of riparian vegetation to be created once the hydroelectric development enters into service, mainly at the Romaine 4 reservoir, will not be achieved. MDDEP wonders why the proponent used slope criteria under 10% for modelling the areas of riparian vegetation to be created when the riparian vegetation grew on 2% slopes in the case of the La Grande complex. The proponent has explained that the topographical data available were not precise enough for it to use a slope criterion of 2% and that it considered a criterion of 10% to represent a gentle slope (DA65, p. 2).

Environment Canada foresees wetland habitat losses for waterfowl breeding and for aquatic birds during the time required for the natural development of the riparian environments. According to Hydro-Québec, this development could take 10 to 15 years. Environment Canada recommends that the proponent consider creating floating peat bogs during the filling of the reservoirs. This measure is believed to have had a beneficial effect on waterfowl in the case of the La Grande complex. However, Hydro-Québec does not think this recommendation is feasible, given the characteristics of the peat bogs along the Romaine River (DB14; PR9.4, pp. 49–51; DA65, p. 9).

Environment Canada is also asking the proponent to considering digging canals and ponds in the existing peat bogs. However, the proponent is currently experimenting with this measure in the projects for the Eastmain-1-A and Sarcelle powerhouses and the Rupert diversion and does not wish to apply it to this project. The proponent feels that this operation is costly and complex. Because of the poor soil support, the work would have to be carried out in the winter, which would require, among other things, the clearing of safe ice roads and the use of specialized machinery (DA65, p. 2).

The Quebec Department of Sustainable Development, Environment and Parks feels that the project's magnitude and impacts on wetlands justify an additional compensation measure for the loss of 649 ha of peat bogs, which cannot be restored because this type of environment takes millenia to develop. MDDEP suggests that the proponent prepare a wetland conservation plan for the Minganie MRC territory, identifying wetlands of ecological interest and sites to be preserved. It suggests this type of plan to municipalities and MRCs so that all projects can be analyzed from a global and territorial perspective and compensation strategies for losses of such environments can be proposed. It is offering to collaborate and hopes that university research centres will participate (DQ6.3, pp. 8–9). The participation of an organization such as the Conseil régional de l'environnement de la Côte-Nord would be valuable.

- ***Recommendation —*** *The panel recommends that the proponent examine, in collaboration with Environment Canada, additional measures to establish favourable habitats for waterfowl and other water birds on the edges of the planned reservoirs.*

- ***Note —*** *The panel shares the opinion of the Quebec Department of Sustainable Development, Environment and Parks, that the magnitude of the project justifies that the loss of 649 hectares of peatland be compensated for by an additional measure, such as a conservation plan for ecologically significant wetlands in the Minganie MRC, proposed by MDDEP, or a contribution for the conservation of one of these habitats.*

Birds

The Romaine River is located in the black spruce-moss bioclimatic domain. Various bird species are distributed across this domain according to habitat and latitude.

Forest birds

In inventories carried out on forest birds, particularly passerines and woodpeckers, six woodpecker species and 55 passerine species were observed within the boundaries of the four reservoirs. There are an estimated 97,000 breeding pairs of forest birds occurring within the four reservoirs.[1] The project would cause the loss of forest bird habitat. Furthermore, the tree clearing would begin in the fall or winter but would continue in the spring and may therefore overlap with the breeding season of certain birds (PR3.11, pp. 53, 92 and 94).

Only one forest bird species with special status, Bicknell's thrush,[2] was observed during the inventories carried out in the study area. It was reported at a listening station outside the Romaine 1 reservoir. Other forest bird species considered to be of interest may be affected by the project. The birds in question are species that have been evaluated by the Committee on the Status of Wildlife in Canada (COSEWIC) and recommended for designation as a species at risk or priority species under a Northern American landbird conservation plan (PR3.4, p. 28-23; PR9.4, pp. 13 and 52; DB14, p. 1).

The proponent acknowledges that the loss of land and wetlands would limit the availability of nesting sites and compel forest birds to look for replacement habitat. Increased forest bird densities in these peripheral sectors could lead to interspecies competition and habitat saturation. Although some birds would be able to find new places to nest in the short term, the proponent predicts a decline in the local population. It believes, however, that mitigation and compensation measures aimed at developing wetlands and creating riparian habitats would benefit bird species. When partially or completely clearing the banks of the various reservoirs, the proponent plants to leave snags for nesting and for feeding by woodpeckers. The proponent also plans to plant shrubs that are suitable for forest birds when the Romaine 1 reservoir bays are created. The proponent points out that similar wetlands were developed as part of the Péribonka River hydroelectric development project and that, two years later, 25 bird species were reported in that area (PR3.11, p. 92; PR9.4, p. 21; DA65, p. 3).

Environment Canada is particularly concerned about the loss of 4 to 7% of the potential habitat of a number of sensitive[3] forest bird species in the study area. Environment Canada is of the opinion that the presence of sensitive birds is a major conservation issues and that additional mitigation measures are required. Environment Canada wants the proponent to limit the loss of rare or significant forest habitat, such as old-growth forests. The path of the access road could be reviewed, and snags in shrubbery could be preserved. Environment Canada also suggests clearing more 3-m strips on the edges of the reservoirs to increase the quantity of riparian habitat. It proposes extending the areas to be developed by scarifying the area, planting trees and shrubs that are favourable to the birds, and adding various nesting boxes to encourage forest birds to use the developments (DB14, pp. 1 and 2). The Club

1. This is the maximum number of breeders as evaluated by Hydro-Québec, which clarifies that the number would be closer to 50,000 to 75,000 breeding pairs if traditional evaluation methods had been used.
2. Bicknell's thrush is listed as a species of concern under the federal *Species at Risk Act* and is likely to be designated threatened or vulnerable under the Quebec *Act respecting threatened or vulnerable species*.
3. Special-status or high-priority bird species.

d'ornithologie de la Côte-Nord thinks that when the 3-m strip is being cleared along the banks of the reservoirs, one large tree should be conserved every 20 m to serve as a potential perch for Boreal pewee (DM22, p. 4).

Environment Canada emphasizes the importance of the *Migratory Birds Regulations* (C.R.C., c. 1035, paragraph 6(a)), which states that "no person shall disturb, destroy or take a nest, egg, nest shelter, eider duck shelter or duck box of a migratory bird." Environment Canada would like the proponent to comply with the regulations by carrying out the clearing and filling of the reservoirs outside the nesting period (DB14, p. 1). Hydro-Québec says that the reservoir clearing and filling schedule will take the nesting period into account (PR9.2, p. 14; DA65, p. 3).

In addition, Environment Canada believes that the proponent should include forest bird monitoring in its program for monitoring the riparian and wetland habitats to be developed (DB14, p. 5).

- *The panel notes that the loss of land and wetlands would limit the availability of nesting sites for some 97,000 pairs of forest birds, including species considered to be sensitive, which would be compelled to look for replacement habitat close to the reservoirs. Increased forest bird densities in these peripheral sectors could lead to interspecies competition and saturation of habitat, which could result in population decline.*

- ***Recommendation —*** *The panel recommends that the proponent and Environment Canada agree on additional measures to limit the impact of the reservoirs and access roads on forest birds. This might involve increasing the acreage of wetland development, adding nesting boxes and limiting losses of rare forest habitat.*

- ***Recommendation —*** *The panel recommends that the proponent conduct reservoir clearing operations outside forest bird nesting periods. The proponent must justify its choice of timing for filling the reservoirs to Environment Canada.*

- ***Recommendation —*** *The panel recommends that the proponent include forest birds in its program to monitor riparian and wetland habitats to be developed and report the findings to Environment Canada.*

Waterfowl

The territory in which the planned reservoirs are located is used by 17 waterfowl species (geese, ducks and loons). Some 170 breeding pairs would be affected by the project because they use this sector during their breeding period. According to Environment Canada, the total number of pairs affected by the project could increase if the construction of the access paths and roads were factored in (DB14, p. 2). The estimated densities of breeding pairs are thought to be higher on the coastal plain, but this sector would not be affected by the hydroelectric developments. The Romaine 4 reservoir territory contains a higher density than

the other reservoirs. The Romaine 3 reservoir sector is used by one special-status waterfowl species, Barrow's goldeneye (PR3.4, pp. 28-5 and 28-21; PR3.11, p. 53).

The proponent expects waterfowl breeding populations to decrease following the completion of the project, since the creation of the reservoirs would result in the loss of wetlands that are important for waterfowl breeding. This loss would be mitigated, however, by the natural recreation of the riparian environments or by proposed measures. The proponent believes that the status of the main species affected would not present a concern, since their populations have been growing over the past two decades. The transformation of the river and ponds into large bodies of water would favour certain species over others that prefer rivers. However, since the duck population density in the study area is low, adjacent environments could serve as replacement habitats (PR3.11, pp. 91 and 92). To this end, Environment Canada would have liked the proponent to assess the local availability of wetlands for the waterfowl, but the proponent feels that this work falls outside the scope of the project (PR9.4, p. 29).

The proponent plans to install 60 artificial nesting boxes on the edges of the reservoirs and near the developed wetlands, in order to mitigate the impact of cutting down the dead trees used by the 58 tree duck pairs (PR9.4, p. 41). Environment Canada predicts that some of the nesting boxes would not be efficient and believes that the number of nesting boxes should be increased (DB14, p. 2). The Club d'ornithologie de la Côte-Nord estimates that 225 nesting boxes would be required, citing a study that calculated a 26% occupation rate for this type of nesting box in Quebec (DM22, p. 4).

The environmental monitoring program for birds that the proponent has put forward consists of, among other things, measuring the impact of the project on waterfowl. In addition, the use of the riparian and wetland environments to be developed as habitat loss mitigation or compensation measures would be evaluated during the waterfowl breeding period. Environment Canada believes that the potential of these developments for other migratory water birds should be evaluated. However, the proponent would record only information related to other water bird species when carrying out its inventories for monitoring waterfowl use of the developments. Environment Canada also recommends that the proponent add another year of waterfowl monitoring in the Romaine 4 reservoir in order to have three post-construction inventories, as is the case for the other reservoirs (PR3.7, p. 47-16; PR9.4, p. 44; DB14, p. 5; DA65, p. 10).

- ***Recommendation —*** *The panel recommends that the proponent plans its program to monitor riparian and wetland habitats to be developed so as to evaluate the use of these habitats not only by waterfowl, but also by other migratory water birds. The program should be discussed with Environment Canada.*

- ***Recommendation —*** *The panel recommends that the number of nesting boxes for tree ducks be increased in collaboration with Environment Canada.*

Barrow's goldeneye: a species at risk

The Romaine River watershed lies at the heart of the range of Barrow's goldeneye in eastern Canada. The Club d'ornithologie de la Côte-Nord states that the North Shore contains most of the nesting sites of Barrow's goldeneye in eastern North America and that, in winter, the St. Lawrence corridor is used by almost all of the Barrow's goldeneyes (DM22, p. 1). It is listed as a species of concern under the federal *Species at Risk Act* (2002, c. 29) and is likely to be designated threatened or vulnerable species under provincial legislation (PR3.11, p. 92).

One of Environment Canada's major concerns about Barrow's goldeneye stems from the fact that Hydro-Québec plans to stock some naturally fishless lakes, a habitat considered preferential for the species, in order to compensate for brook trout habitat loss caused by the project. However, the Barrow's goldeneye recovery plan currently being prepared by Environment Canada advises against stocking naturally fishless lakes. Environment Canada cannot determine at this time whether the number of naturally fishless lakes is a limiting factor for Barrow's goldeneye and therefore advises against stocking such lakes, even if the precise effects that stocking naturally fishless lakes may have on the species' productivity are not known (DB14, p. 2).

During inventories of Barrow's goldeneye carried out as part of the project, two breeding pairs were reported in the two lakes located in the Romaine 3 reservoir flooding area (PR3.4, p. 28-21). In addition, 21 pairs were reported in approximately 100 of the inventoried tributaries and lakes. The breeding pairs were all observed on water bodies located outside the Romaine 2 and Romaine 3 reservoirs, primarily on lakes and ponds with an average surface area of 5.4 ha, at elevations over 450 m. Approximately 95% of the observations were at lakes with an area of 12 ha or under. The proponent therefore believes that there is little risk that Barrow's goldeneye uses the lakes that would be stocked, since the proponent would use species selection criteria to choose the lakes. In addition, the proponent calculates that since naturally fishless lakes account for approximately 30% of the 29,000 lakes in the Romaine River watershed, approximately 8,000 lakes would remain available for the Barrow's goldeneye population, which the proponent estimates to be approximately 49 pairs (PR5.1, p. 177; DA65, pp. 2 and 5; Mr. Benoît Gagnon, DT4, pp. 24 and 44).

Although Barrow's Goldeneye can use fishless lakes regardless of their elevation or surface area, studies conducted by Environment Canada indicate that it prefers small (<10 ha), high-elevation (>450 m) fishless lakes. If naturally fishless lakes must be used in a brook trout stocking program, Environment Canada suggests not stocking lakes at elevations higher than 490 m. Environment Canada recommends starting with lakes located near the access roads because the level of disturbance there would be higher. It also suggests verifying certain things ahead of time, particularly regarding the use of the lake by Barrow's goldeneye. In addition, Environment Canada feels it is important to install only one artificial nesting box per

naturally fishless lake, because Barrow's goldeneye is highly territorial (PR9.4, p. 56; DA65, p. 5; DB14, pp. 2 and 3).

The Club d'ornithologie de la Côte-Nord is dissatisfied with the Barrow's goldeneye inventory carried out by the proponent from May 25 to June 14, 2004. The Club d'ornithologie de la Côte-Nord feels that, because Barrow's goldeneye had been at the nesting sites since early May, brooding females could not be counted. The Club d'ornithologie de la Côte-Nord therefore recommends that Barrow's goldeneye inventories take place in the first few weeks of May in order to determine the exact number of pairs affected by the project. The Club d'ornithologie de la Côte-Nord is also requesting an information campaign for area users, particularly fishers, on the importance of protecting fishless lakes, because Barrow's goldeneye rears its young in fishless lakes, and making the area more accessible would increase the risk of deliberately or inadvertently introducing fish into the lakes (DM22, p. 1).

The panel will continue its analysis of the impact of stocking fishless lakes in the section on aquatic species, when it discusses compensation for the loss of brook trout habitat.

Birds of prey

Thirteen species of birds of prey nest in the large trees and walls along the Romaine River. The total confirmed number of breeding pairs is 47, of which 23 occur in the reservoir sector. In addition, 33 occupied nesting sites have been found, of which eight are located in the reservoir sector. The special-status birds of prey occurring in the study area are the golden eagle, peregrine falcon, bald eagle and short-eared owl. Two bald eagle pairs may be using the sector that would be affected by the project, and there have been two golden eagle sightings in that area. The peregrine falcon and short-eared owl have been observed only outside the sector (PR3.4, pp. 28-22 and 28-23; PR3.11, pp. 52 and 53).

The project would cause the loss of terrestrial and wetland habitat for birds of prey and reduce the number of accessible large trees and walls in which large birds of prey build their nests. According to the proponent, the habitat loss in the reservoirs would alter the hunting grounds of birds of prey, but, given the extent of their home range, the impact would probably be imperceptible. The proponent acknowledges that the nest supports in the large trees and walls, of which eight are occupied, would be flooded, but it claims that the birds could find replacement elements in peripheral areas. The loss of two nests would be mitigated with the installation of two platforms for osprey, a species that the proponent claims voluntarily uses artificial structures. The tree clearing may overlap with the breeding season of certain birds of prey. The proponent would mitigate these impacts through various measures, including the establishment of protective perimeters during the breeding period around two osprey nests in the Romaine 2 and Romaine 3 reservoirs and around one golden eagle nest located near a borrow pit. A third osprey pair may be disturbed by the construction of the access road. A nesting platform would therefore be installed (PR3.11, pp. 92–94).

The Club d'ornithologie de la Côte-Nord believes that the habitat loss would step up competition for food and shelter between birds of prey, which would impact their breeding.

The Club d'ornithologie de la Côte-Nord is of the opinion that the two or three platforms the proponent is planning to install would not be sufficient. It recommends installing 76 platforms, equivalent to the number of confirmed and potential breeding pairs that would be affected by the project (30 osprey pairs, two bald eagle pairs, 40 red-tailed hawk pairs, and four great horned owl pairs). The Club d'ornithologie de la Côte-Nord also recommends installing 57 nesting boxes in open areas to shelter the broods of the 17 American kestrel pairs that would be affected by the project, since it estimates that the occupation rate of the nesting boxes would only be 30%. Furthermore, the Club d'ornithologie de la Côte-Nord is concerned that making the area more accessible may increase trapping pressure, placing birds of prey at an increased risk of accidental capture, particularly in the case of the golden eagle and bald eagle. The Club d'ornithologie de la Côte-Nord feels that trappers should be made aware of techniques that limit the accidental capture of birds of prey (DM22, pp. 2–3).

As for special-status birds of prey, studies conducted by the proponent on traditional Innu knowledge revealed the presence of a bald eagle nest near the mouth of the Romaine River and a golden eagle nest near Bassin des Murailles. The information available shows the two nests to be located outside the Romaine 1 reservoir, but the proponent would verify this in 2012, before the start of the work. The presence of the short-eared owl in the reservoirs would also be verified before the start of the work. The proponent states that it would re-evaluate the impacts of the project on these species and the mitigation measures depending on the results. The use of artificial nesting boxes and platforms would also be examined (PR3.11, p. 92). The Wildlife division of the Quebec Department of Natural Resources and Wildlife could help the proponent determine the exact number of platforms and nesting boxes to install.

- ***Opinion —*** *The panel is of the opinion that the sufficient number of bird of prey platforms and nesting boxes to be installed by Hydro-Québec should be determined in agreement with the Quebec Department of Natural Resources and Wildlife.*

Terrestrial and semi-aquatic wildlife

A number of terrestrial and semi-aquatic wildlife species are found in the Romaine River watershed, in forest, riparian or wetland environments. In this section, the panel examines some of these species, which were selected either because of their status under the Quebec *Act Respecting Threatened or Vulnerable Species* (R.S.Q., c. E-12.01) or under the federal *Species at Risk Act* (2002, c. 29) or because of the value attributed to them by area users.

Large wildlife

Several large wildlife species are found in the Romaine River watershed, namely moose, caribou and black bears. The panel has focused on moose, because it is greatly valued for sport and subsistence hunting, and on the woodland caribou ecotype, because its survival is compromised by human activity.

Moose

The moose density of 0.29 moose/10 km^2 recorded along the Romaine River may be one of the lowest densities in Quebec, perhaps because the presence of moose in the area is fairly recent, dating back to only the 1960s, the hunting rate is relatively high, and the area is dominated by unproductive coniferous stands. The highest moose densities were reported north of the watershed and at the site of the reservoirs, where the best food sources and shelter are found, rather than in the surrounding denuded plateaus and in the south (PR3.4, pp. 26-4 and 26-5; PR3.1, p. 5-24).

Winter habitat is believed to be more critical than summer habitat, because the snow cover makes moose less mobile and the moose are seeking shelter and food, particularly in the valleys. The proponent estimates that the project would result in the loss of 222 km^2 of winter habitat, essentially due to the creation of the reservoirs (PR5.1, pp. 203–206). However, this loss would not hinder east-west moose movements. Telemetric monitoring of moose at the Sainte-Marguerite 3 powerhouse has shown that moose can cross a reservoir similar to the planned reservoirs at any time of year (DQ16.1, p. 3).

Since food and shelter are not currently limiting factors for moose, the proponent believes that the moose population would not decrease, although it may be redistributed across the area. However, the loss of high-quality habitat would hinder moose population growth in the Romaine River watershed (PR3.4, pp. 26-28 to 26-29).

The proponent is proposing mitigation measures such as forest cutting to rejuvenate the forest in order to encourage the regrowth of edible plants for moose and the development of wetlands around the reservoirs. These developments would target not only moose, but also other species such as black bears and porcupines (PR3.4, section 26.2).

- ***Opinion —*** *Although the presence of hydroelectric developments may result in redistribution of the region's moose population, the panel anticipates no significant impact on this population's survival.*

Woodland caribou

The proponent indicated that studies and traditional Innu knowledge emphasize the great sensitivity of the Caribou, a forest-dwelling ecotype, to anthropogenic disturbance (PR3.7, p. 48-35). In this respect, the report of Courtois et al. (2003) states that:

> [Translation] […] human harvest has had a markedly negative impact on woodland caribou. Sport hunting was stopped in 2001, but Aboriginal hunters continue to harvest moose. Poaching does not appear to be widespread, but it seems to persist in certain areas. Caribou are also sometimes harassed by snowmobilers. For a few decades, the caribou habitat has been subjected to forestry development and the impact of the clearings is added to that of the removals.
> (p. 1)

The report also states that the woodland caribou density in the eastern part of hunting zone 19 is now under 2 caribou/100 km^2 (ibid., p. 12). The authors contend that hunting and predation are the main factors behind the species' population decline but that human disturbances such as industrial or recreational activities would also contribute to this decline (ibid., p. 16). They add that although logging is the main industrial activity that may disturb the animal, the creation of hydroelectric reservoirs generally results in permanent habitat loss (ibid., p. 23). The cumulative effect of human activity in Quebec, from James Bay to the North Shore, is thought to have led to a general decline in woodland caribou populations.

The woodland caribou has been designated as a "vulnerable species" under the *Act Respecting Threatened and Vulnerable Species* by the Quebec government and listed as "threatened" under the *Species at Risk Act* by the Government of Canada.

A woodland caribou recovery plan is at the final stage of development at the Quebec Department of Natural Resources and Wildlife (Mr. Daniel Poirier, DT6, pp. 8 and 9). Moreover, in 2004 the Newfoundland and Labrador government published a recovery strategy for three herds of woodland caribou in Labrador (Schmelzer et al., 2004). The strategy lists objectives and identifies critical habitat for the species, where industrial activity would be prohibited. It also advocates education and awareness activities; coordinated action with Quebec and concerned Innu communities; research, inventory, follow-up; and activities for the development of measures to mitigate the impacts of human activity. In this respect, a Quebec–Newfoundland and Labrador round table has been created (Isabelle Auger, DT5, p. 26). The project focuses mainly on the Lake Joseph woodland caribou herd, which includes portions of Labrador and Quebec that is particularly affected. According to the proponent, this herd consists of approximately 1,100 individuals (DQ9.1, p. 26).

According to information from Newfoundland and Labrador, the geographic range of the Lake Joseph herd would include the upper Romaine River watershed, including the planned site of the Romaine 2, Romaine 3 and Romaine 4 reservoirs (Schmelzer et al., 2004, pp. 15–18). This information is corroborated by the impact study, which reports a caribou density of 0.37 caribou/100 km^2 in the vicinity of the three planned reservoirs, giving a total estimated population of 11 individuals primarily using the Romaine 2 sector plateaus in both summer and winter. In late summer, woodland caribou are thought to feed along the banks of the Romaine River (PR3.1, pp. 5-25 and 5-26; PR3.10, maps H and I; PR3.4, p. 26-9).

Alliance Romaine questions this woodland caribou density estimate. According to observations reported by its members along the Romaine River in the summer of 2008, the organization believes that the number of individuals may be higher, because the proponent's method of counting the caribou from a helicopter could trigger escape or avoidance behaviour (DM43, p. 12). The observations of the Alliance Romaine do not necessarily contradict the assessment of the proponent, which observed increased caribou presence by the river in late summer. According to Innu interviewed by the proponent, woodland caribou live in the forest in small groups of five or six individuals, and sometimes in groups of 10 to 20 individuals. The Innu believe that caribou once used the area around the Romaine 1 reservoir but that it may

have been displaced by moose (PR3.6, p. 44-6). It would therefore not be surprising to find multiple woodland caribou occupying a limited territory.

The construction of the hydroelectric complex, particularly the noise from the machinery and the comings and goings of workers, may disturb woodland caribou, yet the proponent discusses this issue only in general terms in the impact statement (PR3.7, pp. 48-35 to 48-43). The sites of the four hydroelectric facilities have a relatively limited surface area, but extensive tree clearing in the reservoirs and on the access road right-of-way leading to the powerhouses and the reservoirs would affect tens of square kilometres. The work may thus cause escape or avoidance behaviour of the animals using these areas.

The proponent is of the opinion that although the creation of the reservoirs would result in the loss of good quality terrestrial winter and denning habitat, it would have little impact on woodland caribou, because the areas at higher elevations favoured by caribou would not be flooded. The proponent believes the reservoirs may actually facilitate winter travel. The main effect of the reservoirs would be the alteration of the caribou distribution pattern in the area, but the access road leading to the hydroelectric generating stations may result in an increase in illegal harvesting and in the disturbance of individuals, which may then hesitate to cross the road during times of heavy traffic. Nevertheless, once the generating stations are in operation, the proponent expects light daily traffic levels of fewer than 50 vehicles, which should not constitute a major obstacle to crossing the access road (PR3.4, pp. 26-30 to 26-33; PR5.1, pp. 205–214). This traffic estimate does not include possible increases in road traffic due to third parties.

- *The panel notes that the work entailed by the project, the presence of workers and the use of the access road connecting Highway 138 to the hydroelectric power plants may cause increased disturbance on woodland caribou in Minganie, a species that is known to be sensitive to human activities.*

In public hearings, the Government of Newfoundland and Labrador expressed concerns about the survival of the Lake Joseph herd, part of which resides in Labrador, should the project proceed (DM62, pp. 4 and 6). The government fears that facilitating access to the Romaine 2, Romaine 3 and Romaine 4 reservoir sectors would lead to an increase in illegal woodland caribou hunting, which would impact the entire herd.

It is difficult for the panel to isolate the effect of the project on the survival of the species, since it appears that a combination of anthropogenic factors has adversely affected woodland caribou throughout Quebec for decades. On the North Shore and in Labrador, the main factors that have contributed directly to the decline of the Lake Joseph herd are intensive hunting, wolf predation, and hydroelectric development on the Churchill River in Labrador. Low-level Canadian Forces training flights may also have had an effect (Schmelzer et al., 2004, p. 34).

It is thought that woodland caribou would avoid the area around the access road, generating stations, dams and reservoirs during the tree clearing and construction. It would likely return

to the area later, although not to the flooded sectors. The presence of the generating stations and reservoirs would mainly alter the movements of individuals that use the Romaine River watershed, which means that the development would probably have little effect on the survival of the Lake Joseph herd. The issue of increased access to the area due to the access road leading to the generating stations remains unresolved.

The proponent discusses various measures and activities that may have a cumulative effect on the North Shore woodland caribou, but omits to quantify this effect or to establish negative effect thresholds (PR3.7, Chapter 48). The construction and presence of powerlines connecting the proposed hydroelectric complex to the Hydro-Québec's grid may contribute to the cumulative effect of human activity on caribou. The powerlines may facilitate the movements of predators and, combined with the presence of the access road, the possible reopening of commercial forestry operations in Minganie and the expansion of the recreational tourism activities, may lead to extensive development of the land.

However, the panel cannot predict the magnitude of the cumulative effect of opening the area, owing to a lack of specific, detailed projects planned for the area, other than the current project. In addition, during the panel's work, no specialist put forward a single cumulative effect threshold to avoid, and the panel was unable to find any such thresholds in scientific literature. Without any reference, the panel could only qualitatively appreciate the cumulative effect on the Lake Joseph woodland caribou herd.

- ***Opinion —*** *The panel is of the opinion that the operation of the hydroelectric complex could have a negative cumulative effect on woodland caribou. This effect should not be significant when the complex is operating. Other cumulative effects could, however, result from increased access to the region because of the presence of the power plant access road.*

The telemetric monitoring of woodland caribou proposed by Hydro-Québec would begin in the winter of 2009, in collaboration with the Quebec Department of Natural Resources and Wildlife and the Quebec Department of Sustainable Development, Environment and Parks (Mrs. Mireille Paul, DT5, p. 29). Assuming the project is carried out, the proponent also plans to carry out aerial monitoring over approximately a dozen years in order to count and locate woodland caribou herds. The purpose of this monitoring would be to better document the home range of caribou in the Romaine River watershed and, farther west, the area crossed by the power transmission lines connecting the hydroelectric complex to the Hydro-Québec grid (PR3.7, pp. 47-14 and 47-15).

- ***Opinion —*** *The panel considers that the telemetric and aerial monitoring proposed by Hydro-Québec would lead to improved knowledge of the habits of the woodland caribou in the region. The monitoring would make it possible to ascertain the size of the local population, learn more about its home range and understand more about how the project and human activities affect these animals.*

In 2007, Nature Québec suggested creating protected areas in Quebec for woodland caribou, using its own methodology for identifying favourable species conservation areas (Nature Québec, 2007). The protected areas would cover at least 5,000 km^2, or ideally over 9,000 km^2, to promote biological diversity and the essential ecological processes of the species. Nature Québec identifies one sector of interest (no. 16) in the vicinity of the Romaine 4 reservoir.

Monitoring could therefore help identify other possible protected areas for woodland caribou in Minganie. These protected areas, in which human activity would be minimized, could help mitigate the effects that the project and other existing or planned human activities may have on woodland caribou. They may also help put an end to the decline of caribou in the region.

- ***Opinion —*** *The panel is pleased that the Quebec Department of Sustainable Development, Environment and Parks and the Quebec Department of Natural Resources and Wildlife are working together to create protected areas for woodland caribou in the Romaine River region in cooperation with the Government of Newfoundland and Labrador so that protected areas on the North Shore correspond to those in Labrador. These areas should be created prior to the filling of the reservoirs.*

Medium and small animals

A number of medium and small animal species occur in the Romaine River watershed. These species would be affected by the project to varying degrees, depending on the size and availability of their home range after the completion of the project. A species that has a small home range and reduced mobility and that also favours sectors corresponding to the construction and development areas would likely be affected. In this section, the panel discusses only certain species, which it selected either because they are valued species or because they are designated threatened, vulnerable or likely to be so designated by Quebec or federal legislation.

Beaver and other fur-bearing animals

Almost a dozen fur-bearing species use the Romaine River watershed, as do about 10 other mammalian species not hunted for their fur. The natural environments within the reservoirs, which consist of coniferous forestland, are thought to generally contain greater species diversity and abundance because the climate they offer is milder than that of the adjacent plateaus. They are also thought to offer a more diversified environment than the bands around the reservoirs or wetlands do. According to the proponent, the presence of the reservoirs and permanent structures would mainly affect the Canada lynx, American marten and squirrel, which favour forest habitats. Species such as the American mink, river otter and red fox, which prefer river and swamp habitats, would be more severely affected near the Romaine 1, Romaine 2 and Romaine 3 reservoirs, but could gain additional habitat in the Romaine 4 reservoir (PR3.4, pp. 26-14 to 26-26 and 26-38).

As general mitigation measures, the proponent plans to transform borrow pits into wetlands, clear a riparian band along parts of the reservoirs, develop bays in the Romaine 1 reservoir,

and build shelters from wood debris. The proponent acknowledges that these measures would not truly replace lost habitat or compensate for the loss of individuals (*ibid.*, pp. 26-37 to 26-40; PR3.6, p. 39-106).

The density of active beaver colonies is estimated to be 1.2 colonies/10 km^2. The entire study area, which covers approximately 1 to 5 km on each side of the Romaine River and the reservoirs, is thought to contain approximately 650 beavers. The Romaine 1 reservoir is believed to contain the highest colony density, 5.55 colonies/10 km^2. About half of the colonies reported would be affected by the project, and fluctuations in the levels of the reservoirs would limit available suitable habitat. In addition, the presence of the access road leading to the generating stations would open up new areas for fur-bearing animal trapping. The proponent proposes an intensive beaver-trapping program to recover beaver pelts and meat prior to filling the reservoirs (PR3.4, p. 26-12; pp. 26-35 to 26-37).

- *The panel notes that the creation of reservoirs would lead to the net disappearance of forest and riparian habitat favourable to fur-bearing animals, and that it would not be possible to completely compensate for these losses.*

- ***Opinion —*** *The panel considers that a marked decrease in the beaver population along the Romaine River is to be expected with the completion of the project. The intensive trapping proposed by the proponent constitutes a measure to recover the resource rather than mitigate the long-term impact of the project.*

- ***Opinion —*** *The panel is of the opinion that the project would have a moderately significant impact on fur-bearing animals currently present in the Romaine River watershed, taking into account the applicable mitigation measures.*

Wolverine, timber wolf, least weasel, southern bog lemming and rock vole

Although the project area falls within the theoretical range of the wolverine, timber wolf, least weasel and southern bog lemming, which are designated vulnerable or threatened under Quebec or federal legislation, no specimens of these species were reported or collected during the proponent's inventories. However, the rock vole, which has special status, was captured during the inventories (PR3.1, pp. 5-26 to 5-29; PR3.4, pp. 26-12 to 26-27).

The proponent states that the wolverine and timber wolf have large home ranges and travel great distances, unlike the least weasel, southern bog lemming and rock vole, the home ranges of which nevertheless cover vast sectors outside those affected by the project (PR3.1, pp. 26-42 to 26-44; pp. 26-61 to 26-63; PR5.1, pp. 223 and 224).

The expected effects of the project, including tree clearing and the filling of the reservoirs, would therefore be less severe on the wolverine and timber wolf than on the other three less mobile species. It must be remembered, however, that only the presence of the rock vole has been confirmed, although traditional Innu knowledge holds that wolverines and timber wolves are occasionally sighted on the Middle and Lower North Shore (PR8.6, pp. 67–70).

The proponent suggests only general mitigation measures, such as developing wetlands around the reservoirs, clearing a 3-m band around part of the periphery of the reservoirs, and setting up piles of wood debris as shelters. The proponent acknowledges that these measures would not replace lost habitat or compensate for the loss of individuals (PR3.4, pp. 26-37 to 26-40).

- *The panel notes that the filling of reservoirs would mean loss of habitat for small and medium-size animals and a loss of individual species, especially among species that have a small home range.*

- ***Opinion —** The panel is of the opinion that the project would not have a significant impact on wolverines and timber wolves, which make, at most, only occasional use of the Romaine River drainage basin and have very large home ranges.*

- ***Opinion —** The panel is of the opinion that least weasels, southern bog lemmings and rock voles would be minimally affected by the project since their home ranges encompass vast sectors outside of the areas targetted by the project.*

Fish Fauna

The impacts of the project on fish are assessed on the basis of the differences between the conditions upstream from the Romaine-1 generating station and those downstream. Fish habitat and production are examined, as are the instream flows and proposed compensation measures.

Reservoir sector (PK 51.5 to 289.2)

Fish habitat

The impact of dam construction and reservoir impoundment is thought to be a rise in the level of the Romaine River over a distance of close to 224 km, resulting in the simultaneous flooding of 275 lakes and all or part of 264 tributaries (PR3.3, p. 23-84). Downstream from the dams, in stretches of the Romaine River, called bypassed reaches, there would be losses of flowing-water habitat due to a total interruption (Romaine-1) or major reduction (Romaine-2, Romaine-3 and Romaine-4) in streamflow.

Table 7 shows the increase in the area of fish habitat that would result from the creation of the reservoirs. This new area would be entirely lacustrine and would result in the disappearance of all lotic sections of the river and tributaries in this sector. In addition to the portion of the river downstream from the Romaine-1 generating station (PK 0 to 51.5), two sectors would retain their fluvial character: Bassin des Murailles (PK 81.8 to 83.7) and the upstream portion of the Romaine 1 reservoir (PK 69 to 81.8).

Table 7 Fish habitat affected by the project upstream from PK 51.5

Current area	Future area

Romaine River	4,111.93 ha	Reservoirs	25,537 ha[1]
Tributaries	395.76 ha		
Lakes	1,100.94 ha		
Romaine River	149.44 ha	Bypassed reaches	40.21 ha
Bassin des Murailles	94.81 ha	Bassin des Murailles	82.03 ha
Total	**5,852.88 ha**	**Total**	**25,659.24 ha**
1. At the average operating level.			

Source: PR 3.3, p. 23-85.

- *The panel notes that the project would significantly increase the area of fish habitat upstream from PK 51.5. This increase would promote the creation of lentic habitats to the detriment of flowing-water habitats.*

Fish production

Before describing the anticipated changes in fish production, the proponent estimated annual fish production of the existing areas that would be flooded, drawing a distinction between pelagic and littoral zones. It then estimated annual fish production in the reservoirs. To do so, it used the results of experimental fisheries conducted in the Romaine River watershed as well as lessons learned from the Caniapiscau reservoir. It also took into account the anticipated change in fish growth rate attributable to the new thermal regime. Water from the Romaine 2, Romaine 3 and Romaine 4 reservoirs would, on average, be warmer than water from the river whereas the water from the Romaine 1 reservoir would be colder. To complete the analysis, an assessment of the use of fish habitat that would retain their fluvial character was conducted (PR3.3, p. 23-94 to 23-115). Table 8 presents the fish community of the river, lakes and tributaries that would be flooded, before and after the project.

Table 8 Fish community upstream from the Romaine-1 dam with implementation of the project

Species	**Proportion by weight**	
	Before[1]	After[2]
Northern pike	43.8%	19.1%
White sucker	14.1%	1.8%
Longnose sucker	12.4%	48.8%
Brook trout	13.5%	0.9%
Arctic char	0.2%	0
Landlocked salmon	0.6%	0[3]
Lake trout	2.1%	0[3]
Lake whitefish	2.1%	26.5%
Other	11.2%	3.0%

Total	100 % (156.67 t/year)	100 % (179.41 t/year)

1. In the portions of the river and tributaries as well as the lakes to be flooded.
2. In the four reservoirs, the Bassin des Murailles and bypassed reaches of Romaine-2, Romaine-3 and Romaine-4.
3. Does not take proposed introductions of landlocked salmon and lake trout into account.

Source: PR3.3, p. 23-103 to 23-111.

Fisheries and Oceans Canada questions the proponent's estimate of the productivity of the littoral and pelagic zones and relative contribution of the two zones to the production of each species. It bases its projections on the experience of reservoirs on the North Shore rather than on that of the Caniapiscau reservoir. On the basis of its own calculations of the productivity of the reservoirs, Fisheries and Oceans Canada anticipates a loss of the order of 37 t/year, whereas the proponent is forecasting a gain of 23 t/year (Table 8) (DB18, p. 23–25).

