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Report 241

Joint Review Panel

— Main Report

Rabaska Project – Implementation of an LNG Terminal and Related Infrastructure

TRANSLATION

Inquiry and Public Hearing Report

May 2007

Canada

Québec

The notion of the environment

In a perspective of sustainable development, the commissions of the Bureau d'audiences publiques sur l'environnement review projects submitted to them by applying the notion of the environment retained by higher courts, which encompasses biophysical, social, economic, and cultural aspects.

Acknowledgements

The Panel thanks the people and organizations who collaborated with it, as well as the personnel of the Bureau d'audiences publiques sur l'environnement and the Canadian Environmental Assessment Agency who provided the necessary support to produce this report.

This document is a translation. In the event of a discrepancy, the French version prevails.

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Bureau
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sur l'environnement
Québec

Quebec City, May 30, 2007

Ms. Line Beauchamp
Minister of Sustainable Development, Environment and Parks
Marie-Guyart Building, 30th floor
675, René-Lévesque Boulevard East
Quebec, QC G1R 5V7

Dear Minister Beauchamp:

I am pleased to submit to you the report of the Bureau d'audiences publiques sur l'environnement entitled Rabaska Project – Implementation of an LNG Terminal and Related Infrastructure. The mandate to hold an inquiry and public hearings regarding the project began December 4, 2006 and was chaired by Mr. Qussaï Samak, assisted by Mr. Jean Paré.

From the standpoint of energy, the Panel found that the project is in line with the directions set by Quebec's energy strategy. The Panel concluded that in the areas of economic and industrial activity the project's added contribution to natural gas supply would have a positive impact on Quebec's energy security as well as in terms of a relative price advantage. The Panel also noted the project's favourable regional economic impact in terms of spin-offs and its structuring potential at the regional level.

In regard to security, on the basis of its own findings and opinions regarding emergency measures planning, the Panel concluded that the risk assessment for the project is in conformity with established practices in the field, and that the risks associated with the project seem therefore acceptable.

In regard to the project's territorial integration, the Panel concludes that the port and on-shore facilities would alter the landscape quality of the Beaumont shore. In its report, the Panel proposes certain measures to enhance the project's potential economic advantages.

Yours sincerely,

William J. Cosgrove

President

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Bureau
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Québec

Quebec, May 28, 2007

Mr. William J. Cosgrove
President
Bureau d'audiences publiques sur l'environnement
Lomer-Gouin Building
575, Saint-Amable Street, Suite 2.10
Quebec, QC G1R 6A6

Dear Mr. Cosgrove:

I am pleased to submit to you the report of the Joint Review Panel on the Rabaska Project – Implementation of an LNG Terminal and Related Infrastructure. Having completed its mandate, the Panel is pleased to note that the project is in line with Quebec's energy strategy. The project also conforms to the government's position and policies that, over the years, have recognized the importance of strengthening Quebec's natural gas supply and diversifying sources of supply. The Panel is of the view that the added supply of gas from the project could lead to a relative reduction in the price of natural gas on the Quebec market.

On other matters, the Panel concludes that there are two major project-related issues that arise: the risks associated with the project; and the integration of port and on-shore facilities into the area under development. These are two considerations that have a major influence on the project's social acceptability within the community.

The Panel is of the opinion that the risk assessment conforms to current recognized practices in the field. The assessment's conclusions are also in keeping with the known historical background of procedures for liquefied natural gas security. On the basis of its own findings and opinions on emergency measures planning, the Panel judges the risk associated with the project to be acceptable.

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In terms of its integration into the area, the Panel observes that the project, by its very nature, would diverge from the current Ville-Guay district's land uses, the area earmarked to receive the facilities for the future project. The Panel is of the opinion that the project's port and on-shore facilities would alter the quality of the Beaumont shore's landscape. If the project is authorized, the proponent should ensure the best possible integration of its facilities to the landscape in the development areas.

Finally, on behalf of the Panel, allow me to acknowledge the extraordinary participation, unprecedented in Quebec, by the people of Lévis, Beaumont, and l'île d'Orléans, as well as the scope of their contribution to its work. Their thoroughness, discipline, and courtesy bear eloquent testimony to their civic engagement and sense of citizenship, and are a tribute to their communities and to the country's vibrant democratic traditions.

Qussaï Samak
Panel Chair

Canada Québec

Quebec, May 30, 2007

The Honourable John Baird
Minister of the Environment
House of Commons
Ottawa, ON K1A 0A6

Ms. Line Beauchamp
Minister of Sustainable Development, Environment and Parks
Marie-Guyart Building, 30th Floor
675, René-Lévesque Boulevard East
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Dear Minister Baird:

Dear Minister Beauchamp:

The Joint Review Panel on the Rabaska Project – Implementation of an LNG Terminal and Related Infrastructure has completed its review in accordance with the mandate it received on December 4, 2006. As chair of the Joint Review Panel, I am pleased to submit its report to you. Please note that the BAPE Commission and the Joint Review Panel agreed to prepare a common report.

The Joint Review Panel assessed the project in the context of sustainable development, applying the concept of environment held by the country's higher courts, which includes biophysical, social, economic and cultural aspects. In addition, the Panel ensured the requirements of the *Canadian Environmental Assessment Act* and the Quebec *Environment Quality Act* were satisfied, as stipulated in the *Canada-Quebec Agreement on Environmental Assessment Cooperation*.

I would like to express my gratitude to my colleagues Jean Paré and Jean-Philippe Waaub, as well as to the team that assisted the Panel throughout the process. Finally, I would like to acknowledge the extraordinary contribution of the many members of the public who took part in the hearings. Their contribution was a tribute to the exemplary quality of their civic engagement and sense of citizenship.

Yours sincerely,

Qussaï Samak
Chair, Joint Review Panel

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In its report and based of its analysis, the Panel sets forth a certain number of opinions and recommendations that are presented hereafter. The ready should nonetheless refer to the context in order to fully appreciate their significance and scope.

Project energy context

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Recommendation 1 — The Panel recommends that the proponent establish a regional committee with the mandate to establish a strategy in an aim to maximize the project's economic spinoffs for the Chaudière-Appalaches region. → p. **90**

Recommendation 2 — If the project is approved, the Panel recommends that the City of Lévis take the necessary measures so that the project can have the maximum structuring effect for the economy of the region and for industrial development. → p. **91**

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Recommendation 3 — If the project is authorized and in order to attract companies that must be physically in proximity to the project's installations,, the Panel recommends that in its land use planning and development plan now being revised, the City of Lévis designates for industrial use of the land adjacent to the project. The Panel also recommends that the City of Lévis include this land in the

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Recommendation 5 — The Panel recommends that, when planning emergency measures, the proponent should provide Environment Canada and the ministère du Développement durable, de l'Environnement et des Parcs with an analysis of sensitive elements when considering an accident scenario for a berthed LNG tanker, on the basis of criteria using a 1,500-mm breach, a steady-state pool and a 3-kW/m^2 thermal radiation threshold. → p. **149**

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Recommendation 9 — The Panel recommends that the proponent take steps to prevent exceeding the criteria of the ministère du Développement durable, de l'Environnement et des Parcs by reducing the number of noise events and their intensity at the source. When that is not enough, the proponent should reduce the spread of residual noise by taking effective anti-noise measures, or by planning measures to compensate residents. → p. **185**

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Recommendation 11 — The Panel recommends that the proponent ensure a proper follow-up, after reaching agreement with the ministère du Développement durable, de l'Environnement et des Parcs with the purpose of assessing the true level of additional air pollutants from the project compared to existing levels within the area currently retained for the planned project. → p. **194**

Recommendation 12 — The Panel recommends that the ministère du Développement durable, de l'Environnement et des Parcs add a new sampling station to its network to show air quality in Lévis. If the project goes ahead, the Panel recommends that the proponent establish a monitoring station in the inhabited area between the jetty and Highway 132 together with the ministry. → p. **194**

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Recommendation 15 — In order to avoid a net loss of wildlife habitats, the Panel recommends that the proponent prepare a compensation plan for deforested areas located in the terminal area and in areas of similar value, to the satisfaction of the ministère du Développement durable, de l'Environnement et des Parcs (MDDEP) and the ministère des Ressources naturelles et de la Faune. → p. **200**

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Recommendation 16 — The Panel recommends that the proponent assess the cumulative environmental effects of the two projects related to his own, i.e. the two power distribution lines and the access road leading to the terminal as regards the extent of deforestation required. → p. **204**

Project impacts on water environments

Recommendation 17 — The Panel recommends that the proponent develop a management plan that would ensure the maintenance of an acceptable flow rate in the ruisseau Saint-Claude and the integrity of the refuge pond. This management plan should be to the satisfaction of Fisheries and Oceans Canada, the ministère du Développement durable, de l'Environnement et des Parcs and the ministère des Ressources naturelles et de la Faune, and should cover the terminal construction, operation and abandonment phases. → p. **204**

Recommendation 18 — Should the project be carried out, the Panel recommends that the proponent take measures to reduce the temperature of vaporizer discharge before it reaches the river so as to minimize the impacts on fish habitat. → p. **208**

Recommendation 19 — The Panel recommends the characterization of vaporizer discharge as well as a periodical follow-up of its compliance with the Environmental Discharge Objectives and toxicity tests on aquatic life, to the satisfaction of Environment Canada and the ministère du Développement durable, de l'Environnement et des Parcs. → p. **208**

Recommendation 20 — The Panel recommends that, subject to an agreement with Fisheries and Oceans Canada and the ministère des Ressources naturelles et de la Faune, the proponent determine the water supply sources for the hydrostatic tests on the pipeline pipes and this, at the environmental assessment phase. This choice should comply with the minimum ecological instream flow regimes of the bodies of water concerned. If needed, mitigation or compensation measures should be taken to reduce impacts on fish habitat. → p. **209**

Recommendation 21 — Noting the fact that the proponent committed himself to producing an inventory of the wells located within the influence perimeter where they would be likely to undergo a drawdown exceeding 0.5 m, the Panel recommends that wells be inventoried and groundwater characterized before construction work begins. Characterizing the groundwater would enable to establish its current physicochemical and microbiological quality to better assess the potential impacts of construction and operation of the terminal. → p. **210**

Opinion 19 — Although the project may have impacts on groundwater, the Panel believes that it is not likely to cause significant adverse environmental effects on the ability to meet the potable water supply

needs of citizens living within the influence perimeter. This takes into account the mitigation, compensation and follow-up measures that would be implemented by the proponent. → p. **210**

Project impacts on wetlands

Recommendation 22 — Noting the mitigation measures put forward by the proponent, the Panel recommends that the latter conduct additional geological studies in order to confirm the groundwater behaviour and the existence of potential links between the groundwater body, the peat bog located north-east of the site, the refuge pond and the ruisseau Saint-Claude. → p. **211**

Recommendation 23 — The Panel recommends that the peat bog be preserved from backfilling by removing the planned concealment berm from the project. The Panel also recommends that any residual loss be compensated, in compliance with the guidelines provided by the ministère du Développement durable, de l'Environnement et des Parcs, to authorize work on an ombrotrophic or minerotrophic peat bog. → p. **211**

Recommendation 24 — The Panel recommends that the proponent study the possibility of modifying the H-I stretch of the route for the pipeline to avoid the Saint-Étienne-de-Lauzon peat bog. If avoiding it is impossible, the Panel recommends that the proponent conduct the required inventories, assess the potential use of this sector by protected animal and plant species and analyze the work's impacts on wetlands. If necessary, mitigation, compensation and follow-up measures should be planned, in compliance with the guidelines of the ministère du Développement durable, de l'Environnement et des Parcs for work to be authorized on wetlands. → p. **212**

Project impacts on fish and their habitats

Recommendation 25 — The Panel recommends that, additional measures be taken when a spawning area for the rainbow smelt is present in the jetty area in order to avoid disrupting the species, to the satisfaction of Fisheries and Oceans Canada and the ministère des Ressources naturelles et de la Faune. → p. **214**

Recommendation 26 — The Panel recommends to the ministries concerned to keep in mind the technical feasibility of the directional drilling as a criterion in the final choice of a pipeline route for the rivières Etchemin, Chaudière and Beaurivage crossings. → p. **216**

Opinion 20 — Insofar as fish habitat losses or disruption caused by the project are compensated and by means of the appropriate mitigation measures, the Panel believes that the project is not likely to cause any significant environmental impacts on fish habitat. → p. **216**

Recommendation 27 — The Panel recommends that the proponent's compensation project for fish habitat losses and disruptions be submitted to Fisheries and Oceans Canada within the present environmental assessment. → p. **216**

Project impacts on avian fauna

Recommendation 28 — The Panel recommends that Environment Canada and the ministère des Ressources naturelles et de la Faune ensure the effectiveness of the mitigation measures suggested by the proponent with regard to avian fauna. → p. **217**

Project impacts on protected plant species

Recommendation 29 — Given the protection statuses of the fringed gentian, Victorin variety, and the spotted water-hemlock, Victorin variety and the threat facing their habitats, the Panel recommends that the proponent take measures to protect the individuals of theses species and their habitats if he develops a crossing over the bank for small craft. These measures should be implemented following an agreement with the ministère du Développement durable, de l'Environnement et des Parcs. → p. **220**

Recommendation 30 — Considering the rich floristic quality of jetty area, the Panel recommends that the proponent compensate for the loss of protected species habitat for the entire area affected by the work. These measures should be assessed following an agreement with the ministère du Développement durable, de l'Environnement et des Parcs. → p. **222**

Recommendation 31 — The Panel recommends that the ministère du Développement durable, de l'Environnement et des Parcs see to it that appropriate measures be taken to ensure the protection of individuals belonging to these protected species and their habitats. Transplantation should be considered only as a last resort. → p. **222**

Recommendation 32 — The Panel recommends that the ministère du Développement durable, de l'Environnement et des Parcs ensure that the proponent performs new inventories during the construction of facilities to ascertain the absence of two-leaved toothworts in the areas covered. In the case where two-leaved toothwort individuals would be recorded in the work area and transplantation would be the only conceivable option, the Panel recommends that the proponent develop a follow-up program to verify the success of the transplantation. → p. **222**

Recommendation 33 — Given the absence of data regarding the success potential of the transplantation of Platanthera blephariglottis, blephariglottis variety, the Panel recommends that the proponent develop a follow-up program following an agreement with the ministère du Développement durable, de l'Environnement et des Parcs. → p. **223**

Environmental monitoring and follow-up

Recommendation 34 — Noting that the proponent has planned to set up a Public Advisory Committee to conduct the follow-up on the project's environmental impacts, the Panel recommends that the entire set of mitigation measures be monitored. The proponent should also establish a liaison committee with the population in the area to ensure appropriate management of the disturbances during work, following an agreement with the City of Lévis, neighboring municipalities and community organizations.
→ p. **224**

Units of measurement

BTU	British Thermal Unit
Gm^3	Billion cubic metres
kW/m^2	Kilowatt per square metre
m^3	Cubic metre
m^3/d	Cubic metres per day
MBTU	Million BTU
Mm^3	Million cubic metres
Mm^3/d	Million cubic metres per day
Mt	Million tons
MW	Million watts
Tm^3	Trillion cubic metres
$\mu g/m^3$	Microgram per cubic metre

Introduction

The Rabaska LNG terminal project and related infrastructure is subject to a federal environmental assessment under the *Canadian Environmental Assessment Act* (L.C. 1992, c. 37), which also has provisions for a public consultation process. It is also subject to the Quebec environmental impact assessment and review procedure as set out in Section 31.1 and subsequent sections of the *Environment Quality Act* (L.R.Q., c. Q-2) which also calls for public participation. In this context, the project undergoes a cooperative environmental assessment in accordance with the May 2004 *Canada-Quebec Agreement on Environmental Assessment Cooperation*, hereafter called the "Agreement". Among other provisions, this Agreement provides for the possibility of creating a joint public review panel for a project when required by federal and provincial authorities.

In April 2004, a project notification was submitted to the federal and provincial authorities by the Gaz Métro Limited Partnership for the Rabaska Limited Partnership that was not yet formed. On the recommendation of the four federal responsible authorities, namely the National Energy Board, Fisheries and Oceans Canada, Transport Canada, and the Canadian Transportation Agency, the Canadian Minister of the Environment decided on January 20, 2005, to submit the project to a federal panel under the *Canadian Environmental Assessment Act*. It should be noted that the National Energy Board then indicated that it was no longer a responsible authority for this environmental assessment.

In turn, after having decided that the impact statement was receivable, the Minister of Sustainable Development, Environment, and Parks, Mr. Claude Béchard, gave the Bureau d'audiences publiques sur l'environnement (BAPE) the mandate to make public the environmental impact study and to hold a public information and consultation period from October 10 to November 24, 2006. During this period, fifty requests for a public hearing were addressed to the Minister (Appendix 1). On October 19, 2006, the Minister gave the BAPE the mandate to hold a public hearing on the project under Section 31.3 of the *Environment Quality Act*. He also asked the BAPE to establish a joint review panel with the Government of Canada if circumstances warranted it.

The President of the BAPE thus created the BAPE commission on October 23, 2006, with the responsibility of reviewing the project and he appointed two members from this commission to be members of the joint review panel, as provided for in the Agreement. The appointment of these two members was then approved by the

Canadian Minister of the Environment, Ms. Rona Ambrose. The federal panel member who joined the joint review panel was appointed by both Canada's Minister of the Environment and by the president of the BAPE in November 2006. At the end of this process, the Minister of Sustainable Development, Environment, and Parks approved the appointment of the three members of the joint review panel (CR2.1, CR2.2, CR2.3).

The joint review panel completed its work at the same time as the BAPE commission in compliance with the BAPE *Rules of Procedure relating to the conduct of public hearings* [Q-2, r. 19]. As provided for in the Agreement, it was decided to produce a joint report. In order to simplify the text, the BAPE commission and the joint review panel will be designated as the "Panel" in the rest of this report.

The Panel's mandate began on December 4, 2006. At the first part of the public hearing, fourteen sessions were held from December 6 to December 15, 2006, in the cities of Québec and Lévis, to allow the proponent and resource people from various departments and agencies to answer questions from the public and the Panel. The second part of the public hearing enabled participants to express their concerns and their opinions about the project during twenty sessions that were held from January 29 to February 12, 2007, in Lévis and Saint-Pierre-de-L'Île-d'Orléans. A total of 699 briefs were received in addition to more than fifteen oral presentations (Appendix 1).

Project Description

The Rabaska Limited Partnership, comprising Gaz Métro, Enbridge, and Gaz de France, proposes to build an LNG terminal on the south shore of the St. Lawrence River to the northeast of Lévis, in the sector known as Ville-Guay (Figure 1). This terminal would enable the import of liquefied natural gas (LNG) that would be regasified and then transported by pipeline to the inter-provincial natural gas pipeline grid operated by Trans Quebec Maritime (TQM) to be sold on the Quebec and Ontario markets.

The LNG terminal would consist of various components (Table 1 and Figure 2), including a maritime jetty reaching out about 500 m into the river that would comprise features including a rockfill platform and berthing wharf equipped with deflecting dykes. This jetty could receive LNG tankers with a capacity ranging from 65,000 m^3 to 160,000 m^3. The proponent is also assessing the possibility of receiving Qflex model LNG tankers, whose capacity reaches 216,000 m^3. The annual LNG supply is estimated to be the equivalent of 60 LNG tankers with a capacity of 160,000 m^3.

The terminal would also comprise a service corridor and underground cryogenic pipes 1.3 km long connecting the jetty to the land facilities. The corridor would pass through a trench in the cliff, and a tunnel would be dug under highway 132 in order to reach the jetty.

The terminal land facilities would include two full-containment LNG storage tanks with a capacity of 160,000 m^3 each and regasification equipment. This equipment would make it possible to transport an average of 14 Mm^3 of natural gas a day with a peak flow of 19 Mm^3. The facilities would also include a nitrogen production unit to inject nitrogen into the natural gas as required so it can be used as fuel, pumps to send the LNG from the jetty to the terminal, impoundment basins, a flare, emergency disconnecting devices, control and surveillance systems, a back-up diesel generator, and service buildings.

The project also calls for construction of a natural gas pipeline linking the LNG terminal to the end of the existing natural gas grid southwest of Lévis, on land in the former city of Saint-Nicolas. The 61-cm diameter pipeline would stretch over 42 km. It would be installed in a permanent right-of-way with a maximum width of 23 m. A delivery station would be built at the end located in the Saint-Nicolas sector, as well as pig launchers at both ends and three cut-off valves spaced along the pipeline.

The construction cost of the LNG terminal is estimated to be $775 M, and the cost of the pipeline, $65 M, for a total of $840 M. The proponent plans to commission the facilities in the summer of 2010.

Table 1 Technical characteristics of the project

Project elements	Dimensions and characteristics
LNG terminal	Operation for 45 years
River and on-shore facilities	
Jetty (trestle bridge)	Length of 500 m
Berthing cell	Length exceeding 500 m
Unloading arm	Height of 19 m
On-shore facilities	Platform with an area of 1.25 ha
1.3-km service corridor connecting river facilities to land facilities	
Cryogenic pipes	Two underground pipes in a 54-m wide concrete caisson
Access road	Running under highway 132 in a tunnel and down the coastal cliff in a trench with a 14% slope. Right-of-way 10.9 m wide and 6-m wide roadway
Land facilities	
Storage tanks	Two storage tanks with a capacity of 160,000 m^3 each 90 m in diameter and 46 m high
Regasification	Rated flow of 14 Mm^3/d Peak flow of 19 Mm^3/d
Flare and vaporizers	Four stacks
LNG tankers	Unloading in 24 hours
Reference model Capacity: 65,000 to 160,000 m^3	For 160,000 m^3: 290 m long, 43 m wide, 41 m high, and 11.5 m draft
QFlex model Capacity: 216,000 m^3	315 m long, 50 m wide, 44 to 52.1 m high, and 12 m draft
Pipeline	42 km long and 61 cm in diameter in a 23-m wide right-of-way
Other infrastructures	
LNG terminal access road	Municipal road to be built by the City of Lévis
Electricity supply (to be built by Hydro-Québec)	Two 230-kV lines over 1.5 km, including 3 or 4 towers in a 60-m wide right-of-way A main power substation

Review framework

The joint review panel reviewed the project from the perspective of sustainable development by applying the concept of environment held by the higher courts, which

encompasses biophysical, social, economic and cultural aspects, for current and future generations. This concept of the environment is broad and it includes the effects of human activities on the environment, life, health, safety, well-being, and comfort of the population, as well as other matters of interest to the communities. The sixteen principles of sustainable development set forth in Quebec's Sustainable Development Act (*Loi sur le développement durable,* R.S.Q., c. D-8.1.1), which must guide government actions, guided the commission.

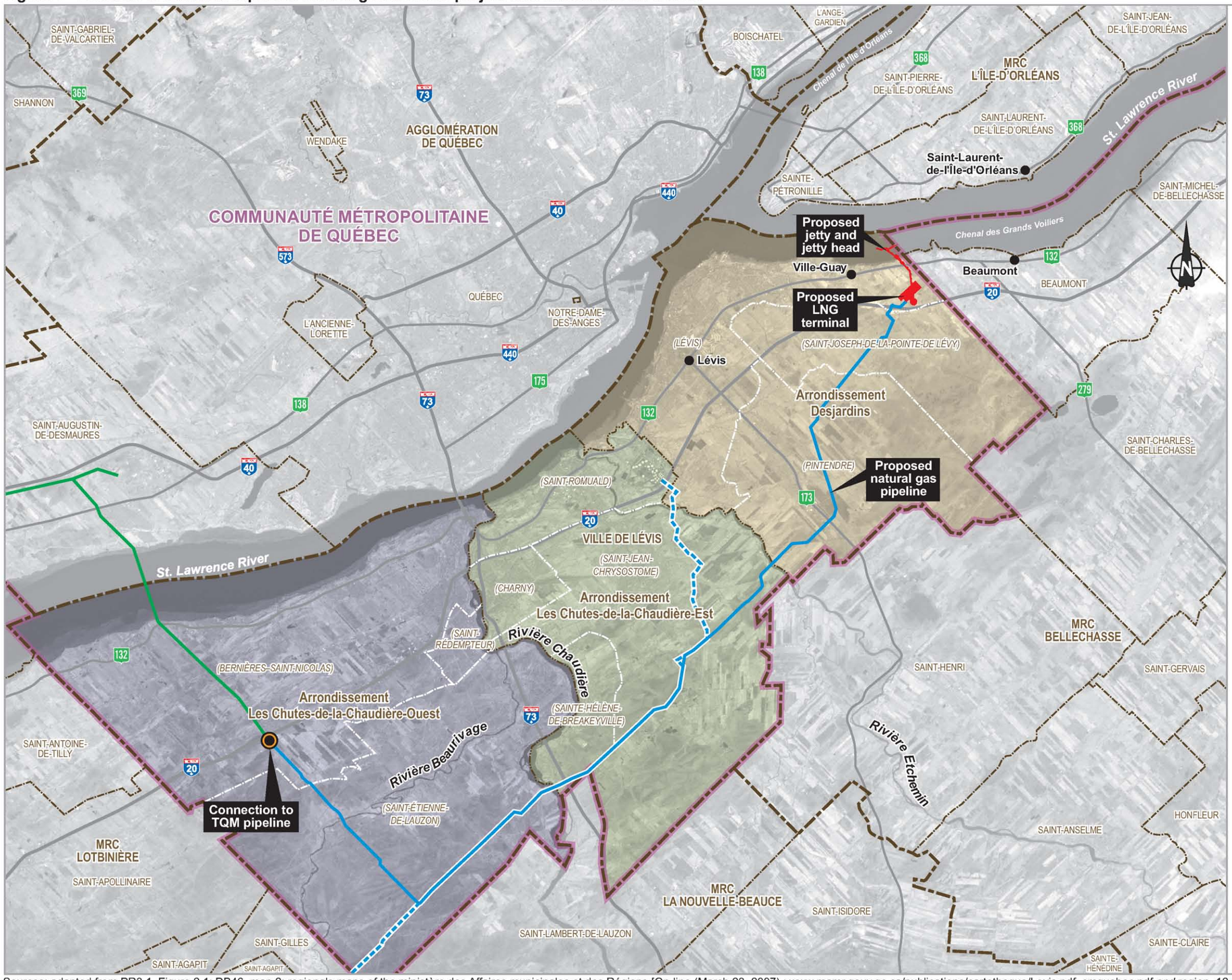
In addition, the Panel reviewed the project in accordance with the requirements of the *Canadian Environmental Assessment Act* and the *Environment Quality Act*, as stipulated in the Agreement. Therefore, it assessed the environmental effects of the project and their significance, including those caused by accidents and malfunctions, and the cumulative environmental effects that the project could cause, when combined with the effects from other works, projects or activities, taking into account measures to mitigate these effects. Project justification, the feasible alternatives, and the need for a follow-up program were part of the review, as well as the capacity of renewable resources to meet current and future needs. The Panel also studied the question of public security, taking into consideration the concerns of the surrounding population, and paid particular attention to project insertion in the natural and human environments.

The Panel conducted its analysis of the project using the information contained in the file assembled by the joint environmental assessment committee. This committee, created in accordance with Section 10 of the Agreement, has the responsibility to manage environmental assessment and ensure that all relevant and necessary information needed to meet the requirements of the *Canadian Environmental Assessment Act* and the Québec *Environment Quality Act* is obtained and taken into consideration. The Panel also based its review on information and documentation tabled during public hearings and from its own research.

In its work, the Panel defined four major issues related to the project: risks linked to project activities and facilities, project energetic timeliness for Quebec and Ontario, potential project impacts on the natural environment as well as impacts on the landscape.

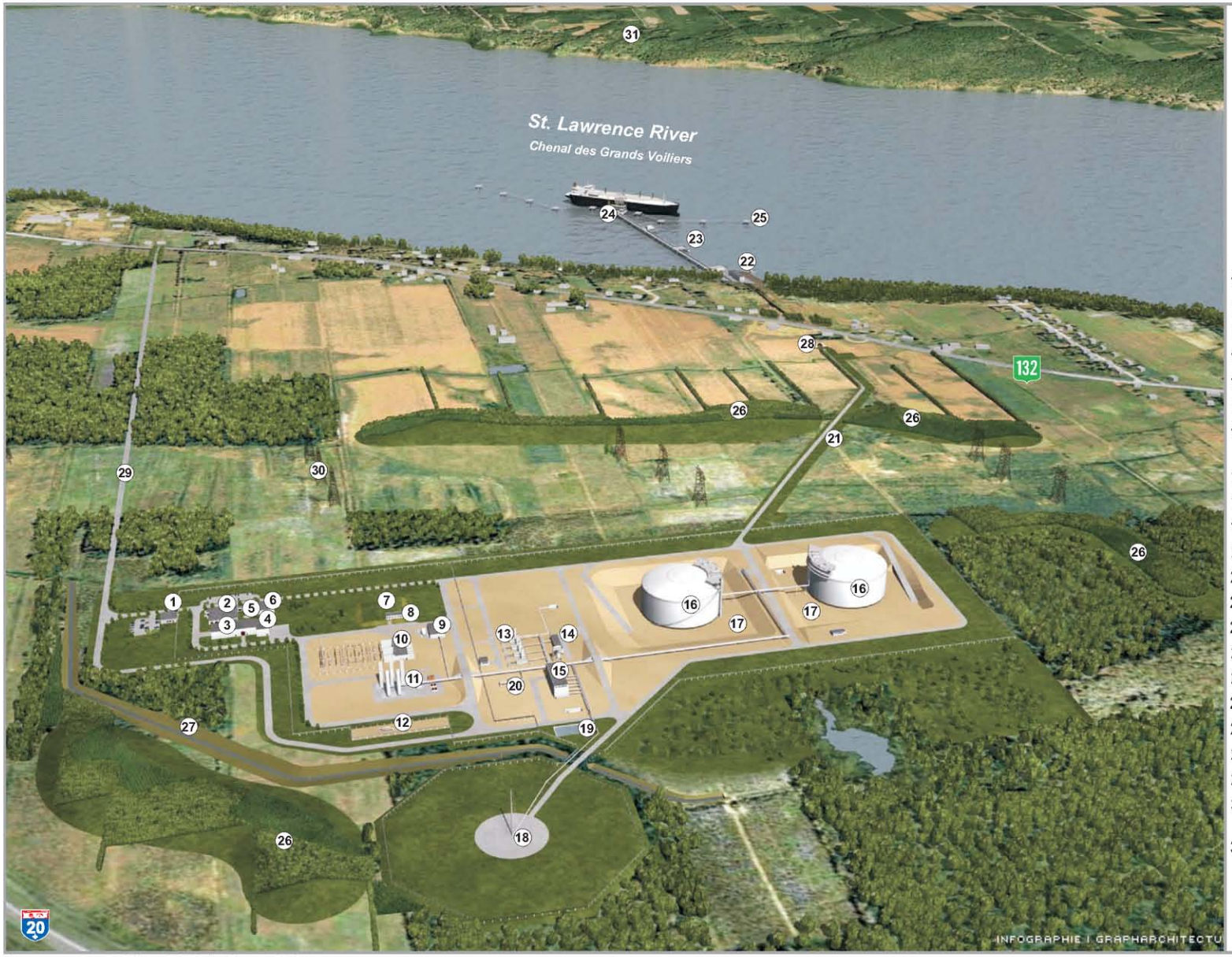
In its report, the Panel provides findings, opinions, and recommendations. A finding refers to a fact. For certain findings, the Panel takes notice of certain facts or measures. This means that the Panel is satisfied with these measures and that there is no reason to pursue the analysis any further. An opinion refers to a Panel's view, whereas a recommendation refers to an action that the Panel recommends either to the proponent or to the responsible government authorities.

Figure 1 Location of Rabaska liquefied natural gas terminal project and related infrastructure



Sources: adapted from PR3.1, Figure 2.1; DB46, map 2; regionals maps of the ministère des Affaires municipales et des Régions [On-line (March 23, 2007) : www.mamr.gouv.qc.ca/publications/cartotheque/Levis.pdf, cmquebec.pdf *and* region_12.pdf]; regional map of the ministère des Transports [On-ligne (March 23, 2007): www.mtq.gouv.qc.ca/images/information/carte_routiere/PDF/web25_Chaud-Appal_nord.pdf]; the map *Réseau de transport et d'alimentation de gaz naturel au Québec*, Novembre 2003 [On-line (February 17, 2007): www.gazmetro.com/data/Media/Carte_Reseau_Gazier.pdf].

Figure 2 Rabaska liquid natural gas terminal project facilities



Legend

1- Guardhouse
2- Administration
3- Workshop and warehouse
4- Fire station
5- Control room
6- Laboratory
7- Fire water storage tank
8- Fire water pumps
9- Utility building
10- Main substation
11- Nitrogen production unit
12- Gas line loading station
13- Vaporizers
14- Dispatch pumps
15- Boil-off gas compressors
16- Full containment (double-walled) LNG storage tanks
17- Tertiary impoundment basin
18- Flarestack
19- Sedimentation pond
20- Metering station
21- Utility corridor
22- Shore facilities
23- Trestle bridge (jetty)
24- Jetty head
25- Docking structure
26- Concealment berm
27- New ruisseau Saint-Claude bed
28- Tunnel under highway 132
29- Acces road not retained
30- Hydro-Québec's 735-kV transmission lines
31- Île d'Orléans

Source: adapted from PR3.1, Figure 2.3.

Chapter 1 Opinions of participants

The Rabaska LNG terminal project and related infrastructure generated a significant amount of interest from the population of Lévis and its surroundings, as well as from within the local and regional socioeconomic communities. This interest was also shared in surrounding regions as well as by various national organizations. The number of briefs tabled and oral presentations heard by the Panel was without precedent. Moreover, participation was abundant and sustained during the second part of the public hearings reserved for the participants' opinions and viewpoints. Many participants have invested a considerable amount of effort in order to contribute to the Panel's proceedings. Obviously, participants voiced numerous concerns and opinions, which were varied in nature and often conflicting. This chapter provides a synthesis of these opinions and concerns. Although the amount of briefs tabled does not permit us to quote each brief individually, the Panel endeavours to provide as representative a summation as possible of all viewpoints expressed in the course of the Panel's proceedings.

This chapter shall first present the local community's reception of the project, i.e. the positions taken by its citizens and the tensions which have arisen since its announcement. The opinions of participants regarding the justification of the project are also discussed, together with project's integration in the implementation zone and its current layout. The project's impacts on the local and regional economy are also covered at length, particularly in regard to job creation as well as its potential economic spin-offs. The possible negative impacts are also covered, specifically those on tourism and the value of adjacent properties. The impacts on the human environment raised by the participants mainly concern population safety with respect to technological risks, the quality of life and the health of residents living nearby, as well as the integrity of landscapes and heritage sites. Opinions and views described also deal with the project's impacts on the natural environment, including climate change, wetlands and aquatic environments, as well as floral species and forest cover. The chapter concludes with a description of the participants' views regarding the project's social acceptability.

