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Joint Review Panel

Lake Kénogami Watershed Flood Control Project

TRANSLATION

Inquiry and Public Hearing Report

October 2003

Québec

Canada

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The documents related to the Panel's works are available at the Bureau d'audiences publiques sur l'environnement as well as at the Canadian Environmental Assessment Agency.

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Quebec City, October 23, 2003

The Honourable Thomas J. Mulcair
Minister of the Environment
Marie-Guyart Building, 30th Floor
675 René-Lévesque Blvd. East
Quebec City, QC G1R 5V7

Dear Minister :

I am pleased to submit to you the report of the Bureau d'audiences publiques sur l'environnement on the Lake Kénogami watershed flood control project.

The panel has completed its inquiry and public consultations and has concluded that the project meets its primary objective of ensuring public safety. It has also concluded that the Pikauba reservoir should be managed at a maximum normal level of 412.7 m, rather than 417.7 m, in order to preserve the rich biological resources of the Pikauba valley.

The panel stresses that the balanced integration of social, economic and environmental aspects is critical to the acceptance of the project by the community and ultimately to its harmonious management.

Yours sincerely,

André Harvey
Chair

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Bureau
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Quebec City, October 20, 2003

Mr. André Harvey
Chair
Bureau d'audiences publiques sur l'environnement
Lomer-Gouin Building
575 Saint-Amable, Suite 2.10
Quebec City, QC G1R 6A6

Dear Mr. Harvey :

I am pleased to submit to you the inquiry and public hearing report on the Lake Kénogami watershed flood control project. I should point out that the joint review panel and the panel of the Bureau d'audiences publiques sur l'environnement agreed to prepare a joint report.

On the basis of its inquiry and public consultations, the panel has concluded that the proposal submitted by the Department of Natural Resources Wildlife and Parks meets its primary objective of ensuring public safety. It has also concluded that, given the rich biological resources of the Pikauba valley and the ecological value and irreplaceable nature of the ecosystems in the area affected by the reservoir, optimization of the project is justified so as to minimize losses of these ecosystems. For that reason, it has proposed that the Pikauba reservoir be managed at a maximum normal level of 412.7 m rather than 417.7 m, as planned by the proponent.

The panel has also proposed a more flexible stabilization option for Lake Kénogami that gives managers more leeway, while still meeting the primary objective of public safety.

…2

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The panel is of the view that the option it prefers should meet the expectations expressed regarding the uses of Lake Kénogami. In addition, it has the advantage of preserving the biological diversity of the Pikauba valley.

I would like to acknowledge the significant contribution of the participants in the hearings and thank the team that assisted the panel throughout the process for its enthusiasm and commitment to serving the public.

Yours sincerely,

Claudette Journault
Chair, Panel of the Bureau d'audiences publiques sur l'environnement

Quebec City, October 23, 2003

The Honourable Thomas J. Mulcair
Minister of the Environment
Marie-Guyart Building, 30th Floor
675 René-Lévesque Blvd. East
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The Honourable David Anderson
Minister of the Environment
East Block, Room 133
House of Commons
Ottawa, ON K1A 0A6

Dear Ministers :

The Joint Review Panel for the Lake Kénogami Watershed Flood Control Project has completed its review in accordance with the mandate it received on August 4, 2003. As chair of the panel, I am pleased to submit its report to you. I should point out that the BAPE panel and the joint review panel agreed to prepare a joint report.

The joint panel reviewed the project in the context of sustainable development and in accordance with the concept of environment as defined by the higher courts, i.e., encompassing biophysical, social, economic and cultural aspects. Similarly, it made every effort to ensure compliance with the specific requirements of the *Canadian Environmental Assessment Act*.

On behalf of the members of the joint panel, I would like to acknowledge the significant contribution of the participants in the hearings and to thank the team that assisted the panel for its enthusiasm and commitment to serving the public. I also wish to recognize the remarkable cooperation of the Canadian Environmental Assessment Agency and Bureau d'audiences publiques sur l'environnement throughout the process.

Yours sincerely,

Claudette Journault
Chair, Joint Review Panel

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Table of Contents

Introduction 1

Chapter 1 Concerns and Opinions of the Participants 11

Justification of the project 11
Public safety and stabilization of Lake Kénogami 11
Hydroelectric generation on the Pikauba reservoir 13

Alternatives and potential scenarios 13

Pikauba River sector 14
The site's ecological value 14
Recreational activities in the Pikauba River sector 16
Level of the Pikauba reservoir 17
The methylmercury problem 17

Lake Kénogami 18
Summer water level 18
Lake outflow 19
Bank erosion 21
Raising Lake Kénogami's dikes and dams 21
The flow of methylmercury towards Lake Kénogami and its outlets 22
Road problems at the Coulée-Gagnon dike 22
Reconciling Lake Kénogami's varied uses 23
Trucking 23

The Chicoutimi River and the Rivière aux Sables 24
Insecurity of shoreline residents 24
River discharges and flood levels 25

Reservoir management procedures 26
Manager of retaining works 26
Watershed management committee 26

Chapter 2 Project Purpose and Alternatives 29

The events of July 1996 29

The project and alternative solutions 30
Flood routing through the creation of a reservoir 30
Securing the Lake Kénogami shoreline 33
Increasing Lake Kénogami's discharge capacity 34
Safety of structures 36
Discharge management 40
An integrated project 42

Chapter 3 Issues Related to the Project 45

Pikauba River sector 45
Construction of a reservoir on the Pikauba River 45
Forest environments and wetlands 46
Moose habitats and hunting 54
Fish habitat and fishing 58
Mercury 68
Navigation on the Pikauba River 70

Lake Kénogami sector 72
Managing water levels in Lake Kénogami 72
Current uses of Lake Kénogami 77
Effects of water levels on the uses of Lake Kénogami 79
Water levels in the lake and safety 86
Summer management levels 89

Sectors of the Rivière aux Sables and the Chicoutimi River 98
Industrial and municipal users 98
Water quality in Rivière aux Sables 101
Navigation on Rivière aux Sables 101

Monitoring and follow-up 103
Monitoring 103
Follow-up 103

Chapter 4 A harmonized approach to managing the Lake Kénogami watershed .. 105

The Panel's proposal for the management of the Pikauba reservoir 105

The Panel's proposal for the management of Lake Kénogami, Rivière aux Sables and Chicoutimi River 112

Summer management levels on Lake Kénogami 112

Lake Kénogami summer management rules 114

Cumulative effects 115

Shoreline erosion 115

Navigation 116

Brook trout 116

Moose 117

Wetlands 118

Sustainable development 119

Conclusion 121

The Panel's Opinions and Recommandations 125

Appendix 1 Information on the Mandates 133

Appendix 2 Documentation 141

Bibliography 167

List of Figures and Tables

Figure 1 Project overview 7

Figure 2 Lake Kénogami, Rivière aux Sables and Chicoutimi River sectors 9

Figure 3 Pikauba River Sector 48

Figure 4 The bathymetry of Lake Kénogami 75

Figure 5 Water level measurements in Lake Kénogami : Pibrac 061002 gauging station 80

Figure 6 Navigability of Lake Kénogami according to the Association pour la protection du lac Kénogami 83

Figure 7 Summer levels in Lake Kénogami from 1982 to 1995 83

Figure 8 Management levels for the Pikauba reservoir 107

Photo 1 Dufour Bay at the extreme point of chemin du Quai 81

Photo 2 Lake Kénogami bank between Ouiqui dyke and Raphaël point 91

Table 1 The storage capacity of Lake Kénogami under the alarm level 87

Table 2 Ideal water levels for Lac Kénogami according to a 1999 survey 93

Table 3 The effect of the Pikauba reservoir's level on the stability of Lake Kénogami in the summer 97

Table 4 Sites built to harness hydropower on the Rivière aux Sables and the Chicoutimi River 99

Table 5 Effects on wetlands and fish habitat by management level of the Pikauba reservoir 106

Table 6 Comparison between previous and proposed summer management regulations for Lake Kénogami 113

Glossary

Aquatic grass bed	Bed of underwater grass or algae.
Avian	Of, relating to, or concerning birds.
Benthic fauna	Organisms living on or near the bottom of a body of water and that are nearly stationary.
Bioamplification	The increase in tissue concentrations of toxins from one level of the food chain to the next.
Biodiversity	See *biological diversity*.
Biological diversity (biodiversity)	The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems
Downstream migration	The action of migrating fish that swim down a watercourse to return to a location essential to their development (breeding or nursery grounds).
Drainage	The act of emptying or discharging water.
Drainage system	All of the rivers and other permanent or temporary watercourses and the lakes and reservoirs in a given region.
Edaphic condition	External condition related to the soil that has a significant impact on the distribution of living organisms.
Hydraulicity	Coefficient of discharge, dynamic energy of water, water condition.

Hydrogeological	Pertaining to the movement, search for and harnessing of groundwater.
Hydrometric	Pertaining to the measurement and analysis of the properties of water or other liquids.
Inorganic	Matter that does not come from or constitute plant or animal matter.
Major flood level	Level above which the flooding of a dwelling begins.
Maximum probable flood	(MPF) The maximum flood that can be expected to occur based on all the conditional factors (geographical, meteorological, hydrological and geological).
Methylation	To introduce a chemical, functional group called a methyl group (containing one carbon and three hydrogen atoms) into a molecule via a biotic (refers to the living components of the environment) or abiotic (refers to the non-living components of the environment) process.
Methyl mercury	Any of various toxic compounds of mercury containing the complex CH_3Hg- that often occur as pollutants which accumulate in living organisms (such as fish), especially in higher levels of a food chain.
Microclimate	The climate of a small or restricted area, which differs from the general climate of the region.
Minor flood level	Level above which the flooding of a property begins.
Nursery areas	Space used by young fish after they hatch.
Outlet	Opening through which water flows out or is extracted from a reservoir or stream.

Run	Upstream migration undertaken by fish to return to their breeding or nursery grounds to spawn.
Safety check flood	The flood that a dam must be capable of withstanding under extreme conditions while continuing to operate safely, accepting some damage and a reduction in safety factors but without causing dam failure.
Sill	A ridge on the river bottom.
Topographic	Pertaining to the configuration or relief of a place, region or country.
Trophic levels	A functional classification of species that is based on feeding relationships.
Watershed	The land area draining into a river, stream or lake.
Zooplankton	Floating and drifting aquatic animal life.

Introduction

In July 1996, heavy rain caused extreme floods in several regions of Quebec, including Saguenay–Lac-Saint-Jean. The sectors of Lake Kénogami, the Chicoutimi River and the Rivière aux Sables were particularly affected by the flooding.

Following analysis of these events by the Commission scientifique et technique sur la gestion des barrages, studies were conducted by Hydro-Québec and the Ministère de l'Environnement on flooding in the Lake Kénogami watershed. A consortium of consultants also assessed various options to ensure the safe flow of flood waters in Lake Kénogami, the Chicoutimi River and the Rivière aux Sables resulting from extreme conditions.

A committee of experts was formed to compare the following four options :

– creation of two reservoirs : on the Rivière aux Écorces and the Pikauba River ;

– construction of two hydrolectric generating stations in addition to the two reservoirs ;

– creation of a reservoir and a hydroelectric generating station on the Rivière aux Écorces, the Pikauba River and the Cyriac River ;

– control of floods without an additional reservoir but with major works on Lake Kénogami and downstream.

Hydro-Québec also compared these options in terms of the summer management of Lake Kénogami, a flood similar in scale to the one of July 1996 and the maximum probable flood[1].

Three scenarios were ultimately submitted to the Cabinet. The first involved raising and consolidating the retaining works along the Lake Kénogami shoreline, raising the flood levels on the rivers downstream and implementing an improved flood forecasting system.

1. Maximum probable flood: greatest flood that may be expected, taking into account all pertinent factors of location, meteorology, hydrology and terrain (*International Glossary of Hydrology*, UNESCO).

The second scenario entailed the construction of a reservoir upstream from Lake Kénogami on the Pikauba River, the consolidation and modernization of existing structures along the shoreline of Lake Kénogami, the construction of a sill in the Rivière aux Sables and the implementation of an improved flood forecasting system.

The third scenario proposed the construction of two reservoirs on the Pikauba River and the Rivière aux Écorces, the consolidation and modernization of existing structures along the Lake Kénogami shoreline and the implementation of an improved flood forecasting system.

These scenarios were analyzed according to the following criteria :

– a flood similar in scale to the one of July 1996 should not exceed the major flood levels[1] on the Rivière aux Sables and the Chicoutimi River ;

– during a maximum probable flood, Lake Kénogami must not surpass the level of 166.67 m (123.25 ft)[2] ;

– all new or existing structures must conform to the *Dam Safety Act* ;

– the level of Lake Kénogami must be stabilized at 163.86 m ± 0.1 m (114 ft ± 4 in) in the summer.

During public hearings, the Ministère des Ressources naturelles[3] specified that these scenarios also took into account the maintenance of minimum summertime discharges to support industrial activities and feed the intakes downstream from the Rivière aux Sables and the Chicoutimi River.

At this stage, a project involving only one reservoir upstream from Lake Kénogami was retained for review by government order (order no. 704-2000, June 7, 2000). It includes the following elements :

– modernization of existing spillways ;

1. The major flood level corresponds to the discharge beyond which a home begins to be flooded ; the minor flood level corresponds to the discharge beyond which one lot begins to be flooded

2. Levels in feet for Lake Kénogami correspond to an arbitrary local scale established by the Commission des eaux courantes when the Kénogami reservoir was created. Conversion is calculated as follows: altitude in m = local level in feet /3.281 + 129.113 m.

3. Now the Ministère des Ressources naturelles, de la Faune et des Parcs.

– construction of a reservoir on the Pikauba River ;

– digging of a sill in the Rivière aux Sables ;

– raising and consolidation of retaining works along the Lake Kénogami shoreline.

With this order, the Government of Quebec authorized the Ministère des Ressources naturelles to mandate Hydro-Québec to carry out technical studies and an impact study of this scenario. Thus, in the capacity of consultant, Hydro-Québec carried out the studies, with the Ministère des Ressources naturelles, de la Faune et des Parcs as project proponent.

In September 2000, the notice of application to develop the Pikauba reservoir and other structures designed to control flooding in the Lake Kénogami watershed was submitted to the Minister of the Environment as per the environmental impact assessment and review procedure stipulated in section 31.1 and pursuant to the *Environment Quality Act* (R.S.Q., c. Q-2). In January 2001, the Minister of the Environment issued a directive indicating the nature, scope and range of the impact study to be conducted. The impact study was submitted in January 2002 and a notice of conformity was issued in January 2003. The Bureau d'audiences publiques sur l'environnement (BAPE) was then mandated to hold an information and public consultation period from February 25 to April 11, 2003. During this period, eight applications for public hearings were sent to the Minister.

On April 11, 2003, then Minister of the Environment, André Boisclair, mandated the BAPE to hold public hearings on the Lake Kénogami watershed flood control project beginning May 5, 2003. The panel established for this purpose by the president of the BAPE held the first session of this public hearing from May 12 to 14, 2003.

The project, however, required authorizations in accordance with the *Fisheries Act* (R.S. (1985), c. F-14) and the *Navigable Waters Protection Act* (R.S. (1985), c. N-22), which set in motion a federal environmental assessment under the *Canadian Environmental Assessment Act* (1992, c. 37). The Department of Oceans and Fisheries is the authority responsible for conducting this type of assessment. Up to March 2002, it conducted an environmental assessment in the form of a comprehensive study. It determined that the project could have a serious negative impact on certain valued environmental components, and asked the federal Minister of the Environment to refer the project to a review panel.

The federal Minister of the Environment thus referred the project assessment to a federal review panel pursuant to paragraph 29 (1)a of the *Canadian Environmental Assessment Act*. On June 13, 2003, Quebec's Minister of the Environment, Thomas J. Mulcair, and the

federal Minister of the Environment, David Anderson, publicly announced a draft agreement to establish a joint review panel to proceed with a public review of the project as part of the standard procedure for BAPE public hearings. A joint review panel was established in accordance with the stipulations of the agreement and public hearings were held from August 5 to 7, 2003, in accordance with the requirements of the *Environment Quality Act* and the *Canadian Environmental Assessment Act*.

In this text, the term “Panel” refers to these two bodies jointly.

The project

The project targets the Lake Kénogami watershed, with an area of 3,390 km^2. Most of the watershed is drained by the Cyriac River, the Pikauba River and the Rivière aux Écorces which all originate in the Laurentides wildlife reserve. Running along a south-north axis, the watershed flows into the Saguenay River through two outlets, the Chicoutimi River and the Rivière aux Sables crossing the boroughs of Chicoutimi and Jonquière respectively in the City of Saguenay. These rivers slope steeply but steadily from south to north (Figure 1).

Lake Kénogami is located in the administrative region of Saguenay–Lac-Saint-Jean, a few kilometres southwest of the Jonquière borough. This reservoir was created in 1924 through the construction of dams and dikes on the periphery of the lake. It is controlled by several retaining works and two dams located upstream from the two outlets. The spillways on Lake Kénogami are currently managed by the Centre d’expertise hydrique du Québec under the Ministère de l’Environnement (Figure 2).

As stipulated in the *Dam Safety Act* (R.S.Q., c. S-3.1.01), the first phase of work has already been authorized by the Centre d’expertise hydrique du Québec. This authorization is specific to work that is not subject to the environmental impact assessment and review process and stands on its own, even if the project is not implemented or is modified in some way. This work includes the modernization of Lake Kénogami’s spillways and the implementation of the first part of the flood forecasting system.

The second phase encompasses interventions subject to the environmental assessment and full implementation of the flood forecasting system. The Pikauba reservoir proposed by the proponent would be created through the construction of a dam located at kilometre 30.2 of the Pikauba River as well as dikes and a control structure (Figure 3). This reservoir would cover an area of 15.6 km^2 corresponding to the reservoir’s maximum normal level of 417.7 m. The reservoir would serve two purposes : to ensure retention of a part of the flood volumes of the Pikauba River in order to fulfill the objective of protecting shoreline residents of Lake Kénogami, the

Rivière aux Sables and the Chicoutimi River ; and it would build up water storage that would serve to stabilize Lake Kénogami during the summer.

Digging a sill in the Rivière aux Sables would increase its spillway capacity. The major flood level will increase from 170 m^3/s to 650 m^3/s. The riverbed would be dug along 600 m with a maximum width of 80 m. Excavation would be done under the Pibrac Bridge and in the section of the rapids located upstream from the bridge.

Stabilization of the shoreline of Lake Kénogami would be achieved through the raising and consolidation of nine existing dikes, in order to store another portion of the flood volumes. In addition, the proponent suggests protective backfilling in four low points (Figure 2).

Lastly, an improved flood forecasting system, including management of the Pikauba reservoir, would be put in place to improve safety. This system is based on the forecast of inflows and the management of water stored in the reservoirs. The system would rely on more accurate information obtained from new forecasting software as well as by an increased number of weather and hydrometric stations in the watershed.

The total project cost was set in order no. 704-2000 which authorizes the study of the project, at a maximum of $170.2 M in constant dollars (base year 1999), including the costs associated with the studies and work of the preliminary project, and excluding inflation and interest (which includes $147 million for executing the second phase). According to the current schedule, the proponent proposes that the work commence in spring 2004 in order to be completed by December 2005 and to carry out the priming of the Pikauba reservoir starting in spring 2006.

Analytical framework

The BAPE panel reviewed the project from a sustainable-development perspective, applying the concept of environment used by the higher courts which encompasses biophysical, social, economic and cultural dimensions. In addition, the Joint Review Panel took care to meet the specific requirements of the *Canadian Environmental Assessment Act.*

The concept of environment that informs the analysis includes several dimensions that extend far beyond the strictly biophysical. The impact of human activity on the population’s surrounding natural environment, life, health, safety, well-being and comfort, as well as social, economic and cultural issues affecting various communities, both Aboriginal and non-Aboriginal, were also considered.

The Panel specifically reviewed the project's environmental effects and their significance including the effects caused by accidents and malfunctions, cumulative effects resulting from the combination of the project with other works, projects or activities. The review also looked at measures that could mitigate the project's environmental impact.

The rationale of the project, realistic alternative solutions and the need for a follow-up program were also examined, as was the capacity of renewable resources to respond to current and future needs.

In addition, the Panel explored the issue of public safety, the project's primary goal. Its analysis was underpinned by a desire to achieve equity, with a view to preserving ecosystems and the potential of natural environments for future generations.

Since the project primarily seeks to manage the circulation and storage of water inside the Lake Kénogami watershed, the analysis employed an integrated watershed-based management approach. This management approach, promoted in the Québec Water Policy,[1] involves the concerted effort of all watershed management players and aims for a better integration of the multiple interests, uses and concerns from a sustainable-development perspective. This approach should lead to the implementation of more effective solutions as well as the protection or improved health of ecosystems. Thus, the following sustainable development principles guided the analysis in the Lake Kénogami watershed flood control project :

– fulfillment of the basic needs of human communities and improvemnet of the overall standard of living ;

– equity between generations, regions and populations ;

– integration of ecological, economic and social considerations in decision-making ;

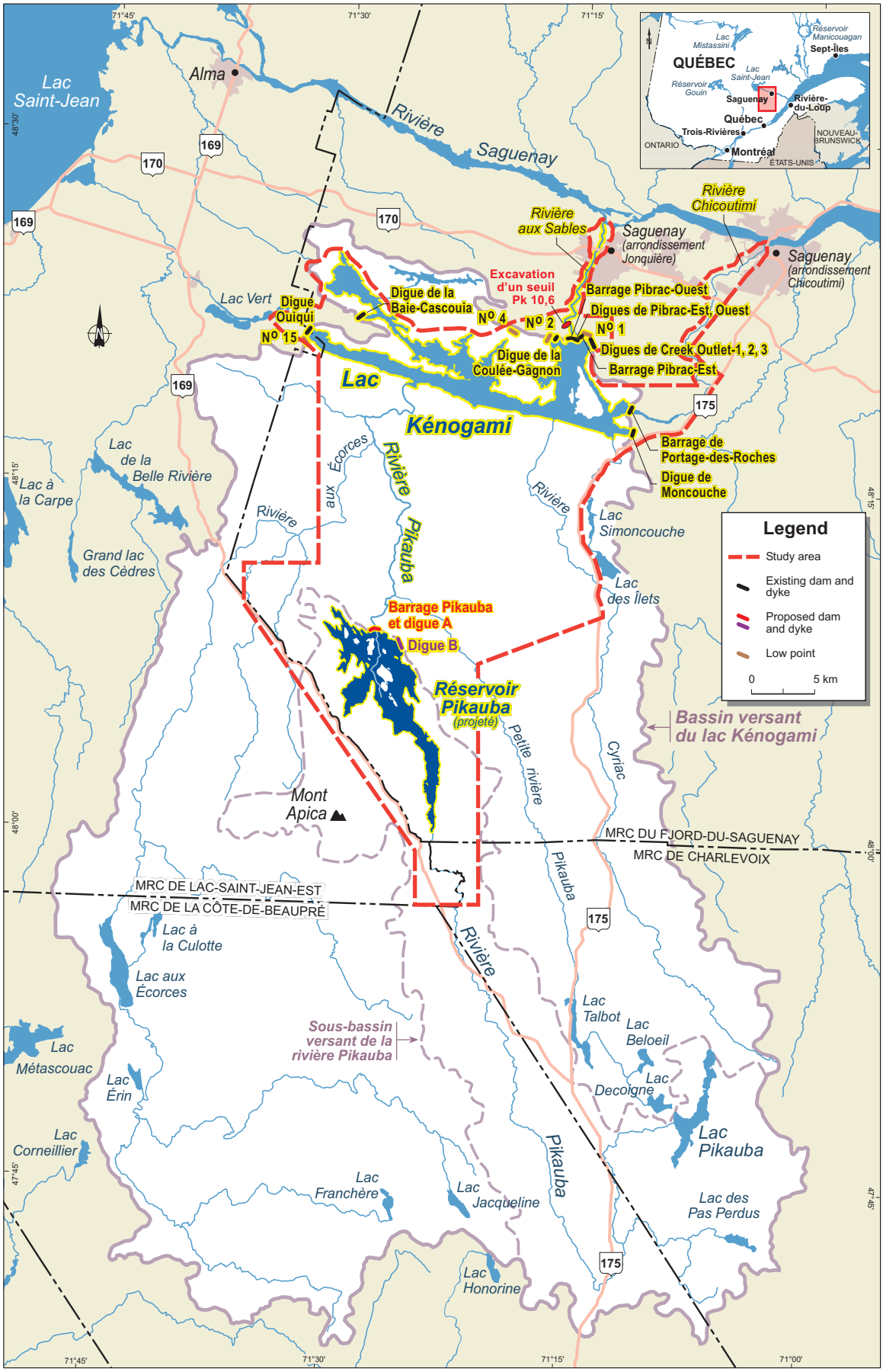
– access for everyone to information and decision-making processes ;

– active involvement and partnership of all groups in society through the sharing of responsibilities ;

– environmental protection based on prevention, including the preservation of biodiversity.

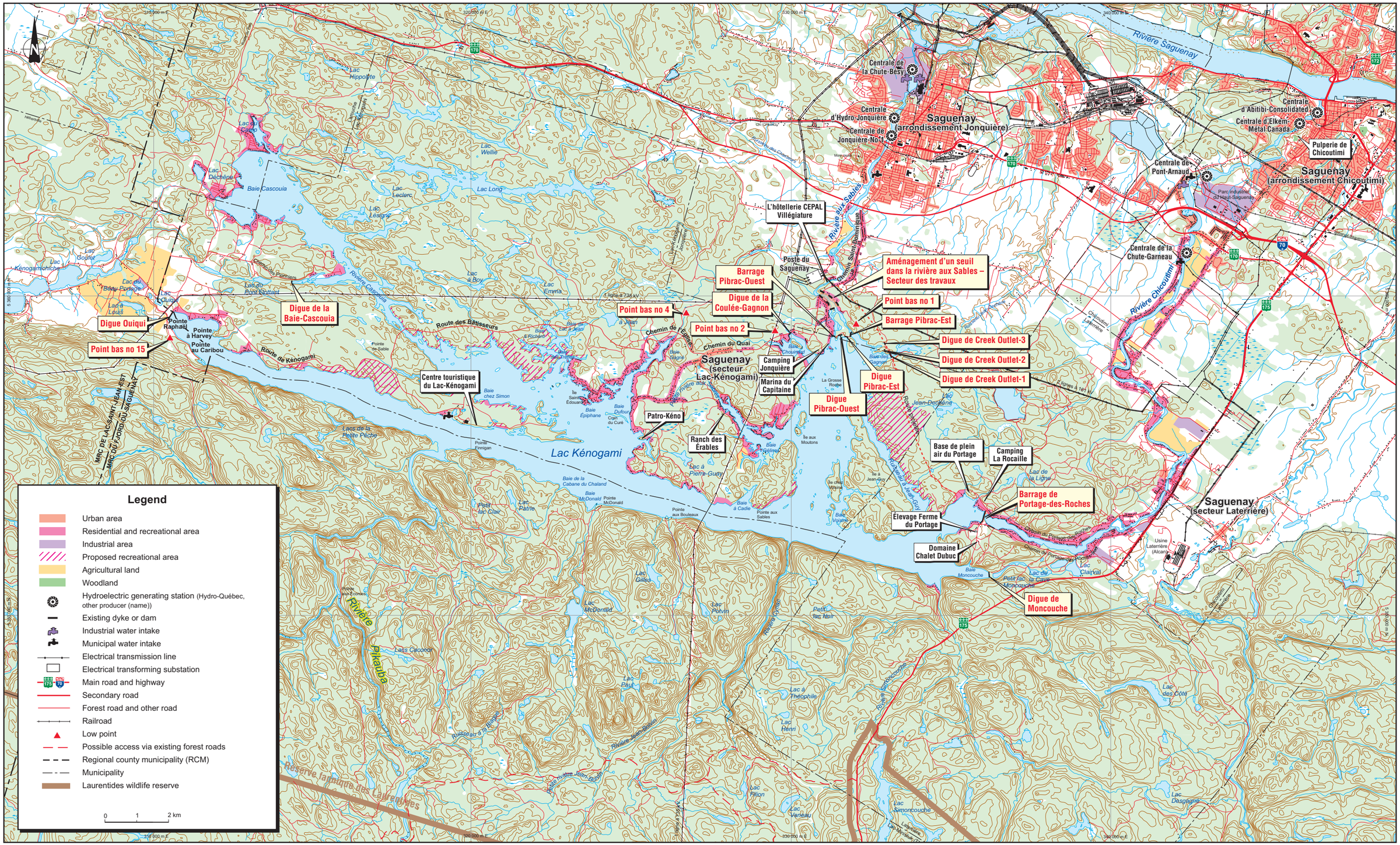
1. Ministère de l'Environnement du Québec, *Water : Our Life, Our Future*. *Québec Water Policy*. 2002.

Figure 1 An overview of the project



Source: adapted from PR 3.1, page iv.

Figure 2 Sectors of Lake Kénogami, Rivière aux Sables and Chicoutimi River



Source: adapted from PR 3.5.

Chapter 1 Concerns and Opinions of the Participants

The public hearing was held in the Jonquière borough of the City of Saguenay. A total of 436 people attended the two-session hearing. During the first session, the eight applicants explained their applications and the proponent presented the project. Then the proponent and resource persons responded to the participants' questions about the project. In all, 12 organizations and government departments as well as two Aboriginal communities appointed resource persons to represent them. The second session of the public hearing gave participants an opportunity to express their opinions and concerns about the project. Twenty-nine briefs were submitted, of which 23 were presented before the Panel, in addition to one oral testimony.

The key points addressed during the public hearing dealt with the justification of the project, alternatives and potential scenarios, the Pikauba River sector, Lake Kénogami, the Chicoutimi River and the Rivière aux Sables, as well as reservoir management procedures.

Justification of the project

Public safety and stabilization of Lake Kénogami

Several participants support the project and its various components. They view it as a way of ensuring public safety and stabilizing Lake Kénogami's water level. For instance, the Association pour la protection du lac Kénogami endorses the project's components, particularly the construction of the Pikauba reservoir. The Association considers this structure to be the cornerstone to ensuring public safety (brief, p. 3). One participant was "in full agreement with the upstream damming of Lake Kénogami on the Pikauba River in order to raise the level of this beautiful lake" (brief by Joseph Thomas). Seasonal residents share the same enthusiasm for the project for similar reasons (brief by Paul-Roger Cantin and Guy St-Jean, p. 1).

The Conseil des Montagnais du Lac-Saint-Jean feels the project is justified to ensure the quality of life of shoreline residents. The council approved the project although it would have liked to have played a significant role from the beginning of the assessment. It would, however, like the government to set up a Quebec-Mashteuiatsh roundtable as soon as possible in order to allow the community to participate in

discussions and be considered a vital player in the development and management of their ancestral lands, thereby ensuring that the concerns of its people are taken into consideration (brief, p. 11 ; DT10, p. 26).

The large majority of citizens and organizations did not question the project's primary objective of ensuring public safety. However, some did express reservations about the efficiency of the project's various components. The Comité des citoyens de Laterrière inc. remains somewhat sceptical about the studies that have been conducted. The committee has doubts about the project's capacity to reach its primary objective of protecting citizens who would be affected by the floods and feels that while the project will stabilize the dams, retaining structures and the water level of Lake Kénogami during the summer, it will not completely prevent property damage (brief, p. 9).

Others are of the opinion that the project is not entirely justified on the basis of public safety. They argue that the construction of a dam on the Pikauba River is not necessary to ensure public safety. Some suspect that the interests of a group of shoreline residents on Lake Kénogami and hydroelectric companies located on the Rivière aux Sables and the Chicoutimi River are taking precedence (briefs by the Comité de l'environnement de Chicoutimi, p. 6-7, the Union québécoise pour la conservation de la nature, p. 5, the Conseil de la nation huronne-wendat, p. 10-11, the Fondation Rivières, p. 6, the Fédération québécoise du canot et du kayak and Club de canot-camping l'Aviron, p. 10-11, and by André Bouchard).

> The Pikauba reservoir project is only justified for the stabilization of Lake Kénogami (secondary objective) and for maintaining a minimum discharge of 42 m^3/s in its outlets (objective not mentioned in the decree).
> (Brief by the Fédération québécoise du canot et du kayak and Club de canot-camping l'Aviron, p. 10-11)

Although the Conseil de la nation huronne-wendat wishes to attain the safety objective, it is also determined to safeguard the environment :

> Like all Quebecers, the Hurons-Wendat are not against the principle of public safety, quite to the contrary. Although exceptional, the events of '96 must not be repeated and we must do everything in our power to prevent recurrence. That said, the exceptional wildlife and living environment that will be affected by the present scenario should not have to pay the price.
> (brief, p. 10-11)

Others feel that the project will create social inequities among Quebecers. For the Fondation Rivières, the project constitutes :

> A dangerous social precedent by protecting a single segment of the population from risk, while these kinds of preventive measures are not established elsewhere

> (…) This precedent could not be applied elsewhere in Quebec without draining the resources of the State and other dam managers
> (Hydro-Québec, private companies, municipalities).
> (Brief, p. 9-10)

Another organization stated that "in order to maintain social equity, residents living on Lake Kénogami and its outlets should not receive better treatment than shoreline residents in other parts of Quebec" (brief by Mouvement Au Courant, p. 2).

Hydroelectric generation on the Pikauba reservoir

During the first session of the public hearing, participants expressed apprehension about the vocation of the Pikauba reservoir which could be modified in the future for the purposes of generating hydroelectric power (André Bouchard, DT3, p. 22 and Gilles Potvin, DT5, p. 77). Should this occur, the Comité des citoyens de Laterrière inc. worries that this could jeopardize public safety by maintaining the Pikauba reservoir at a level too high to ensure reasonable safety downstream (Gilles Potvin, DT5, p. 77).

The proponent pointed out that the Government of Quebec has promised to ensure that there will never be hydroelectric generation at this site. A group of shoreline homeowners supports this decision : "We applaud the government's decision to steer clear of the possibility of using the new installations on the Pikauba River, and we encourage the government to look for socially acceptable solutions when the time comes to renew leases that have already been granted" (brief by Pierre Gauthier and Louise B. Accolas, p. 4). One citizen requested that the government order authorizing the project include a commitment to never generate energy on the Pikauba reservoir (brief by Claude Collard, p. 7).

Alternatives and potential scenarios

Several participants suggested alternatives to the proposed project as well as other solutions in order to attain the stated objectives. Mouvement au Courant believes that the framework for the project is too rigid and limits an examination of alternative solutions (brief, p. 1). Some organizations and citizens would like to see a study on the possibility of implementing a project without building a dam and the construction of a reservoir on the Pikauba River (briefs by the Union québécoise pour la conservation de la nature, appendices, Fondation Rivières p. 12, by the Fédération québécoise du canot et du kayak and Club de canot-camping l'Aviron, p. 11, the Société des établissements de plein air du Québec, p. 3, and by André Bouchard and Mouvement Au Courant, p. 3).

If retaining works are built on the Pikauba River, several participants argue that the best solution is to not fill the Pikauba reservoir, since this would ensure public safety while minimizing the environmental impact (briefs by the Comité de l'environnement de Chicoutimi, p. 15-16, the Conseil régional de l'environnement et du développement durable du Saguenay—Lac-Saint-Jean, p. 5 and the Union québécoise pour la conservation de la nature, appendices).

Other proposed solutions include reassessing the location for the construction of the reservoir, installing outlets toward the Saguenay River and Lake Saint-Jean, and carrying out work on the Chicoutimi River (Gilles Lamontagne, DT2, p. 73, briefs by the Comité des citoyens de Laterrière inc., p. 15-17, by Harold Guay, Linda Boulanger, Richard Mercier and Manon Deschênes, p. 5, the Union québécoise pour la conservation de la nature, p. 9 and appendices, by the Conseil de la nation huronne-wendat, p. 10 and André Bouchard). One citizen views the construction of outlets on Lake Kénogami as an alternative to building a dam on the Pikauba River, and believes that this is "the only safe and viable solution" (brief by André Bouchard).