- *The panel notes that the creation of the four reservoirs in the hydroelectric complex would significantly alter the fish community and that the extent of the changes is the subject of disagreement between the proponent and Fisheries and Oceans Canada. Regardless of the total expected gain or loss in production, the panel also notes that salmonids, which are generally valued in sport fishing, would clearly be disadvantaged.*

Instream flows

The proponent has selected a minimal instream flow of 1% of the mean annual flow, i.e., 2.7, 2.2 and 1.8 m^3/s in the bypassed reaches of Romaine 2, 3 and 4, respectively, and is proposing to implement compensation measures for habitat loss. These reaches total approximately 12 km of river. According to the proponent, the application of the *Politique de débits réservés écologiques pour la protection du poisson et de ses habitats* (Quebec Wildlife and Parks, 1999) is either technically difficult or proposes instream flows that are too high to ensure the economic viability of the project (PR8.18.9, p. 34). This policy proposes an approach for the determination of ecological instream flows,[1] which prevent and minimize adverse effects associated with the implementation of certain projects in hydrologic areas, including the operation of hydroelectric generating stations. Instream flows of between 92 and 182 m^3/s would therefore be required in the bypassed reaches of the Romaine-2, 3 and 4 generating stations. The instream flows proposed by the proponent would result in substantial habitat loss. A certain area would remain in just a few channels and basins and there would be only a trickle of water over the coarse substrate of fast-flowing areas (PR8.18.9, p. 63, 72 and 79; PR3.3, p. 23-83).

[1]. Ecological instream flows are the minimum flows required to maintain a sufficient quantity and quality of habitat to ensure the normal biological functions of fish species.

These impacts would result in a loss of spawning and feeding habitats, particularly for brook trout. Leaving an instream flow that is slightly higher but that is still lower than the ecological instream flow would not significantly reduce habitat losses, while the mitigation of impacts through the implementation of various habitat developments has been abandoned by the proponent for various technical and economic reasons (PR8.18.9, p. 68, 75 and 80). Instead, the proponent is proposing measures aimed at brook trout in the lakes and tributaries located outside the zone of influence of the project to compensate for habitat losses as permitted under the Policy as a last resort (PR3.3, p. 23-93). Fisheries and Oceans Canada accepts Hydro-Québec's arguments (DB18, p. 18–20).

The proponent is proposing to leave no instream flow for the bypassed reach of the Romaine-1 generating station, which is approximately 800 m in length. As compensation, it plans to create juvenile salmon rearing habitat near both the existing spawning habitat and the habitat that is to be developed (PR8.18.9, p. 61 and 62). For this sector, Fisheries and Oceans Canada believes it would be more beneficial to create such habitats rather than to provide for an instream flow, given the average quality of the habitats in the bypassed reach and the fact that the river has little good quality salmon rearing habitat (DB18, p. 19).

Fish of all species could migrate up into the bypassed reaches after waters recede following discharges to the spillways and could then be trapped there. It should be noted that an impassable barrier would limit the upstream migration to 200 m and 300 m in the bypassed reaches of the Romaine-3 and Romaine-4 generating stations, respectively. An impassable barrier would prevent all upstream migration into the bypassed reach of the Romaine-2 generating station. Hydro-Québec estimates that the minimum instream flow in the bypassed reaches would allow the fish to migrate back downstream at any time (PR9.1, p. 67; DB18, 19).

With respect to the bypassed reach of the Romaine-1 generating station, there are no barriers that would prevent the upstream migration of salmon following the diversion of flows over the spillway. The Quebec Department of Natural Resources and Wildlife is concerned that the fish could remain trapped in the basin present in this section once the discharge is completed, at which point the conditions essential to their survival would be absent (DQ7.1, p. 5). Hydro-Québec plans to conduct a follow-up program in this sector and to take action if necessary. The possible measures consist in ensuring acceptable conditions for the survival of aquatic wildlife in the isolated basin or in opening the basin to allow the downstream movement of fish (PR5.1, p. 114; PR9.1, p. 67).

- ***Recommendation —*** *The panel recommends that the proponent conduct monitoring to ensure that fish do not become trapped in stretches that are bypassed when water is diverted to spillways. The findings should be reported to Fisheries and Oceans Canada and the Quebec Department of Natural Resources and Wildlife and, if necessary, the proponent should be required to remove barriers to fish.*

The instream flows in the bypassed reaches would result in habitat losses, specifically for brook trout and Atlantic salmon. The mitigation of these impacts appears to be difficult or ineffective. As a result, compensation aimed at these two species is the only measure that can be considered.

Compensation

Given that there would be no measures to mitigate habitat loss associated with the creation of the reservoirs, the implementation of compensation measures is required under the Department of Fisheries and Oceans' *Policy for the Management of Fish Habitat*. The proponent is proposing four compensation approaches targetting brook trout, lake trout, landlocked salmon and Arctic char. However, the compensation measures were deemed to be inadequate in December 2008 by Fisheries and Oceans Canada (DB18, p. 27).

Brook trout

Brook trout habitat losses are associated with the flooding of the Romaine River, its tributaries and lakes, the interruption or significant reduction in streamflows in the bypassed reaches, the encroachment by the structures and the opening of the area to competitive species. Fisheries and Oceans Canada estimates total brook trout production loss at 22 t/year (DB18, p. 28).

Hydro-Québec is proposing to stock five fishless lakes and three fishless tributaries as well as five other tributaries of the Romaine River watershed located outside the zone of influence of the project with brook trout. It is also proposing to create suitable habitats in eight additional tributaries, three of which are currently fishless (PR3.3, p. 23-93). The anticipated production in the targeted lakes and tributaries is estimated at 4.5 t/year (PR8.18.12, p. 68 and 101). However, Fisheries and Oceans Canada is of the view that given the fairly great depth of the lakes selected and the brook trout's strong preference for shallow feeding grounds, the production could be lower than the proponent's predictions (DB18, p. 28). This point was also noted by the Quebec Department of Sustainable Development, Environment and Parks (PR5.1, p. 177).

The Quebec Department of Natural Resources and Wildlife no longer recommends the stocking of fishless lakes due to the characteristics specific to these ecosystems, which are sought by such species as the Barrow's goldeneye, particularly since the region has many lakes that offer potential brook trout fisheries (Mr. François Bernard, DT4, p. 16). The precarious situation of the Barrow's goldeneye was previously discussed, as was Environment Canada's recommendation to avoid stocking fishless lakes to promote the recovery of the species.

However, according to the proponent, the number of fishless lakes in the Romaine River watershed is such that the benefits to fish of the proposed fish habitat developments would be greater than the risks to Barrow's goldeneye (DA65, p. 5).

The Quebec *Regulation Respecting Aquaculture and the Sale of Fish* [R.R.Q., c. C-61.1, r. 7] allows the stocking of fishless lakes with brook trout. According to the Quebec Department of Sustainable Development, Environment and Parks, the lakes targetted by the proponent are not typically used by the Barrow's goldeneye (Mrs. Isabelle Auger, DT4, p. 14 and 15).

It appears that the possibility of compensating for brook trout habitat losses is limited if fishless lakes are excluded. Fisheries and Oceans Canada has said it is open to considering compensation measures aimed at other species caught by fishers (Mr. Dominic Boula, DT4, p. 10 and 11). In this regard, Hydro-Québec stressed how difficult it was to propose measures that would fully compensate for the impacts on each species (Michel Bérubé, DT4, p. 20).

- *The panel notes that there is a discrepancy between the estimated brook trout production losses and the anticipated gains through compensatory measures proposed by the proponent. Furthermore, it appears to be difficult to compensate for these losses other than by stocking fishless lakes.*

- ***Opinion —*** *Considering the large number of fishless lakes in the Romaine River watershed, the panel is of the opinion that the proponent should be able to stock some of these bodies of water, avoiding sectors and lakes of the type used by Barrow's goldeneye.*

Lake trout

The proponent proposes to introduce a population of lake trout into the Romaine 1 reservoir and to create three spawning grounds covering a maximum area of 830 m^2. The three other reservoirs would not be appropriate due to the considerable rise and fall of their water level, which would dry out the eggs. The proponent estimates the lake trout production potential of the Romaine 1 reservoir at 0.35 t/year, whereas losses associated with the project implementation, estimated at 3.34 t/year, are much higher (PR8.18.12, p. 105–108; PR3.3, p. 23-111).

For the reasons mentioned above, Fisheries and Oceans Canada is of the opinion that the proponent has overestimated the production of the reservoir. There are certain factors that could hinder the success of this measure, such as the absence of true thermal stratification, which could lead to predation of juvenile lake trout by northern pike and cannibalism by adult lake trout, and the current low abundance of lake whitefish in this sector. The rapid colonization of the Romaine 1 reservoir by lake whitefish is important to the success of the introduction of lake trout in that it is a prey species (PR5.1, p. 180 and 181; DB18, p. 28 and 29; PR8.18.12, p. 111).

For its part, the proponent is of the view that its estimates of lake trout production are conservatives and that these factors would not be limiting. It expects that lake whitefish will quickly colonize the Romaine 1 reservoir. The creation of a spawning ground upstream from this reservoir should favour its establishment. In addition, it adds that individuals could be captured upstream of the watershed and then transferred to the reservoir if the follow-up program revealed colonization problems by lake whitefish (PR5.1, p. 182).

- ***Opinion —*** *The panel is pleased with the proponent's proposal to introduce lake trout into the Romaine 1 reservoir, given that this species is highly valued by fishers. However, the panel stresses that the production gains expected as a result of this measure are only one tenth of the losses expected to result from the project in the case of this species.*

Landlocked salmon

Landlocked salmon is not abundant in the study area given the absence of a large body of water, which is necessary for its growth. In this sense, the Romaine 4 reservoir would offer significant potential for this species. In addition, two of its tributaries, the Beaubert River and Katahtauatshupunan Creek, appear to provide suitable spawning and rearing habitat for juvenile landlocked salmon. These tributaries would remain accessible despite the variation in water levels (PR8.18.12, p. 33 and 39; Mr. Michel Bérubé, DT4, p. 21).

The proponent is proposing to stock these two tributaries with juvenile landlocked salmon. The production objectives in the reservoir are 2.69 t/year, by comparison with estimated losses of 0.89 t/year for this species resulting from the implementation of the project (PR8.18.12, p. 40 and 47; PR3.3, p. 23-111).

Fisheries and Oceans Canada is of the view that the production level anticipated by Hydro-Québec is questionable since the presence of landlocked salmon would be closely related to that of rainbow smelt, a prey species absent from the sector of the Romaine 4 reservoir (DB18, p. 29; PR5.1, p. 133 and 174). For its part, the proponent maintains that, in the absence of rainbow smelt, landlocked salmon would feed on lake whitefish and round whitefish (PR8.18.12, p. 38). It adds that several bodies of water near the study area contain landlocked salmon populations, even though they do not contain rainbow smelt (PR5.1, p. 185).

Fisheries and Oceans Canada points out that the introduction of rainbow smelt is an option that should be explored for increasing productivity in the Romaine 4 reservoir. The joint introduction of landlocked salmon and rainbow smelt has already been carried out in the Outardes 2 reservoir (DB18.1, p. 3). Rainbow smelt is currently absent from the sector of the Romaine 4 reservoir, but several individuals were captured in the sectors of Romaine 1 and Romaine 2 (PR5.1, p. 135).

- *The panel notes that the gains the proponent expects to achieve by stocking the Romaine 4 reservoir with landlocked salmon are greater than the losses expected to result from the project. However, Fisheries and Oceans Canada is questioning the extent of these gains because of the absence of rainbow smelt in this body of water.*

- ***Recommendation —*** *To ensure that maximum benefit is derived from the stocking of landlocked salmon, the panel recommends that the proponent, Fisheries and Oceans Canada and the Quebec Department of Natural Resources*

and Wildlife examine the feasibility of introducing rainbow smelt into the Romaine 4 reservoir.

Arctic char

The presence of Arctic Char subspecies *oquassa* has been confirmed in two lakes in the sector of the Romaine 4 reservoir. This subspecies is on the Quebec government's list of species likely to be designated threatened or vulnerable. It has not been federally designated, but a preliminary report suggested that it be assigned the status of species of concern (PR3.3, p. 23-30; DB18, p. 29).

Hydro-Québec is proposing to move part of the Arctic char populations from these lakes to two other fishless lakes in the same sector, but outside the flooded area. Spawning grounds would also be created in these lakes (PR3.3, p. 23-123).

Under the Quebec *Regulation Respecting Aquaculture and the Sale of Fish*, transporting Arctic char populations is not permitted. However, the Quebec Department of Sustainable Development, Environment and Parks has indicated that an exemption would be possible under a special permit (scientific, educational or wildlife management), thereby facilitating the implementation of this measure (Mrs. Mireille Paul, DT4, p. 34).

Fisheries and Oceans Canada points out that Arctic char is certainly present in more than two lakes, considering that only a fraction of the 275 lakes that would be flooded have been sampled. It estimates that Arctic char is likely to be present in 13 of the affected lakes. As a result, it feels it would be more prudent to increase the number of lakes in which the species would be introduced in order to adequately compensate for losses of this species, but also to reduce the risks in the event that the introduction in a lake does not go as planned (DB18, p. 30).

- ***Recommendation —*** *Considering the status of the species, the panel recommends that more than two populations of Arctic char be transferred to fishless lakes. The proponent should agree with Fisheries and Oceans Canada and the Quebec Department of Natural Resources and Wildlife on how many populations are necessary. However, the proponent should avoid lakes of the type used by Barrow's goldeneye.*

- ***Recommendation —*** *Since the measures proposed by the proponent would not be sufficient to compensate for brook trout, lake trout and landlocked salmon production losses upstream from the Romaine-1 dam, the panel recommends that additional measures be proposed to Fisheries and Oceans Canada and the Quebec Department of Natural Resources and Wildlife. These measures could target other valued species, such as Atlantic salmon, and be carried out on the Romaine River or one of its tributaries.*

Downstream section of the River (PK 0 to 51.5)

The portion of the river downstream from the Romaine-1 generating station is characterized by the presence of Atlantic salmon. Access by salmon in the Romaine River is limited by the presence of Grande Chute (PK 52.5), which is considered impassable.

Given that Atlantic salmon is highly prized by sport fishers and given the decline in North American populations of the species, the departments involved have focussed special attention on the possible effects of the project on Atlantic salmon. There are organizations engaged in the protection and sustainable management of salmon in Quebec and elsewhere in Canada and an international agreement to regulate Atlantic salmon catches and promote its conservation was signed some 20 years ago (Atlantic Salmon Federation and Fédération québécoise pour le Saumon atlantique, DM104, p. 6).

In the opinion of several, the Romaine River provides low-quality habitats for salmon due to the predominantly low-flowing conditions and sand substrate, characteristics that are not favourable to this species (PR3.3, p. 23-70; DQ7.1, p. 3; DQ6.3, p. 7; Atlantic Salmon Federation and Fédération québécoise pour le Saumon atlantique, DM104, p. 8).

Fish habitat

According to the proponent, the area and characteristics of the habitats downstream from the Romaine-1 generating station would remain essentially the same due to the instream flow regime, which would protect fish habitat. Under future conditions, the area of fish habitat between PK 0 and PK 51.5 would remain equivalent to 1,424.81 ha (PR3.3, p. 23-85 and 23-114).

The anticipated fish production downstream from the Romaine-1 dam could not be estimated as a function of species as was done in the case of the upstream sector. No recent experimental fishery that could provide such information have been carried out in this sector due to the presence of Atlantic salmon. Nonetheless, the proponent estimates total current and future production downstream from the Romaine-1 generating station at 42.77 t/year and 42.06 t/year, respectively. This slight decline is believed to be attributable to colder water, rather than to a loss of habitat area (PR3.3, p. 23-107 and 23-110).

Thermal regime

The water that would flow in the river, once it passes through the turbines at the Romaine-1 generating station, would come from the Romaine 1 reservoir, which is itself supplied essentially by the Romaine 2 reservoir. The water temperature downstream from PK 51.5 would in part be affected by the temperature of the water drawn from deep in the Romaine 2 reservoir. As a result, starting in mid-September and continuing throughout the winter, the water temperature downstream from PK 51.5 would be warmer than it currently is. Warming of the water would occur earlier in the spring, after which it would be cooler. Moreover, it would remain cooler throughout the summer (Figure 5) (PR3.2, p. 17-16). The discrepancy between the

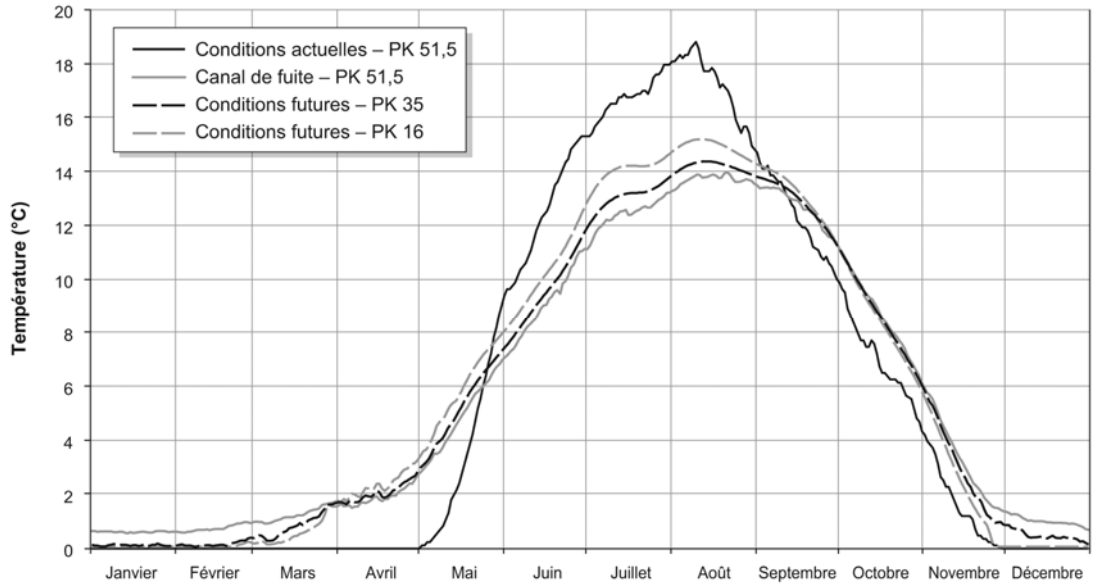
current temperature and that forecast would be greatest at PK 51.5, i.e., close to the generating station, and would decline downstream.

According to the proponent, the modified thermal regime would reduce the growth of several fish species, including Atlantic salmon (-5.36%), American eel (-6.27%) and northern pike (-8.34%). In contrast, it would benefit the growth of brook trout (+5.94%) and longnose sucker (+10.79%) (PR3.3, p. 23-102). For salmon, the proponent predicts that the thermal regime would result in:

- an approximately 10-day delay in spawning;
- an approximately 10-day advance in egg hatching;
- an approximately 2-day delay in fry emergence;
- an approximately 1-week delay in downstream migration of smolts.

(PR3.3, p. 23-126; PR5.1, p. 131)

Figure 5 Water temperature downstream from the Romaine-1 generating station*



Source : adaptée de PR3.2, figure 17-9, p. 17-17.

*Translation key for Figure 5

Current conditions – PK 51.5
Tailrace – PK 51.5
Future conditions – PK 35
Future conditions – PK 16

January, February, March, April, May, June, July, August, September, October, November December

Temperature

Source: adapted from PR3.2, Figure 17-9, p. 17-17

Based on observations from the Betsiamites River, which is harnessed for hydroelectric power generation and which has a thermal regime with a pattern similar to that predicted for the Romaine River, the proponent anticipates that effects of modifying the thermal regime on the growth of Atlantic salmon, its reproduction and the downstream migration of smolts would be negligible for the Romaine River population (PR3.3, p. 23-126 and 23-152). It is even anticipated that more rapid growth than that observed in natural rivers on the North Shore would be observed in salmon in the Betsiamites River. Moreover, smolts in the Betsiamites River would be among the largest in North America and would migrate to the sea at the age of two years as compared to three years on the North Shore. Multiple-spawning salmon would also be more abundant there, possibly due to warmer water in winter, which is favourable to post-spawning survival (DQ6.3, p. 4; DA68, p. 3; PR5.1, p. 130–131). The proponent is proposing to carry out monitoring on the Romaine River to validate these hypotheses.

According to the Quebec Department of Natural Resources and Wildlife, the long time lag between the initial characterization of the salmon population and the implementation of the definitive hydrologic conditions (commissioning of the Romaine-4 generating station) would make it difficult to verify the impact of changes in the thermal regime by means of monitoring, particularly since a salmon restoration program would have been implemented in the meantime (DQ7.1, p. 2). Nonetheless, the minutes of a meeting held in November 2008, prepared by Hydro-Québec, suggests that the Department of Natural Resources and Wildlife is relatively confident about the potential effects of changes in the thermal regime on salmon. The example of the Betsiamites River is cited in addition to that of Rivière aux Rochers, where the delay in summer growth due to colder water is made up over the rest of the year (DA68, p. 3).

Also on the basis of the monitoring of the Betsiamites River, the Quebec Department of Sustainable Development, Environment and Parks agrees with the proponent's assessment. Nonetheless, it is holding discussions with the proponent on mitigation measures that would reduce the anticipated summer temperature difference in the Romaine River (DQ6.3, p. 3–4).

For its part, Fisheries and Oceans Canada is concerned that the changes in the thermal regime will cause increased mortality by altering the synchrony between the timing of the various salmon development phases (egg, fry, downstream migration of smolts) and the conditions favourable to them (availability of food resources, vulnerability to predation). It is also of the view that the lower summer temperatures would reduce growth by more than the 5.36% anticipated by the proponent. Reduced growth could result in higher mortality due to a reduced ability to withstand competition, predation and disease. In addition to the effect on growth, juvenile salmon might have to change their diet since the changes in the thermal regime might potentially have an effect on the invertebrates on which they feed. DFO believes that the large size of juvenile salmon in the Betsiamites River could be due to the absence of small individuals owing to their lower survival rate associated with lower temperatures. Having less competition, larger individuals would have access to a sufficient quantity of food, hence their good growth (DB18, p. 11–15; Mr. Simon Trépanier, DT3, p. 31–34).

Salmon appears to have some ability to adapt to temperature variations, but it is impossible to predict with certainty the magnitude of the anticipated changes over its entire life cycle (DQ7.1, p. 2; DQ6.3, p. 3). At the request of the departments involved, the proponent agreed to study two measures that would mitigate the change in the thermal regime. The first consists in constructing a submerged weir immediately upstream from the headrace canal of the Romaine-2 generating station, which would make it possible to draw water from the first 10 metres of the reservoir in summer and from the first 5 to 10 metres in winter. The second consists in constructing, at the same location, a submerged weir connected to a system of movable gates that would make it possible to draw water from the first 5 metres of the reservoir surface. The first measure would allow an increase of 2.7 and 2.8°C in July and August and the second would almost entirely mitigate the anticipated changes (DB18.1, p. 2).

By the end of the public part of the hearings in December 2008, no measures had yet been retained by the proponent. It was hesitant to opt for a particular solution due to the technical complexity and high costs of certain structures (Mr. Michel Bérubé, DT3, p. 36–37).

- ***Opinion —*** *Considering the socioeconomic importance of Atlantic salmon and the uncertainty as to the effects that altering the river's thermal regime would have, the panel is of the opinion that the measures to mitigate temperature variations merit close examination. If these measures are not practicable or are too costly, compensation measures should be considered.*

Instream flows

During operation

To protect fish habitat, the proponent conducted a study of the ecological instream flow regime applicable to the Romaine River, downstream from PK 51.5, during the impoundment of the reservoirs and the operation of the complex. In brief, the proponent's approach, guided by the *Politique de débits réservés écologiques pour la protection du poisson et de ses habitats*, consists in identifying target species and determining critical biological periods, selecting a methodological approach and establishing an instream flow value for each biological period.

The protection of the three salmon spawning grounds considered in determining the fall instream flow requires different flows. Therefore, the spawning ground at PK 34.5, the most heavily used, requires lower flows than the spawning grounds at PK 46.2 and 48.9. Rather than using a flow of 242 m^3/s calculated with a recognized method, Hydro-Québec proposes a flow of 200 m^3/s, which would protect almost all habitats to the spawning ground at PK 34.5 and creating new spawning grounds at PK 45 and 49 to compensate for habitat losses at the spawning sites at PK 46.2 and 48.9 (Table 9) (PR3.1, p. 12-19). Another spawning ground would be created at PK 51 to compensate for the loss of two small spawning grounds located at PK 51.3 and 51.4 caused by the presence of the structures. A flow of over 200 m^3/s would represent production losses, and therefore financial losses, for the proponent and could not be guaranteed during the maintenance of a turbine-alternator set (DA68, p. 8). Under natural conditions, the flow is less than 200 m^3/s 10% of the time in October and 30% of the time in November (DQ22.1, p. 4).

Table 9 Instream flows during operation

Period[1]	Sensitive biological function	Calculated ecological instream flow (m^3/s)	Proposed instream flow (m^3/s)
Summer (July 8 to October 15)	Juvenile salmon feeding	170	170
Fall (October 16 to November 15)	Salmon spawning	242	200
Winter (November 16 to June 6)	Incubation of salmon eggs Shelter for juvenile salmon	140	140
Spring (June 7 to July 7)	Hatching and emergence of salmon fry Spawning of certain fish species	200 Min 700 for northern pike	200

1. The dates take account of the predicted thermal regime under future conditions.

Sources: PR3.1, p. 12-18 to 12-24; PR8.18.9, p. 60.

Fisheries and Oceans Canada estimates that the instream flows proposed for the spring, summer and winter would protect the biological functions of salmon (Table 9). With respect to the fall instream flow proposed by the proponent, DFO is of the opinion that it is not sufficient to optimally maintain spawning grounds. In its view, it would be preferable to ensure the longevity of existing spawning habitat substrate and to avoid constructing a large area of new spawning grounds, the effectiveness of which it questions. It is asking the proponent to optimize the fall instream flow and redesign the spawning ground at PK 48.9 rather than build new ones (DB18, p. 4; PR9.1, p. 56 and 59; DA68, p. 8–9). The proponent has undertaken to re-examine this option despite the fact that it previously indicated that it was difficult for it to carry out work at the spawning site at PK 48.9 due to the problems accessing the site (DB18.1, p. 1; PR9.1, p. 60; DA68, p. 9).

The Atlantic Salmon Federation and Fédération québécoise pour le Saumon atlantique pointed out in public hearings that there were few known cases of spawning developments for salmon in Quebec and that there is uncertainty regarding their use. The federations feel it is preferable to ensure maximum protection for existing spawning grounds (DM104, p. 17). However, according to the Quebec Department of Sustainable Development, Environment and Parks and the proponent, the creation of salmon spawning grounds, although complex, has been successful in other countries (DQ6.3, p. 7; DA68, p. 8–9).

The Quebec Department of Sustainable Development, Environment and Parks estimates that the instream flow regime proposed by Hydro-Québec is acceptable, but that it should be

verified as part of the follow-up program. Changes to flows and application periods could then be required. With respect to the fall instream flow, MDDEP accepts Hydro-Québec's option, even if it is to the detriment of the two spawning grounds located at PK 46.2 and 48.9. It is of the opinion that the "program to restore and create habitats, which are clearly lacking in the river […], offers clear benefits that go well beyond imposing a larger flow for spawning grounds more upstream" (DQ6.3, p. 6).

- *The panel notes that the instream flow proposed by the proponent for the spring, summer and winter would protect the biological functions of the Atlantic salmon of the Romaine River.*

- ***Recommendation —*** *The panel believes that monitoring use of the spawning grounds that the proponent plans to create would make it possible to validate the effectiveness of this type of structure. If Fisheries and Oceans Canada and the Quebec Department of Natural Resources and Wildlife are not satisfied with their use, the panel recommends that the fall instream flow be reviewed.*

The proposed spring instream flow is much lower than the flow required for spawning by Northern pike. The proposed flow of 200 m^3/s would lead to a reduction of 94% of potential Northern pike spawning areas. A flow of 700 m^3/s would be required to maintain an acceptable potential, which is clearly inconsistent with the implementation of the project (Table 9) (PR3.1, p. 12-23 and 12-24). In addition, such a flow only occurs under natural conditions approximately half of the time in June (DQ22.1, p. 4). The Quebec Department of Sustainable Development, Environment and Parks is of the view that it is not desirable to create Northern pike spawning areas downstream from the Romaine-1 generating station, for this could hinder the success of the measures aimed at Atlantic salmon (DQ6.2, p. 3). Fisheries and Oceans Canada shares this opinion (DB18, p. 6). However, the Quebec Department of Natural Resources and Wildlife is of the view that the risk of salmon parr predation is not a sufficient reason to justify the lack of created spawning habitat for Northern pike downstream from the Romaine 1 reservoir (DQ7.1, p. 1).

- ***Opinion —*** *The panel considers that it would be inappropriate to plan compensatory measures for the loss of Northern pike spawning habitat because they could interfere with efforts to protect the Atlantic salmon population in the Romaine River.*

Environmental maintenance flows

The hydroelectric development of the Romaine River could reduce the fine sediment transport capacity of the river, which is normally controlled by spring flood flows. A solution to limit the deterioration of substrate quality is the implementation of a program of maintenance flows to imitate the action of natural flood flows. A study conducted by the proponent suggests that the current flood flows do not contribute to maintaining the quality of salmon spawning substrates. As a result, it did not propose maintenance flows (PR8.18.9, p. 49–52). These conclusions were called into question by the departments consulted. The proponent therefore proposed a complementary study prior to the start-up of the work (PR5.1, p. 104–106). The Quebec Department of Sustainable Development, Environment and Parks is of the

view that this study would make it possible to validate the role of flood flows in the maintenance of spawning grounds. MDDEP intends to require that the proponent perform maintenance flows if the environmental monitoring suggests that they are needed for the maintenance of the quality of salmon spawning grounds (DQ6.2, p. 4–5). For its part, Fisheries and Oceans Canada notes that there are indications that there would be periods of fine sediment accumulation in the spawning substrate and that it could be necessary to implement a regime of maintenance flows. The study proposed by the proponent would make it possible to define the parameters of such maintenance flows (frequency, duration, magnitude) (DB18, p. 17–18).

- *The panel notes that a follow-up study aimed at validating the role of floods in maintaining the salmon spawning substrate would be conducted before the construction of the hydroelectric complex. The study would allow Fisheries and Oceans Canada and the Quebec Department of Sustainable Development, Environment and Parks to validate the need to implement and define the parameters of a maintenance flood program.*

During impoundment of the Romaine 2 reservoir

The impoundment of the Romaine 2 reservoir would take place in three stages. It would begin in May 2014 and end in July of the same year under average water flow conditions. Given that the Romaine-1 complex would not yet be built, it is the Romaine 2 reservoir that would supply the instream flow regime downstream from PK 51.5.

The instream flow downstream from PK 51.5 would be provided during the first and third stage of the impoundment of the Romaine 2 reservoir. However, when the temporary diversion tunnel is closed and until the reservoir level reaches the spillway level, no instream flow would be provided. The second stage of impoundment is scheduled to take between 17 and 59 days, depending on hydraulicity (Table 10).

Table 10 Phase 2 of the impoundment of the Romaine 2 reservoir as a function of hydraulicity

Hydraulicity	Duration of Phase 2 (days)	Average flow at PK 52 (m^3/s)	Loss of aquatic area downstream from PK 51.5 (%)
Low	59	30	56
Average	24	70	38
High	17	105	29

Source: PR3.2, p. 16-34 and 16-36.

During this period, only the tributaries would provide a flow in the river downstream from the Romaine-2 dam. According to the scenario of average hydraulicity, these inflows would be 70 m^3/s downstream from PK 52 (Table 10). The spawning habitat likely to dry out would be

covered with a geotextile to prevent salmon from spawning there (PR3.3, p. 23-157). According to the proponent, a structure that would ensure a flow during this period is technically risky and costly. It would compensate for the impacts of impoundment with a salmon restoration program (PR9.1, p. 179).

The impacts associated with this temporary interruption of flow are the drying of spawning grounds, high mortality of salmon eggs and fry buried in the substrate, the temporary loss of 38% of aquatic habitats based on average hydraulicity, an increase in fish density leading to increased intra- and inter-specific competition, predation and stress, and reduced access to the tributaries (PR3.3, p. 23-158).

According to the Quebec Department of Natural Resources and Wildlife, the significant decrease in flow associated with the second phase of the impoundment of the Romaine 2 reservoir poses a serious risk since it could result in significant mortalities of adult and juvenile salmon present in the river. Four generations of salmon could be affected and the consequences could be felt over several decades. According to the Department of Natural Resources and Wildlife, no restoration program could compensate for these losses (DQ7.1, p. 2 and 3). Fisheries and Oceans Canada takes the same view and points out that solutions for mitigating the effects of impoundment should be examined (DB18, p. 21; PR9.1, p. 168 and 169). At a meeting held in November 2008, the proponent undertook to examine three solutions: (1) moving construction of the Romaine-1 facility forward in time in order to use the Romaine 1 reservoir to ensure a flow downstream of PK 51.5; (2) building a flow control structure; and (3) building a barrage bay (DB18.1, p. 2). However, the first solution could have impacts on the human environment since the influx of workers would be greater than currently anticipated, potentially affecting road traffic and land use, among other things (DA68, p. 7).

The salmon restoration program proposed by Hydro-Québec and the possibility of its enhancement have prompted the Quebec Department of Sustainable Development, Environment and Parks to accept the temporary interruption of the flow associated with the impoundment of the Romaine 2 reservoir. According to the Department of Sustainable Development, Environment and Parks, the low density of parr in the river reduces the risks associated with an excessively high density of juveniles. Nevertheless, it has said that it is in favour of enhancing the project, but points out that the social impact of any measures aimed at mitigating the effects of impoundment must also be taken into account (DQ6.3, p. 6; DA68, p. 7).

- ***Recommendation —*** *Considering the socioeconomic importance of Atlantic salmon, the panel is of the opinion that cutting the flow during the second phase of the filling of the Romaine-2 reservoir could have a significant impact if mitigation measures are not implemented. The panel recommends that solutions to mitigate these impacts be reviewed in cooperation with Fisheries and Oceans Canada, the Quebec Department of Sustainable Development, Environment and Parks, and the Quebec Department of Natural Resources and Wildlife. If the cost of these measures is prohibitive, compensatory measures should be considered.*

Compensation

Hydro-Québec has proposed measures to mitigate or compensate for the impact of the project on Atlantic salmon. Most of the measures have been outlined in previous sections. This section provides an overview of those measures and identifies measures identified by other parties.

- Creation of three spawning beds at PK 51, 49 and 45 (PR3.3, p. 23-140).
- Creation of rearing areas immediately downstream from the spawning beds created at PK 51, 49 and 45 (PR3.3, p. 23-140).

  These areas would also provide wintering grounds and shelter habitat during peak management periods at the Romaine-1 generating station. At Fisheries and Oceans Canada's request, Hydro-Québec would study the possibility of creating another rearing area downstream from the spawning ground at PK 34 (DB18, p. 5).

- Restriction on the method of operation of the Romaine-1 generating station to avoid stranding or entrainment of juveniles (PR3.3, p. 23-144 and 23-145).

  The water level variations associated with peak management (turbine shutdown and start-up) could harm juvenile salmon during the winter period and at the time of emergence, periods during which their swimming ability is limited. The proposed restrictions, combined with the creation of the wintering grounds mentioned in the preceding point, would make it possible to mitigate the impacts of peak management (DB18, p. 5).

- Placement of geotextile fabric on the spawning grounds that would dry up as a result of the impoundment of the Romaine 2 reservoir (PR3.3, p. 23-157).

- Salmon restoration program

  This program calls for the capture of live salmon and their holding in tanks in a fish facility, assisted fall spawning, deposit of eggs obtained in incubators and the stocking of the river in the spring. Two years prior to impoundment, Hydro-Québec would create a program steering committee on which representatives of local communities and resource managers would be invited to participate (PR9.1, p. 179). This program would run for 20 years and would cost approximately $20 million (Mr. Benoît Gagnon, DT1, p. 20–21).

  According to the Quebec Department of Sustainable Development, Environment and Parks, the restoration programs have been successful on other rivers on the North Shore, such as the Betsiamites River and Rivière aux Rochers. This type of initiative would make it possible to bring Aboriginal and non-Aboriginal communities together around a common goal of conservation and rational management of their respective fisheries (DQ6.3, p. 7). The genetic diversity of

salmon in the Romaine River would also be an important aspect of the program (Mr. Pierre-Michel Fontaine, DT4, p. 41–42).

Others have mentioned a major constraint, namely that the stocking of the river with salmon prior to the impoundment of the first reservoir (Romaine 2) could distort the results of the monitoring of the effects of the project on this species (PR9.1, p. 125; DQ7.1, p. 2).

- Additional mitigation measures

  As previously mentioned, three groups of measures have been examined by Hydro-Québec: the construction of a submerged weir, possibly connected to a system of movable gates to mitigate the effects of changes in the thermal regime, the optimization of the fall instream flow to minimize the impacts on natural spawning habitat and to avoid the construction of a large area of new spawning grounds and finally the implementation of measures to mitigate the effects of the impoundment of the Romaine 2 reservoir.

- Compensation outside the Romaine River

  During the public hearing, the Quebec Department of Natural Resources and Wildlife, the Atlantic Salmon Federation and the Fédération québécoise pour le Saumon atlantique proposed that efforts to compensate for the impacts of the project on salmon be undertaken on a river other than the Romaine River. They based their proposal on the relatively limited salmon production potential of this river and on uncertainties associated with the creation of habitats. Both groups are looking for a river that would provide a large quantity of high-quality habitats but which are not usable due to the presence of natural barriers that limit access. The federations have targetted the Puyjalon River, a tributary of the Romaine River (DM104, p. 17 and 20), whereas Department of Natural Resources and Wildlife suggests that approximately 5% of the funding allocated to the program be invested in another river in the Minganie region, without specifying any particular river (DQ7.1, p. 4; DQ23.1).