The community's reception of the project

The opinions of the community regarding the project are polarized between those in favour and those against. A high percentage of participants living close to the implementation zone, including those from Lévis, the île d'Orléans and Beaumont, are

firmly opposed to the project. Conversely, a wide proportion of participants who live further away from Lévis and its surrounding areas are of the view that the project should be realized as quickly as possible. However, some participants who live outside of the zone in the immediate vicinity of the proposed project site share the concerns of those opposing the project (Ms. Denise Martel, DM205, p. 1; Les associations NPD des régions de la Capitale-Nationale et de la Chaudière-Appalaches, DM379, p. 3; Ms. Chantal Lacasse, DM163, p. 2).

Various factors contributed to the positions taken by citizens and groups in regard to the project. One participant believed that "groups which are opposed to the Rabaska project are defending their environment, their health and safety, while groups in favour, mainly business people, are defending their financial interests" (Ms. Isabelle Pouliot, DM380, p. 8). Another participant stated that the position of the project's opponents was motivated more by the defence of their own personal interests rather than collective ones (Mr. Sylvain Marcoux, DM92, p. 2 and 3).

On the one hand, opponents evoked territorial considerations, as well as public safety and environmental considerations in justification of their position. Many questioned the project's energy justification, or at the very least, believed that Quebec would need only one LNG terminal. They believed that the project would contribute to higher greenhouse gas emissions, which are responsible for climate change, and were worried about the project's environmental impacts. As such, they favoured renewable energy sources and energy efficiency instead. They also believed that the chosen project building site at Lévis is inappropriate. Factors cited in justification of this view included the residential and agricultural character of the zone, as well as its recreational usages, and the closeness of the site to inhabited areas, and the landscape and heritage aspects of the zone. Some apprehended the negative impacts that the project could have on the local economy, through decreased tourism appeal and depreciation of adjacent property values. On the human level, participants feared for their safety because of potential accident risks linked to various components of the project. They were also worried by the harmful impacts it could have on their quality of life and health, as well as on the natural environment.

On the other hand, participants cited the project's energy purpose as well as its importance to the local and regional economy as grounds for supporting it. They believed that the project is justified to ensure Québec's energy security and to diversify available natural gas sources. According to them this diversification would bring about a reduction in natural gas prices and improve the competitiveness of businesses that use it. They also maintained that the expected economic benefits of the project are both significant and much needed in the region; that the project's impacts on the human and natural environment would be limited and that proposed

mitigation measures are adequate. However, some proposed implementing additional measures to reduce impacts as much as possible. Moreover, many believed that the project would favour a reduction in greenhouse gas emissions across North America, mainly by fostering the conversion to natural gas of companies using more polluting fossil fuels such as fuel oil.

The polarization of positions on the project, which many participants lamented, seemed to deepen the social split within the local community. The clash of ideas and opinions was effervescent and very lively. In this respect, a participant shared her perception of the social climate and tensions within the community: “insults, boos, agitation as soon as one brave soul tried to begin a question without starting their sentences by ‘I am against the LNG terminal’ […] families became divided, petitions made the rounds and the door-to-door campaigning began” (Ms. Nicole Picard, DM64, p. 6). Participants reported a major social split within the local community between the various interest groups, elected officials and citizens (Mr. Jacques Levasseur, DM460, p. 2; Mr. Jean-Claude Tardif, DM48, p. 21). According to one participant:

> On one side, there are the project proponents and defenders, who seem to represent an outstanding option for the region’s economic future. On the other, there are unhappy citizens, probably justifiably so in many cases […] and professional environmentalists who saw in this issue a noble cause to defend.
> (J. E. Roy Plastiques inc., DM204, p. 3)

In such circumstances, participants hoped that the public hearings would settle a dispute which is dividing the local community. One participant expressed a viewpoint, shared by many others, to the effect that the BAPE had the duty and responsibility to consider every aspect of the project: “The Panel members must differentiate between both factions and interpret in the fairest way possible the split between both economic development visions and two types of social needs” (Mr. Jean-Claude Tardif, DM48, p. 43).

Moreover, one participant believed that the proponent is partly responsible for the current tense social climate: “Rabaska did nothing to reduce tensions. Quite the contrary, it has repeatedly cast aspersions on the opponents, instead of listening to what they had to say. He speaks of a fear campaign, instead of listening to the fears behind their words” (Ms. Pierrette Bélanger, DM302, p. 38). Some participants underscored their lack of confidence in the proponent and his project (Mr. Dominic Boutin, DM198, p. 1; Mr. Simon Langlois, DM463, p. 1). Another participant added:

> The simple distrust which existed at the start for the proponent became for many a complete lack of trust in him. His promises, which are still being repeated to this day, that he “would never force his project on the population”, in contrast to the legal recourses that he has filed (against the municipality and a group of 100 citizens) are part of the problem.
> (Mr. Jacques Levasseur, DM460, p. 4)

One participant among many stated that he had been reassured by the proponent and the quality of the analyses provided (Mr. Jacques Bouillé, DM467, p. 3). The Société de développement économique de Lévis stated that good corporate citizens such as Rabaska are needed to contribute to the many social and community-based projects of the community (Mr. Pierre Lapointe, DT15, p. 71). Other participants were of the opinion that the proponent had demonstrated his capacity and intention to involve himself with the community (Mr. Michel Roberge, DM88, p. 2; Chambre de commerce de Lévis, DM611, p. 12).

In order to measure the quality of reception for the project in the community, surveys were conducted by various groups and the proponent. To demonstrate the community's favourable reception, the Mouvement populaire À bon port upheld that "survey after survey, it has been clearly established that a majority of the population is in favour of Rabaska" (DM547, p. 9). This group is also of the opinion that the results of the last municipal election in 2005 reflected the population's support (*ibid.*). Conversely, the members of the Coalition Rabat-joie estimated that, based on their own survey, the project does not have the population's support. According to this group, this survey "establishes that a strong majority of people residing within a radius of 2.5 km and less from the future implementation site disapproved the project" (DM606, p. 40). Moreover, some questioned the validity and representativeness of these surveys, while others considered them to be a reflection of the general opinion on the project: "we must be careful with opinion surveys done with the population and businesses. We must be aware of the fact that we gather less information and are less sensitized about issues that don't concern us directly" (Mr. Benoît Bouffard, DM31, p. 4 and 5). Another participant added that:

> […] the popular support upon which he [the proponent] claims he is basing survey results from all across Lévis, i.e. with citizens living as far as 40 km from the site targeted by the proponent. Because they are far from the site, it is normal that these citizens do not feel the same concerns for their safety as those who would have to live within a stone's throw of the Rabaska facilities.
> (Mr. Louis Duclos, DM458, p. 12)

For some participants, "various reliable measures, among which are included three municipal elections and one referendum […] established that most citizens who are directly concerned were opposed to the Rabaska project (Association pour la protection de l'environnement de Lévis, DM459, p. 22). As for île d'Orléans residents, "this project does not meet with the approval of the population of Sainte-Pétronille, as demonstrated by the petition sponsored by the Association de l'île d'Orléans contre le port méthanier" (Municipality of the village of Sainte-Pétronille, DM7, p. 2). In this respect, the Association de l'île d'Orléans contre le port méthanier tabled, during the

hearings, more than 2,000 signatures of island residents who are against the project (DM525, p. 1).

One participant underscored the population's effort to mobilize against the project: "since the very beginning, hundreds of *No to Rabaska* signs were put up in the coveted/targeted area" (Ms. Céline Létourneau, DM594, p. 3). Some participants stated that the strong community mobilisation concerning the Rabaska project was a reflection of the project's negative reception. In this respect, the Groupe d'initiatives et de recherches appliquées au milieu (GIRAM) reported on the mobilization against the project as a sign:

> We can just mention some aspects which typify the rejection from the community: its [the project's] rejection by referendum at Beaumont, a resolution against it at the City of Lévis, […] the APPEL census, the petitions, the marches against it, the demonstrations, the benefit concerts, the civil petitions from 93 citizens, the testimonies and the questions to the BAPE.
> (Mr. Gaston Cadrin, DT16, p. 10 and 11)

Justifying the project

The project's justification was amply discussed at the public hearings from various standpoints, namely Quebec's energy security and diversity, the economic impacts of the project, the increased use of natural gas as an energy source, climate change and the relevance of building one or several LNG terminals in the province.

Ensuring energy security and diversifying our supply sources

Several participants are of the view that the project is perfectly in line with Quebec's energy strategy orientations, one of which is to consolidate and diversify natural gas supply sources[1]. Some maintain that it would be better for the region to be one of the major players and a forerunner in applying this strategy (Mr. Normand Lebrun, DM73, p. 1; Mr. Stéphane Canuel, DM329, p. 1).

Natural gas availability was underscored as a key factor for certain industries, which rely on it for their manufacturing processes, as is the case with the petrochemical sectors (Mr. Jean-Michel Laurin, Les manufacturiers et exportateurs du Québec,

1. Pôle Québec–Chaudière-Appalaches, Chambre de commerce de Québec et Chambre de commerce de Lévis, DM465, p. 4; Association of Consulting Engineers of Quebec, DM556, p. 4; Société de développement économique de Lévis, DM545, p. 15; Canadian Gas Association, DM158, p. 2; Mr. Éric Dubé, DM170, p. 2; Mr. Serge Soucy, DM644, p. 1; Ms. Cindy-Ève Émond, DM679, p. 1.

DT33, p. 13; Canadian Association of Chemical Products Manufacturers, DM608, p. 1). The Pôle Québec–Chaudière-Appalaches, the Chambre de commerce de Québec and the Chambre de commerce de Lévis added that "sectors which use natural gas are well-represented in our region" (DM465, p. 24).

However, the fact that Québec's current requirements for natural gas are dependent on only one supply source, i.e. the Western Canada Sedimentary Basin, and on a single carrier, TransCanada Pipeline, was seen as a disadvantage.[1] Several believed that the demand for natural gas is increasing, that the current network will soon reach full capacity, and they foresaw a shortage[2]. For the Société de développement économique de Lévis, "this state of dependence is even more worrisome for us as a region as we are at the end of the supply network" (DM545, p. 15).

According to the Canadian Gas Association "importing liquefied natural gas (LNG)- will allow Quebec to diversify its energy supply options and reinforce its position within the integrated North American network by having a direct access to abundant world gas resources" (DM158, p. 2). Moreover, just like the municipalité de Saint-Charles-de-Bellechasse, some believed that this project might eventually foster "the improvement and development of the gas network for rural municipalities of the region" (DM99, p. 4).

Some participants[3] had doubts, however, about our real need to import LNG into Québec. They believed that Canada's natural gas resources are sufficient to meet our demand for many years to come, by taking into account gas pools which have not yet been exploited or discovered. Some believed that Canada could also be self-sufficient for years to come by diminishing exports of this substance (Ms. Pierrette Bélanger, DM302, p. 8 and 9; Mr. Dennis Bevington, The New Democratic Party of Canada, DM518.1, p. 7).

Some believed that such a project would render Quebec dependent on outside gas sources[4]. In their opinion, this would be even more harmful as this natural gas would originate from politically unstable countries. According to the Comité Gare au

1. Association québécoise du gaz naturel, DM546, p. 3; Mr. René Huot, DM112, p. 1; Mr. Steve Côté, DM280, p. 2; Table de concertation de l'industrie métallurgique du Québec, DM346, p. 3; Mr. Pierre Savard, DM179, p. 4; Ms. Maryse Paré, DM123; Mr. Tony Laflamme, DM174, p. 2; Mr. François Bisonnette, DM265; Mr. Guy Montmigny, DM485, p. 2.
2. Fédération des chambres de commerce du Québec, DM43, p. 16; Table de concertation de l'industrie métallurgique du Québec, DM346, p. 3; Pôle Québec–Chaudière-Appalaches, Chambre de commerce de Québec et Chambre de commerce de Lévis, DM465, p. 22; Cascades inc., DM574, p. 7.
3. Mr. Christian Lévesque, DM440, p. 1 and 2; Mr. Gilles Castonguay, DM630, p. 8 and 9; Ms. Danielle Carrier and Mr. François Dorval, DM558, p. 1; Mr. François Lafontaine, DM468.
4. Ms. Michèle Lépine and Mr. André Dubois, DM573, p. 7; Ms. Danièle Desjardins, DM646, p. 3; Mr. Jean-Claude Gosselin and Ms. Adèle Bertrand, DM63, p. 2; Ms. Claire Pageau, DM563, p. 4; Mr. Yves St-Laurent, DM377, p. 69; Associations NPD des régions de la Capitale-Nationale et de Chaudière-Appalaches, DM379, p. 2; Ms. Danielle Carrier and Mr. François Dorval, DM558, p. 2.

gazoduc, existing LNG terminals already have a hard time obtaining sufficient LNG supply: “Rabaska would only be one more mouth to feed in a starving world” (DM589, p. 4). Moreover, the Groupe de jeunes citoyens lévisiens believed that “world gas reserves will eventually run out, even if they are still sizeable. This is inevitable as we are literally wasting almost all of our forms of energy simply because we can have access to them” (DM612, p. 9).

Some believed that this project would result in increased mining of oil sands in Alberta, as this mining activity requires a great deal of natural gas[1]. Several participants also had doubts regarding the project’s true goal, i.e. ensuring Québec’s energy security. They believed that a major portion of the imported natural gas would be sent to the U.S, be it directly or indirectly[2]. Some participants were worried that the U.S. would benefit from this new natural gas source, while the population of Québec would suffer safety and pollution drawbacks (Mr. Philippe de le Rue, DM423, p. 4; Ms. Marie Dubé and family, DM399, p. 2; Ms. Lise Thibault, DM436, p. 20).

According to the municipal council of Sainte-Pétronille, “there must be a clear demonstration that this project is essential to ensure the long-term energy future of Québec”. Some participants also stated:

> In 2007, we are facing major societal choices and environmental challenges. Quebeckers must choose energy solutions that best represent their ambitions and vision for the future. The expression of its will must be clearly defined and expressed by its elected officials, who have the mandate to represent the population and not the interests of foreign investments.
> (Mr. Jean-Christian Roy and Ms. Guylaine Piché, DM617, p. 2)

Many participants believed that the natural gas industry should not be favoured. The advantage that hydroelectricity gives Québec as a main source of energy was underscored, because it is renewable and doesn’t pollute much (Mr. Christian Lévesque, DM440, p. 2; Groupe de jeunes citoyens lévisiens, DM612, p. 18; Mr. Yvan Bastrash, DM520). According to some participants: “we were supposed to become independent in terms of energy requirements when electricity was nationalized in the 1960s. And this has been the case. Our energy needs are currently being met in great part by our electrical network” (Ms. Gisèle Perron and Mr. Claude Castonguay, DM54, p. 1).

1. Association pour la protection de l’environnement de Lévis, DM459, p. 41; Ms. Suzanne Rochon, DM536, p. 3; Ms. Andrée Roberge, DM366, p. 1; Les AmiEs de la terre de Québec, DM625, p. 66; Association québécoise de lutte contre la pollution atmosphérique, DM592.1, p. 38.

2. Ms. Martine Samson, DM164, p. 1; Mr. Jacques Clermont, DM224, p. 4; Ms. Louise Crevier-Letendre, DM317, p. 2 and 3; Ms. Sandrine Louchart, DM349, p. 6; Mr. Michel Riou, DM370, p. 1; Ms. Michèle Lépine and Mr. André Dubois, DM573, p. 6; Groupe de jeunes citoyens lévisiens, DM612, p. 11; Ms. Chantal Bernier, DM575, p. 2; Centre de recherche et d’information en consommation, DM9, p. 1; Ms. Suzanne A. Samson, DM186, p. 1; Mr. Jean Dupont, DM301, p. 1; Ms. Sylvie Vincent and Mr. Daniel Bégin, DM314, p. 1; Mr. Claude Lachance, DM426, p. 2.

Many were of the opinion that other sources of renewable energy, such as wind, geothermal and solar power should be given more importance, and that Québec should be bold in setting out in a new direction which would favour their use[1]. Some participants had a lot of faith in the development of wind energy to ensure Québec's energy security in a more ecological way (Mr. Yves St-Laurent, DM377, p. 53; Mr. Félix Maranda Castonguay, DM688, p. 1). Others[2] believed that energy effectiveness and saving measures should be fostered and better-used. According to one participant: "the craze to build LNG terminals is only curtailing the will to do more research into developing real solutions which are energy-responsible" (Ms. Isabelle Carrier, DM624, p. 17).

The Québec solidaire Party recommended stopping the development of the oil and gas industries in Québec. At the same time, it demanded "massive investments in energy efficiency programs and mass transit, as well as in the research and development of energy solutions that are clean, renewable, economically viable and socially acceptable" (DM466, p. 23). The Association québécoise de lutte contre la pollution atmosphérique (AQLPA) believed that Canada's current natural gas reserves are sufficient to give the government time to implement effective measures in this respect: "the issue is not so much the development of these technologies, as it is to put them into practice, at least those which have proven their effectiveness" (DM592.1, p. 117).

However, some participants[3] believed that renewable energy sources, such as wind energy, cannot meet all the needs by themselves, and some specified that part of heavy industry can only use fossil energies for some processes. According to one participant:

> Here in Québec, we are fortunate enough to dispose of a renewable energy source such as hydroelectricity, which meets an important part of our needs. However, it is becoming clearer and clearer that we must now be able to count on other sources. Regardless of what ecological groups say, the potential of wind energy capacity remains very limited, and contrary to Ontario, Québec refuses to rely on nuclear energy. (Mr. Ghislain Pelletier, DM506, p. 2)

1. Ms. Annie Lacharité and Mr. Pierre Pinette, DM12; Ms. Monique Dallaire, DM161, p. 3; Mr. Sylvain Castonguay, DM578, p. 2; Ms. Denyse Rondeau, DM195, p. 1; Mr. Jacques Verreault, DM199, p. 7; Mr. Michel De La Chevrotière, DM267, p. 3; Ms. Louise Crevier Letendre, DM317, p. 5; Ms. Claudia Parent and Mr. Frédéric Vallières, DM533; Corporation de défense des droits sociaux de Lotbinière, DM3, p. 1; Table des groupes populaires, DM6, p. 1; Ms. Yolande Lépine, DM66, p. 1; Réseau du Forum social de Québec–Chaudière-Appalaches, DM438, p. 2; Centre de recherche et d'information en consommation, DM9, p. 1; Ms. Suzanne A. Samson, DM186, p. 1; Mr. Jean Dupont, DM301, p. 1; Ms. Sylvie Vincent and Mr. Daniel Bégin, DM314, p. 1; Ms. Danielle Carrier and Mr. François Dorval, DM558, p. 1; Mr. Dennis Bevington, New Democratic Party of Canada, DM518.1, p. 8 and 9.

2. Ms. Colette Fortin, DM50, p. 1; Mr. Marco Thompson, DM340, p. 3; Mr. Denis L'Homme, DM347, p. 6; Mr. Martin Leclerc, DM393, p. 7; Ms. Chantal Bernier, DM575, p. 4.

3. Mouvement populaire À bon port, DM547, p. 5; Mr. Serge Côté, DM102, p. 1; Mr. Patrice Labrecque, DM214, p. 1; Mr. Serge Belval, DM449, p. 4; Ms. Brigitte Leblond, DM166, p. 2; Mr. Michel Moisan, DM213, p. 2; Ms. Tonia Beaupré, DM478, p. 1.

Economic considerations

A great deal of participants, including several regional economic organizations and businesses, stated that the project would result in lower costs for natural gas by diversifying Quebec's natural gas supply sources, which would increase the competitiveness of companies that use it[1]. The Société de développement économique de Lévis underscored the following: "competitiveness, effectiveness and stability in energy sources are a major concern for large companies throughout the world" (DM545, p. 17).

Along the same lines, the Pôle Québec–Chaudière-Appalaches, the Chambre de commerce de Québec and the Chambre de commerce de Lévis added: "Québec companies that use natural gas need a secure and competitively-priced access to this source to produce more, be more competitive, grow and continue to provide and create jobs" (DM465, p. 26). The Association québécoise du gaz naturel, which assessed that the project could result in a 5 percent decrease in the price of natural gas, stated: "building the Rabaska LNG Terminal will provide access to the international market for this resource at competitive prices, and this new gas supply source will provide the Québec economy with additional supply" (DM546, p. 3).

Some[2] emphasized that a decrease in the price of natural gas would encourage consumers to use this energy source instead of electricity, which could be exported and sold at higher prices, something that would increase profitability for Québec. In this respect, the Chambre de commerce des entrepreneurs de Québec believed that this energy should be used more as an economic development lever by establishing

1. Surplus de pièces d'autos usagées inc., DM385; Centre local de développement Robert-Cliche, DM21, p. 2; Centre local de développement de Beauce-Sartigan, DM23, p. 4; Mr. Pierre Paré, DM83, p. 1; Mr. Éric Linteau, DM41, p. 1; Centre local de développement de Nouvelle-Beauce, DM42, p. 2; Mr. Jacques Mouchet, DM77, p. 2; Jeune chambre de commerce de Québec, DM565, p. 3; Conférence régionale des élus de la Chaudière-Appalaches, DM534, p. 5; Mr. Denis Galipeau, DM104, p. 1 and 2; Mouvement populaire À bon port, DM547, p. 4 and 5; Groupe Perspective, DM519, p. 2; Mr. Michel Bédard, DM183, p. 1; Chambre de commerce et d'industrie de L'Amiante, DM187, p. 3; Groupe SINTRA, DM189, p. 2; Cométal inc., DM201, p. 4; J. E. Roy Plastique inc., DM204, p. 3; Mr. Michel Boissinot, DM217, p. 2; Les entreprises lévisiennes inc., DM351, p. 2; Mr. Raymond Gagnon, DM238, p. 4; Excavation B. Bilodeau, DM246; Mr. Jacques Beaupré, DM296, p. 4; LeggettWood, DM318, p. 1 and 2; Extrudex Aluminium, DM321, p. 2; Matelas Dauphin, DM325, p. 4; Chambre de commerce et d'industrie de Montmagny, DM356, p. 2; Chambre de commerce régionale de Chaudière-Appalaches, DM357, p. 2; Chambre de commerce de la MRC de Bellechasse, DM359, p. 1; Chambre de commerce de Saint-Georges, DM391, p. 5; Mr. Louis Duquet, Chambre de commerce de Québec, DT32, p. 38 and 39; Les manufacturiers et exportateurs du Québec, DM588, p. 9; Centre local de développement de la MRC de Lotbinière, DM595, p. 8; Association régionale du développement économique de la Chaudière-Appalaches, DM597, p. 5; Mr. François Théberge, DM564, p. 3; Mr. Frédéric Drolet, DM680; Association des constructeurs de routes et grands travaux du Québec, DM648, p. 7 and 8; Mr. Michel Thompson, DM697, p. 1; Groupe environnemental Labrie inc., DM188, p. 2; Humijet, DM338, p. 4; Mr. Paul-Émile Carrier, DM400; Solide de Lévis, DM689, p. 6.

2. Association québécoise du gaz naturel, DM546, p. 3; Mr. Gervais Tremblay, DM115, p. 1; Mr. Éric Blais, DM68; Mr. Denis Poulin, DM87, p. 2; Mr. Stéphane Côté, DM91, p. 1.

"a price for electrify that is in accordance with our interests and with the proper management of the global resource" (DM286, p. 6).

However, some had doubts regarding the real capacity of such a project in guaranteeing a decrease in natural gas prices, and believed that such an impact has not yet been established (Ms. Caroline Mongeau, DM30, p. 6; Mr. Jean-Claude Préfontaine, DM417, p. 6). The Conseil régional de l'environnement Chaudière-Appalaches and the Regroupement national des conseils régionaux de l'environnement du Québec believed that various other factors such as the price of oil, political instability, climate events, competition from other energy sources and energy policies also have an influence on natural gas prices (DM591, p. 16; Mr. Louis Maccabée, DT29, p. 60).

For one participant, wanting to substitute gas for electricity, to then export the electricity made available is in contradiction with the first goal of Québec's energy strategy, i.e. to reinforce the security of our energy supplies. He believed that "at a given price, it is in our best interest to favour the energy sources which are available on our territory" (Mr. Denis L'Homme, DM347, p. 5). One participant believed that "it would make no sense to export our own clean and renewable energy and to import fossil energy" (Ms. Caroline Mongeau, DM30, p. 4).

A greater place for natural gas

Natural gas was showcased by several as a clean energy source, in the sense that it pollutes less than other fossil fuels, including coal and fuel oil[1]. Some even emphasized its higher effectiveness in some fields, such as those of space and water heating (Les entreprises G Pouliot ltée and Excavation Gérard Pouliot inc., DM526, p. 3; Association québécoise du gaz naturel, DM546, p. 6; Gaz Métro, DM576, p. 5). According to the Association of Consulting Engineers of Quebec, "it's a matter of using each energy source where it can be the most effective" (DM556, p. 10).

The Association québécoise du gaz naturel was of the opinion that if natural gas had benefited from the same advantages as those given to electricity, such as low prices implemented by government policy, it "would currently occupy a significantly greater place in Québec's energy balance sheet than the one it currently holds" (DM546, p. 8). Some also believed that natural gas will be used in new sectors, specifically the

1. Groupe Giroux, DM184, p. 4; Chambre de commerce et d'industrie de L'Amiante, DM187, p. 3; Neilson inc., DM358, p. 2; Groupe SINTRA, DM189, p. 3; J. E. Roy Plastique inc., DM204, p. 4; Machinerie G.A.S., DM216, p. 3; Pintendre autos inc., DM288; Bâtiments d'acier FINAR, DM323, p. 3; Mr. Marco Thompson, DM340, p. 2; Métaltec inc., DM341, p. 3; D. Bertrand & fils, DM450, p. 3; Mr. Dominique Leclerc, DM651, p. 1; Chambre de commerce des entrepreneurs de Québec, DM286, p. 7 and 8; Mr. Serge Côté, DM102, p. 1; Cam-Trac Bernières inc., DM355, p. 2; Mr. Roger Fortin, DM542, p. 2.

transportation industry (Table de concertation de l'industrie métallurgique du Québec, DM346, p. 5; Mr. Denis Bernier, DM637, p. 5).

Several participants believed that converting to natural gas would be desirable for users of fossil fuels which are more polluting, such as fuel oil[1]. In their view, the expected drop in natural gas prices resulting from this project would be a necessary incentive for this substitution. Some companies specified that they were planning to convert their facilities to natural gas (Fabrication PFL inc., DM207, p. 2; Cométal inc., DM201, p. 4).

Some participants were sceptical, however, regarding such a substitution in energy sources, and believed that no real demonstration supporting this theory had been made[2]. In this respect, the Conseil régional de l'environnement Chaudière-Appalaches believed that a market survey should be carried out to correctly assess this option (DM591, p. 21). Moreover, some feared that natural gas would also become a substitute for electricity, which would represent a more polluting choice in the Québec context (Ms. Suzanne Rochon, DM536, p. 4; Ms. Louise Crevier Letendre, DM317, p. 4; AQLPA, DM592.1, p. 38). The Amis de la vallée du Saint-Laurent suggested the following:

> The LNG terminal project at Lévis must only be authorized if the governments of Canada and Québec take measures against the substitution of natural gas which is imported for less polluting forms of energy where such forms are used, and that it not be used in new developments, unless it would be impossible to use energy savings or less polluting energy sources.
> (DM551, p. 10)

Regarding health considerations, the Agences de la santé et des services sociaux de la Chaudière-Appalaches and of the Capitale-Nationale believed that "choosing an energy approach which favours the use of fossil fuels is not an optimal choice for the public health, even if natural gas offers obvious advantages over other hydrocarbons such as fuel oil" (DM602, p. 15).

1. Mr. Christian Jobin, DM8, p. 1; Centre local de développement Robert-Cliche, DM21, p. 2; Centre local de développement de Beauce-Sartigan, DM23, p. 5; Centre local de développement de Nouvelle-Beauce, DM42, p. 2; Mr. Marcelin Harvey, DM398; Mr. Raymond Miron and Ms. Francine Miron, DM409, p. 1 and 2; Mr. Émile Blais, DM406, p. 1; Ramp-Art inc., DM454, p. 2; Mr. Dominic Doré, DM475.1, p. 1; Mr. Normand Audet, DM480, p. 1; Mr. Alain Boucher, DM561, p. 1.

2. Mr. Louis Maccabée, Regroupement national des conseils régionaux de l'environnement du Québec, DT29, p. 60; Ms. Yolande Lépine, DM66, p. 1; Centre de recherche et d'information en consommation, DM9, p. 1; Ms. Suzanne A. Samson, DM186, p. 1; Mr. Jean Dupont, DM301, p. 1; Ms. Sylvie Vincent and Mr. Daniel Bégin, DM314, p. 1.

Climate change

Climate change was a concern for many participants, including the AQLPA, which stated that these disruptions "pose a great threat to the planet, its inhabitants, its natural resources, a great number of animal and plant species, as well as human societies and the economy" (DM592.1, p. 87). In this respect, Québec solidaire underscored that: "according to several experts, climate changes expected from now until the end of this century represent the greatest challenge that humanity will ever face" (DM466, p. 7).

Stratégie Saint-Laurent, which was especially preoccupied by the potential impacts of these disruptions on the St. Lawrence River's ecosystem and the losses of use that they could result in, "wants to make sure that the development of the natural gas industry will be done in line with the fight against climate change, and that it not become a substitute to the development of other energy sources which are less damaging to the environment" (DM557, p. 6). One participant underscored the fact that environmental dynamics comprise a large number of unknown aspects and believed that "companies cannot allow themselves to be as lax as they were in recent decades" (Mr. François Lafontaine, DM468, p. 2). For other participants, it doesn't seem logical to ask citizens to do their part for the environment while some industries pollute (Ms. Thérèse Carrier and Mr. Claude Labrecque, DM40, p. 2).

Several participants were convinced that an additional supply in natural gas could result in lower greenhouse gas emissions, and therefore be in line with Canada's Kyoto Protocol commitments[1]. The main argument in this respect was based on the fact that users of more polluting fossil fuels such as coal and fuel oil could replace them with natural gas, which generates less greenhouse gases. This conversion would have an especially important impact in the United States (International Brotherhood of Electrical Workers, DM46, p. 6). Some participants[2] specified that the project favours transporting the natural gas by ship and pipeline, which pollute less than road transportation, for example.

1. Mr. Serge Belval, DM449, p. 3; Fabrication PFL inc., DM207, p. 2; Mr. Mario Martin, DM249; Mr. Frédéric Bilodeau, DM275, p. 1; Corporation Nuvolt inc., DM324, p. 5; Hexion Specialty Chemicals Canada, Inc., DM337, p. 4; Location Prince, DM456, p. 2; Mr. Normand Tremblay, DM364, p. 1; Les urnes en bronze Bégin, DM447; Ms. Ève Duchesne, DM567, p. 1.
2. Ms. Thérèse Boucher, DM566, p. 5 and 8; Mr. Christian Jobin, DM8, p. 1; The St. Lawrence Seaway Management Corporation, DM165, p. 2; Mr. Steve Côté, DM280, p. 5.

In contrast, a great deal of participants believed that the activities of the LNG Terminal would generate additional greenhouse gas emissions, which would go against Canada's Kyoto Protocol commitments[1]. One of them maintained that the project was also in contradiction with the Québec action plan on climate change, which specifies that the fight against climate change "among other things, means avoiding the production of new GHG emissions from the production of electricity, heating buildings and industrial processes" (Mr. Denis L'Homme, DM347, p. 5). According to the Regroupement national des conseils régionaux de l'environnement du Québec: "the project will therefore force Québec to increase its reduction activities in other sectors in order to meet its greenhouse gases reduction targets, thereby penalizing citizens and other companies" (Mr. Louis Maccabée, DT29, p. 60).

On the one hand, some participants believed that the proponent did not take into account all GHG emission sources which can be attributed to the project, such as the process to liquefy natural gas, transport by LNG tanker as well as the tugboats and coast guard ships that would accompany the tankers at their arrival (Les associations NPD des régions de la Capitale-Nationale et de la Chaudière-Appalaches, DM379, p. 3; Mr. Louis Duclos, DM458, p. 6; Mr. Gilles Castonguay, DM630, p. 30). Moreover, the Conseil régional de l'environnement Chaudière-Appalaches and the Regroupement national des conseils régionaux de l'environnement du Québec thought that the project would directly contribute to higher GHG emissions by making natural gas more available to mine oil sands (DM591, p. 9 and 10; Mr. Louis Maccabée, DT29, p. 59).

On the other hand, certain participants were of the opinion that the proponent overestimated the decreases in GHG emissions that would result from converting industries using fuels with higher grades of carbon than natural gas. They believed that the forecasted substitution rate has not been established and was unrealistic. The AQLPA thought that such a substitution rate cannot be attributed to only one LNG terminal project (DM592.1, p. 31). The Association considered the assessment to be based on assumptions that were unduly favourable to the proponent, and added that "the substitution rate estimated by Rabaska in the United States, as well as the forecasted exports levels, are not representative of reality, and will result in an unjustified overestimation of GHG emission reductions which can be attributed to the project" (DM592.1, p. 106). This was also the opinion of the Groupe de jeunes citoyens lévisiens, which stated that if the forecasted substitution rate was not

1. Table des groupes populaires, DM6, p. 1; Ms. Yolande Lépine, DM66, p. 1; Réseau du Forum social de Québec–Chaudière-Appalaches, DM438, p. 2; Mouvement des travailleurs chrétiens, DM16, p. 1; Ms. Suzanne A. Samson, DM186, p. 1; Mr. Jean Dupont, DM301, p. 1; Ms. Sylvie Vincent and Mr. Daniel Bégin, DM314, p. 1; Ms. Chantale Jean, Mr. Olivier Lajoie and Mr. Gaétan Lajoie, DM60, p. 1; Ms. Céline Létourneau, DM594, p. 5; Mr. Gaston Fournier and Ms. Réjeanne Guay, DM148; Ms. Sylvie Pharand, DM413, p. 1; Ms. Valérie Bouchard and Mr. Steeve Roy, DM162, p. 3 and 4; Conseil central de Québec–Chaudière-Appalaches, DM120, p. 3; Ms. Diane Martel, DM205, p. 2; Ms. Louise Crevier Letendre, DM317, p. 5; Mr. Gilles Castonguay, DT23, p. 47; Ms. Ariane Bélanger, DM159, p. 1.

reached, the GHG reductions promised by the proponent would not occur, and the project would then become a climate threat (DM612, p. 14 and 16).