Pikauba River sector

The site's ecological value

Several participants expressed interest in the ecological value of the territory that will be flooded with the construction of a reservoir in the Pikauba River valley.

Wetlands and biological diversity

The rich biological diversity of the territory planned for the construction of the reservoir makes it exceptional, according to several organizations and citizens who mentioned the unique and irreplaceable character of the territory as part of the wider Laurentides wildlife reserve. They pointed out that due to its rich ecological value, the territory intended for the construction of the reservoir on the Pikauba River would even meet Ministère de l'Environnement's selection criteria as a protected area (briefs by the Comité de l'environnement de Chicoutimi, p. 8, the Conseil régional de l'environnement et du développement durable du Saguenay—Lac-Saint-Jean, p. 11, the Union québécoise pour la conservation de la nature, p. 6, the Conseil de la nation huronne-wendat, p. 9 and André Bouchard). The Union québécoise pour la conservation de la nature summarized this point of view as follows :

> The Pikauba River basin is characterized by herbaceous meanders, a natural environment that is found in only two other river basins in this vast wildlife reserve. These topographical features underpin extremely diverse habitats, bogs,

> marshes, swamps and forest cover that support a rich biodiversity, as indicated in the impact study
> (brief, p. 6).

The loss of wetlands with the priming of the reservoir is also a concern. “Despite their vital biological role, these wetlands are disappearing at a frightening rate under the stress of all kinds of human activities” (brief by the Comité de l’environnement de Chicoutimi, p. 12). “There may not be any endangered species in the territory, but the environment itself is under threat and must be protected” (brief by the Union québécoise pour la conservation de la nature, p. 7).

The Conseil régional de l’environnement et du développement durable du Saguenay—Lac-Saint-Jean pointed to the adoption of Quebec’s first Strategy on Biological Diversity in 1996 :

> The State is responsible for preserving biodiversity on our land, and given the unique character of the environment destined to be flooded, it is important that a proper analysis be conducted to ensure that the project does not contradict the commitment set out in the Convention on Biological Diversity.
> (Brief, p. 11)

Terrestrial, avian and aquatic fauna

Several participants referred to the territory’s rich and varied fauna, and the fact that the project would have a major impact on this wildlife (briefs by the Comité de l’environnement de Chicoutimi, p. 11, the Conseil régional de l’environnement et du développement durable du Saguenay—Lac-Saint-Jean, p. 12, the Union québécoise pour la conservation de la nature, p. 7-8, the Conseil de la nation huronne-wendat, p. 3-8 and André Bouchard). One citizen feels that “the proponent is minimizing the importance of this sanctuary for the territory’s wildlife” (brief by Yves Truchon, p. 1). Participants emphasized, among other things, the territory’s dense population of moose, the rich avian fauna along the Pikauba River in the sector where the reservoir would be built, as well as other abundant species, such as the beaver. The Union québécoise pour la conservation de la nature argues that a vital part of the moose’s summer habitat would disappear, specifically “marches and swamps which constitute […] an important part of the moose’s summer habitat” (brief, p. 7). The Conseil de la nation huronne-wendat considers this territory as a major route for moose and do not want to see the species disturbed in the future “given the importance of these wetlands for annual requirements, the lack of information about spatial reorganization and the effects on moose populations once the reservoir is in place” (brief, p. 7).

Furthermore, the Conseil de la nation huronne-wendat and the Comité de l’environnement de Chicoutimi foresee a risk of increased collisions with moose along

highway 169 since they would be forced to go around the body of water created by the reservoir on the Pikauba River (briefs by the Comité de l'environnement de Chicoutimi p. 11 ; the Conseil de la nation huronne-wendat, DT1, p. 17).

Participants are also worried about the impact on other wildlife species such as brook trout and waterfowl. They also stressed the importance of the Pikauba River valley as a migratory route and for its sector of meanders which provide an ideal nesting ground for waterfowl (briefs by the Comité de l'environnement de Chicoutimi, p. 9, the Conseil régional de l'environnement et du développement durable du Saguenay—Lac-Saint-Jean, p. 12, the Union québécoise pour la conservation de la nature, p. 8 and the Conseil de la nation huronne-wendat, p. 8).

The loss of habitat and productivity among brook trout populations as a result of the opening of the reservoir causes concern. Some participants believe that the mitigation and compensatory measures proposed by the proponent are inadequate (briefs by Yves Truchon, p. 2, the Union québécoise pour la conservation de la nature, p. 8 and the Conseil de la nation huronne-wendat, p. 3). The Conseil de la nation huronne-wendat concluded that "flooding part of the Pikauba River represents a loss of fish habitat in the river and its entire watershed" (brief, p. 5). Furthermore, since it would be impossible to compensate for losses inside the watershed, the natural environment that would be flooded must not be destroyed.

Recreational activities in the Pikauba River sector

The Pikauba River is of interest to canoe and kayak enthusiasts : "The magnificent beauty of its landscapes and its long sections of challenging rapids make it one of the most popular and coveted rivers in the region" (brief by the Fédération québécoise du canot et du kayak and Club de canot-camping l'Aviron, p. 5). The Club de kayak de la rivière aux Sables considers its rapids to be "exceptionally attractive," and is convinced that the project would destroy the conditions that make the river ideal for kayaking. The Club, therefore, asked that the possibility of opening the Pikauba dam gates to release water be examined (brief, p. 2). The Fédération québécoise du canot et du kayak and Club de canot-camping l'Aviron are concerned that sudden increases in discharge could be dangerous for canoers (brief, p. 9).

In addition, the sector upstream from the Pikauba 3 forest dam is considered unique in terms of its natural environment and landscapes (brief by the Fédération québécoise de canot et du kayak and Club de canot-camping l'Aviron, p. 6). According to several participants, it offers tremendous recreational and eco-tourism potential which has yet to be developed (briefs by the Fédération québécoise du canot et du kayak and Club de canot-camping l'Aviron, p. 8, the Société des

établissements de plein air du Québec, p. 3 and DT9, p. 26-27). “The construction of the Pikauba component would be a definite obstacle to the development of eco-tourism on this exceptional site” (brief by the Société des établissements de plein air du Québec, p. 3 ; Conseil de la nation huronne-wendat, DT1, p. 17-18).

The sector of Pikauba River for the planned reservoir is also prized land for moose hunting which many fear will be disturbed (briefs by the Conseil de la nation huronne-wendat, p. 6-9, the Union québécoise pour la conservation de la nature, p. 8 and the Société des établissements de plein air du Québec, p. 2 ; Conseil de la nation huronne-wendat, DT1, p. 17-18).

In addition, the Société des établissements de plein air du Québec expects to see a “significant reduction in the catch rate of brook trout in the Pikauba reservoir” (brief, p. 2). It believes that the application of compensatory measures at Lac à Jack, although situated in another watershed, remains the only viable compensation (brief, p. 3).

The Comité de l’environnement de Chicoutimi believes that the construction of the Pikauba River reservoir would cause substantial losses in fishing, hunting and tourism revenue (brief, p. 11).

Level of the Pikauba reservoir

The maximum level for managing the proposed Pikauba reservoir is 417.7 m. Some participants would like this level to be approved in order to ensure public safety and to maintain the level of Lake Kénogami at 163,86 m ± 0,1 m (114 ft ± 4 in).

The Conseil régional de l’environnement et du développement durable du Saguenay—Lac-Saint-Jean, however, considers this level to be too high, and prefers a safer level of 412.7 m. It emphasized that “the emptier the reservoir, the greater the margin of manoeuvre for retaining a quantity of water, that is to say, its capacity to route a flood in a timely manner” (brief, p. 7). The council adds that managing the reservoir at 412.7 m, instead of 417.7 m, would allow 330 ha of wetlands to be preserved (brief, p. 12), in addition to maintaining Lake Kénogami at a level that would be satisfactory to shoreline residents 96.5% of the time (brief, p.,9).

The methylmercury problem

The effects of methylmercury contamination due to flooding in the Pikauba River valley worries many participants (briefs by the Comité de l’environnement de Chicoutimi, p. 13 ; the Conseil régional de l’environnement et du développement durable du Saguenay—Lac-Saint-Jean, p. 12 ; the Union québécoise pour la

conservation de la nature, p. 8 and the Conseil de la nation huronne-wendat, p. 8). The Union québécoise pour la conservation de la nature argues that the creation of a reservoir will cause “mercury contamination of fish, the extent and duration of which is unknown” (brief, p. 8). The Comité de l’environnement de Chicoutimi stated that increased methylmercury contamination of certain species prized by fishermen could have an impact on human health (brief, p. 13). The Conseil régional de l’environnement et du développement durable du Saguenay—Lac-Saint-Jean recommends a lower water level for the Pikauba reservoir which, among other things, would reduce the quantity of mercury released into the environment (brief, p. 12).

Lake Kénogami

Summer water level

Lake Kénogami’s water level has long been a topic of discussion among shoreline residents. Some even consider it to be “a major obstacle to any kind of viable development of the Lake Kénogami sector” (brief by Paul-Roger Cantin and Guy St-Jean, p. 2).

The project would allow Lake Kénogami’s water level to be stabilized at 163.86 m ± 0.1 m (114 ft ± 4 in) during the summer. Many participants support the stabilization of the water level (briefs by the Association pour la protection du lac Kénogami, p. 4, Paul-Roger Cantin and Guy St-Jean, p. 2, the municipality of Larouche, p. 4, Joseph Thomas, the Comité provisoire du lac réservoir Kénogami et des rivières aux Sables et Chicoutimi, p. 5 and Jocelyne Girard Bujold, p. 5). Some participants, however, would like the summer season to extend from the end of the spring floods up to the freeze-up season, or at least to the end of September. They feel that the project could allow this extension (briefs by the Association pour la protection du lac Kénogami, p. 4, the Comité provisoire du lac réservoir Kénogami et des rivières aux Sables et Chicoutimi, p. 5 and Claude Collard, p. 7).

The Association pour la protection du lac Kénogami sees the project as a definite improvement of the situation with regard to variations in water levels observed at Lake Kénogami : “The project submitted by the proponent provides for approximately 4 inches during the summer, while, historically, we have been accustomed to about 4 feet” (brief, p. 4). Some feel that the project would afford the population better use of the lake (briefs by Lynn Gauthier and the municipality of Larouche, p. 4).

Not everyone, however, agrees with this position. Some participants are worried about stabilizing the lake at a level higher than the current one, because they believe

that “the desire to maintain the Kénogami reservoir at a high level contradicts the objective of improving public safety” (brief by the Fondation Rivières p. 13). The Comité des citoyens de Laterrière inc. agrees, stating that “the lake level must never exceed 113.5 feet [163.7 m], except in the justified case of an emergency” (brief, p. 14). According to the committee, Lake Kénogami could serve to increase public safety during future floods if it is not completely filled (brief, p. 18-19).

One citizen noted that a level of 163.7 m (113.5 ft) is ideal for boating, but submerges the beaches (brief by Guy Thibeault). Mouvement Au Courant recommended that the lake level be maintained at 163.25 m (112 ft) (brief by Mouvement Au Courant, addenda). In addition, the organization questioned the small variation proposed for the water level : “Focussing on ± 10 cm treats this body of water like a swimming pool, not a lake!” (brief, p. 2).

As for the major ecological impact of building the Pikauba reservoir, the Union québécoise pour la conservation de la nature deemed it unacceptable to maintain water levels for the purpose of recreational activities. It recommended that “the order’s requirement to maintain a constant water level in the lake be modified or thrown out in order to reduce the scope of these constraints on the overall management of the drainage basin” (brief p. 4).

The stabilization of Lake Kénogami at a high level could, according to some groups, reduce its storage capacity in the event of a flood (briefs by the Conseil de la nation huronne-wendat, p. 10 and Fondation Rivières, p. 7).

Furthermore, with regard to the minimum summer level of Lake Kénogami, the mayor of Larouche recommended 113 feet (163.55 m) since a lower level would impede certain activities (brief, p. 3). The Conseil régional de l’environnement et du développement durable du Saguenay—Lac-Saint-Jean also recommended this level in order to avoid boating-related problems (brief, p. 8). The Comité provisoire du lac réservoir Kénogami et des rivières aux Sables et Chicoutimi insisted that residents and lake-users have a role in determining the minimum water level in summer. Users must also agree on a maximum level (brief, p. 5).

One participant pointed out that a minimum water level in the winter is also necessary, since some residents run the risk of not having enough water in their supply wells (Lynn Gauthier, DT7, p. 19-21).

Lake outflow

Questions were also raised about the lake’s current outflow, set at 42.5 m³/s. The absence of any mention of outflow in the authorization order for the study of the

project as well as upcoming deadlines for supply contracts with the energy companies located upstream from Lake Kénogami worries many participants who fear that outflow management does not take into account all of the lake's uses (briefs by the Conseil régional de l'environnement et du développement durable du Saguenay—Lac-Saint-Jean, p. 10, the Comité provisoire du lac réservoir Kénogami et des rivières aux Sables et Chicoutimi, p. 5, the Union québécoise pour la conservation de la nature, p. 5, the Conseil de la nation huronne-wendat, p. 10 and Paul Ruel ; John Burcombe, DT2, p. 9).

Another citizen pointed out that maintaining the current minimum outflow would negatively impact the level of Lake Kénogami and lakeside residents would suffer during water shortages in the Pikauba reservoir (Claude Collard, DT5, p. 29). Lake Kénogami residents and users expressed their desire to establish a minimum level for Lake Kénogami during the summer that would take precedence over the 42.5 m³/s outflow, thus reducing this outflow in case of dry spells (brief by the Comité provisoire du lac réservoir Kénogami et des rivières aux Sables et Chicoutimi, p. 5). The chair of the Comité provisoire du lac réservoir Kénogami et des rivières aux Sables et Chicoutimi presented the position of some of its members that the lake's outflow should be reduced to somewhere in the range of 36 m^3/s during dry spells or when inflows are extremely low (Paul Ruel, DT6, p.39).

For many participants, the absence of a guaranteed minimum outflow for industries would ensure greater flexibility in the management of the lake and its outlets. They argue that this would reduce the project's environmental impact and facilitate a management plan that promotes maintaining the lake level (briefs by the Union québécoise pour la conservation de la nature, p. 5 and Fondation Rivières, p. 13 ; Paul Ruel, DT2, p. 8).

The Comité des citoyens de Laterrière inc. is not opposed to a reduction of the minimum outflow, although studies should be conducted to determine the effects of this reduction on the rivers.

Several participants also demanded that contracts regarding the use of hydroelectric power on rivers be made public and that future contracts be negotiated and signed in a transparent manner (briefs by Yves Truchon, p. 4-5, Lynn Gauthier, the Association pour la protection du lac Kénogami, supplement to the brief, p. 19, Claude Collard, p. 7, Fondation Rivières, p. 13 ; Guy Vigneault, DT7, p. 43).

Lack of knowledge about the profits of hydroelectric companies, the royalties paid to the government, and the government's commitments to these companies were raised by some of the participants (briefs by Yves Truchon, p. 4, Lynn Gauthier and the

Comité provisoire du lac réservoir Kénogami et des rivières aux Sables et Chicoutimi, p. 6 ; André Bouchard, DT3, p. 14).

The Comité provisoire du lac réservoir Kénogami et des rivières aux Sables et Chicoutimi and a citizen proposed that the government reinvest part of the royalties from hydroelectric production in upgrading the Lake Kénogami watershed (briefs by the Comité provisoire du lac réservoir Kénogami et des rivières aux Sables et Chicoutimi, p. 6 and Guy Vigneault, DT7, p. 43). Others hope that public opinion will be taken into account when negotiating agreements and contracts with energy companies on the Rivière aux Sables and the Chicoutimi River (briefs by Lynn Gauthier and Claude Collard, p. 7).

Bank erosion

Several citizens raised the problem of bank erosion in the sensitive zones of Lake Kénogami, particularly the banks located in the far western sector. Specifically, they criticized the lack of attention paid to the further erosion that would occur following stabilization of Lake Kénogami as well as the absence of any mitigating measures to this effect (briefs by Yves Truchon, p. 2, Pierre Gauthier and Louise B. Accolas, p. 2 and Marc Savard, p. 3).

One citizen requested that the project include the protection of sensitive banks since, in his opinion, the project would exacerbate the current state of erosion. He noted that the owner and manager of the structures on Lake Saint-Jean carried out work designed to protect the banks (brief by Marc Savard, p. 5). The City of Saguenay as well as the municipality of Hébertville backed this citizen's request (brief by Marc Savard, appendix). Another citizen wanted "the proponent to propose a bank stabilization program that would take into account both the needs of shoreline residents and those of fishery resources" (brief by Yves Truchon, p. 3). According to another participant, stabilizing these banks after further erosion would be extremely costly (brief by André Bouchard).

Shoreline residents near the Ouiqui dike suggest that the management level of Lake Kénogami be brought back to 163.56 m ± 0.1 m (113 ft ± 4 in) during the summer season in order to counter the inevitable phenomenon of erosion (brief by Pierre Gauthier and Louise B. Accolas, p. 5).

Raising Lake Kénogami's dikes and dams

Raising dikes and dams and the construction of new structures would enable Lake Kénogami to reach a higher maximum level. Some shoreline residents are worried

about the potential repercussions of this level, particularly with respect to compensation for flooding to both permanent and seasonal residents. They fear that shoreline residents would suffer material losses and substantial damages as well as reduced safety for the benefit of the safety of the population living downstream (briefs by the municipality of Larouche, p. 4 and Joseph Thomas).

The Comité provisoire du lac réservoir Kénogami et des rivières aux Sables et Chicoutimi considers it important for the government and the municipalities to define their scope of responsibility in case of flooding in order to determine the compensation that would be awarded to permanent and seasonal residents (brief, p. 5).

The mayor of Larouche pointed out the economic contribution of primary and secondary homeowners who live on the lake. As a citizen, he asked that, in the event of a flood, all shoreline owners on Lake Kénogami receive compensation beyond the 164.16 m (115 ft) mark, based on the real value of their properties (briefs by the municipality of Larouche, p. 4-5 ; DT6, p. 60 and brief by Joseph Thomas).

The flow of methylmercury towards Lake Kénogami and its outlets

The flow of mercury from the Pikauba reservoir to Lake Kénogami is of concern to one citizen who feels that this question was downplayed in the impact study. He is worried that mercury will be deposited at the bottom of Lake Kénogami and will accumulate there, which could have repercussions on shoreline residents and aquatic fauna (brief by Yves Truchon, p. 3-4).

The City of Saguenay considers that “even minimum amounts of methylmercury in the fish and water raises concerns about the treatment of drinking water” (brief, p. 4).

Road problems at the Coulée-Gagnon dike

The problem on Chemin du Quai in the Coulée-Gagnon dike sector was addressed since raising the dike will bring about changes to the layout of this road. The corridor affected by the work includes two non-conformities consisting of two dangerous bends considered to be “successive traps.” Within the scope of the project, the proponent would correct only one of these bends. This upgrade would increase speed in the Coulée-Gagnon sector, but could lead to more accidents since the rest of the road would remain sub-standard (brief by Claude Collard, p. 8).

Reconciling Lake Kénogami's varied uses

Shoreline residents noted that Lake Kénogami's use has diversified over the years. It has been transformed from a reservoir to a "body of water with multiple uses" (brief by Pierre Gauthier and Louise B. Accolas, p. 2).

The Comité provisoire du lac réservoir Kénogami et des rivières aux Sables et Chicoutimi considers the project an opportunity to manage the lake in such a way as to solve the various conflicts arising from its multiple uses : "The management plan should enable conflicts regarding the lake's use to be solved among all players, and should bring about a more equitable sharing of this water resource" (brief by the Comité provisoire du lac réservoir Kénogami et des rivières aux Sables et Chicoutimi, p. 4). Other citizens agree :

> The proposed project also strives to reconcile the various uses made possible by the enormous potential of such a beautiful body of water that can be used for drinking water, hydroelectricity, boating and vacationing, recreational tourism, wildlife activities…, not to mention the development and protection of the environment and ecosystems. In this context, each user represents a key player in reaching the targetted objective.
> (Brief by Pierre Gauthier and Louise B. Accolas, p. 2)

Still, not everyone sees the project as a way to reconcile the lake's varied uses, and some feel that Lake Kénogami's vacationers would be favoured at the expense of other users (briefs by Yves Truchon, p. 6 and Marc Savard, p. 5).

> Improving the quality of life of some (boaters and vacationers) means land lost, risks to homes, a great deal of expenses and a burden […] to be shouldered by others.
> (Brief by Marc Savard, p. 5)

Stabilizing the lake for recreational purposes is also perceived to be an objective that is favoured at the expense of environmental protection as well as public safety (briefs by the Comité de l'environnement de Chicoutimi, p. 5-7, the Union québécoise pour la conservation de la nature, p. 5, the Comité de citoyens de Laterrière inc., p. 17 and the Conseil de la nation huronne-wendat, p. 11 and DT1, p. 18).

Trucking

Problems associated with the construction of the dike at low point 1 and sill excavation in the Rivière aux Sables were raised by one citizen who is worried that possibly tens of thousands of truck trips along the road that leads to her house could alter the pavement, making the road difficult to drive on and presenting a potential safety risk to her children (Nathalie Arpin, DT5, p. 66-67).

The Chicoutimi River and the Rivière aux Sables

Insecurity of shoreline residents

Residents living on the banks of rivers downstream from Lake Kénogami are worried about the capacity of the planned structures to reduce the impact of future flooding. This concern extends not only to potential damage to land, homes and residential or industrial structures, but also to public safety.

The possibility of other major floods is of great concern to the citizens of Laterrière who experienced flooding before the 1996 catastrophe. Fearing recurrence, they feel that no solution has been developed to improve outlet capacity. Furthermore, they question the Pikauba reservoir's capacity to retain enough water to avoid a catastrophe in the event of extreme flooding. They consider the safety of citizens and their property to be a priority (brief by the Comité des citoyens de Laterrière inc., p. 4, 13, 15 and 17).

> We would be happy if lakeside residents could enjoy a stable and acceptable water level for as long as possible. We would be happy if hydroelectric companies and the City of [Saguenay] could generate maximum hydroelectric power for as long as possible. But for those of us who live on rivers, the safety of people and property must come first.
> (Brief, p. 9)

Since they deem the proposed project inadequate in terms of ensuring the protection of shoreline residents on the Rivière des Sables and the Chicoutimi River, they would like the proponent to come up with an additional solution to ensure their safety (brief, p. 32).

An employee from an industrial complex near the Bésy dam, on the Rivière aux Sables, did not hide his concern about seeing the company that ensures his livelihood destroyed if extreme flooding were to recur (brief by Ghislain Lowe). According to him, the Bésy dam would provide only minimal discharge capacity, far from a maximum probable flood, and would not be equipped with a sill for discharging various debris. He suggests that it would be possible to secure and increase its discharge capacity (brief by Ghislain Lowe).

The Comité des citoyens de Laterrière inc. would also like to see the discharge capacity of retaining works increased on the Rivière aux Sables and the Chicoutimi River so that it corresponds "to the maximum discharge of the outlet sluice gates at Portage des Roches and East and West Pibrac" (brief, p. 17). The committee feels that nothing was done to assess and correct the inconsistency of the structures noted by the Commission scientifique et technique sur la gestion des barrages in order to

obtain assurances that their discharge capacity corresponds to the required capacity, as determined by the designers of these headworks (brief, p. 19 and brief by André Bouchard).

River discharges and flood levels

Several participants asked that a minimum discharge be maintained in the rivers. The Club de kayak de la rivière aux Sables would even like to see the discharge increased in the Rivière des Sables in order to facilitate the development of the river and kayaking activities (brief, p. 2). The City of Saguenay would like to have relatively high minimum discharges in order "to maintain water levels upstream from the dams while enabling the supply of the inlets" (brief, p. 9).

Some citizens stated that "for the same discharge on the two rivers, damages were much greater for residents along the Chicoutimi River" (brief by Comité des citoyens de Laterrière inc., p. 6). The City of Saguenay questions the new division of discharges during a major flood between the Rivière aux Sables and the Chicoutimi River (brief by the City of Saguenay, p. 11).

Shoreline residents are also concerned about the possibility of increased discharge fluctuations in the rivers and the impact on their properties (brief by the City of Saguenay, p. 6 and Gilles Potvin, DT4, p. 31).

The project would increase minor and major flood levels in the Rivière aux Sables. This increase is considered unacceptable by four residents living on the banks of this river. They argued that the new flood level marks set by the proponent do not respect the definitions of these levels based on the levels reached on land and homes along the river. They stated that their land and homes would be flooded before discharges reached minor flood level (first land affected) and major flood level (first home affected). They ask that the major flood level on the Rivière aux Sables be reduced to 500 m^3/s or that excavation work be carried out at the entrance of the CEPAL rapids (brief by Harold Guay, Linda Boulanger, Richard Mercier and Manon Deschênes, p. 3-5).

Some participants are concerned about the negative effects of digging a sill in the Rivière aux Sables. The City of Saguenay feels that this could "possibly limit the movement of fish upstream and downstream from this sector" (brief, p. 7).

The Fédération québécoise du canot et du kayak and Club de canot-camping l'Aviron believes that the project would destroy the rapids under the Pibrac Bridge. These rapids are currently used to teach new canoers. The federation, therefore, proposes that a new whitewater section be built higher upstream (brief, p. 5).

Reservoir management procedures

Manager of retaining works

One citizen considers the activities related to the management of public dams and the mission of the Ministère de l'Environnement to be highly incompatible. Furthermore, he concurs with the City of Saguenay in noting that the public's confidence in the Ministère de l'Environnement was eroded following the flood of 1996. As a result, they request that dam management be entrusted to Hydro-Québec (brief by City of Saguenay, p. 12 and Ross Tamblyn, p. 3).

The Comité des citoyens de Laterrière inc. approved the recommendation by the Commission scientifique et technique sur la gestion des barrages, that "the responsibility for controlling the safety of water retaining works be entrusted to an authority that does not own or manage a retaining work" (brief, p. 14).

Citizens requested that the structures be managed from within the region and that a person in charge of Lake Kénogami's dams be present at all times to ensure public safety (brief by the Comité des citoyens de Laterrière inc., p. 14-15 and Guy Vigneault, DT7, p. 45).

Watershed management committee

The Comité provisoire du lac réservoir Kénogami et des rivières Chicoutimi et aux Sables was created as recommended by the Commission scientifique et technique sur la gestion des barrages in its report. The committee was mandated to make recommendations regarding the management of Lake Kénogami's dams. Some would like the interim committee to be officially recognized by the government as a watershed committee (brief by Paul Ruel, p. 2 and the City of Saguenay, DT6, p. 28). In addition, some participants would like the committee's mandate to be expanded to include greater responsibility for watershed management : (briefs by Pierre Gauthier and Louise B. Accolas, p. 6 ; City of Saguenay, DT6, p. 28 and Paul Ruel, p. 2).

> We feel it is important to make sure that discussions between government managers and the region not be limited to very specific periods, such as summer management.
> (Brief by Pierre Gauthier and Louise B. Accolas, p. 6)

This committee must have the power to determine how the Lake Kénogami watershed will be managed. The population in the region must decide how to share water, which is a collective resource, and how this watershed will be managed in the future in order to achieve a more equitable sharing of water, keeping in mind all aspects of sustainable development based on respect for the environment and the populations concerned.
(Brief by Paul Ruel, p. 2)

Chapter 2 Project Purpose and Alternatives

In this chapter, the Panel gives an overview of the events that led to the development of the project, and then examines how effectively the project meets its key goal, namely public safety.

The events of July 1996

From July 19 to 20, 1996, between 150 and 280 mm of rain fell on the Saguenay–Lac-Saint-Jean region, depending on the sector. The population was hard hit by this event. A large number of citizens were evacuated and many lost property. The flood caused damage to hundreds of residential, commercial and industrial properties as well as to hundreds of kilometres of public infrastructure including roads, power lines and aqueducts. Erosion disrupted countless streams and rivers, and whole sections of riverbeds shifted. The damage to infrastructure, rivers, properties and businesses and financial losses in the region were evaluated at over $ 750 million (DB51, p. 4 and DB42, p. 129).

In January 1997, the Commission scientifique et technique sur la gestion des barrages concluded that the disaster was an exceptional event. The Commission also stated, in broad terms, that the scope of the damage and the impact on the population could have been lessened with better land-use planning, different management of discharge control structures, a more suitable design of structures and stricter and more modern emergency, monitoring and control measures. It paid particular attention to the summer management of Lake Kénogami and the antagonism between the needs of shoreline residents and those of hydroelectric companies on the Rivière aux Sables and the Chicoutimi River. The Commission recommended a series of measures designed to revise the legal framework, reinforce the safety of the retaining works and emergency preparedness, improve dam design and management, implement watershed-based water management and conduct land-use planning according to flood plains and risk-prone areas.

In addition, it submitted a series of recommendations specifically for Lake Kénogami, namely creating a watershed committee, conducting studies to find permanent solutions to the flooding problem and temporarily suspending the lake's summer water level management plan until the implementation of permanent solutions (Commission sur la gestion des barrages, p. 10-1 to 10-13 and 11-1 to 11-15).

The project and alternative solutions

The Panel first identified the project's main objective of public safety. It then examined the project's various components from a safety perspective, with the main alternatives proposed during the preliminary design. Objectives pertaining to recreational tourism and hydroelectric power generation are addressed in another chapter.

Flood routing through the creation of a reservoir

Flood routing involves the temporary storage of floodwaters in a reservoir in order to distribute the runoff over a longer period of time. This retention can result from a physical storage structure or from measures designed to delay the runoff of surface water by encouraging water infiltration or retention through vegetation. The result is weaker peak discharges even though the overall volume flowing through the watercourse is the same.

Lake Kénogami's watershed is extremely uneven with rocky soil that is not conductive to rainwater absorption, thus leading to rapid runoff of surface water. Since this watershed is largely forest, however, the vegetation cover, despite commercial cutting in various areas, helps to retain the runoff of surface water. Physical structures must therefore be built to route the flood or to improve the discharge capacity of watercourses in order to avoid or reduce damages caused by flooding and torrential runoffs. There are several possible alternatives for attaining this goal in the Lake Kénogami watershed. One of the measures suggested by the proponent is to implement methods for storing a portion of the floodwater in order to reduce peak discharges downstream.

An evaluation of the scale of the July 1996 flood revealed that the peak discharge from Lake Kénogami reached 1,856 m^3/s according to the reconstruction of events by the Ministère de l'Environnement. Without Lake Kénogami, this peak discharge could have reached 2,780 m^3/s in the lake's outlets since the lake actually served as a storage reservoir by retaining 130 hm^3 of water.[1] Nevertheless, hundreds of shoreline residences were flooded as the water rose to the 166.07 m (121 ft) mark. According to the evaluations, approximately 860 hm^3 of water fell on the watershed and some 589 hm^3 reached Lake Kénogami between July 19 and 24 (DQ13.1, p. 12).

Project design studies revealed that an even greater flood is possible. The peak discharge of this maximum probable flood at the lake's outlets is evaluated at

1. One hm^3 represents 1,000,000 m^3.

4,554 m^3/s in the spring and 3,654 m^3/s in the summer or fall, under the current conditions of the Lake Kénogami watershed.

In the event of another flood similar in scale to the one in July 1996, Lake Kénogami cannot retain enough water to prevent the property damage experienced in 1996, unless the lake is managed at a lower summertime maximum level, that is, below 161.5 m (106.3 ft). According to data collected during the public review of the project, Lake Kénogami would not be very effective in mitigating the damages caused by a maximum probable flood in the summer-fall on the Rivière aux Sables and the Chicoutimi River, as it would be unable to store enough water to prevent peak discharges above 2,400 m^3/s, unless it was maintained at a level significantly below 160.5 m (103 ft). Since the lake is already at its lowest level at the end of the winter in order to partially contain spring flooding, it would not have the necessary margin of manoeuvre to mitigate the major damages caused by a springtime maximum probable flood (DB27, p. 14, 16, 17 and 40, DA5, p. 8-17 ; PR5.5, DB38, p. 5-11 (PR5.1).

A few years ago, an option without a storage reservoir upstream from Lake Kénogami was studied. This alternative involved the flow of very high peak discharges in the Rivière aux Sables and the Chicoutimi River and the flooding of the Lake Kénogami shoreline beyond the 166 m (121 ft) level, with the property damage that this would entail. In order to route some of the springtime maximum probable flood it would, however, be possible to increase the lake's storage capacity by digging sills upstream from the Pibrac and Portage-des-Roches dams to bring the lake to below its minimum level (DQ19.1).

Maintaining Lake Kénogami at such low levels in the spring and summer for safety reasons would, however, significantly alter the lake, thus requiring major changes in its use for recreational tourism, vacationing and as a source of hydroelectricity.

Given the potential environmental effects of this type of lake management, the proponent opted instead to build a storage reservoir upstream from Lake Kénogami in order to safely maintain a higher water level in the lake, particularly in the summer period. This type of reservoir can have a variable capacity, based on the options adopted and the objectives in terms of peak discharges in the watercourses and the maximum level of Lake Kénogami.

In 1997, the Government of Quebec and its agents began to examine several storage options. Eight different reservoir scenarios were studied. These scenarios were analyzed along with other options and variants related to the flow of extreme floods downstream from Lake Kénogami. Some scenarios went as far as to suggest intercepting all surface runoff upstream from Lake Kénogami, while others suggested

intercepting only a portion of the runoff. Clearly, multiple combinations were theoretically possible (DA11).

The proponent deemed the construction of a reservoir on the Pikauba River and another on the Rivière aux Écorces a realistic scenario. This option with two reservoirs would enable the storage of a large enough volume of water to retain a maximum probable flood. While this scenario would slightly increase the level of safety and reduce damages in the event of such a flood, it was rejected by the government due to an additional price tag of approximately $67 million, concerns about the potential effects and the low probability that such a flood would actually recur (DQ13.1, p. 40).

The proponent therefore opted for a scenario with a single reservoir on the Pikauba River, capable of storing up to 272 hm^3 of water in the spring since it would be drained before the snowmelt. This reservoir would intercept 24% of the water from the watershed draining toward Lake Kénogami. During the summer, its normal storage capacity would be reduced to 194 hm^3, since a reserve of water would be kept to sustain the level of Lake Kénogami. The proponent considers that this reservoir, combined with other components of the project, would answer public safety needs and prevent property damage downstream from Lake Kénogami in the event of a flood similar in scale to the one in July 1996. However, in the case of a maximum probable flood, even with an improved flood forecasting system that would provide a few hours notice for the evacuation of residents, it would not be possible to prevent property damage along the Rivière aux Sables and the Chicoutimi River since the major flood level would be surpassed.

Some participants, including the Fondation Rivières, the Fédération québécoise du canot et du kayak and Club de canot-camping l'Aviron, argued that Lake Kénogami can be managed without an upstream storage reservoir and without any additional infrastructure for drainage toward the Saguenay River. One participant commented that the project's criteria for public safety and protection of property were higher than those used in other regions of Quebec. Implementation of the new *Dam Safety Act* alone would meet public safety objectives at a lower cost. This participant stressed that an analysis of the project conducted by the Ministère de l'Environnement in July 1999 concluded that the construction of one or several reservoirs upstream from Lake Kénogami was an exaggerated response considering the construction costs and the very low risk of recurrence of a flood similar to the one in 1996. An option without a reservoir upstream from Lake Kénogami would involve greater but less frequent flooding of residences located around the lake, and property damages in the order of a few million dollars. The Panel noted that the proponent's optimization of the project helped to reduce the need for water storage capacity as well as the costs to

approximately $100 million compared to the 1999 estimate of $250 million (DM20, p. 10 and 11 ; DM23 ; DQ19.1).