♦ ***Opinion —*** *The panel stresses the importance of carefully studying the measures intended to mitigate the project's effects on the river's thermal regime, as well as the effects of filling the Romaine 2 reservoir.*

♦ ***Opinion —*** *According to the panel, the salmon restoration program proposed by the proponent is beneficial in the event that not all the impacts can be mitigated or that one of the mitigation measures presents major technical or financial constraints. However, environmental monitoring of the project's impacts would have to be modified if the program were to be put in place before the reservoirs are filled in order to avoid distorting the results.*

- ***Recommendation —*** *If all technically and financially feasible measures are implemented on the Romaine River, the panel recommends that some of the efforts to compensate for the project's impacts on salmon be carried out on a river other than the Romaine, such as the Puyjalon. Details of this compensatory measure would have to be discussed with Fisheries and Oceans Canada and the Quebec Department of Natural Resources and Wildlife.*

Effects of the project on the marine environment

Romaine River inputs at the mouth

The hydrologic regime

Although the quantity of annual flow would remain unchanged, combined operation of the four reservoirs would considerably change flow distributions over the course of the year. Winter flows would increase to levels closer to current mean summer flows, while the duration and magnitude of spring flooding would decrease substantially. Summer and fall flows would change very little, remaining close to current mean flows, but high flows in the summer and particularly in the fall would be significantly reduced, if not eliminated completely (DQ9.1, p. 41).

Using the series of Romaine River flows measured over 49 years, Hydro-Québec simulated the flow regime during the operating period (PR3.2, Chapter 16; DQ9.1, p.40 and 41; DQ22.1, p.5). It appears that, over the course of the year, at the mouth, mean flows between 200 m^3/s and 500 m^3/s would significantly exceed flows of less than 200 m^3/s, which would be close to eight times less frequent and flows of more than 500 m^3/s, which would be two times less frequent (Table 11). High flood flows would be affected most, with flows of more than 600 m^3/s dropping from 12% to 3% of the time, flows of more than 800 m^3/s from 8% to 1% of the time and flows of more than 1,000 m^3/s, which currently occur during more than a third of high flows, would be virtually eliminated. Nearly half (48%) of annual flow currently occurs under flood flow conditions of more than 500 m^3/s, but during operation of the hydroelectric complex, this percentage would drop to 29%.

Table 11 Average annual frequencies of flows at the mouth of the Romaine River

	Current conditions	Operating period
Low flows of 0 to 200 m^3/s	46.1%	6.0%
Medium flows of 200 m^3/s to 500 m^3/s	37.4%	85.4%
Flood flows of more than 500 m^3/s	16.5%	8.6%
Flood flows of more than 1,000 m^3/s	5.8%	0.44%

Source: Adapted from DQ22.1, p. 5.

- *The review panel notes that operating the hydroelectric complex would substantially decrease the magnitude and duration of high flows in the Romaine River watershed. At the same time, it would strongly reduce the occurrence of low flows.*

Sedimentary regime

The transport of sediment in particulate form is primarily controlled by water flow velocity. The load and size of particles transported increases with the water velocity. Although flow velocity is unevenly distributed within a watercourse, overall, it tends to increase with flow, thereby increasing transport capacity, as well as the size of the transported particles.

Currently, spring flood flows are likely primarily responsible for sediment transport in the Romaine River, carrying approximately 82% of sand and 85% of suspended solids (PR3.2, p. 20-23; PR8.9.3, p. 53; PR8.13.3, p. 82). The rest mainly appears to be attributable to summer and fall flows, particularly during high flow events.

Two modes of sediment transport were evaluated in the river: suspended sediment transport and bedload transport. Particles transported in suspension are clay and silt, but under flood flow conditions, fine sand and sometimes even medium sand can be transported at the same velocity as the water (DQ9.1, p. 31–32). Bedload transport includes sand and sometimes small gravel that rolls or bounces along the bed of the watercourse. Movement of this sediment is irregular and much slower than the water. This type of transport defines the nature and texture of the riverbed.

Suspended sediment transport – Current situation

Close to 95% of the sediment transported in suspension appears to come from the coastal plain (KP 0 to 52), where the river flows mainly through unconsolidated material from marine and coastal sources and where clay and silt are present (PR8.13.3, p.112). Upstream from KP 52, on the Laurentian Plateau, the banks are generally rocky and the granular material here is much coarser (PR3.2, Chapter 19; PR8.13.3, p. 61–68).

The proponent used two methods to evaluate annual suspended solids load (DQ9.1, p. 30–31). The first involved estimating the silt and clay content of the materials eroded annually along the watercourses in the Romaine River watershed. The estimated 16,500 t/year does not include sand transported in suspension during high flows.

The suspended load near the mouth was also quantified directly by measuring concentrations in the water during spring flood flows in 2003 and 2004. In order to establish an annual mass balance, concentrations of 2 mg/l in summer and fall and 1.5 mg/l in winter were assigned arbitrarily, while concentrations in the spring were measured at between 2 mg/l and 32 mg/l (PR8.9.3, p.22 and 53). The results obtained using this method were 62,000 t in 2003 and 43,000 t in 2004 (PR8.13.3, p.84). Unlike the previous evaluation, these loads included the suspended sand load.

Hydro-Québec considers the first evaluation to be an underestimate because it does not include clay outcrops located near KP 80 of the river. The reason for the substantial difference in results from the first method is likely the inclusion of the sand fraction of the suspended sediment transport and the fact that, in places, the samplers captured saltating sand from the bedload. Hydro-Québec concluded that the actual suspended load was

"[Translation] between 16,500 t/year and an undetermined fraction of the measured load of between 40,000 t/year and 60,000 t/year" (DQ9.1, p.31).

The evaluation of the suspended load at the mouth is not precise. This load would be concentrated during spring flood flows particularly because higher concentrations accompany flood flows and only these flows are capable of transporting suspended sand (DQ9.1, p. 32).

Suspended sediment transport – Operating period

It is anticipated that in the first few years following the filling of the reservoirs, stripping of the soil could lead to an increased sediment load in the Romaine River. However, because clay and silt are rare in the areas occupied by the reservoirs and sand would be trapped behind the dams, the increase would be modest. Hydro-Québec expects the suspended clay and silt load at the mouth to remain unchanged at 16,500 t/year in the long term (PR3.2, p. 22-22; PR9.2, p. 33).

The proponent did not allow for a margin of uncertainty in the suspended load estimation and assumed that the substantial reduction in the duration and intensity of high flows would not have an impact on fine particle transport. In addition, the proponent does not expect the sand fraction of the suspended sediment transport to decrease, despite the presence of the reservoirs, which seems directly linked to flood flows (DQ9.1, p.32). The loss in suspended sediment load may be more significant than the proponent's estimate.

Bedload transport – Current situation

Bedload transport near the mouth of the river was evaluated using direct measurements during spring flood flows in 2003 and 2004. The samples collected at the mouth were mainly composed of coarse sand, but also contained medium sand. Although daily loads were irregular, they showed "[Translation] a variation synchronous and proportional to flow values" (PR8.13.3, p. 87). The proponent observed a proportional relationship between flow, flow velocity, transported particle size and bed load. This relationship was particularly evident in the spring 2003 results when bedload became negligible at flows of less than 800 m^3/s (*ibid.*, p. 87–90 and 97). The proponent estimates that the flow threshold would actually be around 500 m^3/s (DQ9.1, p. 33).

The annual mass balances for the two measurement years (2003 and 2004) were obtained by "[Translation] totalling the bed loads estimated during high flows" (PR8.13.3, p. 87). The resulting loads were close to 8,000 t in 2003 and between 8,000 t and 12,000 t in 2004[1] (*ibid.*, p. 84). For both years, the annual mass balance was identical to the spring flood flow mass balance, meaning that bedload transport associated with summer and fall flows was deemed negligible.

[1] Changes to sampling methods during the 2004 season resulted in imprecise evaluations (PR8.13.3, p. 46).

Similar studies were conducted in 2003 at KP 53.5 of the river, which is just upstream from the coastal plain area, near the planned site of the Romaine-1 dam. As was the case at the mouth, the annual bedload transport mass balance at this site was considered identical to the spring flood flow mass balance of 3,159 t for 2003.

Surveys indicate that the coastal plain stretch, i.e., the 50-some kilometres of the river between the mouth and the planned site of the Romaine-1 dam, carries the entire bedload it receives from upstream (estimated at around 3,200 t in 2003) as well as the load from banks along the route to the mouth. The reason for this would be that the sediment traps located between Grande Chute and the mouth are full (P8.13.3, p. 110–112).

Bedload transport – Operating period

Given the nature of this type of transport, the reservoirs built along the river would retain all bedload from upstream. Consequently, the stretch of river downstream from the Romaine-1 dam would be deprived of all sand inputs from upstream. However, Hydro-Québec expects erosion and transport of eroded sand along this stretch to remain essentially unchanged from the current situation, meaning that, at the mouth, bedload transport would lose approximately 3,200 t/year, which is close to one-third of its current load (PR3.2, p. 22-21 and 22-22).

Once the duration and intensity of spring flood flows are reduced and are no longer sufficient to evacuate bedload downstream from KP 53.5, Hydro-Québec anticipates that load transport would be distributed differently throughout the year. High flows in May and June would only be responsible for 48% of annual sand transport, rather than the current amount of approximately 80%, while the rest would reach the mouth during the other months of the year (*ibid.*, p. 20-23).

These forecasts are based on the calculation of theoretical transport capacities based on the fact that a portion of flood flows would be distributed over the rest of the year during hydroelectric operation (*ibid.*, p. 20-18 to 20-24). During operations, calculated transport capacities would be much lower than they are currently. Hydro-Québec believes that this loss in capacity would have little effect because it would generally remain higher than the current load and because the sediment traps would be full between Grande Chute and the mouth.

Using models to predict bedload transport in a river is generally difficult because of the complexity and irregularity of the beds and the local changes in gradient (PR8.13.3, p. 96). When the model applied to the Romaine River predicted a current load relatively close to the load measured at the mouth, it significantly overestimated those of the measurement stations located upstream (*ibid.*, p. 97–101). It should also be noted that, according to the proponent's interpretation, more than half of the bedload transport anticipated during operation would take place during the summer, fall and winter, that is, under medium-flow conditions, which do not currently significantly contribute to this mode of transport.

Summary of impacts on sediment transport at the mouth

In summary, for total sediment load at the mouth, the proponent anticipates a reduction equivalent to the some 3,000 t/year of sand retained in the Romaine 1 reservoir. Despite flood mitigation, the proponent expects the remaining bedload, along with total current suspended load, to continue flowing through the mouth.

Such an eventuality supposes that the substantial reduction in the duration and intensity of flood flows resulting from the development of the river would not affect the downstream contribution of the river to annual sand load (suspended and bed) transport. This also supposes that flows inferior to flood flows (< 500 m3/s), which are currently not sufficient for transporting sand that is suspended or on the bed, would transport more than half of the annual sand load, which seems unlikely.

> **Opinion —** *In view of the planned changes to the hydrologic regime, particularly high water flows, and considering the margin of error involved in evaluating sediment transport, the review panel considers it possible that the reduced sediment load emptied at the mouth of the Romaine River during the operation of the hydroelectric complex would be greater than that anticipated by the proponent*.

Effects in the river mouth zone

Flow dynamics at the river mouth

At its mouth, the Romaine River empties over three drops: Chute de l'Auberge, Fausse Chute and the Aisley River. Chute de l'Auberge is the river's permanent outlet, while Fausse Chute and the Aisley River are temporary outlets that serve as overflows when flow exceeds 385 m^3/s and 500 m^3/s, respectively. Tides, currents and waves do not have an impact upstream from these drops, which mark the border between the fluvial and marine environments. Downstream from the sills is a shallow area in which freshwater and salt water mix and where fluvial and marine dynamics alternate and combine. This zone, known as the mouth, covers close to 15 km^2 and extends between Paradis Point, Île La Grosse Romaine, Île La Petite Romaine and Tshipaihkuhkan Point (Figure 6). Downstream from the mouth zone, the Mingan Channel forms a trench about 20 to 100 metres deep between the shoreline and the Mingan Archipelago (figure 7).

The river mouth zone serves as a transit route for sediments from the Romaine River. Its bed is covered in fine, medium and course sand, depending on the location, and is crossed by a network of channels. The channels are more abundant and better developed in the west of the area located between Paradis Point and Île La Grosse Romaine. All of the water emptied by Chute de l'Auberge and much of the water emptied by Fausse Chute takes this route. Only one channel crosses the other part of the mouth located on the east side of Île La Grosse Romaine. The east channel receives all the water emptied at the Aisley River and part of the water emptied at Fausse Chute. The freshwater inputs in this part of the mouth are only produced in high flow conditions. When flows in the Romaine River are low or medium, these inputs are non-existent or negligible. They are produced during high flows mainly when flow

in the Romaine River exceeds 600 m^3/s and could represent up to 7% to 15% of river inputs for flows of more than 1,000 m^3/s (DQ22.1, p. 7–8).

The mouth zone is divided into two distinct sectors. The west sector, through which most of the water and sediment inputs from the Romaine River permanently flow, is subject to a complex mix of fluvial and marine processes. The east sector only receives significant freshwater and sediment inputs in high-flow conditions, mainly in the spring, while the rest of the year it is subject only to tidal currents (DQ22.1, p. 8).

Although the secondary channels have moved over the years, the distribution and placement of the main channels have remained stable for at least 60-some years, which seems to indicate the prevalence of a dynamic balance in the mouth zone (PR8.9.3, p. 61 and 62).

The sand carried through the mouth zone is deposited along this zone, on the bank and on the bed of the Mingan Channel trench. Sand accumulations are particularly concentrated to the west of Grosse Romaine Island, downstream from the main channels of the west part of the mouth (PR8.9.3, map 4.1.5). Finer particles (silt and clay) can remain suspended and be added to the suspended sediment transported by the currents in the Mingan Channel and are "[Translation] in very large part from the landslides that affect the silt and clay cliffs located east of the Romaine River mouth zone" (PR9.1, p. 207). Hydro-Québec considers the sedimentary contribution from the Romaine River to the Mingan Channel to be small compared with other inputs, such as those from neighbouring cliffs (PR3.2, p. 22-21 and 22-22).

In the west sector of the mouth, changes to the hydrologic regime would increase winter freshwater inputs and reduce spring inputs. These changes would also significantly decrease sand inputs. In the east sector, freshwater and fluvial sediment inputs that supply the east channel in the spring would be significantly reduced by the mitigation of high flows in the Romaine River, while those corresponding to high flows in the summer and fall would be virtually eliminated. As noted earlier, the occurrence of flood flows of more than 600 m^3/s is expected to drop from 12% to 3% of the time and those of more than 1,000 m^3/s are expected to decrease from 6% to 0.4% of the time (DQ22.1, p. 5).

With respect to the mouth zone, concerns have been expressed specifically in relation to the sustainability of eelgrass beds, soft-shell clam colonies, capelin spawning grounds and rainbow smelt habitat. These issues are addressed below.

Eelgrass beds

Eelgrass beds are considered areas of high primary and secondary productivity and are used as feeding, breeding, nursery and sheltering grounds by a number of fish species (DB18, p. 31). The eelgrass beds at the mouth of the Romaine River contribute to the biological richness of the Mingan Channel. Covering close to 3 km^2, they are concentrated in the eastern sector of the mouth of the river, around the eastern channel (Figure 6). A few very small beds have also been reported in the western sector of the mouth of the river, on the borders of certain channels. Eelgrass colonizes the mouths of rivers, seeking zones of intermediate salinity that are partly influenced by freshwater inflow (PR9.1, p. 228).

According to the proponent, the project would not have any impact on the eelgrass beds in the eastern sector of the mouth, because the substrate in that sector is stable and hardly influenced by floods (PR3.4, pp. 29-15 and 29-16; PR9.1, p. 231). It contends that flood reduction may actually favour eelgrass expansion in the western sector of the mouth of the river.

Fisheries and Oceans Canada is concerned about the potential medium- to long-term effects the project may have on the stability of the eelgrass substrate (DB18, p. 31). It believes that modifications to the hydrological regime of the river, particularly the reduction of freshwater inflow from the Aisley River and Fausse Chute, may upset the current balance of the eelgrass substrate in the eastern sector of the mouth. It also fears that an increase and fluctuation in winter flow rates may destabilize the ice cover that protects eelgrass. It therefore recommends that the proponent provide for monitoring of the state of the eelgrass beds at the mouth of the river.

Winter flow rates are expected to remain below the rate required for the river to feed the eastern channel, and winter ice conditions in the eastern sector of the mouth are therefore unlikely to change. A reduction in spring flood overflows may even prolong the stability of the ice cover. However, the panel agrees with Fisheries and Oceans Canada that, because the project eliminates all summer and fall inflows of freshwater and sediments to the eastern channel and greatly reduces spring inflows, it is likely to change the current balance in this part of the mouth.

- ***Recommendation —*** *The panel considers that the reduction in episodic inflows of freshwater and sediments in the eastern sector of the mouth of the Romaine River that would occur as a result of the project could affect the equilibrium of eelgrass beds. Given the importance of these environments for biological productivity, the panel recommends that a program to monitor the condition of the eelgrass beds at the mouth of the river be conducted to the satisfaction of Fisheries and Oceans Canada.*

Benthic communities

The benthic communities in the area at the mouth of the river include edible species such as the softshell clam, baltic clam, waved whelk and sea urchin. Hydro-Québec maintains that the freshwater inflows and strong currents associated with spring flooding, which are particularly evident in the western sector of the mouth, limit the distribution of benthic species in that sector. A number of species flushed out by spring flooding recolonize the area in the summer. Hydro-Québec believes that spring flood mitigation may translate into a slight increase in the abundance and diversity of benthic species in the area at the mouth of the river (PR3.4, pp. 29-10 and 29-13).

Fisheries and Oceans Canada acknowledges that increasing winter flow would probably not harm benthic communities and shares Hydro-Québec's opinion that spring flood mitigation may dampen the depleting effect on colonies at the mouth of the river. It predicts that the colonies will become more stable and diverse over the medium and long term and that modifications to the environment will alter the structure of the communities (DB18, p. 32).

Fisheries and Oceans Canada believes that in the western sector of the mouth, softshell clam would benefit from flood mitigation, but it also foresees possible negative impacts stemming from substrate modifications associated with changes in the hydrological regime and in the

reduction of sediment input. It is therefore requesting that the project's impacts on softshell clam be monitored.

- ***Recommendation —*** *The panel recommends that the proponent carry out a program to monitor softshell clam populations at the mouth of the Romaine River to the satisfaction of Fisheries and Oceans Canada.*

Capelin and rainbow smelt habitat

Two capelin spawning areas were observed in the western sector of the mouth (Figure 6). One is located at Paradis point, where a channel of the main sedimentary transit area of the river (western channel) meets a beach supplied by longshore drift from the Mingan Channel. The other is located on the western shores of La Grosse Romaine island, along a major sedimentary transit channel of the river (central channel), and in the extension of an eelgrass bed.

The proponent firmly believes that the project would have no impact on the two capelin spawning grounds (PR9.1, pp. 215 and 217). Fisheries and Oceans Canada does not share the proponent's certainty, arguing that altering the flow regime and reducing sediment input could, over the medium or long term, alter interactions between marine and fluvial sedimentary dynamics and perhaps affect the stability of the two spawning grounds. It is therefore requesting that the project's effect on the spawning grounds be monitored (DB18, p. 33).

Adult and juvenile rainbow smelt are found at the mouth of the river. Although the thresholds of the Aisley River, Fausse Chute and Chute de l'Auberge are considered impassable, the basins at the foot of these waterways offer favourable spawning conditions (DB18, p. 34). Having searched in vain for evidence of smelt spawning, the proponent has concluded that it does not spawn in the area at the mouth (PR3.4, p. 29-3). Fisheries and Oceans Canada considers this a premature conclusion, because it could take over a year of observation to confirm whether rainbow smelt spawns at that site. The best observation period is very short, and it can be difficult to locate laying areas, particularly in large rivers.

Fisheries and Oceans Canada believes it would be worthwhile to continue to search for rainbow smelt spawning grounds in the area at the mouth before filling the reservoirs. It believes that significantly cutting the flow of the Aisley River during the operating period and reducing the flow rate considerably at the three thresholds of the mouth during the filling of the Romaine 2 reservoir could substantially reduce the area's smelt spawning habitat potential (DB18, p. 34). It does not believe that the expected increase in the flow rate of the river in winter would have an effect on smelt use of the area at the mouth.

- ***Recommendation*** *— The panel recommends that a program to monitoring capelin spawning grounds at the mouth of the Romaine River be implemented to the satisfaction of Fisheries and Oceans Canada.*

- ***Recommendation —*** *The panel recommends that research of rainbow smelt spawning areas in the area at the mouth of the Romaine River continues until the*

reservoirs are filled and that Fisheries and Oceans Canada ensure that there is an assessment of the project's effects on areas that could be identified in the future and determine if monitoring would be relevant.

Birds at the mouth of the river

Sixty-two bird species were observed at the mouth of the Romaine River during inventories carried out by the proponent. A number of species only use the area at the mouth when they are migrating. The eelgrass beds between the La Grosse Romaine and La Petite Romaine islands are the primary feeding areas for several waterfowl species, while bird species that feed on molluscs or fish favour the area between La Grosse Romaine island and Paradis point (Figure 6).

The proponent predicts that hydrological changes in the area at the mouth will increase the abundance and diversity of benthic communities and that a number of bird species may benefit as a result. The birds most likely to benefit would be shorebirds and other species that feed on benthic organisms, molluscs or fish. The proponent is unable to determine whether certain species would be favoured over others. It is of the opinion that the benefit to benthic populations may have no detectable effect on bird abundance in this area. It does not foresee any impact on the birds that use the area at the mouth of the river, nor does it see the necessity of implementing an environmental monitoring program for such birds (PR3.11, pp. 53 and 92).

However, Fisheries and Oceans Canada is of the view that changing the hydrological regime of the Romaine River could have an impact on the eelgrass beds and that the proponent should monitor these environments (DB18, p. 31). Environment Canada believes that eelgrass beds are very rich habitats for several migratory bird species and has concerns about the effects of changes on these habitats (DB14, p. 3). Parks Canada thinks that these changes could lead to competition between various bird species and that their feeding conditions should be monitored. According to Parks Canada, the monitoring it is seeking would help make appropriate rectifications if necessary and assess the conditions for the co-existence of a large hydroelectric development and a national park (DB13, pp. 4 and 5; Mr. Yann Troutet, DT5, pp. 54–56).

At high tide, the western sector of the area at the mouth of the Romaine River contains approximately 30 islets, collectively known as the Rochers de Granite. Parks Canada is concerned about the effect of the project on the community of seabirds that feed or nest on the Rochers de Granite. It is most concerned about common tern and Arctic tern, the two main species that nest at the mouth of the Romaine River (DB13, pp. 1 and 2).

According to Parks Canada, the tern populations in the Mingan Archipelago National Park Reserve of Canada are among the largest in Quebec. The Rochers de Granite tern colony ranked third among 16 colonies in 1999 and second in 2004, with 983 nests. Moreover, the two tern species have been selected as indicator species for major natural resources in the national park reserve. Parks Canada acknowledges that while the Rochers de Granite area has no official designation, it may qualify as a globally significant nesting site for common tern

and Arctic tern according to the standards of the International Union for Conservation of Nature, since it is used by over 1% of the global population of each of these two species (DB13, p. 2).

The proponent analyzed the common tern and Arctic tern as valued environmental components in an effort to address the concerns of Parks Canada. During the 2005 inventory, no terns nested at the mouth of the Romaine River, and no feeding area in the vicinity of the Rochers de Granite could be found. The available data were analyzed by the proponent, which noted major interannual fluctuations in the various sanctuaries in the target area. The proponent feels it has not been able to formulate a clear conclusion on population trends, owing to differences in the methodology used in each inventory and the terns' low nesting-site fidelity and very high mobility (PR3.11, p. 113). It does not foresee any impact on the terns following the completion of the project and proposes no mitigation measures or environmental monitoring for these species (PR3.7, p. 48-48).

Parks Canada finds it unfortunate that no terns were present during the inventory carried out by the proponent. It recorded observations of tern feeding behaviour in the inner part of the area at the mouth in 2007 and found major feeding areas. It feels that, before altering the hydrological regime of the river, the proponent should document the reference state of the terns and characterize their feeding behaviour over one summer at their breeding sites on the Rochers de Granite (DB13, p. 2).

The Club d'ornithologie de la Côte-Nord is also requesting environmental monitoring of the impacts of the project on the birds that use the area at the mouth of the Romaine River, particularly the common tern, Arctic tern and red knot.[25] The red knot has seen its population fall off drastically (DM22, pp. 2 and 3).

- ***Recommendation*** *— Given that some sectors of the mouth of the Romaine River are considered highly attractive sites for a number of migratory bird species and that potential changes are anticipated in these sectors as a result of the project, the panel recommends that the proponent monitor these birds, particularly the common tern, Arctic tern and red knot. Additional mitigation or compensatory measures should be discussed as needed with Environment Canada.*

Effects in the Mingan Channel

Primary and secondary productivity

To assess the effects of the flow regime, as altered by the hydroelectric development, on plankton production, Hydro-Québec used three-dimensional digital modelling of water circulation in the Mingan Channel. The proponent concluded that the planned modifications to the flow rate of the river would not have a significant effect on the production and operation of the ecosystem, which is mainly controlled by the renewal of the channel waters with water

[25]. COSEWIC has recommended designating red knot a species at risk.

from the Jacques Cartier Strait (PR8.4, p. 31). The river's role in productivity is secondary to other circulation mechanisms in effect in the archipelago (tides, winter convection, exchanges with the strait).

Fisheries and Oceans Canada is satisfied with this study's conclusions on primary productivity in the Mingan Channel. However, it has reservations about the study's conclusions on secondary productivity because it feels the model used is not adequate for analyzing effects on zooplankton. It acknowledges that even if the project does not cause significant changes to the physical conditions and primary productivity of the Mingan Channel, it would be "[translation] reasonable to conclude that the project would not have significant local impacts on secondary productivity" (DB18, p. 31).

- *The panel notes that Fisheries and Oceans Canada and Hydro-Québec came to the same conclusion, namely that operation of the hydroelectric complex should not have a significant impact on primary and secondary biological production in the Mingan Channel.*

Molluscs and crustaceans

The participants and the departments have expressed strong concerns about the survival of the commercially harvested species in the Mingan Channel.

Scallop habitat in the Mingan Chanel is located at depths where neither the temperature, nor the salinity, nor the sediments of the water are affected by inflow from the Romaine River. Fisheries and Oceans Canada therefore agrees with the proponent that the project would probably not have a significant effect on scallops (DB18, p. 32).

Snow crab are most vulnerable in the juvenile stage. Juvenile crabs measuring up to 2.5 cm are mainly found at depths of 10 to 40 m, while adult crabs are found at depths over 80 m (PR3.4, p. 29-24). Fisheries and Oceans Canada agrees with the proponent that the waters of the Romaine River have no significant effect on such habitats (DB18, p. 33).

This conclusion also applies to other species present on the bottom of the Mingan Channel, such as rock crab, toad crab, Stimpson's surfclam, and urchin, since there is no indication that their habitat may be altered by the project (PR3.4, p. 29-24).

- *The panel notes that scallop and snow crab habitats in the Mingan Channel are located at depths above the potential area of influence of water from the Romaine River and that the project should not have a significant impact on these species. The same is true for other species of crustaceans and molluscs in the channel.*

Marine mammals

Although a few pinnipeds have been sighted in the area at the mouth of the river, mainly harbour seals in the vicinity of Chute de l'Auberge and Fausse Chute, almost 97% of the

marine mammal sightings reported in the 2004 survey campaign occurred in the Mingan Channel (PR8.9.3, p. 116 and 117). These marine mammals were, in decreasing order of abundance, grey seal, harbour seal, porpoise, minke whale and harp seal.

The impact the project may have on marine mammals would be related to the abundance and distribution of their prey: if the project leads to a reduction in capelin or rainbow smelt populations or eelgrass beds, the marine mammals that forage in the area may be affected and may have to change their habits. However, Fisheries and Ocean Canada believes that this impact would have little effect on marine mammal populations and therefore deems it acceptable (DB18, p. 35).

- *The panel notes that the project could have an impact on marine mammals that feed in the Mingan Channel if it were to lead to a local reduction in capelin and rainbow smelt production, which they eat. However, according to Fisheries and Oceans Canada, this would have little effect on marine mammal populations overall.*

Presence of toxic algae

Fisheries and Oceans Canada has warned that hydroelectric developments may trigger an increase in toxic algae in marine environments. Such increases have been studied in other parts of the world, but never in the St. Lawrence (PR9.1, pp. 258–261; DB18, pp. 35 and 36). The primary causes are thought to be an increase in humic substance and phosphorus loading, due to the decomposition of flooded organic matter, and a decrease in silica loading, due to silica retention in reservoirs.

Hydro-Québec estimates that the increase in the concentrations of nutrients in the water due to the filling of the reservoirs could stretch out over 10 to 15 years, but it believes that this increase would be insufficient to stimulate toxic algae proliferation. It also points out that, like other North Shore rivers, the Romaine River contains low concentrations of nutrients (including silica), whereas the nutrient levels measured in the Estuary and Gulf of St. Lawrence are high (PR9.3, p. 7).

Fisheries and Oceans Canada expects the effects of the project on marine biogeochemistry to be minor and localized, given the low initial nutrient contribution of the Romaine River, and concludes that “[translation] the project is unlikely to cause a significant increase in toxic algae in the St. Lawrence” (DB18, p. 36). It points out, however, that the cumulative effects of all the dams on the biogeochemistry of the St. Lawrence have not yet been examined.

- *The panel notes that Fisheries and Oceans Canada deemed it unlikely that the project would cause a significant increase in toxic algae in the Gulf of St. Lawrence.*

- ***Recommendation** — In order to contribute to a future evaluation of the cumulative effects of the hydroelectric developments on the biogeochemistry of the Gulf of St. Lawrence by Fisheries and Oceans Canada, the panel*

recommends that Hydro-Québec document inflows of silica, humic substances and phosphorus at the mouth of the Romaine River.

Chapter 4 The Human Environment

The project's effects on current land use are dealt with by the panel in terms of a few broad categories: recreational, traditional and cultural uses. The panel also investigates the infrastructure's ability to accommodate the project and the harmful effects of the work. Lastly, it looks at the opening of the territory, conflicting uses and apprehended disadvantages.

The panel considers that three principles of the Quebec *Sustainable Development Act* are especially germane to this chapter. The first is Health and Quality of Life, which reads as follows: ""[Translation] People, human health and improved quality of life are at the centre of sustainable development concerns. People are entitled to a healthy and productive life in harmony with nature." Thus, access to and use of the land to engage in recreational and traditional activities are significant in the maintenance of a healthy quality of life.

The second principle is Social Equity and Solidarity, meaning that ""[Translation] development must be undertaken in a spirit of intra- and inter-generational equity and social ethics and solidarity." The potential conflicts that could emerge between various user groups following project implementation must be taken into account.

Finally, the panel takes into consideration the principle of Protection of Cultural Heritage, defined as follows in the Act: "[Translation] The cultural heritage, made up of property, sites, landscapes, traditions and knowledge, reflects the identity of a society. It passes on the values of a society from generation to generation, and the preservation of this heritage fosters the sustainability of development. Cultural heritage components must be identified, protected and enhanced, taking their intrinsic rarity and fragility into account."

Current land use

This chapter presents a snapshot of land use in Minganie. This succinct description will facilitate a better comprehension of how the project will affect the human environment.

More intensive use by the Minganois[26] and Innu of the lower watershed of the Romaine River is explained by the absence of road access to the back country. The most heavily used areas more or less correspond to the boundaries of the

[26] A name used in the impact study to designate the non-Aboriginal inhabitants of Minganie.

municipality of Havre-Saint-Pierre (Figure 8). This area also accounts for the majority of industrial, commercial, public and residential activities. In addition, the impact study notes that, according to "[Translation] a tacit land use agreement dating back several generations," the coastal zone is occupied mainly by non-Aboriginal people and the back country, by the Innu (PR3.6, p. 44-28). Thus, the Minganois make much more sporadic use of the upper watershed of the Romaine River, but the Innu continue to use these areas in spite of the effort it takes them to go there.

The activities practised by the Minganois and the Innu follow a well-defined cycle. The coastal zone is used mainly in spring and summer (vacationing, hunting of migratory birds, fishing, gathering of wild berries), whereas autumn and winter are the preferred seasons for activities in the more northerly areas (hunting, trapping).

The 1984 creation of the Mingan Archipelago National Park Reserve involved the expropriation of cottages on the Mingan Islands and a ban on hunting, fishing and other traditional activities on the islands. Only certain gathering, snaring and hunting activities are still tolerated there. According to the Association chasse et pêche de Havre-Saint-Pierre, the recreational and vacation habits of the people of Minganie have changed since the protected area was created. They have forsaken their activities along the coast and taken to tent trailers, camper vans, snowmobiles and quads, seeking "[Translation] quiet nooks in the back country" (DM26, p. 2).

Most cottages and vacation zones are still found along the Gulf of St. Lawrence. On the other hand, some one hundred are north of Highway 138, mainly on the shores of Lakes Cormier, Ours and Bourassa, which are on either side of the Romaine River at around KP 50 to 65. There are very few cottages along the Romaine River itself. Five are located within the perimeter of the planned reservoirs (PR3.5, p. 35-3). Accessibility, particularly by snowmobile, is among the main reasons for vacationers to settle within the boundaries of the municipality of Havre-Saint-Pierre (Raynald Thériault, DT7, p. 25).

Figure 8 Areas used by Innu and Minganois

Insert 8″ × 11″ colour figure

Creation of the Mingan Archipelago National Park Reserve has also restricted the Innu's use of the coast, even though they still have cottages there. The summer activities practised there include hunting of migratory birds and small game and harvesting of berries and medicinal plants. Farther north, the Innu stay at cottages and campsites throughout the territory, some of which have been in use for generations. For a few years now, the Innu of the Ekuanitshit community have also been using cottages acquired by the band council. Some of these are in the same vacation zones favoured by the Minganois.

Recreational uses

About three quarters of the Minganois surveyed at the time of the draft project design studies said they fished in the inventory zone. Among the areas most heavily used are the stretch of the Romaine River between its mouth and KP 20, especially for salmon fishing, and some lakes in the vacation zones.

The greatest fishing effort in the Romaine River is for Atlantic salmon and brook trout (averaging between 30 and 40 hours per year, per fisher). Ouananiche (landlocked salmon) and Arctic char are next, with some 25 hours a year on average. Less than 20 hours is spent fishing for other species, namely lake trout, sea trout, lake whitefish, northern pike and rainbow smelt. Brook trout accounts for the bulk of the catch, with more than 5,600 caught between September 2003 and September 2004, or almost 48 catches per fisher on average (PR3.5, p. 33-8).

Two separate development tools reflect the Romaine River's status as a "salmon river." The *Plan d'affectation des terres du domaine public de la Côte-Nord* restates the procedures for forestry work in a buffer strip on either side of the river laid down in Quebec's *Regulation Respecting Standards of Forest Management for Forests in the Domain of the State* [c. F-4.1, r. 7]. The *Plan de développement du territoire public* forbids vacation developments less than 1 km from the Romaine River between its mouth and Grande Chute (KP 52.5). In spite of this status, the Quebec Department of Natural Resources and Wildlife (MRNF) regards the salmon fishery potential of the Romaine River as relatively low because of the low quality of the accessible habitats (François Bernard, DT6, pp. 24–25). One participant in the public session praised the size of the salmon in the Romaine River, and the MRNF has confirmed that the salmon caught there are indeed reported to be bigger than the average for all of Quebec's salmon rivers (René Desbiens, DT3, pp. 49 and 52; François Bernard, DT6, p. 28).

About 30 fishers, residents of Havre-Saint-Pierre, spent 210 half-days fishing for salmon during the 2004 season, mainly in the areas of Les Cayes near the river mouth, the Puyjalon River (KP 13) and Chute de l'Église (KP 16). Anglers' average annual reported salmon catch fell by a little more than two thirds between 1990–1994 and 2000–2004 (PR3.5, p. 33-10); 2006 and 2007 had the

smallest salmon catch since 1964, i.e. 9 and 8 catches respectively (DB5). It seems, however, that 2008 was better, with 28 catches recorded at the beginning of November 2008 (ibid.). Although there is no management structure on the Romaine River (ZEC, outfitter or wildlife sanctuary), and catch recording, though obligatory, is voluntary, the MRNF believes that fishers' participation is quite good (François Bernard, DT6, p. 24).

At the mouth of the Romaine River, near the Aisley River, ice fishing is carried out. For some Minganois, this is a family recreational activity that is practised occasionally, whereas other fishers seek a more intensive harvest, mainly of rainbow smelt.

It appears the Minganois' main hunting grounds are in the southern part of the Romaine River watershed, that is, near the river mouth, between Chutes à Charlie and Grande Chute, and in a broad area on both sides of the Romaine River, between KPs 50 and 70. Big and small game is hunted, as well as waterfowl. Because caribou hunting is banned, moose are prized. Thirteen hunting-related facilities are thought to be within the planned area of the reservoirs, structures or access road (PR3.5, p. 33-20). The number of facilities decreases as one moves northward. Sports hunting for moose is practised in the area of the projected Romaine-4 reservoir, mainly by hunters from outside the region.

Trapping is practised recreationally. Of the 23 trapping grounds inventoried by the proponent, 12 are contiguous to the Romaine River or likely to be crossed by the access roads and trails (ibid., p. 33-17).

Snowmobiling is a popular recreational activity and an essential means of transport for the Minganois. Snowmobiling is closely related to land use, and the network of snowmobile trails is particularly well developed on both sides of the Romaine River between KPs 50 and 65, where there are many cottages on the surrounding lakes and where hunting is practised. The Minganois also regularly cross the Romaine River downstream of the projected Romaine-1 generating station, mainly at KPs 3, 18 and 26, from which many trails branch off (Figure 9).