One participant, however, deemed it irresponsible to oppose this type of project because of the Kyoto Protocol: "a so-called responsible approach would require us to implement concrete measures, together with the oil and gas industries, in order to reduce GHG emissions (Mr. Dominique Hotte, DM71, p. 2). One of these measures, in his opinion, would consist in accelerating the application of industrial CO_2 capture and storage technologies. In the opinion of another participant, "CO_2 capture technologies are always improving. Therefore, there is a possibility that, before long, CO_2 could be captured as soon as it is emitted from the liquefied natural gas regasification process (Mr. Gilles Leclerc, DM103, p. 3). Several participants[1] placed their trust in this new technology and believe that Rabaska should pursue this approach. A company that is specialized in this field emphasized the following:

> We believe that we need every type of energy, according to a given environment, available sources and usage functions. Regardless of the energy source used and the quantity of CO_2 emitted, one must think in terms of sustainability. We therefore believe that realizing a project as major as Rabaska should be an opportunity to propel research and development in order to improve the technology linked to its product.
> (CO_2 Solution Inc., DM118, p. 4)

Regarding the discontinuation of more polluting fuels in favour of natural gas, the Conseil régional de l'environnement Chaudière-Appalaches believed that incentives should be created and the AQLPA recommended that a program be implemented (DM591, p. 21; DM592.1, p. 33). In the AQLPA's view, "in the absence of a structured program that is part of a global GHG emissions reduction strategy, using more natural gas in no way ensures the lowering of emissions which give rise to climate disruptions" (*ibid.*).

Other participants are less optimistic regarding GHG emissions reduction measures. For the Association de l'île d'Orléans contre le port méthanier, "no approach exists, short of scrapping economic growth. At best, technological solutions can only push deadlines back, nothing more" (DM525, p. 3). According to another participant, natural gas consumption should completely disappear from Québec's energy consumption approach, in order to remain consistent in its intention to reduce greenhouse gases: "shouting from the rooftops is no longer sufficient; we must now act. Holes in the ozone layer and climate change are telling us quite clearly that the clock is ticking against us" (Ms. Caroline Mongeau, DM30, p. 3).

1. Mr. Martin Michaud, DM106, p. 1 and 2; Mouvement populaire À bon port, DM547, p. 11; Mr. Émile Leblond, DM173, p. 3; Mr. Gérald Dionne, DM225, p. 3; Mr. Yves Laberge, DM332, p. 2; Mr. Gilles Guay, DM257, p. 3.

The Québec Green Party believed that climate change can only be resolved by "reducing energy consumption and implementing renewable energy sources such as wind or solar power" (DM571, p. 2). The AmiEs de la terre de Québec were also of this opinion, and added that "a green plan with major GHG reduction targets, complemented by innovative, clear and strict regulatory measures is needed" (DM625, p. 67).

Many LNG terminals

Several participants questioned the need to build more than one LNG terminal in Québec, referring to the Cacouna Energy Project, which was recently the subject of a public hearing, and to a third project which is currently being developed in the Saguenay region[1]. According to the GIRAM, "these private terminal projects are deemed to represent four times the daily natural gas consumption in Québec […] this means that there isn't room for two LNG terminal facilities in Québec, unless we wish to play the role of energy carrier for our neighbours" (DM461, p. 75).

Les Amis de la vallée du Saint-Laurent also decried the fact that these projects "had been submitted to Québec society without the benefit of a comprehensive review by the governments of Canada and Québec on this new kind of maritime and port developments" (DM551, p. 6). Moreover, some participants believed that the individual review of LNG terminal projects is a major flaw in the governmental assessment process (Ms. Annie Lebel and Mr. Hubert Pelletier-Gilbert, DM160, p. 5 and 6).

According to Nature Québec, it is advisable to ensure an additional supply to meet Québec's potential needs, but "one terminal by itself, designed with an appropriate capacity in mind or which could be expanded, would suffice to meet predictable needs" (DM638, p. 9). In this respect, some believed that Québec's LNG import facilities could be concentrated in Cacouna (Mr. Raymond Therrien, DT18, p. 54; Mr. Denis Latrémouille, DM462, p. 62). For others, however, Lévis must take advantage of this opportunity to have Québec's first LNG terminal facilities (Mr. Conrad Larose, DM81, p. 2; Mr. Pierre Garant, DM543, p. 4).

Others saw things on a larger scale and believed that the possibility of having the province of Québec supplied in natural gas by LNG terminals that are planned or in place in the Maritimes and on the American East coast should be considered (AQLPA, DM592.1, p. 110; Mr. Louis Duclos, DM458, p. 3; Ms. Lyne Gosselin, DM584, p. 2; Mr. Louis Maccabée, Regroupement national des conseils régionaux de

1. Ms. Caroline Mongeau, DM30, p. 3; Mr. Benoît Bouffard, DM31, p. 6; Ms. Francine Demers Boutin, DM117, p. 4; Conseil central de Québec–Chaudière-Appalaches, DM120, p. 3 and 4; Mr. Jacques Clermont, DM224, p. 4; Mr. Louis Duclos, DM458, p. 2; Les AmiEs de la terre de Québec, DM625, p. 66.

l'environnement du Québec, DT29, p. 61). The Association saw these possibilities to protect the environment of Lévis as "alternatives that are much less costly in terms of funds and the environment, and which would place Québec at the junction point of two distribution networks (DM459, p. 46).

Integrating the project into the landscape

The project's integration into the landscape was an aspect which was raised by several participants at the hearings, especially through questions dealing with the LNG terminal's implementation area, the compliance with the development plan and municipal regulations, the future development of the area as well as the impacts on the landscape, heritage sites and area uses.

Choosing the site

The implementation area of the Rabaska LNG terminal is one of the project's most controversial aspects. This aspect was raised by a great many participants during the hearings. The site chosen offers, for some, optimal conditions regarding security, environmental protection and technical feasibility, while for others it has major constraints regarding the security of neighbouring populations, landscape integration and poor area cohesion. In this respect, and summarizing the controversy surrounding this choice, the Conseil des monuments et sites du Québec stated that "the main question at issue is if the project is suitable for the site, not if the site is suitable for the project" (DM394, p. 3). Many participants believed that the site chosen and the project's nature are incompatible with the host environment. One participant added:

> […] this project is totally incompatible with its environment. The site chosen is a mistake because it is too close to residences (risks and disruptions), because it disrupts the harmony of a rural area located alongside the river, facing the île d'Orléans, and because the position of the local population must be respected, and they are fiercely opposed to it.
> (Ms. Carole Boucher, DM694, p. 17; Ms. Isabelle Carrier, DM624, p. 17)

Several participants thought that the building of an LNG terminal must take place far away from inhabited areas and that, as such, the site chosen is inadmissible as it doesn't meet this crucial population security condition. The municipality of Beaumont was of the opinion that "while residential realities can cohabitate very well with agricultural considerations, this is not the same for an extensive industrial project that poses risks which may be major" (DM619, p. 25). To this end, the GIRAM stated:

> Countries with much less territorial area than Québec, and which are much more densely populated (such as France, for example), find the way to place these high-risk technological facilities far from populations and in maritime corridors that are close to the sea, or outside high-maritime-traffic areas.
> (DM461, p. 32)

In this respect, another participant added:

> These facilities are not located close to populations without their consent. Why should I be forced to leave in order to live in security, and especially to keep my health and quality of life? The proponent should first and foremost choose a site that is far away from the population.
> (Ms. Micheline Gagné, DM287, p. 6)

On another subject, the importance given by the proponent to economic considerations as criteria to choose this site was raised by some participants (Ms. Danièle Desjardins, DM646, p. 1; Mr. Jean-Claude Bouchard, DM408, p. 9; Ms. Pierrette Bélanger, DT24, p. 3; Ms. Francine Demers Boutin, DM117, p. 4). One participant objected to this choice: “the proponent has obviously asked himself only one question: which site closest to the current pipeline could be chosen to build the project? The end result being to save more than one million dollars for every kilometre it was possible not to build” (Mr. Christian Ruel, DM194, p. 5).

Some participants raised the absence of alternatives regarding impact study site choices. Aside from alternatives located nearby, i.e. within a 1-km radius, no other option was analyzed by the proponent. To this end, a participant stated:

> Searching for potential sites is the basis for the environmental assessment process; it is also and especially a requirement that the proponent must meet to justify his project’s site choice. However, the demonstration has not been made that the Lévis site is appropriate to build an LNG terminal.
> (Ms. Danièle Desjardins, DM646, p. 1)

Also, some participants, residing mainly in Beaumont, were deeply concerned that the proponent had only moved his project to the other side of the limits of this municipality, after the population refused to welcome the project (Mr. Sylvain Castonguay, DM578, p. 4; Mr. Jean-Guy Allard, DM24, p. 1). Some considered such a gesture to be unacceptable from a proponent who has asserted his intention to respect the will of the population regarding the project. In this vein, a resident from Beaumont added:

> In spite of the promise from Gaz Métro’s President to respect the population’s decision, the proponent has taken every means possible to convince the economic community of his project’s validity. After the Beaumont referendum, the proponent undertook intensive lobbying activities.
> (Ms. Louise Maranda, DM596, p. 6)

In contrast, others[1] were of the opinion that the site chosen by Rabaska was appropriate to realize such a project. A participant indicated that this site was ideal to build industrial facilities and noted that the area was now coveted by other proponents (Lemieux Nolet, DM444, p. 3). Another participant specified that "the current project site is the least damaging and most acceptable for the Québec region (Excavation Lafontaine inc., DM292, p. 3). In the same vein, one participant believed that the site chosen was appropriate as it covers a small area and affects an ecosystem that he didn't deem as exceptional for Québec" (Mr. Mathieu Lafontaine, DM291, p. 1).

Lastly, for some, the cohabitation of industrial and residential uses was possible in the project's integration area, and as such they judged the project to be in compliance with the implementation area: "in my travels, I was able to note that cohabitation of some historical districts with industrial ones was a reality in Greece or in Venice, Italy, for example. As such, I personally believe that natural gas is a positive for Québec and it is possible to have cohabitation" (Mr. Camilien St-Pierre, DT24, p. 22). Another participant wondered if it was possible to "be more pragmatic and strategic in our thinking, our comments and our actions, in order to make ecology and developments coexist for everyone's best interest" (Mr. Yannick Leclerc, DM659, p. 1). The City of Lévis stated "that the arrival of a large-scale industry will inevitably cause disruptions. In this respect, the issues at play are to make sure that measures are implemented so as to foster the most harmonious coexistence possible over time" (Ms. Danielle Roy Marinelli, Mayor of Lévis, DT16, p. 30 and 31).

Moreover, some participants called upon better planning and the involvement of governmental decision-makers when choosing large-scale integration areas for industrial projects:

> In a society like ours, it is intolerable to let private industry choose heavy industrial area sites by itself. These sites must be carefully planned in advance, far from inhabited areas, while respecting the population and complying with laws in force. It seems as if we are witnessing a giant improvisation session.
> (Mr. Erick Lambert, DM613, p. 3)

Another participant added:

> The government should undertake serious steps to establish a framework, in order to determine which conditions are necessary to realize such a project […] Moreover, this regulatory framework could avoid tensions, stress, social strife, all of which certainly have an impact not only on the quality of life of people, but also their health.
> (Ms. Isabelle Carrier, DM624, p. 16)

1. Mr. Christian Jobin, DM8, p. 1; Ms. Monique Morissette, DM209, p. 1; Ms. Linda Roy-Leblond, DM210, p. 2; Mr. Jean Hémond, DM132, p. 3; Ms. Madeleine Leblond, DM168, p. 2.

Land-use planning and municipal regulations

The project's compliance with the development plan and municipal regulations was an aspect which was widely discussed. Several participants singled out a confusion regarding the development plan of the City of Levis, regarding the current vocation of the area targeted by the project. According to one participant, the designation of lands in this territory is a complex and controversial matter as "we are faced with an industrial-portuary usage which […] carries an important psychological charge, somewhat akin to activities which are said to be delicate such as hog farms, electrical lines, and airports, which generate a certain amount of questions" (Mr. Claude Lavoie, DT17, p. 60).

The Conseil des monuments et sites du Québec was of the opinion that "the port and related infrastructures are set out in the territory in a way that is not very consistent with ancient occupation aspects, disregarding the ground divisions of ancient lands" (DM394, p. 13). For a large proportion of participants, Ville-Guay, the eastern sector of the city of Lévis, was described as a rural and residential district. In the opinion of many participants, this project is not consistent with the area's current usages. As such, several wanted to see this area confirmed as residential and agricultural rather than as an area which is suitable for industrial-portuary facilities[1]. Underscoring the incompatibility between the proposed project and this area, one participant added:

> […] the Rabaska project proponent proposes to implement a heavy industry in an area where usages that are authorized and up to date (dwellings, schools, businesses) are incompatible with those required for his project. Close to one hundred families reside within a 1-km radius of the planned facilities.
> (Ms. Danièle Desjardins, DM646, p. 2)

Some participants objected to the industrial-portuary vocation of the area in question, underscoring the gap between the City of Lévis development plan, which hasn't been reviewed for many years, and the real situation of this area. One participant was of the opinion that the chosen site must not become "an area with an industrial-portuary vocation as, in reality, this site is strictly residential and agricultural, thanks to the 1987 development plan, of which one part for heavy industry was reviewed but not adopted in 2001" (Mr. Jean-Claude Gosselin, DM63, p. 4). According to some participants, the industrial-portuary designation of this area is in fact obsolete, and it should have been modified previously, as the area has developed more into a residential neighbourhood (Mr. Jacques Levasseur, DM460, p. 4).

1. Ms. Annie Lebel and Mr. Hubert Pelletier-Gilbert, DM160, p. 4; Ms. Thérèse Carrier and Mr. Claude Labrecque, DM40, p. 2; Ms. Suzanne Rochon, DM536, p. 4; Municipality of Beaumont, DM619, p. 25; Mr. Jean-Claude Bouchard, DM408, p. 8; Démocratie Lévis, DM371, p 5; Mr. Rosaire St-Pierre, DM412, p. 5; Ms. Denise Martel, DM205, p. 3.

Moreover, certain area residents said that they had verified the area's designation with municipal officials before moving there and that it didn't have any industrial-portuary designation. To this effect, a resident stated "I never would have moved to this area if the city had clearly specified that it wanted to change the area's designation to heavy industry and if public servants would have informed me of this before I purchased my land when I verified its zoning status" (Mr. Christian Ruel, DM194, p. 4). The École Sainte-Famille, located at approximately one kilometre of the planned site, stated:

> In 1990, the founders of the Holy Family School insisted on building the school in a semi-rural environment. They would never have bought a building located in an industrial-portuary area. Our current environment corresponds to the educational profile of our school, thanks to a setting that is quiet, customized and in touch with nature. We feel as if Rabaska is "stealing" our school environment by "perverting" the zoning spirit of Lévis-east and Beaumont.
> (DM146, p. 5)

For its part, the Association pour la protection de l'environnement de Lévis (APPEL) stated that "during all the years when municipal elected officials modified, did not modify or remodified the development plan of their area, residents both new and old were never informed of the consequences that these modifications could have on their living environment" (DM459, p. 28). In the same vein, GIRAM representatives thought that the City of Lévis "had been inconsequent when granting residential building permits in the area that it now considers as industrial-portuary" (DM461, p. 94).

Furthermore, during the public audience, several participants were unhappy with the way the City of Lévis acted as per the Rabaska matter. One participant stated: "regarding the City of Lévis, we are talking about a development plan that dates back to 1987; in my opinion, not reviewing a city's development plan over a twenty-year period is totally unacceptable" (Mr. Érick Lambert, DT19, p. 3). Others[1] were of the opinion that municipal officials failed in their role as citizen representatives regarding potential benefits agreed to by the proponent. For one participant, "the city's attitude in this matter gives rise to a feeling of abandonment, and for some, betrayal or exasperation" (Mr. Jacques Levasseur, DM460, p. 5). Some also denounced the lack of consultation of Ville-Guay area citizens, who are directly affected by this project, from Lévis elected officials (Ms. Fabienne Gagné, DT21, p. 5; Mr. Michel Arsenault, DM604, p. 2).

1. Mr. Jean-Claude Gosselin, DM63, p. 2; GIRAM, DM461, p. 83; Ms. Gabrielle Larose, DM26, p. 1 and 2; Ms. Fabienne Gagné, DM376, p. 2; Ms. Line Caron, DM605, p. 4; Mr. Christian Ruel, DM194, p. 4.

According to several participants[1], the project in its current form was deemed to contravene the agricultural zoning regulation of the *Act respecting the preservation of agricultural land and agricultural activities*, as well as by-law 523 of the neighbouring municipality, Beaumont, which forbids the storage of some hazardous substances up to 1 km from municipality limits. In this respect, a participant believed that compliance with by-law 523 required major changes to the project, such as moving it (Mr. Roger Lambert, DT25, p. 6). Moreover, one participant informed the Panel that a petition had been submitted to the Superior Court of Québec by 93 Lévis and Beaumont citizens regarding the compliance of the Rabaska project with Lévis zoning regulation and with by-law 523 (Mr. Martin Arsenault, DM629, p. 6).

Lastly, some participants who were favourable to the project claimed that this land area had been slated for large-scale industrial facility development for many years, as well as portuary activities along the shoreline. As such, for them, the industrial-portuary vocation of the river's shoreline in the Ville-Guay sector is a given, as it was entered into the development plan and zoning regulations for years (Mr. Bertrand Crète, DM119, p. 6; Société de développement économique de Lévis, DT15, p. 71; Mr. Pierre Garant, DT19, p. 31; Mr. Pierre Vézina, DM180, p. 1; Ms. Danielle Roy Marinelli, Mayor of Lévis, DT16, p. 30).

Future developments in the implementation area

The possible and gradual expansion of Rabaska's facilities was a concern which was expressed many times during the hearings. To this effect, one participant pointed out: "once there are two tanks, adding two more won't bother anyone; and then, once there is a jetty, why not have container ships berth here to take some pressure off the port of the city of Québec?" (Mr. Érick Lambert, DT19, p. 5). A good many participants[2] believed that the arrival of such an industry would foster the creation of new industries in the area. For the Conseil des monuments et sites du Québec, "it is unlikely that the Rabaska facilities will remain isolated over the long term. It is reasonable to think that their presence will justify building other infrastructures" (DM394, p. 5). In this vein, the Conseil régional de l'environnement Chaudière-Appalaches asked:

> To what extent will the project create an opening in the area's current vocation? Will it not create a precedent which will pave the way to introducing related industries and infrastructures, such as a port that will be specialized in petrochemistry? Will we witness the creation of a new industrial focal point, to the detriment of the agricultural, tourism, historical and residential areas?
> (DM591, p. 12)

1. Ms. Sandrine Louchart, DM349, p. 5; Ms. Céline Létourneau, DM594, p. 3; Mr. Jean-Marie Tremblay, DM313, p. 1; Municipality of Beaumont, DM619, p. 25 and 26; Mr. Jean-Marie Létourneau, DM37, p. 2.
2. Mr. Jean-Guy Allard, DM24, p. 2; Mr. Benoît Bouffard, DM31, p. 4; Ms. Madeleine P. Couture, DM111, p. 2; Mr. Jacques Clermont, DM224, p. 2.

Some participants suggested different and more adapted approaches for the future development of the area (Mr. Jean-Claude Florence, DM193, p. 9; Mr. Benoît Bouffard, DM31, p. 3; Québec solidaire, DM466, p. 25). In fact, some participants underscored the fact that a housing development would be a more appropriate choice to use the land of this area (Ms. Line Caron, DM605, p. 5). Another participant suggested that a housing development could be just as profitable for the city, both fiscally and through job benefits (Mr. Louis-Marie Asselin, DM49, p. 12). In the same perspective, GIRAM representatives suggested that the area's development be directed toward new technology industries which don't require portuary infrastructures for their activities (DT16, p. 21).

Some participants wanted the area to grow industrially, believing that expanding the area beyond the limits proposed would be favourable for local economic development:

> To improve the project, the proponent should not hesitate to plan expanding the plant in the coming years as the popularity of the product will continue growing, and to meet the demand, he will have to be in a position to expand his facilities […].
> (Gestion financière Chute-de-la-Chaudière, DM131, p. 1)

Moreover, cryogenic technology was viewed by many participants as an economically promising sector. Some underscored the cryogenic capacities of Rabaska's liquefied natural gas, which could provide leading-edge companies with undeniable development advantages (OmegaChem, DM144, p. 3; Mr. Bertrand Crète, DM119, p. 9; Société de développement économique de Lévis, DM545, p. 18).

The landscape and heritage value

Many participants invoked the project's potential impacts on the landscape and the region's heritage. The Conseil des monuments et sites du Québec explained:

> The heritage value already built and our cultural landscapes are a reflection of the social and cultural progress of our society. It is therefore appropriate to be totally watchful over them and scrupulously ensure their preservation and integration into our contemporary societies. This must be an integral part of a collective responsibility and a political duty.
> (DM394, p. 16)

Several participants considered the areas of the city of Québec, Lévis and the île d'Orléans as the cradle of French American culture, the place where the first settlers of the country established themselves. This land is a collective heritage site for them,

an identity inheritance and a historical reference point that must be preserved[1]. In this respect, some underscored the presence of many heritage buildings in the project's area and on the île d'Orléans, which are a testimony to the past and which have been preserved until now (Mr. Pierre Blouin, DM621, p. 29; Ms. Lise Thibault, DM436, p. 30; Ms. Denyse Rondeau, DM195, p. 2). Moreover, several participants believed that the project is incompatible with the designations of the city of Québec as a Unesco World Heritage Site, and of the île d'Orléans as a historic district[2].

Some of the area's residents[3] expressed their affection for the landscapes that typify the environment they chose. One participant expressed the landscape's importance for her as follows:

> A landscape is more than a painting, more than a watercolour, more than a drawing, more than a picture. A landscape can move us to the very depths of our souls with a single glance. It contains the most secret memories, clings to our very skin, dances about in our heads and imposes the rhythm of our heartbeats.
> (Ms. Yvonne Tschirky-Melançon, DM524, p. 2)

For many participants, the Lévis and Beaumont area has remarkable landscape value. It was described as a site bordered by cliffs and promontories which have exceptional views of the St. Lawrence River, the île d'Orléans and the surrounding area (Mr. Rosaire St-Pierre, DM412, p. 3; Mr. Benoît Bouffard, DM31, p. 2). The île d'Orléans, located in front of this area, also garnered a lot of attention. The visual outlooks that island residents and visitors would have on the project's facilities worried some participants (Ms. Yvonne Tschirky-Melançon, DM524, p. 2; Ms. Chantale Jean, Messrs. Olivier Lajoie and Gaétan Lajoie, DM60, p. 3). Some participants described the landscape's beauty:

> The region seems to be taken straight out of Paradise […] it's a coexistence that is still harmonious between the rural and urban dimensions; it's the parcelling out of the territory into small picturesque villages, with always a rural note that is evocative of the colony's beginnings.
> (Mr. Mathias Brandl, DM635, p. 2)

1. Mr. Joseph Melançon, DM523, p. 7; Ms. Pierrette Bélanger, DM302, p. 43; Mr. Mathias Brandl, DM635, p. 2; Mr. Érick Lambert, DM613, p. 2; Ms. Andrée Labrecque, DM583, p. 2; Ms. Yvonne Tschirky-Melançon, DM524, p. 13.
2. Mr. Jean-Guy Allard, DM24, p. 5; Ms. Adèle Bertrand and Mr. Jean-Claude Gosselin, DM63, p. 7; Mr. Rosaire St-Pierre, DM412, p. 5; Mr. Érick Lambert, DM613, p. 3; Ms. Chantale Jean, Mr. Olivier Lajoie and Mr. Gaétan Lajoie, DM60, p. 3; Ms. Madeleine P. Couture, DM111, p. 2; Ms. Renée Dupuis, DM191, p. 2; Ms. Caroline Levasseur and Mr. Jean-Marie Perrono, DM304, p. 10; Mr. Jean-Christian Roy and Ms. Guylaine Piché, DM617, p. 1; Ms. Michèle Lépine and Mr. André Dubois, DM573, p. 4; Ms. Céline Létourneau, DM594, p. 4; Mr. Marcel Junius, DM633, p. 2; Mr. Pierre Blouin, DM621, p. 27; Mr. Bernard Monna, DM441.
3. Mr. Rosaire St-Pierre, DM412, p. 3; Ms. Lise Thibault, DM436, p. 48; Ms. Lise Lachance, DM603, p. 2; Mr. Jean-Paul Blais, DM110.

> […] we will never be able to replace the balance, beauty, value, human richness and majestic aspect of a site such as ours. Such a landscape is unique in the world. It has slowly become part of our culture, through the subtle and mysterious bond that exists between a land and its inhabitants. In this landscape we can read our history, we recognize our place in the world, and we are building together a future that is open to all of us.
> (Mr. Pierre Morency, DM434, p. 2)

Many participants[1] were of the opinion that the project would have devastating consequences on the area's landscape and heritage aspects. Project components which were deemed to impair the landscape included the storage tanks, the metallic jetty jutting out into the river, the lining with stones of part of the riverbank and the LNG tanker traffic (Ms. Mireille Castelli, DM626, p. 3; Association pour la protection de l'environnement de Lévis, DM459, p. 28; North American Tourism Research Institute Inc., DM297, p. 4 and 5).

Specifically, the feared impacts on the landscape and heritage value were deemed to have an impact on tourism. Some participants[2] underscored the fact that the region is renowned among travellers and that the project would harm its tourism appeal. The river corridor where the project would be built is considered to be the maritime entrance to the region, and many feared[3] that the presence of the LNG terminal would lessen the appeal for cruise travel companies and boaters. One participant believed that the project "goes against the trend to restore the beauty and health of rivers, and of the itineraries taken by excursions and tourist cruises" (Ms. Andrée Roberge, DM366, p. 1).

Some had doubts about the effectiveness of the visual impact mitigation measures proposed by the proponent (Ms. Madeleine P. Couture, DM111, p. 2; Conseil des monuments et sites du Québec, DM394, p. 13). In this respect, the Conseil régional de l'environnement de la Capitale-Nationale and Stratégies Saint-Laurent underscored the importance of implementing all the required measures to integrate the project into the landscape in the most harmonious way possible (DM74, p. 12; DM557, p. 10).

Some participants noted many gaps in the impact study's approach regarding landscape and heritage value aspects (Conseil des monuments et sites du Québec,

1. Mr. Guy Martel, DM405, p. 3; Ms. Marie Dubé and others, DM399, p. 2; Mr. Rosaire St-Pierre, DM412, p. 5; Mr. Marcel Junius, DM633, p. 1 and 2; Ms. Jeanne-D'Arc Dubé-Lavoie, DM373, p. 2; Ms. Marielle and Mr. Serge Gagnon, DM587.
2. Mr. Jacques Jobin, DM18, p. 7; Conseil central de Québec–Chaudière-Appalaches, DM120, p. 6; Ms. Andrée Labrecque, DM583, p. 2; Conseil régional de l'environnement Chaudière-Appalaches, DM591, p. 5; Mr. Denis Guay, DM614.
3. Conseil des monuments et sites du Québec, DM394, p. 11; Ms. Louise Latulippe, DM196, p. 6; Ms. Pierrette Bélanger, DM302, p. 45; Mr. Patrick Plante, DM382, p. 35; Stratégies Saint-Laurent, DM557, p. 9 and 10; Ms. Louise Maranda, DM596, p. 18.

DM394, p. 14; GIRAM, DM461, p. 45; Association pour la protection de l'environnement de Lévis, DM459, p. 29). Specifically, some believed that the visual simulations done by the proponent did not allow the adequate assessment of the potential impact in this respect (Conseil régional de l'environnement de la Capitale-Nationale, DM74, p. 12; Mr. Pierre Blouin, DM621, p. 30).

Some participants were in disagreement with the proponent's assessment, according to which the presence of transmission lines linking the île d'Orléans to the south shore of the river would foster the project's integration into the landscape (GIRAM, DM461, p. 51; Ms. Lise Thibault, DM436, p. 31). The Conseil des monuments et sites du Québec admitted that the building of this structure had been a mistake, and stated that "no other limit will be admissible if we stay within this narrow way of thinking" (DM394, p. 5). For another participant, "the Hydro-Québec lines are not a terminal mitigating factor. Quite the contrary, the LNG terminal would instead be an accumulation factor, by destroying even more what we must protect" (Mr. Patrick Plante, DM382, p. 35).

Some criticized the ministère de la Culture et des Communications for its limited participation, and wanted it to intervene in the matter (Association pour la protection de l'environnement de Lévis, DM459, p. 29; Conseil des monuments et sites du Québec, DM394, p. 16; Mr. Marcel Junius, DM633, p. 2). According to the GIRAM: "it is unacceptable that no one from the cultural community addressed the potential and irreversible damage that this LNG terminal project could cause to the visual and landscape aspect of the island, as well as to its environment" (DM461, p. 45). As some participants expressed, the conservation of the landscape and heritage value aspects of the île d'Orléans also includes the preservation of neighbouring sites such as the St. Lawrence River and its northern and southern shores (Ms. Annie Lebel and Mr. Hubert Pelletier-Gilbert, DM160, p. 5; Mr. Pierre Blouin, DM621, p. 38). For one participant, all the municipalities facing the île d'Orléans on the northern and southern shores of the St. Lawrence should be declared "historic districts, genealogical and cultural heritage sites of the Québec nation", just like the island itself (Mr. Jean-Claude Lespérance, DM22, p. 4).

Some participants were deeply concerned about the lack of legal means and tools available to protect the landscape and heritage sites (Ms. Louise Mercier, DT16, p. 24; Conseil des monuments et sites du Québec, DM394, p. 11; Les Amis de la vallée du Saint-Laurent, DM551, p. 23; Ms. Renée Dupuis, DM191, p. 2). For another participant, the project "goes against every one of the principles of the Charte du paysage québécois" (Ms. Lise Thibault, DM436, p. 30). For one citizen, "the beauty of the area's landscapes must be recognized as a whole, as one entity, and be protected, as there is nothing comparable in the region" (Ms. Isabelle Carrier, DM624, p. 8). The Conseil des

monuments et sites du Québec also recommends to create an idenpendant expert committee to assess, in consideration of the knowledge on the integrated management of territorial heritage, the potential impacts of the implementation of an LNG project at the eastern limit of Lévis (DM394, p. 15).

Furthermore, the GIRAM stated that it wanted to have the area of Ville-Guay and Beaumont, between the Pointe De La Martinière and the Pointe Saint-Vallier, recognized as a man-made landscape, as per the *Natural Heritage Conservation Act* (DM461, p. 41). According to the Conseil des monuments et sites du Québec, "the fluvial and coastal areas targeted by the Rabaska project are part of the oldest and most important man-made landscapes in Québec. No threat to them should be tolerated" (DM394, p. 14).

Conversely, several participants believed that the project's impact on the landscape and heritage aspects would be limited[1]. Regarding the île d'Orléans, some believed that it is sufficiently distant from the facilities to not suffer the consequences of an impaired landscape (International Brotherhood of Electrical Workers, DM46, p. 6; Mr. Normand Cliche, DM494, p. 2). Some believed that the project will even integrate itself rather well into the area's maritime environment, which already includes various portuary facilities. They asserted that the St. Lawrence River not only has an aesthetic value, but also represents the maritime and economic history of the region (Mr. Stéphane Roy, DM244, p. 1 and 2; Mr. Claude Bédart, DM418). One citizen stated: "by walking on the Pointe de Sainte-Pétronille, which has an open view of city of Québec and Lévis, you can see everything, including facilities which aren't aesthetic at all. Regardless, it remains beautiful and it is alive" (Mr. Normand Cliche, DM494, p. 3).

Some participants believed that the mitigating measures proposed by the proponent are adequate, mentioning, among others, the partial burial of the tanks, the setting up of berms with vegetation as visual screens and the burial of lines between the jetty and the land facilities[2]. The City of Lévis invited the proponent to continue with these efforts, especially regarding the flarestack's architecture "which should become a major component of the project" (DM315, p. 19).

1. Mr. Gilles Drouin, DM374, p. 2; Ms. Francine Roy, DM232, p. 1; Mr. Mario Chabot, DM241, p. 1; Mr. Sylvain Clusiault, DM247; Mr. Guy Pichette, DM253, p. 1; Mr. Stephan Chouinard, DM293, p. 2; Mr. Patrice Lemay, DM473; Mr. Martin Fontaine, DM484; Mr. Raynald Pageau, DM490; Mr. Dany Pouliot, DM492; Mr. Serge Asselin, DM498; Mr. Martin Dupont, DM500; Mr. Daniel Bérubé, DM501.
2. Mr. Sylvain Marcoux, DM92, p. 2; Mr. Christian Jobin, DM8, p. 1; Groupe de citoyens de Beaumont, DM65, p. 2; Mr. Daniel Bastien, DM75, p. 3; Ms. Sandra Rainville, DM121, p. 2; Ville de Lévis, DM315, p. 19; Mr. Léo Demers, DM495; Mr. Jean-Claude Tardif, DM48, p. 48 and 49.

The recreational uses of the area

Some participants feared that current fluvial boating uses for this area (small vessel boating, yachting, fishing and kayaking) would be restricted by the project (Ms. Thérèse Carrier and Mr. Claude Labrecque, DM40, p. 3; Ms. Chantal Lacasse, DM163, p. 3; Ms. Louise Grenier, DM615, p. 1). This situation would result in a loss of enjoyment in this site. For one participant, "the area between the Hydro-Québec towers and the Pointe De La Martinière is really an ideal spot for activities, for small vessels, kayaks and family canoeing, as there is much less current along the bank" (Ms. Isabelle Carrier, DT17, p. 82). For the sea kayak club Le Squall *de Lévis*:

> It is crucial to ensure fluvial user security […] we want the proponent to act like a good responsible citizen, and that he maintain good neighbourly relations and a harmonious cohabitation with kayakers and other boaters, in order to comply with elementary nautical security standards, and ensure the security of the portuary facilities.
> (DM1, p. 1)

Stratégies Saint-Laurent wanted to "make sure that small pleasure craft such as sea kayaks will be able to skirt the coast, and therefore cross the terminal's integration area safely" (DM557, p. 9). In this respect, the sea kayak club Le Squall considered that "it is essential for the jetty to be piled, so that kayaks and other small vessels can sail close to the shore and pass under the jetty at all times" (DM1, p. 1).

Some participants wanted to retain access to the St. Lawrence River's bank where certain recreational activities take place in the area, such as swimming and walking. Some believed that the project will be harmful for swimmers: "swimming is allowed in these areas. No one swims close to a port where these kinds of ships berth" (Ms. Louise Latulippe, DM196, p. 5). One participant protested: "they are damaging our river, while the City of Québec spends millions to allow its citizens to swim, relax and exercise once again" (Ms. Aurélie Tanguay, DM25, p. 1). Démocratie Lévis asked if building an LNG terminal is the best way to use the St. Lawrence River's banks in that area (DM371, p. 5). The Comité ZIP de Québec et Chaudière-Appalaches denounced the privatization of the river's banks, and wanted instead to foster access to them (DM636, p. 9). Moreover, Accès Saint-Laurent–Beauport believed that it was crucial to "declare the overall coastal corridor as a public area which is sustainable touristically" in order to protect and consolidate efforts made in this respect and to preserve the river banks for future generations" (DM457, p. 4).