The Ministère de l'Environnement believes, however, that the summer storage capacity proposed by the proponent is insufficient since it is difficult to predict if weather conditions will lead to a major flood, and thus argued that the summer storage capacity should be revised upwards. The Ministère, while acknowledging that the project meets safety objectives, is concerned that it leaves little room for manoeuvre an opinion shared by residents along the banks of the Chicoutimi River who question the ability of the proposed solution to cope with an extreme flood and believe that the reservoir built upstream from Lake Kénogami should intercept a greater proportion of the surface runoff from the watershed and have a larger storage capacity (Yves Rochon, DT4, p. 62-63 ; DM2 p. 29 et 30).

- *The Panel notes that given the Lake Kénogami watershed's fast reaction to precipitation, the period of time required to manage a major flood requires a better capacity to drain the lake as well as greater storage capacity upstream.*

- ***Opinion 1 :*** *The Panel is of the opinion that the construction of a flood retention reservoir upstream from Lake Kénogami is justified and preferable to alternatives not involving a reservoir.*

The Panel considers that this component of the project is essential to attaining the project's public safety objectives, reassuring a public that was severely shaken by the events of July 1996, giving a margin of manoeuvre to the managers of Lake Kénogami's flood-control works and limiting property damage. The dimensions required for such a reservoir, however, are dependent on the forecasting of extreme meteorological events, the capacity of Lake Kénogami to store the flood and the capacity of the Rivière aux Sables and the Chicoutimi River to drain the flood with minimal risk of damage.

Securing the Lake Kénogami shoreline

The July 1996 flood caused structural damage to the dikes around Lake Kénogami. For example, the Jean-Dechêne stream was transformed into a spillway when the nearby Creek Outlet dikes overflowed (Figure 2.1), and the Coulée-Gagnon dike showed worrisome signs of gully erosion. Furthermore, the water level rose high enough (to 166.07 m [121.3 ft]) to flood hundreds of Lake Kénogami shoreline homes (PR8.5 ; Commission scientifique et technique sur la sécurité des barrages, p. 3-11).

The proponent suggests raising four low points and nine dikes around Lake Kénogami, from 1.2 m to 2.4 m. This will enable the storage of 94 hm^3 of water from

the 163.96 m (114.4 ft) mark to the 165.30 m (118.7 ft) mark for a flood similar in scale to the one in 1996, and a total additional volume of 175.4 hm^3 of water from the 163.96 m mark to the 166.67 m (123.3 ft) mark in the event of a maximum probable flood (DA25 ; DA5, p. 10 ; DB27, p. 14 and 40).

Since the dikes failed under the water pressure in July 1996, attaining safety objectives without raising and reinforcing them would require maintaining Lake Kénogami at a lower level in summer, increasing the storage capacity upstream or increasing the discharge capacity in the Rivière aux Sables and the Chicoutimi River.

- ***Opinion 2 :*** *The Panel is of the opinion that raising the dikes and low points around Lake Kénogami is justified since it would increase the margin of manoeuvre for the managers of the flood-control works in the event of a major flood.*

  Lake Kénogami's Chemin du Quai crosses over the Coulée-Gagnon dike. The Ministère des Transports would take advantage of the dike reinforcement work to repair a sub-standard section of the road. Its intention is to only partially repair the problem since only one of the two bends would be modified. Partial repairs could, however, lead to a false sense of security among drivers on the section of the road rebuilt according to the Ministère's standards while other contiguous sections remain unchanged (DQ4.1 ; DM18 ; M. Claude Collard and DT10, p. 7-9).

- ***Opinion 3 :*** *As part of the reconditioning of the Coulée-Gagnon dike, the Panel is of the opinion that the Ministère des Transports should review the layout of the Chemin du Quai and consider whether it is relevant to repair the two sub-standard bends.*

Increasing Lake Kénogami's discharge capacity

The very definition of minor and major flood levels determines the maximum outflows from Lake Kénogami based on the anticipated damage on the Rivière aux Sables and the Chicoutimi River. The minor and major flood levels correspond respectively to 150 and 170 m^3/s on the Rivière aux Sables and 255 and 310 m^3/s on the Chicoutimi River. Thus, the two rivers have a combined capacity of up to 405 m^3/s before the minor flood level is surpassed and 480 m^3/s for the major level. Note that the levels are slightly higher at present because the 1996 flood dredged the riverbeds and banks (DA4, p. 4).

The following hypotheses for increasing Lake Kénogami's discharge capacity were studied between 1997 and 2000 :

– digging 600 m along the Rivière aux Sables ;

– digging several kilometers along the Chicoutimi River ;

– building an outlet toward Lake Saint-Jean along several kilometers via Belle-Rivière ;

– building a canal in the Jean-Dechêne stream which flows for several kilometers before reaching the Saguenay ;

– digging a tunnel several kilometers long toward the Saguenay (DA11).

Building a third outlet, for example in the Jean-Dechêne stream or in the Belle-Rivière, would have significant adverse environmental effects given that these watercourses would be completely transformed along several kilometres due to their weak discharge capacity. The construction cost of a tunnel was estimated at $ 188 million (DQ27.1, p. 6-9).

Rebuilding the discharge capacity of the Chicoutimi River and the Rivière aux Sables would entail digging in these riverbeds at the points where the flood levels are most constraining given their proximity to residential zones. A brief examination of the other hypotheses, taking into account the digging of sills in these rivers, shows that work on a much larger scale would be required to achieve the same results. As part of its mandate from the Government of Quebec, the Comité provisoire du lac réservoir Kénogami et des rivières Chicoutimi et aux Sables examined all of these hypotheses in 1997 (DM16 ; DA11).

Lastly, the alternatives to the above-mentioned hypotheses entail increasing the impoundment capacity of Lake Kénogami for extreme floods as well as the capacity of the reservoir planned for the Pikauba River.

Based on the discharge objectives designed to prevent the kinds of shoreline residential damage along the Rivière aux Sables and the Chicoutimi River experienced in July 1996, the proponent ultimately decided to dig a single sill in the Rivière aux Sables. The combined capacity of the two rivers will increase to 510 m^3/s before the minor flood level is surpassed and to 960 m^3/s for the major level. The proponent specified that achieving the same results in the Chicoutimi River would require work on a much larger scale and would have greater environmental effects since work would be required at various points along several kilometres (Patrick Arnaud, DT1, p. 47).

This decision was contested by property owners located along or close to the planned sill since it requires the expropriation of some land, a lot of truck traffic (up to 40,000

trips), notably on private roads, and the inconvenience of noise and dust from the digging and transport.

Two owners who have been living for a short time downstream from the planned sill in the Rivière aux Sables believe that their property is at risk of being damaged and consequently devalued by extreme flooding (brief by Harold Guay, Linda Boulanger, Richard Mercier, and Manon Deschênes).

As for the work along the Rivière aux Sables, increasing the discharge capacity, while respecting the flood levels, would require the expropriation of residences located along this sill. While this option is less expensive, has a low environmental impact and presents less risk of accident to neighbouring residents during the construction phase, it carries a significant social cost for shoreline residents who enjoy a quality living environment.

- ***Opinion 4 :*** *The Panel is of the opinion that the work planned for the Rivière aux Sables is justified and will generate fewer adverse effects than the other proposals to increase the discharge capacity of Lake Kénogami. This work, combined with other planned measures, will widen the margin of manoeuvre for managing extreme potential floods likely to affect Lake Kénogami, thereby assuring public safety around the lake and downstream.*

- ***Opinion 5 :*** *The Panel is of the opinion that despite the higher costs and greater inconvenience related to the digging of a sill in the Rivière aux Sables, this alternative is preferable to the expropriation of shoreline residents.*

- ***Opinion 6 :*** *The Panel is of the opinion that during the construction of the works, heavy truck traffic in residential areas on roads that were not designed for such use will have significant adverse effects on quality of life, particularly with respect to resident safety.*

- ***Recommendation 1 :*** *The Panel recommends that a truck traffic management plan be developed in collaboration with the municipalities affected in order to minimize to an acceptable level the adverse effects on shoreline residents of the truck traffic necessary to carry out the works, notably those in the Rivière aux Sables.*

Safety of structures

Over the last few years, the Ministère de la Sécurité publique, in collaboration with local partners, has optimized the emergency action plan to protect the public in case of an extreme event. Should there be a repeat of the 1996 flood, the goal is to be able to absorb the flood without any serious damage. For a maximum probable flood, the

goal is to be able to rapidly evacuate the population to a safe location and to keep essential infrastructures operating (Réjean Langlois, DT5, p. 86-90).

In addition to the work realized during phase 1 of the Lake Kénogami flood-control structures, there is work that has also been done on the retaining structures downstream from the lake, along the Rivière aux Sables and the Chicoutimi River. According to the Centre d'expertise hydrique du Québec, dam capacity and operations were revised over the last few years in order to fulfill the requirements of the *Dam Safety Act*. This act and its regulations stipulate, among other things, that the existing or new dam owner must determine dam failure consequences (Julie Lafleur, DT5, p. 17-18).

Dam or dike failure does occur on very rare occasions, for example, during a dry period because of an earthquake or as a result of a design defect. During a flood or overflowing of a dam or dike crest, failure may occur if the flood surpasses the capacity of the structure. Failure can also occur as a result of a construction flaw or gate malfunction.

The *Dam Safety Act* requires proponents to build their structures to withstand major earthquakes and extreme floods which are determined on the basis of the level of consequences of a structure failure (safety check flood). The Pikauba dam and the dikes around Lake Kénogami must be designed to resist a springtime maximum probable flood. Plans and specifications must be prepared by an engineer to support the request for authorization of the structure, with a certificate from the engineer stating that the plans and specifications conform to the safety standards prescribed by regulation.

An impounded water management plan and an emergency action plan describing the measures the owner would take to safely manage the waters, particularly in situations that could compromise the safety of people and property, must be prepared. Lastly, the *Dam Safety Act* stipulates regular inspections to ensure the timely detection and correction of any deficiency and to maintain the structures in good repair.

The Act also stipulates that the proponent must produce a dam failure study before authorization is given to begin construction. In addition, the impounded water management plan and the emergency action plan must be worked out before the structures can be used. The proponent produced a study on the failure of the dikes and dams on the Pikauba reservoir and Lake Kénogami for the Centre d'expertise hydrique du Québec, but this study was not made public during the assessment procedure. Following a request by the Panel, the study was submitted after the second part of the public hearing. However, the impounded water management plan

and emergency action plan were not available for the impact study, although certain elements pertaining to these studies were integrated into the impact study.

In March 2002, Hydro-Québec Production conducted a study on the failure of the dikes and dams on the Pikauba reservoir and Lake Kénogami. It determined that the failure of the Pikauba dam during a dry period would create major damage in the Pikauba River valley, from the dam down to the mouth of the river in Lake Kénogami. Furthermore, the dam break flood wave would cause a sudden increase in the water level of Lake Kénogami in the order of 1.7 m. With a high water of 163.96 m (114 ft), the lake would attain a level of 165.6 m (119.8 ft), which is 1 m below the maximum management level evaluated at 166.67 m (123.25 ft) attained in a maximum probable flood. This level would lead to the flooding of many shoreline properties in the ensuing two hours or so without, however, affecting the integrity of the dams and dikes located around Lake Kénogami (DB57, p. 19).

In the case of Lake Kénogami, the consequences of a failure during a dry period would be very different depending on the dike. The Hydro-Québec Production study addressed the following dikes : Ouiqui, Coulée-Gagnon, Moncouche and Baie-Cascouia. Failure of the Ouiqui and Baie-Cascouia dikes would have the most serious consequences. Homes located downstream could be affected within 20 minutes or so by a dam break flood wave caused by the failure of one of these dams. The considerable volume of water contained in Lake Kénogami would maintain a powerful discharge in the breach of the dike for a few days before the lake would be emptied (DB57, p. 20-30).

The Hydro-Québec Production study refers to studies on dam and dike failures carried out a few years ago by the Ministère de l'Environnement, Hydro-Québec and the Société immobilière du Québec, prior to the July 1996 flood. These studies looked at the Portage-des-Roches, East Pibrac and West Pibrac dams as well as the Creek Outlet-2 and Creek Outlet-3 dikes. Houses located downstream from these structures would be affected within 20 minutes or so by a dam break flood wave caused by the failure (DB57, p. 33-35).

Lastly, this study provides a succinct appraisal of the situation during a flood, without, however, considering structure failure. It focuses on the water levels that would be attained in the Pikauba reservoir and in Lake Kénogami and the maximum inflows and maximum outflows in these two bodies of water. The study does not address the consequences of a possible failure of the Pikauba dam or the structures around Lake Kénogami during a flood. Studies on structure failure during a flood must therefore be produced before the construction of the Pikauba dam or the reconditioning of the

dikes around Lake Kénogami (section 19 of the *Dam Safety Act* [c. S-3.1.01, r. 1] (DB57, p. 31-32).

The project does not include restoration of the structures along the Rivière aux Sables and the Chicoutimi River. The Panel notes that these structures are nevertheless subject to the *Dam Safety Act*. Concerns were expressed during the public hearing regarding the Bésy dam. This dam is owned by Abitibi Consolidated Inc. and is located on the Rivière aux Sables. Its discharge capacity is lower than that of the structures upstream. The concerns focussed on the possibility that debris could jam the dam gates given their decades-old design. This could lead to a rise in water levels upstream from the dam and cause flooding and erosion if the water flows over the dam or the lateral retaining dikes. The Cascades Carton Plat mill and the Kraft Cascades FjordCell pulp mill located immediately upstream from the Bésy dam could be damaged (DM1).

Based on the information obtained during the hearing, the Bésy dam would have a discharge capacity of 770 m^3/s, while the structures upstream would have a capacity of about 1,000 m^3/s. The Centre d'expertise hydrique du Québec explained that this differential is due to the location of the Bésy dam close to the confluence of the Rivière aux Sables and the Saguenay River and that a dam failure consequence would lead to little or no damage downstream. As per the *Dam Safety Act*, the set recurrence interval for the safety check flood is therefore lower. This explains why a lower discharge capacity is tolerated. The Centre specified, however, that the discharge capacity of the Bésy dam is sufficient to absorb a flood similar in scale to the one in July 1996 with a crest of 650 m^3/s, taking into account the project under review. In the event of a maximum probable flood, which would lead to peak discharges exceeding 1,000 m^3/s, this dam would overflow and could possibly fail, which is considered acceptable under the Act. However, if the Pikauba reservoir planned upstream from Lake Kénogami is not built, a recurrence of the July 1996 flood would lead to a combined peak discharge of 1,348 m^3/s in the Rivière aux Sables and the Chicoutimi River, which is significantly above the project's planned discharge of 960 m^3/s (Michel Dolbec, DT5, p. 20-23).

The design criteria for the discharge capacity of the dams located on the Rivière aux Sables and the Chicoutimi River with respect to the safety check flood are thus a function of project approval. If some of the project elements, such as the reservoir planned upstream, are not implemented, this would mean that the required safety check flood would be greater in the Rivière aux Sables and the Chicoutimi River, particularly with respect to the 10,000-year return flood and the maximum probable flood. This could require an increase in the discharge capacity of certain dams.

Lastly, some participants were concerned that the flood-control works, including those that have been improved and reinforced, are operated by remote from Quebec City and that the operator residing at the Portage-des-Roches dam is not present year-round (DM2, p. 14).

- *The Panel notes that if no reservoir is built upstream from Lake Kénogami or that the dikes around the lake are not reinforced, it will be necessary to review the requirements regarding the safety check flood in the Rivière aux Sables and the Chicoutimi River. This could require an increase in the discharge capacity of certain dams.*

- ***Opinion 7 :*** *The Panel is of the opinion that the failure of the Pikauba dam or a dike on Lake Kénogami could have significant adverse environmental effects. However, given the measures set out in the Dam Safety Act it believes that such an event is highly unlikely.*

- ***Opinion 8 :*** *The Panel is of the opinion that it is important the public can examine the studies on dam failure consequences at the same time as the impact study. In the future, this approach should be a requirement.*

- ***Recommendation 2 :*** *The Panel recommends that the gates of the Bésy Falls dam be verified by the Centre d'expertise hydrique du Québec to ensure their capacity to discharge inflows under all circumstances, and that they do not risk being jammed by large debris. If this is the case, alterations to the dam must be required by virtue of the Dam Safety Act.*

- ***Recommendation 3 :*** *The Panel recommends that local methods be established to enable the timely verification of Lake Kénogami's discharge control works, in the event of a flood that may lead to a flood warning.*

Discharge management

Forecasting inflows into Lake Kénogami is part of a management plan that the Centre d'expertise hydrique du Québec has been applying since 1996. The plan allows inflows into Lake Kénogami to be forecasted a few hours in advance. This is accomplished through on-site gauging stations, weather forecasts and discharge simulation software. An engineer on call at the Centre then uses these forecasts to make a decision regarding the outflow from Lake Kénogami. This management enables a given volume of water to be discharged in advance if Environment Canada is predicting major precipitation. The objective is to avoid needlessly issuing a flood warning along the Lake Kénogami shoreline or along the Rivière aux Sables and the Chicoutimi River. Based on established indicators or if there is any doubt about the

flow discharge capacity, the engineer advises the Centre and public services, and implements the emergency measures according to the warning level. These warning levels are currently based on established flood levels on the Rivière aux Sables and the Chicoutimi River as well as around Lake Kénogami. The Centre d'expertise hydrique du Québec has an automatic outdialer, among other things, to advise the population at risk. The project will bring few changes to this process.

The Centre estimates that at least three hours are needed between the moment the warning is issued and the implementation of emergency measures, such as evacuating the population and opening the gates on Lake Kénogami. The more effective the devices, the greater the chance of minimizing damages and implementing emergency measures at the appropriate time (DB46 ; Richard Turcotte, DT5, p. 94-95).

Although the Ministère de l'Environnement has modernized its gauging devices and assessment tools since 1996, the proponent recommends adding gauging stations upstream from Lake Kénogami and using more sophisticated software. This means that a station on the Rivière aux Écorces and another on the Pikauba River would be added to the four existing weather stations. The proponent would also add three gauging stations to the two existing ones located upstream from Lake Kénogami. The data gathered would be used as background information for a new forecasting software model (Hydrotel) supported by comprehensive knowledge of the physical characteristics of the Lake Kénogami watershed as well as Environment Canada's 12-hour weather forecasts. The model would provide an estimate of sudden inflows at 3-hour and 24-hour intervals.

Another software tool will be used to evaluate the potential effects of various decisions related to outflow management. With improved forecasting management, the proponent estimates the response time to be 6 hours in order to make decisions on how to discharge inflows similar to those of July 1996 (DA24 ; DA2).

The Panel noticed that the forecasts made by the Hydrotel software, combined to the data from gauged discharges, differed slightly, particularly with regard to time. While the software may be accurate enough to determine the scope of a sudden inflow, there appears to be a discrepancy of up to several hours between the inflow forecast and the real time of its occurrence. According to the Panel, this situation reveals the limitations of flood simulation and the need for a knowledgeable and experienced person who, ultimately, uses human judgement to make a decision. Moreover, in the event of a critical or dangerous situation, this person must be immediately assisted by a team of experts. Clearly, forecasting management must be carried out by an

organization that has adequate human and material resources to handle the full scale of the task.

The spokesperson for the Ministère de l'Environnement mentioned that, despite the improvements proposed by the proponent, the response time in a critical or potentially critical situation seems short and that any additional leeway would be welcomed. Forecasting management may indeed enable the population threatened by major flooding to be evacuated more quickly, but it cannot be the only tool used to provide the desired margin of manoeuvre or to prevent damages caused by a flood similar to the one in July 1996. Damages caused by an average flood, however, would probably be limited by opening the gates of the flood-control works on Lake Kénogami early on, as demonstrated by the proponent's simulations (Yves Rochon, DT1, p. 44).

The Panel noted that the project recommends a better on-site gauging network upstream from Lake Kénogami and more sophisticated decision-making tools which could enable a more timely assessment of the situation and more effective action, while minimizing the effects of the emergency drainage of inflows.

Some participants asked that the routine management of the structures on Lake Kénogami be entrusted to Hydro-Québec rather than the Centre d'expertise hydrique du Québec since the public's confidence in the Ministère de l'Environnement has been considerably weakened since July 1996. The Centre d'expertise hydrique du Québec is a major dam management organization, but it is also the organization that monitors the construction, maintenance and management of dams in Quebec (DM21, p. 4 ; DM12, p. 12).

- ***Opinion 9 :*** *The Panel is of the opinion that in order to restore the public's confidence in the dam manager, management and monitoring of this entity could be ensured by a different and independent body.*

- ***Opinion 10 :*** *The Panel is of the opinion that it is important to have a communication system in place to inform the population at all times about the management of flood-control works as well as discharges on the Pikauba River, the Chicoutimi River and the Rivière aux Sables and water levels in Lake Kénogami.*

An integrated project

After having examined the project's components, the Panel noted that opting for several measures implemented at various points in the watershed is more prudent than adopting a single intervention at one location. A combination of measures serves to optimize the efficiency of each measure. Since each component functions independently, if one fails, the others continue to function.

Additional work, such as a larger reservoir would reduce the potential of damage to property, but would not increase the level of public safety. Effective management depends on striking a balance between the cost of implementing preventive measures, the estimated cost of compensation for property damage and the environmental effects of these measures. Ultimately, what is needed are the right tools and enough time to ensure public safety, while striving to considerably reduce property damage in the event of a flood similar in scale to the one of July 1996.

- *The Panel notes that the Lake Kénogami watershed flood control project fulfils the objective of public safety.*

In the next chapter, the Panel will examine the issues related to the project's components and its management. The Panel recommends adjustments, where needed, to ensure that the project fits into the framework of sustainable development and does not cause significant adverse effects.

Chapter 3 Issues Related to the Project

In this chapter, the Panel outlines the issues related to the construction and operation of the proposed structures by analyzing their expected impact on the various areas likely to be affected. The issues considered by the Panel correspond to environmental components that are valued by the public or experts and that may be demonstrably impacted by the project.

The Panel first examines the Pikauba River sector and then analyzes the Lake Kénogami, Rivière aux Sables and Chicoutimi River sectors. It concludes the project analysis by discussing the required monitoring and follow-up mechanisms.

Pikauba River sector

Construction of a reservoir on the Pikauba River

After examining various scenarios, the proponent opted to build a reservoir on the Pikauba River. It proposes that the normal maximum operating level of this reservoir be 417.7 m. At this level, the surface area of the reservoir would reach 15.6 km^2. The reservoir would have a minimum level of 400.5 m after being drained in the winter and would reach a high water of 426.5 m during maximum probable floods.

The safety objectives for spring floods would be met by a maximum impoundment capacity of 271.9 hm^3 of water stored between the 400.5-m and 426.5-m levels. For summer floods, the storage volumes would be approximately 194 hm^3, available between the 417.7-m and 426.5-m levels. During the summer months, Lake Kénogami would be stabilized by means of a 78 hm^3 of water storage between the normal minimum and maximum levels of the reservoir. According to the proponent, the 417.7-m level corresponds to the minimum volume of water required to maintain this stabilization at a level of 163.86 m ± 0.1 m (114 ft ± 4 in), from June 15 through the first Monday in September, while guaranteeing a minimum discharge of 42.5 m^3/s for the various industrial users of the Rivière des Sables and the Chicoutimi River.

In this section, the Panel begins its analysis with several considerations related to the priming of the Pikauba reservoir. To this end, issues associated with the protection of forest environments and wetlands, moose habitats and hunting, as well as fish habitats and fishing are examined. The Panel concludes with an examination of the

effects of mercury contamination and the potential impact of the project on navigation on the Pikauba River.

Forest environments and wetlands

At a management water level of 417.7 m, the reservoir would flood almost 1,000 ha[1] of forest vegetation and 463 ha of wetlands (DA6.1, p. 13).

The vegetation within the limits of the proposed reservoir consists of previously cut stands at various stages of maturity. The vast majority of the woodland lost would be very young stands resulting from recent forest cuts (within the last ten years), coniferous and mixed-forest stands. Moreover, a 14.5-ha larch stand would also be entirely eliminated from the study area. According to the proponent, no rare or ecologically valuable stands would be affected by the clearing process and the priming of the reservoir (Jean-François Rougerie, DT4, p. 69).

Most of the 463 ha of wetlands that would be flooded by the reservoir are adjacent to the Pikauba River, in the section upstream from the old Pikauba 3 forest dam, at kilometre 36, but others are located along the Pika River, the Ruisseau Bras des Angers and tributary PP1 (Figure 3). According to the Ministère de l'Environnement, the meanders of the Pikauba River valley and the diversity of the surface deposits constitute a very interesting mosaic of swamps, marshes, peat bogs and deep-water grass beds. This mosaic comprises a significant array of habitats for terrestrial and aquatic flora and fauna (DB53, p. 4; DA32).

The loss of all the wetlands in the flooded areas would amount to 14% of the wetlands in the study area as a whole, and more specifically, almost 25% of the peat bogs and shallow-water wetlands. The proponent anticipates that the most significant ecological loss would result from the flooding of the marsh wetlands, 135 ha of which would be immediately submerged by the priming of the reservoir (PR5.4, p. 17; DA32).

1. One hectare = 0.01 km^2 or 10,000 m^2

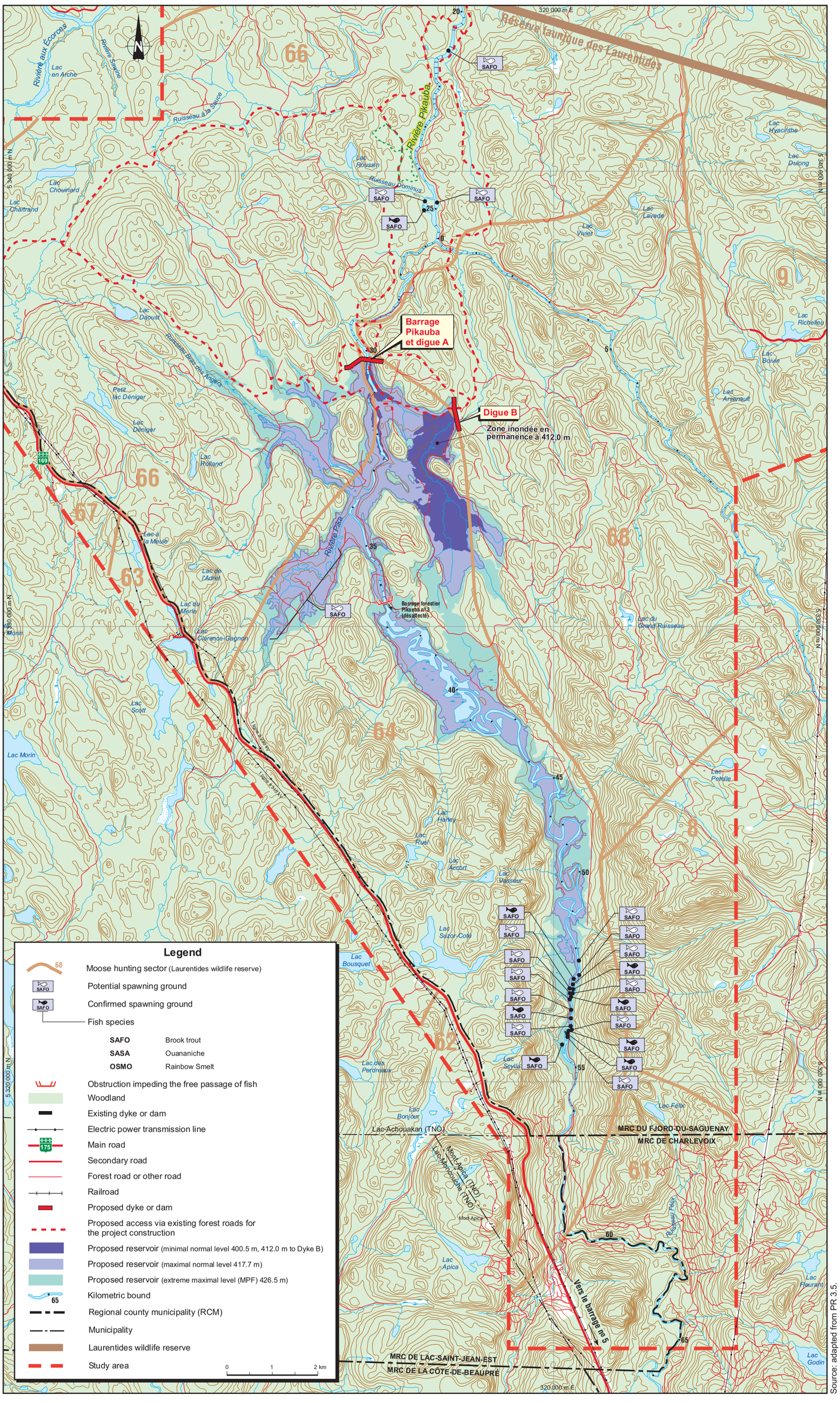
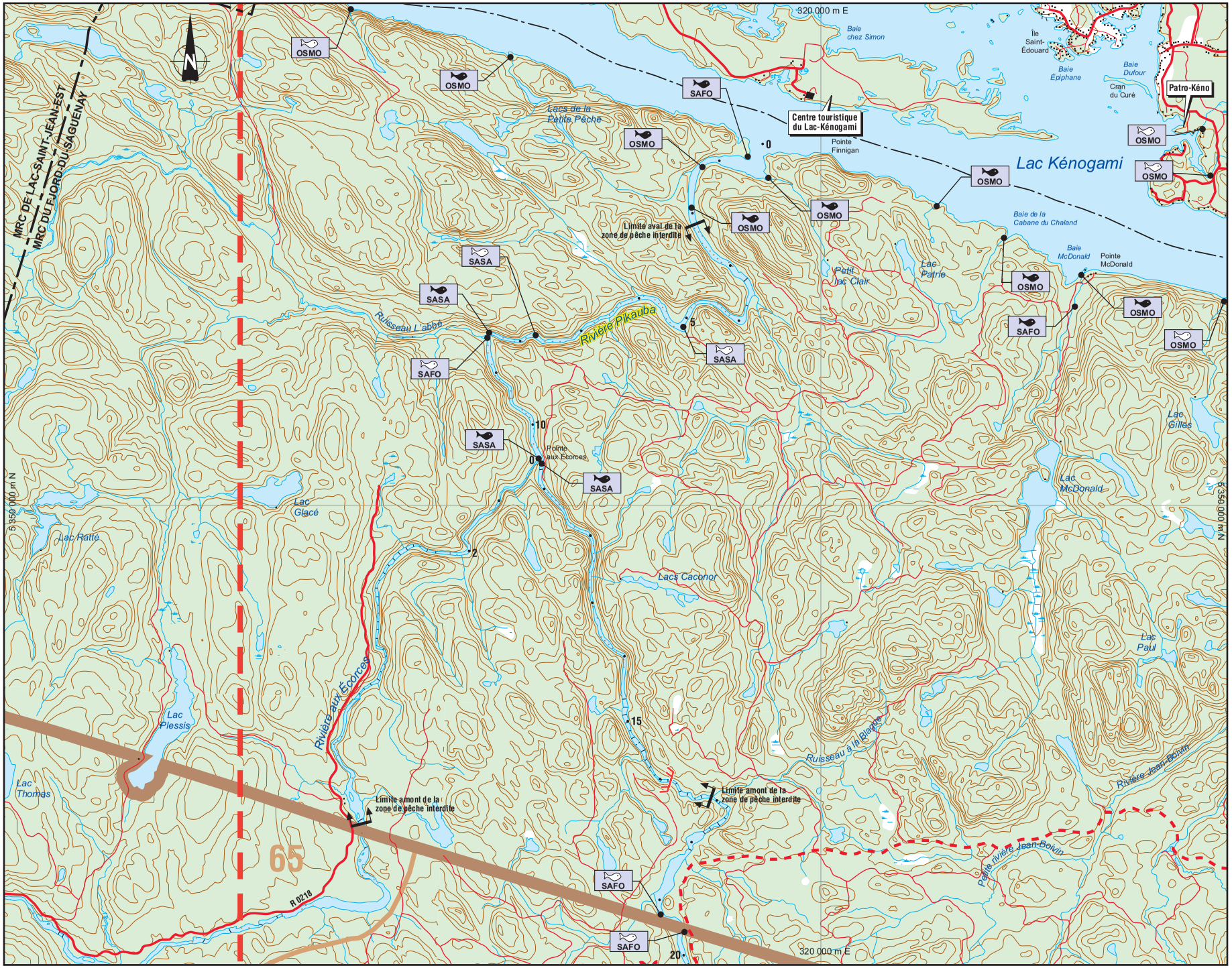


Figure 3 Pikauba River Sector

Source: adapted from PR 3.5.


320 000 m E
5 350 000 m N
MRC DE LAC-SAINT-JEAN-EST
MRC DU FJORD-DU-SAGUENAY
Baie chez Simon
Île Saint-Édouard
Baie Épiphane
Baie Dufour
Cran du Curé
Patro-Kéno
Centre touristique du Lac-Kénogami
Pointe Finnigan
Lac Kénogami
Baie de la Cabane du Chaland
Baie McDonald
Pointe McDonald
Lacs de la Petite Pêche
Limite aval de la zone de pêche interdite
Petit lac Clair
Lac Patrie
Ruisseau L'abbé
Rivière Pikauba
Lac Gilles
Lac McDonald
Pointe aux Écorces
Lac Glacé
Lac Ratté
Lacs Caconor
Lac Paul
Lac Plessis
Rivière aux Écorces
Ruisseau à la Biche
Rivière Jean-Boivin
Lac Thomas
Limite amont de la zone de pêche interdite
Limite amont de la zone de pêche interdite
Partie rivière Jean-Boivin
65
R 0218
OSMO
SAFO
SASA

The proponent contends that forestry activities, beaver dams and above all the partial dismantling of the Pikauba 3 forest dam in 1982 are the main causes of the transformation of the drainage system and of the wetlands in the area. The vestiges of the Pikauba 3 forest dam create a sill and a sufficiently high water level to maintain the wetlands for just over 15 km upstream. According to the proponent, the sustainability of the current wetlands depends on the artificial conditions created by this dam. The proponent also takes the view that the flora and fauna of these wetlands are of no particular interest and not significantly different from those found in other parts of the study area. It thus concludes that the biodiversity of the area affected by the Pikauba reservoir would not be jeopardized by the project (Jean-François Rougerie, DT3, p. 49 and DT4, p. 72 and 74).

For its part, the Ministère de l'Environnement considers that the biophysical characteristics of the valley (geology, soil, vegetation) have a much greater influence on the course of the river—and, consequently, on all the related life forms—than do human interventions (dams, forest cutting, etc.). Therefore, in order to assess the distinctiveness of the area that would be affected by the reservoir, the department compared the ecological parameters of this portion of the region with those of other areas in the Laurentides wildlife reserve. There are three rivers in the reserve with wetlands similar to those of the Pikauba River: the Métasouac River (Lac Saint-Henri sector), the Rivière à Mars and the Cyriac River. However, the characteristics of these ecological units appear to be less interesting and their wetlands less diverse. According to the Ministère, none of these three areas has wetlands equivalent to those of Pikauba River. It thus considers this section of the river to be a "unique and irreplaceable" ecosystem with very high ecological value (Patrick Beauchesne, DT4, p. 65, 67 and 75; DB53, p. 1-5).