Figure 9 Human environment – Land use

Insert 11″ × 17″ colour figure

Most snowmobilers cross the Romaine River at KP 26, with some 3,000 crossings a year, whereas nearly 20% cross at KP 3 and about the same percentage at KP 18. The section of the provincial Trans-Québec No. 3 trail that skirts Highway 138 and crosses the Romaine River at KP 3, at the Highway 138 bridge, is used by local people and some snowmobilers from outside the region, mainly from mid-January or the beginning of February until the end of March. This is the period during which the ice cover meets the safety requirements of the Fédération des clubs de motoneigistes du Québec and of the insurance company of the Le Blizzard de Havre-Saint-Pierre snowmobile club, which is responsible for the section of the provincial trail between Longue-Pointe-de-Mingan and Baie-Johan-Beetz. In addition, though the Minganois do snowmobile on the Romaine River between KPs 16 and 35, very few do so upstream of Grande Chute (KP 52.5) (PR3.5, pp. 35-4 to 35-6; Le Blizzard de Havre-Saint-Pierre snowmobile club, DM35, pp. 2–3).

Use of quads (ATVs) is almost as widespread as snowmobiling. Users of this type of vehicle use more or less the same routes as snowmobilers. Some use a raft (“flatou”) to cross the river (PR3.5, p. 35-3; PR8.14.1.1, pp. 40 and 55).

The Minganois’ boating activities are mainly on the Romaine River downstream of the projected Romaine-1 generating station, and are combined with hunting and fishing activities. In addition, some take advantage of the waves that form under the northern half of the Highway 138 bridge during the summer to do whitewater kayaking (Yann Troutet and André Charest, DM58). Upstream, only occasionally have individuals or groups been seen canoeing down the river by the proponent.

Industrial and commercial uses

For lack of road access, the mining potential of the study area remains largely unexplored. QIT-Fer et Titane, a subsidiary of Rio Tinto Alcan, is mining a seam of ilmenite, the Tio mine, east of the Romaine River, at KPs 70 to 75. A railway crossing the Romaine River at KP 16 allows for transport of the ore to Havre-Saint-Pierre. Two local contractors are mining seams of labradorite upstream of the projected Romaine-3 generating station, in territory that would be flooded. They also have mineral rights in the Des Murailles basin area, for which they have been planning to build an access road (Quebec Labradorite Inc., DM49, pp. 1–2; Daniel Scherrer, DT7, p. 7).

Timber in the project’s inventory zone has never been commercially logged and the hydroelectric complex sites would not impinge on any territory subject to a timber supply and forest management agreement (PR3.5, p. 37-2). There are only a few commercial firewood harvesting lots in the area and two or three licences appear to be granted annually by the Quebec Department of Natural Resources and Wildlife (PR8.7.1, p. 12-1).

Traditional Innu uses

The Innu of the Ekuanitshit community engage in fishing, for salmon in particular, big game hunting, hunting of migratory birds, and trapping in the lower watershed of the Romaine River. Access to the land varies according to the particular activity and the seasons. For example, the Puyjalon River (*Kaminakapeu-shipiss*) watershed is apparently used mainly for winter trapping of beaver because of its relative proximity to the community. It may be reached by snowmobile along the Romaine River (*Unamen-shipu*), which enables day trips to be made from the community and back. In autumn, the Innu also go there by floatplane or by taking the QIT-Fer et Titane Tio mine's train and continuing by canoe (PR3.6, pp. 39-53, 39-60 and 39-61).

The stretch of the Romaine River downstream of the Romaine-1 generating station is accessible by powerboat. Though it is possible to return to the community the same day, the presence of campsites makes it possible to combine several activities, including salmon fishing, beaver trapping and hunting for Canada geese and other waterfowl. At that point the Romaine River is also used as a port of entry to reach territories farther north by snowmobile, where people can stay longer. When travelling the frozen river the Innu know the dangers, in particular the spots where the water does not freeze.

Salmon fishing appears to be done by a number of Innu from the Ekuanitshit community. It has a strong social, cultural and identity value, and the draft project design studies on mercury exposure showed the relatively high percentage of salmon among the fish consumed (PR8.7.2, p. 4-2). The area where salmon is generally fished includes the stretch of the Romaine River between its mouth and Grande Chute (*Ikaikapu*), including the Puyjalon River, where 35 fishing sites were recorded. The size and weight of salmon fished in the Puyjalon River appear to be remarkable. As the stretch between Chute de l'Église and Grande Chute is less used by the Minganois, it is particularly attractive to the Innu, in particular Chutes à Charlie (*Ikaikapiss*), which is their main fishing ground. Unlike the Minganois, for whom salmon fishing is a day-trip activity, the Innu often make camp close to the most popular fishing places.

The Ekuanitshit Band Council is involved in the management and supervision of community members' salmon fishing, in particular through the issuance of fishing permits. It should be noted, too, that the Innu's food fishery catches are not recorded either by the Quebec Department of Natural Resources and Wildlife or by the band council (PR3.6, p. 39-86; François Bernard, DT6, p. 24).

It appears that the use of the area immediately upstream of the Romaine-1 generating station by the Minganois and the Innu of the Nutashkuan community caused the Innu of Ekuanitshit to abandon it. The Romaine-2 reservoir area, now

little used, could have good potential for future use, as the band council has acquired a cottage in the area and beaver appear to be abundant there.

The area of the planned Romaine-4 reservoir appears to be significant for the Innu of the Ekuanitshit community and expeditions are said to be taking place to recreate their ancestral practices. Floatplanes have, however, replaced boats as the means of going there. The area, which can be explored by boat on the Romaine River and the surrounding streams starting from a main campsite, is used in autumn for long campaigns of trapping, fishing and small game hunting. The Innu would prefer not to hunt caribou there, to allow stocks to recover. The area also contains a number of active or former campsites, some of which have heritage value.

The Innu of the Nutashkuan community appear to be mainly using a territory located east of the Romaine River, access to the southern portion of which is facilitated by the presence of Highway 138 and the possibility of snowmobiling to it over frozen lakes and rivers. Various activities seem to be practised there, and those engaging in them can return to the community the same day. Temporary camps can also be established so as to combine several activities. The Innu of the Nutashkuan community would regularly hunt caribou as far as the areas north of the planned Romaine-4 reservoir. The terrain is sometimes rugged and travellers require a good knowledge of the area. Because of the orientation of certain rivers located outside the Romaine River watershed, including the Natashquan, Aguanish and Nabisipi rivers, it is possible to reach the northernmost hunting grounds by snowmobile.

Neither the impact study, the briefs tabled nor the presentations made at the public hearings were able to confirm whether the land in the proponent's inventory zone is currently used by Innu from the communities of Pakua Shipi and Unamen Shipu. In spite of that, the Pakua Shipi and Unamen Shipu Innu Councils dispute the proponent's denial of the past, present and future occupation and use of the study area by members of their two communities (DM94, p. 8). For their part, the Innu of the Ekuanitshit community believe there is no historical or contemporary evidence that Innu from the Nutashkuan, Pakua Shipi and Unamen Shipu communities have used or are currently using the lands west of the Romaine River (DC8, pp. 3–4).

Project effects

Recreational activities

Sport fishing

Besides the salmon sport fishing grounds downstream of the Romaine-1 generating station, the proponent states that the majority of the fishing grounds used by the Minganois are outside the planned work areas, i.e. on vacation lakes. For the 10-odd fishers that use the stretch upstream of the Romaine-1 generating station, the proponent expects that deforestation of reservoirs, traffic and construction of access roads and structures would constitute a temporary source of disturbance (PR3.5, p. 33-35). Creation of the reservoirs themselves would mean the loss or permanent alteration of some fishing grounds. The brook trout fishery would be most affected.

However, the concern most often expressed at the public hearings was with overfishing by workers at the jobsites. According to the proponent's checks on similar projects, the proportion of jobsite workers that are anglers would be minimal. That proportion was reported to be between 9% and 18% for the hydroelectric projects on the Toulnustouc and Péribonka rivers and the Sainte-Marguerite-3 project; this would correspond, for this project, to some 250 to 300 workers during the peak workforce periods expected between 2012 and 2016. Heavy work schedules may limit the number of anglers. As the planned work camps are more than 80 km away, the proponent expects that workers' fishing activities would be distributed over a vast territory.

The proponent nonetheless proposes to take measures to concentrate workers' fishing activities, relying, in particular, on the stocking of some lakes near the work camps and along the projected access road with brook trout. In the case of the Péribonka hydroelectric project, the two fish-stocked lakes for workers accounted for two thirds of the workers' total fishing effort and catches (PR3.5, pp. 33-37 and 33-38).

In this case, the lakes that could be stocked are not those where brook trout losses are to be offset. Of the 11 lakes already chosen by the proponent, some of which could eventually be stocked with fish for anglers, 7 have no fish (PR3.3, p. 23-165). As discussed in the preceding chapter, fishless lakes have particular characteristics that it is important to preserve, in particular for species at risk such as the Barrow's goldeneye.

The proponent also plans to make workers aware of fish harvesting, in particular in terms of the regulations promulgated by the Quebec Department of Natural

Resources and Wildlife, and of the need to harmonize their fishing activities with those of other land users.

- ***Opinion*** *— The panel considers that the stocking of some lakes located near work camps and the generating station access roads, together with worker awareness efforts, would help mitigate the effects of increased fishing pressure during the construction period. However, the proponent should avoid stocking fishless lakes with fish to allow a sport fishery.*

The projected access road would facilitate access to new fishing grounds. More than one third of the anglers surveyed at the time of the draft project design studies indicated their intention to go and fish the new reservoirs (PR3.5, p. 33-8). Moreover, the proponent intends to introduce species prized by anglers, that is, lake trout and ouananiche (landlocked salmon) in the Romaine-1 and Romaine-4 reservoirs respectively. These measures would benefit sport fishing to the extent that they are carried out successfully. The proponent also plans to introduce brook trout into some fishless lakes to offset the habitat loss due to project implementation. These lakes would be easily accessible to anglers (Michel Bérubé, DT4, p. 20).

- ***Opinion*** *— Considering the currently low number of fishers and the abundance of brook trout in the reservoir area, the panel feels the project's impact on the sport fishery would be acceptable. Moreover, the territory's increased accessibility and the introduction of species prized by anglers could foster sport fishing in areas hitherto little used.*

At the public hearing, a number of participants spoke of their concerns about the continuation of salmon fishing if the project goes ahead. It was desired to preserve certain particular fishing grounds representative of the Minganois' fishing practices. These few well-known pools are located close to the river mouth and may be reached on foot and fished from the shore (Gaétan Cassivy, DT7, p. 89).

During construction, the effects on the salmon fishery would particularly be felt during the second phase of impoundment at the Romaine-2 reservoir, in summer 2014, when the flow downstream of Grande Chute would be only from the tributaries of the Romaine River (Figure 9). This low flow could lead to an over-concentration of salmon at the foot of certain obstacles, including Chutes à Charlie, with the attendant danger of overfishing if fishers have too much luck (PR3.5, p. 33-36). Depending on flow conditions, this impoundment phase could be largely during the Minganois' fishing period.

To mitigate the greater vulnerability of the salmon stock during this impoundment phase, the proponent plans to make the Quebec Department of Natural Resources and Wildlife aware of the low-flow condition so that it can exert

greater vigilance in protecting the resource (PR3.3, p. 23-166). It should be noted that the proponent is currently studying solutions to maintain the required instream flow during the impoundment phase. This could alleviate the over-concentration of salmon in certain areas.

- ***Opinion*** *— The panel considers that the Quebec Department of Natural Resources and Wildlife, in co-operation with the proponent, should pay particular attention to the potential overfishing of salmon and to compliance with fishing regulations during impoundment of the Romaine-2 reservoir.*

- ***Opinion*** *— The panel considers that installation by the proponent of an information and awareness mechanism for salmon fishers, in particular with respect to scheduling and the progress of work, would help avoid overfishing of the resource.*

During project operation, the new hydrological and thermal regime would alter the behaviour of salmon, which could be able to go up the Romaine River more quickly in spring and cross certain obstacles more easily. They would reach the pools at the river mouth earlier and would not stay there as long (ibid., p. 23-149).

The Quebec Department of Natural Resources and Wildlife expects major impacts on fishing conditions because of the project's effects on the timing of the salmon run (DQ7.1, p. 3). One fisher suggested at the public hearing that these effects could shorten the fishing season, as salmon might no longer be present in certain pools when he wanted to fish for them. The experience of several generations of anglers would thus be lost (Gaétan Cassivy, DT7, p. 90; ibid., DM28, p. 1). When the hydroelectric complex becomes operational, the proponent confirms that fishers would have to change their fishing practices and could have lower catches at certain times and places, but that the overall quality of salmon fishing and the length of the fishing season should remain unchanged (Michel Bérubé, DT7, pp. 90–91). It agrees, however, that local fishers' experience would become less valuable (ibid., DT6, p. 27).

The monitoring programs, in which representatives of the local communities would be invited to take part, would provide information on changes in salmon behaviour, facilitating the development of new fishing practices (id., DT7, p. 91).

- ***Opinion*** *— The panel considers that the proponent should disseminate the results of the salmon monitoring programs to help all fishers adapt to the new fishing conditions resulting from the operation of the hydroelectric complex.*

The Romaine River is currently a free-use territory subject to the salmon fishing rules of the Quebec Department of Natural Resources and Wildlife. If the salmon stock remains healthy, the MRNF does not intend to limit access to the river in the future (François Bernard, DT6, p. 18). For the proponent, although

hydroelectric production would not constrain access, adjustments to fishing practice could be proposed to ensure the salmon's survival. These adjustments would be discussed in the salmon restoration and development program, in which representatives of the local communities would be invited to take part (Michel Bérubé, DT1, p. 72). However, the Quebec Department of Natural Resources and Wildlife doubts it is realistic to limit salmon fishing on the Romaine River since it is used for traditional purposes by the Innu (PR6, opinion 8, p. 9).

- *The panel notes that discussions on salmon fishing under the salmon development program proposed by the proponent would place the emphasis on dialogue between the main stakeholders with a view to maintaining the quality of salmon fishing on the Romaine River.*

Ice fishing is also practised in the area of the mouth of the Romaine River. The species fished is rainbow smelt. Fisheries and Oceans Canada attributes the presence of this species in the area to the search for food or thermal refuge. It expects the species to continue to frequent the ice fishing areas following project implementation, and that there would be no effect on the practice of ice fishing in this area (DB18, p. 35).

Hunting and trapping

The projected access road would facilitate access to new, larger, more remote hunting territories. The proponent anticipates that only the Romaine-4 reservoir area would see a marked increase in hunting, since the moose density is higher there than elsewhere in the study area (PR3.5, p. 33-20). A suitable area for development of an outfitter with exclusive rights was also delimited by the Quebec Department of Natural Resources and Wildlife, which indicated, however, that there was no plan to lift the moratorium on the creation of this type of enterprise (DQ12.1, p. 1).

The proponent projects a gradual influx of users into the newly accessible territories, because the projected access road would be opened only gradually and certain traffic restrictions could be imposed, for safety reasons, between 2009 and 2016. Moreover, the territories' remoteness from large urban centres and the low moose density ascertained by the proponent would limit the influx of new users from outside the region (PR3.5, p. 33-21). Besides, the Quebec Department of Natural Resources and Wildlife is seeing a constant reduction in the number of hunters, probably due to aging of the population and the lack of any new entrants (Lamontagne and Lefort, 2004).

Reservoir impoundment would bring about a redistribution of species, which would tend to move toward the periphery of the reservoirs. Hunters that now use the territory might be obliged, therefore, to alter their hunting practices (Louise

Émond, DT6, p. 50). According to the Quebec Department of Natural Resources and Wildlife, the creation of the reservoirs, the opening of the territory and the increase in hunting could also tend to drive moose into areas with larger numbers of wolves, thus increasing predation (PR6, opinion 8, p. 12).

The proponent does not anticipate that the presence of workers in the study area would place disproportionate pressure on wildlife resources. The experience at other jobsites leads the proponent to believe that the number of workers that engage in hunting would not be significant. For example, at the hydroelectric site on the Péribonka River, it is reported that some 1% of workers went hunting. For this project, the proponent estimates that from 15 to 40 workers might hunt in the territory between the two work camps. The proponent nevertheless intends to make workers aware of the need to harmonize their hunting activities with those of other land users (PR3.5, pp. 33-32 and 33-33).

It should be noted that the moose population relevant to this project belongs to the hunting area 19 south, where hunting conditions appear to be among the least restrictive in Quebec. For example, all animals (males, females and calves) may be hunted for a period of approximately one month each year (Lamontagne and Lefort, 2004).

- *The panel notes that the opening of the territory by the hydroelectric facility access road could bring about a redistribution of hunters in the territory, rather than an increase in their number.*

For the Minganois who engage in trapping on land adjacent to the Romaine River or likely to be crossed by future access roads, the quality of their experience is likely to suffer because of new snowmobile traffic conditions on the Romaine River, the presence of the access road and the possible influx of new land users. The project could also bring about a redistribution of prized species. The proponent maintains, however, that the total potential harvest would probably remain unchanged and that the trapping pressure generated by the opening of the territory would not increase, in particular because of the declining popularity of trapping and a rather stagnant fur market (PR3.4, pp. 26-36 and 26-39).

Vacations and recreational tourism

The development orientations of the Minganie RCM support the recognition and development of the area's recreational tourism potential. The access road and reservoirs would constitute axes of development for vacationers and recreational tourists. In Quebec, in 2000, there were nearly 7,500 cottages on 71 reservoirs, including 135 cottages on 11 of the 14 reservoirs of the North Shore (PR3.5, p. 35-15). The proponent predicts, however, in its analysis of the project's cumulative effects, that recreational tourism development in the back country

would remain marginal since Minganie's major tourism focus remains the coast (PR3.7, pp. 48-64 and 48-65). Nevertheless, some participants in the public hearing wish initiatives to be taken in support of the development and use of the back country (Jean-François Girard, DT12, p. 26; Jeune chambre de Manicouagan, DM57, p. 10).

Among the facilities already planned by the proponent are boat ramps, portage trails and curb lanes along the access road. Details of these initiatives, in particular the location of the curb lanes, would be discussed with users so that they are put in the right places, according to cottage lease concentrations, for example (Louise Émond, DT2, pp. 63–64). Moreover, the introduction of lake trout and ouananiche (landlocked salmon) into the Romaine-1 and Romaine-4 reservoirs would create new sport fishing opportunities, while the change from a riverine to a lacustrine environment should spur pleasure boating (PR3.5, p. 35-26). Any future vacation or recreational tourism development should, however, take into account the reservoirs' water management and drawdown (ibid., p. 35-34).

Some participants felt the hydroelectric developments as a whole would benefit from tourism promotion, in particular with the anticipated arrival of cruise passengers in Havre-Saint-Pierre (Jean Cassivy, DT7, p. 96). Political and economic stakeholders of Sept-Îles and the Conseil central de la Côte-Nord, affiliated with the Confederation of National Trade Unions (CSN), report that the Manic-2 and Manic-5 facilities receive nearly 16,000 visitors a year (DM69, p. 12; DM80, p. 7). At the public hearing, however, the proponent stated that, out of a concern for safety, it did not plan to open the Romaine-1 generating station (the one closest to Havre-Saint-Pierre) to visitors (Benoit Gagnon, DT7, p. 98). For their part, the regional tourism associations of Manicouagan and Duplessis suggested that the proponent develop a visitor infrastructure for the hydroelectric complex near Highway 138 (DM79, p. 5).

- *The panel notes that the establishment of development measures and the use of the newly accessible territories for vacation and recreational tourism purposes is a matter for local stakeholders, the Minganie RCM and the Quebec Department of Natural Resources and Wildlife.*

Recreational boating

The proponent stated that, because water flow would be regularized during operation of the hydroelectric complex, the intensity and frequency of peak flow would be reduced and navigable periods prolonged (PR3.5, p. 35-25). On the other hand, some participants in the public hearing held that the required ecological instream flow downstream of the Romaine-1 generating station (170 m^3/s between July 8 and October 15) would disrupt whitewater kayaking near the Highway 138 bridge, a place with special wave conditions that make it

unique in Minganie (Yann Troutet and André Charest, DM58, pp. 2–8; Mathieu Bourdon, DM61, p. 3; Jean-François Bourdon, DM102, p. 2).

Participants in the public hearing said that the best range of flow rates lay between 100 m^3/s and 200 m^3/s (Yann Troutet and André Charest, DM58, p. 7). Basing themselves on the mean daily flows recorded since 1957 at the gauging station on the Romaine River at KP 16, they estimated that the suggested instream flow requirement in summer of 170 m^3/s would significantly impair the whitewater potential near the Highway 138 bridge. In any given year, there would be some 15 days on the average with flows between 100 m^3/s and 170 m^3/s (ibid., DM58.1, p. 4).

On this subject, the proponent estimates that the ecological instream flow requirement of 170 m^3/s downstream of the Romaine-1 generating station would be exceeded 85% of the time in August and September. Between July 8 and October 15, the operating flow employed most of the time would be the one offering the best output, that is to say 200 m^3/s (one set) or 400 m^3/s (two sets) (PR3.2, p. 16-15). This validates the kayakers' concerns that flows would be too high for whitewater kayaking near the Highway 138 bridge.

The kayakers also fear that the turbine flows become unpredictable, whereas it is currently possible to predict natural flows 24 to 48 hours in advance on the basis of weather forecasts and data from the Romaine River gauging station (Yann Troutet and André Charest, DM58, p. 7).

- ***Opinion*** *— The panel considers that the proponent should discuss with kayakers the possibility of agreeing on an information mechanism so that they can forecast flows favourable to the practice of their sport near the Highway 138 bridge.*

Even though the upstream stretch of the Romaine River is little used currently for whitewater rafting, the loss of a valuable whitewater heritage was emphasized at the public hearing; in particular, one participant mentioned three stretches of rapids between KPs 85 and 215 that ought to be developed (Mathieu Bourdon, DT12, p. 14).

During construction, occasional disruption of recreational boating could also occur, particularly for powerboats. During the second phase of impoundment at the Romaine-2 reservoir, there would for a few weeks be a reduction in water levels and a loss of navigable area that would make it impossible to maintain a navigable channel at five places downstream of the Romaine-1 generating station and could complicate water access on seven stretches of the river. Canoeing could continue, however (PR3.5, p. 35-40).

Future practice of *Innu Aitun*

Project implementation could impede the Innu's access to their traditional territories and disrupt the practice of *Innu Aitun*[27] and the availability of wildlife and fish resources for the practice of traditional activities.

Access

The access road would make new areas available and affordable for the practice of traditional activities. Development of visitor facilities, such as the parking lot at the Romaine-1 generating station, boat ramps, curb lanes, portage trails, the snowmobile footbridge crossing and possible snowmobile access to the Romaine-1 generating station bridge would also facilitate the practice of *Innu Aitun*. Note that use of these facilities would not be reserved for the Innu. Additional measures could be taken in consultation with the Innu of the Ekuanitshit community, in particular through the upcoming agreement on repercussions and benefits (DQ9.1, p. 15).

For the Innu of the Ekuanitshit community, who fish for salmon in the Romaine River, the 2nd phase of the impoundment of the Romaine-2 reservoir, planned for summer 2014, would affect access to their fishing grounds in that powerboating would be disrupted. Unlike the Minganois, who fish for salmon from the shore, the Innu generally go to their fishing grounds in powerboats heavily laden with equipment and provisions (PR3.6, p. 39-110). They use the landing stage located close to the Highway 138 bridge, close to KP 3. A lower flow would make it impossible to maintain a navigable channel with a minimum depth of 1 m, sufficient to allow passage of a powerboat, at KPs 21.5, 22.9, 24.4, 45.1 and 45.9. Between KPs 3 and 4, a reduction in water depth during impoundment would also bring about a narrowing of the width between banks, which could, among other difficulties, complicate access to the water (PR3.5, p. 35-40). Incidentally, as previously mentioned, discussions are continuing on ways of mitigating the effects of the impoundment of the Romaine-2 reservoir.

Although the access road could facilitate access to certain salmon fishing sites, in particular Grande Chute, traffic restrictions during construction would be lifted in this area only after 2016, when the proponent expects to have finished development at Romaine-1 and Romaine-2.

- *The panel notes that the project would affect access to salmon fishing grounds used by the Innu, especially in the 2014 to 2016 seasons.*

[27] *Innu Aitun* ("Innu life") refers to all activities, in their traditional or contemporary expression, related to the Innu's culture, fundamental values and traditional way of life, which in turn relate to their occupation and use of Nitassinan and the special bond they have with the Earth. This includes practices, customs and traditions, such as hunting, fishing, trapping, gathering and barter activities, for sustenance or for social and ritual purposes. The cultural, social and community aspects are all germane. The practice of *Innu Aitun* implies the use of animal, vegetable and mineral species as well as water and other natural substances (PR3.6, pp. 39-1 and 39-2).

If the project goes ahead, the proponent will recommend that no one snowmobile across or along the Romaine River or the reservoirs given the unstable ice cover conditions. For the Innu of the Ekuanitshit community, it would no longer be possible to travel upriver from the mouth to reach certain much used and not very distant places of *Innu Aitun* practice whence it is currently possible to return to the community the same evening (PR3.6, pp. 39-50, 39-52 and 39-53). As for the Innu of the Nutashkuan community, land use inventory studies have shown that they use places mainly located east of the Romaine River, which they reach by travelling over frozen lakes and rivers that would not be affected by the project (ibid., pp. 40-41 and 40-43; PR3.10, maps P and Q).

- *The panel notes that the project would affect the Innu's winter access to their hunting and trapping areas — mainly the Innu of the Ekuanitshit community, who must travel the Romaine River to practise* Innu Aitun*. They could nevertheless use the access road and the facilities proposed by the proponent to cross the Romaine River by snowmobile.*

Spring activities downstream of the Romaine-1 generating station could also be compromised because Innu do travel in that area, either by snowmobile or by powerboat when water levels are very high (Andras Mak, DT8, pp. 21–22).

How *Innu Aitun* is practised

For the Innu, the project's effects on the practice of traditional activities, in particular salmon fishing, have a significant sociocultural dimension. Traditional Innu knowledge may be imparted to young people during family fishing expeditions. Moreover, the sharing and redistribution of catches, in particular with elders, is reported to eb integral to the fundamental traditional values of sharing and mutual aid that characterize Innu society (PR3.6, pp. 39-94 and 39-95).

The work and development carried out at the Romaine-1 generating station would have a significant impact on the practice of *Innu Aitun* on the Grande Chute fishing ground, which has great social and cultural significance, in particular for its historical and heritage character (PR5.1, p. 323). The structures planned by the proponent to preserve salmon in this stretch of the river could help maintain fishing there. Adaptations of fishing practices could also be necessary at Chutes à Charlie, a site that is frequently and successfully used for fishing. During project operation, the salmon would stay a shorter time and migrate upstream more quickly. The Innu could be obliged to use the stretch between Chutes à Charlie and Grande Chute more intensively (PR3.6, p. 39-119).

- ***Opinion*** *— The panel considers that the follow-up committees to be established under the upcoming agreement on repercussions and benefits between the proponent and the Ekuanitshit community should include information and*

awareness mechanisms for Innu fishers relating to construction schedules, the progress of work and the water management regime..

As previously discussed, the proponent judges that increased awareness and vigilance could prevent overuse in the stretches where there would be excessive salmon concentration during the impoundment of the Romaine-2 reservoir.

- ***Opinion*** *— The panel considers that the Ekuanitshit Band Council, which manages and supervises the salmon fishing activities of its community members, should take part, together with the Quebec Department of Natural Resources and Wildlife, in the public awareness campaign carried out by the proponent.*

Innu fishers are reported to apply the fishing regulations themselves, as the band council is unable to appoint Innu wardens or monitor catches, as is done on the Mingan and Manitou rivers (ibid., p. 39-86).

- ***Opinion*** *— The panel considers that the proponent should, in the upcoming agreement on repercussions and benefits, take measures to encourage the control and monitoring of the salmon catch on the Romaine River.*

The project could also modify the practice of *Innu Aitun* in the Romaine-4 reservoir area. This area would be altered through the flooding of campsites, eight of which have been used within the last 10 years and some of which have heritage value, of riverside stops used as hunting areas, and of several areas where beaver, river otter, American marten, small game, lake trout and brook trout are taken. The presence of the reservoir would also transform the Romaine River, which is easily navigable, into a large body of water where the wind could hinder traffic (ibid., p. 39-116).

Since this area has a higher moose density than the rest of the territory, new non-Aboriginal users could take advantage of the presence of the access road to come and hunt in the autumn, the very time when the Innu are most intensively practising *Innu Aitun*. The impact study does however note that the Innu tend to avoid areas where non-Aboriginals hunt moose (ibid., p. 44-28).

Availability of fish and wildlife resources

Maintenance of the practice of *Innu Aitun* also depends on the availability of fish and wildlife resources: if game flees upon project implementation, “[Translation] *Innu Aitun* too will eventually follow it into oblivion” (Innu of Ekuanitshit [elders, children, young people, men and women], DM77, p. 2). The Innu fear that the presence of the workers and, possibly, new users put pressure on resources and reduce their availability (PR3.6, p. 44-28; DM45, p. 6; DC8, p. 4).

Rather than propose *a priori* restrictions on resource use, the proponent is relying on the workers’ placing only minimal pressure on the availability of fish

and wildlife resources. In particular, fishing by workers should not interfere with the practice of *Innu Aitun* because it is expected to be concentrated in certain lakes to be stocked with fish near the work camps and along the access road.

Cultural heritage

Archaeological heritage

A little more than 300 zones with archaeological potential that could be affected by the project have been listed. Of these, 75 have been inventoried, and the inventories have turned up many archaeological artefacts, most of which date from the contemporary period (after 1950). According to the proponent, erosion of the banks of the Romaine River has probably erased much evidence of past human occupancy. On the other hand, in the Romaine-4 reservoir area, the great number of sites and artefacts listed (campsites and campfires, for example) suggests that the territory has been regularly occupied for at least 4,000 years (PR3.6, p. 45-5).

In addition to the zones already listed, the proponent is waiting until the optimization process for the routing of the acess road is finalized before adding to the inventory of archaeological potential (PR5.1, p. 327).

In all, 23 sites would be destroyed by the work. These would be more thoroughly excavated before work begins. The information collected would make it possible to better document the early 20th century, when trapping of fur-bearing animals was a significant activity on the North Shore (PR3.6, p. 45-8).

Fortuitous archaeological discoveries may be made during the work. In that event, work would be stopped pending more thorough analysis of the importance of the discovery and, if necessary, planning for fieldwork. Contractors' activities would be governed by a standard clause, to be set by the proponent, on technological and architectural heritage and archaeological remains (PR3.8, p. E-33). The Quebec Department of Culture, Communications and the Status of Women and Parks Canada have said that the measures proposed by the proponent meet their expectations (PR6, opinion 1; PR9.2, p. 59).

No Innu burial grounds have been found within the projected development area, either by the proponent during its archaeological inventories, by land users or, upon consultation, by the elders of the Ekuanitshit community (DA63). The agreements on repercussions and benefits call for the creation of an Innu heritage fund to enable studies and work to be undertaken related to Innu culture and to archaeology (DA25).

- *The panel is satisfied with the measures planned by the proponent to protect the archaeological heritage.*

Natural heritage

Many participants in the public hearing wish the project to enable development of the area's natural heritage, among the most prized elements of which, many believe, are the fluvial stretches of the Romaine River, in particular Fausse Chute and Rapide à Brillant near its mouth, Chute de l'Église (KP 16), Rapide à Ferdinand (KP 30.5), Chutes à Charlie (KP 35) and Grande Chute (KP 52.5) (PR8.7.1, pp. 15-7 and 15-8).

The project would eliminate the falls and rapids near the site, including Grande Chute, but the prized sites in the stretch of the river currently most used, i.e. between KPs 0 and 51.5, would stay as they are now (PR3.5, p. 36-13). The proponent is of the opinion that the reservoirs would themselves be scenic and could be enjoyed thanks to the access road (Benoit Gagnon, DT3, p. 76).

In addition to the Romaine River, the Mingan Archipelago National Park Reserve of Canada is a significant element of the natural heritage in the study area. Although the project is not expected to impair the integrity of the Reserve, Parks Canada spoke of the possible visual impact on the landscape and the visitor experience if one of the transmission lines of the Romaine River hydroelectric complex should be visible from Highway 138 or the islands of the archipelago (DB13, pp. 5–6). Though the panel had no mandate to examine the proposed power lines, it notes the Department's concern.

Infrastructure capacity relative to project

Transportation infrastructure

Minganie is connected to other parts of Quebec by Highway 138, which provides access to Havre-Saint-Pierre by Boulevard des Acadiens and Boulevard de l'Escale. Boulevard de l'Escale provides access to Havre-Saint-Pierre's port facilities. That harbour terminal is also connected to the QIT-Fer et Titane mine by a 42-km rail line.

Minganie is also served by the Havre-Saint-Pierre and Natashquan airports and some floatplane bases. Havre-Saint-Pierre is expected to be the jumping-off place for aircraft serving the project. In 2004, indeed, for the purposes of its draft project design studies, Hydro-Québec built a heliport at the Havre-Saint-Pierre airport (PR8.14.1.1, pp. 56–57).

Highway 138

Hydro-Québec intends to use Highway 138 to transport workers, materials and equipment to the jobsites (Benoit Gagnon, DT2, pp. 70 and 73). The highway is the Minganois' only road link and also the gateway for visitors.

According to data provided to Hydro-Québec by the Quebec Department of Transport, the average daily traffic flow in summer 2007 on Highway 138 at Sept-Îles was about 6,000 vehicles and varied from 630 to 930 vehicles between Sept-Îles and Havre-Saint-Pierre. East of the urban part of Havre-Saint-Pierre, as far as the intersection of the projected access road, traffic was 820 vehicles, and heavy vehicles accounted for about 15.7% on this stretch of highway, or 129 trucks (DQ9.1, p. 8). At the Tadoussac ferry crossing, traffic flow is about 3,000 vehicles a day (Marc Larin, DT3, p. 18).

Construction of the hydroelectric complex, including power transmission lines and substations, would lead to a gradual increase in traffic proportional to the jobsite workforce as well as the equipment and volumes of materials and wood to be transported. Hydro-Québec estimates that the average traffic increase would peak at 558 vehicles a day, including 77 trucks, during the summer. The biggest increase would be on Fridays in June 2013, with additional traffic of 1,015 vehicles, including 119 heavy trucks. In winter, the maximum additional traffic flow would be 345 vehicles a day, including 47 trucks. This estimate of the number of additional trips during construction is based on data for the Sainte-Marguerite-3 hydroelectric site. It corresponds to 9.1 trips per worker, per month, and includes goods transport (DQ9.1, pp. 9–12).

Considering that on leaving the jobsites, almost all of the peak additional traffic would be headed for Sept-Îles, traffic flow on the rural stretches of Highway 138 from Sept-Îles to Havre-Saint-Pierre, now considered excellent, would fall from service level A to level D and could even reach level E[28] should more than 90% of the additional flow occur at Friday rush hour. However, Hydro-Québec anticipates that, even if vehicule platooning occur, traffic conditions on Highway 138 would remain acceptable, the capacity of the highway would remain adequate and the average traffic speed would be little changed (PR8.15.1, p. 11).

Peak traffic flow on Fridays could be less than anticipated given that many jobsite workers may not leave each week or may leave another day than Friday because of their work schedule (DQ9.1, pp. 9–10). To decrease traffic on Highway 138, the proponent would encourage carpooling and organize bus transportation for its employees. However, it does not plan to offer a collective transportation service for other workers (PR5.1, p. 303; Benoit Gagnon, DT3, p. 24). It should be noted that the provision of a shuttle during the construction of the Péribonka generating station had, unlike at the Sainte-Marguerite-3

[28] Service level is rated A to F. Level A indicates free-flowing traffic. Levels B and C indicate satisfactory traffic conditions. Level D represents a high-density traffic flow wherein there are significant restrictions on speed and freedom to manoeuvre. Level E is equivalent to the road's theoretical maximum capacity. Finally, level F corresponds to a state of congestion where demand exceeds road capacity (Ministère des Transports (2008). *Tome 1 – Normes de conception routière*, up to date as of October 30, 2008, chapter 3, pp. 5–6).

hydroelectric site, reduced traffic to five trips per worker, per month, and that based on this ratio, the maximum increase in traffic volume for the current project would be 558 vehicles a day rather than 1,015 (DA14, p. 9; DQ9.1, p. 9).

In addition, during operation of the hydroelectric complex, the proponent estimates there would be an increase of some 20 vehicles a day, with a maximum of 40, including a dozen trucks in summer, so that the Highway 138 service level would return to its current level (DQ9.1, pp. 10–12). The service level would also be satisfactory for the majority of trips to the intersection of Highway 138 and the access road to the generating stations during rush hour[29] (PR3.5, p. 37-19). We should note that a left-turn lane (on the eastbound side) is to be added at this intersection because of the volume of turns at peak hours and the probability of vehicule platooning.. The new lane was taken into account in the traffic flow analysis (PR8.15.1, p. 12; DB8, p. 4; Catherine Brouillard, DT7, p. 21).

- ***Opinion*** *— The panel welcomes Hydro-Québec's intention to encourage carpooling and to organize collective transportation for its employees. It holds, however, that the provision of a shuttle service for all workers, together with the announcement of incentives for its use, would help further reduce traffic volume on Highway 138 and enhance traffic flow.*

Havre-Saint-Pierre harbour infrastructure

To reduce heavy truck traffic on Highway 138 during the project, the Quebec Department of Transport and Transport Canada favour water transport between the major centres and Havre-Saint-Pierre (PR6, opinion 9; PR9.1, p. 264). An increase in trucking would likely reduce traffic flow and involve increased damage to the roadway. It should be noted that a single heavy vehicle generally causes as much road deterioration as 40,000 cars, or even 85,000 cars in certain cases.

For goods transshipment, Quebec has 21 strategic commercial ports, those of Sept-Îles, Port-Cartier, Baie-Comeau and Matane being considered "national commercial ports," while the port of Havre-Saint-Pierre is considered a "local port."[30] Regional and national companies also offer shipping and intermodal logistics services (Porlier Express Inc., DM2; Entreprise Simco, DM7; Express Havre-Saint-Pierre, DM20, p. 1). We might point out, among other things, that the rail ferry *Georges-Alexandre-Lebel* plies between Matane and Baie-Comeau

[29] An intersection's service level is defined in terms of the time required (seconds/vehicle) to cross it, depending on the direction of motion (PR8.15.1, p. 12).