Some hoped that a major regional park would be created at the De La Martinière and were worried about the project's impacts on its developmental potential. In the opinion of the Société de développement économique de Lévis, "the Pointe De La Martinière would be the only site where the Rabaska facilities would be visible from the fluvial

area […] this site has been operating on a seasonal basis (June to August) for many years now" (DM545, p. 21). For one participant:

> The Parc De La Martinière is the only wooded park that has access to the riverbanks in the region of the city of Québec […] opening the door to heavy industry just a few meters from there is in my opinion totally incompatible with the preservation and development of this majestic park, which will attract its share of tourists in the years to come, and will contribute to the population's well-being. This site is simply amazing!
> (Ms. Isabelle Carrier, DM624, p. 3)

Lastly, some participants wondered about the practice of cross-country skiing in this area (Ms. Francine Dupont, DM109). According to the Sierra Club of Canada, "the Ville-Guay cross-country skiing centre will see part of its trails closed off during the duration of the worksite. The portion in question crosses directly the area where the terminal is planned, and the trail passing in this area joins with the one from Beaumont, which makes for a 15-km itinerary" (DM699, p. 16).

The project's economic spinoffs

According to the participants, some of the potential economic spinoffs from the project include job creation, revitalizing the regional economic base, generating revenues for the city of Lévis and other levels of government, providing economic diversification and consolidating expertise companies. On the other hand, some apprehended the negative impacts the project could have on local and regional tourism, as well as on the property value of residences close by. According to some participants, the project's economic spinoffs would be limited to taxes for the City of Lévis and jobs would only be created during the construction phase.

Local and regional economic development

A strong proportion of the social-economic community and of the participants greeted the project's economic contribution to the overall regional territory favourably[1]. The Chambre de commerce de Lévis stated:

> We view the Rabaska project as a strategic economic lever to consolidate and diversify our economy. We have, within arm's reach, a major private investment which is offering jobs to our workers, high-end technology expertise, sizeable fiscal benefits, a long-term advantage for our industries, and decreased access costs to this resource for consumers and companies. This is an exceptional opportunity that we must seize!
> (DM611, p. 10)

The Groupe Perspective underscored the fact that the Rabaska project "represents the biggest investment in the past ten years in the region, and maybe even on a provincial scale" (DM519, p. 3). The major private investment that the project represents was also highlighted by many participants[2]. Moreover, some were of the opinion that the arrival of a project like Rabaska project would contribute to attracting new investors[3]. According to the Jeune chambre de commerce de Québec, "not seizing this opportunity could hurt our credibility, even the possibility of doing other large projects" (DM565, p. 4). For another, "The Rabaska project must be successful, and must be used as a calling card for investors who have given up on Québec for many years, for fear of not being welcomed" (Mr. Régis Cauchon, DM537, p. 9).

1. Fabrication PFL inc., DM207, p. 1; Regroupement d'appui au projet Rabaska, DM156, p. 16; Alu-Rex inc., DM208, p. 4; Machinerie G.A.S., DM216, p. 3; Les Entreprises lévisiennes inc., DM351, p. 3; Ms. Francine Roy, DM232, p. 1; SuperMétal Structures inc., DM300, p. 3; Vitrerie Lévis, DM354, p. 4; Conférence régionale des élus de la Chaudière-Appalaches, DM534; Conseil économique de Beauce and Ville de Saint-Georges, DM19; Mr. Alain Boily, DM29; Mr. Yves Côté, DM76, p. 1; Mr. Denis Lépinay, DM93; Mr. Alfred Bédard, DM98; Mr. Steeve-Michel Côté, DM114, p. 2; Ms. Micheline Dumas, DM129; Ms. Catherine Constantin, DM137, p. 4; Ms. Nathalie Villeneuve, DM157, p. 3; Mr. Richard Leblond, DM172, p. 1; Mr. Éric Leblond, DM211, p. 1; Mr. Michel Lachance, DM228, p. 1; Mr. Marc Paquet, DM242; Ms. Johanne Laflamme, DM250; Ms. Élaine Laflamme, DM256; Mr. Gérard Ruel, DM271, p. 1; Ms. Mélanie Pérusse, DM277; Mr. Jacques Lachance, DM278; Mr. Alain Giroux, DM279; Mr. Pierre Tremblay, DM294; DK-SPEC inc., DM322, p. 3; Ms. Diane Baillargeon, DM328; Honco, DM342, p. 4; Supervac 2000, DM343, p. 4; Sturo Métal, DM344, p. 3; S. Labranche inc., DM345; Les Structures Pelco inc., DM350, p. 3 and 4; Excavation Marcel Vézina inc., DM383; J. M. Demers Excavation inc., DM384; Orizon mobile, DM389; Mr. Dario Dumais, DM420; Côté Isolation inc., DM448, p. 2; Mr. Yves Tessier, DM476, p. 2; Charles-Auguste Fortier inc., DM503, p. 2 and 3; Mr. Martin Vézina, DM511, p. 1; Mr. Hervé Ferland, DM515, p. 1; Transport Jean-Guy Bergeron et Le Groupe Theco inc., DM529; Verreault, DM554, p. 6; Mr. Bastien Barrette, DM562, p. 1; Mr. Ronald Fiset, DM654, p. 1; Mr. Jacky Kenty, DM661, p. 1; Ms. Chantalle De Roy, DM675, p. 1.
2. Mr. Normand Lebrun, DM73, p. 1; Quebec Employers' Council, DM535, p. 2; Les Équipements EBM, DM61, p. 1; Mr. Guy Pelletier, DM229; Mr. Michel Picard, DM331, p. 1; Mr. André Turcotte, DM428, p. 2.
3. Électricité du St-Laurent ltée, DM96, p. 5; Mr. Jean Lefort, DM140, p. 2; Mr. Normand Lebrun, DM73, p. 2; Mr. Pierre Hébert, DM538, p. 1; Société de développement économique de Lévis, DM545, p. 8; Jeune chambre de commerce de Québec, DM565, p. 3; Mr. Hugo Bellefleur, DM378, p. 2; Mr. Patrick Fontaine, DM396, p. 1; Mr. Ghislain Labonté, DM504, p. 1; Canadian Liquid inc., DM649, p. 2; Mr. Maxime Lapointe, DM664, p. 1.

On another subject, some participants believed that the project, by its very industrial nature, will help diversify the regional economy (Chambre de commerce des entrepreneurs du Québec, DT16, p. 3; Ms. Nathalie Lafond, DM124; Mr. Mario Castonguay, DM237, p. 1; Mr. Pierre Fraser, DM285, p. 1; Mr. Richard Tremblay, DM387, p. 1; Mr. Lucien and Ms. Monique N. Dion, DM568, p. 1). In this respect, a participant mentioned:

> The city of Québec area has always been known as a "public servant area", because governmental offices were concentrated there. The decentralization of these services has reduced the work potential for citizens. In the past few years, we have seen a change in the direction of development, which is now focussing more and more on industrializing the economy. The Rabaska project would breathe new life into the region, which is already ailing from the closing of the shipyard.
> (Ropaq Construction inc. DM95, p. 7)

In the same way, the Société de développement économique de Lévis was of the opinion that the Rabaska project will help maintain the region's development rhythm, which would compensate for a slowdown in some economic sectors (DM545, p. 10).

However, some participants believed the city of Lévis to be in a prosperous phase, and that, consequently, the project isn't essential for its growth (GIRAM, DM461, p. 86). Some participants deemed the project's drawbacks for part of the population as outweighing its economic spinoffs. According to one of them, "the economic spinoffs are not really that great when considering what our society must give to the proponent, i.e. a complete section of an extraordinary landscape located on the riverbank, right in front of the île d'Orléans" (Mr. Christian Ruel, DM194, p. 5). Moreover, accepting the project was seen by some more as "a precedent which sends the message that at Lévis, in Québec, a proponent can show up anywhere with promises of economic spinoffs and jobs, regardless of the environment, regardless of the local population" (Ms. Isabelle Carrier, DM624, p. 13).

Job creation

The Société de développement économique de Lévis, as well as many participants, underscored the importance of this project's job creation component, specifically during the construction phase which would span more than three years[1]. Other participants evoked the diversity of jobs required to build an LNG terminal, which will include "not only construction workers, but also many technicians and engineers who will be assigned exclusively to work monitoring and quality control duties for the entire building duration" (Inspec-Sol, DM62, p. 2). Moreover, the Fédération des chambres de commerce du Québec was of the opinion that direct and indirect job creation related to the project could in some way diminish the impacts that affected some parts of the region's social-economic community (Ms. Françoise Bertrand, DT15, p. 53).

Several participants highlighted the fact[2] that quality jobs would be created and that the proponent would favour the hiring of local workers. For Développement PME Chaudière-Appalaches, "the arrival of a jobsite like Rabaska, with the proponent's promise to favour local labour and companies, is therefore a breath of fresh air for our region's contractors" (DM607, p. 3). Some participants were preoccupied, however, about where the required workers to build the LNG terminal will come from, and suspected that some specialized labour may be called in from outside the region (Ms. Louise Latulippe, DM196, p. 8). The Groupe Perspective, following the example of other social-economic stakeholders, demanded a firm commitment on the part of the proponent "in order to favour our great region's youth, workers and companies, by assuming the responsibility for developing the region's qualified labour" (DM519, p. 5).

1. Quebec Employers' Council, DM535, p. 3; Cométal inc., DM201, p. 2; Alu-Rex inc., DM208, p. 1; Métallurgie Pelchat inc., DM227, p. 1; Lucien Fournier et fils, DM230, p. 1; Excavation B. Bilodeau, DM246, p. 1; Transport d'agrégats du Québec inc., DM289, p. 6; Mr. Philippe Martel, DM69, p. 3; Mr. Jasay Bernard, DM212, p. 2; Mr. Paul Ferron, DM482, p. 2; Mr. Guy Boissonneault, DM491, p. 1; Mr. Pierre Paré, DM83, p. 2; Mr. Michel Brochu, DM86, p. 1; Mr. Marc Duguay, DM90, p. 1; Mr. Guy Duguay, DM107; Ms. Ghislaine Mr. Durepos, DM122; Ms. Carole Goudreault, DM127; Mr. Jean-François Dion, DM130; Ms. Rachel Chabot-Moisan, DM171, p. 2; Ms. Anette Roy, DM176; Mr. Éric Simoneau, DM219, p. 4; Mr. Daniel Lachance, DM236; Ms. Maude Laflamme, DM248; Mr. Émile Laflamme, DM251; Mr. Robert Brisebois, DM254; Mr. Alain Roy, DM255, p. 2; Mr. Guy Lachance, DM258; Mr. Frédéric Lachance, DM260; Ms. Sonya Denis, DM261, p. 2; Mr. Martial Fortier, DM262; Mr. Jacques Legros, DM263; Mr. Pierre Breton, DM264; Ms. Andrée Caron, DM272; Mr. Robert Grandbois, DM330; Plomberie Y. Beaudoin (2002) inc., DM339, p. 3; Fins Gourmands, DM352; Mr. François Moulin, DM368, p. 2; Mr. Gaétan Cahier, DM415; Entreprises P. A. Goulet et fils inc., DM474; Mr. Jean-Paul Drouin, DM481; Mr. Réal Labrecque, DM516, p. 3; Mr. Jean-François Leclerc, DM528; Autobus Auger, DM532; Ms. Linda Poirier, DM642, p. 2; Ms. Martine Demers, DM643; Mr. Guildo Brisson, DM682; Mr. Gaétan Lapointe, DM683, p. 1.

2. Cogémat inc., DM2, p. 2; Maxi-Paysage inc., DM5, p. 2 and 3; Pierquip inc., DM178, p. 2; Mr. Luc Castonguay, DM245; Les membranes Naulin inc., DM453, p. 2; Construction Raoul Pelletier (1997) inc., DM469, p. 2; Mr. Joel Ouellet, DM541, p. 1.

A certain number of participants[1] came to bear witness to the Rabaska project's importance to counter the exodus of industrial construction workers witnessed in the region, an exodus which causes insecurity in this economic sector. One worker from this activity sector added: "I am an electrician in the Pintendre area. As a father, I am constantly looking for work. The situation in construction is unpredictable and uncertain. A project like Rabaska is desirable for our sector" (Mr. Mario Labrie, DM100, p. 2). Moreover, construction workers believe that the project would offer them a job opportunity close to home. One participant detailed the difficult social and family situation affecting some workers when they need to leave their region because they are without work:

> Regarding my experiences of working outside of the region, let's say that there have been many people with whom I worked outside, who are now separated or divorced, from communities where we, as jobsite stewards on major jobsites, witness broken homes, and men who are 50 and 60 years old who arrive crying, because there isn't any work.
> (Mr. Gérard De Repentigny, DT19, p. 25)

Many participants and organizations specified the project's potential contribution in keeping young people in the region by providing them with interesting and well-payed jobs[2]. According to the Jeune chambre de commerce de Lévis, "the migration balance for those between 24 and 35 is negative for this area. The Rabaska project has, in our opinion, an undeniable appeal and retention factor to counter this phenomenon" (DM565, p. 2). Regarding jobs in the maritime sector, the project would allow the creation of jobs for graduates in this field. One participant specified that "graduates leave for Finland, Denmark and other countries with a maritime past. Even our field is dealing with a brain drain. The Rabaska project would allow Québec workers to remain home" (Mr. Jean Lefort, DM140, p. 1).

The Rabaska project represents a "good opportunity for workers from the Chaudière-Appalaches and the city of Québec region to show their skills and know-how" (International Brotherhood of Electrical Workers, DM46, p. 3). It was showcased as an opportunity to develop regional expertise in the LNG field, in engineering or even in

1. Mr. Jean-Yves Bisson, DM691, p. 5; Ms. Johanne Blouin, DM222, p. 2; Lambert Somec, DM268, p. 3; Mr. Gérard De Repentigny, DM435; Enfer design, DM452, p. 1.
2. Groupe Perspective, DM519, p. 4; Mr. François Lafontaine, DM468, p. 2; Mr. Jean Lamontagne, DM52, p. 1; International Brotherhood of Electrical Workers, DM46, p. 8; Mr. Mario Bélanger, DM32; Mr. Vincent Bilodeau, DM269; Mr. Réjean Bouchard, DM273; Mr. Jacques Beaudoin, DM334, p. 2; Mr. Dave Gaudreau, DM336; Mr. Sylvain Bolduc, DM401; Mr. Paul André Goulet, DM496, p. 1; Mr. Sylvain Haller, DM530, p. 1; Mr. Jérémie Belval, DM641; Ms. Martine Bouffard, DM650, p. 1; Mr. Robert Guérard, DM655; Ms. Mélanie Lapointe, DM665, p. 1; Mr. Yvon Chateauvert, DM666, p. 1; Mr. Gérald Larose, DM681; Mr. Guy Lapointe, DM684, p. 1; Ms. Juliann Rochette, DM695.

cryogenics[1]. The proponent plans on setting up a Chair of Energy Efficiency and LNG Technologies Studies, and this piqued the interest of some. For them, developing this knowledge represents an important innovation and research opportunity. In this respect, a participant underscored its potential: "Consequently, the university community will be called upon to become involved. I think that the city of Québec region, and by extension the province of Québec, can position itself on the gas technology world stage, thanks to the potential of all our stakeholders" (Mr. Stéphane Côté, DM91, p. 2). For la Chambre de commerce de Lévis, "new applications on the transfer of "frigories" or cold unites for thermal conversion and cold-processing industries are concrete examples of the project's contribution to innovation, scientific research and energy efficiency" (DM611, p. 7). The Conseil régional de l'environnement Chaudière-Appalaches was of the opinion that "to reach its goal of maximizing its contribution to sustainable development, this research chair should devote itself to developing and applying renewable and non-polluting energy sources" (DM591, p. 19).

However, many had doubts[2] about the project's real job creation benefits, and were of the opinion that these jobs will be scarce after the construction phase: "the proponent has promised that 70 permanent positions will be created thanks to this project. We don't believe that this is worth the trouble it would cause the region. We will receive little in comparison to what the proponent has promised" (Mr. Gaston Fournier and Ms. Réjeanne Guay, DM148). The Conseil régional de l'environnement Chaudière-Appalaches also voiced some concerns in this respect: "If we make comparisons with other activity sectors, we can note that the $850 million of proposed investments by the proponent could generate a significantly higher number of jobs, over a much-longer time span" (DM591, p. 4). Some were of the opinion that the community should commit to finding ways to increase the project's benefits and the jobs created during the operating phase (Mr. Renald Plourde, DM218, p. 4; Mr. Clément Lapointe, DM509, p. 2).

Revenues for the City of Lévis and the governments

The Pôle Québec–Chaudière-Appalaches, the Chambre de commerce de Lévis and the Chambre de commerce de Québec emphasized the importance of "the property tax revenues for the City of Lévis, which will total $7 million, government tax revenues for Québec which will total $71 million, and government tax revenues for Canada which will total $31 million" (Mr. Gaston Déry, DT15, p. 56). In this respect, a

1. Mr. Claude Vien, DM388, p. 1; Mr. Gaston Godbout, DM395, p. 2; Vaperma, DM446, p. 2; Mr. Normand Lebrun, DM73, p. 2; Mr. Daniel Bastien, DM75, p. 2; Mr. Jacques Pouliot, DM80, p. 2; Mr. Pierre Hébert, DM538, p. 1; Mr. Conrad Marceau, DM472, p. 1; Mr. Claude Brochu, DM514, p. 1; Usinacom, DM451, p. 1.
2. Ms. Suzanne Rochon, DM536, p. 3; Conseil central de Québec–Chaudière-Appalaches, DM120, p. 4; Mr. Philippe de le Rue, DM423, p. 5; Quebec Green Party, DM571, p. 4; Ms. Colette Fortin, DM50, p. 1; Mr. Jean-Claude Florence, DM193, p. 8; Mr. Jacques Clermont, DM224, p. 9; Mr. Jean-Guy Allard, DT15, p. 37.

participant specified that “the company will become the biggest taxpayer in the city, and therefore support a large portion of the services that are offered to citizens, thus probably improving our quality of life” (Ms. Christine Dubé, DM138, p. 3). Many were of the opinion that the tax revenues for the City of Lévis and the two levels of government represent sizeable sums which can be reinvested into the upkeep and development of infrastructures and services[1]. Regarding this aspect, one participant emphasized the importance of the economy when improving quality of life:

> If we want to improve our community’s social component, our services and our jobs for young people, we must unfortunately or fortunately think about the economy. How will we be able to reach our collective goals without funds, without development, without consolidating our local and provincial economy? Our regional economy is stable and growing slowly. Now, with Rabaska, we have a very important development opportunity.
> (Mr. Steve Boutin, DM151, p. 1)

The Mouvement populaire À bon port stated that Rabaska would also contribute to the community’s well-being by financing the Lévis mass transit network: “milestones were set out by the proponent in this respect through his written approval for financial aid to develop mass transit in the Lévis community. As such, this is very promising for the future” (DM547, p. 8).

The impacts apprehended on tourism

On the regional level, some participants apprehended impacts on tourism after building an LNG terminal on the St. Lawrence River’s banks. Some believed that building such a terminal at Lévis “would diminish our cultural environment, and by the same token, the internationally recognized tourism component of our destination” (GIRAM, DM461, p. 51). Several believed that the cruise and tourism industry in Vieux-Québec and on the île d’Orléans could experience a decrease in traffic. According to the North American Tourism Research Institute Inc. (NATRI), “the presence of an LNG port compromises not only a major part of our tourism appeal, but also opens the door to portuary expansion, which would drastically confine our tourism and historic richness to a lower class, something which is unacceptable for the regional tourism industry” (DM297, p. 6).

1. Mr. Denis Galipeau, DM104, p. 4; Mr. Jean-François Desjardins, DM105, p. 1; Société de développement économique de Lévis, DM545, p. 11; Mr. Claude Caron, DM33, p. 2; Poitras Service d’exposition, DM361, p. 1; Mr. Mathieu Lafontaine, DM291, p. 2; Mr. Gilles Bégin, DM39; Mr. Eddey Charbonneau, DM82, p. 2; Mr. Sylvain Martineau, DM101, p. 1; Mr. Jacques Breton, DM215, p. 2; Mr. Mario Rochette, DM327; Qualité Granit inc., DM335, p. 2; Mr. Jean-Yves Goineau, DM386; E. Hyland, DM403; Mr. Thomas Enright, DM527, p. 1; Mr. Yan Vallé, DM658, p. 1; Ms. Nancy Grégoire, DM667, p. 1; Mr. Stéphane Damphousse, DM657, p. 2.

The Société de développement économique de Lévis believed, for its part, that the project "would have little impact on regional tourism, as the Rabaska facilities would be far from tourism attractions, or because they would be located outside of the river's edge" (DM545, p. 20). Along the same lines, one participant added that the presence of an LNG terminal wouldn't stop tourists from visiting the city of Québec (Mr. Patrick Langlois, DM152, p. 1).

As for local tourism, some participants questioned the project's impacts: "what will be the long-term tourism impacts of integrating an industrial component which is incompatible with the site's vocation? Will highway 132 gradually lose its many appeals for passing tourists? What would be the impact on the occupancy level of the area's three camping sites? (GIRAM, DM461, p. 88). One participant was also worried about "lower occupancy levels in the camping sites nearby during the construction phase, due to disturbances" (Mr. Michel Riou, DM370, p. 1). Like the NATRI, the tourism and historic richness of the south-east coast of Lévis "has an aesthetic value whose economic spinoffs largely outweigh the direct (and even more indirect) revenues that an LNG port can supply, as 66 percent of its revenues are shared with foreign companies" (*ibid.*).

From another point of view, the Société de développement économique de Lévis believed that tourism attractions "should not suffer from the presence of the LNG terminal as it will not be visible from any of them […] the potential for economic losses stemming from fewer visitors to the attractions located close to the terminal will be, in the end, not very significant" (DM545, p. 21). Moreover, in its opinion, most tourists in Lévis and surrounding areas come to visit family, which would have little influence on local tourism levels.

The impacts apprehended on the market value of residences

Some participants[1] living in the area, as well as some residents of the île d'Orléans facing the project feared a loss of property value for their homes after the LNG terminal has been built, and also because of related disturbances. Furthermore, one participant was especially worried about the potential impact of the pipeline on her land: "the *usus fructus* of my possessions is compromised, as the value of the land changes with such a layout. Who would want to buy a land that has been affected this way? This project will prevent my future inheritors in purchasing a land that is free

1. Ms. Hélène Létourneau and Mr. Daniel Cantin, DM27, p. 2; Ms. Renée Dupuis, DM191, p. 3; Mr. Louis Guilmette, DM10, p. 11; Ms. Louise Maranda, DM596, p. 10; Ms. Fabienne Gagné, DM376, p. 2.

from perpetual constraints, which would prevent the enjoyment of the land taken by the companies" (Ms. Kathleen Brochu, DM15, p. 2).

Some participants stated that should their residences be sold, replacing them with another of a similar value and in a comparable location would be difficult in the current real estate market:

> In general, all of the people who live in our area own plots of land of 10,000, 20,000, 30,000 sq. ft. and more; many have views on the river and good neighbours; it's a tightly knit community; and now, they are being asked to go I don't know where, in a plot that measures 6,000 sq. ft.. Where are you going to find that?
> (Mr. Jean-Guy Allard, DT15, p. 38)

In addition, one participant evoked the impact that moving will have on his life plan: "my retirement plan has come to an end, as I will be forced to take on another mortgage. I know full well that I will never be able to purchase another home with the equivalent land at the same price" (Mr. Jacques Côté, DT21, p. 73 and 74).

Area residents emphasized the value of the human capital they invested on their homes and land (time, effort and energy) (Ms. Annie Marcoux and Mr. André Voros, DM631, p. 8). In this respect, some expressed their total refusal to sell their properties: "Mr. Kelly will never offer me enough money to obtain what I own right now (Ms. Fabienne Gagné, DT21, p. 2). To this effect, the GIRAM was of the opinion that, "for the proponent, everything is for sale. If you are stressed because you live next to a terminal or if you fear that your quality of life will suffer, then you are offered a nice plan to sell your home and move. Forget the fact that you have been living there for many generations!" (Mr. Gaston Cadrin, DT16, p. 11).

Some participants disagreed with the financial compensation measures proposed by the proponent with respect to the sale of their residences. Some wanted to obtain the replacement value rather than the market value. Should the project get the green light, one participant suggested that Rabaska purchase "the residences without delay and pay a premium of at least 25 percent more than an assessment performed by an independent appraiser" (Mr. Louis Guilmette, DM10, p. 12).

Impacts on the population and its environment

Many participants described the possible negative impacts from the project on the local community's living environment as follows: impacts on the population's security; on their quality of life and on human health; impacts through visual and sound disturbances; psychosocial impacts; moving and being uprooted.

The technological risks

The potential risks which could be linked to the project regarding the population's security in the event of an accident were the subject of many concerns. Several participants believed that this was a crucial aspect which must be taken into consideration: "security is certainly one of the major factors of acceptability for this project […] it isn't enough that the facilities be totally safe, this must be proven fully and completely" (Démocratie Lévis, DM371, p. 6) and, "regarding the population's well-being, nothing is more important than protecting it against health and safety risks, and this to the highest degree possible" (Association des manœuvres interprovinciaux, DM35, p. 4).

In addition to the general security aspect of area residents and users close to the planned site when building the LNG terminal and the pipeline, maritime transport was specifically identified as a source of worry for several participants. The proponent's risk assessment and risk management were also aspects which were discussed.

The security of the area's residents and other users

The project's potential realization was seen as a "time bomb" or even as a "Sword of Damocles" hanging over their heads[1]. It also gave some of them a feeling of helplessness, as they felt that the proponent was deciding their fate: "we are experiencing a great deal of insecurity at this time over this project, which has poisoned our lives" (Ms. Annie Lacharité and Mr. Pierre Pinette, DM12).

In spite of the technical sophistication of the facilities and the security measures that the proponent plans on implementing, several believed[2] that the project will not be free from human error, technical malfunctions or disasters which could occur. According to some, "if people have to live while worrying that an accident could occur, then that is no way to live" (Ms. Johanne Delaunais and Mr. Pierre Martel, DM59). For others, the fact that their insurance premiums may increase because of the project proved that it poses a real risk that is not insignificant (Mr. Louis Guilmette, DM10, p. 11; Mr. François Viger, DM348, p. 2).

Many participants were of the opinion that the project's planned site is too close to inhabited areas and that the security or exclusion perimeter established by the

1. Mr. Jacques Jobin, DM18, p. 1; Ms. Francine Robin and Mr. Claude Filion, DM13, p. 2; Mr. Philippe de le Rue, DM423, p. 4; Ms. Pauline Mercier, DM577, p. 2.
2. Ms. Lucette Hade, DM559, p. 9 and 17; Mr. Benoît Bouffard, DM31, p. 4; Ms. Annie Marcoux and Mr. André Voros, DM631, p. 12; Mr. Normand Gagnon, DM155, p. 1.

proponent is much too restricted[1]. They believed that the project should not be built close to Levis, the île d'Orléans or the city of Québec, and that it should be located several kilometres from these urban and semi-urban agglomerations. It was also suggested that such projects be built at sea, at a distance from the shores (Ms. Fabienne Gagné, DM376, p. 3; Mr. Bernard Vachon, DM427, p. 3; Ms. Line Caron, DT21, p. 18). The planned pipeline was also a source of concern for the Comité Gare au gazoduc which feared "the devastating effect that an explosion could have in a populated area like ours" (DM589, p. 2).

Many questioned the use of the 5 kW/m^2 thermal radiation level in the event of a fire as a criterion to establish the exclusion area around the project's facilities. For one participant: "the public's exposure criteria should instead reflect a thermal radiation level that doesn't result in any detrimental effects, even if someone is exposed in a continuous fashion" (Mr. Gaétan Paradis, DM590, p. 4). In this respect, they believed[2] that a lower thermal radiation level should be used in order to obtain a greater exclusion area. Regarding the pipeline, the Agences de la santé et des services sociaux de la Chaudière-Appalaches et de la Capitale-Nationale recommended that its layout be modified so that the surrounding residences be "sheltered from the domino effect area in the event of a major break followed by fire", which would correspond to the limit of the 8 kW/m^2 thermal radiation level (DM602, p. 31).

Some recalled that Cacouna Energy, the proponent of another LNG terminal project, had rejected the project site studied for security reasons, and as such did not understand why Rabaska had chosen it (Mr. Pierre-Paul Sénéchal, DM414, p. 26; Mr. Mathieu Boutin, DM305, p. 2; Ms. Louise Maranda, DM596, p. 5). Others were of the opinion that the City of Lévis already has enough facilities which represent high risks for its population, specifically the Ultramar refinery (Comité Gare au gazoduc, DM589, p. 1; Mr. Benoît Bouffard, DT18, p. 49).

One participant asked: "would it not be commendable to build the first project far from residences and wait a few years to see what the real impacts are […]. We could then assess the relevance of this type of project for the province and implement adequate regulation to protect its citizens" (Mr. Louis Bastien, DM108, p. 3). The Alliance pour

1. Mr. Louis Guilmette, DM10, p. 7 and 12; Ms. Caroline Mongeau, DM30, p. 6; Mr. Jean-Marc Létourneau, DM37; Mr. Michel Arsenault, DM604, p. 4; Mr. Gaétan Paradis, DM590, p. 2; Mr. Dominic Boutin, DM198; Ms. Lucie Létourneau, DM200, p. 4; Ms. Diane Martel, DM205, p. 3; Ms. Suzanne Rochon, DM536, p. 5; Ms. Micheline Gagné, DM287, p. 8; Ms. Céline Drouin, DM362; Ms. Sandra Bouchard, DM367; Mr. Rogers Gonthier and Ms. Aline Provençal, DM390; Ms. Josée Belles-Isles, DM421; Ms. Chantal Gilbert, DM432; Ms. Claire Pageau, DM563, p. 4; Ms. Michèle Lépine and Mr. André Dubois, DM573, p. 3; Mr. Hans Brandl, DM550, p. 3 and 5; Mr. Jean-Christian Roy and Ms. Guylaine Piché, DM617, p. 1; Ms. Chantale Jean, Mr. Olivier Lajoie and Mr. Gaétan Lajoie, DM60, p. 1; Mr. Benoît Grenier, DM363; Mr. Roger Boutin, DM698.

2. Ms. Pierrette Bélanger, DM302, p. 24 and 25; Association pour la protection de l'environnement de Lévis, DM459, p. 14; Mr. Sylvain Castonguay, DM578, p. 8; Agences de la santé et des services sociaux de la Chaudière-Appalaches et de la Capitale-Nationale, DM602, p. 57 and 82.

une gestion des interfaces industrielles-résidentielles responsable believed that the province of Québec should enact a regulatory framework to ensure "a safe distance by providing transition zones around the industrial facilities" and that it should impose "a moratorium on all construction that would result in a residence being within the impact radius of the worst alternative scenario for a facility with major industrial accident risks" (DM44, p. 2 and 3). Moreover, some participants were convinced that the precautionary principle should apply in this case and that the project should not be authorized at this location[1].

In addition to the project's potential risks for residents living close by, some concerns addressed other area uses, as well as sensitive elements that can be found in it. This is the case for the École Sainte-Famille located close to the St. Lawrence River's shore, which was concerned about the security of its students[2]. The security of boaters was another cause for concern for some, who questioned the security measures that would be implemented in the area (Club de kayak de mer Le Squall, DM1; Mr. Patrick Plante, DM382, p. 21; Stratégies Saint-Laurent, DM557, p. 9). One participant was worried for the municipal park near the planned jetty (Mr. Louis Guilmette, DM10, p. 6). Others were concerned about the section of Highway 132 that is slated to pass over the cryogenic line, between the jetty and the land facilities of the planned LNG terminal, as well as Highway 20 nearby, which instilled reservations regarding the security of those who use these infrastructures (GIRAM, DM461, p. 18; Mr. Sylvain Castonguay, DM578, p. 9; Ms. Pierrette Bélanger, DM302, p. 22; Ms. Lise Thibault, DM436, p. 43 and 44).

Being favourable to the project, several participants[3] were of the opinion that its related risks must be put into perspective, as danger is part of everyday life. For one participant, "when you think about it, are there any activity sectors nowadays which, while providing major economic contributions, are totally free from danger? (Mr. Michel Gobeil, DM70, p. 1). Others maintained[4] that the project comprises technology that is known, and has been tried and tested for 40 years, while being constantly improved. According to the International Brotherhood of Electrical Workers:

1. Corporation de défense des droits sociaux de Lotbinière, DM3, p. 2; Table des groupes populaires, DM6, p. 2; Ms. Yolande Lépine, DM66, p. 2; Ms. Gemma Pellerin, DM142; Mr. Richard Gagné, DM143; Ms. Hélène St-Pierre, DM145; Mr. Yves St-Pierre, DM147; Réseau du Forum social de Québec–Chaudière-Appalaches, DM438, p. 3; Mr. Gilles Castonguay, DM630, p. 38; Ms. Catherine St-Pierre, DM182; Mr. Marcel Gaudreault, DM585, p. 9.
2. École Sainte-Famille, DM146, p. 2; Ms. Louise Plouffe, DM306; Mr. Jean-Claude Dupuis, DM307, p. 1; Mr. Roger Lalonde, DM308; Mr. Jeannot Goyette and Ms. Jacinthe Roy-Goyette, DM309; Ms. Chantal Genesse-Paquet, DM310; Ms. Thérèse Lemieux, DM312; Mr. André Lambert and Ms. Nathalie Lambert, DM311; Mr. Gaétan H. Morin, DM632; Ms. Irma Maria Crosara, DM639.
3. Mr. William Keays, DM55, p. 3; Mr. Régis Cantin, DM274; Mr. Christian Lamontagne, DM531, p. 2; Mr. Jean Lamontagne, DM52, p. 2; Mr. Jean-François Cellard, DM79, p. 1.
4. Mr. Michel Bernard, DM167, p. 2; Mr. Michel Couture, DM223, p. 3; Mr. Serge Larouche, DM513, p. 1; Association of Consulting Engineers of Quebec, DM556, p. 10.

> We are perfectly aware of the fact that risks will remain, which in our opinion will be calculated risks that are acceptable considering the evolution of monitoring and automation technology. It is increasingly easier to master processes used in industry by using controllers and sophisticated surveillance systems.
> (DM46, p. 7)

In this respect, some emphasized that the area already comprises facilities which present risks for the population, such as the Ultramar refinery, whose operations have proven to be reliable in terms of security for many years[1]. Others gave the example of the Everett LNG Terminal located in the suburbs of Boston, which has thousands of people living nearby (Mr. Jean-Paul Montmigny, DM319, p. 3; Mr. Steve Goulet, DM486, p. 4).