Environment Canada also recognizes the special value of these wetlands, specifying that the meander sector constitutes a rare ecosystem in the Laurentides wildlife reserve of a type not frequently encountered in the boreal forest. Furthermore, wildlife inventories indicate that this habitat attracts a great many waterfowl. According to the Société de la faune et des parcs du Québec, it is a distinct natural environment with an exceptionally rich and diverse range of fauna: "there is no other environment with a similar habitat (encased valley, microclimate) or such a rich array of wildlife (number and density of species)" (DB33, p. 1; Louis Breton, DT4, p. 77; DQ22.1, p. 3).

Many wildlife species can be observed in the area around the proposed reservoir, including high densities of species such as moose, beaver and snowshoe hare. This area is also frequented by the American black bear, the Canadian lynx, wolf and land otter, and by fish and amphibian species. Furthermore, Environment Canada considers this area to be a good nesting site for several species of waterfowl,

including the American black duck. According to an inventory prepared by the proponent, birds belonging to two species classified as vulnerable were observed flying in the study area on one occasion.[1] The species in question are the bald eagle and the *anatum* subspecies of the peregrine falcon, which is also considered to be a threatened species by the Committee on the Status of Endangered Wildlife in Canada. However, no evidence has been found indicating that either of these birds of prey nests in the study area. No other threatened or vulnerable wildlife species, or any species likely to be so designated, has been observed by the Centre de données sur le patrimoine naturel du Québec within a 10-km wide band on the periphery of the proposed reservoir. However, the proponent noted that the Canadian lynx, a species likely to be designated as threatened or vulnerable, was observed in the study area in the winter of 2001 (PR5.1, p. 64; DQ22.1, p. 3).

The proponent estimates that the net loss of habitats will be small on the Pikauba River upstream from kilometre 30, the proposed reservoir site. In fact, it anticipates that the disappearance of wetlands, such as shallow-water wetlands (30 cm deep or less), may be compensated by the creation of new similar environments covering a larger surface area. Although the reservoir would be responsible for the disappearance of 26 ha of shallow water, the proponent contends that 50 ha of wetlands with an equivalent level of biological productivity could be created. It anticipates that the flooding of the area would create banks twice as long as the existing ones—100 km of banks compared with the current 48 km. However, the environmental impact assessment indicates that only one-third of these new banks would have the characteristics (superficial deposits, degree of slope) required to restore riparian habitats (PR5.4, p. 16).

Moreover, with respect to wildlife habitats, the proponent acknowledges that the restored wetlands may not serve the same functions as the current ones, since the types of habitats created as well as their surface areas would be different. Environment Canada also noted that these new riparian habitats would be less ecologically valuable than the wetlands lost, which are home to a significant density of nesting duck pairs (DQ22.1, p. 6).

The main constraint on the development of vegetation along the edges of a reservoir is the fluctuating water level. The project proposal stipulates that the level of water in the reservoir would be maintained at or near its normal maximum (417.7 m) throughout most of year. Between the beginning of January and the end of April, the preventive draining of the reservoir would lower the water to its minimum level

1. Order 902-2003 of August 27, 2003

of 400.5 m, and the spring flood would then return the reservoir to its maximum normal level or thereabouts. According to the proponent, this management method, which involves an annual fluctuation of almost 17 m, would hinder the development of riparian vegetation, resulting in the reduction of wetlands.

According to the Department of Fisheries and Oceans and the Société de la faune et des parcs du Québec, a fluctuation of this magnitude is unlikely to facilitate the development of productive and stable wetlands. A recent Hydro-Québec study demonstrates that, 20 years after the priming of the reservoirs for the La Grande complex, very little of the riparian vegetation around the reservoirs has naturally restored itself (PR5.1, p. 36; DB27, p. 92).

> […] much of the current riparian vegetation is precarious: it may disappear if the water in the reservoirs returns to its maximum level. Generally speaking, the natural restoration of the riparian vegetation around the reservoirs is proceeding slowly and varies depending on the type of substrate, the water conditions and the manner in which the power plants are operated.
> (DA19, p. 54)

Since the proponent is of the opinion that the loss of 463 ha of wetlands in the flooded area would not compromise the integrity of such environments in the study area as a whole, it has not provided for the implementation of any standard or special mitigation measures. The establishment of the vegetation around the Pikauba reservoir would be monitored to determine the appropriateness of restoring the peripheral wetlands. However, Environment Canada is of the opinion that the proponent should, before implementing any compensation or mitigation measures, revise its project to minimize the loss of habitats, particularly by avoiding the flooding of the area upstream from the Pikauba 3 forest dam (PR 5.1, p. 35 and 36; DQ22.1, p. 3).

Wetlands are particularly important ecosystems for the maintenance of biological diversity. The Quebec Strategy on Biological Diversity and the Canadian Biodiversity Strategy emphasize the importance of maintaining wetlands to preserve biodiversity. To this end, the Government of Quebec has defined six strategic directions, one of which is to contribute to maintaining biological diversity when planning and carrying out field interventions. With regard to energy-related activities, its objective is to promote compensation measures with respect to biodiversity for all new hydro-development plans, whether public or private. As for the Federal Policy on Wetland Conservation, it specifies that compensation measures should be designed to ensure that there is no net loss of wetland functions. It should be noted that the extent of wetlands is one of the six environment and sustainable development indicators for Canada selected by the National Round Table on the Environment and the Economy (DQ22.1, p. 3).

- *The Panel notes that the creation of a reservoir on the Pikauba River with a maximum normal management level of 417.7 m would flood almost 1,000 ha of forest vegetation and 463 ha of irreplaceable wetlands.*

- ***Opinion 11 :*** *The Panel is of the opinion that the ecological importance and irreplaceability of the wetlands in the area of the Pikauba River valley where the proposed reservoir would be built justify their protection.*

- ***Opinion 12 :*** *The Panel is of the opinion that it is appropriate to apply the objectives of the* Federal Policy on Wetland Conservation*, which are designed to prevent the net loss of wetland functions in such environments. This would also be in keeping with the objective of the* Quebec Strategy on Biological Diversity *to the effect that compensation measures designed to maintain biodiversity be included in all new hydro-development plans, whether public or private, even if the project is a flood-control initiatives.*

Moose habitats and hunting

According to the environmental impact assessment, the area where the proposed Pikauba reservoir would be built is home to a diverse and abundant array of wildlife. According to the Société des établissements de plein air du Québec, the moose is the most prized species in this area, and the hunt for this large mammal, the greatest source of income after brook-trout fishing (DB27, p. 139).

Moose habitats

The moose density in the study area is approximately 4.5/10 km^2, which is markedly higher than the density observed in the Laurentides wildlife reserve as a whole (2.4/10 km^2). These moose numbers are among the highest in Quebec, even approaching those observed in regions where hunting is prohibited.

According to the proponent, the abundance of moose in the study area is mainly attributable to its controlled harvesting as well as to the quality and quantity of forest stands favourable to this species. A forest mosaic comprising a mixture of very young and mature hardwood and softwood stands provides the moose with adequate protective cover and a high-quality food supply.

The environmental impact assessment points out how attractive the wetlands along the Pikauba River are to this species. Moose often frequent these environments notably during the fall breeding season, and even more so during the search for partners. Moreover, a forest inventory conducted by the proponent in fall 2000

confirmed the presence of many beds, trails and paths in the wetlands located along the Pikauba River, between kilometres 37 and 52 (PR5.1, p. 69).

However, according to the proponent, fewer moose seek food and shelter in the Pikauba River wetlands during the summer months. There are almost no aquatic grass beds in the area, or too few to attract the mammal. Moreover, the banks are made up of extensive areas of upland meadow where grasses such as blue-joint, which are of little interest to the species, grow in abundance. Also present are large areas of speckled alder, a plant species unattractive to the moose.

In the opinion of the proponent, the forest environments adjacent to the Pikauba River, and more specifically the portions that were cut about ten years ago, are the areas most attractive to the moose, providing high-quality food in summer and cover in winter (Jean-François Rougerie, DT3, p. 65).

Based on the assumption that the late-winter habitats are more critical for the species than those frequented at any other time of the year, the proponent conducted an aerial inventory in the winter 2001. The findings of this inventory indicate that in winter the largest concentrations of moose are found north and northeast of the boundaries of the proposed reservoir. The proponent thus concluded that the moose are not particularly interested in the wetlands (DA17, Figure 5.10 and Table 5.1; Jean-François Rougerie, DT3, p. 65).

This conclusion has been challenged by managers and users of the land, particularly by members of the Huron Wendat Nation, who regard the Pikauba River valley as prime moose territory. They even refer to it as a “crossroads” and consider it to be an exceptional ecosystem (DB8, p. 2).

In order to gain a better understanding of how wetlands are used in the life cycle of moose, the proponent carried out a second series of aerial inventories in the summer and fall of 2002. A ground inventory was also taken in the summer. Fifteen moose were observed, particularly along the east bank of the Pikauba River, and more specifically in sectors where forest cuts occurred two or three years ago. The fall inventory, however, enabled many trails on the periphery of the Pikauba River to be observed as well as five moose in and around the meanders (Jean-François Rougerie, DT3, p. 73; DA41, p. 16 and Figure 3).

The Conseil de la nation huronne-wendat considers the results of these last inventories to be unreliable, given that the aerial inventory was taken in the summer and fall which do not provide appropriate conditions for observing moose. Furthermore, it stated that the method used for the ground inventory provides extremely limited possibilities for analysis. The Société de la faune et des parcs du

Québec feels that the results of one-time inventories in the summer and fall cannot be used to conclude that the wetland zones are of no importance for moose (DQ16.1, p. 1 and 2; DB55).

The proponent feels that these inventories do not clearly show that moose use the wetlands. In its opinion, even if the hypothesis that wetlands are frequented by moose were accepted, it is very unlikely that the reduction of land area would have an impact on the dynamics of the population. The proponent considers the loss of approximately 16 km^2, of which close to one-third is wetlands, to be relatively minimal in relation to the 8,300 km^2 area of the Laurentides wildlife reserve. Furthermore, the proponent doubts that this reduction in habitat would have any effect on the dynamics of the population in the reserve (Jean-François Rougerie, DT3, p. 61; PR5.1, p. 68; DA52).

The Société de la faune et des parcs du Québec is also of the opinion that the construction of a reservoir should not compromise the survival of the species since the surrounding forests provide abundant food. Nevertheless, given the loss of wetlands, it believes that the project could change the moose's home range, that is the area required for its activities. If the moose's preferred habitat (open areas with deciduous plants) were reconstituted after the construction of the reservoir, moose could very easily adapt to their new environment. Otherwise, they would have to move to another habitat that provides for their needs (Gérald Guérin, DT2, p. 33 and 34; Paul-Émile Lafleur, DT3, p. 61; DQ16.1, p. 2).

The Comité de l'environnement de Chicoutimi and the Conseil de la nation huronne-wendat argued that these displacements could lead to more frequent moose crossings on highway 169, located west of the planned reservoir, thus increasing the risk of collisions with vehicles. These types of accidents are already very common (DB8, p. 12 and DM13, p. 1).

The proponent proposed a follow-up program in order to document the use of wetlands by moose. Ground inventories would therefore be taken at various times in the summer and fall, in and around the reservoir zone, in order to compare the use of the wetlands before and after the priming of the reservoir.

Moose hunting

Restricted moose hunting in the Laurentides wildlife reserve takes place in September and October and covers six four-day hunting periods, with a bag limit of one moose per group of four hunters. This period is followed by a second eight-day period reserved for hunters from the Huron Wendat Nation, as set out in a 1996 agreement between the Government of Quebec and the Hurons-Wendat which gives the Nation

exclusive rights to hunt moose at the end of the usual hunting season in this reserve (DB55).

The Laurentides wildlife reserve is divided into 60 moose hunting sectors. Seven were selected by the Société des établissements de plein air du Québec as the best hunting grounds in American hunting plans[1]. Sectors 64 and 66 are among these territories so prized by hunters. The boundaries of sector 64 include the Pikauba reservoir, excluding the section comprising the Ruisseau Bras des Angers which is predominantly located in sector 66 (Figure 3).

According to the proponent, the flooding of the Pikauba River could result in the loss of approximately 18% of the hunting area in sectors 64 and 66, which represent territories with the highest hunting success rates in the Laurentides wildlife reserve.

The Société des établissements de plein air du Québec is concerned that sector 64 could become unusable given that hunting is currently practised in the bottom of the valley. The proponent admits that the priming of the reservoir would reduce the possibilities of moose hunting and sightings in the sector, since a portion of the open environments (shallow waters, marshes and swamps along the Pikauba River) would be replaced by a deep body of water, which is not suitable for the species during the breeding season. Despite these constraints to accessing the resource, the proponent believes that the availability of the resource will be unaffected by the project, although the hunting challenge may increase slightly. Furthermore, the proponent feels that the managers of the Société des établissements de plein air du Québec would have to locate new fertile hunting grounds in sectors 64 and 66 (Sylvain Boucher, DT3, p. 64; DB27, p. 105).

Given the limited repercussions it foresees, the proponent does not envisage any mitigation measures with respect to moose habitat. According to the proponent, the impact would be much greater on the use the resource rather than on the resource itself. Discussions are planned between the proponent and the Société des établissements de plein air du Québec in order to put in place new hunting structures or facilities. The hunting camp located on the left bank of the Pikauba River, at kilometre 40, as well as miradors and trails for all-terrain vehicles and skidoos would be affected by these measures (Jean-François Rougerie, DT3, p. 72).

1. An exclusive territory of approximately 80 km² is provided to a group of three or four hunters for a five-day period. The price includes accommodation, meals and a hunting guide. The sectors devoted to hunting under the American plan remain unchanged as long as the habitat, resources and logistical conditions allow it.

- *The Panel notes that, despite diverging views between the Ministère des Ressources naturelles, de la Faune et des Parcs and users of the territory with regard to the use of wetlands in the Pikauba River valley by moose, all parties agree on the importance of these environments in the fall, during the breeding season.*

- *Although the priming of the Pikauba reservoir would not have significant adverse effects on moose populations along the Pikauba River, the Panel notes that the project would contribute to the loss of 463 ha of wetlands which constitute a preferred moose habitat.*

- ***Opinion 13 :** The Panel is of the opinion that the flooding of the Pikauba River valley up to the 417.7 m mark could modify the territory used by moose. This could alter their movements, thereby increasing the hunting effort.*

- ***Opinion 14 :** Since wetlands are a preferred habitat for moose, the Panel is of the opinion that their conservation has a direct impact on hunting and the protection of the species.*

- ***Opinion 15 :** The Panel is of the opinion that the principle of no net loss of wildlife habitats must be applied. In this respect, it is important to preserve both the area and characteristics of moose habitats. In case of loss, the Ministère des Ressources naturelles, de la Faune et des Parcs must try to compensate for all lost habitat by new habitats in the same sector or the same ecological unit.*

Fish habitat and fishing

The priming of the Pikauba reservoir would have a significant impact on fish habitat between kilometres 30.2 and 55.0. At its normal maximum operating level of 417.7 m, the Pikauba reservoir would flood 24 km of the main stem of the river as well as 16.9 km of its tributaries (Figure 3).

Brook trout is the most sought-after sport fish in this part of the Pikauba River. At least five other species are also present here: fallfish, Northern suckers, white suckers, long-nose dace and certain cyprinids (minnows). The proponent's study focussed on three species in the Lake Kénogami watershed, namely brook trout or speckled trout, ouananiche or landlocked salmon, as well as rainbow smelt. According to the Panel, these three species well represent the issues related to all fish populations in the Lake Kénogami watershed, given their ecological requirements and their value.

Eight species are found downstream from the planned reservoir, between kilometers 0 and 30.2, of which three are particularly prized for sportsfishing: brook trout, ouananiche and rainbow smelt. This segment of the river is also important

because it provides spawning grounds for these three species. Several brook trout nests were observed in this sector, near kilometre 25, as well as ouananiche spawning grounds between kilometres 5 and 11. Rainbow smelt are also known to spawn in the first few kilometres of the Pikauba River in the spring (DM3).

Assessing gains and losses

The creation and management of the planned reservoir would have a major impact on brook trout by transforming river habitats into lake habitats, thus causing significant losses in their habitat and productivity.

According to the proponent, brook trout nursery areas within the boundaries of the proposed reservoir would undergo profound changes during the project's operating phase. High concentrations of spawning grounds between kilometres 53 and 55 (Figure 3) would be seriously affected since they are located in the reservoir's fluctuation zone. The same would apply to the spawning grounds located on the Pika River as well as those in the seven other small tributaries. In all, 16,700 m² of spawning grounds would be lossed. These habitats would be flooded in the summer and fall when the reservoir reaches its normal maximum level of 417.7 m, while they would be unwatered at the end of the emptying period in the winter.

Habitats sought by brook trout for feeding and reproduction are particularly sensitive to environmental disturbances, such as changes in water levels. A water level fluctuation in the order of 17 m provides the planned reservoir with a low capacity for biological production since it prevents or limits the development of benthic fauna, a major food source for fish.

In addition, the lake environment created by the reservoir will favour certain predatory species that compete with brook trout, thus further reducing the productivity of this species. According to the Department of Fisheries and Oceans, the increased presence of competing species in the reservoir would result in up to a 95% reduction in brook trout productivity.

The construction of the reservoir could also affect water quality, particularly by reducing the quantity of dissolved oxygen. The proponent believes, however, that even at the lower level of 400.5 m, the quantity of dissolved oxygen available to ensure the survival of fish would be more than sufficient (±10 mg/l). In this regard, the Department of Fisheries and Oceans noted that, in the winter, aquatic organisms would gradually become confined as the reservoir begins to drain. The Department of Fisheries and Oceans is of the opinion that the concentration of residual oxygen could easily drop to 4 to 5 mg/l in the winter, that is, close to the minimum tolerance level established for salmon species (DQ8.1, p. 8).

The assessment of net gains and losses in brook trout productivity in the reservoir and the main stem of the Pikauba River was carried out by the proponent using the Valin method, that is, in kilograms of fish per year. The total loss of brook trout production due to the priming of the reservoir at the normal maximum level of 417.7 m would, therefore, be 816 kg/year. At its minimum level of 400.5 m, only two residual bodies of water would remain in the Pikauba reservoir: one representing 0.38 km^2 (upstream from the Pikauba dam); the other 2.16 km^2 (upstream from dike B) (Figure 3). The proponent estimates the potential brook trout production in these residual bodies of water at 631 kg/year. The final assessment, calculated according to the same method, would result in a net loss of productivity of 185 kg/year (DA6, p. 22).

The Department of Fisheries and Oceans does not determine losses in fish habitat based on kilograms per year but, rather, according to biological functions lost and areas of habitat affected. According to the Department of Fisheries and Oceans, physical (habitat area or volume, type of habitat) and biological attributes (spawning grounds, nursery, rearing, food-supply and migration areas) are the only means available to define habitat productive capacity. It also specified that establishing productive capacity requires more than simply counting the number of fish present in a habitat at a given moment, or simply evaluating the fishing potential of a given habitat. Furthermore, the Department of Fisheries and Oceans pointed out that the method employed by the proponent to count brook trout probably largely underestimates the density of the juvenile population of the species in the Pikauba River.

The Department of Fisheries and Oceans is also of the opinion that the reservoir's productive capacity would be weakened by the presence of competing species, reduced benthic production, lower levels of dissolved oxygen in winter during the draining of the reservoir and the confinement of fish communities in residual bodies of water. Major problems would also arise with regard to population renewal, caused by truncated fish passages and the destruction of most of the available spawning grounds. Losses in nursery and feeding areas could reach 105 ha (24 km of river), and 16,700 m^2 of spawning grounds would be flooded. It added that the residual bodies of water upstream from dike B would offer only a marginal habitat in terms of productive capacity for the species living there.

For all of these reasons, the Department of Fisheries and Oceans concluded that the proposed reservoir's productive capacity at a normal maximum operating level of 417.7 m would be markedly reduced for species in the reservoir, particularly due to the diminished quality of fish habitats. The Department of Fisheries and Oceans believes that losses of this scope are not justified since the Pikauba reservoir could be

managed at a level below 417.7 m while still respecting the project's objectives (DQ8.1, p. 1 to 8).

The Société de la faune et des parcs du Québec concurs with the Department of Fisheries and Oceans. It considers the estimated productivity of 631 kg/year for these two residual bodies of water to be very optimistic. The presence of species that compete with brook trout constitutes one of the factors that could reduce its productivity (PR6, p. 4).

The Panel notes that productivity losses of 185 kg/year, put forward by the proponent, seem to be low given the negative effect of water level fluctuations, predators that would be favoured by the creation of the reservoir, low concentrations of dissolved oxygen in the winter and a low reproduction rate among brook trout in a non-conducive environment. Assessing net losses in brook trout productivity is a question that remains unanswered since there appears to be a lack of consensus between the proponent and the government officials responsible for managing this resource and its habitat. The Panel believes that discussions between the proponent and these government officials will enable these losses to be more clearly identified so that they can be adequately compensated as stipulated in the *Fisheries Act*.

- *The Panel notes that a reservoir managed at a normal maximum level of 417.7 m would flood virtually all of the brook trout's nursery and feeding areas as well as all of the species' spawning grounds along nearly 24 km of the Pikauba River.*

- ***Opinion 16 :*** *The Panel is of the opinion that the assessed losses in brook trout productivity presented in the impact study were underestimated.*

- ***Opinion 17 :*** *The Panel is of the opinion that brook trout spawning grounds, in high concentrations between kilometres 53 and 55 of the Pikauba River, must be preserved.*

Water temperature

Water temperature can have a significant impact on the development of fish eggs as well as on fry growth. From mid-June to Mid-August, under natural conditions, the average water temperature in the Pikauba River is 12.5 to 16.5°C. The thermal regime immediately downstream from the Pikauba reservoir would differ from present conditions as a result of cold water released directly from the reservoir's bottom outlet. The modelling produced by the proponent shows that change in temperature immediately downstream from the Pikauba dam could reach 5 °C in the summer and the warming up in winter could reach a maximum of 0.7 °C. The temperature during the operating phase could vary between 8.2 °C and 13 °C in the summer. The

projected cooling of the water for that period could be significant enough to slow down growth for various fish species. According to the proponent this affects mainly the section between Pikauba dam and Petite Rivière Pikauba, and would greatly diminish downstream to become nil at the mouth of the Pikauba River.

Fisheries and Oceans Canada is of the opinion that since the reservoir would serve for water level regulation during the summer and that the flow of the Pikauba River would be more significant than the lateral inflow, the effect on fish growth and on the thermal regime would be felt much more downstream. The quality of the fish habitat would suffer because of the significant decrease in average temperature downstream of the dam during fish growth season, because of an increase in the duration of extreme temperatures and also because of the absence of ice cover on a stretch of several kilometres during the winter period. Following the public hearing, Fisheries and Oceans Canada asked the proponent to submit additional information in order to better analyze the importance of this effect (DQ 8.1, pp 4-5, DB 54.3, pp. 5-6).

The proponent conducted a new and more precise modelling regarding the variations in temperature. The new results show weaker variations in temperature compared to the ones previously estimated. According to these results, changes in temperature downstream of the Pikauba dam would generally be less than 2 °C compared to actual conditions and could reach 2.5 °C in the summer and less than 1 °C in the winter (DB 54.3, p.6).

- *The Panel notes that fish loss of productivity associated with changes in water temperature downstream of the Pikauba dam will be established by the responsible authorities, and if necessary, will be compensated pursuant to the Fisheries Act.*

The need for a minimum flow

In 1999, the Government of Quebec adopted a policy with regard to maintaining ecological minimum flows in its rivers. The policy emphasizes the importance of maintaining an ecological minimum flow modulated according to biological periods, and strictly limited to the purposes of fish protection. The policy's objective is to define the methodological process leading to the identification of adequate conservation and enhancement measures designed to ensure the permanent protection of habitats and the free circulation of fish in watercourses. The policy defines an ecological minimum flow as the minimum flow required to maintain fish habitats at a level deemed acceptable.

Downstream from the planned reservoir, the proponent plans to maintain a minimum flow in order to protect the targeted species, namely brook trout, ouananiche and rainbow smelt. The flow would be modulated according to four key biological periods

in the development of these species: spring spawning, feeding, fall spawning and the salmon egg incubation period. The flow would therefore vary depending on the time of year. It would be 4 m^3/s from November 6 to May 10 for the egg incubation period; 10 m^3/s from May 11 to June 30 for spring spawning; and 7 m^3/s from July 1 to November 5 for feeding and fall spawning. The annual average natural low flow of the Pikauba River in the winter is 3.9 m^3/s, that is, below the proposed minimum flow. The proponent pointed out that a minimum flow of 4 m^3/s would generally be higher than the natural flow of the Pikauba River between December 1 and March 30. The proponent stresses, however, that this flow could only be guaranteed by a reservoir managed at a level of 417.7 m (PR5.5, Appendix B, p. 13).

The Department of Fisheries and Oceans is of the opinion that establishing a minimum flow regime would only be needed during the filling of the reservoir. It feels that it would be more important and beneficial for the fish habitat to reduce the water level in the reservoir in order to protect spawning grounds upstream, rather than increasing water storage in the Pikauba reservoir to ensure flows, downstream, that are higher than those in natural conditions. Thus, it considers that a minimum flow would not be necessary following the draining of the reservoir since the river would return to its natural regime (DQ8.1, p. 7; DQ20.1, p. 4).

The Panel notes that, when the reservoir is maintained at a constant level or is being drained, its outflows would necessarily be equal to or higher than the reservoir's natural inflows. By contrast, during the filling of the reservoir, outflows would always be below natural inflows. The Panel therefore concludes that a minimum flow would only be necessary during the priming of the reservoir.

- ***Recommendation 4 :*** *The Panel recommends that an ecological minimum flow downstream from the Pikauba dam be maintained during reservoir filling periods. This flow should be determined in collaboration with the responsible authorities, taking into account the biological requirements of fish and government policies.*

The free passage of fish

At present, four obstacles impede the free passage of fish in the study area. The first obstacle, at kilometre 11.6, can probably be surmounted by brook trout and ouananiche. A second obstacle, considered insurmountable for all species in the Pikauba River, is situated at kilometre 16. A third obstacle, also considered insurmountable, is the Pikauba 3 forest dam, at kilometre 36.5. Lastly, an impassable waterfall at kilometre 63 constitutes the upstream limit of the study area. These obstacles do not prevent the passage of fish downstream, but do limit their access upstream.

With regard to the downstream migration of fish, the proponent is of the opinion that fish would rarely pass through the bottom outlet of the dam, even in the winter when the reservoir level is at its lowest level. In fact, at the minimum level of 400.5 m, the outlet would be in more than 10 m of water. It is possible, however, that a higher density of fish in the residual body of water at the foot of the dam could cause the displacement of fish to this location. The proponent stated that fish migrating downstream through the bottom outlet may not survive sudden changes in pressure and could sustain injuries during their passage. Since fish entrainment may be greater in the winter, during the draining of the reservoir, the proponent plans to lower the level of the reservoir very gradually over a period of three months. The Department of Fisheries and Oceans feels that it is impossible to predict the behaviour of brook trout during the reservoir-draining period. Despite the fact that the proponent plans to gradually drain the reservoir, the Department of Fisheries and Oceans estimates that the entrainment of fish toward the bottom would be stronger in the winter during the draining of the reservoir (DQ8.1, p. 4).

Furthermore, after examining the impact study, the Department of Fisheries and Oceans stated that a rigorous evaluation was not carried out with regard to the possibility of allowing the passage of fish upstream during the construction of the reservoir and its operation. The Department of Fisheries and Oceans is of the opinion that the biological needs of brook trout, that is, spawner runs, require analysis in order to maintain the passage of this species (DB53.3, p. 4).

In response to the Department of Fisheries and Oceans' concerns, the proponent conducted an analysis in order to validate the possibility of maintaining the passage of fish upstream from the dam. The proponent concludes that it is inappropriate to maintain a passage for the fish upstream from the proposed dam, since the creation of a migratory fish-pass at kilometre 30.2 would come up against major technical difficulties due to the considerable height and size of the dam's crest. According to the proponent, a fish-pass could not be built to compensate for such a steep denivellation without major and costly engineering work. In fact, a fish-pass of this size does not exist anywhere in the world. Furthermore, the proponent stressed that brook trout do not circulate between the downstream section of the proposed dam and the spawning grounds at kilometres 53 and 55, but probably up to the Pikauba 3 forest dam, 6.5 km upstream from the proposed dam. To mitigate this effect, the proponent recommends the creation of a spawning ground at the foot of the proposed dam (DB54.3, p. 4).

- ***Opinion 18 :*** *The Panel is of the opinion that the proponent should conduct a follow-up program during the first two years of the Pikauba dam's operation in order to monitor the scope and effects of fish entrainment toward the dam outlet.*

♦ ***Opinion 19 :*** *The Panel is of the opinion that a fish-pass at the Pikauba dam is not justified due to the low biological productivity afforded by the reservoir, the height of the dam, technical difficulties with regard to design and operations, as well as excessive costs.*

The effects of the project on sportfishing

Brook trout is the most popular species for fishing in the Laurentides wildlife reserve. The proponent reported that over 471,000 brook trout were harvested in the Laurentides wildlife reserve in 1998, at a success rate of 8 fish/fishing day. Of this number, 8,600 were taken from the Pikauba River for a fishing effort of 909 rod days.

Of the rivers in the study area, the meander sector of the Pikauba River as well as the sector at kilometre 20 are the only ones where fishing can be practised from a boat. Although the proponent claims that the meander sector is not very popular among fishers, it admits that the sector is used more than any other on the river where only wading is possible (DB27, p. 113).

And yet, statistics compiled by the Société des établissements de plein air du Québec reveal that fish catches in June and July 2003 on the Pikauba River, between the Pikauba 3 forest dam and dam 5, were 8.3 fish/fisher. This success rate is slightly above the rate for all the rivers in the study area. The Huron Wendat Nation added that the river segment slated for the construction of the reservoir represents a sector where fishing is considered very good, both in the spring and fall (DB8 and DD5).

The proponent believes that the creation and management of the Pikauba reservoir would have effects on fishing. On the one hand, a loss of productivity of 185 kg/year among brook trout would influence its productive capacity and, on the other hand, current river-fishing conditions would be transformed into lake-fishing conditions. The proponent therefore predicts a decline in the potential success rate of brook trout fishing.

According to the Société des établissements de plein air du Québec, there is no doubt that the transformation of current fishing conditions in the river would have an impact on users. The Société stated that for a large body of water to be of interest to fishers, it must offer a high success rate for brook trout, that is, more than 10 catches per day, or a prized species such as lake trout. The Société des établissements de plein air du Québec feels that these two conditions would be lost with the proposed reservoir and fears that water level fluctuations in the Pikauba reservoir would discourage users (DB27, p. 138).

In the sector located near the mouth of the Pikauba River, the proponent does not foresee any effects on ouananiche fishing or on rainbow smelt ice fishing.

- *The Panel notes that losses in brook trout productivity, resulting from the priming of the Pikauba reservoir, and the transformation of river-fishing conditions to large-lake fishing conditions could have adverse effects on the fishing success rate in the sector upstream from the proposed dam.*

- ***Opinion 20 :*** *The Panel is of the opinion that in order to reduce the adverse effects of the project on the fishing success of brook trout, it is important to minimize the species' productivity losses and to compensate for residual losses.*

Compensation for loss of productive capacity

The federal government's Policy for the Management of Fish Habitat and Quebec's Lignes directrices pour la conservation des habitats fauniques are based on the guiding principle of no net loss of habitat productive capacity. They propose that loss of productivity be avoided by relocating or redesigning a project. If relocation or redesign is impossible, losses must be mitigated and compensated.

To compensate losses in productivity, the federal Policy for the Management of Fish Habitat suggests a hierarchy of options:

– Create similar habitat at or near the development site within the same ecological unit;

– Create similar habitat in a different ecological unit that supports the same stock or species;

– Increase the productive capacity of existing habitat at or near the develpment site and within the same ecological unit;

– Increase the productive capacity of another ecological unit that supports the same stock or species;

– As a last resort, increase the productive capacity of existing habitat for a different stock or different species of fish either on or off the site.

The proponent proposes the creation of 500 m² of suitable spawning ground for brook trout in the segment between kilometre 25.6 and the dam. These permanent undertakings will serve, in part, as measures to compensate the obstacle effect of the dam. They will be subject to environmental follow-up to ensure the sustainability and performance of these new habitats.

To compensate losses in productivity of brook trout, the proponent also suggests raising Lac à Jack to a level that has historically favoured the habitat of this species. The lake is located in the Laurentides wildlife reserve, outside the Lake Kénogami watershed. Renowned for its exceptional fishing, this lake's harvestable biomass of brook trout dropped from 3,000 kg/year to 1,400 kg/year when deteriorating retaining works prompted the manager to lower the lake level for safety reasons. The compensation project would require this dam to be rebuilt in order to return the lake to its former level. According to the proponent, this project would restore brook trout production to 3,000 kg/year (DB54.1, p. 14).

The Department of Fisheries and Oceans is of the opinion that this compensation is an inadequate solution. It believes that the loss of fish habitat resulting from the lowering of water levels should be subject to authorization under the *Fisheries Act* and be compensated. Consequently, restoring a body of water to its original level as the only compensation measure is unacceptable (DB54, p. 7).

The Panel notes that an agreement has not yet been reached with respect to the scope and nature of compensation for loss of brook trout productivity. A compensation program must, however, be put in place as stipulated by the *Fisheries Act*, and a satisfactory solution must be proposed before the Department of Fisheries and Oceans can issue the necessary authorizations.

Furthermore, the Panel believes that compensation for loss of brook trout productivity should not be limited to the Laurentides wildlife reserve since the Lake Kénogami watershed surpasses the administrative limits of this reserve. For instance, the possibility of compensation in Lake Kénogami could be explored. Given the major fluctuations of water levels in this lake, it is not, under current conditions, a suitable location for the establishment of brook trout spawning grounds. It may be appropriate to study ways to increase the productivity of this lake, for example by reducing winter fluctuations through the removal of one of the lake's bays by means of a sill to promote the natural introduction of brook trout into the lake. This could constitute an interesting compensatory work which could, over the years, restore Lake Kénogami as an attractive fishing destination. Furthermore, the proponent could consider the ecological benefits of circumventing the obstacles on the Pikauba River, downstream from the proposed dam, in order to maximize access to the brook trout's spawning grounds as well as its nursery and food supply areas.

- ***Opinion 21 :*** *The Panel is of the opinion that the integrity of the ecosystems in the sector targeted by the Pikauba reservoir must be preserved before compensating the residual losses of brook trout, in accordance with the federal government's* Policy for

the Management of Fish Habitat *and Quebec's* Lignes directrices pour la conservation des habitats fauniques.

Mercury

Sources of mercury

Mercury is a naturally-occurring element and is widespread in the environment. Mercury emissions can also result from human activities related, among other things, to the combustion of petroleum products and coal, the incineration of industrial and domestic waste, metal refining and certain industrial processes. On a global scale, natural and anthropic mercury emissions are about equivalent.

Priming the Pikauba reservoir would lead to the bioamplification of mercury contamination in the food chain, possibly quintupling the mercury content in the tissue of certain species. This phenomenon would be perceptible in the reservoir for a period of about 20 years. Mercury contamination resulting from the creation of reservoirs is now well documented. When a reservoir is primed, bacteria decompose the organic material that is flooded. This phenomenon is accompanied by the methylation of mercury already present in the natural environment, a process that begins as soon as the reservoir is primed and attains its maximum level in the ensuing two or three years. This leads to an increase in mercury levels all along the food chain, the transformation of inorganic mercury into methyl mercury, which is much more easily absorbed by organisms. Five to eight years after a reservoir is primed, when all of the easily decomposable organic matter has been exhausted, the quantity of methyl mercury released into the water is about nil. The quantity of methyl mercury released into the water is a direct function of the area of land flooded by the creation of the reservoir (Jackson, 1988; Lucotte and others, 1999).