[30] Forum de concertation sur le transport maritime (2003). *Rapport sur le réseau portuaire stratégique*, January , pp. 17 and 23.

and has, since 2008, connected the port of Sept-Îles to the south shore of the St. Lawrence River.[31]

The deep water port of Havre-Saint-Pierre has two berths: the commercial wharf used by commercial fishers, private coasting vessels and Relais Nordik, which does weekly runs between Rimouski and Havre-Saint-Pierre, then between Havre-Saint-Pierre and Blanc-Sablon, and the QIT-Fer et Titane wharf, which has an industrial role. A boat ramp and the Havre-Saint-Pierre marina are adjacent to these wharves, as well as Parks Canada facilities and those of seagoing vessels offering excursions to the islands of the Mingan Archipelago.

According to Hydro-Québec, use of the commercial wharf at Havre-Saint-Pierre, which is accessible from Highway 138 by way of Boulevard de l'Escale, could generate harmful effects for the part of town it crosses, as well as a conflict with tourist activities; besides which the pavement of this boulevard, between the port and Rue de la Digue, is unsuited to heavy traffic (PR9.2, pp. 83–84). Moreover, use of the harbour infrastructure would generate additional heavy truck traffic on Boulevard de l'Escale and in the port area, which is already congested in tourist season (PR8.17.1.1, pp. 73 and 91). Projects in the harbour area are also being discussed regionally, including the plan for a sea link between Havre-Saint-Pierre, Port-Menier on Anticosti Island and Grande-Vallée in the Gaspé, which could help increase the number of visitors to Minganie (PR3.5, p. 30-7; PR3.7, p. 48-65).

The QIT-Fer et Titane wharf could possibly be used for transshipment of outsize equipment. A 2.5-km gravel road, on land to which access is controlled by QIT-Fer et Titane, connects the wharf to Highway 138. Moreover, a beach west of the wharf could be used for unloading materials and heavy machinery. An agreement with QIT-Fer et Titane on the use of the site would, however, be necessary (PR3.5, pp. 37-20 and 37-21; PR8.17.1.1, pp. 74 and 75).

Hydro-Québec noted that the choice of means of transport would be the contractors' and suppliers' responsibility and that several factors influence this choice, including the volume of goods transported, the distance to be travelled and the transshipment and storage infrastructure available between origin and destination. Water transport would be preferable for long distances or large volumes. Conversely, the project's delivery policies and implementation conditions, oriented towards the "just-in-time" principle, would be an incentive for contractors to use road transport (PR9.2, pp. 82–84; Benoit Gagnon, DT2, pp. 70 and 73).

[31] Steeve Paradise. "Le port de Sept-Îles très actif en 2008," *Le Soleil* (accessed on January 17, 2009: <www.cyberpresse.ca/le-soleil/actualites/les-regions/200901/16/01-818403-le-port-de-sept-iles-tres-actif-en-2008.php>).

Furthermore, because local people are concerned that the merchantable timber recovered from the reservoir sites be sent to processing plants in Minganie, road haulage would be required. About 30% of the truckloads are expected to come from deforestation activities (Catherine Brouillard, DT2, p. 80). Note that the choice of destination is for the Quebec Department of Natural Resources and Wildlife to make and is not yet known.

Nonetheless, the Conférence régionale des élus de la Côte-Nord maintains that Hydro-Québec must place greater emphasis on water transport (DM51, p. 30), whereas the Quebec Department of Transport is calling for "[Translation] a more formal commitment" thereto by Hydro-Québec (PR6, opinion 9, p. 3). Moreover, the Corporation de développement et de gestion du port de Havre-Saint-Pierre and the MNA for Duplessis consider that Hydro-Québec would do well to consider the use of the harbour facilities of Havre-Saint-Pierre (DM98, p. 3; Lorraine Richard, DT14, pp. 5–6). The political and economic stakeholders of Sept-Îles propose that a working committee be struck to facilitate transport on this "[Translation] blue highway" (DM69, p. 13).

In addition, in 2001, the Government of Quebec set out a Marine Transportation Policy, one of the goals of which is to increase use of the St. Lawrence for transportation and trade by supporting the use of cabotage to complement other means of transport (Quebec [Province], 2001, p. 36). Let us note that shipping is the most energy-efficient mode of transportation. On one litre of fuel, a ship could move a tonne of goods 200 km, compared with 80 km for a train and 25 km for a truck. Moreover, GHG emissions from seagoing transport are less than 10 g per tonne-kilometre, compared to 100 g for road transport.[32] Thus, there is potentially both an environmental and a financial benefit, not to mention the reduction of traffic on Highway 138.

- *The panel notes that the port of Havre-Saint-Pierre, because it is near the area of operations, gives contractors and suppliers the option of shipping supply materials in bulk and outsize equipment to the jobsites.*

- ***Opinion** — To reduce truck traffic and support energy efficiency, the panel considers that Hydro-Québec should encourage its contractors to use shipping, to the extent that this does not unduly aggravate harmful effects in the municipality of Havre-Saint-Pierre.*

Utility infrastructure

The municipalities located near the area of operations would have to accommodate from 60 to 394 workers for the work period from July 2009 to February 2010. These workers would be assigned to the preparatory work

[32] St. Lawrence Economic Development Council (SODES). *Navires sur le Saint-Laurent* (accessed in February 2009: <www.lesaint-laurent.com/pages/naviresdemarchandises.asp>).

necessary for the construction of the Romaine-2 generating station as well as part of the power lines (DA62, p. 1).

Workers or persons occupying indirect jobs related to the project could choose to take up residence in Minganie, and particularly in Havre-Saint-Pierre. Hydro-Québec estimates that for the construction period, from 2009 to 2014, some 100 new housing units would be needed in Havre-Saint-Pierre, or an increase of about 8.3% in the current building inventory[33] (DQ15.1, pp. 1–2). It is expected that the construction of new dwellings would be limited after 2014, as long-term jobs will have been filled. In addition, the workers' departure at the end of the construction of the complex in 2020 would free up between 3 and 28 dwelling units in Minganie, including 3 to 23 in Havre-Saint-Pierre, and the number of workers assigned to project operation would not be sufficient to fill all these units (PR3.5, pp. 31-19 and 31-30).

The construction of new dwellings would require the municipality of Havre-Saint-Pierre to undertake water supply, sewer and road works as well as upgrade existing infrastructure (ibid., p. 37-9; DQ13.1, p. 24). The Remedial Measures Fund for local municipalities created under the agreement between Hydro-Québec and the Minganie RCM would be used to establish the requisite infrastructure (PR5.1, p. 231; DA38, p. 1; Pierre Cormier, DT6, pp. 12–13).

- *The panel notes that construction of the hydroelectric complex would involve housing requirements that would necessitate new and improved utility services in the municipality of Havre-Saint-Pierre and other municipalities of Minganie as appropriate. The Remedial Measures Fund for local municipalities created under the agreement between Hydro-Québec and the Minganie RCM would be used to partially offset the cost of this work.*

Harmful effects of the work

People could suffer harmful effects because of project-related activities and road traffic. The proponent would deal with complaints about noise and dust caused by its activities and would take the necessary readings. It would take action as required (PR9.2, p. 58; Benoît Gagnon, DT3, pp. 24–25). Moreover, Hydro-Québec, through its community follow-up committee, would periodically inform the local population of the progress of the work and the busiest times and areas (Benoit Gagnon, DT4, p. 87 and DT7, p. 46).

Road noise

Readings and simulations of noise levels have been done by Hydro-Québec on Highway 138 at Rivière-au-Tonnerre and Ekuanitshit and east of Havre-Saint-

[33] According to Hydro-Québec, the housing requirements for the construction period, 2009 to 2012, would be 62 to 105 new units for all of Minganie, including 56 to 94 in Havre-Saint-Pierre. In 2013 and 2014, 3 to 6 units would be necessary in Minganie, including 3 to 5 in Havre-Saint-Pierre (PR3.5, p. 31-19).

Pierre. In the summer of 2011, 2013 and 2015, the increase in road traffic on these three sections as a result of the project would cause an increase in noise in the order of 1 to 4 dBA[34] averaged over 24 hours. Thus, the calculated daily noise levels, which were from 44 to 60 dBA in 2007, would reach between 46 and 62 dBA, the highest noise level being east of Havre-Saint-Pierre, 15 m from Highway 138 (PR8.19.1, p. 14).

This estimate is based mainly on traffic volume, the percentage of heavy trucks and the vehicles' speed corresponding to a limit of 90 km/h in the country and 50 km/h in built-up areas—which residents say are never obeyed (Ilya Klvana, DT3, p. 14; Sylvie Angel, DM82, p. 6; A group of Mingan residents, DM93, pp. 3–4; A group of residents of the village of Magpie, DM103, pp. 2–3). The Quebec Department of Sustainable Development, Environment and Parks has, for its part, indicated at the public hearing that use of a higher speed than was assumed for the noise simulations would require noise readings during the work to validate the results obtained (Mireille Paul, DT6, p. 6).

Moreover, to estimate the level of disturbance and the sound pressure, Hydro-Québec used the corrective approach recommended by the Quebec Department of Transport in its noise policy, the *Politique sur le bruit routier,* enacted in March 1998, which is now under review.[35] This approach is aimed at providing noise abatement measures in sensitive areas of existing roads where the average noise level is equal to or greater than 65 dBA over a 24-hour period (Quebec [Province], 1998, pp. 3–4). Thus, Hydro-Québec does not plan any abatement measures, since the noise levels found in the simulations of the projected situation were less than 65 dBA (PR8.19.1, p. 18).

According to the World Health Organization, to avoid serious disturbance during the day and evening, the noise level must be limited to 55 dBA.[36] A maximum noise level of 45 dBA is also recommended at night to allow sleep, and peak noise levels should not exceed 60 dBA during this period. These guideline values will be used by the Quebec Department of Sustainable Development, Environment and Parks in the environmental analysis of the project (Mireille Paul, DT3, p. 13). Moreover, Health Canada "[Translation] pays close attention to the sound climate during the night, taking into account the potential for sleep disturbance" (DB17, p. 8).

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[34] The A-weighted decibel (dB(A)) is the unit in a system for measuring sound energy on a logarithmic curve designed to represent the human ear's response to sound, emphasizing the more readily detected high frequencies.

[35] Quebec (Province), 2007. *Révision de la Politique sur le bruit routier – État de situation*, a paper presented to the Bureau d'audiences publiques sur l'environnement with reference to the proposed widening of Highway 131 between Notre-Dame-des-Prairies and Saint-Félix-de-Valois and a bypass at Saint-Félix-de-Valois, document DA2.1, May, 2 p.

[36] World Health Organization. *Guidelines for Community Noise* (accessed in February 2009: <http://www.who.int/docstore/peh/noise/guidelines2.html>).

To limit outdoor noise in built-up areas affected by the project, the guideline values suggested by the World Health Organization for the various times of day should be used in the analysis. An increase in noise in a calm environment is likely to be more noticeable in that it disrupts the existing quiet. We should note that when a heavy truck drives by the noise level can reach 90 dBA, the equivalent of 20 cars (Quebec [Province], 2000, pp. 9 and 11).

- ***Opinion*** *— To reduce road noise, the panel considers that Hydro-Québec must take measures to reduce night-time truck traffic to and from jobsites. Hydro-Québec should also actively monitor noise.*

Noise from jobsites

Noise from jobsites and from traffic would discommode the residents of about 10 cottages and 2 rough shelters located near the Romaine-1 generating station, less than 3 km from the projected access road (PR3.5, pp. 35-16 and 35-33). Similarly, overflight of the territory by helicopters has been a source of disturbance for some during the draft project design studies that could continue during the work period (Denis Boudreau, DT7, pp. 43 and 45; Simon d'Hauterive, DM99.1).

According to Hydro-Québec, the noise generated by trucks and jobsite activities would average 92 dBA and would quickly decrease with distance. Reduction of the noise at source is the preferred means of offsetting its effects. Thus, contractors would be required to perform regular maintenance on equipment that may generate significant amounts of noise (PR3.8, p. E-9; PR9.2, pp. 145 and 146). Hydro-Québec also indicated at the public hearing that helicopter traffic would be less during construction than during the draft project design studies (Benoit Gagnon, DT7, p. 46). In addition, dynamiting would be limited to the future reservoir sites and the right-of-way for the projected access road (Catherine Brouillard, DT4, pp. 83–84).

Contractors are required to abide by the Quebec *Regulation Respecting Pits and Quarries* [R.R.Q., c. Q-2, r. 2] with regards to hours of activity and noise levels near built-up areas. The Department of Sustainable Development, Environment and Parks also makes contractors aware of the wildlife disturbances when they request certificates of authorization under section 22 of the Quebec *Environment Quality Act* (PR3.8, p. E-10; Sylvain Bouliane, DT4, p. 88).

- *The panel notes that Hydro-Québec would be obliged to require suitable measures to ensure the contractors comply with the noise requirements of the Quebec* Regulation Respecting Pits and Quarries*.*

- ***Opinion*** *— Given that the use of helicopters during work would have the same harmful effects as road traffic, the panel considers that Hydro-Québec should to*

the extent possible, plan air corridors away from inhabited or heavily used places.

Air quality

Air contaminants would be emitted into the environment during construction, in particular respirable suspended particulates. Contractors would be required by the proponent to limit dust emissions and to damp down suspended particulates from traffic. Dust would be controlled primarily with water. Moreover, Hydro-Québec indicated that once paved, the access road should no longer produce significant amounts of dust (PR3.8, p. E-22; PR9.2, pp. 1–4 and 10).

Some pollutants emitted by road vehicles are harmful to health, including carbon monoxide, nitrogen oxides, volatile organic compounds including hydrocarbons, sulphur dioxide and, in particular for diesel vehicles, fine particulate matter, with a diameter equal to or less than 10 micrometres (PM_{10}), and those very fine with a diameter of less than 2.5 micrometres ($PM_{2.5}$). The latter can have a more marked effect on health, as they can reach the area of the lungs where gas exchange occurs and aggravate cases of bronchitis or cardiovascular diseases and impair respiratory function. PM_{10}, and more particularly $PM_{2.5}$, are considered toxic substances by Environment Canada and Health Canada (Environment Canada and Health Canada, 2000, pp. 1–2).

- *The panel notes that control measures would be required of contractors by Hydro-Québec to minimize the emission of respirable suspended particulates by road vehicles during the construction phase.*

- ***Opinion** — The panel considers that, even if the general quality of the air was not significantly affected by the increase in road transport, the reduction of haulage on Highway 138 should be encouraged by Hydro-Québec to reduce the discharge of atmospheric pollutants, in particular the fine particulate matter recognized as a health concern.*

Opening of the territory and conflicting uses

The conceptual distinction between Aboriginal and non-Aboriginal people with respect to use of the land and its resources seems quite significant, and absolutely must be taken into account to minimize conflicts between the two groups:

> [Translation] For the Innu, land is an essential component of their culture. Whereas non-Aboriginals can easily conceive of a territory belonging to a person or group, the Innu concept of land instead implies stewardship. (PR3.6, p. 39-47)

The proponent summarizes in the following terms the impacts of the construction of its access road:

> [Translation] Given its quality and length (more than 150 km), the Romaine road will have a notable impact on the opening of the territory and its multi-purpose use. This situation should, in the medium and long term, influence regional planning and development, within the framework of the orientations set by managers and other community stakeholders.
> (PR3.1, p. 13-6)

However, it agrees that the impacts would not be exclusively positive:

> [Translation] The Innu, as well as some vacationers, are very worried about the opening of the territory. They fear an influx of new users and increased pressure on wildlife resources.
> (Ibid., p. 3-10)

Current and future users may indeed be tempted to use the access road and to take advantage of new opportunities in the territory. Among these might be the Minganois, jobsite workers and outdoor enthusiasts captivated by the newly accessible territories and eager to harvest the new resources. Some will want to preserve their stillness to maintain the safety level, while others will put greater pressure on wildlife resources and still others will want to hasten the commercial development of these new territories. Wiithout any supervision, land use conflicts may be expected, particularly in the first years of construction (2011–2016), when it is estimated that more than 2,000 workers will be on site.

In addition to conflicts between the various user groups over land use, we should mention the possibility of conflicts between the Aboriginal and non-Aboriginal communities. Moreover, the access road would also make it possible for the Innu community of Nutashkuan to more easily use the lands of the Ekuanitshit community; in some ways this could seem advantageous, but it could also cause tension between the two communities.

Nevertheless, the proponent made the point that:

> [Translation] […] the project's impact on land use for the duration of complex operations will actually be positive and of average intensity, [that] the change in land users' practices and the development of competing land uses will be offset by the intensification of the practice of *Innu Aitun*, which the road will facilitate.
>
> The improvement in the practice of *Innu Aitun* made possible by the road will also be reinforced by measures now under discussion as part of the negotiations […] to reach an agreement on repercussions and benefits.
> (PR5.1, p. 384)

- ***Opinion*** *— The panel considers that the Quebec Department of Natural Resources and Wildlife must support a mechanism for dialogue between Aboriginal and non-Aboriginal people and a mechanism to settle any land use conflicts.*

Another potential element of discord is land use by the various non-Aboriginal groups. Many residents have sought quiet and isolation by making use of the territory along the Romaine River. The access road wouls bring with it a number of advantages, particularly as regards to ease of travel, but it would change certain practices. These users might have to share and make compromises with a greater number of users having different and even opposing interests. This situation would be of greater concern for the construction period, when residents and workers would have to live side by side and share the territory.

- *The panel notes that the risk of conflicts between users is significant in the context of work on the Romaine River, where for a few years more than 2,000 workers would occupy the territory.*

- ***Opinion** — To minimize the risk of conflicting uses during the construction period, the panel considers that the proponent should ensure constant, effective communication with Minganois and Innu alike.*

Apprehended disadvantages

It should be recalled that a number of participants in the public hearing, mainly those from Minganie, were worried about the possible drawbacks or inconveniences of project implementation in terms of the natural and human environments.

The back country access afforded by the access road to the generating stations of the hydroelectric complex could provide development opportunities, which are favourably viewed by many, and the panel does not want to discount their expected socio-economic benefits. These opportunities could nevertheless involve cumulative effects on the biophysical environment and greater impacts or disadvantages for users. The apprehensions expressed are legitimate and fully relevant to the social issues surrounding the project.

The proponent is proposing valuable measures in many cases. Of course, these measures, like the community follow-up committees, the hiring of resource persons and other forms of worker support, must be backed up with the necessary resources and their effectiveness re-evaluated periodically, to be able to make any adjustments required. They must support information dissemination, contact with and listening to people concerned about the project's effects on their practices, activities, quality of life or work, and must lead to the establishment of equitable solutions.

- ***Opinion** — The panel considers it essential for the proponent to provide information on the various stages of the project, as well as a consultation and feedback mechanism for the interested parties, in order that the social impacts during construction may be monitored and minimized, taking into account the*

scale of the project, the length of time the hydroelectric complex would be operating and the diversity of the territory and the natural environments affected.

Chapter 5 Socio-Economic Impact

According to Hydro-Québec, the project is expected to generate significant economic spinoffs for Quebec as a whole and for the Middle North Shore in particular.

In this chapter, the panel will examine the key socio-economic aspects of the project, starting with an overview of the region from an economic and social perspective, and followed by an analysis of the expected economic spinoffs of the project and the impact on employment. The panel will also examine the project's impact on commercial fishing and fishery resources and, finally, will look at the social issues associated with the development project.

For the purposes of this chapter, the panel has applied two principles of the Quebec *Sustainable Development Act*. The first of these is economic efficiency, which is defined in the Act as follows: "The economy of Québec and its regions must be effective, geared toward innovation and economic prosperity that is conducive to social progress and respectful of the environment."

In terms of social issues, the panel has applied the principle of social equity and solidarity, which is defined as follows: "Development must be undertaken in a spirit of intra- and inter-generational equity and social ethics and solidarity."

Socio-economic profile of the region

The project would take place in the Minganie RCM (regional county municipality), which is bordered to the west by the Sept-Rivières RCM and to the east by the Lower North Shore. The Minganie RCM comprises eight municipalities: Rivière-au-Tonnerre, Rivière-Saint-Jean, Longue-Pointe-de-Mingan, Havre-Saint-Pierre, Baie-Johan-Beetz, Aguanish, Natashquan and L'Île-d'Anticosti. Of the five Innu communities on the Middle and Lower North Shore, two—Ekuanitshit and Nutashkuan—are located in the Minganie RCM.

In 2006, the population of the Côte-Nord administrative region was 95,948, down 8.4% from a decade earlier. The Minganie RCM recorded a population of 6,390 inhabitants, a drop of 7.9% over the same period. The population of the two Innu communities in the Minganie RCM, however, grew by approximately 14% during that period. According to demographic forecasts, by 2016, the population of the Côte-Nord region as a whole is expected to shrink by 15.5%, and that of the Minganie RCM by 12.4% to 6,076. This situation highlights the exodus of young people to urban centres. With 3,150 inhabitants, the municipality of Havre-Saint-Pierre is considered to be the major centre in the region. It is where the main

government services are located, including the Minganie Centre de santé et de services sociaux [health and social services centre], which is supported by nine clinics throughout the RCM.

The industrial structure of the Côte-Nord administrative region is based primarily on natural resources: mining, forestry, fishing and hydroelectricity. In Minganie, 300 people work for the QIT-Fer et Titane mining company, which is the main employer. Tourism has developed considerably since the creation of the Mingan Archipelago National Park Reserve of Canada, which attracts 30,000 visitors a year. In addition, over half of the Côte-Nord's total fishery product landings, both in terms of value ($4.6 million in 2003) and volume (1,200 tonnes), occur in Minganie. The primary sector accounts for 17.7% of jobs in the Minganie RCM, and the secondary sector, 19.5%. The service sector is most prevalent in Havre-Saint-Pierre.

In 2006, the unemployment rate in Minganie was 26%, 3.5 times higher than in the Sept-Îles region (7.5%) or in Quebec as a whole (6.7%). In the Innu communities, however, the rates were even higher: 34.4% in Ekuanitshit in 2001, and 28.9% in Nutashkuan (DQ9.1, p. 23). Although the Côte-Nord administrative region recorded a total of 2,700 construction workers in 2006 (an important indicator of the region's economic health), the number of hours worked was down 65% from 2004.

In short, the economic situation is precarious: "[Translation] For over 20 years, Minganie has been facing serious socio-economic challenges. It is now counting on a build-up of momentum in the region in order to restructure its economy and counter the decline in its population" (Côte-Nord Community Futures Development Corporation, DM24, p. 8).

Economic spinoffs and jobs

Economic spinoffs and jobs were among the key issues raised by participants at the public hearings. For example, the Conférence régionale des élus de la Côte-Nord summarized its interest in the project as follows: "[Translation] The construction of the complex, its operation, and the financial compensation for local communities and businesses that support the project will have a significant impact on the development of the North Shore, and the Minganie in particular" (DM51, p. 33).

The proponent has evaluated the economic spinoffs of the project using the intersectoral model of the Quebec economy, an analysis tool developed by the Institut de la statistique du Québec (PR3.9, p. M20-3). This model "[Translation] evaluates the direct and indirect effects on the workforce, salaries, value added,

and tax and quasi-tax revenue attributable to the various levels of government" (Institut de la statistique du Québec, 2004, p. 1).

According to the proponent, construction spending is forecast to reach approximately $4.9 billion, out of a total cost of $6.5 billion (PR3.5, p. 31-12). Of this amount, approximately $3.5 billion would be spent in Quebec, including $1.3 billion in the Côte-Nord region. The proponent believes that these spinoffs would create new jobs and business opportunities, and would lead to the development of local expertise and businesses (DA7, pp. 70–71). In comparison, the Quebec Department of Economic Development, Innovation and Exports estimated total private- and public-sector investment intentions for 2008 in the Côte-Nord region at $1.1 billion.[37]

Construction spending would generate $822 million in tax revenue for the governments of Quebec and Canada. In addition, Hydro-Québec would contribute to Quebec's Generations Fund, based on the quantity of electricity produced. According to the proponent's calculations, the project, if it goes ahead, would result in a total of $489 million in contributions to this fund between 2014 and 2030 (PR3.1, p. 2-19).

During the construction phase, which is scheduled to run from 2009 to 2020, the project would the potential to create or maintain 18,533 person-years[38] of direct employment and 14,877 person-years of indirect employment, for a total of 33,410 person-years. More specifically, the direct jobs would include 11,224 person-years of site-related jobs and 7,309 person-years of engineering jobs and other off-site activities. An average of 975 jobs would be maintained annually during the construction phase (Benoît Gagnon, DT1, p. 25). The peak work period would be between 2011 and 2016, at which time between 1,600 and 2,400 employees would be expected to be working on the jobsites. Based on its experience,[39] the proponent is forecasting a 60% participation rate among Côte-Nord workers. Between 100 and 110 direct jobs would subsequently be created for the operation of the generating stations.

37. Web site: <www.mdeie.gouv.qc.ca/index.php?id=2637> [accessed on December 18, 2008].

38 The concept of person-year represents the total number of full-time jobs during a given year. For example, 10,000 person-years correspond to 1,000 jobs over 10 years.

39 Estimate based on the results of the Sainte-Marguerite-3 and Toulnustouc hydroelectric projects, as well as on forecasts for the Péribonka River and Chute-Allard / Rapides-des-Cœurs development projects.

Agreements pertaining to the project's impact and benefits

Hydro-Québec has signed confidential agreements with the host communities, the main points of which were released during the public hearings. For the proponent, the objective of these agreements was to establish a framework for co-operation with the communities, reconcile individual interests, foster the integration of the project within the community and address concerns that had been expressed (DA25, p. 4).

The Minganie RCM signed an agreement with the proponent in January 2008. At the time of the public hearings, the RCM had already received $13 million. Of this sum, $1 million covered the cost of negotiating the agreement and $6 million was set aside for a government approvals fund, the purpose of which was to

> [Translation] […] support the Minganie RCM in its activities aimed at assisting Hydro-Québec in obtaining the government permits and approvals required for the Romaine project, as well as for its activities aimed at promoting the Romaine project and fostering acceptance in the host community (DA38, p. 1).

An additional $6 million was earmarked for a project integration fund to be used to "[Translation] set up programs and initiatives aimed at fostering the social acceptance and integration of the Romaine project within the host community" (ibid.). Should the project go ahead, the RCM would also benefit from a $15-million remedial works fund,[40] to be paid out over the four-year period following the start of the construction work, as well as a $71-million regional development fund, the first payment of which would be made when the Romaine-2 generating station becomes operational in 2014, followed by payments over a period of 50 years.

In July 2008, the proponent signed the Nanemessu-Nutashkuan agreement, worth $43 million, with the Nutashkuan Innu community. This agreement would be in effect from 2008 until 2070. In October 2008, Hydro-Québec announced the signing of the Unamen-Pakua agreement, worth a total of $14.5 million, with the communities of Pakua Shipi and Unamen Shipu. It, too, would cover the period from 2008 to 2070. The Ekuanitshit Innu Council reached an agreement in principle with the proponent in October 2008. This agreement is seen as a step toward the drafting of a proposed agreement that would be presented to the community for approval in a referendum (DM74, p. 16).

[40]. All sums to be paid out after 2009 would be indexed at an identical rate. The discount rate would vary according to the terms and conditions established for each agreement (DA40).

Maximizing economic spinoffs

At the public hearings, North Shore socio-economic stakeholders repeatedly indicated that their goal is to obtain maximum economic spinoffs for their region. Hydro-Québec plans to introduce various measures aimed at optimizing the economic benefits of the project for the local and regional economies during the construction period. A committee, made up of representatives of regional economic organizations and Innu communities, would be set up to monitor calls for tender and the project's economic spinoffs. In addition, a resource person would be hired to facilitate relations between the local business community and companies outside the region (PR3.5, pp. 31-16 and 31-17).

Hydro-Québec has included subcontracting clauses in its contracts aimed at encouraging contractors to do business with North Shore goods and service suppliers. When submitting bids, contractors would be given a virtual discount if they agree to subcontract locally. To avoid limiting contractors in their ability to carry out their work, and to keep costs at a reasonable level, this credit would be limited to a maximum of 20% of the total amount of the bid. The credit would be calculated based on an assessment by the proponent of the volume of business that can be carried out in the region, and would be limited to a maximum of 40% of the amount of the subcontracts that the contractor agrees to give to regional enterprises. The proponent's previous experience has demonstrated that these clauses allow small regional companies to establish business relationships with larger contractors. They also provide the regional companies with an opportunity to develop their businesses and subsequently participate in larger-scale tendering processes (DA66, pp. 1–2). Some of these companies have asked the proponent to expand this discount system.

Other companies have asked the proponent to divide up the contracts as much as possible in order to take into account the bidding capacity of local and regional businesses. According to the proponent, dividing up contracts could lead to increased costs, as well as a failure to meet deadlines, given the problems associated with coordinating several independent contractors on the same jobsite (ibid., p. 1). The proponent cited similar reasons regarding the regional subcontracting system. However, it has been decided that contracts worth less than $350,000 would be set aside for North Shore businesses, as long as there are enough of these businesses to ensure healthy competition (PR3.5, p. 31-17).

- ***Opinion*** *— The panel is satisfied with the measures that the proponent would implement to maximize economic benefits on the North Shore in the course of the Romaine River hydroelectric complex project.*

Economic benefits for Innu communities

Partnership agreements between Innu communities and the proponent include measures relating to the training of workers and the awarding of contracts by mutual agreement to Innu businesses. Two of the objectives of these agreements are to foster the social and economic development of these communities and to encourage them to participate in the project. The agreements provide for an economic and community development fund, the amount of which is not known (DA25, pp. 5–7).

Ekuanitshit

The Ekuanitshit Innu Council has signed an agreement in principle with the proponent, which includes terms and conditions relating to economic benefits such as jobs and business opportunities (Yves Bernier, DT8, p. 34). Under this agreement, contracts would be offered to the community, provided that the Innu businesses are able to perform the contracts at a competitive price and that they have the required skills (Alain Bourbeau, DT5, pp. 92–93).

The Ekuanitshit Innu Council set up the Société de gestion Ekuanitshinnuat Inc., which represents all businesses in which the community is involved. The corporation's mandate is to increase collective wealth and reinvest part of the profits back in the community, with priority being given to hiring local workers. The corporation's objectives, which focus on maximizing the project's economic benefits, are as follows:

> [Translation] Foster access to stable, well-paid employment that matches the skills and interests of members of the community; promote skills acquisition; encourage the emergence of new Innu businesses and strengthen existing businesses through subcontracting and the provision of goods and services; and generate revenue that can be used to improve community services (DM76, p. 4).

To this end, the corporation relies on partnerships with businesses that have the financial and technical means required for projects of the scope of the one in question, as well as on the development of private businesses by members of the Ekuanitshit community (ibid.). By its own admission, the corporation is facing major roadblocks in its efforts to obtain a share of the project's economic spinoffs. At the time of the public hearings, there was only one construction company in the community. Although other businesses could be set up if the project goes ahead, they would not be considered regional subcontractors because they would have been operational for less than a year. Hence, contractors who want to take advantage of the regional subcontracting clause would likely not use the services of these new businesses (Yves Bernier, DT8, pp. 36–39).

Nutashkuan

The Nutashkuan Band Council supports the project insofar is it provides "[Translation] an opportunity for our members to develop skills and expertise in various fields that will enable them to gradually integrate into the economic life of the Côte-Nord region" (DM45, p. 2). The Band Council is the community's main employer and is responsible for almost all of the community's economic activities. In 2007, there were only two private enterprises in the community—a general contractor and a computer service (PR3.6, p. 40-31). In the project, the Band Council is specifically targeting the harvesting and processing of forest resources, and hopes to obtain logging contracts for areas affected by the impoundment of reservoirs (ibid., p. 3).

The proponent estimates that approximately 754,500 m^3 of timber would be cut (PR3.5, p. 31-21). Its final destination would be determined by the Quebec Department of Natural Resources and Wildlife, with priority being given to local processing plants that are operational at the time the timber becomes available and that are interested in receiving the amount cut. The Department considers this timber as a supplementary supply. If there are no mills operating in Minganie that are interested in processing it, the timber would be offered to other mills on the North Shore (Donald Gingras, DT1, pp. 108–109; DT5, pp. 103–104). The Conférence régionale des élus de la Côte-Nord believes this timber could help revive forest activity in Minganie. Scierie GDS, a sawmill in Rivière-Saint-Jean and the only wood processing plant in the Minganie RCM, had been shut down for about five years. In September 2008, the mill is reported to have been acquired by the Innu of Nutashkuan (51%) and Rémabec (49%), who plan to reopen it (DM51, p. 37).

According to the Nutashkuan Montagnais Band Council, a review of previous Hydro-Québec projects shows that the awarding of contracts by mutual agreement to Innu businesses is the key to ensuring that workers from these communities are hired. Consequently, the Band Council is counting on the proponent to set aside contracts for the Innu of Nutashkuan, taking into account their ability to qualify for and carry out the contracts (François Bellefleur, DT10, p. 23). Moreover, the Band Council believes that the obtaining of contracts entered into by mutual agreement by Innu businesses depends on the ability of the proponent and of contractors and subcontractors to "[Translation] assist businesses in order to help them develop the skills needed to qualify for and carry out the contracts as the work progresses" (DM45, p. 4).

Unamen Shipu and Pakua Shipi

For the Unamen Shipu and Pakua Shipi Innu Councils, the joint agreement signed with the proponent provides opportunities in terms of training, employment and contracts (DM94, p. 6). The Unamen Shipu Band Council is

virtually the sole employer in this community, which has only two private businesses—a convenience store and a hardware store (PR3.6, p. 41-27). Furthermore, only 15 Innu from Pakua Shipi worked in the construction industry in 2001 (ibid, p. 42-10). The possibility that these communities would obtain contracts is therefore very slim.

- *The panel notes that there are few Innu-owned firms in the communities affected by the project that would benefit from business opportunities that arise from the project.*

- ***Opinion** — The panel is of the opinion that Innu communities would require technical support to help them start up businesses if they wish to obtain contracts related to the project.*

- ***Recommendation** — The panel recommends that the Quebec Department of Economic Development, Innovation and Exports, and Canada Economic Development for Quebec Regions support the start-up of Innu businesses and coach them so as to maximize the economic benefits of the project in the communities concerned.*

Employment and the training of Innu workers

Agreements between the proponent and the Innu communities provide for a fund to support training for project-related jobs (DA25, p. 7). The fund could be used to pay for apprenticeships or tuition fees to enable Innu to learn a trade (Benoît Gagnon, DT5, p. 96).

In 2001, 61.1% and 55.9%, respectively, of the members of the communities of Ekuanitshit and Nutashkuan between the ages of 20 and 34 did not have a high-school diploma (PR8.7.1, p. 7-12), compared with 24.4% of Quebecers in the 25–64 age group.[41] Thus, the training of Innu workers seems to be a determining factor in the participation of these communities in the project, given the growing job qualification requirements.

In order to encourage the hiring and integration of Innu workers, the proponent would appoint a coordinator for each community, as well as an Innu adviser who would be present at the jobsite. These individuals would work in co-operation with available resources in the communities with a view to informing Hydro-Québec about significant movements of Innu workers to the jobsite. Furthermore, monitoring over a period of several years would provide insight into the development of the Innu workforce (DQ9.1, p. 23). The proponent also plans to

41. Web site: <http://www12.statcan.ca/english/census01/Products/Analytic/companion/educ/qc.cfm> [accessed on February 2, 2009].

outline the type of labour that would be required and help interested individuals pursue a career path.

The public hearings revealed high expectations on the part of community representatives regarding training for Innu workers and the participation of these workers in the project. The Nutashkuan Montagnais Band Council noted that 50% of its population is under 25, and that these available workers want to receive training and become active members of the labour market (DM45, p. 5).

The Band Council hopes that the training will lead to actual employment opportunities, despite the new graduates' lack of experience. The Toulnustouc River hydroelectric project has shown that a vocational diploma does not provide a guarantee that Innu workers will find employment at jobsites. In the case of this project, a dozen or so Innu from Pessamit who had received training in the operation of heavy construction equipment prior to the start of the work were not hired because they lacked the necessary experience (PR3.6, p. 39-27). For this reason, the Band Council believes that it would be appropriate to develop work/study initiatives or to offer Innu workers work placement opportunities (François Bellefleur, DT10, p. 23).

The panel considers the proposal to offer Innu work placements in co-operation with educational institutions to be an interesting one. Hydro-Québec could offer such placements or could include clauses in its contracts requiring contractors to hire trainees. Given the relatively lengthy construction period, members of the communities would thus have an opportunity to develop their expertise. Of course, for these initiatives to be successful, the Innu must be involved in the project right from its early stages, and trainees must receive ongoing follow-up to ensure their integration into the jobsites.

- ***Opinion*** *— The panel is of the opinion that the proponent should offer Innu work placements in co-operation with North Shore educational institutions.*

Commercial fishing and fishery resources

The fishing industry accounts for a major share of economic activity in the Côte-Nord administrative region. In the early 2000s, the volume of landings in the region was almost 15,000 tonnes, representing close to 25% of total Quebec landings. The coastal region of the Middle North Shore accounted for nearly half of all Côte-Nord landings in 2003, both in terms of volume (5,300 tonnes, all species combined) and value ($17 million). Three of the four largest Middle North Shore ports of landing are located in Minganie, namely Havre-Saint-Pierre, Mingan and Natashquan.

In 2003, shellfish and crustaceans accounted for over 90% of landings at Middle North Shore ports, and just over 300 fishers and fisher helpers worked out of these ports. The main species landed were snow crab (42%), scallops (17%), whelk (17%) and Stimpson's surfclams (14%) [Figure 10] (Fisheries and Oceans Canada, 2004, p. 38).

The proponent's analysis of commercial fishing focused on two sectors: the Mingan Channel and the area around the mouth of the Romaine River. These two sectors cover fishing areas located within a 10-km radius of the Romaine River (PR3.5, p. 34-5).

In 2003, the Middle North Shore recorded 83 commercial fishing operations, accounting for almost one third of all Côte-Nord fishing operations. Of these, 38 primarily fished for crab, 24 for whelk, 7 for scallops, 4 for lobster, and the remaining 10 for other species. It should be noted that all of the 83 operations have access to the fishing areas at the mouth of the Romaine River but, for reasons of proximity, less than 25% of them fish in this sector.

Fishers consider the Mingan Channel to be a productive area in terms of catches; however, they especially like the area because of the shelter provided by its numerous islands when the winds are high. The main species fished are snow crab, rock crab, scallops, waved whelk, Stimpson's surfclams, softshell clams and sea urchins. Of these, it is primarily snow crab and scallops that have the highest commercial value.