Marine security

Many participants were worried about the risks related to transporting LNG with tankers. Several were worried about the uncommon navigation conditions of the St. Lawrence River: "no existing terminal deals with all the particular aspects of the St. Lawrence River" (Municipality of Saint-Jean-de-L'Île-d'Orléans, DM149, p. 2) and "this terminal would in fact be the only one in the world to be built so far inland on a continent" (Mr. Pierre-Paul Sénéchal, DM414, p. 3). Some mentioned more specifically the manoeuvres of LNG tankers in narrow and shallow areas, with unfavourable winds and currents, winter conditions which result in ice forming as well as the dense ship traffic already occurring in this seaway[2].

The traverse du nord is a sector of the river which was especially worrisome because of the narrowness of the seaway and its proximity to the population of the île d'Orléans (Mr. Jacques Jobin, DM18, p. 2; Municipality of Saint-Jean-de-L'Île-d'Orléans, DM149, p. 2). In this respect, one participant recommended allowing LNG tankers to navigate only downstream from the Traverse du Nord (Mr. Denis Latrémouille, DM462, p. 60). Another element that was considered by the Amis de la vallée du Saint-Laurent dealt with the manoeuvres that these large tankers would have to execute when arriving at and departing from the terminal. They were worried that these manoeuvres "could pose specific and significant risks or could disturb the displacement of other ships" (DM551, p. 13). Another participant was of the opinion that the annual frequency of strong winds which could prevent the berthing of the LNG

1. Ms. Claire Rousseau, DM135, p. 2; Mr. Pierre Julien, DM133; Ms. Gilberte Lamontagne Dubé, DM128, p. 1 and 2; Excavations Lafontaine inc., DM292, p. 3; Ms. Carole Boucher, DM694; Mr. Charles Fortin, DM134; Mr. Claude Consigny, DM181.

2. Mr. Gilles Bernier, DM34; Ms. Madeleine P. Couture, DM111, p. 4; Ms. Denyse Rondeau, DM195, p. 2; Mr. Jacques Côté, DM141, p. 1 and 2; Mr. Sylvain Castonguay, DM578, p. 8; Mr. Jean Morin and Ms. Carole Gaulin, DM295, p. 1; Ms. Sandrine Louchart, DM349, p. 10; Ms. Michèle Roy and Mr. Ralph H. Nocon, DM45, p. 3; Mr. Rogers Gonthier and Ms. Aline Provençal, DM390.

tankers was underestimated by the proponent (Mr. Sébastien Blouin, DM424, p. 14). The Municipality of Saint-Jean-de-L'Île-d'Orléans expressed its concerns regarding the planned waiting area for LNG tankers close to the island: "since LNG tankers carry hazardous material, the municipality is preoccupied by the fact that this area is located less than 900m from residences on the banks" (DM149, p. 1 and 2).

One participant also believed that a security perimeter should be planned around the LNG tankers as their danger area moves with them, and they therefore become a risk for populations on the banks (Mr. Denis Latrémouille, DM462, p. 2). Moreover, even if he considered these tankers as well-built and properly maintained, "the other ships that sail in the seaway, and with whom they will have to coexist, won't be inspected" (*ibid.*, p. 57). Another participant recommended that "every person involved in operations related to these types of ships and facilities have the opportunity to benefit from relevant training […]. We must make sure that these people are sufficiently prepared and equipped to deal with emergencies before the first tankers berth at the terminal" (Mr. Mathieu Vachon, DM499, p. 1).

However, several participants believed that limited risks are part and parcel of maritime transport. In this respect, the Québec Port Authority was of the opinion that a safe coexistence is possible among the various types of navigation occurring in the area (DM552, p. 16 and 17). The Canadian Maritime Union stated that the LNG tankers are "known to be the safest and most reliable ships in the global fleet" (DM20, p. 1). The Société de développement économique du Saint-Laurent emphasized that the maritime approach has security advantages over other transportation methods as it has recorded lower accidents and spills rates than rail and road transportation (DM381, p. 5).

The Comité des utilisateurs du port de Québec stated that most factors which can influence navigation conditions are known in advance and "perfectly managed by river navigation specialists which are involved in the management of marine traffic close to the city of Québec" (DM281, p. 2). Moreover, some emphasized that the legal framework, the procedures and the security measures that frame maritime traffic are strict (Ms. Julie Côté, DM139; Agences océaniques du Bas-Saint-Laurent ltée, DM185; The Shipping Federation of Canada, DM442, p. 2). Others added that maritime piloting and escorting LNG tankers with pilots who know the river's characteristics are excellent ways to reduce navigation-related risks in the area (Mr. Jean-Marc Boisvert, DM136, p. 2; Mr. Michel Pouliot, DM298, p. 5 and 6; Corporation des pilotes du Bas-Saint-Laurent, DM544, p. 10 and 11).

The risk assessment carried out by the proponent

Some participants disagreed with the risk assessment method used by the proponent. They believed that a probabilistic approach was favoured to the detriment of a deterministic approach (Mr. Normand Gagnon, DM155, p. 1; Ms. Lise Thibault, DM436, p. 38; Agences de la santé et des services sociaux de la Chaudière-Appalaches et de la Capitale-Nationale, DM602, p. 53). For one participant:

> There are two possible approaches for this field: the probabilistic approach, which consists in having a chance in X of a disaster occurring, and waiting for the disaster to take place before doing something and living with the consequences. […] The other approach is the deterministic one, which consists in: let's be preventative because an accident may occur. […] Doing what it takes to prevent something can also mean not building the terminal […].
> (Mr. Pierre Blouin, DM621, p. 13)

Several participants believed that the proponent underestimated the risks that completing the project represents, and the consequences that an accident could have on the population. For one of them, "the scenarios which were chosen by Rabaska do not seem to translate the scope of the risks which are inherent in the project" (Mr. Yves St-Laurent, DM377, p. 96 and 97). Various elements were deemed to not have been considered adequately when assessing risk, as was the case for terrorist acts or intentionally caused breaches in an LNG tanker[1]. In this respect, several questioned the size of the breach that could occur after a possible collision involving an LNG tanker, and the one which was used by the proponent to assess the consequences of such an accident. In their view[2], using a bigger breach would be more realistic and would result in more serious consequences than those found in the proponent's assessment.

Some were also preoccupied by the presence of Hydro-Québec high voltage transmission lines close to the planned facilities, and feared an incident related to an electric arc or an electrostatic discharge[3]. Others were worried about the risk of an earthquake occurring in the Charlevoix-Kamouraska area (Ms. Marie-Hélène Blanchet, DM416). According to one participant, "this active area is only 70 km to the north-east of the site being studied. […] A major earthquake could occur in the Lévis region,

1. Mr. Pierre Langlois, DM116, p. 2; Mr. Jacques Jobin, DM18, p. 4; Ms. Michèle Roy and Mr. Ralph H. Nocon, DM45, p. 5; Mr. Andrew Webb, DM58, p. 23 and 26, 36 and 37; Mr. Yves St-Laurent, DM377, p. 85 and 92; Mr. Martin Brandl, DM599, p. 1; Ms. Isabelle Pouliot, DM380, p. 10; Mr. Michel Duguay, DM601.
2. Mr. Pierre Langlois, DM116, p. 3 and 4; Mr. Denis Latrémouille, DM462, p. 52 and 53; Mr. Normand Gagnon, DM155, p. 8; Mr. Louis Duclos, DM458, p. 10; Mr. Michel Duguay, DM601, p. 3; Mr. Yves St-Laurent, Coalition Rabat-joie, DT19, p. 13.
3. Mr. Jean-Claude Gosselin and Ms. Adèle Bertrand, DM63, p. 6; Mr. Pierre Langlois, DM116, p. 5; Mr. Pierre-Paul Sénéchal, DM414, p. 17; Mr. Mathieu Boutin, DM305, p. 2; Mr. Gilles Castonguay, DM630, p. 36; Ms. Lucette Hade, DM559, p. 53; Mr. Gilles Bernier, DM34.

damage the LNG tanks and lines and cause major leaks" (Mr. André Vallières, DM647, p. 5 and 6).

Managing risks and emergency measures

For a large number of participants, it was crucial that all required measures be implemented to ensure the security of facilities and citizens, and that the project meet the most demanding security standards[1]. For many participants in favour of the project, risks and inconveniences can be managed[2]. According to another, "the secret is knowing how to control them, how to prevent danger and minimize impacts. It's the story of our lives" (Mr. Jean Lamontagne, DM52, p. 2). Some were confident that all required measures will be applied by the proponent (Mr. Steve Côté, DM280, p. 5; Groupe Giroux, DM184, p. 5; Mr. Sylvain Marcoux, DM92, p. 1). The City of Lévis underscored the importance of the emergency measures plan:

> […] its goal is to ensure the optimal coordination among various partners regarding security. This document specifies the respective responsibilities of the stakeholders, and comprises a "minute-by-minute" action plan. This emergency measures plan is regularly updated according to actual experience, and it also serves as a reference point to identify personnel, training and equipment needs. (Ville de Lévis, DM315, p. 10)

The Municipality of Saint-Charles-de-Bellechasse underscored the fact that should an accident ever occur, it must be able to act effectively and safely, with worrisome security elements being mainly related to the harmonization of the municipality risk coverage actions plans (DM99, p. 3 and 4). The Bellechasse MRC and the Centre local de développement de la MRC wanted the Municipality of Beaumont to receive financial compensation "should additional equipment be required to ensure the security of its territory" (DM560, p. 8).

Moreover, some participants wondered about the effectiveness of the emergency measures planned. The Comité Gare au gazoduc was deeply concerned that the City of Lévis still hasn't completed its fire security action plan, while it has reached citizen security agreements with the proponent (DM589, p. 4). For one citizen:

1. Municipality of the village of Sainte-Pétronille, DM7, p. 4; Mr. Christian Jobin, DM8, p. 1; Pôle Québec Chaudière-Appalaches, Chambre de commerce de Québec et Chambre de commerce de Lévis, DM465, p. 32; MRC de Bellechasse et Centre local de développement de la MRC, DM560, p. 7.
2. Mr. Gilles Drouin, DM374, p. 3; Mr. Rolland Paquet, DM470, p. 2; Mr. Réal Gagnon, DM477; Mr. Yannick Courtemanche, DM479, p. 2; Mr. Guillaume Tremblay, DM483, p. 2; Mr. Jocelyn Jalbert, DM487, p. 3; Mr. David Brosseau, DM488, p. 2; Mr. Pierre Bolduc, DM493, p. 2; Mr. Marc Labonté, DM502, p. 2; Mr. Gilles Paquet, DM507, p. 2; Mr. Gaivens Ross, DM510, p. 2.

> Should an accident occur, here's what the emergency measures look like: run fast, hide in your homes, and close your windows. Is this a responsible attitude to have when dealing with a population? […] If effects occur on humans as quickly as in 20 or 30 seconds, is it possible to have good reflexes in such a short period of time?
> (Ms. Louise Maranda, DM596, p. 11)

One concern also dealt with the emergency measures planned for the île d'Orléans, as one participant was deeply concerned that an accident requiring the evacuation of island residents had not been considered: "the fact that the proponent believes such scenarios cannot occur is not a guarantee that they won't" (Ms. Renée Dupuis, DM191, p. 3 et 4). The Agences de la santé et des services sociaux de la Chaudière-Appalaches et de la Capitale-Nationale also wondered about the capacity of the regional community health network to act effectively should an accident affecting île d'Orléans residents occur, as emergency services are far away and there is only one access to the island (DM602, p. 58).

Generally speaking, a nurse from the region believed that the proponent should simulate a major accident with many victims, in order to establish the capacity of hospital services to correctly deal with the consequences of such an event. In her opinion, one must always plan for the worst and prepare in advance (Ms. Isabelle Pouliot, DM380, p. 10 and DT28, p. 45 to 47). Furthermore, there were doubts regarding the application of the security measures planned by the proponent:

> Who is going to monitor the compliance of commitments made, other than those contained in signed agreements, i.e. during the construction phase, and especially during the operating phase? […] Bypassing certain security standards or not complying in full can help save a lot of money when the stakes are high.
> (Mr. Jacques Clermont, DM224, p. 7 and 8)

According to another participant, "this follow-up should be performed by an independent and especially unbiased organization (Mr. Michel Barras, DM97, p. 3). For the Pôle Québec–Chaudière-Appalaches, la Chambre de commerce de Québec et la Chambre de commerce de Lévis, this surveillance is the government's responsibility and it "mustn't let up this required monitoring during the project's lifetime" (DM465, p. 34).

The Conférence régionale des élus de la Chaudière-Appalaches supported the proponent's intention to be part of the Comité mixte municipalité-industrie (CMMI) of Lévis: "similar experiences with such committees have demonstrated their great effectiveness in reassuring the population living close to sites at risk. Moreover, the CMMI comprises experts from various sectors, which greatly reduces the risks that are inherent in this type of operation" (DM534, p. 9). It also considered that adjacent municipalities, including Beaumont, would benefit from taking part in CMMI. The MRC

de Bellechasse and the CLD de la MRC recommended that a representative designated by the MRC de Bellechasse be asked to be part of this committee (DM560, p. 8).

The quality of life and health of residents living nearby

Several participants related various concerns regarding the project's possible impacts on the noise environment, atmospheric emissions and dust, as well as night time brightness. Some residents[1] feared that their living environment would be disrupted, and apprehended the project's impacts on their quality of life. Moreover, some concerns were related to the project's impacts on the population's health. Some participants also thought that health aspects had been underestimated in the impact study (Ms. Isabelle Pouliot, DM380, p. 3; Mr. Éric Tessier, DM600, p. 14).

Regarding quality of life, some residents[2] specified that one of the major aspects which had motivated them to live in the area was that it was peaceful. The project's arrival in this area, deemed to be peaceful by many, worried them: "the inevitable increase in traffic over a very long period of time […] will certainly result in constant noise, vibrations, dust, increased risks of accidents, heavy goods vehicle traffic, traffic in general, etc." (Ms. Annie Marcoux and Mr. André Voros, DM631, p. 5). Several were of the opinion that the noise impact will be far greater than the one assessed by the proponent:

> There is a problem of expected, stated and recognized noise excesses during the construction phase, mainly for the jetty. The population doesn't have any protection against noise excesses, and if the project gets the green light, citizens will have to suffer consequences to their health, which have been identified as harmful to human health by the international scientific community.
> (APPEL, DM459, p. 13)

Regarding noise impact, the Agences de la santé et des services sociaux de Chaudière-Appalaches et de la Capitale-Nationale specified that "the ambient noise environment expected for residential neighbourhoods surrounding the Rabaska LNG terminal facilities will likely result in negative impacts on health, such as disturbing the sleep of residents, which can, in turn, result in a series of other latent effects (DM602, p. 78). The École Sainte-Famille located nearby was especially sensitive to the noise and peacefulness aspects, to ensure the optimal learning environment for its students (DM146, p .5).

1. Ms. Lucie Létourneau, DM200, p. 3; Mr. Michel Riou, DM370, p. 2; Les AmiEs de la terre de Québec, DM625, p. 51 to 59; Agences de la santé et des services sociaux de Chaudière-Appalaches et de la Capitale-Nationale, DM602, p. 33 to 48; Ms. Céline Drouin, DM362, p. 1.
2. Mr. Louis Bastien, DM108, p. 2; Mr. Rosaire Gauthier, DM412, p. 4; Mr. Jean-Guy Allard, DM24, p. 1; Ms. Louise Cazelais Côté, Mr. Réal Côté and Ms. Stéphanie Côté, DM177, p. 2; Ms. Hélène Létourneau and Mr. Daniel Cantin, DM27, p. 2.

Some participants[1] were especially concerned by the air quality aspect during the construction phase, and its impacts on their health. They believed that the project will suspend dust and fine particulates in the air through the intensive movement of machinery, as well as by emitting GHGs, toxic substances and other contaminants. Furthermore, these concerns were also expressed by the Agences de la santé et des services sociaux de Chaudière-Appalaches et de la Capitale-Nationale, who thought that "one of the project's health risks is the dispersal of breathable particles stemming from dust which could be suspended in the air during the construction phase" (DM602, p. 42). More specifically, some residents living nearby were preoccupied by the impact of emissions from the flarestack, and the risks to human health (Ms. Hélène Létourneau and Mr. Daniel Cantin, DM27, p. 2; Ms. Edna Cantin, DM38, p. 1).

One participant also feared the impacts from the blasting slated for the construction phase:

> I am very worried about the various work planned if such a project is given the green light, among others the blasting and its impacts on our residences (the structure, the foundations), as well as the quality of water in our artesian wells, our septic tanks, our agricultural drains, the ambient air and noise levels.
> (Ms. Lucie Létourneau, DM200, p. 2)

Some residents were also opposed to the building of the project's planned waterworks. This possible mitigation measure was contested by some participants, who highlighted the current quality of the water coming from their personal wells (Ms. Josée Belles-Isles, DM421; Ms. Fabienne Gagné, DM376, p. 2; Ms. Pierrette Bélanger, DM302, p. 56). Furthermore, several residents wanted this privilege to be maintained:

> The citizens from Lévis east don't need the waterworks wanted by Lévis to accommodate Rabaska, as 84 of 101 owners signed a petition against the waterworks promised by Lévis in the memorandum of understanding signed with the proponent. Only 15 owners did not sign it, including four individuals who are having problems with their wells.
> (Mr. Martin Arsenault, DM629, p. 6)

Psychosocial impacts

Some participants[2] stated that building the project close to their residences would result in anxiety and stress, because of the negative perception of the terminal's security

1. Ms. Annie Marcoux and Mr. André Voros, DM631, p. 5 and 6; Ms. Lucie Létourneau, DM200, p. 3; Les AmiEs de la terre de Québec, DM625, p. 51 to 63; Ms. Louise Maranda, DM596, p. 15; Ms. Jocelyne Leclerc, DM429, p. 3.
2. Ms. Fabienne Gagné, DM376, p. 1; Ms. Denise Carpentier and Mr. Normand W. Ouellet, DM192, p. 1; Ms. Michelle and Mr. Pierre Lamoureux, DM586, p. 3; Mr. Louis Guilmette, DM10, p. 12; Ms. Louise Maranda, DM596, p. 7; Ms. Annie Lord, DM266, p. 2.

regarding its facilities and operations. Several residents from Lévis east and Beaumont have experienced intense emotions since the project was announced. One participant evoked the range of emotions undergone by some participants:

> […] these difficult emotions [anger, fear, sadness] are all stirred up in their various forms of expression: frustration, sorrow, deception, concern, anxiety and dread. Sometimes, the situation will give reason to hope, said hope then often being crushed by other elements. Rabaska is a powerful trigger of emotions that are painful, repetitive and hard to manage, because it threatens people's personal space and their deepest values.
> (Ms. Pierrette Bélanger, DM302, p. 36)

Some "people have become fragile and their concern is very evident" (Ms. Louise Maranda, DM596, p. 7). In this respect, the Agences de la santé et des services sociaux de Chaudière-Appalaches et de la Capitale-Nationale stated that people who live closer to the project's planned site have different psychosocial experiences than others. These individuals reported higher stress levels, as well as a greater degree of tension in their family, social or work relationships (DM602, p. 69).

Some compared the succession of events experienced since the project was announced, close to three years ago, to an aggression (Ms. Fabienne Gagné, DM376, p. 3). A doctor who was a participant elaborated a list of symptoms observed in the community:

> The aggression is present, and the list of symptoms which stems from it is long: fear, insecurity, concern, a feeling of injustice and social inequity, anxiety, distress, demoralization, hypochondria, sleep problems, various physical ailments, denial, defeatism, frustration, discouragement, anger, exasperation, distrust, feeling abandoned / betrayed or facing hypocrisy. All of the population within the target area has been affected at various levels, in accordance with each individual's defence mechanisms.
> (Mr. Jacques Levasseur, DM460, p. 8)

According to this participant, "it is obvious that financial compensation, the usual panacea of proponents, will not remedy this established fact" (*ibid.*). Another added that "our quality of life and health are priceless" (Mr. Marco Fortin, DM593, p. 1). One participant asked: "by what right do they have the ability to expropriate people against their will, or to buy them out by using the power of money?" (Mr. Rock Turcotte, DM445, p. 1).

Several residents living close by described how they felt torn between choosing to sell their residence or living with the disruptions linked to the projects and with the insecurity stemming from the fear of experiencing a major accident. One participant typified the dilemma that many of the area's residents were grappling with: "let's just

use our common sense, and imagine for 10 minutes that Rabaska would be built next to your home – what would you say then? […] It's easy to answer – move! And go where? We have been living on our farm for three generations, and eventually for four" (Ms. Edna Cantin, DM38, p. 1). The possibility of moving has made several residents feel insecure since the announcement of the Rabaska project (Ms. Louise Latulippe, DM196, p. 6; Mr. Jean-Guy Allard, DM24, p. 3). Some participants shared their experiences in this respect:

> For about the past two years a dark cloud has hung over our heads. […] When the possibility of this project was first announced, I felt like someone had just taken 28 years of our life and brushed us away from our wonderful life environment like a speck of dust. The feeling that inhabited us at that time could be characterized as a "state of shock". Even today we feel this latent cloud hanging over our heads.
> (Mses. Louise Cazelais Côté and Stéphanie Côté, and Mr. Réal Côté, DM177, p. 1)

Moreover, some participants saw the possible relocations as an involuntary uprooting of their community: "should the project get the green light, we would have no alternative but to move, thereby losing our dreams and our roots […] This would entail changing our living environment, losing our view of the river, our great open spaces, and for our children, changing schools and losing their friends" (Ms. Guylaine Bélanger and Mr. Roberto Caron, DM360, p. 2). Another added: "the compensation policy is more akin to an invitation to leave the area, if not an outright deportation order" (Mr. Roger Lambert, DM555, p. 1). In this respect, the GIRAM was of the opinion that, "regardless of the number of years that a person has lived on the land, they feel just as torn, just as uprooted, and experience the same stress that everyone in this population will experience" (DM461, p. 59). One participant compared this situation to the one surrounding the construction of Mirabel Airport in the 1970s, where "the local population, forced to sell lands and homes, some of which were family farms, felt torn and uprooted from the living environment, which resulted in significant difficulties on personal, family, social and professional levels" (Ms. Louise Latulippe, DM196, p. 6). In the case in point, this participant feared that similar problems will be caused by these relocations.

From a collective point of view, some participants believed that the time lapsed between the project's announcement and the importance of the social split has led to a deterioration in the local community spirit. According to one participant, "some opposing views have resulted in interpersonal family and social conflicts, and continue to fuel major tensions within municipalities, between municipal councils and citizen groups, and within communities themselves" (Ms. Pierrette Bélanger, DM302, p. 38). From the standpoint of the Agences de la santé et des services sociaux de Chaudière-Appalaches et de la Capitale-Nationale, "positions which hardened into 'winners' and 'losers' will result in harmful consequences, which are often greater than

the expected disturbances" (DM602, p. 83). Regardless of the approval or rejection of this project, the consequences of this social split will remain, because "there is already a profound split within the population, and whether the project sees the light of day or not, this split will remain for years to come" (Municipality of Beaumont, DM619, p. 50). Another participant added:

> Since March 2004, this project has left scars on our citizens which will probably never go away. Regardless if you are for or against it, I don't know any citizen who could state that the social fabric has not been harmed in the Ville-Guay/Beaumont region.
> (Mr. Yves St-Laurent, DM377, p. 187)

Lastly, some participants wondered how the social cohesion could be rebuilt within the community. For one of them, the bridge between the local community and the proponent will be hard to rebuild:

> If this project gets the green light, the area's population will feel beaten and betrayed. […] Many will leave the area, but the wounds will never disappear. The follow-up committee proposed by the proponent to take charge of this matter and arrive at solutions will in no way appease any of the bitterness and conflicts, and will quickly become a source of strife in itself. Things will only get harder.
> (Mr. Jacques Levasseur, DM460, p. 9)

Impacts on the natural environment

Several participants, becoming more and more conscious of how fragile ecosystems are and how human activity causes environmental degradation, were concerned by the project's impact on the natural environment (Mses. Louise Cazelais Côté and Stéphanie Côté, and Mr. Réal Côté, DM177, p. 2; Ms. Mélanie Jalbert, DM437, p. 1; Mr. Pierre Morency, DM434, p. 1). In this respect, one resident of the île d'Orléans quoted a Cree saying: "when the last tree falls, the last river is poisoned, and the last fish is caught, only then will you realize that you can't eat money" (Ms. Yvonne Tschirky-Melançon, DM524, p. 20). For another participant, "whether we like it or not, we are all involved collectively in a fight to save our immediate environment. It is being degraded on a yearly basis exponentially, given that our efforts to protect it are weak and totally insufficient" (Mr. Claude Lapointe, DM197, p. 2). Québec solidaire underscored the necessity of taking into account the cumulative impacts of human activity on the environment:

> It can seem harmless to nibble a few forest hectares here, backfill some hectares of wetland there, put concrete on a couple of dozen meters of shoreline […] Very little consideration is given to the cumulative effect of various industrial projects on a provincial, regional or even local scale, and often we have no idea of the immense pressures that this can have on various ecosystems.
> (DM466, p. 13 and 14)

The main elements addressed dealt with the aquatic environment, wetlands, the flora and forest stands.

For several participants, the St. Lawrence River is an exceptional ecosystem, and the aquatic fauna it contains must be preserved. Some participants feared that the good fishing spots which can be found there will be destroyed (Mr. Marcel Boutin, DM411). Others talked about the presence of seals in the area (Ms. Michèle Roy and Mr. Ralph H. Nocon, DM45; Ms. Louise Latulippe, DM196, p. 4). The collectif *Mémoire du fleuve* described it in the following words:

> […] I can remember exactly at this time of the year […] the île d'Orléans of my youth, in the middle of the 1940s, its waters suddenly beginning to swell early in the morning, at daybreak. In reality, the swelling was patches of belugas and white porpoises migrating, going upriver among the vermilion-blue vapours of the subzero waters. I am writing these lines and remembering autumn tides which gave us a gift of six hundred eels in only one fishing box. We will never see this again […] the St. Lawrence is a unique biological organism.
> (DM570.1, p. 2)

The turbidity which would be caused by the construction work in the aquatic environment, and the shoreline erosion which could take place with the passing of LNG tankers were some of the concerns described about the St. Lawrence River fauna (Ms. Pierrette Bélanger, DM302, p. 55; Ms. Jeanne d'Arc Dubé-Lavoie, DM373, p. 1). Some participants also believed that the effluent from the project's facilities could contribute to the degradation of fish habitats by changing the physicochemical properties of the environment. According to one of them, "no information was provided on the noxiousness of various substances included in the effluents, specifically for the marine fauna and flora. The proponent must absolutely perform a follow-up" (Ms. Jeanne d'Arc Dubé-Lavoie, DM373, p. 7). On this topic, another participant repeated that the area affected is a migratory corridor upon which the indirect survival of many fish species depends, some of which are endangered (Ms. Marie-Julie Roux, DM628, p. 2). More specifically, the Conseil régional de l'environnement de la Capitale-Nationale believed that the project could harm the reintroduction of the Striped Bass in the St. Lawrence River, which began in 2001, as the chosen site to build the jetty was once a reproductive migratory route for this species, which disappeared from the estuary at the end of the 1960s (DM74, p. 10).

Impacts were also apprehended on other water bodies in the area, specifically the ruisseau Saint-Claude, whose derivation has been planned as it crosses the site chosen to build the LNG terminal's land facilities. Some participants were worried about the resulting degradation of water quality and the disruption of habitats, and underscored the fact that the mouth of this waterway comprises spawning areas for endangered fish species (Ms. Annie Lebel and Mr. Hubert Pelletier-Gilbert, DM160, p. 4; Ms. Pierrette Bélanger, DM302, p. 56; Sierra Club of Canada, DM699, p. 12 and 13). Moreover, the Comité de restauration de la rivière Etchemin expressed its concern regarding the planned pipeline crossing in this spot. It believed that the proponent might not be able to use directional drilling to put it in place, as the proponent of another pipeline project was unable to use this approach to cross the same body of water at four kilometres from the chosen site: "the other types of processes are more damaging for the body of water. Moreover, the risky use of directional drilling could result in the leaking of noxious products in the river, which would also be very harmful to the environment" (DM553).

The Amis de la vallée du Saint-Laurent believed that the impacts on the natural environment, specifically on the river and its banks, should be compensated by broader and stronger measures. In their view, "it would be better if initiatives […] were proposed and implemented in close and relatively similar environments, specifically with the help of regional specialists" (DM551, p. 25 and 26). The Comité ZIP de Québec City et Chaudière-Appalaches added that the compensations for the loss of fish habitats should target the Greater city of Québec region, and not just the south shore (DM636, p. 11). The Groupe Océan inc. was of the opinion that building the submerged structures should be seen as a gain which would become "an excellent spawning area, where aquatic flora and micro organisms (krill, phytoplankton, zooplankton, etc.) which fish feed upon would proliferate" (DM316, p. 8).

Several participants[1] were deeply concerned about the loss of wetlands which would be brought about by the project's completion, specifically the tourbière Pointe-Lévis, whose ecological value was underestimated by the proponent, according to some.

The Comité pour la conservation des tourbières de Lévis underscored the importance of preserving wetlands: wetlands represent extremely valuable ecosystems and economic assets; goods and services which contribute to the well-being of humans everyday" (DM521, p. 7). The Comité reported the presence of marshes both on the site chosen for the LNG terminal's land facilities and on the pipeline layout, and were deeply concerned about the impacts the project could have on these environments. It

1. Ms. Céline Létourneau, DM594, p. 5; Ms. Sylvie Pharand, DM413, p. 1; Ms. Annie Lebel and Mr. Hubert Pelletier-Gilbert, DM160, p. 4; Mr. Gilles Labrecque and Ms. Monique Guay, DM190, p. 2; Sierra Club of Canada, DM699, p. 10.

underscored the fact that the loss of a marsh cannot be compensated by creating another: “since it is impossible to move marshes, the authors ask the proponent to move his facilities into ecosystems that have less environmental value” (*ibid.*, p. 3 and 4). The Comité ZIP de Québec et Chaudière-Appalaches also believed that adequate mechanisms should be put into place to protect wetlands. It also proposed to protect the wetlands targeted for the real estate expansion in the area as a compensation measure (DM636, p. 10).

Some participants were interested in several endangered species of flora found on the St. Lawrence River’s banks, in the area which would be affected by the project. They emphasized that some of them are very rare, being found only in the river’s estuary, and they believed that protecting these plants and their habitats is essential (Ms. Annie Lebel and Mr. Hubert Pelletier-Gilbert, DM160, p. 3; Ms. Gisèle Lamoureux, DM686.1; Sierra Club of Canada, DM699, p. 8). The Association pour la protection de l’environnement de Lévis believed that transplanting species which are affected isn’t an appropriate mitigation measure in this respect (DM459, p. 33), while the Conférence régionale des élus de la Chaudière-Appalaches recommended “conducting a study to quantify the loss of floristic habitats and, if required, that the proponent commit to taking part in a protection program for another threatened site in order to compensate for the losses” (DM534, p. 10).

According to one participant, “it’s an irreplaceable component. We cannot recreate such a habitat, and we cannot replace these vulnerable or threatened species. […] I really don’t see any possible satisfactory compensation” (Ms. Gisèle Lamoureux, DM686, p. 26). She believed that it was necessary to “reject the project for this site or for whichever bank of the fresh water estuary between Grondines and Saint-Jean-Port-Joli” (DM686.1). Other participants were of the opinion that “shoreline construction projects should be built in areas which have been made artificial, and not those which are still intact” (Ms. Annie Lebel and Mr. Hubert Pelletier-Gilbert, DM160, p. 3).

Moreover, one participant specified that the proponent omitted to consider a tree plantation that is more than ten years old in his project’s deforestation assessment. In his opinion, the loss of habitat and wood materials would be tangible and the planned berms to mitigate the project’s visual impact could not replace the environmental value of these forest stands (Mr. Pierre Cadorette, DM522, p. 4 and 13). The Chambre de commerce de Lévis supported the proponent’s intention to reforest areas that are equivalent or greater than the area cut down, which by the same token would contribute to improving the landscape (DM611, p. 12). Another participant emphasized that such a project could have positive impacts on a greater scale by creating revenue streams for the government levels, which could be invested in the

environment's quality: "our forests are one of our greatest renewable resources, but they need our help to continue to meet our needs, and it's thanks to a rich and prosperous economy that we will find the means to fulfill our aspirations" (Mr. Mathieu Lafontaine, DM291).

The project's social acceptability

Many participants came to assess the motivations and factors which justify accepting or rejecting the project under study. Without a doubt, the aspect of the project's social acceptability transcended the overall debate during the public hearings. For some, social acceptability represents a determining factor in the project's success as "the proponents have little chance of succeeding if their project can't win the support the local populations" (Mr. Yves St-Laurent, DM377, p. 13). In this respect, Démocratie Lévis recalled the importance of social acceptability when accepting or rejecting large-scale projects:

> The social acceptability of a project is now an integral part of the decision-making process to build a new project in an inhabited area, especially if this project is major in scope and has impacts which are measured over several decades, as is the case with the Rabaska project […]. In point of fact, social acceptability is, in our opinion, a *sine qua non* condition for this Panel to approve a project […]. (DM371, p. 8)

Consequently, several participants shared their views on the factors which influence the definition of the project's social acceptability. More specifically, the following aspects were of interest: the project's justification and purpose, the collective interest, the ratio of pros and cons as well as the integration of sustainable development principles.

The project's purpose

For a large number of participants, there is a close relationship between the social acceptability and purpose of the Rabaska project. As such, the GIRAM was of the opinion that "one of the first conditions of a project's acceptability is its purpose. Regarding Québec's energy needs, the proponent is having a great deal of difficulty convincing people of his project's necessity" (DM461, p. 75). In this perspective, its purpose, from an energy and economic standpoint, wasn't at all established according to some participants and, consequently, compromised its social acceptability. In this respect, one participant specified:

> There is a close relation between the notions of social acceptability and energy opportunity. As such, the drawbacks linked to a public service meeting the needs of the community (e.g. a highway) will obtain a greater degree of social approval than those stemming from a private project whose first objective is to be profitable in terms of investments and financially pleasing to shareholders.
> (Mr. Bernard Vachon, DM427.1, p. 5)

Another added: "how can we, through inaction, consent to having families expropriated and having other citizens leave our community for good to satisfy insatiable energy needs, specifically those of our southern neighbours" (Mr. Rosaire Saint-Pierre, DM412, p. 6). Moreover, some were of the opinion that demonstrating natural gas energy needs would further justify relocating residents living in the area required to build the project: "Having an urgent need for this gas would make it more acceptable to me. I would be ready to move, but I am far from being convinced of this at the moment" (Ms. Pierrette Bélanger, DT24, p. 14).