Contamination of the food chain

Methyl mercury is transferred to fish through predation. According to the proponent, longnose suckers and brook trout measuring 30 cm in length that are caught in the Pikauba River, between the proposed dam and the confluence with the Petite Rivière Pikauba, would have quadruple the maximum mercury content. It would take about 18 years for the content in these fish to return to levels representative of the area prior to the creation of the reservoir.

The mercury content in longnose suckers and brook trout of the same size caught downstream from the Pikauba River, between its confluence with the Rivière aux Écorces and Lake Kénogami, would double. It would take about 14 years for the

natural levels to be restored. It is important to note that no data is available on the mercury content in rainbow smelt and ouananiche.

The proponent believes that there will not be any significant increase in mercury levels in the fish in Lake Kénogami. It bases this assessment on the fact that it has been demonstrated that fish mainly accumulate mercury through the food they ingest, and very little from their water intake. Monitoring of new reservoirs has shown that zooplankton account for over 90% of mercury transport out of a reservoir. When this zooplankton enters a lake, it is consumed by fish close to the mouth. As a result, the mercury that enters the lake becomes much less available to the general fish population throughout the receiving lake, a scenario that applies to Lake Kénogami.

The sector where the Pikauba River empties into Lake Kénogami is a popular zone for rainbow smelt winter fishing. This type of fishing attracts persistent fishers who can catch several thousand fish over the winter season. While there is little reason to believe that there will be a significant increase in the mercury contamination of fish in this area, caution dictates that the situation be monitored in this sector of Lake Kénogami in order to provide fishers with up-to-date information.

The project plans to drain water from the Pikauba reservoir using a bottom outlet therefore reducing the amount of zooplankton transferred downstream and, by extension, the amount of mercury available to fish. The Panel recognizes that the proponent's evaluation represents the "worst case scenario" since it corresponds to a situation in which the surface water, where zooplankton concentration is the greatest, would be drained, instead of water from the bottom of the dam.

Public health

The *Guide de consommation du poisson de pêche sportive en eau douce* recommends safety levels for monthly consumption of fish. It takes into account species, size and average mercury levels in tissue. This guide is based on recommendations by the World Health Organization. For fish in the Pikauba River upstream from its confluence with the Rivière aux Écorces, the number of recommended meals of fish would be reduced from eight to about four per month for a period of about 10 years.

It is important to point out that there are approximately 59,000 sport fishers in the region, out of a total population of 280,000. A large percentage of the population is, therefore, likely to consume relatively large quantities of fish. Experts from Health Canada and the Ministère de la Santé et des Services sociaux believe that protecting the public from mercury contamination in the food chain requires rigorous monitoring and an effective communication programme.

While the Ministère de l'Environnement does not have data on mercury concentrations in Lake Kénogami, the quality of the drinking water is believed to be acceptable based on conclusions drawn from data on the Chicoutimi River. The proponent stated that the La Grande complex experience confirms this conclusion since the concentrations observed in the complex's water reservoirs are about 420 times below the quality criteria for mercury in drinking water. Thus, one would have to drink 40,000 litres per day to attain the daily allowable intake for children and pregnant women, and more than 90,000 litres per day to attain the daily allowable intake for the general adult population.

Health Canada's current guidelines are 0.2 µg/kg per body weight per day for children and pregnant women, while the U.S. Environmental Protection Agency puts that level at 0.1 µg/kg per body weight for adults. In light of this discrepancy, Canadian criteria may change with new research results.

The proponent suggested the implementation of a risk management program as part of the follow-up program. "This program includes the monitoring of mercury levels in fish tissue so that, in collaboration with local health organizations, it would be possible to inform consumers of the risks associated with eating fish."

- ***Opinion 22 :*** *The Panel is of the opinion that this project will not lead to health risks related to mercury levels in drinking water taken from Lake Kénogami, the Rivière aux Sables and the Chicoutimi River.*

- ***Opinion 23 :*** *The Panel is of the opinion that reducing the area of the proposed reservoir on the Pikauba River will lessen mercury contamination in the food chain.*

- ***Recommendation 5 :*** *The Panel recommends that the reference state for mercury contamination be established in relation to the species most likely to be consumed in the Pikauba River sector and at its mouth, where rainbow smelt winter fishing is practised.*

- ***Recommendation 6 :*** *The Panel recommends that the effectiveness of the mercury information campaign be monitored in collaboration with community representatives. The Panel believes that an effective communication program is key to prevention.*

Navigation on the Pikauba River

According to the proponent, navigation would be modified by the project upstream and downstream from the Pikauba dam. The Pikauba River is designated a canoe-navigable river by the Fédération québécoise du canot et du kayak. Most of the canoe-

camping route is located in the Laurentides wildlife reserve, and total approximately 118 km between Pikauba Lake and Lake Kénogami.

About 55 km are located outside the study area and will not be affected by the creation of the Pikauba reservoir. The section upstream from the proposed dam extends along 32.5 km and is mainly composed of segments of calm water and a few rapids of average difficulty. The construction of the dam would constitute an obstacle on the river, while the creation of the reservoir would flood two camp sites. To mitigate these effects, the proponent plans to build a portage route at the dam and to move the two camp sites before priming the reservoir. The proponent is of the opinion that there will only be a minor residual effect since the river will continue to be available to canoers and may even be enhanced through greater accessibility upstream from the proposed dam. According to the Fédération québécoise du canot et du kayak and the Club de canot-camping l'Aviron, this section of the Pikauba River offers canoers an exceptional wildlife. While this section is less frequented than the one upstream, both organizations are of the opinion that is has great potential for the recreational development of canoeing and sea kayaking. The representative of the Laurentides wildlife reserve confirmed that he plans to develop ecotourism in this section of the river (Sylvain Boucher, DT9, p. 26).

Downstream from the proposed dam, the canoe route extends 30.5 km up to Lake Kénogami. This section is used mainly by kayakers when flows are high, and by skilled canoers who use it throughout the summer. According to the guide des parcours canotable du Québec (Québec canoe routes guide), this watercourse represents one of the most challenging for experienced canoers. The proponent is of the opinion that the control of discharges from the Pikauba River downstream from the dam will improve navigation conditions in the summer. The change is therefore positive since the current fluctuation of flows in the summer limits the use of this section of the river when the flow is very low. Furthermore, sudden increases in water levels that can occur in the summer can create dangerous conditions for navigation (DB27, p. 116).

The Fédération québécoise du canot et du kayak and the Club de canot-camping l'Aviron stated that this section of the river is most used by canoers who access it at kilometre 36, for a two-day descent, and at kilometre 25 for a one-day descent (Figure 3). This section is navigable during the entire summer season at any flow rate. These two organizations pointed out that the use of this section of the Pikauba River is not marginal, and is one of the most prized by canoers from the region and elsewhere. They are concerned, however, about the extreme and unforeseeable variations in flows that could occur in the summer when the gates of the proposed dam are opened. This sudden increase in flows could represent a serious safety

problem since the level of difficulty for this river varies greatly depending on the flow. They are also concerned that conditions could become dangerous for less experienced canoers faced with a sudden increase in flow (DM23).

The Club de kayak de la rivière aux Sables also stressed the importance of preserving the rapids along the final 34 km of the Pikauba River. The Club is of the opinion that since the proposed control structures objective is to reduce water swellings, the periods at which the river is at its best for kayakers would disappear. To mitigate this effect, the Club suggested opening the gates to release water at times and discharge levels that would be known in advance by canoe and kayak clubs.

- ***Opinion 24 :*** *The Panel is of the opinion that the Pikauba River dam manager must establish, with representatives of users of the river, ways and means that can be used to inform canoeist and kayakers of the daily discharges planned downstream from the dam.*

- ***Opinion 25 :*** *The Panel is of the opinion that the Pikauba River dam manager must establish, with representatives of users of the river, ways and means to ensure that releases of water downstream from the proposed dam allow users to continue practicing their activities in good conditions.*

- ***Opinion 26 :*** *The Panel is of the opinion that the Pikauba River dam manager must establish, with canoeists and kayakers, alert procedures so that they are not caught by surprise by a sudden increase in the flow of the river, in the event of an emergency opening of the gates.*

- ***Opinion 27 :*** *Given the proposed mitigation measures, the Panel is of the opinion that the project should not have significant adverse effects on navigation on the Pikauba River.*

Lake Kénogami sector

Managing water levels in Lake Kénogami

First used as a travelling route by Aboriginal populations, then by European explorers, fur traders and settlers, it was only in the 20th century that the level of the vast Lake Kénogami was raised and the body of water was transformed into a reservoir.

A reservoir created to supply water to industry

Since the early 20th century, Lake Kénogami has been used as a water supply by several industries located along the Rivière aux Sables and the Chicoutimi River. In 1906, the lake's water level of 153.5 m (80 ft) was raised to 157.15 m (93.1 ft). In 1911, a ruling by the Quebec Superior Court settled differences among the users of these two rivers. It imposed a distribution of the outflows from the lake based on a constant proportion of one-third for the Rivière aux Sables and two-thirds for the Chicoutimi River. It also set the minimum operating level of Lake Kénogami at 154.56 m (83.5 ft) in order to guarantee inflows into the Rivière aux Sables. These Lake Kénogami management constraints are still applied.

In 1924, the Commission des eaux courantes du Québec once again raised the level of the lake by building the three dams and nine dikes that currently ring Lake Kénogami and control the water drained by the Rivière aux Sables and the Chicoutimi River. Bringing the lake's maximum operating level to the 164.16 m (115 ft) mark doubled its area by flooding 25.9 km² of land mostly located on the north side, and increased the hydroelectric capacity for local industrial purposes. These measures led to the disappearance of the Saint-Cyriac municipality.

Lake Kénogami becomes a vacation destination

Vacation homes began to appear around Lake Kénogami beginning in the 1940s, primarily along the shallow bays on the north shore. Today, residences occupy 20% to 25% of the Lake's shores. Lake Kénogami management practices were originally designed for industrial purposes and have not been particularly suitable for the lake's vocation as a vacation destination. Wide variations in water levels occasionally reduce access to the water and hinder the use of docks. These effects are most pronounced in the shallowest bays (Figure 4) (DA37, p. 88; DB50, p. 12 and 13).

In 1982, in order to mitigate the effects of water level fluctuations on recreational activities, the Ministère de l'Environnement implemented new rules for the summer management of the lake. In effect from June 15 to the first Monday in September, these rules set the outflow under normal conditions at a maximum of 68 m³/s, while supplying a minimal discharge of 42.5 m³/s most of the time (DQ5.2, p. 6 and 7).

Safety issues and the 1996 flood

The catastrophic flood of July 1996 served to highlight safety issues related to the management of Lake Kénogami. During the flood, the lake level rose to a record 166.07 m (121.3 ft), exceeding the crests of the dams and five of the nine dikes. Some 563 riverside homes in the municipalities of Larouche and Lac-Kénogami were damaged, in addition to the considerable damage downstream along the Rivière aux

Sables and the Chicoutimi River (Commission scientifique et technique sur la gestion des barrages, p. 3-11 and 3-12). The lake constributed to mitigating the effects of the flood by temporarily retaining 130 of the 589 hm³ between July 19 and 24. While the inflow into the lake reached 2,778 m³/s, the maximum discharge downstream peaked at about 1,856 m³/s (DQ27.1, p. 2-11, 2-18 and 2-21).

In light of the events of July 1996, the Commission scientifique et technique sur la gestion des barrages recommended, in January 1997, increasing the lake's retaining capacity during summer floods by suspending the 1982 management plan and lowering the maximum operating level in summer from 164.16 m (115 ft) to 163.5 m (112.8 ft). This temporary maximum level should be maintained until the construction of one or several reservoirs upstream designed to route floods and reduce the required storage in Lake Kénogami (Commission scientifique et technique sur la gestion des barrages, p. 11-13 to 11-15). The maximum summer operating level of 163.5 m (112.8 ft) was only in effect in the summer of 1997. Considered too limiting for the recreational use of the lake, it was raised to 163.7 m (113.5 ft) the following year.

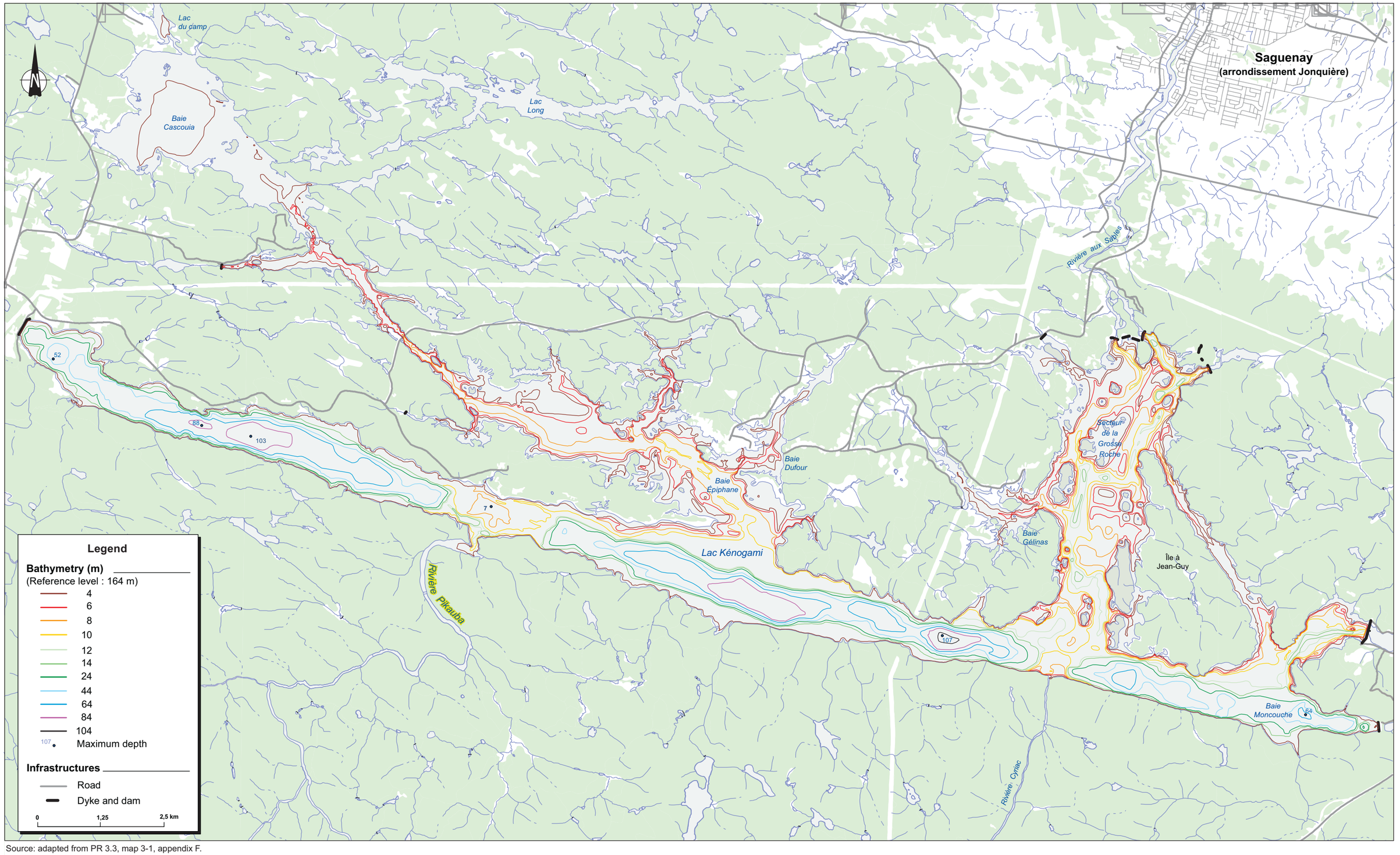
Current management rules

Changes to lake levels are determined on the basis of an assessment of inflows and outflows. Inflows into the lake are completely natural and follow meteorological fluctuations, while outflows can be controlled by Lake Kénogami's dam manager.

The rules currently governing the management of Lake Kénogami were adjusted after 1996 by the Ministère de l'Environnement, in consultation with the Comité provisoire du lac Kénogami et des rivières Chicoutimi et aux Sables. The minimum and maximum summer management levels currently in effect are 163.25 m and 163.7 m (112 ft and 113.5 ft), respectively. However, in the winter, the lake can be emptied to the minimum level of 154.56 m (83.5 ft) while, during floods, an alert is issued if its level reaches 164.16 m (115 ft). The State, as the reservoir manager, owns the riverside property up to the 164.16 m (115 ft) mark.

The manager of Lake Kénogami's structures considers that it has flood rights acquired by the Commission des eaux courantes. However, the height and the exact scope of this right are unclear and controversial. The Centre d'expertise hydrique du Québec believes that a flood right can extend up to the dam crest, at 165.68 m (120 ft). The City of Saguenay, however, considers 165.07 m (118 ft) the historic submersible level according to the agreement regarding the reservoir, while the municipality of Larouche contests the existence of such a flood right beyond the 164.16 m (115 ft) mark (DQ28.1, p. 2; City of Saguenay, DM12, p. 8 and Réjean Lévesque, DT6, p. 61).

Figure 4 Bathymetry of Lake Kénogami



Source: adapted from PR 3.3, map 3-1, appendix F.

The Ministère de l'Environnement still offers a minimum outflow of 42.5 m³/s. In 1997 it did, however, raise the normal maximum discharge from 68 m³/s to 79 m³/s to respond to the additional capacity of new turbines installed at Chute-Blanchette generating station (Julie Lafleur, DT4, p. 6). The flow discharged into the lake can, however, exceed 79 m³/s during a flood in order to limit increases in the level of the lake or prior to an expected flood in order to increase the lake's retaining capacity by lowering its level.

An increase of 11 m³/s in the maximum normal outflow of Lake Kénogami, capable of speeding up the lowering of the lake water level, is linked to an increase in the power producing capability of the Chute-Blanchette generating station. During the repair work of the damage caused by the July 1996 flood, the capability of the Chute-Blanchette generating station was raised from 31 MW to 38 MW. This power increase has not received a certificate of authorization under section 22 of the *Loi sur la qualité de l'environnement* and has not been subject to the environmental assessment and review procedures (DQ31.1). The decision to respond to this power increase by raising the maximum normal outflow of the Kénogami Lake was taken without public consultation.

- ***Recommendation 7 :*** *The Panel recommends that any significant change in the management rules of Lake Kénogami be subject to public consultation to show transparency in the management of the watershed.*

Current uses of Lake Kénogami

In the Saguenay region, Lake Kénogami is considered an ideal location for vacationing and recreational tourism. The vacation zones are concentrated in a few bays on the north shore of Lake Kénogami, mainly the Cascouia, Épiphane, Dufour, Gélinas and Chouinard bays (Figure 2). Before the recent municipal mergers, the north shore of Lake Kénogami cut across the municipalities of Hébertville, Larouche, Lac-Kénogami, Jonquière and Laterrière. Since 2002, the last three municipalities belong to the new City of Saguenay. Over 80% of the length of the south shore belongs to the unorganized territory of Lac-Ministuk (DQ9.2, p. 6; DQ10.1, p. 35; DB50, p. 12 and 29).

For the most part, the shoreline occupation of the lake is concentrated on the territory of Lac-Kénogami, although there are a few built zones in Laterrière close to the Portage-des-Roches dam and the Moncouche Bay as well as in Larouche in the Cascouia Bay. According to the City of Saguenay, there were 1,242 houses in the Lac-Kénogami territory in 2002, of which 60% were permanent. These properties generate $1.1M in tax revenue. Statistics Canada reports that the permanent

population of Lac-Kénogami was 1,834 in 2001. In the summer, close to 1,000 vacationers and approximately 500 users of various recreational facilities join this resident population (DQ9.1, p. 1; DQ9.3; DQ29.1).

A dozen or so recreational tourism facilities exist along the shoreline of Lake Kénogami and, since 1994, the Lake Kénogami regional park initiative has been under development. The most popular activities on the lake are water sports and swimming. About 741 private docks, 7 public boat ramps, 2 marinas, 5 public beaches and several private beaches facilitate access to the body of water used by close to 1,500 boats (DB50, p. 13 and 15).

The economic spinoffs from recreational tourism activity on Lake Kénogami have not been quantified. Demographic data, however, show that there is a growing demand for housing and vacationing. Between 1986 and 1996, the municipality of Lac-Kénogami showed the greatest rate of growth in the region with an annual population increase of 2.8%. In addition, from 1996 to 2001, with an average annual growth rate of 4.2%, it was one of the only municipalities in Saguenay–Lac-Saint-Jean that did not experience population decline. The taxable real estate value has also increased greatly, from $28M in 1985 to $89M in 2003 (DB50, p. 13; DQ9.3; DQ9.1; DQ10.1, p. 34).

For the MRC of Fjord-du-Saguenay, Lake Kénogami is practically the only large body of water close to the City of Saguenay that offers development potential for vacationing. It considers this potential to be largely underused. In fact, several development zones have been identified along the shoreline. The recent construction of a 9.2 km section of the Route des Bâtisseurs opened up 228 residential lots for sale and promotes the development of tourism on Lake Kénogami while giving new access to riverside property (DQ9.2, p. 6 and 11; DQ9.6, p. 11; DB50, p. 13-14).

- *The Panel notes the evolution of Lake Kénogami over the 20th century. Initially transformed into a reservoir in order to control industrial water supply, areas around the lake have become important residential and recreational sites while contributing to flood control.*

- *The Panel notes the growing demands for the use of Lake Kénogami and its socioeconomic importance in the region.*

Effects of water levels on the uses of Lake Kénogami

The water level influences the duration, the quality and the uses of Lake Kénogami. Severe drops in the water level in the summer or fall can negatively impact the use of the lake for vacation or recreational tourism purposes. High summer levels, however, can also be inconvenient for certain users and shoreline residents.

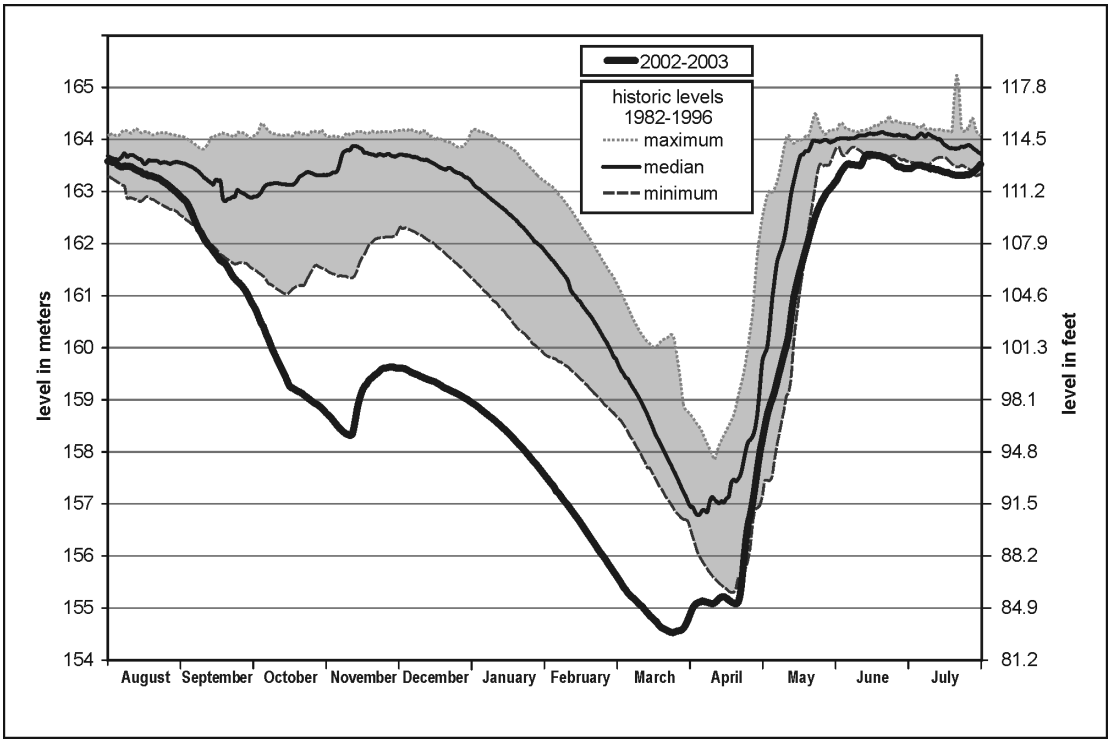
Drops in water level

Since most vacation areas and residences are located close to shallow bays, they are vulnerable to major fluctuations that result from the exploitation of Lake Kénogami. The annual scope of the fluctuations can be as great as 10 metres while the maximum depth of several of the bays is not even 10 m (Figure 4). This is the case, for instance, in Cascouia Bay which has a maximum depth of 5.5 m. The emptying of the lake in the fall and winter can lead to unwatering along huge portions of the lake and even entire bays (Photo 1). Unwatering alters the quality of the landscape and is a source of distress for shoreline dwellers particularly when it occurs early in the fall, as was the case in 2002 (Figure 5) (DB50, p. 5; Claude Collard, DT10, p. 4-5).

Just over one-third of shoreline residents use intakes installed in the lake, often in zones that are susceptible to unwatering in the winter. Others, supplied by surface wells, can have their water source run dry in winter or spring when the lake level drops to its minimum operating level, as occurred in the winter of 2003 (DB50, p. 42; Lynn Gauthier, DT7, p. 19 and 21).

Fall and winter decreases in water levels are not the only source of discontent for shoreline residents. Low summer levels can make navigation difficult in several bays and hinder access to docks and certain beaches. The Larouche municipal beach in the Cascouia Bay as well as the Ranch des Érables beach in the Gélinas Bay are particularly sensitive to these variations.

Figure 5 Water level measurements in Lake Kénogami : Pibrac 061002 gauging station



Source : Adapted from the Centre d'expertise hydrique du Québec

To facilitate navigation, the Corporation du parc régional du lac Kénogami beacons the lake each year with about one hundred buoys. Furthermore, to improve access to docks, the Ministère de l'Environnement authorized dredging in the Dufour Bay and the Jonquière campground marina. A sign set up by the Association pour la protection du lac Kénogami, along Chemin du Quai informs visitors of lake levels (Figure 6).

The proponent stated that navigation problems occur when the level drops below 163.55 m (113 ft). This was confirmed by the municipality of Larouche which specified that "[…] below this level, a lot of activities become impossible." It is not unusual, however, for Lake Kénogami's level to drop below this mark in the summer (DB44, p. 2 and Patrick Arnaud, DT1, p. 52, DM9, p. 3).

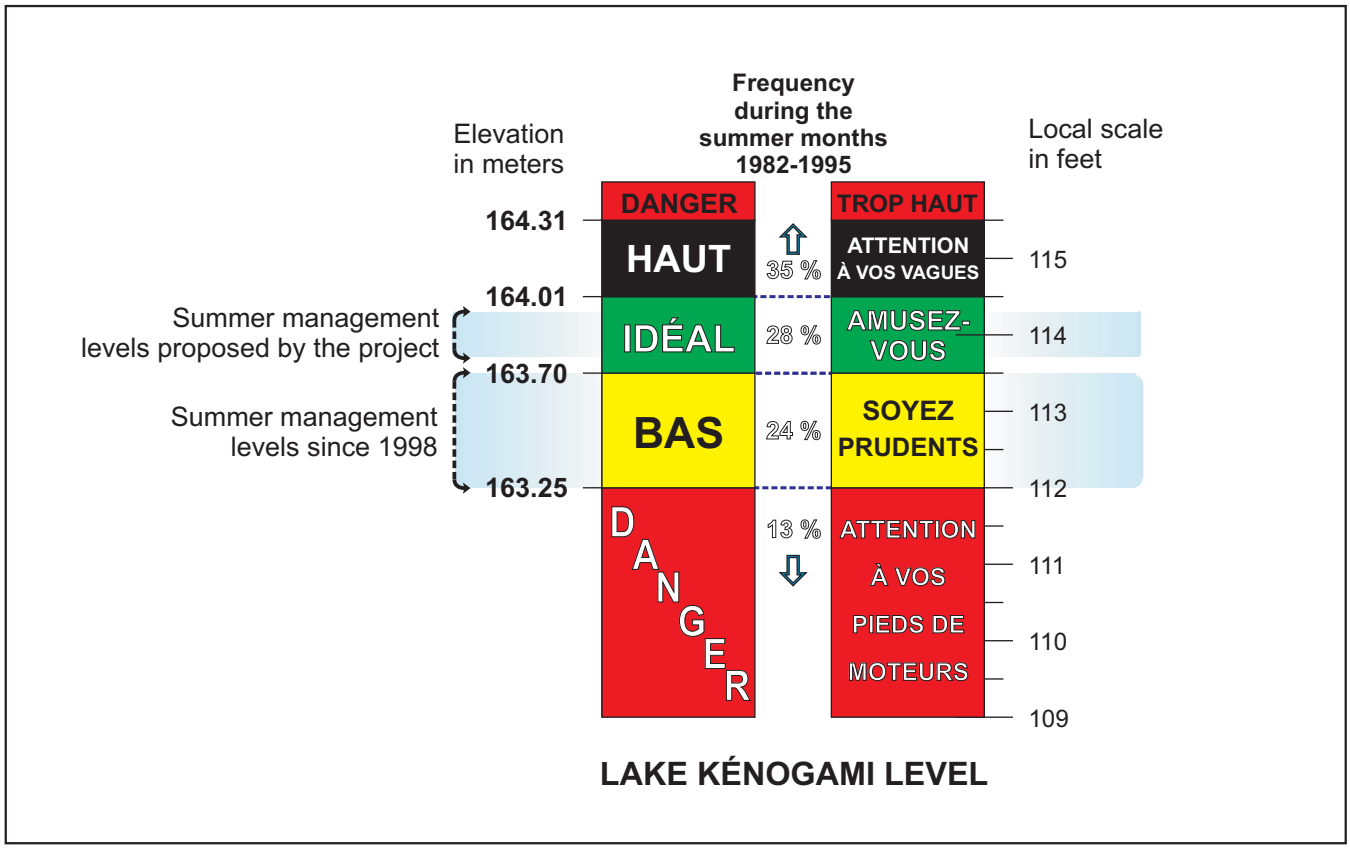
Many are of the opinion that the water level hinders the development of Lake Kénogami as a vacation destination. Indeed, the proponent believes that wide summertime fluctuations in the water level are slowing down real estate development along the shoreline of the lake and reducing its recreational tourism potential (DB50, p. 13).

Photo 1 Dufour Bay at the extreme point of chemin du Quai

Photo 1A: April 29, 2003 (Lake water level at 157.7 m or 93.8 feet).

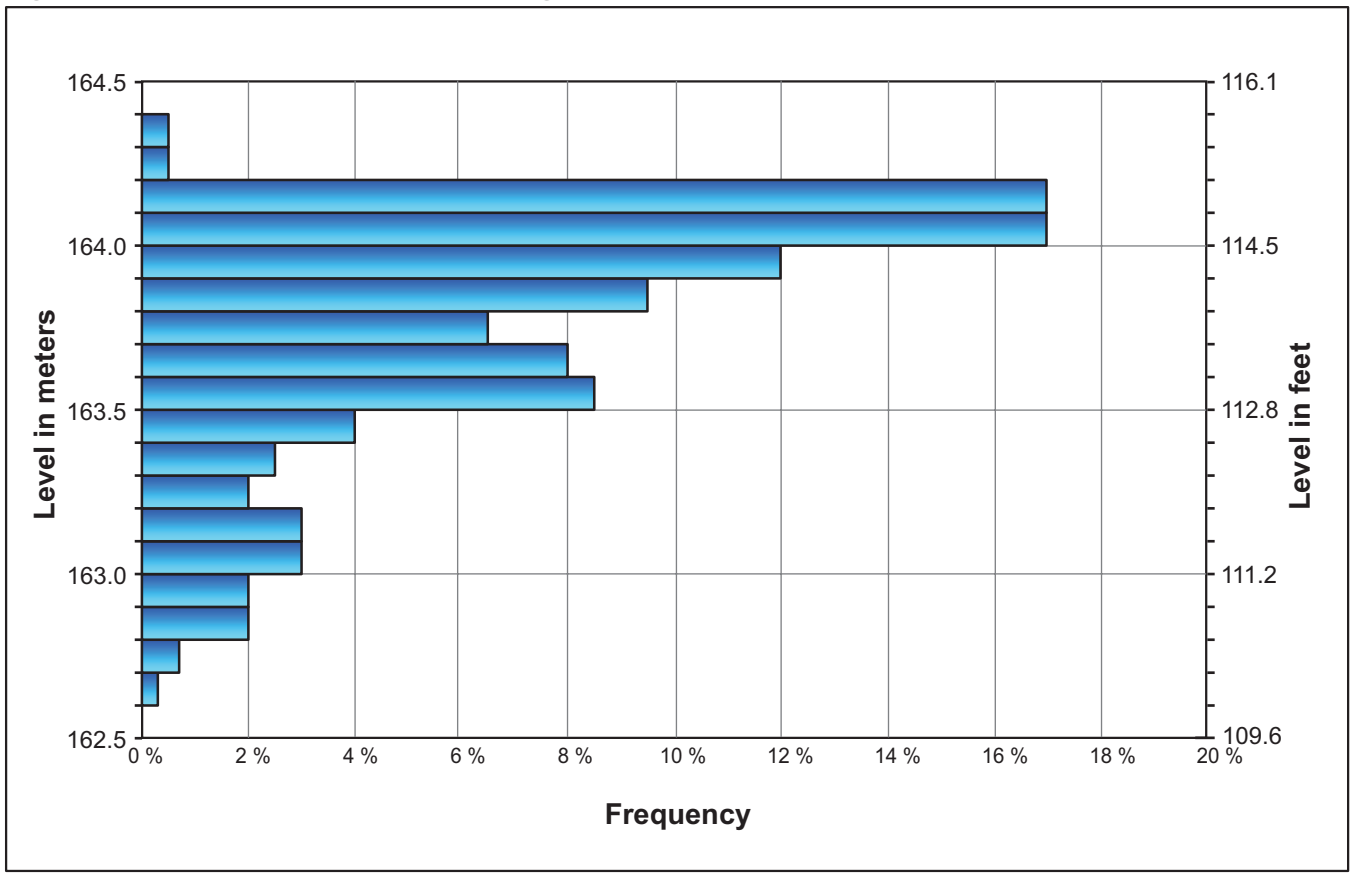
Photo 1B: July 29, 2003 (Lake water level at 163.4 m or 112.5 feet).

Figure 6 Navigability of Lake Kénogami according to the Association pour la protection du lac Kénogami



Sources : adapted from a sign by the Association pour la protection du lac Kénogami and from DB44.

Figure 7 Summer levels in Lake Kénogami from 1982 to 1995



Source : adapted from DB44.

- *The Panel notes that major decreases in Lake Kénogami's water level in summer and fall can hinder its development.*

High summer water levels

High water levels in the summer are less criticized, although they can be a nuisance for shoreline residents and users of the lake. With the raising of the lake in 1924, new banks were destabilized and seriously eroded by waves. The normal maximum level was set at 164.16 m (115 ft). The erosion zones represent about 6% of the banks and are primarily concentrated in the western section of the lake. Caribou Point, for example, has lost 150 m in length and 15 m in width to erosion. This kind of erosion has translated into the loss of significant portions of land for many shoreline dwellers. The proponent's geomorphologic study specifies that the base of the erosion talus are close to the 163.86 m (114 ft) mark, that is, at precisely the average level proposed in the project. In addition, when the lake reaches this level, it submerges most of the private beaches developed by shoreline residents. The sign set up by the Association pour la protection du lac Kénogami indicated that as of 164 m (114.5 ft), the lake level is high and boaters should be prudent with the waves they create with their crafts (Figure 6) (DB50, p. 33; brief by Marc Savard, p. 3; DA37, p. 73 and 74).