Figure 10 Commercial fishing

Insert 8½″ × 11″ colour figure

According to the proponent and various resource persons, the project would not cause any significant changes to deep-sea temperature and salinity levels, nor to the sediments in the Mingan Channel. There would therefore be no significant impact on scallops or, for the same reasons, on snow crab (DB18, pp. 32–33).

- *The panel notes that the project would not result in significant changes to the resource biomass available for commercial fishing in the Mingan Channel.*

Species with commercial potential that can be found at the mouth of the river and in the surrounding areas include shellfish—softshell clams and whelk—and two types of fish—capelin and rainbow smelt. Despite the fact that these species only represent a small percentage of total landings in Minganie in terms of volume and value, for some fishers they provide a means of generating additional income, while for others they are an important part of Minganie recreational fishing activities.

As was previously noted, the proponent and Fisheries and Oceans Canada have diverging opinions regarding potential impacts on the area around the mouth of the river, particularly with regards to impacts on softshell clams, capelin and rainbow smelt.

- ***Recommendation*** *— The panel recommends that the project be monitored to the satisfaction of Fisheries and Oceans Canada to ensure the sustainability of fishery resources that are commercially harvested at the mouth of the Romaine River and that it be sent the results. If the fishery is impacted by the project, the proponent would have to propose financial compensation for the fishers affected.*

Social issues associated with the development project

The “social impact of a project” does not appear to be clearly defined, since this is an emerging concept in the area of environmental assessment for which, according to the Quebec Department of Sustainable Development, Environment and Parks, an analytical framework has yet to be developed (DQ6.1, p. 3). The Agence de la santé et des services sociaux de la Côte-Nord defines it as “[Translation] the social and cultural consequences for a population of public or private measures that change the way people live, work, play, relate to each other, organize their activities to respond to their needs and generally carry out their daily activities as members of a society” (DM38, p. 3).

A researcher at the Université de Montréal has proposed the following definition regarding the psychosocial impacts of a project: “[Translation] For an individual or a community, any changes, whether positive or negative, to their sense of being

in control and their feelings of trust and power caused by a project and by a combination of previous individual, social and community factors, that lead to a change in behaviour."[42] The Quebec Department of Sustainable Development, Environment and Parks agrees with this definition, and believes that a psychosocial impact can be considered as a reaction to a change (DQ6.1, p. 3).

New jobs in the communities

It must be remembered that the jobs created by the project would account for a significant proportion of available workers in the Minganie region, and would often require specific qualifications and skills. It is logical to assume that workers from the Minganie region would be interested in these jobs, as would specialized workers from elsewhere on the North Shore or other parts of Quebec. The proponent believes that people from the region who are currently unemployed would be most interested by the non-specialized trades available. Moreover, in comparison with the other Minganie communities, the four Innu communities mentioned in the environmental impact statement are notable for their relatively low employment rates and their lower average median income (PR3.5, pp. 31-15 and 31-10; DQ9.1, pp. 22–23).

One of the points brought up at the public hearings dealt with skills training for local workers who do not have any specific prior training with a view to ensuring that they have access to a maximum number of skilled jobs, rather than just unskilled jobs. More specifically, serious concerns were raised by the representatives of the Innu communities, including the Regroupement Mamit Innuat Inc., regarding support for Innu, both during the training period, especially for individuals who have to leave their communities, and on the jobsite, to ensure that they do not get discouraged as a result of the dramatic change in lifestyle. Support would also be needed for the workers' immediate family members who stay behind in the community. Additional concerns were raised about the destabilizing effect on family members of a sudden rise in family income, which could have negative unintended consequences.

The proponent intends to support activities aimed at creating an environment and a way of life that fosters and promotes Innu participation at the jobsites (DQ9.1, p. 23; PR3.6, p. 39-98). To this end, an interesting suggestion was made at the hearing. The participant in question proposed that an "Innu cultural centre" be set up at the jobsite, open to both Innu and other workers (Daniel Malec, DT10, p. 28). For its part, the proponent has proposed that the project-related employment situation be monitored, both in the Innu communities and in Minganie as a whole. The proponent has also indicated that it would offer support to workers experiencing problems, and would even go so far as to seek out such workers (PR3.7, pp. 47-18 to 47-23; PR5.1, pp. 306–307). Everything

[42] Presentation made on March 17, 2008, before the BAPE in Quebec City by Pierre André, Associate Professor of Human Environment at the Université de Montréal's department of geography.

possible should be done to support the new workers and encourage them to purse their career paths.

With regards to concerns about participants' fears that the project would result in a shortage of local workers, especially in the service sector and the fishing and tourism industries, the decision about whether or not to change jobs lies with the individuals concerned and amounts to a personal choice. There is no question, therefore, of putting local workers at a disadvantage when it comes to hiring for the construction phase of the project.

- ***Opinion*** *— The panel proposes that the monitoring planned by the proponent cover the impact of the jobs offered during the project on both local Aboriginal and non-Aboriginal communities. The concerns expressed that workers looking to improve their situation by transferring to the jobsites could result in a local labour shortage for small employers, such as those in the tourism and fishing industries, should be monitored. The social and psychological impact of a sudden increase in the standard of living of certain families should also be considered.*

- ***Opinion –*** *The panel is of the opinion that specific supervision is required by the proponent and the Agence de santé et des services sociaux de la Côte-Nord [North Shore health and social services agency] to carefully monitor and fully document the training of Innu workers and their integration at the jobsites of the proposed hydroelectric complex in order to maximize Innu participation in the project.*.

Fairness as concerns economic spinoffs

A number of the participants at the public hearings voiced concerns about the project's economic spinoffs. The majority of them were from local communities and stressed that, since they were the main users of the environment, they would also be the most affected by the project's negative aspects. In addition, many of them would have to change their habits as a result of the changes brought on by the project. They agreed that Quebec would benefit from the project's economic spinoffs without being subject to the drawbacks; however, they too wanted to see long-term benefits, notably through the participation or assistance funds provided for in the agreements pertaining to the project's impact and benefits. The Innu participants expressed a similar desire, albeit with certain qualifications. At the public hearings, they indicated that they considered themselves to be stakeholders and key players in development projects, both in Minganie and elsewhere on the North Shore.

Other participants, however, felt that these agreements and the associated funds have effectively muzzled the representatives of local communities, forcing them to defend the project and preventing them from criticizing it, and that this might

have prompted them to overlook certain undue environmental impacts caused by the project. Also, a number of participants were frustrated by the fact that these agreements were confidential at the time of the public hearings.

The panel does not intend to express an opinion on the relevance of agreements between the proponent and local communities, nor on the time at which they are negotiated and concluded, since it believes that these are issues that concern the parties to the agreements. With respect to the confidentiality of the agreements, the panel is of the opinion that transparency ensures a more enlightened debate, and generally prevents mistrust and innuendo, even though it may not necessarily lead to greater acceptance of a project. However, the panel recognizes that the confidentiality of the agreements was based on sound legal premises.[43] The panel also notes that the proponent indicated, during the public hearings, its intention to eventually make all of the agreements public, subject to the approval of the other parties involved (Alain Bourbeau, DT6, p. 79).

Finally, the panel wishes to point out that these agreements were not taken into consideration in the panel's investigation and analysis of the project's environmental impact. Consequently, their existence in no way affected the panel's opinions and recommendations aimed at avoiding, mitigating or offsetting the project's impact on natural and human environments.

Regional accommodation capacity

A few participants representing the tourism industry at the public hearings voiced their concerns about the potential difficulty for tourists to find accommodation in Minganie, especially during the summer period and while the access road is being built. They feared a decline in the number of visitors and the resulting impact on local businesses, as well as long-term economic losses.

The proponent indicated that it had drawn up a list of available accommodation for workers from outside the region, and that it would discuss the situation with the lead contractor in order to ensure that sufficient accommodation is available for the entire period during which the access road is under construction. The proponent does not, however, plan to impose any specific directives. Since the two jobsites projected for the construction of the hydroelectric complex are relatively far from Havre-Saint-Pierre, the proponent believes that available accommodation in the community would be sufficient during the entire period that the other work is being carried out (Louise Émond, DT6, pp. 36–37).

Beginning in March 2010, the majority of the workers would live in two work camps set up by Hydro-Québec, namely the Murailles camp and the Mista

43. Quebec *Act Respecting Access to Documents Held by Public Bodies and the Protection of Personal Information* [R.S.Q., C. A-2.1], Division II.

camp.[44] Hydro-Québec also plans to build a permanent facility near the Mista camp, which would include a 72-room residence for employees working on the operation of the hydroelectric complex (PR3.1, p. 13-7; DA62, p. 1).

- ***Opinion*** *— The panel is of the opinion that the proponent, along with the hotel industry in Havre-Saint-Pierre and environs and the Association touristique régionale de Duplessis, should ensure that tourists can find accommodation in this sector of Minganie during peak work periods.*

Other participants, including social services agencies, are concerned about the capacity of government services, such as daycares, health care services and water and sewer systems, to respond to the needs of the new workers and their families. Some fear housing shortages and rent increases in the Havre-Saint-Pierre region, given the relatively small size of this community of 3,200 inhabitants in comparison to the project's significant labour requirements.

According to the proponent, "[Translation] only those families who move to the region when the project is implemented could cause an increase in demand for [social] services. The needs of employees at the jobsite will be taken care of at the camp by nurses from the Health-Construction unit" (DQ15-1, p. 1). The proponent estimates that approximately 34 to 134 people, some with families, would move to Havre-Saint-Pierre over a period of several years during the gradual commissioning of the hydroelectric complex. In the proponent's view, this would not result in excessive demand for social services and accommodation, but rather would help stabilize a population that is currently in decline (PR8.17, pp. 27-30). Available economic data confirm this decline, and representatives of the Minganie RCM noted during the public hearings that all of the RCM's municipalities were struggling. In their view, the financial resources made available via the project, along with the additional tax revenue generated, "[Translation] could help kick-start development in the Minganie region" (DM52, p. 5).

- ***Opinion*** *— In view of the fact that the proponent would offer health and social services to workers on jobsites and that the number of people who would permanently settle in the Minganie region would be relatively small, the panel does not anticipate any major housing problems or problems with the supply of social services during the course of the project*.

- ***Opinion*** *— The panel is of the opinion that the proponent should make itself available to social services organizations to answer their questions and make it easier for them to plan their future needs.*

44. Up to 2016, the Murailles camp would be able to accommodate a maximum of 2,408 people. From 2012 to 2020, the Mista camp would be able to accommodate 1,744 people (PR3.1, pp. 14-1 and 14-2). The respective capacities of these camps include lodging for visitors (PR8.17.1.1, p. 12).

Chapter 6 Safety, Accidents and Malfunctions

In this chapter, the panel deals with aspects related to safety, accidents and malfunctions during the construction and operating periods. The chapter begins with an analysis of road safety on Highway 138 and the projected access road and the safety of jobsites, followed by a look at pleasure boating and snowmobiling safety. Finally, the panel examines the safety of structures, focusing on the impact of a dam rupture and the planning needed to respond to such an incident.

The panel took two principles of the Quebec *Sustainable Development Act* into account, Health and quality of life, and Prevention, the latter of which indicates, "In the presence of a known risk, preventive, mitigating and corrective actions must be taken, with priority given to actions at the source." Accidents and malfunctions are also environmental effects that were examined in accordance with subsection 16(1) of the *Canadian Environmental Assessment Act*.

During the construction phase

Road safety

Highway 138

From January 2001 to June 2006, there were 229 accidents on Highway 138 between Sept-Îles and the intersection with the access road to the hydroelectric complex, including 2 fatal accidents, 10 accidents with serious injuries and 56 with minor injuries. Accidents on the highway are usually between Longue-Pointe-de-Mingan and Havre-Saint-Pierre. This section of the highway sees the heaviest traffic in Minganie (PR8.15.1, pp. 15–16; DQ9.1, pp. 8 and 13).

On the basis of data provided by the Quebec Department of Transport (MTQ), Hydro-Québec feels that this section of Highway 138 does not present any safety problems, since current figures are below the critical rate.[45] In addition, in the MTQ's opinion, the section of Highway 138 in Mingan and the intersections with secondary roads would not be accident-prone. The anticipated increase in traffic would not lead to noticeable changes in current accident rates, as the hydroelectric complex would not generate traffic, according to the MTQ (DB9; Mr. Marc Larin, DT3, pp. 16 and 20). However, it must be noted that the accident rate in the section close to the intersection with the access road is higher than the

[45] The accident rate is expressed as the number of accidents per million vehicles driving 1 km or using an intersection (main and secondary roads). The Quebec Department of Transport uses the critical accident rate to establish priorities for action.

average for a comparable road and does approach the critical rate.[46] Driving conditions are sometimes hazardous in winter on Highway 138 east of Havre-Saint-Pierre (PR3.5, p. 37-7). In addition, the volume of light and heavy vehicles generated by the project could double during peak summer construction periods (Mr. Benoît Gagnon, DT3, p. 24).

According to Hydro-Québec, heavier traffic during the construction phase could lead to rush-hour traffic jams on Highway 138 and increase the risk of head-on collisions resulting from passing cars. The current percentage of no-passing zones is 60%, and the number of head-on collisions is already higher than the average on comparable roads (PR8.15.1, pp. 2 and 17). The Quebec Department of Transport indicated at the public hearing that if some curves were improved, leading to better visibility, there would be more safe passing zones on Highway 138 (Mr. Marc Larin, DT3, p. 22). According to MTQ standards, "[Translation] the construction of auxiliary lanes for passing may be justified if vehicles are regularly held up by traffic or if specific safety conditions require the construction of auxiliary passing lanes."[47] A group of political and economic stakeholders from Sept-Îles have also expressed their wish to have auxiliary lanes built (Mr. Denis Smith, DT16, p. 32).

The municipality of Rivière-au-Tonnerre, groups of Mingan and Magpie residents, the governing board of Saint-François-d'Assise school in Longue-Pointe-de-Mingan and many residents are concerned that heavier traffic on Highway 138 in urban areas, including in Ekuanitshit, Longue-Pointe-de-Mingan, Rivière-Saint-Jean, Magpie and Rivière-au-Tonnerre/Sheldrake, would increase the risk of accidents, especially for young children, school-aged children, elderly people and cyclists. Residents frequently cross Highway 138 and use the road for their activities (DM16, p. 1; DM93, pp. 2–4; DM103, pp. 1–4; DM108, pp. 2-4). Hydro-Québec admits that pedestrian crossings in municipalities close to Havre-Saint-Pierre would not be very safe if over 43% of the additional traffic anticipated during the construction peak were to be concentrated during the Friday rush-hour period in the summers of 2013 and 2014. This concentration could also lead to safety problems for snowmobilers who cross Highway 138 (PR8.15.1, pp. 17–21).

Some measures could be taken, including ensuring greater police presence, installing signals and signage for pedestrian and snowmobile crossings, and hiring school crossing guards. To implement these measures, Hydro-Québec plans to provide the Quebec Department of Transport, the Sûreté du Québec and affected municipalities with site supply scenarios and the volume of traffic generated by the construction. In addition, Hydro-Québec would inform snowmobilers and quad users so that they limit their crossings of Highway 138 during peak periods. It would

[46] The accident rate from 2001 to 2006 was 1.01 accidents/million vehicles per km between Sept-Îles and Havre-Saint-Pierre and 1.24 for the section near the intersection with the projected access road. The average rate on comparable roads is 1.11, and the critical rate is 1.36 (PR8.15.1, p. 15).

[47] Quebec (Province). Ministère des Transports (2008). *Tome 1 – Normes de conception routière*, updated October 30, 2008, Chapter 6, p. 18.

also make workers aware of the need to comply with road safety regulations (PR5.1, p. 295; PR8.15.1, pp. 20–22; Mr. Benoît Gagnon, DT3, p. 24).

Many residents have doubts as to how effective these measures would be and, rather, recommend that a road be built to bypass a number of Minganie municipalities west of the project, especially Ekuanitshit and Longue-Pointe-de-Mingan. The Quebec Department of Transport would prefer to implement traffic calming measures[48] on the existing road, as the current traffic volume does not justify a bypass road, even with increased volumes stemming from the project (Mr. Marc Larin, DT3, pp. 16–17). Moreover, the Le Blizzard de Havre-Saint-Pierre snowmobile club has suggested relocating part of the provincial Trans-Québec Trail No. 3 to reduce the number of crossings (DM35, pp. 2 and 4).

- *The panel notes that the increased traffic related to the construction of the hydroelectric complex would likely cause a rise in the number of accidents on Highway 138 and that Hydro-Québec plans to join with the Quebec Department of Transport, the Sûreté du Québec and affected municipalities to implement measures to reduce the risk of accidents.*

- ***Opinion** — For safety reasons, the panel is of the opinion that Hydro-Québec should encourage contractors to stagger their trips on Highway 138 so as to reduce the anticipated volume of traffic during peak periods. This measure would avoid the relocation of the provincial Trans-Québec Trail No. 3 since there is little road traffic in winter.*

- ***Opinion** — The panel is of the opinion that the Quebec Department of Transport should plan on adding passing lanes on Highway 138 to minimize the risk of head-on collisions and on applying traffic calming measures on the outskirts of the municipalities it runs through.*

Access road to the hydroelectric complex

The Quebec Department of Transport and the Fédération des travailleurs et travailleuses du Québec, including both of their regional councils—Haute-Côte-Nord et Manicouagan, and Sept-Îles et Côte-Nord—raised concerns about the safety of users on the access road, which would be about 152 km long and from which about 75 km of access roads to structures would branch off (DB8, p. 1; DM72, pp. 12–13; Mr. Daniel Blais, DT15, p. 7). During the construction phase, the access road would be opened to public in stages. Once construction was completed, it would provide access to existing resorts; hunting, fishing and trapping land; the hydroelectric complex's reservoirs and boat ramps. The road could also promote the development of holiday resorts, forestry and mining. Secondary access roads to other lakes and rivers could also be built.

[48] These measures are intended to lower speed in urban areas and may include narrowing of road roadbeds and different road geometry, including medians (Quebec. [Province]. Ministère des Transports (2008). *Tome 1 – Normes de conception routière*, updated October 30, 2008, Chapter 4, p. 6).

In the proponent's view, this road is in a remote location and its main purpose is to provide access to resources. It also feels that annual average daily traffic (AADT) stemming from the project would be 441 vehicles at most, including 62 trucks, during the construction period, and 18 vehicles, including 6 trucks, during the operating phase (DQ9.1, p. 10). Hydro-Québec design criteria correspond to those of the Quebec Department of Transport for a low-traffic road,[49] with a design speed equivalent to the posted speed, except for sections where speed is reduced due to rugged landform.[50] In addition, the geometry of most of the access road to the Romaine-2 generating station would comply with MTQ criteria for speeds higher than the posted speed (PR9.2, p. 90).[51]

In the opinion of the Quebec Department of Transport, "[Translation] in terms of speed regulation, the new access road would be managed as a public roadway, as it would be a private road open to public traffic, including vacationers and forestry companies" (DB8, p. 1). According to the MTQ, the safety of users and compliance with public road construction standards therefore require the access road to be built with a design speed 10 km/h higher than the posted speed, and minimum curve radii and maximum gradients have been established in keeping with this speed on most of the road (*ibid.*, pp. 1–2). The section of the access road between Highway 138 and the Romaine-2 generating station would meet this requirement.

Hydro-Québec plans to build a roadbed that is 9.2 m wide, 2.2 m wider than a low-traffic road.[52] The width of the roadbed of roads leading to structures would be the same as that of the access road, expect for roads to the dikes, which would be between 10 m and 14 m wide (PR3.1, p. 13-1 and 13-3). A few curb lanes, the location of which remains to be determined with land users, would also be built along the access road for parking purposes. Parking would not be allowed elsewhere along the road.

According to the Quebec Department of Transport, the width of the roadbed must be sufficient to accommodate trucks. A regional road in a rural area, with one lane in each direction and an average daily traffic rate of 500 to 2,000 vehicles, must be 6.6 m wide and include 2-m shoulders, for a total roadbed of 10.6 m (Type D).[53] Hydro-Québec expects that access road traffic stemming from its

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[49] A road is considered to be low traffic with fewer than 200 vehicles per day during the construction phase and, at most, 400 vehicles per day 10 years later (Quebec. [Province]. Ministère des Transports (2008). *Tome 1 – Normes de conception routière*, updated October 30, 2008, Chapter 12, p. 3).

[50] Curve radii, gradients and visibility distances have been established for a speed of 70 km/h, the posted speed, except for three sections totalling 8 km, where the gradient exceeds 10% and the design and posted speed is to be 50 km/h (DQ16.1, p. 8).

[51] According to Hydro-Québec, most of the horizontal curves on the access road between Highway 138 and the Romaine-2 generating station would have a radius greater than 350 m, except for two sections that have 12% gradients and another section with a 14% gradient over 100 m on approach to the bridge at the Romaine-1 generating station (PR9.2, p. 90). According to Quebec Department of Transport standards, a 350-m radius corresponds to a speed of 90 km/h. The minimum curve radius is 250 m for a speed of 80 km/h and 190 m for a speed of 70 km/h. (Quebec [Province]. Ministère des Transports (2008). *Tome 1 – Normes de conception routière*, updated October 30, 2008, Chapter 6, p. 5).

[52] *Ibid.*, Chapter 12, pp. 6 and 8.

[53] *Ibid.*, Chapter 5, p. 3 and Standard Drawing No. 004.

operations would be lower, but the volume of traffic eventually generated by the road has not been considered or assessed. In addition, the MTQ believes that Hydro-Québec should plan to pave shoulders in curves to ensure greater safety when two vehicles cross, since heavy vehicles would be using the road (DB8, p. 2).

Since a number of trails have been created mainly around the Romaine-1 and Romaine-2 generating stations, where there are a number of cottages, shelters and hunting facilities, the access road may be crossed or used by off-road vehicles (Figure 9). In winter 2016–2017, Hydro-Québec would start authorizing snowmobiles to cross a bridge built at Romaine-1 generating station and would allow people to park in a lot with about 30 parking spots near the generating station. Hydro-Québec intends to control access to this road during the construction phase and put up signage at the bridge and where the main off-road trails intersect the access road.

According to the Quebec Department of Transport, lighting and an eastbound left-hand turning lane would be required to ensure the safety of the intersection of the access road and Highway 138, about 30 km east of Havre-Saint-Pierre. Visibility at this intersection would have to meet MTQ criteria for the posted speed of 90 km/h and the number of traffic lanes (DB8, p. 4). Hydro-Québec and the MTQ need to agree on this. The intersection would also serve one of the two stops of the Le Blizzard de Havre-Saint-Pierre snowmobile club and provincial Trans-Québec Trail No. 3. Hydro-Québec has made a commitment to implement safety measures with the snowmobile club, which nonetheless wants to relocate the rest stop (PR3.5, pp. 35-35 and 35-36; DM35, pp. 3–4).

- *The panel notes that the curves and gradients of most of the access roads between Highway 138 and the Romaine-2 generating station meet Quebec Department of Transport public road design standards. However, the width of the roadbed chosen by Hydro-Québec would be based solely on the volume of traffic anticipated for the length of the project, without taking into account future use. Moreover, traffic on the access road during construction, particularly of heavy vehicles, could pose a risk to user safety.*

- ***Opinion** — The panel is of the opinion that a sub-standard design for the access road north of the Romaine-2 generating station would pose a risk to user safety. Hydro-Québec should thus design the curve radii and gradients on the basis of a design speed 10 km/h faster than the posted speed on the vast majority of this section. Attention should also be focused on areas where the access road runs alongside a sector used by off-road vehicles, as well as on the visibility of crossing points.*

- ***Opinion** — The panel is of the opinion that, for road safety reasons, Hydro-Québec and the Quebec departments of Transport and Natural Resources and Wildlife should review the width of the access road roadbed to take account of the large number of potential uses.*

Jobsite safety

Hydro-Québec intends to implement safety measures for land users and workers during the construction period. Hydro-Québec's industrial safety division would be responsible for all aspects of the safety of people and facilities. Regular meetings with contractors' employees and Hydro-Québec safety inspectors would be held (PR5.1, p. 66).

A gate would be installed on the access road, near Highway 138. As the work progressed, and in keeping with safety criteria, the gate would be moved farther north to open the road to the public. On some occasions, access may be limited or even prohibited for safety reasons. During blasting operations, the area would be evacuated and the road closed within a perimeter of 500 m to 600 m (PR3.5, p. 37-20; PR9.2, p. 3).

A safety perimeter would also be set up around construction areas. Canoeists would have to go around perimeters, within which snowmobiling and ATVing would not be permitted. For safety reasons, boating would be strongly discouraged when the reservoirs were flooded (PR3.5, pp. 35-36 to 35-38). Hunting would also be prohibited within a radius of 1 km of the jobsites and within 1 km of both sides of the access road (DA61, p. 1). Hydro-Québec would regularly keep land users informed about the progress and status of the work and about areas to be avoided for safety reasons. Local residents would be warned in advance about flooding periods (Mr. Benoît Gagnon, DT7, p. 95).

An emergency measures plan covering accidents, fires and accidental spills of contaminants and toxic products would also be drawn up at the beginning of the construction period (PR5.1, p. 65). The Société de protection des forêts contre le feu has established limited protection along the Romaine River, and the intensive protection zone is limited to a 20-km wide corridor near the shore, along Highway 138. The Société must have authorization from the Quebec Department of Natural Resources and Wildlife to intervene in limited protection zones (DB6; Mr. Donald Gingras, DT7, p. 2). Nevertheless, at the public hearing Hydro-Québec indicated it plans to come to an agreement with the Société on the terms and conditions for the monitoring and protection of the land concerned (Mrs. Louise Émond, DT6, p. 58). There were forest fires on the land concerned in 2003 and 2005, when 1,735 ha and 1,452 ha, respectively, of forest were destroyed. In addition, Hydro-Québec would make its workers and contractors aware of fire hazards related to the work (Mr. Benoît Gagnon, DT6, p. 30).

To avoid unnecessary travel and reduce the risk of accidents on the access road, the Quebec Department of Transport would like Hydro-Québec to inform workers when Highway 138 will be closed. According to the Department, "[Translation] blowing snow is frequent on Highway 138 in the sector concerned, forcing MTQ officials to close the road" (PR6, avis 9, p. 1).

- *The panel notes that Hydro-Québec has undertaken to ensure safety on jobsites and notify land users of locations to avoid for safety reasons as the work progresses. The panel also notes that in order to prevent and control forest fires,*

Hydro-Québec plans to come to an agreement with the authorities concerned on the terms and conditions for the monitoring and protection of hydroelectric complex land that would take into account the specific characteristics of the environment.

- ***Opinion*** *— The panel is of the opinion that Hydro-Québec, in co-operation with the Quebec Department of Transport, should implement a communication plan to prevent use of the access road in the event that Highway 138 has to be closed.*

During the operating phase

Pleasure boating safety

Hydro-Québec plans to implement pleasure boating safety measures. Sirens would announce when spillways were periodically opened to lower water levels, which suddenly changes water currents. Booms and signage indicating potential hazards would be installed near facilities (PR5.1, p. 242; PR9.1, p. 266; Mrs. Louise Émond, DT6, p. 21). Hydro-Québec is also required to comply with federal requirements under the *Navigable Waters Protection Act* [S.C., 1985, C. N-22] (DB12, pp. 3–4).

Over a nine-year period, Hydro-Québec would monitor the volume and distribution of floating wood debris that may accumulate along banks and reservoir bays and would remove debris that could present a risk to user safety. Although debris would cover only a small ratio of the surface area of reservoirs, the floating wood could hinder pleasure boating. Hydro-Québec also expects that, after reservoir operating levels were lowered in winter, ice would poll the crowns of trees that are not cut down (PR9.1, pp. 276–277).

A boat ramp would be built on the banks of each reservoir to facilitate access. Users could take access roads to go around facilities and short-circuited segments. Portage trails would also be developed (PR3.5, p. 35-23; PR9.1, p. 266). A boat landing would enable canoeists and kayakers to bypass the Romaine-1 generating station facilities. They would be able to take a portage trail providing access downstream on the Romaine River. Signage would also be installed. Some portaging would be done on access roads to hydroelectric structures. However, the proponent expects the volume of traffic to be extremely low during the operating period. In addition, canoeing and kayaking facilities would be located so as to minimize portaging and would be outside the dam's safety zone (Mrs. Louise Émond, DT3, pp. 77–79). Boaters currently portage on the right bank of the Romaine River to go around the impassable falls of Grande Chute at KP 52.5 (PR3.5, p. 35-11).

- *The panel notes that Hydro-Québec plans to implement pleasure boating safety measures that have to meet the requirements of the* Navigable Waters Protection Act*. It also notes that Hydro-Québec would remove floating wood debris that might pose a risk to boater safety.*

- ***Opinion*** *— The panel is of the opinion that Hydro-Québec, through the monitoring and community relations committee, should make users aware of the prevailing boating conditions and the safety measures in place so they do not end up in unsafe situations.*

Snowmobiling safety

People currently snowmobile on the Romaine River and cross it, mainly on the lower reaches of the river (Figure 9). Operating a hydroelectric complex would warm up the water on this part of the river in winter. As a result, ice cover in a number of locations downstream from the Romaine-1 generating station would not be safe anymore. Ice cover between KP 30 and KP 51.5 would be unstable or non-existent. During warm spells, the river could even be ice free up to KP 16 (PR3.5, p. 35-19).

Hydro-Québec is proposing that crossings over the Romaine River be concentrated at two points. A bridge built at the Romaine-1 generating station, open for use in winter 2016–2117, and a prefabricated 3-m wide footbridge, installed in winter 2014–1015, would enable snowmobilers to cross the river. It was initially proposed that this footbridge be built near KP 15.5 of the river, near the Mistahukan rail bridge used by QIT-Fer et Titane (PR3.5, pp. 35-20 and 35-21; PR9.1, p. 271). However, Hydro-Québec indicated at the public hearing that the location of the footbridge was being discussed with land users and that instead it could be installed near KP 30 (Mr. Benoît Gagnon, DT7, p. 31).

The Association chasse et pêche de Havre-Saint-Pierre feels that snowmobilers would have to make long detours, often in difficult winter conditions, if only one footbridge were built. An additional footbridge would accommodate the majority of users in the back country and prevent traffic from being concentrated at a single location (DM26, p. 4).

In Hydro-Québec's opinion, snowmobilers would have about two fewer weeks at the end of the season to safely cross the Romaine River on Trans-Québec Trail No. 3 (Mrs. Louise Émond, DT7, pp. 14-15).[54] Thin ice and earlier thaws could pose a safety risk for snowmobilers who cross the Romaine River there. According to Le Blizzard de Havre-Saint-Pierre snowmobile club, because of future conditions, the only safe option to cross the river at KP 3 would be to use the bridge on Highway 138. The club suggests that a lane be added for snowmobiles (DM35, pp. 3–4).

Hydro-Québec does not plan to build additional crossings farther north, near the Romaine-3 and Romaine-4 generating stations. Since the access road would provide an opportunity to access this land more easily on snowmobile, however,

[54] According to the requirements of the Fédération des clubs de motoneigistes du Québec and the insurance company of the Le Blizzard de Havre-Saint-Pierre snowmobile club, ice cover at water crossing points must be 45.7 cm for an ice resurfacer and 20.3 cm for a snowmobile to cross (PR3.5, p. 35-4; DM35, p. 3). According to Hydro-Québec simulations, the period during which ice cover at KP 3 would be at least 20 cm thick would end on March 14 in average winter conditions rather than on April 10 (PR3.2, p. 18-16).

the proponent would monitor the situation (PR5.1, p. 325). In addition, ice cover on the Romaine 2, Romaine 3 and Romaine 4 reservoirs would change due to fluctuating water levels; cracks could appear near the shore and some areas could have thin ice or no coverage at all. The proponent would therefore advise against snowmobiling on the reservoirs. Hydro-Québec plans to develop a communication plan for snowmobilers who travel on the reservoirs and the Romaine River downstream from the Romaine-1 generating station and intends to design signage (PR3.5, p. 35-18 and 35-20).

- *The panel notes that, given the instability or disappearance of the ice cover on the Romaine River during the operating period, Hydro-Québec is recommending the river only be crossed on a bridge built at the Romaine-1 generating station, on a footbridge at a location still to be determined with users; or at KP 3, near the Highway 138 bridge, where early ice melt shortens the period during which it is currently possible to cross.*

- ***Opinion** — The panel is of the opinion that, for safety reasons, Hydro-Québec should monitor ice cover at KP 3 on the Romaine River and regularly send the results to local users and managers of the Trans-Québec Trail. Monitoring of the ice cover on reservoirs is also proposed.*

- ***Opinion** — The panel is of the opinion that Hydro-Québec should install at least two footbridges downstream of the Romaine-1 generation station which are wide enough to cross the river and avoid significantly lengthening current snowmobile routes. The proponent should also continue discussions with users in order to reach a consensus on measures to be agreed on for the largest number of users.*

Safety of structures

The design and construction of structures have to comply with the requirements of the Quebec *Dam Safety Act* [R.S.Q., C. S-3.1.01] and regulations, including the *Dam Safety Regulation* [Chap. S-3.1.01, r. 1]. Dam owners and operators must adhere to flooding and earthquake standards, prepare and update a water management plan, develop and update an emergency measures plan with public safety officials, and monitor and maintain the structures. The Quebec *Civil Protection Act* [R.S.Q., C. S-2.3] provides a framework for risk prevention and management.

Hydro-Québec indicated that the design capacity of the Romaine-4 spillway is based on probable maximum flood (PMF) criteria stemming from an analysis of various floods and extreme meteorological events in the region from 1956 to 2004. Data from a 10,000-year spring flood forecast were used in designing the spillways of the other reservoirs. According to Hydro-Québec, these criteria take into account the potential impact of climate change (PR3.1, pp. 9-6, 10-8, 11-12 and 12-7; PR3.9, p. M3-3; PR9.3, p. 98). Furthermore, seismic factors would be taken into account in future engineering phases (DQ13.1, p. 25).

Hydro-Québec plans to apply preventive measures to reduce the risk of accidents. These measures would be based on monitoring, maintenance and follow-up of structural behaviour and on preventive hydraulic management. Also, an emergency measures plan would enable Innu community band councils and municipal authorities to incorporate the risks posed by the hydroelectric complex into their own emergency plans (PR3.1, pp. 15-1 and 15-2; DQ9.1, pp. 5–6). Hydro-Québec also intends to share its own expertise in managing risks associated with dams.

For the operating phase, Hydro-Québec submitted a summary of its emergency measures plan, including the consequences of a hypothetical dam rupture leading to extreme events, the characteristics of the wave and a map of the maximum flood areas (PR5.1.1). A temporary emergency plan would also be developed for the construction phase. An application for a certificate of authorization would be submitted for the plan, in accordance with section 22 of the Quebec *Environment Quality Act* [R.S.Q., C. Q-2]. Since facilities would be gradually commissioned as part of the project, each work site would be subject to an emergency plan (PR5.1, p. 65; DQ6.1, p. 5).

According to Hydro-Québec, the worst-case scenario would be a rupture of the Romaine-4 dam, leading to a chain reaction resulting in the rupture of the three other dams downstream. In this scenario, water levels would rise in some areas, including on Highway 138 east and west of Havre-Saint-Pierre, at the Highway 138 bridge crossing the Romaine River and at the Mistahukan rail bridge at KP 16 of the river. The eastern part of Havre-Saint-Pierre, where homes, mobile homes and a camping campground are located, would be flooded. Situated at a higher altitude, Havre-Saint-Pierre Airport would be the safest area in the event of an evacuation resulting from a dam rupture.

Emergencies involving the hydroelectric complex would be managed in real time by Hydro-Québec's Manicouagan branch, from the Baie-Comeau regional emergency coordination centre. Hydro-Québec's alert and mobilization procedure includes the acquisition of information on the detection of a structural malfunction or breakdown, the validation of information and the initiation of procedures in keeping with the level of alert that may or may not require the evacuation of employees and residents concerned (PR3.1, pp. 15-2 and 15-3; PR5.1.1, p. 8).

- *The panel notes that municipal authorities and Innu community band councils would be prepared by Hydro-Québec to respond to any disasters that could occur on their land. They would have to be harmonized with the emergency measures implemented by Hydro-Québec.*

- ***Opinion** — The panel is of the opinion that a committee overseeing the operations and security of the structures should be created by Hydro-Québec and the municipalities, Innu communities and Civil Protection so that relevant information, expertise and dam security procedures can be shared on an ongoing basis.*

At the public hearing, the Government of Newfoundland and Labrador expressed concerns about the potential risk of flooding in Labrador should the Romaine 4 reservoir overflow (DM62, pp. 4–5). Hydro-Québec indicated that the maximum water level in the Romaine 4 reservoir would be 458.6 m, since the 10,000-year spring flood forecast is 2,168 m^3/s and the spillway could release up to 3,038 m^3/s of water, the probable maximum flood level, which is considered to be the safety check flood for the Romaine-4 generating station. Furthermore, the crest of the dam is to be built at an altitude of 459.6 m, which would be the forecast maximum water level should an improbable flood occur.

Near the Quebec-Labrador border (Privy Council's 1927 alignment), the average annual water level would be 460 m and over 462 m during an average flood. It is possible that during a flood the water in the Romaine 4 reservoir would back up into the section of the river where the left bank borders Labrador. However, the back-up would not significantly increase the water level at the border or, even more unlikely, flood adjacent land, since the crest of the reservoir would be practically at the same height as the average water level in the river at the border during average conditions and 2 m lower than average flood levels (PR3.1, p. 9-1; PR5.1.1, p. 5; DQ21.1, p. 1; PR3.2, p. 16-10; PR3.10, Map I).

- ***Opinion*** *— On the basis of the information provided by the proponent, the panel does not anticipate any risk of flooding in Labrador should a rare flood of the Romaine River occur and put the Romaine 4 reservoir in a situation where the maximum water levels are reached or even exceeded.*

Chapter 7 Summary of the Cumulative Effects of the Project

In this chapter, the panel deals with the cumulative effects of the project on valued environmental components, as required by the *Canadian Environmental Assessment Act*. The panel addresses the heritage of rivers on the North Shore, power transmission lines, the public's exposure to mercury, greenhouse gas emissions, the capacity of renewable resources to meet needs and the water and fishery resources of the Gulf of St. Lawrence.