Another participant added:

> I think that, if the project was really necessary, […] of course, then that would be a good reason […] in my opinion the only reason which can justify the expropriation of citizens. However, in this case, with the project as it is, I don't believe it's necessary.
> (Ms. Isabelle Carrier, DT17, p. 87)

According to some participants, the fact that Rabaska is a private investment consortium represented a negative factor in the project's justification, and as such, an obstacle to its success. For the Coalition Rabat-joie, "we cannot state that a private project is in Québec's interest if it isn't treated as such overall" (Mr. Yves St-Laurent, DT19, p. 12).

Weighing the pros and cons

To establish the social acceptability of the Rabaska project, some participants[1] suggested instead weighing its pros and cons. For one participant:

> The decision to accept or reject the project must be carefully thought out after having weighed the pros and cons. To be sure, a project's perception can vary markedly from one individual to the next, depending on their expectations. As such, what can be deemed as acceptable by one person may be deemed as unacceptable by another.
> (Mr. Sylvain Marcoux, DM92, p. 1)

1. Ms. Monique Morissette, DM209, p. 3; Mr. Denis Levasseur, DM290, p. 2; Mr. Patrick Langlois, DM152, p. 1; Mr. Éric Tétreault, DM233, p. 1.

On this topic, the Chambres de commerce de Lévis et de Québec believed that "in economic terms, we believe that there are great opportunities for the region, and they may be gained at the price of some small inconveniences, but the quality of their benefits can be far greater" (Mr. Christian Lévesque, DT15, p. 59). The Municipality of Saint-Charles-de-Bellechasse used similar terms, by stating that the project "should be approved, considering the fact that its advantages far outweigh its disadvantages" (DM99, p. 4).

Defending the collective interest as a decisive factor of social acceptability was a view which was supported by many participants in favour of the project. One participant among many was of the opinion that, "in such a context, it appears […] that elected officials […] from various levels of government have the duty and responsibility to elucidate and defend this much-talked about collective interest" (Mr. Pierre Garant, DT19, p. 32). Several participants believed that the project should go ahead, to the extent where the need for the collective interest is established (Mr. Patrice Labrecque, DM214, p. 1; Mr. Éric Dubé, DM170, p. 1; Ms. Dominique Hotte, DM71, p. 2). By the same token, one participant was of the opinion that "this project is of public and collective interest. Even if 250 make enough noise for 2,000, the interests of Québec must have precedence over this background noise" (Mr. Robert Gaboury, DM113, p. 1). Another participant mentioned that the Rabaska project concerns an entire region and a province rather than only a shoreline, and that the economic spinoffs justify the project's approval (Mr. Éric Dubé, DM170, p. 3).

From another point of view, some participants[1] defined the project's social acceptability by mainly considering the interests of those living nearby, who would have to cope with the project's disadvantages directly. As such, Démocratie Lévis asked of the Panel:

> [...] that the citizens who are the most directly affected by various disruptions linked to security, degradation of the immediate environment and quality of life, and others, be asked to express their opinions; we are thinking, more specifically, of those who are located in a perimeter comprising a certain amount of danger from the LNG terminal's operation, as well as by the pipeline crossing.
> (DM371, p. 9)

The GIRAM was also of the opinion that "approval for the project must come first and foremost from the community that is most affected. The residents who are on the front line of a project must have their say; they are the ones who will suffer from the disruptions and environmental impacts, as well as security risks" (DM461, p. 54). As such, one participant stated that, "in this case, the proponent's interest is passing ahead of the collective interest. This is a sharp blow to the great basic principles of liberty and democracy chosen by our society" (Mr. Louis Bastien, DM108, p. 3).

1. Ms. Chantal Lacasse, DM163, p. 2; Mr. Jean-Guy Allard, DT15, p. 40; Mr. Louis Duclos, DM458, p. 12.

Moreover, the “Not in My Backyard” syndrome was abundantly referred to as a reason to explain the defence of interests from residents living nearby (Ms. Christina Jobin, DM8, p. 1; Mr. Stéphane Labrie, DT16, p. 57). Viewed by many as being a pejorative expression, several participants denounced the use of the “Not in My Backyard” designation to describe their interests, which they believed was not representative of their reality and the interests they defend (Ms. Marie-Pierre Fortier, DM640, p. 1; Mr. Mario Fortier, DM572, p. 1; Mr. Yves St-Laurent, DM377, p. 20).

Sustainable development

For some participants, the integration of sustainable development principles is closely linked to the project’s social acceptability. One participant added in this respect:

> The proponents of the Rabaska LNG terminal project committed themselves publicly many times […] to never impose their project and to work in harmony with the population. This project is moving farther and farther away from social acceptability and sustainable development principles.
> (Ms. Céline Létourneau, DM594, p. 2)

One citizen challenged the sustainable aspect of the project: “In life, no one wants to lose or sell their property for a project which doesn’t respect sustainable development principles, as this is a vital and personal asset” (Ms. Gabrielle Larose, DM26, p. 2). From the perspective of Québec solidaire, “the Rabaska project doesn’t fall within the scope of sustainable development principles at all, as it doesn’t respect any of the three pillars which are essential for this type of development, […] i.e. protecting the environment, social justice and long-term economic viability” (DM466, p. 24). The organization Vision développement durable was of the opinion that:

> Having performed a detailed examination of a good many parameters which characterize the development planned, it appears that the project to build an LNG terminal at Lévis isn’t sustainable for at least three of the four essential components of sustainable development, i.e. those of the society, of the environment and of consistency.
> (DM375, p. 15)

Consequently, some participants[1] wondered about the project’s degree of compliance with sustainable development principles with respect to the future impacts of the project, and because of its low degree of integration with social and environmental aspects. One participant among others was of the opinion that the project must be rejected because of the many uncertainties linked to safety and environmental impacts on future generations (Mr. Marcel Gaudreault, DM585, p. 9). Some asked the Panel to

1. Québec solidaire, DM466, p. 2; Ms. Lise Thibault, DM436, p. 18; Ms. Suzanne Rochon, DM536, p. 6; Ms. Lise Lachance, DM603, p. 6; Ms. Annie Marcoux and Mr. André Voros, DM631, p. 9; GIRAM, DM461, p. 94

assess the project according to the project's integration in a perspective of sustainable development, and social acceptability should be assessed from this viewpoint:

> In a sustainable development perspective, the principles of which are now set out in a Québec provincial law, social acceptability was evoked many times as an imperative condition to get the green light for high-risk projects such as Rabaska. (Ms. Diane Simard, DM433, p. 5)

Chapter 2 Project energy context

The proposed project fits into an energy context which warrants analysis at the world and continental scales, and also on the level of Ontario and Quebec, given that they represent the project's targeted market. Such an analysis would not be complete without also dealing with the project utility from the standpoint of diversification of natural gas supply sources and the relationship between this diversification and the security of supply for the project's markets.

World context

Natural gas consumption

The International Energy Agency (IEA) predicts that 70 percent of demand between 2003 and 2030 will come from countries not belonging to the Organisation for Economic Co-operation and Development (OECD). According to Hughes of the Geologic Survey of Canada, natural gas is the third largest energy source in the world following oil and coal, and it accounted for 23 percent of primary energy needs for 2005[1]. Specialists of the National Energy Technology Laboratory (NETL) of the United Sates Department of Energy[2] recall that world natural gas consumption in 2001 was 2.57 Tm^3 and that it is predicted to reach 5 Tm^3 by the year 2025.

World NG reserves

According to the Energy Information Administration (EIA) of the United Sates Department of Energy, confirmed natural gas reserves on the world scale were of the order of 173 m^3 in 2006[3], with the leading 20 countries in terms of size of reserves, which include Canada and the United States, accounting for 90.2 percent of the reserves.

1. J.D. Hughes, *Natural Gas in North America*: *Should We be Worried?*, World Oil Conference, ASPO – USA, Boston, Massachusetts, 26 October 2006, 28 pages [On-line: www.aspo-usa.com/fall2006/presentations/pdf/Hughes_D_NatGas_Boston_2006.pdf].
2. Obenschin and Sheffield, *op. cit.*
3. EIA, International Energy Outlook 2006 [On-line (12 February 2007): www.eia.doe.gov/oiaf/ieo/nat_gas.html].

Moreover, according to the IEA[1], OECD member countries have only 10 percent of confirmed natural gas reserves whereas more than 50 percent of these reserves are shared by only three countries: Russia (30%), Iran (15%) and Qatar (9%). The IEA estimates that import needs for OECD member countries will go from 274 Gm^3 on an annual basis in 2000 to 1,091 Gm^3 (or more than 40 percent of their consumption) in 2030. It should also be noted that confirmed and exploitable natural gas reserves on the world scale correspond to predicted production duration of 70 years based on current production levels (DQ35.1, p. 2).

Development of the international LNG trade

There are now 52 active LNG terminals in the world. Mokhatab *et al.*[2] estimate that significant world LNG demand growth will be maintained, increasing from the predicted 312 Gm^3 for 2008 to 764 Gm^3 on the 2030 horizon. The IEA in turn believes that it is the market with the highest growth rate among all energy sectors in the world. Based on these projections, the market would double in volume between 2005 and 2010, thus representing almost 40 percent of total natural gas supply growth in five years[3]. According to the EIA LNG export volume was less than 113 Gm^3 in 1997 and that world liquefaction capacity is supposed to have reached 266 Gm^3 in 2007[4].

In addition, other observers have underscored the fact that North America has to compete with Europe and Asia for LNG supplies in market conditions in which global demand is clearly on the rise. Thus, Jensen[5] recalls that the regional LNG delivery commitment balance broke down as follows en 2005: 25 percent for Europe, 38 percent for Japan, and 14 percent for the United States, which only left 23 percent of world LNG supply for LNG spot destinations without long-term contractual commitments.

Jensen also notes that the United States, and by extension North America, are at a competitive disadvantage with respect to Europe and Asia considering transportation distances and costs.

1. International Energy Agency, *International Energy Agency Security of Gas Supply in Open Markets. LNG and Power at a Turning Point,* OECD, Paris, 2004, 497 pages.
2. S. Mokhatab, Economides and D. Wood, *Natural gas and LNG trade – A global perspective New dynamics within the gas industry, hydrocarbon processing*, July 2006.
3. International Energy Agency, *Natural Gas Market-Executive Summary Review 2006*, 5 p., [On-line: www.iea.org/textbase/npsum/nat_gas.pdf].
4. [On-line (16 March 2007): www.eia.doe.gov/oiaf/analysispaper/global/overview.html].
5. J. T. Jensen, *LNG – The Challenge of Including an Internationally traded Commodity in a North American Natural Gas Forecast*, presentation at the 2006 IEA conference Energy Outlook and Modelling, Washington D.C., 27 March 2006, 38 p.

- *Finding — The Panel notes the significant growth currently under way and projected in the global LNG market. The Panel also notes the limits of natural gas reserves in gas-consuming countries and the fact that few countries account for most of LNG supply on the world market.*

The continental context[1]

According to the IEA[2], North America is the largest natural gas market in the world with a consumption capacity that was of the order of 717 Gm^3 in 2002. For North America, confirmed natural gas reserves were 6,908 Gm^3 in early 2003, which corresponds to 4 percent of world reserves, and between nine and ten years of supply based on current consumption rates. Three quarters of these reserves are found in the United States (5,293 Gm^3). The proponent in turn recalls that the North American market accounts for 29.4 percent of the planet's available natural gas (PR3.2, p. 2.29).

Hirschhausen[3] reports that the United States is the second largest natural gas producer in the world (526 Gm^3 in 2005, or 20% of the total world production of that year) as well as the largest consumer (634 Gm^3 for the same year). In 2005, US imports from Canada accounted for 13 percent of consumption (102 Gm^3). According to the same source, US LNG imports tripled between 2002 and 2005, increasing from 6.5 to 18.5 Gm^3, or 3 percent of consumption.

Canada is the second largest natural gas exporter, after Russia, and the fifth largest consumer, with 3.4 percent of annual world consumption[4]. According to the National Energy Board (NEB), the average natural gas production rate in Canada was 484 Mm^3/d in 2005[5], and 60 percent of Canadian production was exported to the United States[6].

According to the NEB, estimated natural gas resources in Canada, including undiscovered resources, total between 15,525 Gm^3 and 16,880 Gm^3. Approximately half of these resources are in the Western Canada Sedimentary Basin (WCSB) and

1. For analysis purposes, the Panel deals only with the United States and Canada.
2. *Op. cit.*
3. C. Hirschhausen, *Infrastructure Investments and Resource Adequacy in the Restructured US Natural Gas Market – Is Supply Security at Risk?*, Center for Energy and Environmental Policy Research, December 2006 [On-line: http://tisiphone.mit.edu/RePEc/mee/wpaper/2006-018.pdf].
4. *An Energy Summary of Canada* [On-line: www.cslforum.org/canada.htm].
5. [On-line (16 March, 2007): www.neb-one.gc.ca/energy/EnergyReports/EMAGasSTDeliverabilityCanada2006_2008/EMAGasSTDeliverabilityCanada2006_2008_e.pdf].
6. Energy Information Administration, Canada: Natural Gas [On-line (16 March 2007): www.eia.doe.gov/emeu/cabs/Canada/NaturalGas.html].

almost half the natural gas in the WCSB has been already extracted. The NEB does not foresee the natural gas from northern regions reaching the market before the end of the decade, and no additional supply is foreseen from Canada's east coast offshore deposits before 2010. Thus, according to the Board, "Overall, it will be difficult to increase indigenous natural gas production[1]".

The NEB also foresees considerable difficulties regarding the stability of supply and the price of natural gas. It also predicts strong competition among consumers as the gap between supply and demand grows. These circumstances could result in major impacts and constraints experienced by large natural gas-consuming industries located the farthest from supply sources.

The NEB estimates that uncertainty and risk remain in regard to the development of new natural gas sources and the time to develop them. For the NEB, LNG will have to contribute significantly to reducing the gaps foreseen between supply and demand of natural gas in Canada and in the overall North American market.

The increase of LNG imports would provide enough time to discover and develop new resources or to build new LNG terminals in the United States and Canada. Thus, until the new sources of natural gas are accessible on the market, the possibilities of increasing supply will mainly come from LNG imports.

The NEB foresees no increase in Canadian natural gas exports to the United States and estimates that Canadian natural gas production will peak at its current level by 2010 (between 452 and 480 Mm^3/j)[2]. It is predicted that net natural gas exports from Canada will reach the record level of 105 Gm^3 in 2010, and decline to the level of 73 Gm^3 on the 2025 horizon or before.

- *Finding — The Panel notes the consensus to the effect that the natural gas reserves, confirmed or currently being exploited, in the Western Canada Sedimentary Basin are in decline and likely to be exhausted in nine or ten years. The Panel also found that other Canadian reserves are not accessible to the continental natural gas transport network and that their possible development could take several years.*

1. *Ibid*.
2. [On-line (8 May 2007): www.eia.doe.gov/emeu/cabs/Canada/NaturalGas.html].

Project context at the Quebec – Ontario level

According to the proponent, the additional natural gas of the order of 5.2 Gm^3 on an annual basis provided by the project would be destined to supply the Quebec and south-eastern Ontario markets. However, natural gas does not play the same role on these two markets. The contribution of natural gas to Ontario's total energy consumption is almost three times higher than in the case of Quebec's energy consumption (Table 2).

Table 2 Relative contribution to total energy consumption in Quebec and Ontario by source (2004)

Energy source	Quebec (%)	Ontario (%)
Oil	38.79	37.36
Electricity	38.55	18.75
Natural gas	12.33	34.3
Biomass	9.31	4.32
Coal	1.02	5.27

Source: adapted from DB71, p. 2.

As for consumption by sector, Table 3 provides the relative contribution of natural gas by sector of activity for Ontario and Quebec.

Table 3 Natural gas consumption in Quebec and Ontario by sector, 2004

Sector	Share of total natural gas consumption in Quebec	Share of total natural gas consumption in Ontario
Residential	12.96%	36.3%
Commercial	36.77%	23.7%
Transportation	0.02%	4.6%
Industrial	50.25%	35.5%

Source: DB71, p. 8.

Average daily natural gas consumption in Quebec is 17.88 Mm^3. Natural gas is mainly used for space or water heating in the industrial, commercial, and residential sectors, for electricity generation (Bécancour), and as raw material in the chemical and petrochemical industries, particularly for hydrogen production. Unlike the rest of Canada, natural gas is used very little in Quebec in the residential sector since 64 percent of demand is met with electricity (Mr. Ronald Richard, DT7, p. 86; DQ23.1; DB78, p. 84).

Table 4 provides projections made by the ministère des Ressources naturelles et de la Faune (MRNF) regarding the evolution of natural gas demand in Quebec by sector of activity on the 2026 horizon.

Table 4 Evolution of natural gas demand in Quebec between 2006 and 2026

Sector	Consumption in Mm^3 2006	Projected consumption in Mm^3 2026
Manufacturing	3,389	4,519
Residential	564	339
Commercial	1,836	2,146
Electricity generation (Bécancour)	706	706
Transportation	0	0
Other	282	339

Source: adapted from DB71, p. 9.

Wider use of natural gas as a cleaner fuel is part of Ontario's and Quebec's strategies and plans both for energy development and for overall carbon dioxide emissions reduction. A spokesperson for the Ontario Ministry of Energy (OME) informed the Panel that natural gas would play a more important role in that province's plans in both energy policy and greenhouse gas (GHG) emissions reduction efforts (DQ93.1). He referred to the plans to shut down coal-fired electricity generation facilities and the future role of natural gas as a reliable way to meet the province's electricity demand.

On this point, the Ontario Power Authority has signed contracts for electricity generation capacity above 3,800 MW for combined-cycle, gas-fired generating stations that are set for commissioning between 2007 and 2010. The Ontario Ministry also informed the Panel that it heartily welcomes the possible completion of the project under study as well as other similar LNG projects.

The Ontario Power Authority also signed contracts for gas-fired combined electricity-heat generation for a total capacity of 414 MW to be commissioned between 2008 and 2010. According to OME, that would effectively increase natural gas demand in Ontario by nearly 30 percent, a projection which does not include possible demand increases for other uses (commercial, residential, industrial).

As for Quebec, the energy strategy 2006-2015 specifies as a second objective the diversification of its natural gas supply[1]. The strategy adds that: "construction of a new LNG terminal in Quebec could be a useful way of reducing our dependency on our only existing source of natural gas". Recognizing the disadvantage of Quebec's dependence on WCSB as the only natural gas supply source, the strategy notes that:

> In the case of natural gas, all our supplies come from Western Canada, via a single transportation system – the network owned by TransCanada PipeLines. The only gas reserves to which we have direct access appear to have reached their peak, since known reserves have declined by 40% in 20 years. New discoveries will respond primarily to needs deriving from the operation of oil sands in Alberta. We must therefore diversify our supply sources in order to strengthen our energy security in the longer term.

In a passage linking Quebec's interest in reinforcing security of supply in hydrocarbons to its geographical location, the strategy adds:

> In its energy strategy, the Government applies a range of measures to diversify and strengthen the security of our fossil fuel supplies, and to take full advantage of Quebec's geological potential and geographical location. Proposals for LNG terminals could be of considerable interest to Quebec. The creation of new terminals would help diversify our supplies and would have a very positive impact on regional economies, due to the jobs created at the construction phase and the spill-over effect on other industrial investments.

This interest in the security of Quebec's natural gas supply is not new. In its 1996 policy, *Energy at the Service of Quebec, A Sustainable Development Perspective,* the Quebec government underscored the importance of being able to count on complementary natural gas supplies (DA41.8).

In addition, the MRNF referred to similar orientations by the Quebec government that go further back in time. Thus, before the recently confirmed decline in the traditional Canadian sources of natural gas, the MRNF had recognized, in energy policy dating back to 1978, the interest in building an LNG terminal in Quebec (DQ35.1, p. 3 and 4). On this point, the ministry underscored the importance of having regasification infrastructures on Quebec territory as a way to diversify supply sources and security. Moreover, such infrastructures "have another important advantage for Quebec in that they modify the end-of-the-line position that currently characterizes its natural gas

1. Gouvernement du Québec, *Using Energy to Build the Quebec of Tomorrow: Quebec's Energy Strategy 2006-2015*, Orientations and Priority Actions 2006, 138 p. [On-line: www.mrnf.gouv.qc.ca/publications/energie/strategie/strategie-energetique-2006-2015.pdf].

supply. Presence of the LNG terminal would put Quebec at the head of the network, thus providing increased flexibility in supply and demand management".

- *Finding — The Panel takes note of the fact that Quebec's energy strategy calls for a role for natural gas in the energy and economic development in Quebec. The Panel also takes note of the importance that the strategy gives to natural gas supply source diversification for the Quebec market in general and the particular role that LNG terminals could play in that diversification. The Panel also notes the continuity that has marked the strategic visions of successive Quebec governments in this area for nearly thirty years.*

- ***Opinion 1 —*** *The Panel is of the opinion that the establishment of LNG facilities in Quebec would represent a diversification of its natural gas supply and would have the effect of reinforcing its energy security.*

Alternatives

Alternatives to the project concern the functionally different ways to meet the project need and achieve the project purpose[1]. The project aims to provide Quebec and Ontario with a source of supply other than the WCSB, thus increasing the security and competitiveness of these provinces (PR3.2, p. 2.37 to 2.39).

In order to meet these objectives, the proponent envisioned several options, including hook-up by pipeline to the reserves on Sable Island, Nova Scotia. This option was nonetheless dropped because the amount of natural gas found in that basin proved to be less than expected (PR3.2, p. 2.53 and 2.54). The following solutions were then explored.

One of the options envisioned by the project consisted in importing natural gas from the Canaport project at St. John, New Brunswick. In order to send this volume of natural gas to Quebec and to Ontario, two routes were considered to reach the TQM pipeline facilities at Lachenaie, one 920 km long and the other 870 km long. The proponent nonetheless deemed these two options economically unviable due to higher transportation costs, and to the higher prices of natural gas in the northeast United States market compared to prices in Quebec and Ontario. This latter point would imply that suppliers would agree to sell their natural gas at a price below that which they could obtain on another market, a prospect which the proponent considers unrealistic (PR3.2, p. 2.53 to 2.58).

1. [On-line (30 mars 2007): www.ceaa-acee.gc.ca/013/0002/addressing_f.htm].

The proponent also considered drawing on supplies from a new terminal or from a terminal being expanded along the Gulf of Mexico. Major expansion to existing pipelines would also be required to transport the natural gas as far as Dawn in Southern Ontario, and then farther downstream to supply the target markets. The proponent estimates that the costs would be much greater than those required on the TransCanada and TQM Pipeline networks to deliver the natural gas to the same markets from Saint-Nicolas. The proponent concluded that this solution would not be viable unless the pipelines in the United States were to offer major reductions on their transportation charges in order for the gas prices to be competitive at Dawn and at markets downstream from there. However, the US markets would likely be ready to pay higher transportation charges than the Quebec and Ontario markets, and this prompted the proponent to reject this alternative (*ibid.*, p. 2.57).

Finally, the proponent considered an alternative consisting in setting up offshore facilities to receive LNG tankers with the necessary equipment to regasify and pressurize the natural gas. The tankers would moor at buoys linked to the gas pipeline network by an underwater pipe and would remain as long as required to regasify their cargo. The proponent deemed however this technology inappropriate for the St. Lawrence River in views the presence of ice and of its uncertain economic viability (*ibid.*, p. 2.58).

- *Finding — The Panel found that the proponent assessed various alternatives to natural gas sources from Western Canada to supply the Quebec and Ontario markets.*

The project and carbon dioxide emissions[1]

Canada stands out among OECD member countries for certain characteristics that influence its energy consumption, as well as the relative carbon footprint of the country's economic and human activities. These characteristics include geographic location, the rigour of its sub-arctic winters, the large expanse of its land and its implications in transportation loads, its demographic growth rate, and the nature of its industry based on the development of natural resources, and the resultant costs of all these factors for the manufacturing and agricultural sectors. Canada also stands out owing to the large place renewable hydro power occupies in its energy mix, as

1. Given that this mainly concerns carbon dioxide emissions, the Panel will use the terms "carbon dioxide" and "greenhouse gases" interchangeably.

compared to other countries such as France, Sweden and Belgium where nuclear power plays a major role in meeting their energy needs[1].

According to federal government data and analyses[2], Canada's GHG emissions were an estimated 758 Mt of carbon dioxide equivalent in 2004, up 27 percent from 1990, the Kyoto baseline year, when they were estimated to be 599 Mt. When Canada ratified the Kyoto Protocol, an appendix to the United Nations Framework Agreement on climate change, in December 2002, it committed to reduce these emissions by 6 percent compared to the 1990 baseline on the 2012 horizon[3].

According to federal government data, the energy sector (which includes the highway transportation sector, the fossil fuel energy industry and thermal generated heat and electricity) was responsible for 81 percent of total Canadian emissions in 2003, and 91 percent of growth in these emissions between 1991 and 2003. Moreover, these data show that the intensity of these emissions per unit of gross national product (GNP) decreased by nearly 12 percent in 2003 as compared to 1990.

Figure 3 provides the territorial breakdown of emissions across Canada according to the Canadian Environmental Sustainability Indicators program.

With respect to the emissions growth rate by province, data calculated by the Suzuki Foundation[4] shows that Quebec had the third lowest increase in emissions for all Canadian provinces and territories during the same period.

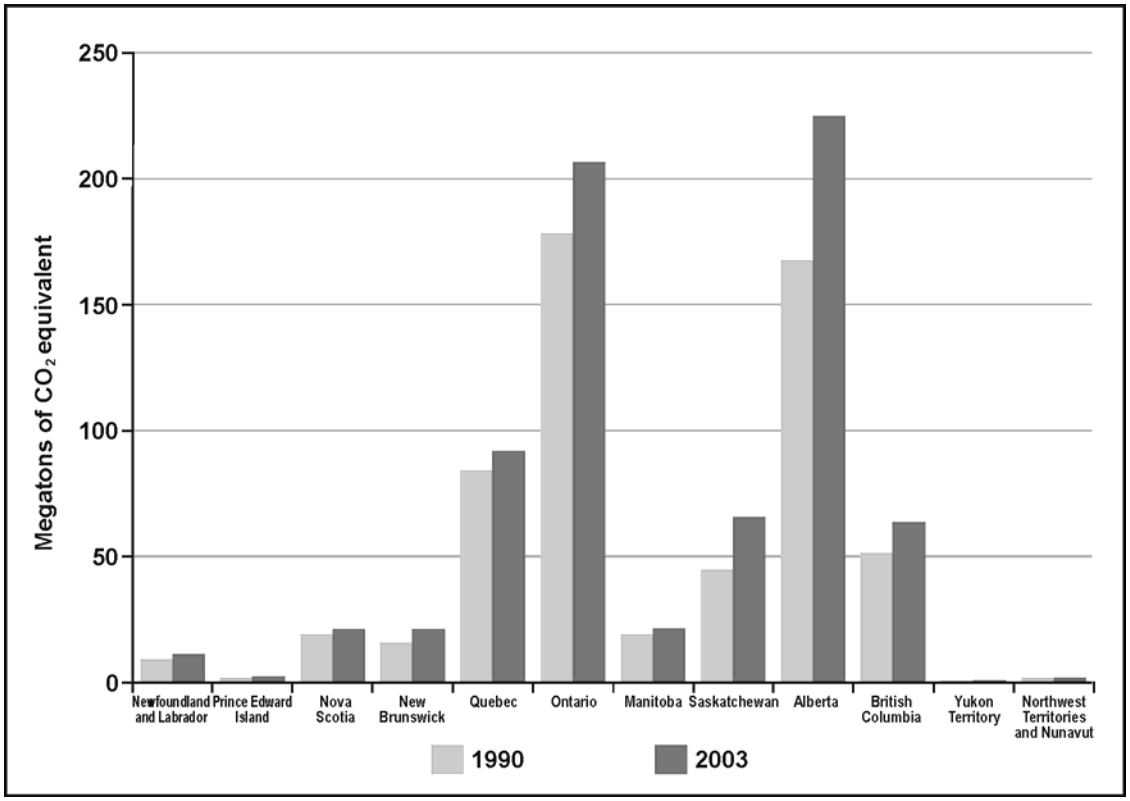
1. See, among others:
European Renewable Energy Council, *Renewable Energy Policy Review Sweden*, May 2004 [On-line: www.erec-renewables.org/documents/RES_in_EUandCC/Policy_reviews/EU_15/Sweden_policy_final.pdf];
H. Nifenecker, *Comparison of the energy structure between Denmark, France and Sweden* [On-line: www.ecolo.org/documents/documents_in_english/Comparison-denmark-france.doc];
International Energy Agency, *World Energy Outlook 2006*, Summary and Conclusions [On-line: library.iea.org/textbase/weo/summaries2006/french.pdf].

2. Government of Canada, *National Status and Trends* [On-line: www.environmentandresources.gc.ca/default.asp?lang=Fr&n=843A8EEB-1]

3. On April 26, 2007, the Government of Canada announced an action plan to reduce GHG and atmospheric pollution. The plan calls for an absolute reduction by 150 Mt by 2020.

4. Dale Marshall, *All Over the Map: A Comparison of Provincial Climate Change Plans,* David Suzuki Foundation, 2005 [On-line: www.davidsuzuki.org/files/climate/Ontario/All_Over_the_Map.pdf].

Figure 3 Territorial breakdown of GHG emissions across Canada



Source: Environment Canada. 2005. *Canada's Greenhouse Gas Inventory, 1990-2003.*

GHG in Quebec

According to federal data[1], in 2004 Quebec represented 23.6 percent (7.5 million) of the population of Canada, 21.6 percent ($224.4 billion) of Canada's GDP, and 12.3 percent (91.8 Mt) of GHG gases emitted across Canada. The same data show that per capita GHG emission are of the order of 12.2 t compared to the Canadian average of 24 t per capita[2], the economic intensity of GHG, nearly 0.41 Mt per billion dollars of GDP, were below the Canadian average. It is also noted that since 1990, GHG emissions in Quebec increased by 6.1 percent, whereas its population increased by 7.7 percent and its economic productivity grew by 37.8 percent over the same period.

1. Canada [On-line (15 March 2007): http://ncrweb.ncr.ec.gc.ca/pdb/ghg/inventory_report/2004_report/2004_report_f.pdf].
2. Canada, *Canadian Environmental Sustainability Indicators 2006* [On-line (15 March 2007): www.ec.gc.ca/environmentandresources/CESIFull2006_e.cfm#321].

Emissions profile and action plan

According to the Quebec *Inventory of GHG 1990-2003* produced by ministère du Développement durable, de l'Environnement et des Parcs (MDDEP), the breakdown of GHG emissions in 2003 by sector of activity is presented in Table 5.

Table 5 GHG emission breakdown by sector of activity for Quebec, 2003

Sector of Activity	Share of GHG emissions in Quebec (out of a total of 90.9 Mt of carbon dioxide equivalent) for 2003
Industry	31.1%
Transportation	37.4%
Residential, commercial and institutional	14.5%
Agriculture	9.4%
Garbage	5.9%
Electricity generation	1.7%

Source: DB58.

According to the same data, the percentage of change in emissions is presented in Table 6 for the same period. It should be noted that the total increase of overall emissions was 6.5 percent for Quebec during the same period.

Table 6 GHG emissions changes by sector of activity for Quebec between 1990 and 2003

Sector of Activity	Emissions changes between 1990 and 2003 (%)
Transportation	19.9%
Industry	-6.8%
Residential	-10.8%
Commercial and institutional	66.4%*
Agriculture	5.5%
Garbage	-9.3%
Electricity generation	6.5%

* In an answer to a question from the Panel (C27), the MDDEP explained that the considerable growth in this sector during that period was due to natural gas and electricity price increases, which favour conversion to sources that contain more carbon and pollute more such as No. 6 fuel oil.

Source: DB58.

Quebec undertook to implement on Quebec territory Canada's GHG emissions reduction commitments. That corresponds to a 6 percent reduction compared to the 1990 baseline on the 2012 horizon, as called for in the Kyoto protocol. Whereas the gap between reality

and the commitment is of the order of an increase of 36 percent for Canada, the same gap is now about 12.5 percent for Quebec.

To achieve this objective, Quebec prepared an action plan for the 2006-2012 period[1]. According to the plan, the government undertakes to reduce Quebec's GHG emissions to the level of 80.2 Mt, which would be in compliance with Canada's commitments to reduce these emissions by 6 percent compared to the 1990 baseline. It should be noted that without implementing the measures set forth in the 2006-2012 action plan, Quebec emissions would reach the level of 94 Mt by the year 2012 according to the data provided by the MDDEP.

Quebec's action plan calls for the use of economic instruments in the form of emission charges so as to modify behaviour and energy choices in the economic and industrial sectors and to promote practices and energy forms that can reduce carbon dioxide emissions in Quebec. The plan thus proposes that the Régie de l'énergie establish charges to be applied to non renewable fuels (responsible for 73 percent of carbon dioxide emissions in Quebec) which would be calculated on a pro rata basis of emissions carbon dioxide for each energy form. The plan also calls for these emission charges, expected to be of the order of $200 million a year, to be paid into a green fund reserved for funding measures that would favour reduction of the carbon footprint of Quebec, such as the promotion and development of public transit.

The project's carbon footprint

The proponent carried out a "life cycle" analysis, estimating GHG emissions along the entire LNG chain, compared to the Alberta natural gas supply chain (PR3.3.1, p. 6.17). To that end, he analysis took into account the fact that the Atlantic basin would be used to supply LNG to the project and the fact that its markets would be in Quebec and southeast Ontario. On this basis, the analysis concludes that, for the overall chain, LNG emissions would be about 8.5 percent higher than those from Alberta natural gas (64.6 instead of 59.7 g eq CO_2/MJ).

However, the analysis also concluded that the specific emissions from LNG remain lower than those of fuel oil. According to the results, natural gas combustion, whatever the source or means of delivery, generates approximately 51 g/MJ of GHG, compared to nearly 74 g/MJ on average for No. 2 fuel oil or No. 6 fuel oil, all based on emission factors approved by Environment Canada.

1. *Québec and Climate Change, A Challenge for the Future, 2006 - 2012*, June 2006 [On-line: www.mddep.gouv.qc.ca/changements/plan_action/2006-2012_en.pdf].