- *The Panel notes that, in some sectors, summer management levels beyond 163.86 m (114 ft) can cause damage through erosion and hinder certain uses of the lake.*

Summer water levels in Lake Kénogami since 1982

Until 1982, outflows were managed as a function of the needs of industrial producers located downstream. Since then, the manager of the dams located at the lake's outlets applies the summer management regulations in order to slow down and mitigate drops in lake level and to minimize harmful effects for users.

The Ministère de l'Environnement has compiled water level frequencies for Lake Kénogami dating back to 1911. These statistics indicate that the summer management program has helped to improve the situation for shoreline dwellers. Indeed, since 1982, the lowest summertime level has been above the 162.67 m (110.1 ft) mark, while in the past it would drop to 154.97 m (84.8 ft). Navigation conditions, however, are not always ideal : while the water level, since 1982, has been above 163.7 m (113.5 ft), 63% of the time, it has dropped below 163.55 m (113 ft) 24% of the time, and below the normal minimum level of 163.25 m (112 ft) 13% of the time (Figure 7) (DB44; DB48).

Between 1982 and 1995, the lake's summer level was within the proposed summer management range (163.86 ± 0.1 m or 114 ± 0.3 ft) only 19% of the time. During this

period, the average summer level was 163.77 m (113.7 ft) and the summer fluctuation attained 1.8 m (Figure 7). The alarm level of 164.16 m (115 ft), which corresponds to the maximum operating level established in 1924, was reached 5% of the time in the summer period.

Water levels in the lake and safety

The choice of summer management levels does not only influence conditions for the lake's use, but also has an impact on the safety of shoreline residents around the lake and downstream.

Flood storage

The management level of Lake Kénogami is directly related to its ability to mitigate the impact of a severe flood. Its impoundment capacity is greatest when its level is lowest, generally in the early spring. In contrast, when its level is at its highest, generally at the beginning of the summer, its impoundment capacity is the weakest.

Table 1 presents the storage capacity of Lake Kénogami between a range of levels and the alarm level of 164.14 m (115 ft). For example, between the minimum operating level of 154.56 m (83.5 ft) and the alarm level, the lake can store 396.2 hm^3, that is, a volume equivalent to 117 mm of precipitation in the entire watershed. In the summer, however, this capacity is at least ten times lower. During the summer, the management level can significantly modify the residual storage capacity. Consequently, at the normal maximum summer level recommended in the report by the Commission scientifique et technique sur la gestion des barrages, this capacity would be seven times greater than the level that preceded the July 1996 flood, and three times greater than that of the maximum level proposed by the proponent.

The project proposes adding to the current storage capacity of Lake Kénogami a new reservoir that can impound 22% of the water from its watershed. The Pikauba reservoir's flood storage would therefore complement that of Lake Kénogami. The lake would continue to play a pivotal role in flood control. Given its location downstream from the watershed and its ability to impound the waters from a territory four and a half times greater than that feeding the Pikauba reservoir, Lake Kénogami's flood storage offers the manager greater flood control. Furthermore, it gives a margin of manoeuvre of a few additional hours, which can be crucial for forecast management.

The size of Lake Kénogami gives it a large storage capacity. In the summer, a 1.7 m increase in the level of Lake Kénogami is enough to retain 1 hm^3 of water, which, in the Pikauba reservoir, would require an increase of 7 to 14 cm. A 10-cm decrease in

the summer level of Lake Kénogami means that its flood storage can be increased by about 6 hm³, while to obtain the same result in the Pikauba reservoir, the water level would have to be lowered from 40 to 84 cm. Lake Kénogami's impoundment capacity continues to be a significant consideration when choosing the summer management level, even with the possible complementary presence of a Pikauba reservoir.

- *The Panel notes the essential role of Lake Kénogami in flood control. It understands that the development of a reservoir on the Pikauba River is designed to add impoundment capacity that complements, rather than replaces, that of Lake Kénogami.*

Table 1 The storage capacity of Lake Kénogami under the alarm level

Level of Lake Kénogami	Storage capacity up to the alarm level (equivalent precipitation on the watershed)
164.16 m (115.0 ft) alarm level	none (0 mm)
164.06 m (114.7 ft) level preceding the July 1996 flood	6.2 hm³ (1.8 mm)
163.96 m (114.3 ft) proposed normal maximum summer level	12.3 hm³ (3.6 mm)
163.86 m (114.0 ft) proposed average summer level	18.2 hm³ (5.4 mm)
163.76 m (113.7 ft) proposed minimum summer level	24.0 hm³ (7.1 mm)
163.70 m (113.5 ft) current normal maximum summer level	27.5 hm³ (8.1 mm)
163.50 m (112.8 ft) maximum summer level recommended by the Commission scientifique et technique sur la gestion des barrages	39.2 hm³ (11.6 mm)
154.56 m (83.5 ft) minimum operating level in winter	396.2 hm³ (116.9 mm)

Sources : Values calculated on the basis of data presented in DB27, Table 1, p. 14 and DQ13.1, Figure 2.1, p. 10.

Extreme levels and shoreline flooding

The main reference levels for floods in Lake Kénogami are the alarm level at 164.16 m (115 ft) and the critical flood level without damage at 164.5 m (116.1 ft). In 2001, the Ministère de l'Environnement conducted a study of Lake Kénogami's flood-

risk areas and inventoried the homes built in sectors corresponding to four areas defined according to their flood risk (DQ13.1, p. 12) (DQ11.2) :

– area 1 : “high risk,” between 164.0 and 165.0 m (114.5 to 117.8 ft);

– area 2 : “medium risk,” between 165.0 and 165.5 m (117.8 to 119.4 ft);

– area 3 : “low risk,” between 165.5 and 166.0 m (119.4 to 121.05 ft);

– area 4 : “safe,” above166.0 m (121.05 ft), that is, the level of the 1996 flood.

The inventory included all of the shoreline homes in the municipalities of Lac-Kénogami, Larouche and Laterrière, with the exception of an area of homes recently built along the border of the Centre touristique du lac Kénogami. Of the 1,025 homes inventoried, close to two-thirds (659) were built in the safe area. Nevertheless, 8% (87) were located in the high-risk area, 13% (135) in the medium-risk area and 14% (144) in the low-risk area. The total real estate value of the homes in the flood zones was $17.6M, of which $3.8M was in the high-risk area, while the homes in the safe area were valued at $38.8M. Of the 87 homes located in the high-risk area, two-thirds were concentrated in the same sector, bordering Cascouia Bay (24) and Lac du Camp (34).

The study compared the regulations applied to the flood-risk areas in the three municipalities. In the conclusion, the Ministère de l’Environnment asked the MRC of Fjord-du-Saguenay to take the measures necessary to ensure that suitable regulations are implemented in all the municipalities bordering the lake. It also recommended that all new homes be built above the 166 m (121 ft) mark, until such a time as flood control measures are implemented.

At present, the City of Saguenay requires that the foundations of all new primary buildings be located above the 165.07 m (118 ft) mark. Owners can, however, disregard this rule, and build between the 165.07 m (118 ft) and 164.16 m (115 ft) mark if they sign a waiver form for any possible flood damage. In the short term, the City is waiting for the government to indicate the regulation it should implement with respect to flood-risk area. In order to help it manage its flood-risk area, the City of Saguenay is asking the government to map and survey the various flood levels around Lake Kénogami. The municipality of Larouche allows construction as of the 164.16 m (115 ft) mark and does not believe that it has the power to restrict constuction at higher levels (DQ24.1; DM12, p. 6; Réjean Lévesque, DT6, p. 60).

The project would reduce the scope of flooding around Lake Kénogami. Consequently, in the event of a flood with a 100-year return period, the level of the

lake should not exceed 164.16 m (115 ft), while in the current situation, it would attain 164.36 m (115.7 ft). In the event of a repeat of the flood of July 1996, the level of Lake Kénogami would be 78 cm below that attained in 1996, that is, 165.30 m (118.75 ft) rather than 166.08 m (121.25 ft). Lake Kénogami's critical level for flood damage to occur is around 164.5 m (116.1 ft). This level is higher than the current level for a 100-year return flood, but could be attained by a 1,000-year return flood (DA21, p. 9; DQ7.1, p. 2-18; DQ13.1, p. 12; DQ27.1, p. 2-18, Table 2.6).

Despite improvements the project could bring, the flood risk, while low, would persist around the lake. The report by the Commission scientifique et technique sur la gestion des barrages (p. 6-9) stresses that efficient management of the reservoir could, in the long term, have a perverse effect :

> […] the more dam managers improve the performance of their structures in controlling the water regime, the more residents gain a false sense of security which encourages them to live closer to the water's edge. This increases the risk of a catastrophe should an extreme event occur and adds to the difficulty of establishing management plans that are acceptable to all.
> (Commission scientifique et technique sur la gestion des barrages, p. 6-9)

Furthermore, implementation of the project will not eliminate the need for effective measures to prevent the expansion of construction in flood-risk areas. Since the ultimate goal is to invest in public protection and flood prevention, it is important to simultaneously implement measures that will ensure that this safety is not eroded by the rate of new construction in flood-risk areas.

- ***Recommendation 8 :*** *The Panel recommends that, to minimize property damage, the Government of Quebec, concurrently with the implementation of the project, map the flood levels around Lake Kénogami and establish, in collaboration with the MRC of Fjord-du-Saguenay and the affected municipalties, rules for the construction of infrastructure and buildings around Lake Kénogami by setting a minimum level for all construction.*

Summer management levels

Since it was converted into a reservoir close to a century ago, the role of Lake Kénogami has changed gradually. Its vocation is no longer simply to store water for industry and route floods upstream from the Rivière aux Sables and the Chicoutimi River. It has become a living environment for close to 2,000 shoreline dwellers and an asset in the development of recreational tourism in the region. In this context, reconciling the expectations of shoreline dwellers with the rules governing the generation of hydropower and the imperatives of public safety is a difficult task. Nonetheless, finding a new balance in the allocation of a collective resource must

from now be an integral part of an expanded process that takes into account this shared interest in the lake and all of its uses, both upstream and downstream. It is in this context that the Panel explores Lake Kénogami's summer management levels.

Expectations of shoreline residents

Drawn up in 1999, the *Portrait environnemental des rives et du littoral du lac Kénogami* presents what residents consider to be the ideal lake level (DB50, p. 50-52). Respondents' answers are divided as follows :

– from 163.25 m to 163.55 m (112 ft to 113 ft) : 3.6%;

– from 163.55 m to 163.86 m (113 ft to 114 ft) : 50.4%;

– from 163.86 m to 164.16 m (114 ft to 115 ft) : 27.2%;

– over 164.16 m (over 115 ft) : 18.8%.

The results are divided geographically according to 12 shoreline sectors (Table 2). In addition to enjoying the support of an absolute majority of the 276 individuals surveyed, a level between 163.55 m and 163.86 m (113 to 114 ft) also garnered the support of an absolute majority in six of the 12 shoreline sectors and a relative majority in four others. Only a majority of residents in two sectors located on Cascouia Bay preferred a level between 163.86 and 164.16 m (114 to 115 ft). Very few supported levels lower than 163.55 m (113 ft), except in the Ouiqui dike sector where they garnered 29% support.

While the survey reveals the clear preference for a level between 163.55 m and 163.86 m (113 to 114 ft), it also illustrates the divergence between the aspirations of residents in the Ouiqui dike sector and those of residents in the three sectors located in Cascouia Bay. The first group, residing in a sector where the lake is deep and the shores are steep, can accept drops in level but are more inconvenienced by higher levels (Photo 2). The other group, living in one of the shallowest bays in the lake, feels particularly vulnerable to drops in water levels (Photo 1). Paradoxically, residents in the vacation zones located in Cascouia Bay seek the highest levels, even though these zones include the greatest number of buildings located in areas with a high flood risk (DQ11.2, p. 20-21).

Photo 2 Lake Kénogami bank between Ouiqui dyke and Raphaël point

Photo 2A: April 29, 2003 (Lake water level at 157.7 m or 93.8 feet).

Photo 2B: July 29, 2003 (Lake water level at 163.4 m or 112.5 feet).

Table 2 Ideal water levels for Lac Kénogami according to a 1999 survey

Preferred level by residential sector	163.25 to 163.55 m (112 to 113 ft)	163.55 to 163.86 m (113 to 114 ft)	163.86 to 164.16 m (114 to 115 ft)	over 164.16 m (over 115 ft)
Ouiqui dike	28.6%	64.3%	0%	7.1%
SEPAQ (Île de Sable)	0%	100%	0%	0%
Cascouia River dike sector	11.1%	44.4%**	22.2%	22.2%
Cascouia Bay	0%	27.8%	55.6%	16.7%
Cascouia West Bay	0%	28.8%	36.7%	34.5%
Lac du Camp	0%	43.9%	22.0%	34.1%
Épiphane Bay	8.0%	52.0%	16.0%	24.0%
Dufour Bay	0%	45.6%	36.8%	17.5%
Dufour Bay Chemin des Polices	0%	62.5%	37.5%	0%
Rue des Gélinottes	0%	46.2%	39.8%	14.1%
Gélinas Bay	5.9%	64.7%	17.6%	11.8%
Chouinard Bay	0%	56.5%	34.8%	8.7%
Total surveyed (276 individuals)	3.6%	50.4%	27.2%	18.8%

Absolute majority

** Majority preference

Source : adapted from DB50, Table XXI, p. 51.

In 1996, the municipality of Larouche, which includes the north and west shores of Cascouia Bay, stated that a level of 163.7 m (113.5 ft) was an acceptable summer objective and that the 163.55 m (113 ft) should be respected as a ceiling level. On the basis of a 1984 survey, the Association pour la protection du lac Kénogami also believes that 163.7 m (113.5 ft) is an ideal level for shoreline residents and users. While its past preferences were between 163.7 m and 164 m (113.5 ft and 114.5 ft) and then, following the 1996 flood, between 163.55 m and 163.86 m (113 ft and 114 ft), the Association is now asking that the lake level be maintained annually for as long as possible around 163.86 m (114 ft). In September 2003, it initiated a survey of shoreline residents in order to update information on their water level preferences for the lake (DM19, p. 3; DM7.1, p. 12, 13 and 17; DM7.2).

Many shoreline residents, and particularly permanent residents, consider the implementation period for the summer management program to be too short. They

would like the summer management level to be maintained during the fall in order to extend the water sports season to September and October, and to be able to enjoy a nice view of the lake for as long as possible. The current summer management program designed to maintain an adequate waver level for vacationers and water sports is in effect from June 15 to the first Monday in September, that is, 78 to 84 days or 21% to 23% of the year. After the first Monday in September, management of the lake is geared to maximizing hydroelectric production. Many are critical of the rapid drop in the level of the lake at the end of this period.

Loss of various uses of the lake can occur very quickly once the summer period is over. In 2003, for example, the lake became dangerous for navigation[1] as of September 5 (level below 163.25 m or 112 ft). Measurements by the Pibrac gauging station supplied by the Centre d'expertise hydrique du Québec[2] show that this level dropped below 163 m (111.2 ft) before September 10 and had already hit the 162 m (107.9 ft) mark by September 26, 2003.

The oft-cited emptying in the fall of 2002 created a lot of discontent among shoreline residents. The water level, which, on September 1, was already at 163 m (111.2 ft), plunged at a steady rate of 2 m (6.6 ft) per month in September and October. Between October 2002 and April 2003, it remained well below the lowest levels measured since 1982 (Figure 5). In March, it even dropped to 154.51 m, that is, 5 cm below the minimum operating level.

Many shoreline residents, however, consider the proposed summer level of 163.86 ± 0.1 m (114 ft ± 4 in) too high and too stable. They are concerned that it will exacerbate erosion and beach flooding. Some believe that an average summer level of 163.7 m (113.5 ft) or 163.55 m (113 ft) would be an acceptable compromise offering good conditions for navigation while leading to fewer inconveniences and loss of uses.

The proponent's proposal

The proponent suggests using the Pikauba reservoir to stabilize the summer level of Lake Kénogami by retaining water up to the normal maximum management level of the reservoir. This way, it could control not only the outflows from Lake Kénogami, as is currently the case, but also part of the lake's inflow. The proposed project would maintain the summer level of Lake Kénogami between 163.76 m and 163.96 m

1. According to the Association pour la protection du lac Kénogami (Figure 6).

2. www.menv.gouv.qc.ca/cehq/suivi/hydro/index.htm

(113.7 ft and 114.3 ft). The volume of the Pikauba reservoir required to reach this objective is estimated to be 78 hm³ and presupposes the filling of the reservoir up to a normal maximum level of 417.7 m. The summer management plan proposed for Lake Kénogami differs from the one currently in place in terms of both the target water level and the planned fluctuations.

The proposal represents a 26-cm increase of the current normal maximum level, which would also reduce Lake Kénogami's flood storage by some 15 hm^3. The proposed average level of 163.86 ± 0.1 m (114 ft ± 4 in) is slightly higher than the average level recorded between 1982 and 1995 (163.77 or 113.7 ft). In addition, this would represent a significant reduction in summer fluctuations, generally exceeding 1 m, recorded since 1982 (DB44 and DB48).

Among the lakes managed by the Centre d'expertise hydrique du Québec, three are similar to Lake Kénogami insofar as their summer management plans must reconcile the needs of vacationers with the requirements of hydroelectric production downstream. The three lakes, Saint-François, Aylmer and Poisson Blanc, have a summer fluctuation of 1.1 m, 0.62 m and 1.5 m, respectively. It should be noted that for the last two years, the summer management period of Saint-François Lake and Aylmer Lake was extended to Thanksgiving (the second Monday in October). At Lake Saint-Jean, where the level is managed by Alcan's dams, the normal fluctuation established in the summer management plan is in the order of 0.75 m (2.5 ft).[1] By comparison, the proposed summer fluctuation for Lake Kénogami seems low (DQ5.2, p. 1-2).

The choice of a very stable summer level that corresponds with the base of the taluses vulnerable to erosion would accelerate the erosion process along 6% of the banks already affected, thus increasing the total length of destabilized banks by about one-third. In addition to submerging most of the beaches put in place by shoreline residents, it could also deteriorate about 5% of the stabilization structures on their land (DA37, p. 84 and 88).

Simulations carried out by the proponent showed how the summer level retained for Lake Kénogami had no significant effect on the volume of water to be maintained in the Pikauba reservoir. However, the lowering of the normal maximum level of the Pikauba reservoir and, consequently, the quantity of water maintained, compromised Lake Kénogami's degree of stability (Table 3). Therefore, by managing the Pikauba reservoir at 413 m instead of 417.7 m, with active storage reduced by nearly two-thirds (24.9 hm³ instead of 78.1 hm³),

1. www.energie.alcan.com

the minimum lake level objective of 163.76 m (113.7 ft) would be reached or surpassed 94.3% of the time as opposed to 100% (DA6.1).

Without the Pikauba reservoir, that is, without any storage, the proponent believes that the targeted minimum level of Lake Kénogami would be respected 79.2% of the time. This result shows that the lake's stability could already be markedly improved by simply changing how outflows from Lake Kénogami are managed, since the lake's level only reached this mark 48% of the time between 1911 and 1995, and 60% of the time between 1982 and 1995. The use of water storage upstream could definitely contribute to further stabilizing Lake Kénogami. However, choosing the right volume of water for this purpose must be based on a compromise between the degree of stabilization sought and the area flooded by the Pikauba reservoir.

An analysis of shoreline resident's expectations regarding the management of Lake Kénogami revealed other stabilization scenarios than those proposed which could greatly improve the situation while minimizing ecological and social repercussions. The project would render the lake even more stable compared to what has been traditionally requested by the Association pour la protection du Lake Kénogami (Figure 6). The recommended average level (163.86 m or 114 ft) would be situated at the higher limit of the range of levels considered to be ideal by the majority of shoreline residents (Table 2), and is about 15 cm higher than the level of 163.7 m (113.5 ft), viewed by many as an acceptable, even ideal, compromise.

The Panel stresses that a more flexible stabilization objective for Lake Kénogami, allowing larger fluctuations and reducing the amount of exposure of levels more sensitive to erosion, would be wise since it would help to enhance the lake and significantly improve the conditions for all users, while reducing the areas flooded upstream. Furthermore, greater flexibility in setting a minimum outflow could contribute favourably to Lake Kénogami's stabilization strategy.

Table 3 The effect of the Pikauba reservoir's level on the stability of Lake Kénogami in the summer

Normal maximum level of the Pikauba reservoir	Volume of active storage in the Pikauba reservoir (hm^3)	Portion of time in the summer under the minimum level of 163.76 m (113.7 ft)
417.7 m	78.1	0.0%
415.8 m	40.0*	0.5%
414.0 m	32.9	3.5%
413.0 m	24.9	5.7%
411.0 m	15.5	10.3%
Without the Pikauba reservoir		
Simulation	0	20.8%
Historical observations		
Period 1982-1995	0	40.0%
Period 1910-1995	0	52.0%

* Value obtained by interpolation.

Sources : DA6.1, p. 3; DB27, p. 18; DB38, p. 6-14; DB44, p. 3; and PR5.5, p. 8

- ***Opinion 28 :*** *The Panel is of the opinion that it would be relevant to use a volume of water stored in the Pikauba reservoir to improve the summer stability of Lake Kénogami for the benefit of the entire community.*

- ***Opinion 29 :*** *The Panel is of the opinion that the low fluctuation established in order no. 704-2000 provides very little flexibility for the summer stabilization of Lake Kénogami.*

- ***Opinion 30 :*** *The Panel is of the opinion that attaining the stabilization objective established in order no. 704-2000 at a level of 163.9 ± 0.1 m (114 ft ± 4 in) would cause inconvenience and loss of some of the shoreline residents' uses of Lake Kénogami, due to more serious erosion problems in certain sectors and to the drowning of several beaches.*

- ***Recommendation 9 :*** *The Panel recommends that the stabilization methods for Lake Kénogami established in order no. 704-2000 be relaxed to reduce the adverse environmental effecst, while allowing to reconcile the various uses around the lake as well as downstream.*

Sectors of the Rivière aux Sables and the Chicoutimi River

Industrial and municipal users

Since 1904, industrial users have been taking advantage of the water stored for developing hydropower in Lake Kénogami. Table 4 lists these users on the Rivière aux Sables and the Chicoutimi River (Figure 2). In addition, the City of Saguenay owns two drinking water intakes on the Chicoutimi River and another on the Rivière aux Sables. Alcan also owns a water intake on the Chicoutimi River, and Papiers Cascades has two on the Rivière aux Sables. These water intakes draw a total of up to 1.7 m^3/s from the two rivers, and the power stations can now operate at a capacity of up to 79 m^3/s. Following a ruling in 1991, water discharges were shared between the Rivière aux Sables and the Chicoutimi River at a respective proportion of one-third and two-thirds. Under normal conditions, the project would not change these proportions, however, during flood periods, they would be modified if Lake Kénogami's outflow exceeded 405 m^3/s (255 m^3/s in the Chicoutimi River and 150 m^3/s in the Rivière aux Sables). These proportions would then be established so as to minimize damage along each of the two rivers (Yves Rochon, DT4, p. 5; DA5).

Hydroelectric power stations generate significant revenues. Operators use the energy produced for their own purposes or sell it to Hydro-Québec. With a 60% theoretical utilization factor, a total installed power of 55.6 MW and at a rate of $0.05/kWh, annual gross revenues surpass $14 million. For instance, the City of Saguenay's power station on the Rivière aux Sables has been operating at an average utilization factor of 61.4% over the last two years. If the unused power stations were reconditioned, potential revenues would probably exceed $3 million. The Panel points out that the economic benefit of developing hydropower on the Rivière aux Sables and the Chicoutimi River, thanks to the contribution of Lake Kénogami, would be significant for the regional economy. Hydroelectric power could even be increased by reconditioning the Chute-Garneau and Pont-Arnaud power stations (DB52).

The government collects royalties from hydropower generation and elsewhere to maintain and operate the structures on Lake Kénogami. These royalties are estimated at $325,000 annually.[1] Several participants expressed a desire that the region benefit more directly from these royalties (DQ13.2).

1. This estimate for all hydroelectric producers was obtained by extrapolation, based on the data from Elkem Metal Canada Inc.

Table 4 Sites built to harness hydropower on the Rivière aux Sables and the Chicoutimi River

Chicoutimi River	Operator or user	Power (MW)	Height of falls (m)	Note
Chute-Garneau generating station	Hydro-Québec	2.2	10.3	In operation from 1925 to 1994. Not operating at present.
Pont-Arnaud generating station	Hydro-Québec	5.4	17.0	In operation from 1913 to 1993. Not operating at present.
Chute-Blanchette generating station	Centrale SPC inc./Elkem Metal Canada Inc.	38.0	84.1	In operation since 1957.
Chicoutimi generating station	Abitibi-Consolidated inc.	8.2	21.3	In operation since 1923.
Rivière aux Sables				
Jonquière generating station	Abitibi-Consolidated inc.	4.85	20.4	Rebuilt after the 1996 flood.
Jonquière No. 1 generating station	City of Saguenay	4.5	15.0	In operation from 1906 to 1988, and since 1996.
Kénogami generating station	Abitibi-Consolidated inc.	5.0	80.5	Not in operation since 1996.
Total power generated/Total installed power		55.6/ 68.15		

Source : DA7, p. 3

Data provided by the Ministère de l'Environnement regarding outflows from Lake Kénogami indicate that before 1996, hydroelectric producers were in a position to operate their power stations 97% of the time in the summer when they benefited from the required minimum discharge. On an annual basis, the situation was markedly less favourable since the power stations could only benefit from a minimum discharge 85% of the time. As a result of the project, the water stored in the Pikauba reservoir at 417.7 m would ensure the minimum discharge at all times during the summer, and about 99% of the time throughout the year. The project would, therefore, slightly increase electric production on the two rivers, thus improving the utilization factor of the power stations. According to the proponent, this improvement would translate into an increase of approximately 4% in the production of hydroelectricity (DB44, p. 12; PR5.4, p. 5; DA6.1, p. c-14)

- ***Opinion 31 :*** *The Panel is of the opinion that retaining part of the inflows into the Pikauba reservoir and releasing them during dry periods would enable the level of Lake Kénogami and its multiple uses to be maintained, and would also increase the utilization factor of the hydroelectric stations powered by the Rivière aux Sables and the Chicoutimi River.*

Many of the participants feel that the time has come to renegotiate the contracts so that hydroelectric companies share the water, during the minimum-flow period, with Lake Kénogami's shoreline residents in order to prioritize the stabilization of the lake. The expiry of the last contract in 2005 (Elkem Metal Canada Inc.) is seen as a good opportunity to ensure that Lake Kénogami's recreational activities in the summer and fall are taken into consideration. These participants would like the public to play a role in future negotiations between the Government of Quebec, managers responsible for development rights on the rivers, and hydroelectric companies.

The Government of Quebec grants waterpower leases. According to the Ministère des Ressources naturelles, de la Faune et des Parcs :

> […] the government, upon recommendation of the Ministère des Ressources naturelles, de la Faune et des Parcs, authorizes the lease. It confirms and specifies the conditions for the granting of the lease. The Ministère is responsible for managing the rights conferred and keeps a register to this effect. It also ensures that the lessee respects the clauses and the terms and conditions of the lease, including the payment of rent and royalties. Rights are granted for a limited duration. Furthermore, the government may, at the end of the lease, recoup at no cost all operating facilities constructed by the lessee.[1]

It is, therefore, possible to expect that in 2005, the government will renegotiate all development rights related to waterpower on the Rivière aux Sables and the Chicoutimi River. In this context, the economic viability of the power stations will likely constitute the basis for negotiations.

Residents along the Chicoutimi River and the Club de kayak de la rivière aux Sables specified during the public hearings that while they are in favour of stabilizing Lake Kénogami's level and revising the guaranteed minimum discharge, they also want a sufficient discharge in the Rivière aux Sables and the Chicoutimi River to maintain aquatic life and recreational activities.

1. www.mmfp.gouv.qc.ca/energie/forces/forces-gestion.jsp

- ***Opinion 32 :*** *The Panel is of the opinion that, if water were to be stored and maintained in the Pikauba reservoir, this water should be prioritized for the stabilization of Lake Kénogami in the summer and, if possible, up to mid-October. For the remainder of the year, this stored water could be prioritized for hydroelectric production.*

- ***Opinion 33 :*** *The Panel is of the opinion that upcoming renegotiations of the development rights regarding waterpower on the Rivière aux Sables and the Chicoutimi River should take into account the current needs of those who use Lake Kénogami and the two rivers, and ensure the equitable sharing of the advantages and disadvantages during severe minimum flows. The parameters and criteria framing these renegotiations should be made available to the public.*

Water quality in Rivière aux Sables

The project plans for the digging of a sill, 600 m long and 80 m wide, in the upper segment of the Rivière aux Sables. This digging could deteriorate the water quality by stirring up sediment.

The City of Saguenay is concerned about the effects this work could have on the quality of the water entering the water treatment plant downstream. It is worried that abrupt variations in the quality of water in the Rivière aux Sable could have a direct impact on the treatment line, which could clog equipment, deteriorate the quality of the treated water and reduce the efficiency of disinfection. In order to mitigate this effect, the proponent suggested that measures be applied during the work in the Rivière aux Sables, including the installation of geotextile curtains ballasted downstream from the hydraulic shovels and the floating barriers installed closed to the excavation work. It believes that these measures will suffice to avoid an increase in the muddying of the water (DM12, p. 9 and 10; DQ30.1).

- ***Recommendation 10 :*** *The Panel recommends that, given the scope of the work on the Rivière aux Sables, a water quality monitoring program be designed in collaboration with the users who have water intakes in order to ensure that their efficiency is maintained. Before the work begins, a contingency plan should be developed in partnership with the users.*

Navigation on Rivière aux Sables

The sector of the Rivière aux Sables where the digging of a sill is planned, it is primarly at the height of the CEPAL Villégiature where canoing and kayaking is practised. The Club de kayak de la rivière aux Sables has been using this river

since 1979. According to the proponent, this site is considered one of the best in Quebec for kayaking with its waterfalls and rapids offering different degrees of difficulty. It is used by the Fédération de canot kayak du Québec for the selection of the Canadian team as well as for Canadian championships. According to the Club, if the river is readjusted it could once again become the site for the world championships as it was in summer 1979. The 1996 flood destroyed the installations for the slalom race course and modified the river. Since then, the site was partly redeveloped, leaving the riverbed too wide for the summer flows. At present, the river is only good for kayaking in spring and fall. In fact, for certain events requiring greater volumes of water, flows in the order of 25 to 35 m³/s were allowed (DM17, p. 7).

Even if the proponent does not believe the project would modify conditions in the CEPAL rapids, the Club de kayak is hoping that the proponent will take advantage of the digging of the sill in the Rivière aux Sables to reclaim rocks in order to complete the development of the rapids. This contribution of material in strategic locations would recreate optimal conditions, even at low flows, as in the summer. The Club would therefore like to know what the average summer flow would be on the Rivière aux Sables once the project is completed so that the rapids can be redeveloped accordingly (Jean Dussault, DT8, p. 43).

Furthermore, the rapid located immediately downstream from Pibrac Bridge is used by the Club de canot-camping l'Aviron to train novices. According to the Club, although the site has become less attractive since the 1996 flood as a result of the slower current following changes to the riverbed, it is still ideal for beginners. For these reasons, it wants assurances that this rapid will not be disrupted by the project, worrying that the digging of the sill under the Pibrac Bridge will destroy the rapid. It offered the proponent its full cooperation to find a solution to this problem.

- ***Opinion 34 :*** *The Panel is of the opinion that the project should not have serious adverse effects on navigation on the Rivière aux Sables. It does, however, consider it desirable that the Ministère des Ressources naturelles de la Faune et des Parcs, in concert with the Club de canot-camping l'Aviron, document the water conditions at the location of the rapid used for teaching canoers and that it ensure that the digging of the sill will not have an impact on that rapid. Should there be an impact, the proponent must ensure that a rapid with similar features is recreated.*

- ***Opinion 35 :*** *The Panel is of the opinion that the project offers the possibility of optimizing navigation conditions on the Rivière aux Sables. It invites the Ministère des Ressources naturelles, de la Faune et des Parcs to work in concert with the Club de kayak de la rivière aux Sables in order to recreate attractive summer water conditions for kayakers in the CEPAL rapids.*

Monitoring and follow-up

Monitoring

The proponent is responsible for environmental monitoring, the principal goal of which is to ensure the protection of the environment for the duration of the work. It involves verifying the implementation and effectiveness of mitigation measures during construction.

The proponent drew up a list of activities that it plans in particular to monitor during the construction period, namely, work in the Rivière Sables, management of hazardous materials, excavations and earthworks as well as accidental spills. The monitoring program must ensure enforcement of environmental protection laws, regulations and policies in effect. The proponent must also verify that the conditions of any future order and of the issuance of authorization certificates be respected as well as the implementation of measures that it agreed to implement in order to mitigate the effects of its project on the environment.

The Panel believes that the effects of trucking on the quality of life of shoreline residents during the work on the sill in the Rivière aux Sables should be monitored. This monitoring should focus on safety, noise levels, vibrations, dust and the state of the roads. Monitoring would allow modifying mitigation measures in a timely manner during the work.

Monitoring water quality should not be limited to the Pikauba River sector. One of the City of Saguenay's drinking water intakes is located on the Rivière aux Sables. Furthermore, industries draw their water from the river. Deterioration in the water quality could occur during excavation. The quality of the water taken from this river could be inadequate given the requirements of the water intakes. It is therefore important to monitor water quality during the work on the sill in the Rivière aux Sables. Establishing the parameters could be done in concert with the City of Saguenay, the Ministère de l'Environnement and the Ministère des Ressources naturelles, de la Faune et des Parcs.

Follow-up

The follow-up program is designed to verify the effectiveness of the mitigation and compensation measures and, if needed, to control unforeseen effects and make the necessary corrections.

It is important that a reference state of the environment be established prior to the work in order to be able to follow any changes to the environment. The proponent already has available a range of data that will enable it to determine the state of the situation prior to the project. The Panel notes, however, that the information regarding mercury concentration in the tissue of rainbow smelts and the ouananiche must be completed before the development of the Pikauba reservoir.

The proponent has selected certain components that require environmental follow-up. It has established the outline of the follow-up program that it plans to implement. While the Panel considers these components relevant, it believes that others need to be added. This is particularly the case for the Lake Kénogami sector. Since concerns have been expressed over mercury contamination, a follow-up should target the tissue of rainbow smelts fished in the lake at the mouth of the Pikauba River. This follow-up wouldl also be an opportunity to increase knowledge of the transport of mercury downstream from reservoirs.

Two Aboriginal nations, local, regional and governmental organizations and many shoreline residents will be affected by this project. Good coordination is essential in the implementation of the follow-up program to ensure that it is effective and that it takes into account the interests of all parties concerned.

- ***Opinion 36 :*** *The Panel is of the opinion that since the project is under the jurisdiction of the Government of Quebec, its repercussions should be followed up by the various government departments according to their respective areas of expertise. All those from the affected area must have the opportunity to participate in the follow-up program. A consultation committee should be created for this purpose, which would include Aborginal communities.*

- ***Opinion 37 :*** *The Panel is of the opinion that the information gathered during the follow-up should be easily accessible to the public.*

Chapter 4 A harmonized approach to managing the Lake Kénogami watershed

The Panel's proposal for the management of the Pikauba reservoir

The Panel believes that the management level of the Pikauba reservoir has a direct impact on the productivity of the fish habitat and the extent of the wetlands that will be flooded. To determine how the reservoir's various operating levels would affect these habitats, the proponent presented management options of 412.7 m, 415.8 m and 417.7 m (Figure 8). Table 5 shows these various options and their effects on the area of the wetlands that will be affected and the biological productivity of the brook trout.