Heritage of North Shore rivers

The loss of natural heritage is often raised when a hydroelectric project is subject to an environmental assessment. This aspect was also raised at the public hearing, where participants discussed the Romaine River as an ecosystem and landscape heritage and a recreational and tourism resource, especially fast-flowing sections. The river's watershed is also considered to be a natural hydrosystem that contributes to the ecology of the Gulf of St. Lawrence by providing it with fresh water. All aspects of the cumulative effects on the heritage of rivers are addressed.

River protection in Quebec

Concerns about keeping rivers in their natural state have grown with the spread of hydroelectric development in Quebec (Table 12). In the 1990s, inspired by what was being done in Norway, it was decided that rivers should be zoned or classified so as to group rivers that could be used for energy development apart from those that would be kept in their natural state and protected (DB15). In its 1996 energy policy, the Government of Quebec made a commitment to classify the province's rivers on the basis of their usage. Launched in 1997 (Quebec [Province], 1996), this initiative was to lead to a public consultation; however, it never came to fruition, and no rivers were classified. The 2006 Energy Strategy, which is an update of the 1996 policy, makes no mention of protecting rivers.

Table 12 Recent developments concerning hydroelectric generating stations on Quebec rivers

Year	Generating station	Source
1996	106 generating stations on 30 rivers	Quebec (Province), 1996, p. 42
2000	145 generating stations on about 50 rivers	Quebec (Province), 2002, p. 91
2008	162 generating stations on 115 rivers	DQ11.1
	174 existing and planned generating stations on 121 rivers	DQ11.1

In the early 2000s, the Quebec Strategy for Protected Areas picked up the issue of river protection (Mrs. Mireille Paul, DT7, p. 59). In the Quebec Water Policy, issued in 2002, the government made a commitment to "create a network of 'aquatic reserves' in Québec by 2005":[55]

> The government will ensure that the protection of watercourses and lakes, as well as brackish or saltwater ecosystems, is henceforth integrated with the protection of Québec's natural heritage by creating aquatic reserves. Thus, to complement the efforts undertaken in the context of Québec's biodiversity strategy and its strategy for protected areas, the government undertakes to inventory and characterize the rivers, lakes, St. Lawrence, and estuary and offshore zones representative of the natural provinces of the ecological reference framework.
> (Commitment No. 24, Quebec [Province], 2002, p. 50)

As of January 2009, not a single territory has been granted aquatic reserve status in the Quebec register of protected areas. However, nine territories currently have temporary protected status as projected aquatic reserves.[56] These territories will have temporary reserve status from September 2009 to June 2012. Although temporary reserve status lasts a maximum of four years, it may be extended. The Quebec Department of Sustainable Development, Environment and Parks (MDDEP) emphasizes that other types of protected areas, including Quebec parks, ecological reserves and biodiversity reserves, may also be extended to protect rivers in whole or in part (DQ6.3, pp. 9–12).

In fall 2008, the Quebec Premier tabled the Northern Plan, proposing a vision for the development of land above the 49th parallel. Among other things, the Plan provides for the addition of 3,500 MW to the 4,500 MW in electric power

55. Commitment No. 24 stems from Orientation 5.2, Protecting Aquatic Ecosystems.

56. [Accessed on January 21, 2009] Web site: <www.mddep.gouv.qc.ca/biodiversite/aquatique/index.htm> .

generation projects included in the Quebec Energy Strategy for 2006–2015.[57] In preparing its next strategic plan, Hydro-Québec started reassessing Quebec's hydroelectric potential to identify the most advantageous hydroelectric projects. The strategic plan is slated for release in August 2009 (DQ18.1, pp. 2–3).[58] In addition, the Premier has also proposed that "50% of the Northern Plan's area . . . be protected from industrial, mining and energy development [and] devoted to the protection of the environment and to recreation and tourism."[59]

North Shore rivers

Watersheds

The North Shore makes up about one fifth of Quebec's territory and comprises a major tract of land that drains fresh water directly into the salt waters of the Estuary and Gulf of St. Lawrence. The region's watersheds are almost exclusively in forested areas. It has a number of major rivers, and seven watersheds of over 10,000 km² make up more than half the territory (Table 13 and Figure 11).

Watersheds that have undergone hydroelectric development and whose hydrological regimes have been altered currently make up roughly one third of the territory. If both this project and the announced Petit Mécatina River project are carried out, the proportion would rise to 43%. Of the seven watersheds larger than 10,000 km² on the North Shore, three have already been developed (Manicouagan, Aux Outardes and Betsiamites), and hydroelectric complex projects have been announced in two other watersheds in the short and medium terms (Table 13). The list of hydroelectric projects and the rivers concerned in the region could be lengthened when Hydro-Québec issues its 2009–2013 strategic plan, which is expected to be released soon.

57. *The Northern Plan's Energy Component – 3 500 MW: To ensure our energy security, industrial development, and clean energy exports*, press release of November 14, 2008.
[Accessed on January 21, 2009: <www.plq.org/en/comm_14_11_2008_01.php>].

58. *Report du dépôt du plan stratégique d'Hydro-Québec 2009-2013 – Être prêt à mettre à profit notre énergie verte*, press release of February 3, 2009.
[Accessed on February 3, 2009: <www.mrnf.gouv.qc.ca/presse/communiques-detail.jsp?id=7329>].

59. *The Northern Plan's Sustainable Development Component – Quebec's North: A new sustainable development space*, press release of November 15, 2008.
[Accessed on January 21, 2009: <www.plq.org/en/comm_15_11_2008_01.php>].

Table 13 Principal North Shore watersheds

	Watershed	Area (km²)	Hydroelectric development
1	Manicouagan	45,908	Hydroelectric complex
2	Petit Mécatina (du)	19,580	Hydroelectric project in preparation
3	Moisie	19,192	– Not developed
4	Outardes (aux)	18,712	Hydroelectric complex
5	Betsiamites	18,204	Hydroelectric complex
6	Natashquan	16,110	– Not developed
7	**Romaine**	**14,500**	**Hydroelectric complex pending authorization**
8	Saint-Augustin	9,510	– Not developed
9	Magpie	7,640	Hydroelectric generating station
10	Saint-Paul	7,370	– Not developed
11	Sainte-Marguerite	6,190	Three hydroelectric generating stations
12	Aguanish	5,776	– Not developed
13	Saint-Jean	5,594	– Not developed
14	Olomane	5,439	– Not developed
15	Rochers (aux)	4,439	– Not developed
16	Musquaro	3,626	– Not developed
17	Etamamiou	3,030	– Not developed
18	Portneuf	2,642	Diversion
19	Manitou	2,642	– Not developed
20	Mingan	2,344	– Not developed
21	Nabisipi	2,062	– Not developed
22	Sault aux Cochons (du)	2,033	Diversion
23	Pentecôte	1,971	– Not developed
24	Coxipi	1,660	– Not developed
25	Godbout	1,575	– Not developed
26	Washicoutai	1,536	– Not developed
27	Napetipi	1,248	– Not developed
28	Sheldrake	1,184	– Not developed
29	Watshishou	1,064	– Not developed
30	Quétachou	1,015	– Not developed
7 watersheds covering 10,000 km²:		152,206	54% developed (77% including Romaine and Petit Mécatina rivers)
30 watersheds covering over 1,000 km²:		233,796	40% developed (55% including Romaine and Petit Mécatina rivers)
All North Shore watersheds:		298,471	32% developed (43% including Romaine and Petit Mécatina rivers)

Sources: DA42; DQ18.1, pp. 3–4; PR3.1, p. 5-1.

Figure 11 Main watersheds of the North Shore

Insert 8½ x 11 colour figure

The Moisie and Natashquan rivers, the North Shore's two watersheds of over 10,000 km^2 that have not been developed or targeted for hydroelectric projects, are being considered for protected area status. The Moisie River's projected protected area covers 3,897 km^2, making up a corridor between 6 and 30 km wide from km 37 to km 358 of the river and including part of its two main tributaries, the Carheil and Aux Pékans rivers.[60] With respect to the Natashquan River valley, there are plans to designate it as a biodiversity reserve, covering 4,089 km² between km 83 and km 273 of the river and the first 105 km of the Natashquan East tributary.[61] Although the current status of both of these protected areas precludes the development of hydroelectric power, it is not permanent; their boundaries, even their existence, might be reviewed.

There is also a project involving designating the Magpie River watershed as a biodiversity reserve, where a hydroelectric generating station and reservoir have been developed near the mouth. The projected biodiversity reserve of the massif of lakes Belmont and Magpie covers 1,575 km², including Lake Magpie and short sections of the Magpie and Magpie West rivers. Its temporary protected status expires in June 2011. The Matamec ecological reserve (186 km²) protects the southern part of the watershed of the river of the same name. The proposed ecological reserve of the Matamec River (northern part)[62] should extend protection to the entire watershed (725 km²).

Whitewater in the rivers

Whitewater rapids, cascades and falls are prized by both water sport enthusiasts and hydroelectric developers.

According to Hydro-Québec, there is only a passing interest in the Romaine River for canoeing and kayaking activities compared with other rivers in the area (PR3.7, p. 48-64). Some participants disagreed with this opinion, relying on a quantitative analysis to characterize and compare sporting interest in canoeing on the main rivers of Minganie and the entire North Shore (Mr. André Charest and Mr. Yann Troutet, DM58 and DM58.1). According to their analysis, which took into account the length, technical level, frequency and distribution of rapids, the Romaine and Magpie rivers are among the longest and largest rivers in the region that would generate the most interest as whitewater rivers.

Participants asked that, should the project go ahead, the natural course of the Magpie River be protected, both to preserve part of the whitewater in the region and to compensate for the loss of the Romaine River. Whitewater on the Magpie River can be divided into two sections, the Magpie West River (upstream from

60. [Accessed on January 21, 2009: <www.mddep.gouv.qc.ca/biodiversite/aquatique/index.htm>].
61. [Accessed on January 21, 2009: <www.mddep.gouv.qc.ca/biodiversite/reserves-bio/index.htm>].
62. [Accessed on January 21, 2009: <www.mddep.gouv.qc.ca/biodiversite/reserves-eco/index.htm>].

Lake Magpie) and the downstream portion, between Lake Magpie and the St. Lawrence River.

The proposed biodiversity reserve of the massif of lakes Belmont and Magpie would offer little protection to the whitewater section on the Magpie River. The BAPE panel that examined the hydroelectric project at the mouth of the river recommended that the third falls of the river and its rapids be protected (BAPE, Report No. 198, p. 47). Another panel, which analyzed the biodiversity reserve proposal, concluded thus:

> At the same time, the stretch of Rivière Magpie located south of the proposed biodiversity reserve, due to its special nature, should be exempted from future hydroelectric development and should be granted protected status in order to preserve its wilderness aspect and recreation and tourism potential.
> (BAPE, Report No. 236, p. 38)

The MDDEP indicated that it had wanted to extend the biodiversity reserve farther south to achieve this end, but that it had met with opposition from Hydro-Québec (*ibid.*, p. 23). Hydro-Québec, which had indicated that it "[Translation] opposed an extension of the proposed biodiversity reserve to the third falls in light of the attractive short and medium-term hydroelectric potential on that part of the river," confirmed that it was maintaining this position (DQ18.1, pp. 2–3).

Arbitration

Mechanisms announced to help settle on the vocation of the rivers have not been put in place yet. Officials recently expressed that they wanted to speed up hydroelectric development north of the 49th parallel, while protecting half the territory, bringing to the fore the need to determine the vocation of the rivers in terms of hydroelectric development. Almost all the North Shore watersheds are north of the 49th parallel and, as a result, in the territory covered in the Northern Plan (Figure 11). Protecting half the territory could provide an opportunity to ensure the conservation of part of the environmental, land and recreational heritage of North Shore rivers.

- *The panel notes that the portion of North Shore watersheds devoted to hydropower generation is already substantial, particularly among the largest basins. It also notes that this project and the project being prepared on the Petit Mécatina River are likely to increase this portion significantly*

- *The panel notes that an effort has been made to protect some of the heritage of North Shore rivers, but the protection is still largely provisional.*

- ***Opinion** — The panel is of the opinion that harnessing rivers for hydroelectric purposes on the North Shore should be accompanied by the protection, in the*

region, of a natural heritage that is qualitatively and quantitatively equivalent in terms of ecosystem, landscape and recreational richness.

- ***Opinion*** *— The Romaine River, because of its whitewater, has undeniable valued qualities that contribute to the landscape and recreational heritage of North Shore rivers. The panel is therefore of the opinion that if the project goes ahead, a similar river in the region offering comparable aesthetic and recreational features according to recognized criteria in this area should be protected.*

Power transmission lines and substations

Connecting the hydroelectric complex to the power grid would require 161-kV,[63] 315-kV and 735-kV power transmission lines over 500 km long, with rights-of-way between 75 m and 150 m wide, on towers of up to 66 m in height. Permanent substations should also be built at each of the generating stations (DQ9.1, p. 3; Mr. Benoît Gagnon, DT2, pp. 13–14). Modifications or additional equipment would also be needed at the Arnaud, des Montagnais, de Bergeronnes, de Lévis, de la Jacques-Cartier, de Duvernay, de la Chamouchouane, des Laurentides, du Saguenay and de Boucherville substations (DA29, Bulletin No. 1, p. 2).

Electricity produced at the Romaine-1 and Romaine-2 generating stations would be transmitted to the Arnaud substation, and electricity from the Romaine-3 and Romaine-4 stations would be transmitted to the des Montagnais substation (Figure 1). According to Hydro-Québec, the load needs to be distributed this way to meet network reliability and stability criteria and to comply with regulations of North American organizations, which cap the loss of power transmission lines and transformers at 1,000 MW (DA61, p. 5). The 470 km of power lines set up to handle a load of 735 kV, but operated at 315 kV for the project's requirements, would provide some leeway for other potential hydroelectric and wind energy projects on the North Shore (PR5.2, p. 5; Mr. Benoît Gagnon, DT2, p. 18).

The power line and substation construction schedule would be adjusted to that of the work on the hydroelectric complex on the Romaine River (DA29, Bulletin No. 3, p. 6). According to Hydro-Québec, some of the power transmission lines would already be installed at the start-up and commissioning of the Romaine-2 generating station in 2014 (Mr. Benoît Gagnon, DT2, p. 10).

A number of participants at the public hearing, including Parks Canada, are concerned about the potential impact of power transmission lines on the landscape (DB13, p. 6 and appendices 1 and 2). The cumulative effects on

[63]. This 161-kV line, which at first will power the work sites and camps, will permanently link up the Romaine-1 generating station with the existing 161-kV network along Highway 138 (Circuit No. 1652) (PR3.1, p. 1-18).

health and quality of life and on the natural surroundings, including flora, wildlife habitat, woodland caribou and migratory birds, were also expressed as concerns. The proponent's impact study addressed some of the impacts of the transmission lines in terms of cumulative effects.

Nevertheless, the environmental impact of power transmission lines and substations, as well as various modifications to be made to the power grid, would be addressed in a separate assessment, to be submitted to the Quebec Department of Sustainable Development, Environment and Parks in spring 2009 (DA29, Bulletin No. 3, p. 6; Mr. Benoît Gagnon, DT2, p. 13). A number of participants feel that the power transmission lines are a fundamental, integral component of the project and should be included in this review. According to the MDDEP, however, the proponent may submit its hydroelectric complex project separately from a power transmission line project, in accordance with the Quebec *Regulation Respecting Environmental Impact Assessment and Review* [c. Q-2, R. 9] (Mrs. Mireille Paul, DT2, p. 8).

- ***Opinion*** *— In the panel's opinion, the Quebec Department of Sustainable Development, Environment and Parks should examine the relevance of eventually modifying the environmental impact assessment and review process to ensure power transmission line projects are subject to a concurrent environmental assessment.*

Mercury exposure

There is a consensus among public health specialists that the creation of reservoirs leads to higher mercury concentrations in fish. Bacterial decomposition of terrestrial organic matter transforms inorganic mercury into methylmercury. Aquatic organisms assimilate methylmercury, the concentration of which increases at each trophic level of the food chain. As a result, fish that feed on other fish accumulate more mercury than fish that eat insects and plankton (PR3.3, pp. 24-4 and 24-5).

Human exposure to mercury largely stems from eating fish, seafood, waterfowl and marine mammals. The proponent estimates that higher mercury concentrations anticipated in fish as a result of the project would reduce the recommended number of fish meals for up to 28 years (PR3.5, pp. 32-26, 32-27 and 32-31 to 32-33). The proponent plans to regularly monitor mercury levels in fish in the reservoirs and update regional fish consumption guides in co-operation with local public health agencies.

To assess the health risk to local populations as a result of higher mercury concentrations in fish, the proponent has determined the current level of mercury exposure of Havre-Saint-Pierre and Longue-Pointe-de-Mingan residents, as well

as Innu residents of Ekuanitshit. It appears that current levels in the region are low and comparable to those observed elsewhere in Quebec (Mr. Michel Plante, DT1, p. 67). The proponent has also examined the eating habits of residents in terms of wildlife resources. According to the proponent, Havre-Saint-Pierre, Longue-Pointe-de-Mingan and Ekuanitshit residents eat very little of the wildlife resources that would be affected by the project. The total mercury increase for these residents would be on the order of 0.8%, 0% and 3.3%, respectively (PR3.5, pp. 32-5, 32-10 and 32-13).

In light of higher fish mercury concentrations and eating habits, the proponent expects that the project would have only a very small impact on residents' exposure to mercury. This conclusion is based on a pessimistic scenario in which one quarter of the fish currently being eaten would be replaced by fish from the reservoirs (*ibid.*, pp. 32-46 to 32-48). The proponent plans to monitor local residents' exposure to mercury and inform them of the risks and benefits of eating fish.

Health Canada (HC) is satisfied with the proponent's analysis and confirmed at the public hearing that the current level of exposure of residents is low and not a cause for concern. On the basis of the proponent's modelling, the procedure for communicating risks and the environmental follow-up that would be carried out, HC is of the opinion that the level of exposure to mercury would remain low and would not be a cause for concern when the project is completed. HC nevertheless suggested that the situation be monitored to determine when mercury concentration in reservoir fish peaks. Health Canada is part of a working group established with Hydro-Québec and the Direction de santé publique de la Côte-Nord which discusses informing the public about risks (DB17, pp. 3–7).

At the public hearing, the Société pour vaincre la pollution questioned forecast increases of methylmercury in fish and the mercury exposure threshold used by Hydro-Québec to calculate recommended fish consumption (Mr. Daniel Green, DT13, pp. 59–67). Hydro-Québec challenged these views. According to the proponent, it is the amount of organic carbon decomposition that determines the production of methylmercury, not the amount of inorganic mercury in soil, as maintained by the Société pour vaincre la pollution. The proponent's exposure threshold of 14 ppm in mothers' hair corresponds to that of the World Health Organization. Under this threshold, there is no undesirable impact on the foetus (DA64; Mr. Benoît Gagnon, DT13, pp. 70–71).

According to the panel, few people eat fish and other wildlife resources in the area affected by the project, and monitoring and public information mechanisms have been relatively well tested over the 30 years of experience Quebec has acquired in developing hydroelectric reservoirs. The panel therefore relies on

Health Canada's opinion that the mercury exposure level stemming from the project would not create a concern for human health.

At the public hearing, the Government of Newfoundland and Labrador expressed concerns about its residents' exposure to mercury as a result of eating fish from the Romaine 4 reservoir which may migrate to its territory (DM62, p. 5). The proponent agrees that fish may indeed migrate to Labrador to spawn upstream from the reservoir, but notes that these fish would return to the reservoir following the spawning season. The proponent expects that the risk that fishers from Newfoundland and Labrador eat fish with high mercury content would be low, since fishing is not allowed during the spawning season and fish from the reservoir would mingle with local fish that would not have abnormal mercury concentrations (DQ14.1, pp. 6–7).

- *The panel notes that the creation of reservoirs would increase mercury concentrations in fish and would require additional limits on fish consumption. However, given the local population's eating habits, the communication of risks and the monitoring proposed, this increase would not create a concern for human health.*

- ***Opinion** — The panel estimates that there is a low risk of fishers in Newfoundland and Labrador consuming fish containing high mercury concentrations from the Romaine 4 reservoir. As a preventive measure, the panel is of the opinion that monitoring of mercury concentrations in fish should also be carried out in watercourses situated close to the Quebec–Newfoundland and Labrador border. If applicable, measures should be taken to inform the people who use this area of the potential risks they could face.*

Greenhouse gas emissions

In 2006, greenhouse gas (GHG) emissions in Canada stemming from electricity production accounted for 16.4% of total emissions in the country, or 118 Mt of CO_2eq.[64] This figure does not include emissions from hydropower generation. GHGs associated with this type of energy are mainly attributable to the production of organic carbon created by decaying biomass after land is flooded. Canada does not quantify the amount of GHGs emitted this way in the national GHG inventory kept by Environment Canada.

When we compare GHG emissions from hydropower generation with other means of electricity generation, the former emits fewer GHGs than thermal power generators that use fossil fuels. In Quebec, where the main source of electricity comes from the hydroelectric sector, GHG emissions declined by about 1% between 1990 and 2006 (from 82.7 Mt CO_2eq to 81.7 Mt CO_2eq),

[64]. [Accessed on February 16, 2009: <www.ec.gc.ca/pdb/ghg/inventory_report/2008_trends/trends_eng.cfm>], Annex 1.

despite economic growth. This is mainly attributable to the fact that hydroelectricity is the main source of energy for the residential, industrial and commercial sectors in the province and that this type of energy's share of total energy consumption increased in the period concerned.[65]

In its analysis of the project's cumulative effects, the proponent did not consider GHG emissions, which it deems to be substantially lower than those from fossil fuel generators (DA20.2; PR9.3, p. 100; Duchemin, 2001). For hydroelectric complexes in northern environments, the standard emission factor is 15 grams of CO_2eq/kWh, which is 30 to 60 times less than the factors used for fossil fuel–generated energy. In their life-cycle analysis of the hydroelectric reservoirs, however, Gagnon and Van de Vate (1997) have shown that emissions during construction phases are insignificant.

Although GHG emissions are not quantifiable for hydropower generation, GHGs are generated during the construction and operation of hydroelectric structures (Duchemin, 2001).

Construction of the entire project is expected to take about 11.5 years. The proponent estimates that GHG emissions from fuel consumption would amount to slightly over 85,000 t CO_2eq during the construction phase. To this must be added 53,420 t CO_2eq generated by the production of cement for the construction of dams and generating stations. Fuel quantities consumed by vehicles and helicopters would also be monitored (PR9.4, pp. 75–76).

- ***Recommendation*** *— The panel considers that greenhouse gas emission monitoring planned by the proponent during the construction phase of the project is essential. The panel recommends that this information be communicated to Environment Canada and the Quebec Department of Sustainable Development, Environment and Parks in order to document the relative contribution of the hydroelectric facilities to the provincial and national greenhouse gas inventories.*

Productive forest land would be cleared prior to impoundment of the reservoirs to mitigate the loss of forest resources. Depending on their stage of development and geographic location, forests can be either GHG sinks or GHG sources. On average, high-growth forests that are younger than 50 years are GHG sinks, while mature forests are carbon neutral. Forests are considered to be carbon neutral over their entire life cycle (100 to 150 years); in other words, all the carbon they absorb returns to the atmosphere when they decay or as a result of fires (PR9.3, p. 4).

[65]. [Accessed on February 16, 2009: <www.ec.gc.ca/pdb/ghg/inventory_report/2008_trends/trends_eng.cfm>], Chapter 3.

According to the proponent, natural aquatic environments (lakes, rivers, estuaries, swamps, beaver ponds and oceans) generally emit significant quantities of greenhouse gases (PR3.7, p. 49-1). For this project, the proponent estimates that combined CO_2 and CH_4 emissions are currently between 5,050 t and 24,000 t CO_2eq per year in aquatic environments affected by the project, in part made up of existing bodies of water of about 55 km^2 in surface area. These measurements are based on the gross mean flux measured on Quebec's natural lakes and a 150-day ice-free season.

Part of the project would be located in forests, burned areas and peatland, making up a total surface area of 224 km^2. Taking into account gross mean fluxes of Canadian boreal forests and peatlands and a growth period of 180 days, the proponent estimates gross annual emissions to be between -59,000 t and 52,500 t CO_2eq (CO_2, CH_4 and N_2O) for land environments affected by the project. When we combine both natural environments (aquatic and land), annual gross emissions range between -54,000 t and 76,500 t CO_2eq; in other words, there is a great deal of uncertainty, depending on the natural environments in question, and natural areas may be either carbon sources or carbon sinks (*ibid.*, p. 49-2). On the basis of available information, it is not possible to assess the impact of changes to land and aquatic environments following forest clearing and the impoundment of reservoirs on GHG emission and capture levels.

According to the proponent, since a small surface area of land would be flooded by the reservoirs and the residence time would be relatively short (433 days), GHG emissions are expected to be low. Taking into account the maximum surface area of the reservoirs (279 km^2), gross mean flux measurements of CO_2 on Quebec's reservoirs and a 150-day ice-free season, annual gross emissions would be between 150,000 t and 475,000 t CO_2eq (CO_2 and CH_4) at maximum GHG emissions during the operating phase and between 61,000 t and 78,000 t CO_2eq subsequently. Emissions would therefore increase rapidly and represent four to five times the emissions of the natural environment, before gradually decreasing within 5 years for CH_4 and 10 years for CO_2. The proponent estimates that, after 10 years, emissions would therefore be similar to those of the natural environment before impoundment (*ibid.*, pp. 49-2 to 49-4). In comparison, these emissions are much lower than those generated by gas fired plants and, especially, coal-fired power plants (DA20.2). It is also important to mention that, of Quebec's hydroelectric complexes, the Romaine complex would be among the smallest in terms of reservoir surface area, with a ratio of 35 km^2/TWh (DQ22.1, pp. 2–3).

- *The panel notes that the hydroelectric complex is likely to produce greenhouse gases during its initial years of operation. Emissions would peak 10 years after the complex goes into operation, after which they would drop back to a level equivalent to the emissions rate in the natural environment.*

- ***Recommendation*** *— The panel recommends that the proponent validate its greenhouse gas emission forecasts. Environment Canada should require accountability for greenhouse gas emissions at Canadian hydroelectric facilities in the national Greenhouse Gas Inventory, during both the construction and operation of the hydroelectric generating stations.*

The capacity of renewable resources to meet current and future needs

Under the *Canadian Environmental Assessment Act*, the panel is required to assess how renewable resources likely to be greatly affected by the project would be able to meet current and future needs.

Fish populations in the reservoirs are deemed to be the only renewable resources to be affected in the long term, after implementation of mitigation measures, within the meaning of the Act. In spite of the fact that the relative abundance of species would vary under the new conditions created by the impoundment of the reservoirs, the proponent feels that proposed mitigation and compensation measures would ensure the survival of the resource (PR3.7, p. 50-3).

Specifically, the proponent believes that measures proposed for valued salmonid species, including the brook trout, Arctic char and Atlantic salmon, would preserve populations following the completion of the project. The proponent and specialized departments are still discussing some measures so as to minimize the environmental impact and maximize their effectiveness. Spending by the proponent on salmon monitoring, restoration and enhancement programs, in which Minganois and Innu representatives should be able to participate, would also enhance scientific knowledge of salmon populations in the Romaine River and thus benefit fishers in the future.

- ***Opinion*** *— The panel is of the opinion that the project would not have an impact on the capacity of renewable resources likely to be significantly affected by the project to meet the needs of current and future generations if the mitigation and compensation measures proposed by the proponent and the panel are put in place.*

Fishery resources of the Gulf of St. Lawrence

A number of participants at the public hearing expressed their opinions about the cumulative effects of hydroelectric developments and the flow regulation of St. Lawrence tributaries and the Great Lakes on the St. Lawrence River and Gulf in the past century.

A number of scientific articles[66] that discuss potential cumulative effects on the St. Lawrence River were submitted. The main argument is that the development of reservoirs has held back both a large portion of the spring flood, reducing freshwater inflow in the Gulf of St. Lawrence in the spring, and matter retention (silica, nutrients and particles) that plays a role in primary biological production in brackish and salt water and contributes to bank stability.

In its impact study, the proponent states that "[Translation] hydrological conditions were not treated as valued environmental components in the assessment of cumulative effects, as they would not have an impact on water circulation in general nor on primary and secondary biological production in the Gulf of St. Lawrence" (PR9.3, p. 8). The proponent's reasoning is largely based on the fact that natural inflows of silica and nutrients from the Romaine River are low compared with those of marine currents and that the spring plankton bloom and flooding of the river occur at different times.

The scientific documentation deals with changes to biological production in the St. Lawrence ecosystem and attempts to establish links with flow regulation. Hypotheses and correlations are based on observations, but the documentation does not provide a validated quantification of cumulative effects in relation to flow regulation. Although spring floods stored in the Great Lakes and St. Lawrence tributaries can be analyzed reliably, it still is not possible to assess the cumulative effect of this storage on the physicochemical parameters of the Gulf of St. Lawrence and, as a result, on fishery resources. It is even more difficult to establish links between this project and potential cumulative effects.

Wide-scale shoreline erosion around the Gulf of St. Lawrence should nevertheless be addressed, as this issue was raised at the public hearing. The proponent does not see a causal link with hydroelectric dams and does not expect the project to contribute to shoreline erosion in the Gulf of St. Lawrence. None of the participants concerned about shoreline erosion submitted studies at the public hearing or demonstrated that major North Shore hydroelectric developments had exacerbated the problem.

Two specific cases were reported on rivers with hydroelectric developments. One was at the mouth of the Sainte-Marguerite River and dealt with the erosion of several hundred metres of shoreline. Hydro-Québec is currently assessing the situation to determine whether the dams on this river are partly to blame (Mr. Benoît Gagnon, DT1, p. 94). The other case concerns the river mouth of the Aux Outardes River (Mr. Jean Daniel Ngatcha Kuipou, DT13, p. 54). In both cases, the erosion is limited to the mouth, and it is difficult to extrapolate them to provide a partial explanation for the widespread problem of hundreds of kilometres of

[66]. Including Rosenberg et al. (1997), Rosenberg et al. (2000), Gibson (2006), Neu (1982a and b), Drinkwater (1987), Bernatchez and Dubois (2004), Keith et al. (2008), Stoneman (2005).

eroded shoreline around the Gulf of St. Lawrence[67] or to establish a cumulative link with this project, which is located hundreds of kilometres to the east.

- ***Opinion*** *— The panel is unable to assess the project's cumulative effect on the Gulf of St. Lawrence and its fishery resources due to a lack of data and studies.*

The lack of scientific studies demonstrating cumulative effects in the St. Lawrence River does not mean that there are no cumulative effects stemming from hydroelectric developments and St. Lawrence flow regulation. The existence of scientific articles on the subject provides justification for taking an interest, especially at Fisheries and Oceans Canada (DFO), whose mission is to maintain healthy and productive aquatic ecosystems as well as sustainable fisheries and aquaculture. DFO has indicated to this effect that, "[Translation] in light of the dynamics of the St. Lawrence River and the Romaine River's small contribution in nutrient salts, the impact of the project's structures on marine biogeochemistry would be rather small and localized. Nevertheless, the cumulative effects of all the dams on the biogeochemistry of the St. Lawrence River are still unknown" (DB18, p. 36). In addition, DFO recently established the Centre of Expertise on Hydropower Impacts on Fish and Fish Habitat (CHIF).[68] Two research projects stemming from the Centre's 2008–2009 business plan deal with this issue:

- Characterization of the natural flow regime in eastern Canadian rivers and ecologically relevant flow indices for improved instream flow studies ;

- Quantification of natural freshwater flows in the St. Lawrence watershed in natural and controlled situations.

This research may eventually provide a clearer picture of the impact of flow regulation on freshwater inflows in the St. Lawrence River, Estuary and Gulf, and delve into the cumulative effects of major hydroelectric developments on the biophysical environment. Ecological indicators would also help quantify cumulative changes and potentially allow for a consensus to be reached on effects thresholds that should not be exceeded, two fundamental aspects of the assessment of cumulative effects on the environment.

67. Ouranos (2008).

68. [Accessed on January 7, 2009: <www.qc.dfo-mpo.gc.ca/iml/en/centres/chip/mandat.htm; www.qc.dfo-mpo.gc.ca/iml/en/centres/chip/CHIF-final-plan.pdf>].

Chapter 8 Monitoring and Follow-up

As prescribed by the *Canadian Environmental Assessment Act,* the panel studied the measures that the proponent intends to put in place for monitoring and follow-up purposes; it also looked at decommissioning jobsites and dams.

Decommissioning

The proponent intends to build two work camps for its jobsite facilities. The first, the Murailles camp, would be used from 2009 to 2016. The second, the Mista camp, would be built for the 2012–2020 period. Each camp would have its own drinking water and wastewater pumping and treatment facilities.

Jobsite and camps

The Murailles work camp would be used by workers assigned to the Romaine-1 and Romaine-2 jobsites, while the Mista camp would be used by workers assigned to the Romaine-3 and Romaine-4 sites. The proponent indicated that both camps would be decommissioned after construction is completed. The land would be redeveloped and reforested (PR3.1, p. 14-5). In addition, a permanent accommodation centre would be erected near the Mista camp for employees operating the Romaine River complex. When asked about the possibility of building a permanent camp instead of the Mista work camp, the proponent indicated that, when the permanent camp is designed, the possibility of using temporary facilities would be reviewed, but that they were generally intended for other work sites, because the standards for permanent camps differ from those of temporary camps (PR5.1, p. 58). Hydro-Québec has plans for decommissioning the camp sites and redeveloping the sites, as well as restoration criteria that are properly governed by standard clauses.

In the event of a spill of contaminated substances, the proponent's study provides for the disposal of contaminated soil in accordance with the *Soil Protection and Contaminated Sites Rehabilitation Policy* and the *Regulation Respecting the Burial of Contaminated Soils* [c. Q-2, r. 6.01]. However, it provides no indication that there would be a verification of the existence of residual contamination after the completion of the work, which would be carried out over a number of years, nor of the work sites, where hazardous materials would be stored (PR3.7, p. 14-3; PR3.8, appendices E-42 to E-44).

- ***Opinion —*** *The panel is of the opinion that Hydro-Québec should plan on conducting a site environmental assessment of its work sites and camps to ensure that there is no residual contamination after the work is completed, and that it submit the results of the assessment to the Quebec Department of Sustainable Development, Environment and Parks.*

Dams and generating stations

The proponent submitted that the lifespan of the hydroelectric facilities is at least 50 years. A lifespan of nearly a hundred years is not uncommon because of the possibility of rebuilding dams (Gagnon and Van de Vate, 1997). The panel agrees that it would be premature to prepare a plan for dismantling the facilities.

Nevertheless, the proponent would have to submit decommissioning plans to Fisheries and Oceans Canada, Transport Canada and the Quebec Department of Sustainable Development, Environment and Parks, and comply with the regulations in force at the time the hydroelectric complex facilities are decommissioned.

Waste management

Waste generated in the temporary camps would be managed according to the type of waste: household waste, tires and metallic waste, and dry materials and hazardous materials (PR3.1, p. 14-3). Construction waste would be managed on site according to Hydro-Quebec's standard waste management clauses (PR3.8, Appendix E).

Household waste and dry materials from the work camps would be buried in trench landfills authorized under the provisions of the *Regulation Respecting the Landfilling and Incineration of Residual Materials* [c. Q-2, r. 6.02] (PR3.1, p. 14-3 ; PR5.1, p. 61-62). The proponent is also considering the possibility of having household waste from the Romaine-1 and Romaine-2 jobsites sent to the intermunicipal management board's engineered landfill site, and construction waste to a dry landfill.

At a public hearing, the Municipality of Havre-Saint-Pierre indicated that the intermunicipal management board to which it belongs has had its own landfill that meets regulatory requirements since November 2008 (Municipality of Havre-Saint-Pierre, DM17, p. 5). The proponent is not planning to do any recycling or composting because of the camps' remote location. Rather, it expects contractors to optimize waste management because of the facilities' remote location and to reuse certain waste materials elsewhere in the construction when possible.

- ***Opinion —*** *The panel is of the opinion that Hydro-Québec should prepare a comprehensive waste management plan and hold discussions with the Municipality of Havre-Saint-Pierre to determine the feasibility of using the regional engineered landfill site.*

Environmental monitoring

Environmental monitoring is a method for verifying compliance with the proponent's undertakings and the requirements of departments issuing permits. From the moment the

plans and specifications are prepared and while the work is being carried out, Hydro-Québec would ensure that its employees and contractors comply with the acts and regulations in force (PR3.7, p. 47-1).

Hydro-Québec has undertaken to ensure that its contractors comply with the standard clauses through monitoring by environmental advisors on site.

Environment Canada has asked Hydro-Québec to revise its standard clauses before the work begins to be in compliance with federal environmental standards (PR9.2, p. 57). At the annual review of its standard clauses, Hydro-Québec also undertook to consider the changes made to Quebec's regulations.

Environmental monitoring and follow-up committees

Follow-ups are done to verify whether the findings of the environmental assessment are accurate and whether mitigation measures are effective.

The proponent has prepared a detailed program of the measures it intends to put in place, follow-up objectives and methods for measuring results (PR3.7, pp. 47-2 to 47-24). Some of the follow-ups would begin during the first phases of construction and would end no later than 2039. The proponent mentions that the duration and frequency of the follow-ups could vary with the results.

The details of Hydro-Québec's follow-up programs do not describe the measures that would be put in place if the mitigation measures do not meet the objectives (PR3.7, p. 47-2).

Hydro-Québec also intends to set up a number of committees to deal with the community and the socio-economic monitoring. It also intends to meet with local public health agencies to monitor mercury levels (PR3.5, p. 32-22).

Some participants in the public hearings declared there was a need to monitor certain wildlife and fish species, and offered to participate in any future committees related to hunting and fishing activities. In many cases, the results of the follow-ups would be of public interest, and would be an opportunity to inform the public and users of the land about the performance of mitigation measures.

- ***Recommendation*** *— The panel recommends that the departments responsible for issuing permits, namely Fisheries and Oceans Canada, Transport Canada and the Quebec Department of Sustainable Development, Environment and Parks, ensure that*

the proponent's monitoring results and reports are released to the public and made easily accessible.