Moreover, the proponent conducted an analysis aimed at evaluating the project's net GHG emissions for Quebec, Canada, and North America. This analysis is based on projections, qualified as conservative, drawn from the market study conducted by the Energy and Environmental Analysis Group concerning natural gas demand growth levels on the North American scale, and for Ontario and Quebec. The calculations also take into account a possible drop in price of the order of $0.46/million BTU (in 2004 Canadian dollars) in Quebec and eastern Ontario predicted by the market study, and the stabilizing effect on supply that the project could entail if built. The analysis also assumes an 80-percent conversion rate from fuel oil to natural gas, a rate which the study considers realistic, According to the proponent's analysis the price advantage and stabilization of supply the project entails would favour such a conversion.

According to these results, the project would have the net effect of increasing GHG to the order of 125,000 t of CO_2 eq. per year for Quebec, reducing emissions by about 100,000 t per year for Ontario, reducing emissions by 317,000 t per year for Canada, and reducing emissions by 1,860,000 t per year for Canada and the United States.

These results suggest that the overall result of the project for combined emissions in Canada and the United States would be a major drop in emissions by nearly 1.9 Mt of carbon dioxide equivalent. This would stem from the fact that the project would result in increased gas exports from WCSB (of the order of 189 pet joules a year), and the likelihood that additional natural gas available would replace more polluting fuels with higher carbon content . According to the proponent, this likelihood is recognized in a forecast scenario considered to be representative by the Canadian government (DA86.3.4).

Whatever the estimated reduction level, the proponent believes that his project would have the effect of contributing to the reduction of North American GHG emissions compared to what they would be without the project or another equivalent LNG project.

- *Finding — The Panel notes that the project would result in a net increase in Quebec's carbon gas emissions of the order of 125,000 t of carbon dioxide equivalent per year. This increase would correspond to 0.16 percent of the 2003 emissions balance.*

The Project's contribution put in question

During the hearing, several participants called into question the project analyses as regards its contribution to GHG emissions in Quebec and cast doubts on the proponent's conclusions in that regard. Some reject project legitimacy as its

implementation would result in a net increase in carbon dioxide emissions for Quebec The criticisms and doubts expressed arise form considerations that the Panel studied in greater depth.

The Panel notes that the problem of the presumed relationship between anthropogenic carbon dioxide and unfavourable climate change constitutes a global challenge. In that sense, it is of the view that the territorial origin of emissions is of little importance inasmuch as the ultimate results of the efforts deployed by the countries and regions on the world lead to a reduction in the concentration of carbon dioxide in the atmosphere. The Panel estimated that the increase in emissions in a given sector of activity is not necessarily incompatible with the objective, or the feasibility, of reaching overall GHG emissions reductions of a country, a state, or a region. Increases by sector could in fact be compensated, depending on their magnitude, by compensatory or higher reduction measures in other sectors. That is how, for example, the allotment of national reduction charges divided among European Union member countries foresees and allows carbon dioxide emissions growth for member countries such as Norway and Portugal whereas emissions reduction targets are higher than the average of 6 percent of other member countries such as Germany.

- ***Opinion 2 —*** *In the Panel's judgement, the carbon dioxide emissions reduction commitments under the Kyoto protocol allow increases by sector, when the situation justifies it, inasmuch as the overall reduction objective is achieved by compensatory reductions in other sectors of the economy such as transportation or by the adoption of proportional compensation measures aimed to counter these increases.*

Moreover, without denying the potential of the project to provide supply and price conditions that would favour the substitution of high carbon content fuels by natural gas in Quebec, the AQLPA expressed reservations about this potential. That organization believes that the projected fuel replacement level could not be attributed to a single LNG terminal project (DM592.1). It also believes that the beneficial effect of the project could diminish over time, thereby diminishing the carbon dioxide emission reduction advantages forecast in Quebec.

On that basis, the AQLPA is of the opinion "that a program with objectives and adequate means making it possible to achieve a substitution level should underlie any development of the natural gas sector" in Quebec. It is also of the opinion that the uncertainty around the means the proponent would implement in order to concretely achieve the fuel replacement levels would make the GHG emission reductions "too hypothetical".

The Panel considers that the advantages foreseen in this area could only occur if a price differential in favour of natural gas exists in the Quebec market compared to

other fuels such as fuel oil and heavy oils. The Panel is also of the view that, even if the project were to result in a reduction in natural gas prices, such an effect would remain subject to the economic, climatic, and political contingencies that result in price fluctuations for hydrocarbons on the world and continental markets. The Panel cannot thus exclude the possibility that the advantage the project would represent in terms of price could be cancelled in favour of other fuels less environmentally advantageous. Moreover, Quebec's 2006-2012 Climate Change Action Plan calls for the application of emission charges on fossil fuel based on their carbon content. Such charges would represent an economic instrument which would ensure a price advantage in favour of natural gas on the Quebec market.

- *Finding — The Panel found a positive potential that can be attributed to the project in terms of natural gas substitution of high carbon fuels among industrial customers in Quebec, and takes note of gains this substitution could represent in terms of Quebec's carbon dioxide emissions balance.*

- ***Opinion 3 —** The Panel is of the opinion that the system of emission charges set forth in Quebec's Climate Change Action Plan 2006-2012 would ensure the potential advantages of substituting high carbon content fuels with natural gas.*

Chapter 3 Economic context of the project

In the current chapter, the Panel addresses the economic context for the project. The project's impact on gas prices in Quebec and Ontario is also addressed, as are growth perspectives of these markets. The Panel also examines the spinoffs the project on the regional level.

Natural gas prices in Quebec and Ontario

The price of natural gas paid by consumers usually comprises the cost of the basic product[1], transportation[2], and distribution[3]. Though the basic cost is determined by the market, transportation and distribution costs are regulated in both Quebec and Ontario. Quebec is located at the eastern end of the trans-Canada natural gas transportation network (Figure 4). For this reason, natural gas transportation costs for delivery in Quebec are higher than in markets farther west upstream on the network such as in Manitoba.

Since 2000, natural gas price increases and volatility have had the effect of lowering industrial demand for natural gas in favour of other fuels (NEB, 2004, p. 15[4]). In addition, certain industries that depend exclusively on natural gas had to transfer their activities to places where gas price is not as high. According to the NEB, "certain [industries] had to slow down their activities or temporarily stop activities given the high gas prices" (*ibid.)*.

Industries often have facilities that enable them to switch from fuel oil to natural gas and back depending on prices. However, industries in the petrochemicals sector in Quebec are captive of natural gas, since they need it in their manufacturing process (Canadian Association of Chemical Products Manufacturers, DM608, p. 1).

Gaz Métro recalled the negative impacts of natural gas price volatility on the market and mentioned the loss in 2001 of the equivalent of 850 Gm^3 of natural gas sales, which represented 15 percent of total volume distributed. Of this volume, 566 Gm^3 was dropped by Gaz Métro's industrial customers for No. 6 fuel oil, with the environmental consequences that result in terms of atmospheric pollution and increased carbon dioxide emissions (DM576).

1. The price paid for natural gas at the supply or transaction centre.
2. The cost of transporting natural gas from its source to the local distribution company's door.
3. Natural gas transportation costs in the territory of a local distribution company, including the service charges for storage and balancing of loads.
4. [On-line: www.one.gc.ca/energy/EnergyReports/EMAGasLookingAhead2010August2004_e.pdf].

Cascades Inc. in turn recalled the harmful impacts from the environmental standpoint of having to use No. 6 fuel oil because of the natural gas prices. Cascade also mentioned that it pays the highest prices on the continent to cover natural gas transportation costs, since its Quebec facilities are at the eastern end of the natural gas distribution network (DM574).

Moreover, certain Quebec companies located at the end of the network have already experienced supply interruptions during winter demand peak periods (Mr. Martin Chouinard, DT30, p. 78). Other natural gas supply sources could have the advantage of countering this problem by stabilizing supply to industrial companies in Quebec.

Impact of the project on the Quebec and Ontario markets

Based on a nominal capacity of 5,183 Mm^3, the contribution of the project would correspond to 82 percent of total natural gas demand in Quebec (6.2 Mm^3 in 2004), and about 20 percent of Ontario's demand. On the scale of the North American market, the contribution of the project would however be only 0.75 percent of demand. The project would also have the effect of multiplying by 8.35 the current natural gas storage capacity in Quebec, increasing it from 2 percent to more than 16 percent of annual consumption. That would have the advantage of ensuring the availability of more reserves during peak demand periods. It should be noted that the current storage capacity in Ontario is 6,844.4 Mm^3, which corresponds to 21 percent of that province's annual consumption (PR3.2, Appendix G, p. 20; DB78, p. 179).

According to a MRNF representative, access to a new natural gas source would represent an advantage for Quebec consumers who are now at the eastern end of the Canadian natural gas transportation network. He estimated that transportation fees would be less in Quebec than in Ontario (Mr. Ronald Richard, DT12, p. 31).

According to a study commissioned by the proponent, , the project would have the effect of lowering gas prices by about 5.4 percent on the eastern Ontario and Quebec markets due its additional supply of natural gas for the 2010 to 2025 period. . This price reduction would be due as much to the proximity of the facilities as to the additional volume available on these markets. According to project supporters, this type of reinforcement of supply means a competitive drop in price of the order of $0.46 per million BTUs[1].

- ***Opinion 4 —*** *The Panel is of the opinion that the additional supply of natural gas proposed by the project could result in a relative reduction in price on the Quebec market.*

1. 1 million BTUs is a quantity of energy equivalent to about 28 m^3 of natural gas.

Figure 4 Quebec natural gas transportation network

Sources: adapted from the map *Réseau de transport et d'alimentation de gaz naturel au Québec*, Novembre 2003 [On-line (February 19, 2007): www.gazmetro.com/data/Media/Carte_Reseau_Gazier.pdf]; DA21.15.

The project's economic spin-offs

Construction phase

According to the proponent, the project would represent an overall investment of $840.2 million, which would include the cost of building the terminal ($775 million) and the gas pipeline linking the terminal to the TQM pipeline station at Saint-Nicolas ($65.5 million). According to the planned schedule, construction would extend over a period of three years (PR8.2, p. 1 and 7).

Total project economic spinoffs for Quebec are estimated to be $444 million. According to the proponent, construction work represents the equivalent of 4,995 person-years, divided among 2,440 direct jobs[1] and 2,555 indirect jobs[2]. As regards manpower required on site, the project would require 1,580 person-years, or the equivalent of 474 people for 40 months, the majority (87 percent) coming from the construction sector (PR8.2, p. 14). According to the proponent's projections, nearly 73 percent of the manpower needed would come from Quebec City and the Chaudière-Appalaches regions. The limiting factor for recruiting workers on the regional level is the availability of qualified manpower in the trades in high skilled sectors (*ibid.*, p. 1).

During the hearing, many companies in the region expressed interest in obtaining contracts from the proponent or his agents. Some also wished to acquire through such contracts new expertise in areas such as construction techniques linked to cryogenics. Others expressed concerns in regard to the commitment of the proponent to take into account the fiscal inequity that prevails in Quebec. They expressed the hope that the contracts will not all be directed towards the resource regions at the expense of central regions like Chaudière-Appalaches or Québec City.

Certain provisions in the agreement reached between the proponent and the City of Lévis are meant to maximize economic spinoffs in that city. Thus, according to the agreement "Rabaska intends to favour manpower and companies established in Lévis" (DM315, Appendix A, p. 6).

1. The direct effects correspond to the spinoffs stemming directly from project related expenses. There are two types: wages paid to workers and income obtained by firms that executed construction contracts awarded by the proponent and his agents.
2. The indirect effects measure the spinoffs generated by successive suppliers. These include all jobs and value added by intermediate suppliers on the proponent's entire supply chain and entering into the construction process.

It is foreseen here that the companies will be informed of the possibilities to obtain contracts through sector meetings. These meetings could provide the opportunity to provide offers of services and lists of areas of specialization, the proponent's goal being to develop a data base of companies in the region, which could then be provided to the main bidders.

The Panel noted that no particular advantage is offered to companies in Chaudière-Appalaches that do not have a business office in Lévis in terms of a privileged access to project contracts. They would thus potentially be subject to l competitive bidding for the awarding of contracts. The Panel noted however that the proponent undertook to generate as many spinoffs as possible in the regions (*ibid.*, p. 6.120). In this context, the Panel judges that the provisions aiming to maximize economic spinoffs in the city of Lévis are fair. It also considers that an additional mechanism aimed at generating spinoffs for contractors in the Chaudière-Appalaches region should also be planned for.

- *Finding — The Panel found that the project would have economic spinoffs for the region and Quebec. The Panel also takes note of the provisions in the agreement linking the proponent and the City of Lévis, aimed to maximize the project's economic spinoffs for that city.*

- ***Recommendation 1 —*** *The Panel recommends that the proponent establish a regional committee with the mandate to establish a strategy in an aim to maximize the project's economic spinoffs for the Chaudière-Appalaches region.*

The operating phase

According to data provided by the proponent, the annual operating budget predicted for the LNG terminal would reach $46.5 million, excluding marine fees ($10 million a year) charged to the LNG carrier. Total annual economic spinoffs in Quebec are estimated at $37 million. Moreover, the activity generated would support the equivalent of 288 person-years and would enable the development of a new expertise in the LNG sector in Quebec. These jobs would comprise 70 direct jobs, to which 218 indirect jobs would be added.

The proponent also undertook to pay a minimum of $7 million annually in municipal taxes and $1 million annually in school taxes. In addition, certain provisions of the agreement reached on October 16, 2006, provide for financial and technical support from the proponent for certain regional recreation projects, including the Route verte and the Parc de la Pointe-De La Martinière (PR8.2, p. 2, 6 and 7). The MRC de Bellechasse, which encompasses the municipality of Beaumont, has asked to sign an agreement with the proponent, similar to the one reached with the City of Lévis (Mr. Pierre-Paul Deblois, DT19, p. 49).

The structuring potential of the project

The project provides a major potential for use of the LNG cryogenic capacity. Certain companies need refrigeration in their operations, particularly in areas such as agro foods, biotechnology, and pharmaceuticals. For this potential to be used optimally, the refrigeration user companies must be located within a radius of less than 500 m of the project facilities (Mr. Raynald Bourassa, DT20, p. 25). This kind of industrial linkage would provide advantages in the area of energy efficiency and the optimal use of the resource. It is a case of a beneficial symbiosis that would represent a source of savings both for the proponent in terms of natural gas consumption for LNG regasification and for companies that consume "frigories" or cold units. The emergence of this type of industrial cluster would be favoured by the City of Lévis since the agreement of October 16, 2006, with the proponent stipulates to this effect:

> Rabaska will provide hook-up points enabling the transfer of frigories for reclamation of thermal waste from the project and, for this purpose, will favour any concrete project that complies with municipal regulation that would be submitted and that would make it possible to draw benefits from Rabaska's activities on the basis of a formula in which everybody stands to gain.
> (DM315, Appendix B, p. 2)

The Panel noted the importance of maximizing spinoffs on the regional and national scale for a project with private investment of more than $800 million. The magnitude of this investment argues in favour of this type of industrial linkage around the project. That would be the guarantee of efficiency in the use of resources and economic development which are dimensions of sustainable development. However, for this type of linkage to be possible, the companies concerned must be able to locate near the project if it is to be carried out.

- ***Recommendation 2 —*** *If the project is approved, the Panel recommends that the City of Lévis take the necessary measures so that the project can have the maximum structuring effect for the economy of the region and for industrial development.*

Chapter 4 Territorial context of the project

Locating an LNG terminal is a process in which project feasibility and profitability requirements as well as the capacity of prospective sites to host the project come into play. In addition to describing the process that led the proponent to consider the Ville-Guay sector, the Panel presents in this chapter the geographic, social, and economic framework of the project. It addresses land use planning and landscape considerations and then analyses the issues concerning the project's integration in the territorial context.

Site selection

The site selection process was conducted by the proponent. Having qualified access to the ocean as a fundamental factor, the proponent sought out a site that provided an adequate sea-to-land interface (i.e., satisfactory navigation and navigational manoeuvring conditions near land which meet the project needs). At the same time, for profitability reasons, the proponent sought to locate as close as possible to the markets and to the existing natural gas transportation and distribution network.

In this process, the proponent excluded sites located upstream of Québec City, where river depth is insufficient for LNG tankers that would supply the project. Downstream, the proponent studied places previously considered by the government during preliminary studies in the 1970s. He retained four sites for more detailed evaluation, namely Gros-Cacouna, near Rivière-du-Loup, 220 km from the Québec City, Pointe Saint-Denis at Rivière-Ouelle, 100 km from the Québec City, Pointe de Saint-Vallier, 35 km from the city of Québec, and the Ville-Guay sector at the limits between Lévis and Beaumont.

After having rejected Saint-Vallier because of the presence of a bird sanctuary, among other reasons, the proponent arranged for a prefeasibility study for the other three sites (DA3). Subsequently, the proponent selected the Ville-Guay sector. In the impact statement, he lists the following technical and economic considerations justifying this choice:

– Wind, wave, and ice conditions are the most suitable.

– Pilots are very familiar with navigating conditions.

– Seismic conditions are acceptable.

– Shoreline vegetation is not highly developed.

– Sea mammals do not frequent the site.

– The site is zoned for industrial, port, and agro industrial uses.

The impact statement also recognizes that the Ville-Guay sector presents disadvantages the most significant of which are:

– The plateau for land facilities is located over a 50 to 70-m high cliff.

– The landscape is highly valued by the local population, though it has already been disturbed by existing Hydro-Quebec power lines.

– The population is divided and opposition to the project is foreseeable.

The Québec City -Lévis region is at the upstream end of deep water river navigation. If the terminal is built at Ville-Guay, the LNG tankers will be able to travel to the closest point to the Quebec gas market and neighbouring markets. In addition, the existing natural gas network ends at Saint-Nicolas, at the western limits of Lévis. The gas pipeline linking the terminal to this network would be 42 km long, a shorter distance than for any other site along the St. Lawrence River.

The proponent also assessed several options for building the terminal around the Ville-Guay sector, on both sides of the Lévis-Beaumont municipal limits. In the impact statement, he compared three sites of about 1.3 km^2 each, one in Beaumont (eastern option) and the other two in Lévis (northern option and western option), adjacent to the Beaumont limits. The northern option is located between highway 132 and the Hydro-Quebec power lines. The western option is located between those power lines and the Jean-Lesage expressway. The proponent retained the western option, on grounds such as the distance from the population, Lévis' industrial zoning, the agricultural use of the lands, and visual considerations.

In fact, the three options considered near the Ville-Guay sector are quite similar to one another. They are in agricultural zones under the *Act respecting the preservation of agricultural land and agricultural activities*, the visual impact of river and shoreline facilities would be similar, and the community affected, which includes residents of Lévis and Beaumont, is the same. These options for building the terminal correspond less to three sites than to three variants of a site.

- *Finding — The Panel found that the process leading the proponent to retain the Ville-Guay sector for the LNG terminal follows a selection and assessment method in compliance with the technical requirements and profitability considerations of this type of project.*

Geographical framework

In the impact statement, the proponent retained two separate study areas. The first includes the land considered for building the LNG terminal and the natural gas pipeline, namely an area of 600 km^2 along the St. Lawrence River, from Beaumont to Saint-Nicolas. The second study zone (70 km^2) encompasses the area likely to be affected by the terminal. It covers part of the Desjardins borough in Lévis and part of the municipality of Beaumont. The zone also includes the southern edge of the île d'Orléans at Sainte-Pétronille, Saint-Laurent, and Saint-Jean (PR3.1, Fig. 2.1).

Biophysical context

The two study areas are located in the freshwater estuary of the St. Lawrence River (DesGranges and Ducruc, 2000)[1]. The estuary comprises three sections including the section which is concerned by the project and which extends from Neuville to Saint-François, at the eastern end of île d'Orléans, where the brackish water begins. The normal navigation channel known as the chenal des Grands Voiliers, goes along the south side of île d'Orléans, across from Ville-Guay. It is dredged periodically to a depth of 12.5 m for one section and it reaches a maximum depth of 32 m towards the east (PR3.3.1, p. 2.27).

From a phytogeographic standpoint, the St. Lawrence River estuary extends from Grondines to Montmagny. The estuary has large tides that average 4.4 m and can reach more than 7 m. Shoreline vegetation develops in very particular conditions arising from the mix of fresh water and brackish water and to the tidal pattern. Several plant species peculiar to the estuary are found there, including some with a special or a precarious status. The river estuary is thus considered to be a unique ecosystem in North America (EB experts conseils, 2004)[2], which is also reflected in its benthic, fish, and avian fauna, illustrating both diversity of species and special status species. The project would be located in the bioclimatic zone of the basswood sugar-maple forest, and mixed forest dominates the regional forest landscape in the area where the

1. DesGranges, J.-L., J.-P. Ducruc, 2000. *Biodiversity Portrait of the St. Lawrence.* Canadian Wildlife Service, Environment Canada, Québec Region and Direction du patrimoine écologique, ministère de l'Environnement du Québec, [On-line: www.qc.ec.gc.ca/faune/biodiv].
2. EB experts conseils in collaboration with le Groupe Optivert et Beauregard et ass. 2004. Concept et orientations d'aménagement d'un réseau vert et bleu unifié sur le territoire de la Communauté métropolitaine de Québec. p. 59.

project is to be set up. It also should be noted that nearby there are many peat bogs including one, the Grande Plée Bleue, which is quite large.

Socioeconomic context

The general project location area overlaps the limit separating Lévis and Beaumont. The land for which the proponent took an option to buy is located at the eastern end of the Desjardins borough of the City of Lévis, and it is adjacent to Beaumont.

Since January 2002, Lévis comprises ten former municipalities. The new city takes over from two previous MRCs, namely Desjardins and Chutes-de-la-Chaudière. Moreover, Lévis is part of the Communauté métropolitaine de Québec (CMQ) which also includes the MRC de L'Île-d'Orléans, the urban agglomeration of Québec, and the MRCs de La Jacques-Cartier and de La Côte-de-Beaupré. The municipality of Beaumont belongs to the MRC de Bellechasse which is not part of the CMQ. The only official administrative entity common to Lévis and Beaumont is the administrative region of Chaudière-Appalaches, to which Lévis and the MRC de Bellechasse both belong.

In 2006[1], the CMQ had a population of 718,740 and Lévis had a population of 129,521. Of this population, the borough of Desjardins accounted for 50,818. The MRC de Bellechasse in turn had a population of 34,238. Beaumont, with a population of 2,291, is both the most densely populated municipality in the MRC and the one whose growth was the greatest in the previous half century. Across from Beaumont and Ville-Guay, the MRC de L'Île-d'Orléans had a population of 6,781, including 1,034 at Sainte-Pétronille, 1,576 at Saint-Laurent, and 897 at Saint-Jean.

With respect to proximity to the project site, the inhabited area forms a low-density residential strip along highway 132, between the limit of the Lévis urbanized perimeter, at the level of Lallemand road, and the heart of the village of Beaumont, to the east of Hydro-Québec TransÉnergie power lines. The projected LNG terminal shoreline and land facilities would be located on both sides of the residential strip along highway 132 which the cryogenic pipes would cross in linking the jetty to the LNG storage tanks.

In the absence of demographic data for Ville-Guay and western Beaumont, the proponent's count of residences points to 66 units in a one-kilometre perimeter around the projected facilities and 328 within a 2.5-km perimeter. Without any speculation on the seasonal or permanent nature of the residences and by using the average number of people per household in the Québec Metropolitan Area 2001

1. Data from the population decree for 2006 [On-line: www.mamr.gouv.qc.ca].

Census, namely 2.3 persons, the population can be evaluated to be about 150 people living less than one kilometre from the LNG terminal site and about 750 people less than 2.5 km away.

Aboriginal land claims

The proponent indicated in his impact statement that, based on information obtained from the Malécites de Viger First Nation (MVFN), the project is located on the ancestral land of this first nation. In a letter sent to the proponent, the MVFN indicated that is has "discussions with the Crown in right of Canada based on this title and these rights" (PR3.3.1, p. 2.94; PR6, p. 95).

Indian and Northern Affairs Canada informed the Panel that the sector targeted by the project, namely to the east of the Pointe de Lévis, at the limit of the municipality of Beaumont, is located within the land claimed by the MVFN (DQ16.2). Quebec's Secrétariat des affaires autochtones also indicated to the Panel that it had received a detailed description of the territorial limits of that claim (DB113.1).

No representation was made however by the Aboriginal people during the Panel's hearings and no issue was raised regarding this point by hearing participants.

Pipeline environment

The gas pipeline linking the projected LNG terminal to the existing natural gas network would be 42 km long. As shown in Figure 1, it would reach across the three boroughs belonging to the City of Lévis, namely Desjardins, Les Chutes-de-la-Chaudière-Est and Les Chutes-de-la-Chaudière-Ouest. The environment it would cross is shown in Figure 5.

According to the impact statement, the first section of the route, in the Desjardins borough, would pass through agricultural land along rights-of-way for the expressway, power lines, and railways, to the rivière Etchemin. Between the LNG terminal and that river, there are eleven crossings of minor waterways, nine highway crossings, including the Jean-Lesage expressway, and three railway crossings.

In the Chutes-de-la-Chaudière-Est borough, once the rivière Etchemin is crossed, the gas pipeline route continues in a wooded area to highway 275. It would go around a peat bog of approximately 3 km^2, and then near two wetlands of about 40 ha. Near the limit of the MRC de La Nouvelle-Beauce, the route would turn before crossing highway 73, highway 175, and the rivière Chaudière. In addition, this section of the route would cross three roads, two railways, and nine minor waterways.

In the Chutes-de-la-Chaudière-Ouest borough, the route would go mainly through wooded areas. Once across the rivière Chaudière, the route would go along a Hydro-Québec easement crossing 2 km of a large plot of forest belonging to the Société Stadacona. The route would then continue to the Sainte-Anne Ouest road, along the right bank of the rivière Beaurivage, it would cross that river, and then go to the delivery station at Saint-Nicolas. In the last section of the route, in addition to crossing the rivière Beaurivage, the route would cross five roads, a bicycle path along a Hydro-Québec right-of-way, and thirteen minor waterways (PR3.4.2, p. 7.1 to 7.3).

- *Finding — The Panel found that the projected natural gas pipeline would go mainly through rural lands, crossing many waterways, including the rivières Etchemin, Chaudière, and Beaurivage. It would follow the rights-of-way for linear infrastructures over a large section of the route.*

Land use planning and management

The legislative and regulatory framework for land use planning is established under the *Act respecting Land Use Planning and Development* (R.S.Q, c. A-19.1), that sets forth the principle to the effect that land use planning and development decisions are political in nature. The Act defines the planning and development management instruments and prescribes consultation mechanisms for citizens at different stages in the planning process. Application of the land use planning and development regulations is the responsibility of the MRCs and local municipalities. For the Montreal and the Québec metropolitan areas, where land use planning and development issues justify it, the government created metropolitan community authorities called *communautés métropolitaines*.

Under the Act, each MRC is obliged to maintain in force a land use planning and development plan providing the main guidelines for development of the territory. In order to foster discussion of common issues among adjacent MRCs, the Act stipulates that each MRC should inform the neighbouring MRCs of any proposal to modify or revise the plan. It also allows two MRCs to request the creation by decree of a joint land use development commission where the issues of development of interest to both can be discussed, such as projects located along their common limits.

Land use and applicable by-laws

The proposed LNG terminal would represent a new use in a sector currently occupied by agricultural activities and low-density residential and cottage uses. The Master Plan in force in Ville-Guay is the one of the former MRC de Desjardins, adopted in 1987. The

urban development plan is the one that was applicable to the territory belonging to the former City of Lévis; it has been in force since 1991. The most relevant by-law is the Lévis zoning by-law No. 234 (DB65; DB64; DB63). The main elements of the land use regulatory framework in the project study area appear on Figure 5.

In the land use planning and development plan, the designated use that covers the largest part of the site is industry and port activities (DB27, p. 1). It includes two areas. One reaches more or less from highway 132 to the Jean-Lesage highway, between Lallemand Road and the Beaumont limits. The other, in the river, runs along the shore for about 1 km starting from the Beaumont limit. The land between highway 132 and the river is assigned as an “extra-urban area”.

The industrial and port use provided for in the plan aimed to “recognize a site that lent itself particularly well to large scale industry and deepwater port construction” and to “protect this part of the MRC territory against uncontrolled interventions likely to harm the industrial vocation” (*ibid.*, p. 5 and 6). At the same time, in reference to the long lead time required for industrial projects, the plan points out that uses in the areas of agriculture, forestry, and different types of housing are compatible with the industry and port activities (*ibid.*, p. 9). As regards the assignment for an “extra-urban area” between highway 132 and the river, this concerns “a concentration of year-round or seasonal residences” outside the urbanized perimeter (DB65, p. II-32).

In the 1991 Master Plan, the land between the Jean-Lesage expressway and highway 132 was given two uses that would overlap, namely “heavy and large-scale industry” and “agriculture”. In conformity with the land use plan, the Master Plan intends to “recognize the industrial and port potential of Lévis with its choice site located in the St. Lawrence Seaway corridor” (DB27, p. 12) and to “develop a major port infrastructure” (DB27.1). It also includes “as a compatible use a technical corridor between the potential port infrastructure host site and the area that could possibly host heavy or medium to large-scale industry” (DB27, p. 12). Finally, it calls for, on a temporary basis, “agricultural or comprehensive uses that do not jeopardize the industrial and port potential of the sector” (*ibid.*, p. 3).

Under the Lévis zoning by-law, the project site overlaps five zones (DB63; DB27, p. 4). The two largest zones stretch from the Jean-Lesage expressway to the edge of highway 132. These zones encompass two main types of uses: on the one hand, agriculture and forestry, and on the other, various commercial, industrial, and recreational uses. The third zone is a strip about 60 m deep, running along the south side of highway 132 starting from the Beaumont limit. Agriculture with no livestock and isolated single-family and two-family dwellings are authorized.

The fourth zone, between highway 132 and the river, is designated as rural. Housing is authorized, as are office buildings and various services. A technical corridor destined to link the industrial facilities to port facilities is authorized in both zones. The fifth zone, in the river, stretches over about 1.5 km to the west from the Beaumont limit. Port facilities, marine terminals, and various types of industry are permitted there.

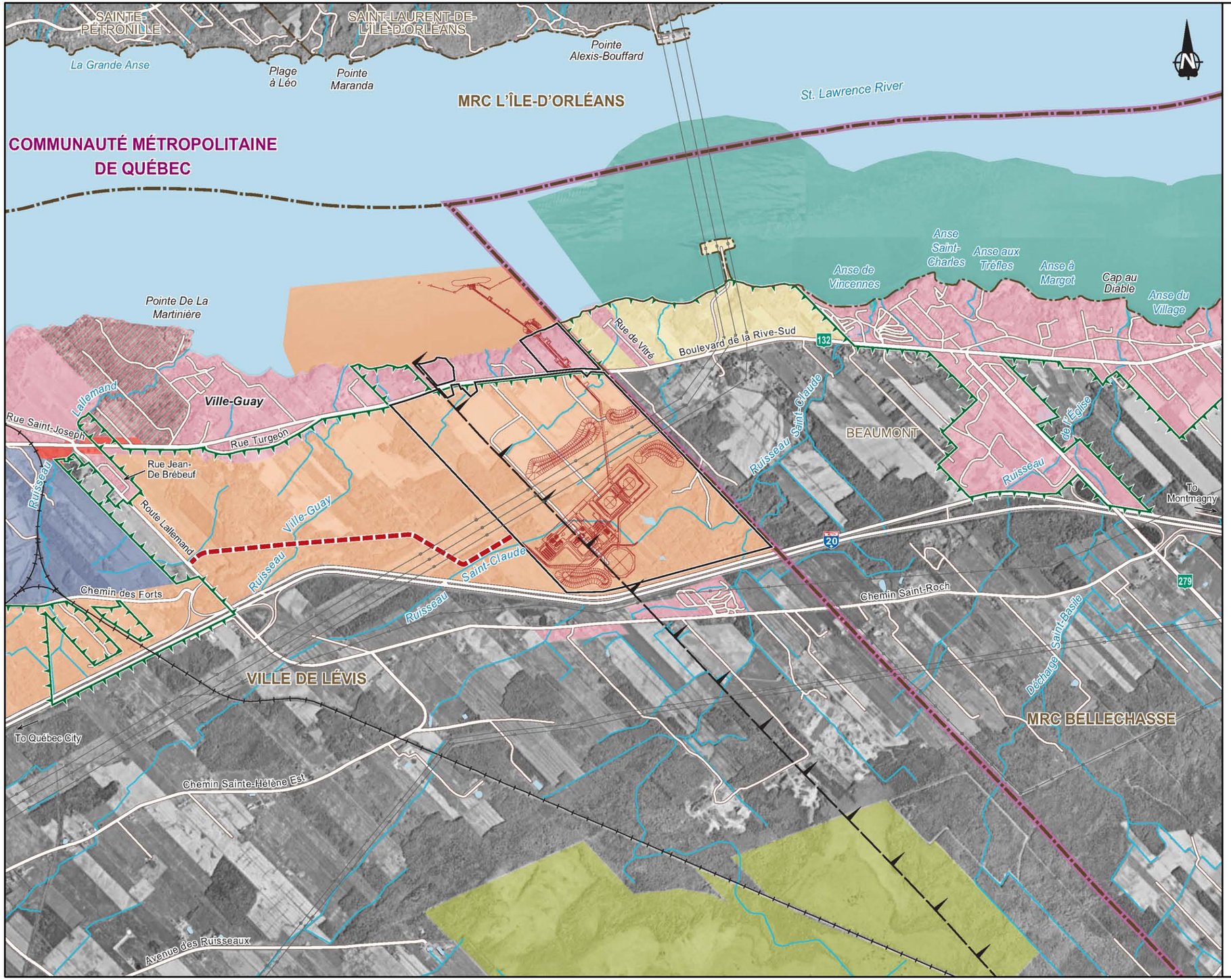
The project site is also protected by the *Act respecting preservation of agricultural land and agricultural activities*. Almost all the land is, in fact, in an agricultural zone, the "green zone" established under the Act. The construction of the LNG terminal land facilities is thus subject to a decision by the Commission de protection du territoire agricole du Québec (CPTAQ). On this issue, the City of Lévis adopted a resolution regarding the request to exclude part of this land from the agricultural zone and this resolution must be forwarded to the CPTAQ for the project to go ahead (DB109). The agricultural status of the site was invoked several times during the public hearing, particularly in relation to tree-growing activities. However, no specific claims have been made regarding the land by farmers or farmers unions.