Since the sector concerned is relatively flat upstream of the Pikauba 3 forest dam, a slight increase in the reservoir level could flood a large section of the wetlands. For example, a difference of just 1 m in the reservoir's management level could increase the flooded area by about 100 ha (Jean-Philippe Détolle, DT4, p. 77).

In terms of the total flooded area, 161 ha of wetlands would be lost using a management level of 412.7 m, which represents a saving of more than 300 ha or about 65% of the total surface area of the wetlands that would be flooded with a management level of 417.7 m. Savings would drop to 20% using a management level of 415.8 m since only 94 ha of wetlands would be spared. Those wetlands located upstream of the Pikauba 3 forest dam would be almost completely flooded.

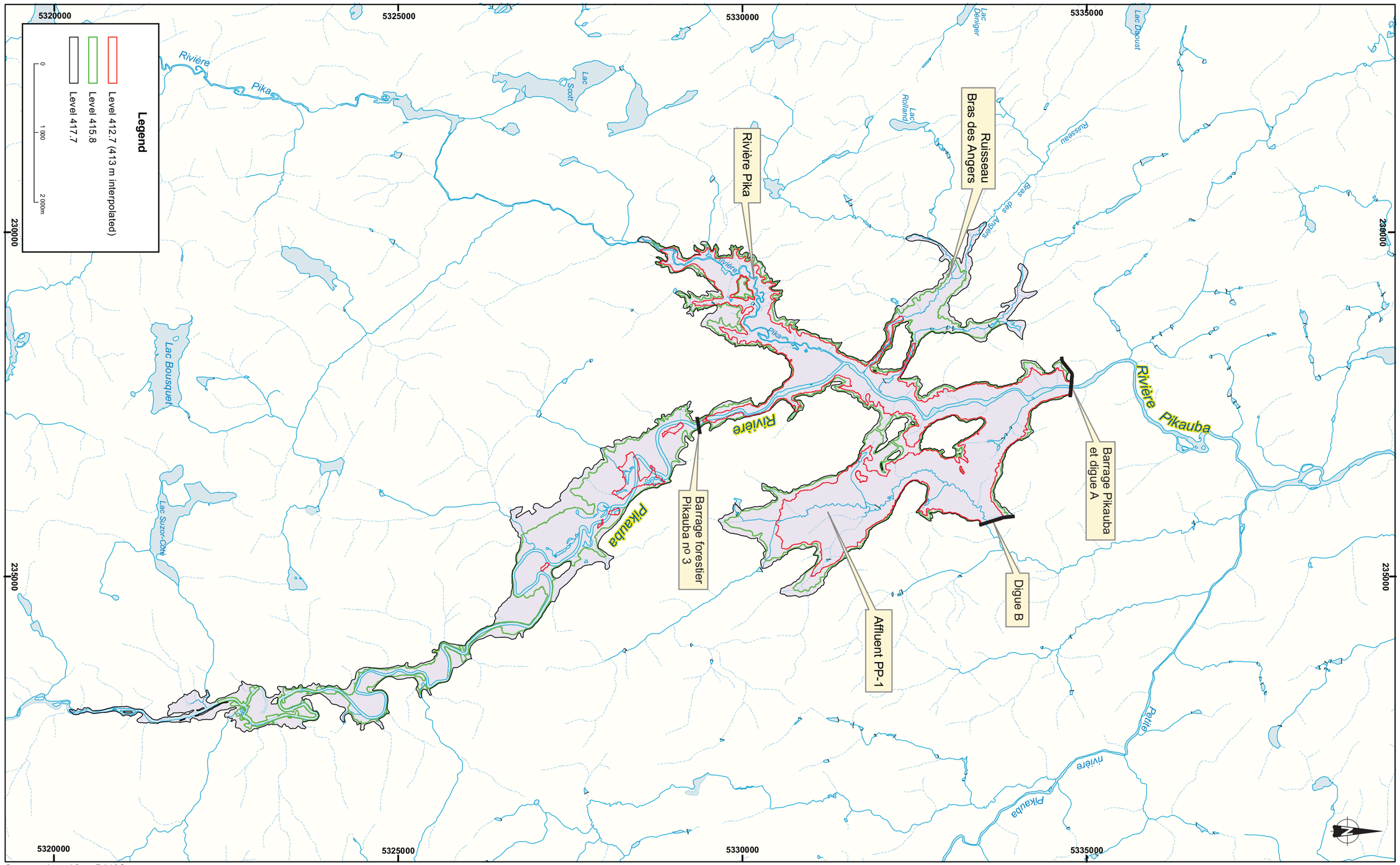
The sector of the study area that is of greatest interest in terms of wetlands is located upstream of the Pikauba 3 forest dam. These wetlands extend over 15 kilometres, from kilometre 36 to 51 (Figure 3). Data provided by the proponent indicate that 17.6 ha of wetlands in this sector would be flooded at a management level of 412.7 m, compared with 180.7 ha and 250.4 ha at management levels of 415.8 m and 417.7 m, respectively.

Table 5 Effects on wetlands and fish habitat by management level of the Pikauba reservoir

Management level of Pikauba reservoir	412.7 m	415.8 m	417.7 m
Extent of the river flooded (boundary upstream of the reservoir)	9.8 km (40 km)	23.1 km (53.3 km)	23.8 km (54 km)
Surface area of reservoir	659 ha	1,210 ha	1,561 ha
Surface area of flooded wetlands upstream of the Pikauba 3 dam at kilometre 36	17.6 ha	180.7 ha	250.4 ha
Total surface area of flooded wetlands	161 ha	369.3 ha	463 ha
Surface area of affected fish nursery and food supply areas	34.7 ha	Data unavailable	105 ha
Surface area of affected spawning grounds	5,000 m^2 (Pika River)	Data unavailable	Between 15,000 m^2 and 16,700 m^2
Surface area of unaffected spawning grounds	11,812 m^2	Data unavailable	1,262 m^2
	Wetlands compose 25% of the reservoir's surface area . Those located upstream of the former Pikauba 3 forest dam would be spared for the most part as would those in the Bras des Angers Stream valley.	Nearly 75% of the surface area of the wetlands located upstream of the Pikauba 3 forest dam would remain flooded. This percentage increases for those in the Pika River valley and along the PP-1 tributary.	All the wetlands along the Pikauba River would be flooded.

Source : adapted from DA6.1, p. 11 and 13

Figure 8 Reservoir Pikauba's different management levels



Source: adapted from DA16C.

Therefore, compared with a management scenario of 417.7 m, a level of 412.7 m would allow for a very large portion of the wetlands of greatest interest (93% or nearly 232.8 ha) to be saved. A level of 415.8 m would save only 69.7 ha, or about 28%. The proponent concurs with this observation and stated at the public hearing that a level of 412.7 m reaches just to the top of the Pikauba 3 forest dam and spills very slightly into the main area of the wetlands (Jean-François Rougerie, DT4, p. 70).

Although the environmental benefits of a 412.7 m summer management level seem obvious, the proponent has some reservations about the risk of hydrogeological changes to the riverbed immediately upstream of the former Pikauba 3 forest dam. The proponent anticipates that the reservoir will exceed this management level one out of every two years. The Ministère de l'Environnement estimates that the level will be exceeded during recurring floods occurring every two to twenty years, and that wetlands can tolerate these flooding periods. The ministry adds that the wetlands' capacity to support these periods depends on their frequency and duration, as well as water levels, season and vegetation present. The proponent's simulations show that this management level would have been exceeded about a dozen times in an 87-year period. At a management level of 417.7 m, this area would be flooded about nine months out of the year and during the growing period for vegetation (DA6.1 annex A, p. 10 and 14 ; DQ25.1, p. 2 and 3).

The proponent also states that a management level of 412.7 m means that the reservoir's water level would be about 70 cm over the Pikauba 3 forest dam's current sill, resulting in an increase in the level of the water table in the areas along the river. Some changes to the area's edaphic conditions can be anticipated and could lead to changes in vegetation and the habitat's characteristics (DA6.1, Appendix C, p. 40).

The Ministère de l'Environnement also mentioned the risk associated with a higher water table and that the reservoir may change the wetlands' hydrogeological conditions and cause their distribution in the sector to change. The ministry estimates that this phenomenon could become less apparent moving upstream from the dam. However, information from the proponent's simulations shows that the maximum management level of 412.7 m would be maintained only one month out of the year, on average, from mid-May to mid-June (DQ5.1, p. 2).

While a management level of 412.7 m could spare a very large portion of the wetlands in the flooded sector, 161 ha would still be lost. The Panel is still concerned that the proponent has not planned any mitigation or compensatory measures for the management level of 417.7 m even after indicating there would be a loss of function in wildlife habitats. All participants at the public hearing and the proponent recognized the value of these areas as a preferred habitat for many wildlife species (DQ26.3, p. 2-4).

- *The Panel notes that a management level of 412.7 m for the Pikauba reservoir would still result in a residual loss of 161 ha of wetlands.*

- ***Opinion 38 :*** *The Panel is of the opinion that extensive areas of wetlands would be lost if the Pikauba reservoir were kept above a normal management level of 412.7 m. Since these wetlands are important in terms of biodiversity and have great ecological value, a management level that would protect most of these wetlands is a necessity.*

Fish habitat

The proponent estimates net losses in the production of brook trout to be 185 kg/year at a management level of 417.7 m. Losses would rise to 285 kg/year at a management level of 412.7 m. This situation is explained as follows:

> A level of 412.7 m does not offer any reach here, and we feel that there is no productivity associated with that. However, a reservoir with a level of 417.7 m is more stable […] under normal conditions during production seasons […], however, a reservoir at 412.7 m […] fluctuates very quickly and at several times over one growing season.
> (Jean-François Rougerie, DT3, p. 50)

Fisheries and Oceans Canada and the Société de la faune et des parcs du Québec question the proponent's method for evaluating productivity. They feel that the loss of productivity at a management level of 417.7 m would be greater than that estimated by the proponent. Fisheries and Oceans Canada believes that a level of 412.7 m would result in fluctuations of 13 m and greatly limit benthic production in the water and food supply for the fish. According to the department, there would be an impact on the fish habitat, regardless of the extent of the fluctuation. In addition, it feels that the two residual bodies of water would have very low productivity, particularly the body of water upstream of dike B, and that the fish habitat could not be maintained there. The department feels that this component of the project should be dropped. The Société de la faune et des parcs du Québec states that managing the reservoir at a lower level would make it easier to maintain the quality of the fish habitat (DQ8.1, p. 12 and DQ6.1, p. 2).

According to the proponent, fish nursery and food supply areas would be permanently flooded while the Pikauba reservoir was managed at a maximum normal level of 417.7 m. At that level, their total surface area would be 105 ha, most of which would be under the main stem of the Pikauba River (Table 5). At a level of 412.7 m, the surface area of the fish nursery and food supply areas that would be flooded would be about 35 ha – a decrease of 67% in relation to the 417.7 m level. Most of this gain would occur under the main stem of the Pikauba River. However, the areas located in

the PP-1 tributary upstream of dike B would definitely be flooded and those downstream of this dike would remain disturbed by a major reduction in discharge (DQ8.1 p. 3 and 10).

The brook trout's spawning grounds are located between kilometres 53 and 55 of the main stem of the Pikauba River. Although the proponent did not evaluate the surface area of spawning grounds affected by a level of 415.8 m, we can estimate that the spawning grounds would likely be disturbed as well since, at this level, the reservoir would extend to kilometre 53.3 (Figure 8). At a level of 412.7 m, all potential or confirmed spawning grounds in the Pikauba River would be conserved. However, those located in the Pika River, representing some 5,000 m^2, would be affected since they are found near the planned dam (Table 5).

In addition, the Panel points out that conserving wetlands by using a management level of 412.7 m offers benefits for moose habitat as well.

- ***Opinion 39 :*** *The Panel is of the opinion that a reservoir managed at a maximum normal level of 412.7 m would make it possible to safeguard nearly 14 km of the Pikauba River and, as a result, all the spawning grounds of the brook trout located between kilometres 53 and 55. This management option would also conserve a large part of the fish nursery and food supply areas.*

- ***Opinion 40*** *: The Panel is of the opinion that managing the Pikauba reservoir at a level of 412.7 m would nevertheless result in a residual loss of about 5,000 m^2 of spawning grounds in the Pika River.*

- ***Opinion 41 :*** *The Panel is of the opinion that there would be no major adverse effects if the Pikauba reservoir were managed at a maximum normal level of 412.7 m and measures were implemented to compensate the residual loss of wetlands and fish habitat.*

- ***Recommendation 11 :*** *The Panel recommends that the Pikauba reservoir be managed at a maximum normal level of approximately 412.7 m to minimize the loss of wetlands and fish habitat. Furthermore, at this level, the primary objective of ensuring public safety would be respected. Summer flood storage would be even greater.*

- ***Recommendation 12 :*** *The Panel recommends that, according to the principle of no net loss of wildlife habitat, the Quebec Ministère des Ressources naturelles, de la Faune et des Parcs reach an agreement with the government officials concerned regarding the measures required to compensate residual losses of wetlands and fish habitat.*

The Panel's proposal for the management of Lake Kénogami, Rivière aux Sables and Chicoutimi River

The Panel has already concluded that a reservoir appears to be required upstream to ensure public safety without compromising the current and future uses of Lake Kénogami. The proposed reservoir on the Pikauba River maintained at a maximum normal management level of 417.7 m would allow for Lake Kénogami to be stabilized at a summer level of 163.86 ± 0.1 m (114 ft. ± 4 in.) 100% of the time.

The Panel also recognizes the importance of improving the stability of Lake Kénogami. It notes that the very low summer fluctuations proposed under this project complicate lake management since they give the manager very little room to manœuvre. In addition, the proposed water level would worsen erosion problems and flood most of the beaches developed by shoreline residents. At the end of its analysis, the Panel concludes that a more flexible stabilization option for Lake Kénogami allowing for greater fluctuations would also meet the needs of most shoreline residents.

Summer management levels on Lake Kénogami

An acceptable stabilization scenario must help to improve conditions for use of Lake Kénogami, particularly with respect to navigation, while decreasing the length of time that the most sensitive zones are exposed to erosion and giving the operator more room to manœuvre. However, the scenario must, first and foremost, meet the project's primary objective of ensuring public safety.

The Panel feels that an average lake level of about 163.7 m (113.5 ft.) seems to be the most advantageous and realistic summer target (Table 6). This level is close to the preferred water levels identified during the 1999 survey and those considered ideal for navigation (Figure 6 and Table 2).

Minimum and maximum normal summer levels could be 163.5 m and 164 m (112.8 and 114.5 ft.), respectively. The minimum normal level corresponds to the point at which shoreline residents say that navigational problems arise. The maximum level is equivalent to the upper summer level desired by l'Association pour la protection du lac Kénogami. The variation in the normal level would therefore be in the order of 50 cm, rather than 20 cm as anticipated under the project. However, the Panel estimates that these limits could be surpassed under conditions of low or high hydraulicity. An increase up to the warning level of 164.16 m (115 ft.) could be tolerated on occasion. During dry periods, the level could dip below 163.5 m (112.8 ft.). Bear in mind that the current minimum normal summer level is set at 163.25 m (112 ft.).

Table 6 Comparison between previous and proposed summer management regulations for Lake Kénogami

SUMMER MANAGEMENT REGULATIONS (normal conditions)	1982-1995	1998-2003	THE PROJECT (Pikauba reservoir at 417.7 m)	PANEL'S PROPOSAL (Pikauba reservoir at 412.7 m)
Average target level	---	---	163.86 m (114 ft.)	**163.7 m (113.5 ft.)**
Minimum normal level	---	163.25 m (112 ft.)	163.76 m (113.7 ft.)	**163.5 m (112.8 ft.)**
Maximum normal level	164.16 m (115 ft.)	164.16 m (115 ft.)	163.96 m (114.3 ft.)	**164.0 m (114.5 ft.)**
Normal fluctuation	1.80 m	1.09 m	0.20 m	**0.50 m**
Length of summer management period	June15 to the first Monday in September (78 to 84 days)	June 15 to the first Monday in September (78 to 84 days)	June 15 to the first Monday in September (78 to 84 days)	**June15 to mid-October** if possible (115 to121 days)
Minimum outflow	42.5 m³/s non-guaranteed	42.5 m³/s non-guaranteed	42.5 m³/s guaranteed 99.9 % of the time	**42.5 m³/s but could be less during low hydraulicity** if the level is below 163.5 m (112.8 ft.)
Maximum outflow	68 m³/s	79 m³/s *	79 m³/s *	**79 m³/s** if the level exceeds 163.86 m (114 ft.) * **below 79 m³/s** if the level is lower than 163.86 m (114 ft.)
Exceeding minimum and maximum normal levels	Major flood: level above 164.16 m (115 ft.)	Major flood: level above 164.16 m (115 ft.) Low hydraulicity (extremely low flow: level below 163.25 m (112 ft.)	Level never lower than 163.76 m (113.7 ft.) Extreme flood: level above 163.96 m (114.3 ft.)	Low hydraulicity (extremely low flow): **level below 163.5 m (112.8 ft.)** High hydraulicity: **level between 164 m and 164.16 m (114.5 and 115 ft.)** Extreme flood: **level higher than 164.16 m (115 ft.)**

* As a preventive measure to avoid a flood warning being issued, a discharge of more than 79 m³/s is released in response to measured inflows or weather forecasts.

Although the proponent has not simulated managing a stabilization scenario of 163.7 m (113.5 ft.) with a fluctuation of 163.5 to 164 m (112.8 ft. to 114.5 ft.), it seems to be a realistic one. The proponent simulated a similar scenario with a level of 163.76 ± 0.2 m (113.7 ft. ± 8 in.). Using the water stored in the Pikauba reservoir managed at a maximum normal level of 412.7 m, the minimum level of 163.56 m (113 ft.) planned for Lake Kénogami would be respected 94% of the time (DA6.1, annex A, p. 15).

When the lake level is between 163.5 m (112.8 ft.) and 163.25 m (112 ft.), the outflow from Lake Kénogami could be gradually reduced to below 42.5 m³/s during periods of low hydraulicity.

Lake Kénogami summer management rules

To implement the Panel's summer stabilization scenario, a set of regulations is required that would allow the manager to optimize operations. The Panel feels that these regulations should be defined jointly by the manager of Lake Kénogami and a watershed committee. However, it has a few suggestions regarding ways to get the best results. Under normal management conditions, and to reduce the erosion that worsens when the level reaches or exceeds 163.86 m (114 ft.), the outflow from the lake could approach 79 m³/s – the maximum capacity of hydroelectric facilities. Between the levels of 163.5 m (112.8 ft.) and 163.86 m (114 ft.), management of the outflow could vary based on the inflows, similar to current practices.

Given the number of shoreline residents and the importance of water activities, the Panel believes that summer management regulations should be extended until mid-October if conditions permit, as is currently the case for lakes Saint-François and Aylmer (DQ5.2, p. 1-2).

As a basis for determining the minimum discharge from Lake Kénogami, the Panel points out that, according to the Ministère de l'Environnement's compilations, the minimum discharge offered to hydroelectric producers before 1996 was not respected at all times since the outflow from the lake was lower about 3% of the time in the summer and 15% of the time throughout the year (DB44, p. 12).

- ***Opinion 42 :*** *The Panel is of the opinion that the water storage maintained in the Pikauba reservoir, managed at a maximum normal level of 412.7 m, would help to stabilize Lake Kénogami during the summer.*

- ***Opinion 43 :*** *The Panel is of the opinion that stabilizing Lake Kénogami in the summer at an average level of about 163.7 m (113.5 ft.), with a normal variation of between 163.5 m and 164 m (112.8 ft and 114.5 ft.), would be a suitable target to*

meet the expectations of shoreline residents while minimizing the project's adverse effects.

- ***Opinion 44 :*** *The Panel is of the opinion that summer management rules should be extended, if possible, to mid-October.*

- ***Opinion 45 :*** *The Panel is of the opinion that the outflow of 42.5 m³/s from Lake Kénogami could gradually be reduced in the summer when the lake level is below 163.5 m (112.8 ft.).*

Cumulative effects

To comply with the *Canadian Environmental Assessment Act* and the guideline issued by the Quebec Ministère de l'Environnement, the proponent submitted a cumulative effects assessment. According to the *Cumulative Effects Assessment Practitioners Guide*, cumulative effects are changes to the environment that are caused by a project or an action in combination with other past, present and future human actions.

As part of this analysis of cumulative effects, the proponent followed the assessment method suggested by the Canadian Environmental Assessment Agency. As a first step, it determined the valued environmental components that are affected by the project and at greatest risk of cumulative effects. The proponent focused on the following five components: the shoreline, navigable waterways, brook trout, moose and wetlands. The next step was to determine a geographic boundary for examining these effects, namely, the Lake Kénogami watershed. A timeframe of 20 years into the past and 10 years into the future were set for the first four components. As for the wetlands, the timeframe extends back to 1964 to take advantage of aerial photographs showing changes in the wetlands (PR8, p. 3-6).

The Panel notes that the proponent systematically selected activities and projects within establish geographical boundaries and timeframes that could affect the valued components selected. The Panel supports the valued environmental components, the geographic boundaries and timeframes selected. It also supports the identification of other projects and activities that could have cumulative effects.

Shoreline erosion

In terms of cumulative effects on the shoreline, by keeping lake levels more stable, the project could increase erosion in some sectors of Lake Kénogami and put pressure on the shoreline through even greater development of vacation areas in the

north sector of the lake. These effects could add to the gradual deterioration of the shoreline that has occurred over the past 20 years through erosion, increased encroachment on the buffer strip and the disappearance of the natural shoreline. The proponent also points to the major impact of the 1996 flood on shoreline erosion and notes that, in 1987, Quebec adopted the *Politique de protection des rives, du littoral et des plaines inondables*, which promotes conservation by providing a framework for shoreline activities. The proponent feels that it is possible to manage the risk of compounding existing effects if the government ensures its policy on shoreline protection is followed closely. In this respect, the Panel notes that a level which is too stable and too high could encourage residents to redevelop the shoreline, particularly by reconstructing beaches.

- ***Opinion 46 :*** *The Panel is of the opinion that the project should not worsen the erosion of the Lake Kénogami shoreline. By maintaining the lake at a lower average level than that proposed and allowing some fluctuation in the summertime level as suggested, the erosion would be comparable to past conditions. Therefore, the modified project would have no residual adverse effect that may add to other sources of shoreline erosion.*

Navigation

In terms of navigable waterways, the proponent concludes that the project would improve navigational conditions on Lake Kénogami, the Rivière aux Sables and the Pikauba River. The proponent therefore concludes that the project would not have a cumulative effect on navigation on these waterways. However, based on the testimony of some whitewater boaters who use the two rivers, the Panel notes some localized negative effects around the Pikauba dam and near the sill proposed for the Rivière aux Sables. The Panel concludes, however, that there may not be major cumulative effects on whitewater boating provided that the measures it proposes to mitigate these effects are implemented.

Brook trout

The proponent anticipates that the project may have major effects on brook trout for various reasons, including the fact that large spawning areas on the Pikauba River would be flooded and the species would face reduced productivity. In addition, the proponent showed that brook trout populations in the study area have decreased markedly over the past 20 years. This decline may be the result of habitat degradation and hindrances to the free movement of the fish, caused mainly by logging and its related roadways. Consequently, fishermen may not be going to bodies of water with low yields. The proponent emphasizes that environmental managers are willing to

eliminate these problems and develop the resource. However, the proponent believes that, in the future, brook trout populations in the Laurentides wildlife reserve could increase given improved forestry practices, the installation of run-off sensors near main roadways and the improvement of forest dams following the proclamation of the Dam *Safety Act*.

The Panel points out that the proponent, in cooperation with federal and provincial authorities, must re-evaluate productivity losses for brook trout caused by the creation of a reservoir operated at the maximum normal management level selected. The Panel deems that the cumulative effects would be lessened if the losses calculated are compensated in a satisfactory manner, as set out in the *Fisheries Act.*

Although the project's effects on brook trout populations must be compensated, the Panel is of the opinion that, given the cumulative effects already noted for this species, it is important to reduce the project's effects on this valued component to the greatest extent possible. Therefore, the spawning grounds located between kilometres 53 and 55 of the Pikauba River must be preserved. The Panel emphasizes that all these spawning grounds would be saved if the reservoir were maintained at a maximum normal management level of 412.7 m.

If the Pikauba reservoir project were managed at the level of 417.7 m, it could greatly affect brook trout, a species that needs to be protected. With its proposed modifications, the Panel estimates that the capacity of renewable resources to meet the needs of future generations would not be greatly affected.

Moose

According to the proponent, moose habitat losses estimated at 15.6 km^2 would have no measurable effect on the productivity of this population given the size and quality of habitat available around the reservoir. The proponent concludes that, although the project may cause loss of habitat, the moose population would be maintained at the current level and could even increase if pressure from hunting did not exceed the critical threshold. In the Laurentides wildlife reserve, where hunting is strictly controlled, the moose population is stable or growing. The proponent therefore concludes that the project would have no major direct effects on the moose.

However, the Panel notes that there would definitely be a loss of habitat for the moose and its home range would be modified. It concludes that a reservoir maintained at a maximum normal management level of 412.7 m would reduce habitat loss, in comparison with the proponent's proposal. The Panel estimates that the residual

adverse effects on the moose that could result from its project option, even when added to effects from other sources, would not be significant.

Wetlands

The proponent expects that the creation of the Pikauba reservoir, managed at a level of 417.7 m, will result in a loss of 463 ha of wetlands. This loss would accentuate the reduction in wetlands observed in the study area over the past few decades. The proponent's analysis has shown that, overall, wetlands have decreased slightly in size between 1964 and 2000. This decrease may be linked to the natural process of change in wetland areas and may have been accelerated by forestry operations. While not specifying the significance, the proponent concludes that there may be a cumulative effect with other activities affecting wetlands regionally, which contributes to a decrease in surface area and a change in the function of wetlands.

Both levels of government have demonstrated their willingness to protect wetlands. The Government of Quebec, with its *Politique de protection des rives, du littoral et des plaines inondables*, has set the objective of ensuring the conservation, quality and biological diversity of these areas by limiting activities that could make them accessible. The policy also confirms the importance of protecting banks and shorelines from degradation and erosion. Furthermore, the federal government's main objective is to promote wetlands conservation with a view to maintaining their ecological and socioeconomic functions, now and in the future. To reach this objective, Environment Canada recommends that the principle of no net loss of function be applied, as recommended in the *Federal Policy on Wetland Conservation*.

- ***Opinion 47 :*** *The Panel is of the opinion that reducing the loss of wetlands in the Pikauba reservoir sector would respect the spirit of the federal and Quebec policies to protect wetlands while meeting the objective of increased public safety. The Panel notes that, if the Pikauba reservoir were maintained at a maximum normal management level of 417.7 m, 463 ha of wetlands upstream of the Pikauba 3 forest dam would be flooded, causing significant cumulative effects. The Panel concludes that a reservoir maintained at a maximum normal management level of 412.7 m would reduce the extent of wetlands that would be flooded. The cumulative effects would therefore be reduced and would not be significant insofar as residual losses are compensated.*

Sustainable development

The Panel's analysis was guided by the sustainable development principles presented at the beginning of the report. Using these principles, the Panel examined the ways in which the project could meet the primary objective of public safety as well as the other objectives to meet the needs of current residents without depriving future generations. The Panel also assessed the capacity of the renewable resources affected by the project to meet present and future needs.

In terms of the current situation and in order to ensure public safety, the option proposed by the Panel would stabilize Lake Kénogami and thereby improve the quality of life of shoreline residents. Residents concerns were taken into account when selecting preferred water levels for Lake Kénogami.

The Pikauba River valley is known for its biological diversity, especially its wetlands and high wildlife density. It is also an area for recreational activities such as canoeing, kayaking, hunting and fishing. The Panel believes that its option enables almost the entire Pikauba River valley, with its wealth of natural features, to be protected. A reservoir level that reduces the extent of the Pikauba River valley that is flooded while meeting the objectives of public safety and stabilization of levels in Lake Kénogami seems to be the best choice.

The Panel considers that, to be sustainable, the project must also take into account the economic support offered by people who vacation around Lake Kénogami, recreational tourism in the project's area of influence, and industrial activities downstream of Lake Kénogami, particularly those using hydroelectric power from the Rivière aux Sables and the Chicoutimi River.

The Panel considers it essential for flood control in the Lake Kénogami watershed to be conducted in an integrated manner so that all interests may be reconciled. The environmental issues related to the project are distributed across the entire watershed and affect various groups and individuals. Participants, who have diverse concerns, need to be represented in the same forum. Official recognition of a watershed committee would enable people to continue participating actively in their community in a sustainable development approach.

To ensure that the project is carried out in a harmonious manner, the ecological, economic and social aspects must be treated equally. Conciliation is essential. The Panel feels that its preferred option could meet the many expectations concerning the uses of Lake Kénogami, the Chicoutimi River and the Rivière aux Sables as well as

the primary objective of public safety. This option also offers the advantage of preserving biological diversity in the Pikauba River valley.

- *The Panel notes that its preferred option – maintaining the Pikauba reservoir at a normal management level of 412.7 m – would support the equity principle of sustainable development and would ensure the sustainability of renewable resources.*

- ***Opinion 48 :*** *The Panel is of the opinion that the Comité provisoire du lac réservoir Kénogami et des rivières aux Sables et Chicoutimi requires an expanded mandate and representation touching on all concerns regarding the watershed. The Panel also agrees that the Government of Quebec should officially recognize it as a watershed committee.*

Conclusion

Following the inquiry and public consultations, the Panel concluded that the Lake Kénogami Watershed Flood Control Project submitted by the Ministère des Ressources naturelles, de la Faune et des Parcs is consistent with the project's primary objective, namely ensuring public safety.

The Lake Kénogami watershed reacts rapidly to precipitation, which means that improved capacity to discharge water from the lake and greater storage capacity are required because of the time needed to manage a major flood. It would be technically possible to acquire a similar storage capacity in summer by considerably decreasing water levels in Lake Kénogami. However, this approach would compromise current uses of the lake, Rivière aux Sables and the Chicoutimi River. Furthermore, since water levels in Lake Kénogami are already very low in spring, it would be impossible to improve public safety in the event of a major spring flood. For these reasons, storage capacity has to be increased upstream from the lake.

The combination of the measures proposed, that is, the construction of a flood retention reservoir upstream from Lake Kénogami on the Pikauba River, raising the dikes and low points on the periphery of Lake Kénogami, and increasing the lake's discharge capacity by digging a sill in Rivière aux Sables, would maximize the project's effectiveness, thereby ensuring the safety of shoreline residents along Lake Kénogami, Rivière aux Sables and the Chicoutimi River. Implementing an improved flood forecasting system will also ensure greater public safety.

The Panel's proposal regarding the Pikauba reservoir

The Pikauba River valley is known for its biological richness, in particular its wetlands and very diverse wildlife. Canoeing, kayaking, hunting, fishing and other recreational activities are also practised in the area. Since Pikauba River valley ecosystems are of such great ecological value and cannot be replaced, it is important to optimize the project so as to minimize their loss.

Consequently, the Panel recommends that the Pikauba River be managed at a normal maximum level of 412.7 m rather than 417.7 m, as proposed by the proponent. This solution would save 93% of the surface area of the wetlands of great interest located in the Pikauba River's meander and preserve 14 km of its course where a number of brook trout spawning grounds are located. An important area of fish rearing and feeding habitat would also be preserved under this management regime. In

addition, moose habitat would be better maintained without compromising the development of an exceptional ecotourism site.

Even if the management level is lowered to 412.7 m, construction of the Pikauba reservoir will necessarily require various measures to compensate for the ensuing residual losses for wetlands and fish habitat.

The Panel's proposal regarding Lake Kénogami, Rivière aux Sables and the Chicoutimi River

Under a sustainable development approach, the Panel feels it is essential that, while meeting its primary objective of public security, the project not neglect regional economic development. Thus, hydroelectric power should continue to be produced on Rivière aux Sables and the Chicoutimi River while recreational and tourism development is encouraged around Lake Kénogami. Accordingly, it seems appropriate to use the Pikauba River to improve the lake's stability without impinging on uses of the Rivière aux Sables and the Chicoutimi River. However, the Panel feels that the very small variation in summer water levels being proposed by the proponent would complicate management of Lake Kénogami by leaving the manager too little room to manoeuvre and requiring the Pikauba reservoir to be managed at a high level in order to create a sufficient volume to stabilize water levels.

Consequently, the Panel proposes a more flexible stabilization alternative for Lake Kénogami that should improve conditions for uses of the lake, particularly navigation, and reduce the length of exposure of the most erosion-sensitive areas. This alternative would give the manager of the control structures more room to manoeuvre while meeting the primary goal of public safety.

Stabilizing Lake Kénogami in summer at an average level of 163.7 m (113.5 ft at the local scale), with a normal variation of between 163.5 m and 164 m (112.8 ft and 114.5 ft), would meet shoreline residents' expectations and minimize the project's adverse environmental effects. The application of summer management rules should also be extended, insofar as possible, until mid-October.

A project consistent with the principles of sustainable development

The equitable integration of ecological, economic and social factors is essential to community acceptance of the project and harmonious management in the future. In

order to meet these objectives, an effort to achieve reconciliation must be made. The Panel tried to find a common ground where these interests converge.

The Panel feels that its proposal for the Pikauba River and management of Lake Kénogami would have the advantage of preserving the biodiversity of the Pikauba River valley while meeting the expectations of users of the lake, Rivière aux Sables and the Chicoutimi River and achieving the goal of public safety.

Sustainable development depends on the commitment and partnership of all groups in society through a fair division of responsibilities and the advantages and disadvantages associated with a project. It would thus be advisable that the Comité provisoire du lac réservoir Kénogami et des rivières aux Sables et Chicoutimi acquire a broader mandate and have members representing all concerns related to the watershed. The Panel proposes that the Quebec government grant the Interim Committee official status as a Watershed Committee.

The Panel's opinions and recommendations are presented below.