Conclusion

The mandate of the BAPE Review Panel and the Joint Review Panel was to review and hold public hearings on the proposed development of a hydroelectric complex on the Romaine River. On the basis of the concerns and views expressed at the public hearings and of its own review, the panel focused on a certain number of issues and analysed the impact of the project on those issues. However, some of the issues raised by the participants fell outside the scope of its mandate, in particular Hydro-Québec's decision to develop hydropower rather than another energy source. That decision arose from a Quebec government statement that was debated in a parliamentary committee and was the subject of public consultation, and which led to the publication, in 2006, of an energy strategy, which is referred to by the panel. Moreover, the transmission lines that would connect the power plants to the Quebec power grid are part of a separate environmental assessment process.

On completion of its analysis, the review panel concluded that the project fulfills three of the objectives of the Quebec energy strategy, namely to enhance security of energy supply, to make greater use of energy as an engine of economic development, and to give a greater role to local and regional communities and Aboriginal groups. To achieve these objectives, the Strategy calls, among other things, for an acceleration of development to enhance electricity exports in the short-term market. Moreover, because it is intended to produce electricity to respond, with flexibility, to daily or seasonal fluctuations in the demand of the target markets, the only feasible alternative to the project would be another similar hydroelectric project.

With regards to the project's effects on the natural environment, additional measures are required of the proponent to protect woodland birds and waterfowl. The same holds for offsets for the loss of salmonid fish habitat and wetlands caused, primarily, by the creation of four reservoirs.

One case that should be mentioned is the mitigation of impacts on salmon in the lower reach of the Romaine River. There is not yet any consensus between the proponent and the departments involved, namely Fisheries and Oceans Canada, the Quebec Department of Sustainable Development, Environment and Parks and the Quebec Department of Natural Resources and Wildlife, on the probable extent of the impact or on the implementation of certain mitigation measures, in particular the impacts to the future thermal regime of the river. These measures, while they must be effective, should be realistic from a technical and economic standpoint. If they are not, the parties concerned should examine other avenues, such as compensation in a tributary or adjacent river.

For the marine environment at the mouth of the Romaine River, the proponent's forecasts involve some uncertainty as to the project's effects on certain valuable species, such as terns, capelin or eelgrass beds. A specific follow-up program is

therefore required for that environment, supplemented if necessary by compensatory or corrective measures.

The project would probably create many jobs locally and generate increased demand for commercial and social services. This economic stimulus would provide opportunities for the municipalities and Innu communities of Minganie. In this context, the communities and workers could receive support from the proponent, but they would also need the support of the relevant government agencies if they are to take full advantage of the project's economic benefits and ensure that the social and personal issues that could arise from its implementation are quickly identified and addressed.

During its construction and operation, the project would disrupt land users, as well as alter portions of the Romaine River and its watershed that are used by Innu and non-Aboriginals. In this context, the emphasis must be on user safety. The proponent has therefore been asked to make various adjustments to measures relating to project implementation, and would need to promptly inform users on the progress of the work so that they can govern themselves accordingly. Finally, for the same reasons, the results of environmental follow-ups should be made public and distributed without delay.

There are no studies or information to show that development of large dams in the St. Lawrence River system cause cumulative, large-scale effects, or to relate this project to such effects. However, scientific concerns do warrant the decision by Fisheries and Oceans Canada to embark on a study of the effects of hydroelectric development on the St. Lawrence River. Project implementation could nonetheless contribute to a cumulative anthropogenic effect on the Woodland Caribou, considered endangered by the governments of Quebec, Newfoundland and Labrador, and Canada. The creation of protected areas for Woodland Caribou could eventually constitute a recovery measure for the population.

It would also be appropriate for the government to include, in its plan for the economic development of the resources of northern Quebec and ecological land protection, measures to protect environments similar to those affected by the major projects. At the same time that hydroelectric development is taking place, rivers could be afforded heritage protection.

Finally, with regards to the requirements of the *Canadian Environmental Assessment Act*, the review panel concludes that the project is unlikely to produce significant adverse environmental effects. However, this conclusion is conditional on the implementation of the mitigation, compensation and follow-up measures planned by the proponent, as well as those proposed by the panel.

Done at Quebec City,

BAPE Commission

Michel Germain, Chair

Louis Dériger, Commissioner

Joint Review Panel

Michel Germain, Chair

Jean-Guy Beaudoin, Panel Member

Louis Dériger, Panel Member

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Appendix 1

Information on the Mandates

Public hearing applicants

Rivers Foundation
Anne-Marie Saint-Cerny

Hydro-Québec
Réal Laporte

Minganie RCM
Pierre Cormier

Nature Québec
Charles-Antoine Drolet

Mandates

The mandate entrusted to the Bureau d'audiences publique sur l'environnement, under the Quebec *Environment Quality Act* [R.S.Q., c. Q-2] was to hold public hearings and to report its findings and analyses to the Minister of Sustainable Development, Environment and Parks.

The mandate entrusted to the Joint Review Panel under the Canada-Quebec Agreement on Environmental Assessment Cooperation of May 2004 was to conduct a public review of the project in compliance with the requirements of the *Canadian Environmental Assessment Act* [L.C. 1992, c. 37] and the Quebec *Environment Quality Act*.

The mandates began on October 27, 2008.

The Commission, Review Panel and team members

BAPE Commission

Michel Germain, Chairman
Louis Dériger, Commissioner

Joint Review Panel

Michel Germain, Chairman
Jean-Guy Beaudoin, Panel Member
Louis Dériger, Panel Member

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Hélène Marchand, Publishing Manager

Public hearings

Preparatory meetings

October 8 and 9, 2008 — Preparatory meetings held in Quebec City

First round

October 27 to 30, 2008
Basement of Saint-Pierre Church
Havre-Saint-Pierre

Second round

December 2, 2008, at 1:30 p.m.
Ekuanitshit Community Hall
Mingan

December 2 to 4, 2008
Community Hall, Denis Perron Arena
Havre-Saint-Pierre

December 9 and 10, 2008
Place de Ville
Sept-Iles

Proponent

Hydro-Québec

Benoît Gagnon, Spokesperson
Michel Bérubé
Alain Bourbeau
Christian Brosseau
Catherine Brouillard
Henri-Paul Dionne
Louise Émond
Danielle Messier
Michel Plante
Isabelle Thériault
Françoise Trudel

Resource people

	Brief
Louis Breton, Spokesperson Daniel Bergeron Mark Dionne Judy Doré	Environment Canada

Mireille Paul, Spokesperson Isabelle Auger Sylvain Boulianne François Delaître Pierre-Michel Fontaine Carl Ouellet	Quebec Department of Sustainable Development, Environment and Parks	
Marilène Laroque	Quebec Department of Health and Social Services	
François Barnard Gilles Gaudreault Donald Gingras Daniel Poirier Taoufik Sassi	Quebec Department of Natural Resources and Wildlife	
Marc Larin	Quebec Department of Transport	
Denis Buteau Pierre Cormier Jean-François Girard Nathalie de Grandpré	Minganie RCM	DM52
Danys Jomphe Gaétan Tanguay Gilles Thibeault	Municipality of Havre-Saint-Pierre	DM17
Yann Troutet	Parks Canada	
Dominic Boula Alain Kemp Stéphanie Rioux Simon Trépanier	Fisheries and Oceans Canada	
Lucie Pagé, Spokesperson René Laperrière	Transport Canada	

Participants

	Brief
Sylvie Angel	DM82
Pierre Barriault and Raynald Thériault	DM109
Carle Bélanger	DM100
Nicolas Boisclair	

Jean-François Bourdon	DM102
Mathieu Bourdon	DM61
Philippe Bourdon and Thomas Buffin-Bélanger	DM114
Gaétan Cassivy	DM28
Jean Cassivy	
André Charest and Yann Troutet	DM58 DM58.1
Lionel L. Cormier	DM81
Guylaine Côté	DM115
Lorraine Côté	
Paul de Bané	DM34
René Desbiens	
Étienne d'Hauterive	DM92
Simon d'Hauterive	DM99 DM99.1
Sophie England and Martin Desrosiers, Julie Lanthier and Christophe Rolland, Christian Morissette	DM112
Jean-Guy Fortin and André Vigneault	DM21
Carole Gasse	
Guy Giasson	
F. Pierre Gingras and Roger F. Larivière	DM23
Chantal Guillemette	DM105
Laurent Jomphe and Joël Landry	DM88
Réal Jomphe	
Ilya Klvana and Amélie Robillard	DM97
Ed Labenski	DM68
Pierre Lévesque	DM84

Claude Lussier		DM113
Joël Malec		
Serge Marchand		DM37 DM37.1
Denis McCready		
Sylvain Roy		DM83
Raynald Thériault		
Yves Thériault		Verbal
Pauline Vachon		DM95
Monique Vanbugghe		DM107
Patrick Vibert		DM86
Lorraine Vigneault		
Agence de la santé et des services sociaux de la Côte-Nord		DM38
Air Labrador		DM3
Alliance Romaine	Fran Bristow	DM43 DM43.1
Aluminum Association of Canada		DM14
Association chasse et pêche de Havre-Saint-Pierre	Denis Boudreau Yves Thériault	DM26
Association communautaire du lac Daigle	Dany Levesque Roberto Stéa	DM31 DM31.1
Association de l'industrie électrique du Québec	Louis Bolullo Paul Hudon Jean-François Samray	DM63 to DM63.2
Association de Québec solidaire Duplessis	Olivier Noël	DM59
Association des commissions scolaires de la Côte-Nord	Lucy de Mendonça Luc Noël Rodrigue Vigneault	DM39
Association des constructeurs de routes et grands travaux du Québec	Denis Turgeon	DM32

Association des pêcheurs de Havre-Saint-Pierre		DM6
Association of Consulting Engineers of Quebec	Sylvain Brisson Jacques Parent	DM55
Associations touristiques régionales de Manicouagan et de Duplessis	Denis Cardinal Marie-Soleil Vigneault	DM79
Atlantic Salmon Federation and Fédération québécoise pour le Saumon atlantique	Charles Cusson Michel Jean	DM104
Caisse populaire Desjardins de Sept-Îles		DM11
Canadian Hydropower Association	Gabrielle Collu	DM29 DM29.1
Centre de la petite enfance Picassou		DM71
Centre de plein air de la Minganie		DM90
Centre de santé et de services sociaux de la Minganie	Carold Boies Danièle Limoges Jean Parisée	DM33
Centre Le volet des femmes		DM1
Centre local de développement de la Basse-Côte-Nord	David Calderisi	DM47
Centre local de développement de la MRC de Caniapiscau		DM96
Centre local de développement de la MRC de Sept-Rivières inc.		DM64
Centre local de développement Minganie	Carold Boies Claudia Carbonneau Jean-François Girard	DM54
Chambre de commerce de Havre-Saint-Pierre	Richard Boudreau	DM73
Chambre de commerce de Manicouagan	Marcel Cadoret	DM42
Chambre de commerce de Port-Cartier and Corporation de développement économique de la région de Port-Cartier	Yves Desrosiers Bernard Gauthier Michel Gignac	DM40
Club d'ornithologie de la Côte-Nord		DM22

Club optimiste de Havre-Saint-Pierre		DM9
Coalition pour la réalisation du projet Romaine	Patric Frigon Georges-Henri Gagné	Verbal
Comité de spectacles de Havre-Saint-Pierre	Ariane Prévéneault Claudia Richard	DM13
Conférence régionale des élus de la Côte-Nord	Georges-Henri Gagné Patrick Hamelin	DM51
Conférence régionale des élus du Saguenay–Lac-Saint-Jean and Lac-Saint-Jean Montagnais Council	Gilbert Dominique Réjean Laforest	DM67
Conseil central Côte-Nord	Réjean Bradley	DM80
Conseil des maires de la Basse-Côte-Nord	Randy Jones Karine Monger	DM48
Conseil provincial du Québec des métiers de la construction (international)	Donald Fortin France Hudon	DM66 DM66.1
Conseil régional de l'environnement de la Côte-Nord and Regroupement national des conseils régionaux de l'environnement du Québec	Philippe Bourke Sébastien Caron Patrick Déry	DM65
Construction Leclerc & Pelletier Inc.		DM18
Corporation de développement économique de Havre-Saint-Pierre	Nico Flowers	DM53
Corporation de développement économique Ekuanitshinnuat Inc. and Société de gestion Ekuanitshinnuat Inc.	Yves Bernier Ghislain Piétacho	DM76
Corporation de développement et de gestion du port de Havre-Saint-Pierre		DM98
Corporation des services universitaires du secteur ouest Côte-Nord	Jean Daniel Ngatcha Kuipou	DM41 DM41.1
Corporation Nishipiminan	Andras Mak Vincent Napish	DM75
Côte-Nord Community Futures Development Corporation		DM24 DM24.1
Distributions J.R.V. Inc.		DM12
Ekuanitshit Innu community	Louis Lalo Patrick Michel	Verbal

	Raphaël Mollen	
Ekuanitshit Innu Council	Vincent Napish David Schulze	DM74
Entreprise Simco		DM7
Express Havre-Saint-Pierre		DM20
Fédération des chambres de commerce du Québec		DM25
Fédération des chasseurs et pêcheurs de la Côte-Nord		DM116
Fédération des travailleurs et travailleuses du Québec; Conseil régional FTQ Haute-Côte-Nord, Manicouagan; and Conseil régional FTQ Sept-Îles et Côte-Nord	Daniel Blais Réjean Gérard Roland Labonté Bertrand Méthot Charlène Sirois	DM72
Governing board, École Saint-François-d'Assise, Longue-Pointe-de-Mingan		DM108
Government of Newfoundland and Labrador	Charles Bown Don Burrage Sean Dutton Martin Goebel	DM62
Green Party of Canada and Green Party of Quebec	Jacques Gélineau	DM70 DM70.1
Group of residents from Mingan		DM93
Groupe de recherche appliquée en macroécologie	Jean-François Lefebvre	DM56 to DM56.2
Groupe of residents from the village of Magpie		DM103
Groupe-conseil TDA	Sylvain Brisson Jacques Parent	DM78
Héli-Excel inc.		DM10
Innu of Ekuanitshit (elders, children, youth, men and women)	David Basile Rita Mestokosho	DM77
Jeune chambre de commerce de Sept-Îles		DM27
Jeune chambre de Manicouagan	Patric Frigon Josée Parisée	DM57

Le Blizzard deHavre-Saint-Pierre snowmobile club	Steeve Arsenault André Thériault	DM35
Les AmiEs de la Terre de Québec		DM91
Location d'autos b.c. Inc.		DM4
Marché Vigneault	Daniel Dresdel Karine Vigneault	DM19
MNA for Duplessis	Lorraine Richard	Verbal
Mouvement Au Courant	John Burcombe	
Multi Meubles Havre-Saint-Pierre		DM110
Municipality of Île-d'Anticosti		DM30
Municipality of Rivière-au-Tonnerre	Carmelle Anglehart Anne-Marie Boudreau Jeannot Boudreau	DM16
Municipality of Rivière-Saint-Jean		DM87
Nature Québec		DM111
Nemetau		DM15
Nutashkuan Innu community	Jean Malec	
Nutashkuan Montagnais Council	François Bellefleur Daniel Malec	DM45
Pakua Shipi and Unamen Shipu Innu Councils and their representatives	Guy Bellefleur Dominique Lévesque Pascal Mark Richard Mollen Andrew Poker Ken Rock Alain Sachel Alfred Tenegan	DM94
Political and economic stakeholders from Sept-Îles: Chambre de commerce de Sept-Îles Inc., Corporation de promotion industrielle et commerciale de Sept-Îles Inc., and the City of Sept-Îles	Luc Dion Ghislain Lévesque Denis Smith	DM69
Porlier Express Inc.		DM2
Québec Labradorite Inc.	Mario Picard	DM49

	Daniel Scherrer	
Quebec Manufacturers and Exporters		DM60 DM60.1
Quincaillerie Vigneault		DM89
Regroupement des jeunes chambres de commerce du Québec	Maxime Bernard Éric Paquet	DM85
Regroupement Mamit Innuat Inc.	Sylvie Basile Jeannine Bellefleur	DM50
Rivers Foundation	Réal Reid Anne-Marie Saint-Cerny	DM101
Société historique de Havre-Saint-Pierre		DM8
Société pour vaincre la pollution	Daniel Green	DM106
Socio-economic partners of the Manicouagan RCM: Centre local de développement de Manicouagan, Service d'actions entrepreneuriales Manicouagan and Manicouagan Community Futures Development Corporation	Patrick Ferrero Martin Ouellet Pierre Rousseau	DM36 DM36.1
Tecsult Inc.	Michael Cosgrove	DM46
Uashaunnuat, Takuaikan Innu Council Uashat mak Mani-Utenam and some Innu families in the community	Jean-François Bertrand Jonathan McKenzie Lyne Morissette James O'Reilly	DM44
Vitrerie Norcristal		DM5

In all, 116 briefs, including 57 presentations at the public hearings, were submitted to the panel, as well as 4 verbal opinions. With respect to the briefs that were not submitted at the hearings, the panel took measures to confirm their authorship**.**

Appendix 2

Documentation

Consultation centres

Louis-Ange-Santerre Library
Sept-Îles

Natashquan Innu Council
Natashquan

Unamen Shipu Innu Council
La Romaine

Canadian Environmental Assessment Agency
Quebec City

Université du Québec à Montréal
Montreal

Ekuanitshit Innu Council
Mingan

Pakua Shipu Innu Council
Pakua Shipu

Municipality of Havre-Saint-Pierre
Havre-Saint-Pierre

BAPE Office
Quebec City

Documentation submitted in conjunction with the project under consideration

Procedure

Federal registry ref.	BAPE Ref.	
	PR1	HYDRO-QUÉBEC PRODUCTION. *Avis de projet*, March 2004, brochure.
	PR2	MINISTÈRE DU DÉVELOPPEMENT DURABLE, DE L'ENVIRONNEMENT ET DES PARCS. *Directive du ministre indiquant la nature, la portée et l'étendue de l'étude d'impact sur l'environnement*, April 2004, 27 pages.
57	**PR3**	HYDRO-QUÉBEC PRODUCTION. *Documentation relative à l'étude d'impact déposée au ministre du Développement durable, de l'Environnement et des Parcs*.
57-1	**PR3.1**	*Volume 1 – Vue d'ensemble et description des aménagements*, December 2007, various pagings.
57-2	**PR3.2**	*Volume 2 – Milieu physique*, December 2007, various pagings.
57-3	**PR3.3**	*Volume 3 – Milieu biologique (1 of 2)*, December 2007, various pagings.
57-4	**PR3.4**	*Volume 4 – Milieu biologique (2 of 2)*, December 2007, various pagings.
57-5	**PR3.5**	*Volume 5 – Milieu humain, Minganie*, December 2007, various pagings.
57-6	**PR3.6**	*Volume 6 – Milieu humain, communautés innues et archéologie*, December 2007, various pagings.

PR3.6.1 *Information complémentaire relative à la communauté de Pakua Shipi*, April 2008, 33 pages.

57-7 **PR3.7** *Volume 7 – Bilan des impacts et des mesures d'atténuation*, December 2007, various pagings.

57-8 **PR3.8** *Volume 8 – Annexes*, December 2007, various pagings.

57-9 **PR3.9** *Volume 9 – Méthodes*, December 2007, various pagings.

57-10 **PR3.10** *Volume 10 – Cartes en pochette*, December 2007.

PR3.11 HYDRO-QUÉBEC PRODUCTION. *Résumé*, August 2008, 119 pages.

PR5 MINISTÈRE DU DÉVELOPPEMENT DURABLE, DE L'ENVIRONNEMENT ET DES PARCS. *Questions et commentaires adressés au promoteur*, May 2, 2008, 58 pages.

PR5.1 HYDRO-QUÉBEC PRODUCTION. *Réponses aux questions et commentaires du ministère du Développement durable, de l'Environnement et des Parcs*, June 2008, 395 pages.

PR5.1.1 *Sommaire du Plan des mesures d'urgence en cas de rupture de barrage*, supplement to questions QC-55 and QC-58, May 2008, 28 pages and maps.

PR5.2 HYDRO-QUÉBEC PRODUCTION. *Réponses aux questions et commentaires du ministère du Développement durable, de l'Environnement et des Parcs*, second series, August 2008, 9 pages.

PR5.3 MINISTÈRE DU DÉVELOPPEMENT DURABLE, DE L'ENVIRONNEMENT ET DES PARCS. Addenda – *Questions et commentaires (QC-223 à QC-241) adressés au promoteur*, June 4, 2008, 5 pages.

PR5.4 MINISTÈRE DU DÉVELOPPEMENT DURABLE, DE L'ENVIRONNEMENT ET DES PARCS. Addenda *n^{o} 2 – Questions et commentaires (QC-242 à QC-250) adressés au promoteur*, June 20, 2008, 3 pages.

PR6 MINISTÈRE DU DÉVELOPPEMENT DURABLE, DE L'ENVIRONNEMENT ET DES PARCS. *Recueil des avis issus de la consultation auprès des ministères et organismes sur la recevabilité de l'étude d'impact*, March 25 to July 28, 2008, various pagings.

PR6.1 MINISTÈRE DU DÉVELOPPEMENT DURABLE, DE L'ENVIRONNEMENT ET DES PARCS. *Avis de la Direction régionale de l'analyse et de l'expertise de la Côte-Nord*, September 3, 2008, 2 pages.

PR7 MINISTÈRE DU DÉVELOPPEMENT DURABLE, DE L'ENVIRONNEMENT ET DES PARCS. *Avis sur la recevabilité de l'étude d'impact*, September 4, 2008, 8 pages.

PR8 **Sectoral studies about the project done by consultants**

60-14 **PR8.1** CONSULTANTS FORESTIERS DGR INC. *Études forestières – Portrait forestier*, January 2006, 25 pages and photographs.

60-52 **PR8.2** PRODHYC INC. *Aspects glaciologiques de la zone estuarienne*, rapport final, September 2006, 16 pages and appendices.

60-1 **PR8.3** V. ALBERT and L. BERNATCHEZ. *Caractérisation génétique des populations de Saumon atlantique*, report presented by Université Laval to GENIVAR and Hydro-Québec Équipement, December 2006, 30 pages and appendices.

60-45 **PR8.4** François SAUCIER, B. ZAKARDJIAN, S. SENNEVILLE and V. LE FOUEST. *Étude de l'effet de l'aménagement du complexe hydroélectrique de la rivière Romaine sur les conditions biologiques et physiques du chenal de Mingan à l'aide d'un simulateur numérique tridimensionnel à haute définition*, report presented by the Institut des sciences de la mer, Université du Québec à Rimouski, May 2007, 63 pages.

60-30 **PR8.5** LASALLE CONSULTING GROUP INC. *Réévaluation du régime des glaces de la rivière Romaine avant et après aménagement*, report presented to Hydro-Québec, Design of production, hydraulic and geotechnical facilities, August 2007, 27 pages and appendices.

60-13 **PR8.6** Daniel CLÉMENT. *Le savoir innu relatif à la Unaman-Shipu*, final report presented to Hydro-Québec Équipement, September 2007, 186 pages and appendices

PR8.7 Nove Environment Inc.

60-31 **PR8.7.1** *Étude d'impact sur l'environnement – Milieu humain*, inventory report presented to Hydro-Québec, Groupe Équipement, June 2005, various pagings, maps and appendices.

Nove Environment Inc. and QSAR Risk Assessment Inc.

60-33 **PR8.7.2** *Le mercure et la santé publique – Exposition au mercure et perception du risque de contamination par le mercure de la population d'Ekuanitshit*, November 2007, various pagings.

60-34 **PR8.7.3** *Le mercure et la santé publique – Exposition au mercure et perception du risque de contamination par le mercure des populations de Havre-Saint-Pierre et de Longue-Pointe-de-Mingan*, November 2007, various pagings.

PR8.8 Archéotec Inc.

60-2 **PR8.8.1** *Dérivation partielle de la rivière Romaine – Étude du potentiel archéologique*, May 2000, 122 pages and maps.

60-3 **PR8.8.2** *Dérivation partielle de la rivière Romaine – Interventions archéologiques 1999 dans les secteurs des aménagements à l'étude*, May 2000,

213 pages.

60-4 **PR8.8.3** *Parcs à carburant et stations limnimétriques – Inventaire archéologique mai 2003*, March 2004, various pagings.

60-6 **PR8.8.4** *Interventions archéologiques 2004*

60-6 **PR8.8.4.1** *Volume 1 – Texte et cartes des secteurs archéologiques*, report presented to Hydro-Québec Production, April 2006, 210 pages and map.

60-6 **PR8.8.4.2** *Volume 2 – Tableaux du matériel recueilli, plans des sites et fiches des zones inventoriées, des sites répertoriés et des outils*, report presented to Hydro-Québec Production, April 2006, 414 pages.

60-5 **PR8.8.5** *Inventaire archéologique 2005*, February 2006, 289 pages and map.

PR8.9 Environnement Illimité Inc.

60-16 **PR8.9.1** *Caractérisation physico-chimique de la qualité de l'eau dans la rivière Romaine, été-automne 2001*, report presented to Hydro-Québec, Direction Environnement et Services techniques, Ingénierie, approvisionnement et construction, June 2002, 31 pages and appendices.

60-15 **PR8.9.2** *Description du milieu : océanographie physique et biologique, été-automne 2001*, report presented to Hydro-Québec, Direction Environnement et Services techniques, Ingénierie, approvisionnement et construction, July 2002, 88 pages and appendices.

60-36 **PR8.9.3** *S. LORRAIN, G. GUAY and J. GINGRAS. Études sédimentologiques et océanographiques de la rivière Romaine et de la zone de l'embouchure – Rapport de mission 2004*, report produced for Hydro-Québec, June 2005, 129 pages and appendices.

60-37 **PR8.9.4** *S. LORRAIN, J. GINGRAS and C. MORIN. Études sédimentologiques et océanographiques de la rivière Romaine et de la zone de l'embouchure – Océanographie physique*, report produced for Hydro-Québec, March 2006, 155 pages and appendices.

PR8.10 Institut des sciences de la mer de Rimouski (ISMER) and Environnement Illimité Inc.

60-35 **PR8.10.1** *Études océanographiques complémentaires – Observations sur le crabe des neiges et les crabes araignées dans le chenal de Mingan*, report presented to Hydro-Québec, Direction principale, Expertise Unité Environnement, March 2006, 46 pages and appendices.

60-17 **PR8.10.2** *Études océanographiques complémentaires*, technical brief, November 2007, 17 pages and appendices.

PR8.11 Foramec Inc.

60-11 **PR8.11.1** D. BOUCHARD and J. DESHAYE. *Étude de la végétation et de la flore*, presented to Hydro-Québec Équipement, Direction Développement de projets et Environnement, July 2005, 54 pages and appendices.

60-18 **PR8.11.2** C. FORTIN and M. OUELLET. *Étude de l'herpétofaune*, presented to Hydro-Québec Équipement, Direction Développement de projets et Environnement, July 2005, 34 pages and appendices.

60-38 **PR8.11.3** F. MORNEAU and R. BENOIT. *Étude de la faune aviaire – Oiseaux de proie*, presented to Hydro-Québec Équipement, Direction Développement de projets et Environnement, July 2005, 64 pages and appendices.

60-9 **PR8.11.4** R. BENOIT. *Étude de la faune aviaire – Sauvagine et autres oiseaux aquatiques*, presented to Hydro-Québec Équipement, Direction Développement de projets et Environnement, July 2005, 169 pages and appendices.

60-10 **PR8.11.5** R. BENOIT, C. LATENDRESSE and F. BÉDARD. *Étude de la faune aviaire – Oiseaux forestiers*, presented to Hydro-Québec Équipement, Direction Développement de projets et Environnement, July 2005, 95 pages and appendices.

60-12 **PR8.11.6** D. BOUCHARD and J. DESHAYE. *Étude de la végétation littorale dans la zone d'influence du panache d'eau douce de la rivière Romaine*, presented to Hydro-Québec Équipement, Direction Développement de projets et Environnement, February 2006, 22 pages and appendices.

60-46 **PR8.11.7** H. SÉNÉCHAL, R. BENOIT, A. CHOUINARD, A. MALONEY and F. BÉDARD. *Étude de la faune aviaire – Zone d'influence du panache d'eau douce de la rivière Romaine*, presented to Hydro-Québec Équipement, Direction Développement de projets et Environnement, March 2006, 189 pages and appendices.

PR8.12 Hydro-Québec Équipement

PR8.12.1 *Régime thermique de l'eau. Avant-projet phase 2.*

60-32 **PR8.12.1.1** *Rapport sectoriel*, Direction Ingénierie de production, November 2007, 148 pages.

60-32 **PR8.12.1.2** *Annexe A – Recueil des séries observées*, Direction Ingénierie de production, November 2007, 52 pages.

60-32 **PR8.12.1.3** *Annexe B – Seuil du canal d'amenée de Romaine-2 à la cote de 206 m*, Direction Ingénierie de production, November 2007.

PR8.13 Poly-Géo Inc.

60-39 **PR8.13.1** *Caractérisation des sols indurés (ortsteins) et évaluation de leur toxicité potentielle dans les secteurs inondés par les réservoirs projetés*, technical brief presented to Hydro-Québec Équipement, March 2006,

22 pages and appendices.

60-40 **PR8.13.2** *Géomorphologie, caractérisation de l'évolution des rives et sensibilité à l'érosion.*

60-40 **PR8.13.2.1** *Volume 1 – Texte et annexe A*, report presented to Hydro-Québec Équipement, March 2006, 117 pages and appendices.

60-40 **PR8.13.2.2** *Volume 2 – Annexe B*, report presented to Hydro-Québec Équipement, March 2006, maps.

60-40 **PR8.13.2.3** *Volume 3 – Annexes C à H*, report presented to Hydro-Québec Équipement, March 2006.

60-41 **PR8.13.3** *Étude de la dynamique sédimentaire*, presented to Hydro-Québec Équipement, March 2006, 122 pages and appendices.

60-53 **PR8.13.4** *Évaluation des concentrations de mercure dans les sols de l'aire inondable des réservoirs projetés*, final report presented to Hydro-Québec Équipement, April 2008, 35 pages and appendices.

PR8.13.5 *Étude des risques d'érosion en phase de remplissage des réservoirs*, final report presented to Hydro-Québec Équipement, July 2008, 33 pages and maps.

PR8.14 Hydro-Québec and Roche

PR8.14.1 *Accès routiers aux ouvrages.*

60-42 **PR8.14.1.1** *Rapport final*, March 2006, 159 pages and appendices.

60-43 **PR8.14.1.2** *Caractérisation des cours d'eau*, June 2006, 7 pages, maps and appendices.

PR8.14.2 *Complément à l'étude d'impact*, final report, July 2008, 53 pages and appendices.

PR8.15 Roche

60-44 **PR8.15.1** S. CHAPDELAINE, Y. EDDARAI and C. VIEN. *Étude de circulation*, technical brief, final version, presented to Hydro-Québec, April 2007, 22 pages and appendices.

PR8.16 Tecsult Inc.

60-47 **PR8.16.1** *Étude des limicoles et des oiseaux forestiers, printemps et été 2001*, final report presented to Hydro-Québec, May 2002, various pagings.

60-49 **PR8.16.2** *Étude de la petite faune*, final report presented to Hydro-Québec Équipement, July 2005, various pagings.

60-48 **PR8.16.3** *Étude de la grande faune*, final report presented to Hydro-Québec Équipement, July 2005, various pagings.

60-50 **PR8.16.4** *Inventaire de l'utilisation par la faune des milieux humides, des espèces menacées ou vulnérables et des colonies de castors*, final report presented to Hydro-Québec Équipement, July 2005, various pagings.

60-51 **PR8.16.5** *Caractérisation des sites de mise bas du caribou*, final report presented to Hydro-Québec Équipement, February 2006, various pagings.

PR8.17 Groupe-conseil TDA

PR8.17.1 *Impacts sur les infrastructures municipales, municipalité de Havre-Saint-Pierre.*

60-29 **PR8.17.1.1** *Rapport d'étape 1*, revised June 15, 2007, 204 pages.

60-29 **PR8.17.1.2** *Annexes,* June 15, 2007.

PR8.18 GENIVAR Consulting Group Inc.

60-26 **PR8.18.1** *Étude de la population de Saumon atlantique de la rivière Romaine en 2001*, report presented to Hydro-Québec, Direction Environnement et Services techniques, May 2002, 119 pages and appendices.

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- instream flow regime downstream from KP 51.5 and mitigation and compensation measures planned by the proponent;
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- the project's impact on fish productivity and compensation measures;
- impacts of reservoir filling and mitigation and compensation measures;
- impacts associated with changes to the thermic regime downstream from KP 51.5 and impact mitigation and compensation measures;
- hydrosedimentary dynamics of Atlantic salmon spawning grounds and the need to plan for maintenance floods;
- the project's impacts on the mouth and coastal zone; and
- follow-up programs, November 6, 2008, 2 pages.

(Answer DB18)

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(Answer DB18.1)

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- forest birds;
- migratory birds;
- waterfowl;
- species at risk and species of special status;
- mercury levels in birds;
- wetlands;
- water quality;
- air quality;
- shellfish waters;
- sustainability of eelgrass beds;
- greenhouse gases and climate change;
- pollution prevention;
- environmental emergencies; and
- follow-up programs, November 6, 2008, 2 pages.

(Answer DB14)

DD3 BUREAU D'AUDIENCES PUBLIQUES SUR L'ENVIRONNEMENT. *Request for information from Transport Canada*

- navigation conditions and access to reservoirs; and
- shipping of construction materials, November 6, 2008, 1 page.

(Answer DB12)

DD4 BUREAU D'AUDIENCES PUBLIQUES SUR L'ENVIRONNEMENT. *Request for information from Natural Resources Canada*

- seismicity;

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- remobilization of mercury; and
- indurated soil, November 6, 2008, 1 page.

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DQ10.1 The answers are in document DQ9.1.

DQ11 BUREAU D'AUDIENCES PUBLIQUES SUR L'ENVIRONNEMENT. *Questions addressed to the Quebec Department of Natural Resources and Wildlife concerning the status of rivers developed in Quebec,* November 7, 2008, 2 pages.

DQ11.1 MINISTÈRE DES RESSOURCES NATURELLES ET DE LA FAUNE. *Responses to the questions in document DQ11*, December 16, 2008, 2 pages.

DQ12 BUREAU D'AUDIENCES PUBLIQUES SUR L'ENVIRONNEMENT. *Questions addressed to the Quebec Department of Natural Resources and Wildlife concerning the development of outfitters*, November 7, 2008, 1 page.

DQ12.1 MINISTÈRE DES RESSOURCES NATURELLES ET DE LA FAUNE. *Responses to the questions in document DQ12*, December 5, 2008, 1 page.

DQ13 BUREAU D'AUDIENCES PUBLIQUES SUR L'ENVIRONNEMENT. *Questions addressed to Hydro-Québec by Alliance Romaine*, November 10, 2008, 10 pages.

DQ13.1 HYDRO-QUÉBEC. *Responses to the questions in document DQ13*, November 24, 2008, 26 pages.

DQ14 BUREAU D'AUDIENCES PUBLIQUES SUR L'ENVIRONNEMENT. *Questions addressed to Hydro-Québec by the Government of Newfoundland and Labrador*, November 10, 2008, 4 pages.

DQ14.1 HYDRO-QUÉBEC. *Responses to the questions in document DQ14*, November 28, 2008, 9 pages.

DQ15 BUREAU D'AUDIENCES PUBLIQUES SUR L'ENVIRONNEMENT. *Questions addressed to Hydro-Québec by the Centre de santé et services sociaux de la Minganie*, November 10, 2008, 3 pages.

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DQ17 BUREAU D'AUDIENCES PUBLIQUES SUR L'ENVIRONNEMENT. *Questions addressed to the Quebec Department of Natural Resources and Wildlife concerning the choice of rivers to develop and rivers to preserve*, November 11, 2008, 2 pages.

DQ17.1 The answers are in document DQ6.3.

DQ17.2 MINISTÈRE DES RESSOURCES NATURELLES ET DE LA FAUNE. *Complementary information to the answers in response to the questions in document DQ6.3 regarding document DQ17*, December 18, 2008, 1 page.

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DQ18.1 HYDRO-QUÉBEC. *Answers to the questions in document DQ18*, November 28, 2008, 6 pages.

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DQ20 BUREAU D'AUDIENCES PUBLIQUES SUR L'ENVIRONNEMENT. *Questions addressed to Hydro-Québec concerning the update of the producer's energy balance, the producer's power budget and tables 2-1, 2-2, 2-3 and 2-4 of volume 1 of the impact study,* November 27, 2008, 2 pages.

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DT2 Hearing held in the afternoon of October 28, 2008, in Havre-Saint-Pierre, 100 pages.

DT3 Hearing held in the evening of October 28, 2008, in Havre-Saint-Pierre, 86 pages.

DT4 Hearing held in the afternoon of October 29, 2008, in Havre-Saint-Pierre, 89 pages.

DT5 Hearing held in the evening of October 29, 2008, in Havre-Saint-Pierre, 107 pages.

DT6 Hearing held in the afternoon of October 30, 2008, in Havre-Saint-Pierre, 98 pages.

DT7 Hearing held in the evening of October 30, 2008, in Havre-Saint-Pierre, 115 pages.

DT8 Hearing held in the afternoon of December 2, 2008, in Mingan, 41 pages.

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DT10 Hearing held in the afternoon of December 3, 2008, in Havre-Saint-Pierre, 47 pages.

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DT12 Hearing held in the afternoon of December 4, 2008, in Havre-Saint-Pierre, 37 pages.

DT13 Hearing held in the evening of December 9, 2008, in Sept-Îles, 72 pages.

DT14 Hearing held in the morning of December 10, 2008, in Sept-Îles, 31 pages.

DT15 Hearing held in the afternoon of December 10, 2008, in Sept-Îles, 45 pages.

DT15.1 Unofficial [French] translation of the presentation of the Government of Newfoundland and Labrador's brief in the afternoon of December 10, 7 pages and appendix.

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DT16.1 Correction made to line 2014: the word *inévitable* should be replaced by the word *inéquitable*, December 2008, 1 page.

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