Signed in the City of Quebec,

BAPE Panel

Claudette Journault, Chair

Michel Germain, Member

Joint Review Panel

Claudette Journault, Chair

Claude E. Delisle, Member

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The Panel's Opinions and Recommandations

Flood routing through the creation of a reservoir

- ***Opinion 1 :*** *Construction of a flood retention reservoir upstream from Lake Kénogami is justified and preferable to alternatives not involving a reservoir.*

Securing the Lake Kénogami shoreline

- ***Opinion 2 :*** *Raising the dikes and low points around Lake Kénogami is justified since it would increase the margin of manoeuvre for the managers of the flood-control works in the event of a major flood.*

- ***Opinion 3 :*** *As part of the reconditioning of the Coulée-Gagnon dike, the Ministère des Transports should review the layout of the Chemin du Quai and consider whether it is relevant to repair the two sub-standard bends.*

Increasing Lake Kénogami's discharge capacity

- ***Opinion 4 :*** *The work planned for the Rivière aux Sables is justified and will generate fewer adverse effects than the other proposals to increase the discharge capacity of Lake Kénogami. This work, combined with other planned measures, will widen the margin of manoeuvre for managing extreme potential floods likely to affect Lake Kénogami, thereby assuring public safety around the lake and downstream.*

- ***Opinion 5 :*** *Despite the higher costs and greater inconvenience related to the digging of a sill in the Rivière aux Sables, this alternative is preferable to the expropriation of shoreline residents.*

- ***Opinion 6 :*** *During the construction of the works, heavy truck traffic in residential areas on roads that were not designed for such use will have significant adverse effects on quality of life, particularly with respect to resident safety.*

- ***Recommendation 1 :*** *The Panel recommends that a truck traffic management plan be developed in collaboration with the municipalities affected in order to minimize to an acceptable level the adverse effects on shoreline residents of the truck traffic necessary to carry out the works, notably those in the Rivière aux Sables.*

Safety of structures

- ***Opinion 7 :*** *The failure of the Pikauba dam or a dike on Lake Kénogami could have significant adverse environmental effects. However, given the measures set out in the Dam Safety Act it believes that such an event is highly unlikely*

- ***Opinion 8 :*** *It is important the public can examine the studies on dam failure consequences at the same time as the impact study. In the future, this approach should be a requirement.*

- ***Recommendation 2 :*** *The Panel recommends that the gates of the Bésy Falls dam be verified by the Centre d'expertise hydrique du Québec to ensure their capacity to discharge inflows under all circumstances, and that they do not risk being jammed by large debris. If this is the case, alterations to the dam must be required by virtue of the Dam Safety Act.*

- ***Recommendation 3 :*** *The Panel recommends that local methods be established to enable the timely verification of Lake Kénogami's discharge control works, in the event of a flood that may lead to a flood warning.*

Discharge management

- ***Opinion 9 :*** *In order to restore the public's confidence in the dam manager, management and monitoring of this entity could be ensured by a different and independent body.*

- ***Opinion 10 :*** *It is important to have a communication system in place to inform the population at all times about the management of flood-control works as well as discharges on the Pikauba River, the Chicoutimi River and the Rivière aux Sables and water levels in Lake Kénogami.*

Forest environments and wetlands

- ***Opinion 11 :*** *The ecological importance and irreplaceability of the wetlands in the area of the Pikauba River valley where the proposed reservoir would be built justify their protection.*

- ***Opinion 12 :*** *It is appropriate to apply the objectives of the* Federal Policy on Wetland Conservation*, which are designed to prevent the net loss of wetland functions in such environments. This would also be in keeping with the objective of the* Quebec Strategy on Biological Diversity *to the effect that compensation measures designed to*

maintain biodiversity be included in all new hydro-development plans, whether public or private, even if the project is a flood-control initiatives.

Moose habitat and hunting

- ***Opinion 13 :*** *The flooding of the Pikauba River valley up to the 417.7 m mark could modify the territory used by moose. This could alter their movements, thereby increasing the hunting effort.*

- ***Opinion 14 :*** *Since wetlands are a preferred habitat for moose, their conservation has a direct impact on hunting and the protection of the species.*

- ***Opinion 15 :*** *The principle of no net loss of wildlife habitats must be applied. In this respect, it is important to preserve both the area and characteristics of moose habitats. In case of loss, the Ministère des Ressources naturelles, de la Faune et des Parcs must try to compensate for all lost habitat by new habitats in the same sector or the same ecological unit.*

Fish habitat and fishing

- ***Opinion 16 :*** *The assessed losses in brook trout productivity presented in the impact study were underestimated.*

- ***Opinion 17 :*** *Brook trout spawning grounds, in high concentrations between kilometres 53 and 55 of the Pikauba River, must be preserved.*

- ***Opinion 18 :*** *the proponent should conduct a follow-up program during the first two years of the Pikauba dam's operation in order to monitor the scope and effects of fish entrainment toward the dam outlet.*

- ***Opinion 19 :*** *A fish-pass at the Pikauba dam is not justified due to the low biological productivity afforded by the reservoir, the height of the dam, technical difficulties with regard to design and operations, as well as excessive costs.*

- ***Opinion 20 :*** *In order to reduce the adverse effects of the project on the fishing success of brook trout, it is important to minimize the species' productivity losses and to compensate for residual losses.*

- ***Opinion 21 :*** *The integrity of the ecosystems in the sector targeted by the Pikauba reservoir must be preserved before compensating the residual losses of brook trout, in accordance with the federal government's* Policy for the Management of Fish Habitat *and Quebec's* Lignes directrices pour la conservation des habitats fauniques*.*

- ***Recommendation 4 :*** *The Panel recommends that an ecological minimum flow downstream from the Pikauba dam be maintained during reservoir filling periods. This flow should be determined in collaboration with the responsible authorities, taking into account the biological requirements of fish and government policies.*

Mercury

- ***Opinion 22 :*** *This project will not lead to health risks related to mercury levels in drinking water taken from Lake Kénogami, the Rivière aux Sables and the Chicoutimi River.*

- ***Opinion 23 :*** *Reducing the area of the proposed reservoir on the Pikauba River will lessen mercury contamination in the food chain.*

- ***Recommendation 5 :*** *The Panel recommends that the reference state for mercury contamination be established in relation to the species most likely to be consumed in the Pikauba River sector and at its mouth, where rainbow smelt winter fishing is practised.*

- ***Recommendation 6 :*** *The Panel recommends that the effectiveness of the mercury information campaign be monitored in collaboration with community representatives. The Panel believes that an effective communication program is key to prevention.*

Navigation on the Pikauba River

- ***Opinion 24 :*** *The Pikauba River dam manager must establish, with representatives of users of the river, ways and means that can be used to inform canoeist and kayakers of the daily discharges planned downstream from the dam.*

- ***Opinion 25 :*** *The Pikauba River dam manager must establish, with representatives of users of the river, ways and means to ensure that releases of water downstream from the proposed dam allow users to continue practicing their activities in good conditions.*

- ***Opinion 26 :*** *The Pikauba River dam manager must establish, with canoeists and kayakers, alert procedures so that they are not caught by surprise by a sudden increase in the flow of the river, in the event of an emergency opening of the gates.*

- ***Opinion 27 :*** *Given the proposed mitigation measures, the project should not have significant adverse effects on navigation on the Pikauba River.*

Managing Lake Kénogami

- ***Opinion 28 :*** *It would be relevant to use a volume of water stored in the Pikauba reservoir to improve the summer stability of Lake Kénogami for the benefit of the entire community.*

- ***Opinion 29 :*** *The low fluctuation established in order no. 704-2000 provides very little flexibility for the summer stabilization of Lake Kénogami.*

- ***Opinion 30 :*** *Attaining the stabilization objective established in order no. 704-2000 at a level of 163.9 ± 0.1 m (114 ft ± 4 in) would cause inconvenience and loss of some of the shoreline residents' uses of Lake Kénogami, due to more serious erosion problems in certain sectors and to the drowning of several beaches.*

- ***Recommendation 7 :*** *The Panel recommends that any significant change in the management rules of Lake Kénogami be subject to public consultation to show transparency in the management of the watershed.*

- ***Recommendation 8 :*** *The Panel recommends that, to minimize property damage, the Government of Quebec, concurrently with the implementation of the project, map the flood levels around Lake Kénogami and establish, in collaboration with the MRC of Fjord-du-Saguenay and the affected municipalties, rules for the construction of infrastructure and buildings around Lake Kénogami by setting a minimum level for all construction.*

- ***Recommendation 9 :*** *The Panel recommends that the stabilization methods for Lake Kénogami established in order n^{o}. 704-2000 be relaxed to reduce the adverse environmental effecst, while allowing to reconcile the various uses around the lake as well as downstream.*

Industrial and municipal users of Rivière aux Sables and the Chicoutimi River

- ***Opinion 31 :*** *Retaining part of the inflows into the Pikauba reservoir and releasing them during dry periods would enable the level of Lake Kénogami and its multiple uses to be maintained, and would also increase the utilization factor of the hydroelectric stations powered by the Rivière aux Sables and the Chicoutimi River.*

- ***Opinion 32 :*** *If water were to be stored and maintained in the Pikauba reservoir, this water should be prioritized for the stabilization of Lake Kénogami in the summer and, if possible, up to mid-October. For the remainder of the year, this stored water could be prioritized for hydroelectric production.*

- ***Opinion 33 :*** *Upcoming renegotiations of the development rights regarding waterpower on the Rivière aux Sables and the Chicoutimi River should take into account the current needs of those who use Lake Kénogami and the two rivers, and ensure the equitable sharing of the advantages and disadvantages during severe minimum flows. The parameters and criteria framing these renegotiations should be made available to the public.*

Water quality in Rivière aux Sables

- ***Recommendation 10 :*** *The Panel recommends that, given the scope of the work on the Rivière aux Sables, a water quality monitoring program be designed in collaboration with the users who have water intakes in order to ensure that their efficiency is maintained. Before the work begins, a contingency plan should be developed in partnership with the users.*

Navigation on Rivière aux Sables

- ***Opinion 34 :*** *The project should not have serious adverse effects on navigation on the Rivière aux Sables. It does, however, consider it desirable that the Ministère des Ressources naturelles de la Faune et des Parcs, in concert with the Club de canot-camping l'Aviron, document the water conditions at the location of the rapid used for teaching canoers and that it ensure that the digging of the sill will not have an impact on that rapid. Should there be an impact, the proponent must ensure that a rapid with similar features is recreated.*

- ***Opinion 35 :*** *The project offers the possibility of optimizing navigation conditions on the Rivière aux Sables. It invites the Ministère des Ressources naturelles, de la Faune et des Parcs to work in concert with the Club de kayak de la rivière aux Sables in order to recreate attractive summer water conditions for kayakers in the CEPAL rapids.*

Follow-up

- ***Opinion 36 :*** *Since the project is under the jurisdiction of the Government of Quebec, its repercussions should be followed up by the various government departments according to their respective areas of expertise. All those from the affected area must have the opportunity to participate in the follow-up program. A consultation committee should be created for this purpose, which would include Aborginal communities.*

- ***Opinion 37 :*** *The information gathered during the follow-up should be easily accessible to the public.*

The Panel's proposal for the management of the Pikauba reservoir

- ***Opinion 38 :*** *Extensive areas of wetlands would be lost if the Pikauba reservoir were kept above a normal management level of 412.7 m. Since these wetlands are important in terms of biodiversity and have great ecological value, a management level that would protect most of these wetlands is a necessity.*

- ***Opinion 39 :*** *A reservoir managed at a maximum normal level of 412.7 m would make it possible to safeguard nearly 14 km of the Pikauba River and, as a result, all the spawning grounds of the brook trout located between kilometres 53 and 55. This management option would also conserve a large part of the fish nursery and food supply areas.*

- ***Opinion 40 :*** *Managing the Pikauba reservoir at a level of 412.7 m would nevertheless result in a residual loss of about 5,000 m^2 of spawning grounds in the Pika River.*

- ***Opinion 41 :*** *There would be no major adverse effects if the Pikauba reservoir were managed at a maximum normal level of 412.7 m and measures were implemented to compensate the residual loss of wetlands and fish habitat.*

- ***Recommendation 11 :*** *The Panel recommends that the Pikauba reservoir be managed at a maximum normal level of approximately 412.7 m to minimize the loss of wetlands and fish habitat. Furthermore, at this level, the primary objective of ensuring public safety would be respected. Summer flood storage would be even greater.*

- ***Recommendation 12 :*** *The Panel recommends that, according to the principle of no net loss of wildlife habitat, the Quebec Ministère des Ressources naturelles, de la Faune et des Parcs reach an agreement with the government officials concerned regarding the measures required to compensate residual losses of wetlands and fish habitat.*

The Panel's proposal for the management of Lake Kénogami, Rivière aux Sables and Chicoutimi River

- ***Opinion 42 :*** *The water storage maintained in the Pikauba reservoir, managed at a maximum normal level of 412.7 m, would help to stabilize Lake Kénogami during the summer.*

- ***Opinion 43 :*** *Stabilizing Lake Kénogami in the summer at an average level of about 163.7 m (113.5 ft.), with a normal variation of between 163.5 m and 164 m (112.8 ft*

and 114.5 ft.), would be a suitable target to meet the expectations of shoreline residents while minimizing the project's adverse effects.

- ***Opinion 44 :*** *Summer management rules should be extended, if possible, to mid-October.*

- ***Opinion 45 :*** *The outflow of 42.5 m³/s from Lake Kénogami could gradually be reduced in the summer when the lake level is below 163.5 m (112.8 ft.).*

Cumulative effects

- ***Opinion 46 :*** *The project should not worsen the erosion of the Lake Kénogami shoreline. By maintaining the lake at a lower average level than that proposed and allowing some fluctuation in the summertime level as suggested, the erosion would be comparable to past conditions. Therefore, the modified project would have no residual adverse effect that may add to other sources of shoreline erosion.*

- ***Opinion 47 :*** *Reducing the loss of wetlands in the Pikauba reservoir sector would respect the spirit of the federal and Quebec policies to protect wetlands while meeting the objective of increased public safety. The Panel notes that, if the Pikauba reservoir were maintained at a maximum normal management level of 417.7 m, 463 ha of wetlands upstream of the Pikauba 3 forest dam would be flooded, causing significant cumulative effects. The Panel concludes that a reservoir maintained at a maximum normal management level of 412.7 m would reduce the extent of wetlands that would be flooded. The cumulative effects would therefore be reduced and would not be significant insofar as residual losses are compensated.*

Sustainable development

- ***Opinion 48 :*** *The Comité provisoire du lac réservoir Kénogami et des rivières aux Sables et Chicoutimi requires an expanded mandate and representation touching on all concerns regarding the watershed. The Panel also agrees that the Government of Quebec should officially recognize it as a watershed committee.*

Appendix 1

Information on the Mandates

Public hearing applicants

Richard Mercier
Manon Deschênes
Harold Guay
Linda Boulanger

Conseil de la nation huronne-wendat,
Wellie Picard

Marc Savard

Conseil régional de l'environnement et du développement durable du Saguenay–Lac-Saint-Jean
Monique Laberge

Association pour la protection du lac Kénogami
Louis Pilote

Mouvement au Courant
John Burcombe

Comité des citoyens de Laterrière inc.
Serge Forget

Union québécoise pour la conservation de la nature
Charles-Antoine Drolet

Mandates

The BAPE was mandated under the *Environment Quality Act* (R.S.Q., c. Q-2) to hold a public hearing and to report its findings and analysis to the Minister of the Environment.

The Joint Review Panel was mandated, in accordance with the agreement between the Government of Quebec and the Government of Canada, to conduct a public review of the project in a manner which respects the requirements of the *Canadian Environmental Assessment Act* (1992, c. 37) and the *Environment Quality Act*.

Mandate periods

Mandate of the BAPE panel
May 5 to October 24, 2003

Mandate of the Joint Review Panel
August 4 to October 24, 2003

The Panel and its team

BAPE panel

Claudette Journault, Chair
Michel Germain, Member

Joint Review Panel

Claudette Journault, Chair
Claude E. Delisle, Member
Michel Germain, Member

The team

Anne-Lyne Boutin	Secretariat Coordinator
Judy Doré	Analyst Trainee
Chantal Dumontier	Secretariat Officer
Karine Lavoie	Communications Consultant
Jean Roberge	Analyst
Linda St-Michel	Analyst
Marie-France Therrien	Analyst

With the collaboration of:

Rosemary Al-Hayek	Communications Consultant
Bernard Desrochers	Computer Graphics Coordinator
Hélène Marchand	Editor
Kathleen Martineau	Secretariat Officer

Public hearing

Preparatory meetings

April 29 and 30, May 1 and 2, 2003

Preparatory meetings held in Saguenay and Quebec City

1st part

May 12, 13 and 14, 2003
Holiday Inn Saguenay
Salle Jonquière

2nd part

August 5, 6 and 7, 2003
Holiday Inn Saguenay
Salle Ouananiche

Site visits

April 28 and 29, 2003
July 29, 30 and 31, 2003

BAPE panel
The Panel

Proponent

Ministère des Ressources naturelles, de la Faune et des Parcs	Liette Pelletier, Engineer
Its consultant	Patrick Arnaud, Spokesperson
Hydro-Québec	Jean-François Rougerie Pierre Bruneau Robert Piché Christiane Rompré Luc Roy Francis Therrien

Resource persons

Paul Ruel Réjean Lévesque	Comité provisoire du lac réservoir Kénogami et des rivières Chicoutimi et aux Sables	DM16
Louis Lesage	Conseil de la nation huronne-wendat	DM19 DM19.1
Alain Nepton	Conseil des Montagnais du Lac-Saint-Jean	DM22
Louis Breton	Environment Canada	
Yves Rochon, Spokesperson Jean-Philippe Détolle Patrick Beauchesne	Ministère de l'Environnement	
Julie Lafleur, Spokesperson Richard Turcotte Michel Dolbec	Ministère de l'Environnement Centre d'expertise hydrique du Québec	
Benoît Girard Michel Savard	Ministère de la Santé et des Services sociaux	
Réjean Langlois	Ministère de la Sécurité publique	
Donald Martel	Ministère des Transports	
Maurice Savard	Municipality of Hébertville	
Simon Trépanier Richard Jones	Fisheries and Oceans Canada Maurice Lamontagne Institute Canadian Coast Guard	

Sylvain Boucher	Société des établissements de plein air du Québec	DM24
Gérald Guérin Paul-Émile Lafleur	Société de la faune et des parcs du Québec	
Roger Lavoie	City of Saguenay	DM12

Participants

	Briefs
Louise B. Accolas Pierre Gauthier	DM4
Nathalie Arpin	
André Bouchard	DM27
Germain Bouchard	
Paul-Roger Cantin Guy St-Jean	DM8 DM8.1
Claude Collard	DM18
Lynn Gauthier	DM6
Gilles Girard	
Jocelyne Girard Bujold, Jonquière MP	DM25
Ghislain Lowe	DM1 DM1.1
Harold Guay and Linda Boulanger Richard Mercier and Manon Deschênes	DM11 DM11.1
Gilles Lamontagne	
Jean-Claude Ratté	
Paul Ruel	DM28
Marc Savard	DM5 DM5.1
Ross Tamblyn	DM21

Joseph Thomas		DM10
Gilles Thibeault		DM26
Yves Truchon		DM3
Guy Vigneault		Oral
Association pour la protection du lac Kénogami	Louis Pilote Paul-Roger Cantin	DM7 DM7.1 DM7.2
Club de kayak de la rivière aux Sables	Jean Dussault André Proulx	DM17
Comité de l'environnement de Chicoutimi		DM13
Comité des citoyens de Laterrière inc.	Serge Forget Gilles Potvin	DM2 DM2.1 DM2.2
Conseil de la nation huronne-wendat	Simon Picard	DM19 DM19.1
Conseil régional de l'environnement et du développement durable du Saguenay–Lac-Saint-Jean	Daniel Groleau Luc Tessier	DM14
Fédération québécoise du canot et du kayak and Club de canot-camping l'Aviron	Christian Hudon	DM23
Fondation Rivières	Alain Saladzius	DM20
Municipality of Larouche	Réjean Lévesque	DM9
Mouvement Au Courant	John Burcombe	DM29 DM29.1
Union québécoise pour la conservation de la nature	Charles-Antoine Drolet	DM15 DM15.1
City of Saguenay	Jean-Marie Beaulieu Roger Lavoie Daniel Poitras	DM12

A total of 29 briefs and one oral testimony were submitted to the Panel.

Appendix 2

Documentation

Consultation centers

Mashteuiatsh Library
Mashteuiatsh

Paul-Émile-Boulet Library
Chicoutimi

Quebec University in Montréal
Montréal

Cégep de Jonquière
Jonquière

Jonquière Municipal Library
Jonquière

Laterrière Public Library
Laterrière

Bureau du BAPE
Québec

Documents submitted for the project under review

Procedure

PR1 HYDRO-QUÉBEC. *Avis de projet*, septembre 2000, 23 pages et annexes.

PR2 MINISTÈRE DE L'ENVIRONNEMENT. *Directive du ministre de l'Environnement indiquant la nature, la portée et l'étendue de l'étude d'impact sur l'environnement*, 11 janvier 2001, 29 pages.

PR3 MINISTÈRE DES RESSOURCES NATURELLES ET HYDRO-QUÉBEC. *Documentation relative à l'étude d'impact sur l'environnement déposée au ministre de l'Environnement*.

PR3.1 *Volume 1 – Vue d'ensemble*, janvier 2002, pages 1-1 à 9-2 et annexes.

PR3.2 *Volume 2 – Aménagement du réservoir Pikauba*, janvier 2002, pages 1-1 à 9-13 et annexes.

PR3.3 *Volume 3 – Sécurisation du pourtour du lac Kénogami*, janvier 2002, pages 1-1 à 14-4 et annexes.

PR3.4 *Volume 4 – Aménagement d'un seuil dans la rivière aux Sables*, janvier 2002, pages 1-1 à 8-2 et annexes.

PR3.5 *Résumé de l'étude d'impact sur l'environnement*, novembre 2002, 31 pages et cartes.

PR3.5.1 Errata *au résumé de l'étude d'impact sur l'environnement*, 1er avril 2003, 1 page.

PR4 MINISTÈRE DES RESSOURCES NATURELLES ET HYDRO-QUÉBEC. Errata *à la documentation relative à l'étude d'impact sur l'environnement.*

PR4.1 *Volume 1 – Vue d'ensemble*, novembre 2002, 4 pages.

PR4.2 *Volume 2 – Aménagement du réservoir Pikauba*, novembre 2002, 4 pages.

PR4.3 *Volume 3 – Sécurisation du pourtour du lac Kénogami*, novembre 2002, 4 pages.

PR4.4 *Volume 4 – Aménagement d'un seuil dans la rivière aux Sables*, novembre 2002, 4 pages.

PR5 MINISTÈRE DE L'ENVIRONNEMENT. *Questions et commentaires adressés au promoteur*, juillet 2002, 21 pages.

PR5.1 MINISTÈRE DES RESSOURCES NATURELLES ET HYDRO-QUÉBEC. *Réponses aux questions et commentaires du ministère de l'Environnement*, août 2002, 106 pages.

PR5.2 MINISTÈRE DE L'ENVIRONNEMENT. *Questions et commentaires adressés au promoteur, deuxième série*, octobre 2002, 7 pages.

PR5.3 MINISTÈRE DE L'ENVIRONNEMENT. *Complément aux questions et commentaires adressés au promoteur, deuxième série*, 31 octobre 2002, 2 pages.

PR5.4 MINISTÈRE DES RESSOURCES NATURELLES ET HYDRO-QUÉBEC. *Réponses aux questions et commentaires du ministère de l'Environnement, deuxième série*, novembre 2002, 27 pages et annexes.

PR5.4.1 MINISTÈRE DE L'ENVIRONNEMENT. *Demande de précisions concernant la réponse à la question 1 de la deuxième série de questions et commentaires*, 16 décembre 2002, 2 pages.

PR5.5 MINISTÈRE DES RESSOURCES NATURELLES ET HYDRO-QUÉBEC. *Précisions concernant la réponse à la question 1 de la deuxième série de questions et commentaires*, janvier 2003, 14 pages et annexes.

PR6 MINISTÈRE DE L'ENVIRONNEMENT. *Recueil des avis issus de la consultation auprès des ministères et organismes sur la recevabilité de l'étude d'impact*, du 19 mars 2002 au 22 janvier 2003, pagination diverse.

PR7 MINISTÈRE DE L'ENVIRONNEMENT. *Avis sur la recevabilité de l'étude d'impact*, janvier 2003, 6 pages.

PR8 MINISTÈRE DES RESSOURCES NATURELLES ET HYDRO-QUÉBEC. *Complément de l'étude d'impact sur l'environnement. Évaluation des effets cumulatifs*, septembre 2002, 78 pages.

PR8.1 MINISTÈRE DES RESSOURCES NATURELLES. *Liste des lots touchés par le projet*, juillet 2001, 2 pages.

PR8.2 CORPORATION DU SENTIER DE MOTONEIGE DANS LA RÉSERVE FAUNIQUE DES LAURENTIDES. *Lettre adressée au Bureau d'audiences publiques sur l'environnement relative au sentier de motoneige régional n°365 dans la réserve faunique des Laurentides*, 3 avril 2001, 2 pages.

PR8.3 MINISTÈRE DES RESSOURCES NATURELLES. *Présentation faite lors de la séance d'information tenue par le Bureau d'audiences publiques sur l'environnement*, 18 mars 2003, 26 pages.

PR8.3.1 MINISTÈRE DES RESSOURCES NATURELLES. *Transparents de la présentation faite lors de la séance d'information tenue par le Bureau d'audiences publiques sur l'environnement*, 18 mars 2003, 57 photos, 29 pages.

PR8.4 MINISTÈRE DES RESSOURCES NATURELLES. *Simulations visuelles*, 18 mars 2003, 9 pages.

PR8.5 MINISTÈRE DES RESSOURCES NATURELLES. *Saguenay, juillet 1996*, 15 photos, 8 pages.

PR8.6 MINISTÈRE DES RESSOURCES NATURELLES. *Échelle de référence des niveaux d'eau du lac Kénogami*, 21 mars 2003, 1 page.

Correspondence

CR1 MINISTRE DE L'ENVIRONNEMENT. *Lettre mandatant le Bureau d'audiences publiques sur l'environnement de tenir une période d'information et de consultation publiques*, 5 février 2003, 3 pages.

CR2 BUREAU D'AUDIENCES PUBLIQUES SUR L'ENVIRONNEMENT. *Nomination des membres de la commission*, avril et août 2003, 3 pages.

CR3 *Requêtes d'audience publique adressées au ministre de l'Environnement.*

CR3.1 *COMITÉ DES CITOYENS DE LATERRIÈRE INC.*, 12 mars 2003, 1 page.

CR3.2 UNION QUÉBÉCOISE POUR LA CONSERVATION DE LA NATURE, 27 mars 2003, 2 pages.

CR3.3 Marc SAVARD, 29 mars 2003, 2 pages.

CR3.4 Richard MERCIER et autres, 2 avril 2003, 2 pages et annexes.

CR3.5 ASSOCIATION POUR LA PROTECTION DU LAC KÉNOGAMI, 7 avril 2003, 2 pages.

CR3.6 CONSEIL RÉGIONAL DE L'ENVIRONNEMENT ET DU DÉVELOPPEMENT DURABLE DU SAGUENAY–LAC-SAINT-JEAN, 10 avril 2003, 2 pages.

CR3.7 CONSEIL DE LA NATION HURONNE-WENDAT, 10 avril 2003, 2 pages.

CR3.8 MOUVEMENT AU COURANT, 11 avril 2003, 2 pages.

CR5 MINISTRE DE L'ENVIRONNEMENT. *Lettre mandatant le Bureau d'audiences publiques sur l'environnement de tenir une audience publique*, 11 avril 2003, 1 page.

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Communications

CM1 BUREAU D'AUDIENCES PUBLIQUES SUR L'ENVIRONNEMENT. *Liste des centres de consultation*, avril 2003, 1 page.

CM2 BUREAU D'AUDIENCES PUBLIQUES SUR L'ENVIRONNEMENT. *Communiqué de presse annonçant le début de la période d'information et de consultation publiques*, 25 février 2003, 2 pages.

CM3 BUREAU D'AUDIENCES PUBLIQUES SUR L'ENVIRONNEMENT. Curriculum vitæ *des commissaires*.

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CM5.3 JOINT REVIEW PANEL AND BAPE PANEL. *Press release announcing the creation of the Joint Review Panel and the second part of the public hearings*, July 28, 2003, 2 pages.

Avis

AV3 BUREAU D'AUDIENCES PUBLIQUES SUR L'ENVIRONNEMENT. *Compte rendu de la période d'information et de consultation publiques qui s'est tenue du 25 février au 11 avril 2003*, 14 avril 2003, 6 pages.

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DA1 MINISTÈRE DES RESSOURCES NATURELLES, DE LA FAUNE ET DES PARCS. *Présentation du projet*, 12 mai 2003, 27 pages.

DA1.1 MINISTÈRE DES RESSOURCES NATURELLES, DE LA FAUNE ET DES PARCS. *Rectificatif apporté au texte de la présentation du projet*, 12 mai 2003, 1 page.

DA2 MINISTÈRE DES RESSOURCES NATURELLES, DE LA FAUNE ET DES PARCS. *Copie des transparents de la présentation du projet*, 12 mai 2003, 57 photos, 29 pages.

DA2.1 MINISTÈRE DES RESSOURCES NATURELLES, DE LA FAUNE ET DES PARCS. *Rectificatif apporté au texte descriptif de la photo n° 20*, 12 mai 2003, 1 page.

DA3 GROUPE-CONSEIL GÉNIVAR 2002. *Projet de régularisation des crues du bassin versant du lac Kénogami – Note technique sur le calcul des gains et pertes d'habitat et de production de l'Omble de fontaine*, 10 pages et annexes.

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DA5 MINISTÈRE DES RESSOURCES NATURELLES, DE LA FAUNE ET DES PARCS. *Les débits sortant du lac Kénogami*, mai 2003, 18 pages.

DA6 MINISTÈRE DES RESSOURCES NATURELLES, DE LA FAUNE ET DES PARCS. *Projet versus variantes de gestion normale*, mai 2003, 34 pages.

DA6.1 MINISTÈRE DES RESSOURCES NATURELLES, DE LA FAUNE ET DES PARCS ET HYDRO-QUÉBEC. *Étude de variantes de gestion estivale du niveau du lac Kénogami*, juin 2003, 17 pages et annexes.

DA7 MINISTÈRE DES RESSOURCES NATURELLES, DE LA FAUNE ET DES PARCS. *Les caractéristiques des centrales sur la rivière aux Sables et la rivière Chicoutimi*, 13 mai 2003, 3 pages.

DA8 MINISTÈRE DES RESSOURCES NATURELLES, DE LA FAUNE ET DES PARCS. *Les niveaux simulés classés du réservoir du lac Kénogami pour la période estivale*, 13 mai 2003, 1 page.

DA9 HYDRO-QUÉBEC ET TECSULT. *Localisation des interventions forestières projetées à proximité du réservoir Pikauba*, 1 figure.

DA10 HYDRO-QUÉBEC. *Compte rendu de la rencontre tenue avec les guides de la chasse à l'orignal de la réserve faunique des Laurentides*, 26 février 2003, 9 pages.

DA11 MINISTÈRE DES RESSOURCES NATURELLES, DE LA FAUNE ET DES PARCS. *Synthèse des études réalisées sur les variantes de projet*, mai 2003, 2 pages.

DA12 MINISTÈRE DES RESSOURCES NATURELLES, DE LA FAUNE ET DES PARCS. *Résumé des causes justifiant le rejet de la variante de projet Belle-Rivière*, mai 2003, 3 pages et 2 figures.

DA13 MINISTÈRE DES RESSOURCES NATURELLES, DE LA FAUNE ET DES PARCS. *Les débits turbinés journaliers à la centrale Chute Garneau de 1976 à 1990*, 1 page.

DA14 MINISTÈRE DES RESSOURCES NATURELLES, DE LA FAUNE ET DES PARCS. *Photographies d'une résidence près de la rivière aux Sables*, 25 juillet 2001, 2 photos.

DA15 MINISTÈRE DES RESSOURCES NATURELLES, DE LA FAUNE ET DES PARCS. *Copie des transparents relatifs à la présentation sur la problématique de l'érosion des berges*, 13 mai 2003, 8 pages.

DA16 MINISTÈRE DES RESSOURCES NATURELLES, DE LA FAUNE ET DES PARCS. *Copie des transparents relatifs à la présentation sur l'habitat du poisson et sur les frayères*, 13 mai 2003, 9 pages.

DA17 MINISTÈRE DES RESSOURCES NATURELLES, DE LA FAUNE ET DES PARCS. *Copie des transparents relatifs à la présentation sur la problématique de l'orignal*, 13 mai 2003, 8 pages.

DA18 Marc LUCOTTE et autres. Extrait du document *Mercury in the Biogeochemical Cycle*, pages III à XIV.

DA18.1 Marc LUCOTTE et autres. *Résumé et synthèse*, pages 1-23**.**

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DQ15 BUREAU D'AUDIENCES PUBLIQUES SUR L'ENVIRONNEMENT. *Questions complémentaires adressées au promoteur*, 12 juin 2003, 2 pages.

DQ15.1 MINISTÈRE DES RESSOURCES NATURELLES. *Réponses aux questions du 12 juin dernier concernant les plans d'eau résiduels*, 2 juillet 2003, 4 pages.

DQ16 BUREAU D'AUDIENCES PUBLIQUES SUR L'ENVIRONNEMENT. *Question complémentaire adressée à la Société de la faune et des parcs du Québec sur l'habitat de l'orignal*, 17 juin 2003, 2 pages.

DQ16.1 SOCIÉTÉ DE LA FAUNE ET DES PARCS DU QUÉBEC*. Réponses aux questions des 17 juin et 17 juillet (DQ23) derniers*, 30 juillet 2003, 2 pages.

DQ17 BUREAU D'AUDIENCES PUBLIQUES SUR L'ENVIRONNEMENT*. Questions complémentaires adressées au promoteur*, 20 juin 2003, 2 pages.

DQ17.1 MINISTÈRE DES RESSOURCES NATURELLES. *Réponses aux questions du 20 juin dernier concernant la « Solution A » soumise au gouvernement du Québec*, 4 juillet 2003, 4 pages.

DQ18 BUREAU D'AUDIENCES PUBLIQUES SUR L'ENVIRONNEMENT*. Demande d'information adressée au ministère de l'Environnement*, 20 juin 2003, 1 page.

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DQ22.1 ENVIRONMENT CANADA. *Response to questions of July 17, 2003, August 29, 2003,* 6 pages.

DQ23 BUREAU D'AUDIENCES PUBLIQUES SUR L'ENVIRONNEMENT. *Question complémentaire adressée à la Société de la faune et des parcs du Québec sur les mesures d'atténuation proposées par le promoteur à l'égard de l'orignal et de son habitat et celles visant à limiter les répercussions sur les efforts de chasse*, 17 juillet 2003, 1 page.

La réponse à cette question est indiquée dans le document DQ16.1, page 2, dernier paragraphe.

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DQ24.1 VILLE DE SAGUENAY. *Réponses aux questions du 17 juillet dernier*, 25 juillet 2003, 2 pages.

DQ25 BUREAU D'AUDIENCES PUBLIQUES SUR L'ENVIRONNEMENT. *Questions complémentaires adressées au ministère de l'Environnement concernant le réservoir à un niveau de 412,7 m et les zones inondables à l'amont et à l'aval du lac Kénogami*, 17 juillet 2003, 2 pages.

DQ25.1 MINISTÈRE DE L'ENVIRONNEMENT. *Réponses aux questions du 17 juillet dernier*, 31 juillet 2003, 2 pages.

DQ26 BUREAU D'AUDIENCES PUBLIQUES SUR L'ENVIRONNEMENT. *Questions complémentaires adressées au promoteur concernant les mesures de compensation, les zones inondables à l'amont et à l'aval du lac Kénogami, des précisions sur les variantes de gestion du réservoir Pikauba à 412,7 et 413 m, la demande de production d'une variante de gestion du réservoir Pikauba à 400,5 m, les milieux humides, le processus d'indemnisation, la capacité des ressources renouvelables et le dépôt d'un document complémentaire en référence à la section 3.6.3 de l'étude d'impact*, 17 juillet 2003, 5 pages.

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DQ28.1 MINISTÈRE DE L'ENVIRONNEMENT. *Réponse à la question du 12 août 2003*, 11 septembre 2003, 2 pages.

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DQ29.1 VILLE DE SAGUENAY. *Réponse à la question du 19 août dernier*, 20 août 2003, 1 page.

Transcripts

DT1 Session held in Jonquière on May 12 in the evening, 64 pages.

DT2 Session held in Jonquière on May 13, 2003 in the afternoon, 80 pages.

DT3 Session held in Jonquière on May 13, 2003 in the evening, 76 pages.

DT4 Session held in Jonquière on Mai 14, 2003 in the afternoon, 79 pages.

DT5 Session held in Jonquière on May 14, 2003 in the evening, 115 pages.

DT6 Session held in Jonquière on August 15, 2003 in the evening, 62 pages.

DT7 Session held in Jonquière on August 6, 2003 in the afternoon, 57 pages.

DT8 Session held in Jonquière on August 6, 2003 in the evening, 55 pages.

DT9 Session held in Jonquière on August 7, 2003 in the afternoon, 53 pages.

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