- *Finding — The Panel found that the land use planning and development plan, the Master Plan, and the zoning by-law that apply to the site retained for the project facilities includes both existing uses as well as industrial and port activities with the corresponding categories of authorized uses.*

- *Finding — The Panel found that the project, diverges, by its nature from current land uses in the Ville-Guay sector.*

- *Finding — The Panel found that the site retained for the project facilities is part of the agricultural zone protected under the* Act respecting preservation of agricultural land and agricultural activities. *For this reason, the Commission de protection du territoire agricole du Québec will have to make a decision on the request to exclude part of the agricultural zone to enable the project to go ahead.*

Figure 5 Characteristics of the host environment and land use



Legend

Project

- Proposed LNG terminal
- Land subject to option to buy
- Proposed municipal road

Land uses

- Urbanized area
- Urban reserve
- Business axis
- Industrial pole
- Industry-port
- Agricultural
- Recreation and tourism
- Recreo-ecological
- Ecology, conservation
- Protected agricultural land

Beaumont regulation component

- Applicability limit of Municipality of Beaumont By-Law 523 (land section)

Limits

- Communauté métropolitaine de Québec
- MRC and equivalent territory
- Municipality

Approximate scale 0 600 m

Sources: adapted from PR3.3.2, Figures 2.7 and 2.9; PR5.1, Figure 40; PR5.2.1, Figure 4; DQ44.2; regionals maps of the ministère des Affaires municipales et des Régions [On-line (March 22, 2007): www.mamr.gouv.qc.ca/publications/cartotheque/region_03.pdf, region_12.pdf *and* cmquebec.pdf].

Issues in dispute

For the City of Lévis, the designation for industry and port activities around the Ville-Guay area bears witness to a long-standing desire to take advantage of a favourable situation, namely the potential for deep-water ships to dock at the farthest point upstream, coupled with large flat lands that suit large-scale industrial plants. Lévis considers that the proposed LNG terminal corresponds well to this type of use and that its city by-laws allow it to host the terminal, subject to two amendments, qualified as minor and that did not cause any controversy. Lévis will also have to modify some sections of its urban development regulations that cover the projected gas pipeline route. The city council mandated its planning department to prepare the required modifications (DM315, p. 13; DB27, p. 14).

Some one hundred opponents to the project nonetheless applied to the Superior Court to have the project declared as not in compliance with the City of Lévis zoning by-law No. 234 (DC97). This application is based especially on the expertise of a city planner, for whom the uses authorized by the zoning by-law do not cover most of the LNG terminal components. He explained that these components were largely incompatible with many of the uses authorized since they involve health and public security risks (Mr. Claude Lavoie, DT17, p. 52 to 62; DC3).

Moreover, under the authority of the *Municipal Code of Québec* (L.R.Q., c. C-27.1), the Municipality of Beaumont adopted by-law No. 523 on December 19, 2005, "Règlement relatif à l'entreposage de certaines matières explosives, inflammables ou autrement dangereuses" (DB14; DM619, p. 22). This by-law forbids, among other things, the storage of gaseous or liquid methane and liquefied natural gas on Beaumont land and within a radius of 1 km beyond Beaumont's municipal limits. Since the land retained by the proponent is adjacent to the Beaumont municipal limits, the perimeter affected by by-law No. 523 encompasses the major part of the project site. According to the municipality of Beaumont, the proposed LNG terminal could not be operated without violating its by-law No. 523.

However, this interpretation by Beaumont is rejected by the proponent and the City of Lévis. In addition, in an aim to counter the Beaumont by-law, on May 7, 2007, the Lévis city council adopted the by-law *Règlement RV-2007-06-18 permettant l'emmagasinage and l'entreposage de certaines matières sur une partie du territoire*[1]. This by-law aims specifically to allow the storage of the substances forbidden by by-law 523, and also asserts that the Beaumont by-law is not applicable on the territory of Lévis (DM619; DB62; DB111).

1. It should be noted that this by-law was not in force when it was sent to the Panel

It is not the Panel's responsibility to settle this dispute between the two municipal administrations. This dispute will nonetheless have to be resolved in the case where the project is authorized. As for the dispute regarding the project's compliance with the Lévis by-laws, it will be up to the courts to settle the matter, and not the Panel. This being said, the Panel notes that these litigious issues bear witness to the opposition to the project among the citizens living near the sector proposed for the project.

- *Finding — The Panel found that the City of Lévis considers that the project respects its land use planning and development by-laws, except for two modifications that it qualifies as minor. The Panel notes however those citizens in Lévis and Beaumont who live near the project site have taken legal action before the Superior Court to declare the project not in conformance with Lévis' zoning by-law.*

- *Finding — The Panel noted a dispute between the Municipality of Beaumont and the City of Lévis regarding application of Beaumont by-law 523 prohibiting storage of gaseous or liquid methane and liquefied natural gas in Beaumont and within a 1-km radius beyond that land, which encompasses the sector in Lévis proposed for the project.*

Evolution of the land use framework

In its analysis, the Panel took into account the process of preparing and revising the legal instruments which govern land use and development. This process was referred to by both those who support the project and those who oppose it. The former submit that the industrial and port vocation of the Ville-Guay sector was planned a long time ago. The latter consider that, since industrial and port projects have not yet been developed, Ville-Guay should be dedicated only to its existing uses.

In 1994 the former MRC of Desjardins had undertaken the revision of the 1987 development plan. A revised plan was proposed and adopted as a by-law on November 28, 2001. However, since it never received ministerial approval, that revised plan was never applied. After the January 2002 merger, the new City of Lévis started the revision process again. Despite a proposal dated December 23, 2004, the second revision process was interrupted in fall 2005 (DB61, p. v; DQ32.1; DC86.1, p. 13).

With the *Act to amend various legislative provisions concerning municipal affairs* (S.Q. 2006, c. 60, s. 131 and 132; DB94.2), Lévis is now obliged to adopt a plan for its entire territory by June 14, 2007 at the latest. In order to comply with this obligation, on February 7, 2007, Lévis adopted a second proposed land use and development plan, which it must submit to public consultations (DB105).

The industrial and port vocation of the Ville-Guay sector was maintained in most of the proposals to revise the land-use plan, except for the proposal dated December 2004, that does not show the designated industry and port perimeter either in the map of designated uses or in the map of infrastructures. The text of that proposal nonetheless mentions the industry and port potential of the Ville-Guay sector (DC86.1).

In the most recent development plan proposal, the one Lévis adopted on February 5, 2007, the lands with the proponent's option to buy on them are known as "Parc industriel Lévis-Est". The transportation infrastructure map includes a sketch of the LNG terminal project in a reference box with the mention "tentative, this project is now under study". The area designated for industrial use appears limited to the LNG terminal facilities (DB105, Map 2). That is in line with a statement by the legal advisor of Lévis during the presentation of the city's brief before the Panel on January 30, 2007. He pointed out that the revised plan that was to be adopted a few days later would only indicate an industrial designation for the lands planned for the projected terminal (Mtre Michel Hallé, DT16, p. 34). The same would apply to agricultural land protected by law according to the Mayor of Lévis, who said that only the land for the project would be concerned by the request for exclusion addressed to the CPTAQ (Ms. Danielle Roy-Marinelli, DT16, p. 33).

As mentioned above, several participants, including some interested companies, referred to the potential for heat or cold exchange or for CO_2 capture that could be developed with the project. These companies would have to locate in the immediate vicinity of the project, namely within 500 m of the project's land facilities. However, by limiting the industrial zone to the proponent's lands, the City of Lévis is susceptible to reduce the terminal's economic and environmental benefits and spinoffs. Although the Panel is aware that the land is protected under the *Act respecting preservation of agricultural land and agricultural activities*, it considers that it is preferable to preserve the project's full potential for economic spinoffs by authorizing industrial uses not only on the project site but also on land adjacent to the project's facilities.

- *Finding — The Panel found that, since the 1987 land use plan of the former MRC de Desjardins, the industrial and port vocation of the eastern section of Lévis has been maintained in one form or another throughout the revision procedures that were conducted until 2007. However, no industrial or port facility has been built there until now.*

- *Finding — The Panel notes that, in the revised plan proposed in February 2007, the City of Lévis proposed to limit the industrial and port vocation only to the land planned for the project.*

- ***Recommendation 3 —*** *If the project is authorized and in order to attract companies that must be physically in proximity to the project's installations,, the Panel recommends that in its land use planning and development plan now being revised, the City of Lévis designates for industrial use of the land adjacent to the project. The Panel also recommends that the City of Lévis include this land in the request for exclusion that it will address to the Commission de protection du territoire agricole du Québec.*

Landscape

In this section, the Panel addresses project integration in the landscape unit to which Ville-Guay belongs, as well as the visual analysis approach adopted by the proponent. The following landscape components are considered by the Panel in its analysis:

– The visual experience, in part based on the visible characteristics of the land.

– The landscape structure revealed by the interaction between human activity and the environment and including biophysical and anthropogenic elements.

– The heritage value landscape in its multiple dimensions.

The *Sustainable Development Act* establishes a link between heritage, landscape, and identity:

> The cultural heritage, made up of property, sites, landscapes, traditions and knowledge, reflects the identity of a society. It passes on the values of a society from generation to generation, and the preservation of this heritage fosters the sustainability of development. Cultural heritage components must be identified, protected and enhanced, taking their intrinsic rarity and fragility into account.
> (Section 6)

Beyond the qualified expert in visual assessment, it is widely accepted today that local, regional, and national players contribute to defining, qualifying, and assessing landscapes, since they are the ones who experience it. In this perspective, the experts have more of a role in translating and reflecting the perceptions and representations linked to the facts and realities experienced by these actors (Fortin, 2005) [1].

1. M.-J. Fortin, *Paysage industriel, lieu de médiation sociale et enjeu de développement durable et de justice environnementale: les cas des complexes d'Alcan (Alma, Québec) et de Péchiney (Dunkerque, France)*, Doctoral Thesis, Université du Québec à Chicoutimi, 2005, p. 541.

Landscape unit to which Ville-Guay belongs

According to the St. Lawrence River ecological reference framework (DesGranges and Ducruc, 2000[1]), the Québec City metropolitan area and, particularly, the land concerned by the project have a relief which includes varied landscapes at the intersection of three large natural regions, namely the Canadian Shield, the Appalachians, and the St. Lawrence Lowlands.

More specifically, the study zone contains an elevated plain. Although the slopes are generally gentle, they are steep in many places along the banks of the main waterways. The coast of Beaumont on the St. Lawrence River comprises cliffs.

The landscape of the project considered site is located at about 4 km east of the Lévis, Québec City, and Beauport industrial and port complex. The complex includes the MIL Davie shipyard which is located in the urban environment of Lévis, grain elevators, and other infrastructures belonging to the port of Québec. On the south shore, the Pointe De La Martinière in Lévis marks the transition to a rural landscape. It constitutes a natural and historic landmark with Fort De La Martinière, an opening towards the rural environment, and an entry to the National Capital via highway 132, also known as the Route des Pionniers, a name which underscores its historic past. Beyond that, industrial activities near the river are only found at Montmagny. At Ville-Guay itself, the environment has been modified by agriculture, highway 132, expressway 20, and by urbanization. 735-kV power lines cross the river between the south shore and île d'Orléans 1.6 km east of the project.

At the CMQ scale, a high level of artificialization of the banks is noted, more than 77 percent according to the atlas *Biodiversity Portrait of the St. Lawrence* (DesGranges and Ducruc, 2000[2]). Nonetheless, Lévis as well as Saint-Jean and Saint-Laurent de l'île d'Orléans, represent a transition zone towards the east with their less "artificialized" banks. Beaumont, on the south shore, and Saint-Pierre and Sainte-Famille, on the north bank of île d'Orléans, are among the municipalities that have been best preserved against artificialization along the St. Lawrence River in Quebec.

- *Finding — The Panel notes that the landscape unit in which the LNG terminal project and related facilities would be integrated is characterized by a varied landscape, which stems from the encounter of three large natural regions, as well as the low degree of artificialization of the river banks downstream from Pointe De La Martinière.*

1. *Op. cit.*
2. *Op. cit.*

Visual impact of the project

In this section, the Panel considers the visual impact of the LNG terminal. As regards the natural gas pipeline, the only modifications to the landscape to be noted are the visual impact of a corridor through a forest environment and possible temporary trenches for the river crossings. Revegetation work is planned once the trenches are refilled. Local adjustments could also be made by the proponent to ensure good visual integration of the natural gas pipeline (PR3.4.1, p. 6-11).

The area of visibility of the LNG terminal project considered by the proponent for his analyses is illustrated in Figure 6. According to certain participants, the area of visibility reaches farther and the analysis should have included Québec City and other municipalities on the south shore and île d'Orléans.

The permanent infrastructures, operational activities, and nighttime lighting would be the main sources of visual impact for the project. The most visible infrastructures would be the following:

– The service corridor including the access road to the jetty and the right-of-way for the cryogenic pipes, part of which would be cut into the cliff.

– The 500-m long jetty.

– The 20-m high water towers and the 19-m high unloading arms located at the jetty head.

– The buildings on the shoreline.

– The storage tanks, visibly 46-m high and 90-m in diameter.

– The vaporizer stacks.

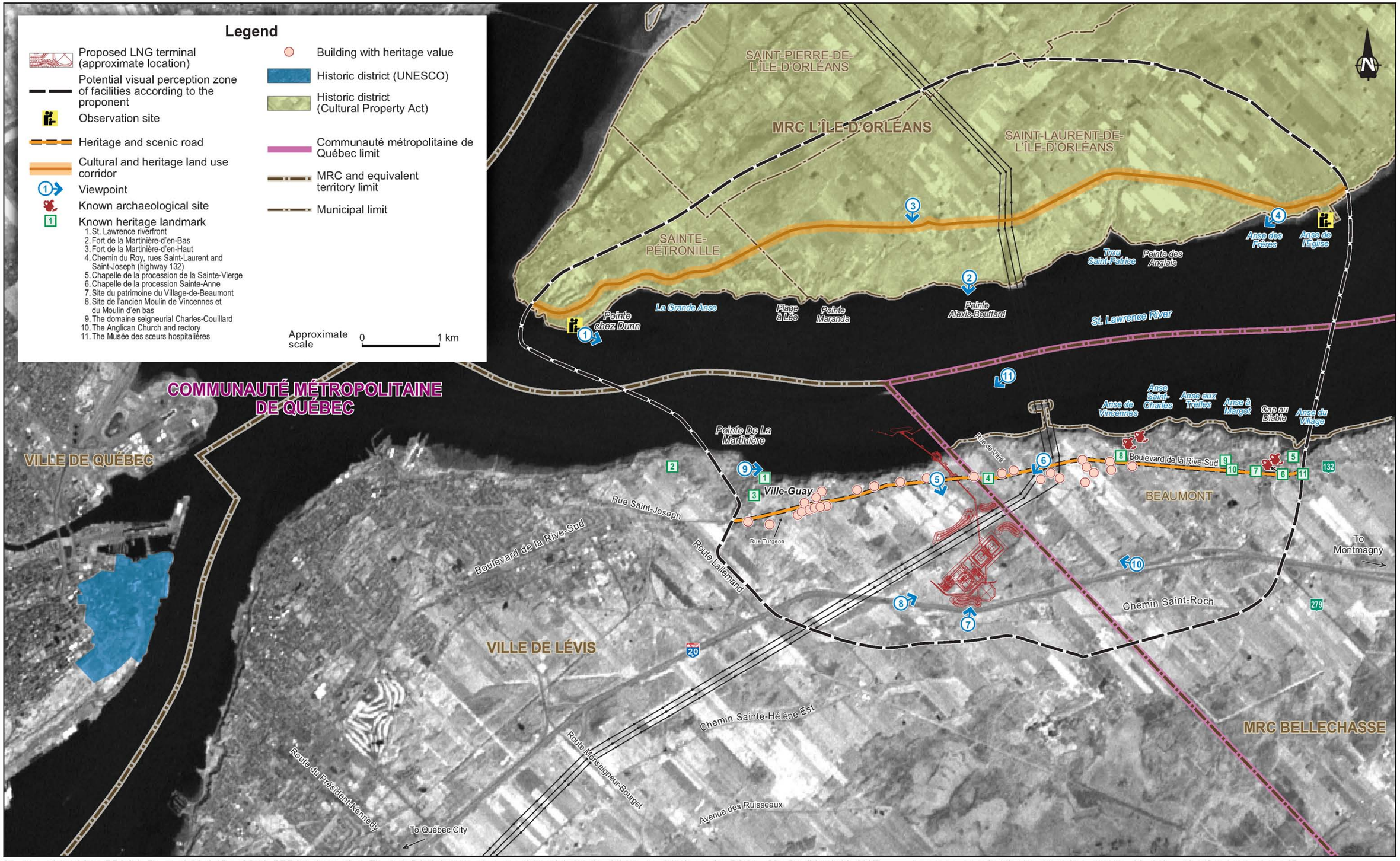
– The 60-m high flare.

– The two 230-kV electricity supply lines involving a 60-m right-of-way requiring control of wooded vegetation.

– The docked LNG tankers[1].

1. An LNG tanker is 300-m long, 40 to 50-m wide, and 41 to 52-m high. That corresponds to a 15 to 18-storey tower or the height of the cliff across from the zone retained for the shore and port facilities.

Figure 6 Landscape and heritage analysis components



Sources: adapted from PR3.3.2, Figures 2.11, 2.15 and 6.12; PR5.2.1, Appendix 1, Figure 1; DA19-3; regionals maps of the ministère des Affaires municipales et des Régions [On-line (March 22, 2007): www.mamr.gouv.qc.ca/publications/cartotheque/region_03, region_12.pdf *and* cmquebec.pdf].

At night, the site would be lit up during construction and during operation of the terminal. The brightness during the night would be 50 lux at the access points and gates, 20 lux in the area of the jetty with no ship docked, and 50 lux when a ship is there. In comparison, a highway is lit up at 13 lux and a residential street at 4 lux (PR3.3.1, p. 4.117).

The nighttime lighting of the land facilities would be reduced by the berms and forested areas. Moreover and subject to worker safety standards, the lighting fixtures would produce light beams directed downward to minimize the halo phenomenon (*ibid.*).

For the purpose of his analysis of the landscape impact of the project's facilities, and more specifically the two storage tanks, the proponent considered certain "viewing points" under summer, winter, day, and night viewing conditions. The analysis included nine strategic viewing points that were used for visual simulations (Figure 6). Other simulations, including from the river and the chemin Royal on île d'Orléans were also carried out

The Panel is of the view that the impact of the utility corridor with the access road to the jetty was not adequately taken into account. As this corridor does not appear on the proponent's visual simulations. Considering the topography, the access road would go through a slanted-slope trench cut into the cliff with a maximum depth of about 20 m. The right-of-way of the access road and that of the caisson for the cryogenic pipes would require dynamiting on a large section of the stretch between highway 132 and the shoreline, and that would permanently impair the integrity of the cliff.

After analysis, the Panel notes that the visual impact of the utility corridor would be present at two main spots. The first would be where the ramp leading to the access road and the service road parallel to the pipes would meet highway 132. Once the cryogenic pipes are buried and the access road tunnel is completed, the visible components would be the ramps and the service road.

The second impact area would include île d'Orléans and the river. Once construction is completed, the straight trench in the cliff for the access road would be visible. The caisson for the cryogenic pipes would also remain visible on the lower section that is not buried. On île d'Orléans, the utility corridor axis is in line with the "plage à Léo" sector in Sainte-Pétronille, on the limits of Saint-Laurent.

- ***Opinion 5 —*** *The Panel is of the opinion that the utility corridor and particularly the access road to the jetty would create a visible fracture in the Ville-Guay cliff, in the absence of mitigation measures capable of diminishing the visual impact.*

The proponent undertook with the City of Lévis to invest in the construction of infrastructures and facilities to welcome tourists at Pointe De La Martinière (DM315, p. 18). There, trails giving access to the St- Lawrence river offers walkers a view of île d'Orléans and down the river. Owing to the proximity of the Pointe De La Martinière to the proposed terminal facilities and the contrast between the natural features and the industrial aspect of the LNG terminal, the proponent qualified the visual impact of his facilities as high from this point of view (PR8.3, p. 52; DQ14.1, p. 2). The presence of the LNG terminal maritime infrastructures would be added to those of Hydro-Quebec's power lines, and would create a cumulative impact on the visual appreciation of the landscape and on the experience visitors would have at the Parc de la Pointe-De La Martinière.

The Panel went to the shore of the river near the Pointe De La Martinière during a public visit along with the proponent and many citizens. It considers that the impact of the project seen from the bank should have been documented further, for example from the Parc de la Pointe-De La Martinière.

- ***Opinion 6 —*** *The Panel is of the opinion that, even if visual simulations were not produced from the public access points on the river, the visual experience of residents and visitors to these spots would be modified by the project.*

Heritage Value of the Landscape

Several participants, including groups that have a long history in studying and defending the landscape, pointed out that the landscape cannot be reduced to its visual aspect, but must also be considered in light of its heritage value. They underscored the cultural, identity, and symbolic dimensions of the landscape. Commenting on the impact of the projected infrastructures on the landscape, a number of participants emphasized its homogeneity and the necessity to preserve it as a collective heritage[1].

On this point, a participant spoke of the value of the landscape in the following terms:

> […] people need to have elements for identification, or better yet, authentic geo-symbols to exits, if not for their well-being. […] These geo-symbols definitely define a well-determined territorial identity. They open the doors to reflection on the link between landscape and the land in all its forms. We don't simply live on a territory; the territory also lives in us. […] This place is Lévis, a unique [and] historic […] environment.
> (Ms. Yvonne Tschirky-Melançon, DM524, p. 10-11 and 18-19)

1. Last year, the GIRAM began to develop a project to have this sector of the river recognized as a "cultural landscape" under the *Natural Heritage Conservation Act* (DM461, p. 41).

From the MIL Davie shipyards in Lévis to Montmagny, highway 132 goes through rural landscapes with a major natural and heritage component and provides viewing points for île d'Orléans, which itself is a historic district. No heavy industrial activity has been established in this part of the land which has maintained its original land divisions for 350 years. In fact, according to testimony received during the hearing, the river corridor between Pointe De La Martinière and the eastern end of île d'Orléans is one of the few sectors of the St. Lawrence River that still presents such features of historical integrity and continuity.

From this standpoint, the 735-kV electricity transmission line that crosses the river from île d'Orléans to Beaumont is considered by most of those who referred to it as an error of the past. For some, the presence of these power lines reduces the quality of the landscape on the coast of Beaumont in such a way that the LNG terminal facilities, though visible, would lose some of their impact. For others, the construction of the terminal would be the equivalent of repeating the error of Hydro-Québec's power lines or of installing the equivalent of Ultramar's Saint-Romuald facilities at Ville-Guay.

- *Finding — The Panel notes that the project, with its on-shore and port components, would be the first development of this type in the high heritage value landscape along the coast of Beaumont.*

Territorial integration issues

Integration of the project in the Ville-Guay sector raises two main issues. One pits the residential, agricultural, and recreational and tourism use in a permanent agricultural zone against the establishment of a use that would implement a long-planned industrial and port development potential. The other pits a highly valued landscape known for its continuity and integrity against the permanent and visible presence of LNG terminal facilities.

With respect to the first issue, the Panel concluded[1] that the project corresponds to the industrial and port designation and uses that are provided for in the applicable land development plan, municipal Master Plan, and zoning by-law.

With respect to the landscape, though the Ville-Guay sector provides conditions that meet the requirements for construction of an LNG terminal, the question whether or

1. Subject to the upcoming judgment that could be rendered by the Superior Court in the action brought by cittizens of Lévis and Beaumont seeking a declaration that the Rabaska project is not in conformance with the City of Lévis zoning by-law.

not the LNG terminal is suited for Ville-Guay remains legitimate. Analysis of the landscape issues shows that the coast of Beaumont is an integral and major part a highly valued landscape. Analysis also shows that the projected development, particularly in the river, on the bank, and the cliff, would represent a visible, local and permanent break in the integrity of the cost of Beaumont landscape.

This issue illustrates the fact that the knowledge and preservation of the landscape, that are part of the intentions and orientations of many municipalities, must be consolidated. For example, the CMQ is now developing a unified green and blue network for its territory. This project aims particularly to reconcile the green and blue elements of the landscape. This type of initiative gives effect to the soundness of the testimony made by hearing participants as to the importance of considering the river in all landscape and heritage strategies.

In regard to the knowledge of the landscape, the analysis and assessment methodologies and tools combining the contribution of visual analysis experts with those of citizens in a participative approach are recommended in dealing with landscape in all its dimensions. These combined procedures remain dependent on basic knowledge of the land, making it possible to develop a landscape typology. Diagnostic tools include, for example, the “Macro-inventaire du patrimoine québécois” (Quebec Heritage General Inventory) and the “Cadre écologique de reference” (CER) (Ecological Reference Framework) developed by the MDDEP. The adoption of Landscape Charters, establishment of buffer zones or landscape envelopes are just some of the means to be implemented in Quebec.

As an integral part of the Lévis, the Ville-Guay landscape comes under the jurisdiction of the City in terms of development control and management of its territory. By designating this sector for industrial and port use, the City chose to favour the economic development potential at the risk of impairing the integrity of the landscape. Although this choice of development is contested by a large number of Ville-Guay residents, by other residents of Lévis and by citizens of Beaumont and île d’Orléans, it is supported by a majority of the population of Lévis.

- ***Opinion 7 —*** *The Panel is of the opinion that the project’s port and on-shore facilities and the infrastructures cutting through the cliff would impair the landscape on the coast of Beaumont.*

- ***Recommendation 4 —*** *If the project is to be carried out, the Panel recommends that within the framework of, and during, the current environmental assessment, the proponent take all measures necessary to ensure the best possible integration of the port and on-shore facilities in the landscape, particularly the access road to the jetty.*

Chapter 5 Assessing the risks related to the project

In this chapter, the Panel addresses the potential risks associated with the construction of the LNG terminal and related infrastructures. The analysis was guided by the concerns, opinions and views expressed during the public hearings, as well as by the assessment and the criteria used by the proponent in his studies. The risks related to the project concern three aspects: LNG tanker navigation in the seaway; the project's land facilities, including berthed LNG tankers; and the proposed pipeline.

The properties and related hazards of liquefied natural gas

Chemically, LNG is essentially made up of methane in a proportion that can vary between 85 and 95 percent on a volume basis, depending on its origin. Liquefied by cooling at -160 ºC, and reduced to 1/600th of its original volume in this state, with a slightly lower density than water, LNG becomes easily storable and transportable under close to atmospheric pressure conditions. It is clear, transparent, odourless, non-corrosive and non-toxic.

The potential hazards of LNG are mainly linked to its very low temperature and the cryogenic aspects that stem from it. Specifically, these hazards concern, first and foremost, employees working in close proximity to the liquefaction and tanker loading areas, unloading areas or storage and LNG regasification equipment facilities. There are also risks of thermal embrittlement and damage caused to the component materials of the facilities which are not meant to come into direct contact with the LNG.

LNG is only flammable in its gaseous state, as is the case for other hydrocarbons. Consequently, in the presence of an ignition source, or if the temperature is sufficiently high to reach the point of auto-ignition, LNG will ignite, with a combustion rate that is relatively slow[1]. Natural gas has an auto-ignition temperature of 540 ºC, a higher temperature compared to diesel (260 ºC) and to premium grade gasoline

1. The minimal energy required to ignite LNG vapours is 0.29 millijoule (mJ). This would justify the conclusion that it would be unlikely that LNG clouds could travel and spread over great distances without quickly igniting close to their sources. To compare, the electric energy freed by walking on a carpet or by combing hair is in the order of 10 mJ, or 35 times the minimal energy required to ignite LNG vapours [On-line: http://archives1.iomosaic.com/whitepapers/Managing%20LNG%20Risks.pdf].

(400 ºC). Correspondingly, it is more difficult for LNG to auto-ignite, compared to flammable petroleum products, as well as other hydrocarbons (butane: 430 ºC, propane: 468 ºC).

Natural gas can only explode when pressurized inside a confined space, with the presence of oxygen and a heat source. For natural gas to be flammable, it must be concentrated in the ambient air within a range between 5 to 15%, on a volume basis, with the presence of oxygen required for ignition. When the concentration is greater than 15%, i.e. the upper flammability limit, then oxygen concentration is insufficient for ignition. Concentration levels below 5% are insufficient to cause flammability, i.e. this is the lower flammability limit. In the same context, the flammability range for propane is between 2.2 and 9.5% and between 1.3 and 7.1 for gasoline.

Moreover, in confined spaces and with the absence of a thermal source that could cause an explosion, natural gas will help decrease the oxygen concentration, resulting in an asphyxiant environment.

- *Finding – The Panel notes that the physicochemical properties of liquefied natural gas make it relatively more difficult to ignite than other much more commonly used and better-known hydrocarbons.*

The thermal properties of liquefied natural gas

Leaks or spills from an LNG tanker tank, land pipeline or storage facilities in an LNG terminal could result in certain physical phenomena, which are examined in the following sections.

Spills over water and the forming of a liquid pool

According to the impact study, a spill could occur after an accident with an LNG tanker. Thus, a collision or grounding may result in a spill with a large surface pool of LNG. In the event of large spills, the thermal contribution from the air may be insufficient to ensure LNG evaporation, which would lead to a pool forming on the water (PR3.3.2, F-2, p. 97 and 98).

When in contact with water, the LNG pool would evaporate quickly, thereby creating a natural gas cloud that would be dispersed at a rate depending on the speed and direction of the wind. As the wind would disperse the gas cloud, the cloud would extend and mix with the air depending on atmospheric conditions. Through thermal exchanges, the cloud would finally reach a density comparable to air, depending on the ambient temperature, and could then be dispersed according to prevailing air

turbulence. Generally speaking, an LNG cloud floats, i.e. it is lighter than air. However, the very cold temperature of the cloud, and the presence of heavier hydrocarbons, could reduce its initial buoyancy. The cloud could then become sufficiently diluted close to its source before becoming lighter than air, and thereby not present any further risks of ignition (*ibid.*, p. 100 and 101).

Flash fires

A cloud of dispersing methane gas becomes flammable if its concentration falls within the lower and upper flammability limits. Most ignited clouds become ignited at their perimeter when they meet an ignition source. If a cloud ignites, it undergoes a "back propagation" phenomenon of flames towards the source, and a flash fire occurs throughout the entire flammable part of the cloud. The cloud then burns at the upper flammability limit until the hydrocarbon source is depleted. The flashback will occur almost always up to the source, and the pool will ignite. However, the cold methane, heavy with condensed humidity from the water vapour in the atmosphere, is not very flammable, and experience has shown that several cloud fires go out on their own (*ibid.*, p. 101 and 102).

Most of LNG fires propagate at a relatively slow speed, of 10 to 20 m/s up to the source, and burn the flammable substance at a relatively low rate, while emitting a limited thermal radiation. The greatest portion of thermal energy emitted is absorbed by the flue gases that would probably be emitted over the cloud. Several flash fires have broken out after industrial accidents in refineries or chemical product plants. Their consequences have been properly modeled with respect to the scope of the lower flammability limit area during the cloud's spread. In these cases, the fires are an alarming situation for anyone caught inside the flammable cloud. According to the proponent, significant impacts outside of the flammability area have rarely been recorded, an opinion that was shared by the Environment Canada representative (*ibid.*, p. 101 and 102; DA86.1, p. 52):

> A flashback could result in serious consequences for whoever would be in its path, within the flames, but it would pose few problems through heat flux for whoever would be in the vicinity.
> (Mr. Robert Reiss, DQ75.1)

- *Finding – The Panel notes that flash fires which can occur in natural gas clouds present a low risk for public exposure outside of the cloud's flammability area.*

Pool fires on the water

In the wake of a spill, an LNG pool can ignite after a flash fire, burning until it is depleted. According to the information provided by the proponent, a pool that has

spread after the LNG spill's gravitational pull, known as an initial spill pool, could not support the initial combustion rate for long. Once the balance is established between the combustion rate and the pool's supply rate, the pool shrinks to reach the decreased dimensions of a smaller pool, known as a steady-state spill pool. While the combustion of the initial spill pool produces more heat during a short period of time, the combustion of the steady-state pool produces relatively less heat for a longer period of time (PR3.3.2, F-2, p. 102). In that regard, the MDDEP stated that the description given by the proponent for this physical phenomenon was satisfactory (Ms. Marie-Claude Théberge, DT2, p. 13).

Spills on land

As for spills which occur over water, natural gas is dispersed by wind, and the cold vapours of the LNG appear in the shape of a white cloud, stemming from the water condensation phenomenon in the air. In such circumstances, an ignition source could result in a localized fire.

The risk-analysis process

In this section, the Panel briefly examines the risk-analysis process, including the two main approaches used as well as risk assessment methods. It also covers the methodology used by the proponent, as well as reservations expressed by a number of participants in the hearing in this respect.

The probabilistic and deterministic approaches

The proponent used two approaches when assessing risks. The exclusion areas of the proposed land facilities were established according to a deterministic approach based on predetermined consequence scenarios. On the other hand, the probabilistic approach, based on the occurrence probability of events and accidents, was used to establish the acceptability of the risks deemed to be the greatest for this project.

The ministère de la Sécurité publique specified to the Panel that the probabilistic approach was appropriate to establish the acceptability of risks associated with a given industrial project (Mr. Romain St-Cyr, DT8, p. 75). As for the MDDEP, it believed that the consequences of accident scenarios, as well as their respective occurrence, must be considered in a complementary fashion to determine the acceptability of a given project (DQ61.1, p. 1).

Lastly, the Agences de la santé et des services sociaux de la Chaudière-Appalaches and de la Capitale-Nationale thought that the deterministic approach should be favoured over the probabilistic approach when assessing risks (DM602, p. 53).

- ***Opinion 8 —*** *Considering the characteristics and goals of the probabilistic and deterministic analyses when assessing risks, the Panel is of the opinion that the approach used by the proponent is the one recommended and largely used in this field.*

Assessing risks

The risk assessment process quantifies the risks related to the LNG terminal from two perspectives: individual risk and societal risk. In order to determine their acceptability, each of these types of risks can subsequently be judged against criteria established by regulatory organizations such as the Major Industrial Accidents Council of Canada (MIACC)[1] or the Health and Safety Executive (HSE) of the United Kingdom, among others.

Individual risk

The MDDEP explained that individual risk is assessed according to the consequence, frequency of occurrence of a given accident and the probability that an individual be affected. Thus, the assessment quantifies the risk of death for a person during the year following an industrial accident, if this person lives in the same place during the entire year[2]. In order to assess the risk associated with the project's land facilities (the terminal, including a berthed LNG tanker and the pipeline), and on the basis of acceptability criteria established by regulatory organizations from around the world, the proponent selected the criterion stipulating that the acceptable maximum risk for the public should not have a frequency exceeding one undesirable event (often death) every 10,000 years. According to the proponent, this criterion is the maximum acceptable occurrence of most industrial risks for individuals who aren't sheltered and are thus the most exposed.

According to the same analysis, a risk is deemed negligible when it occurs once every 10 million years or more. To establish the acceptability of the individual risk, the proponent referred to criteria proposed by the MIACC and which are still recognized by the governments of Quebec and Canada, notwithstanding the fact that the MIACC ceased operations in 1999. Deemed still relevant by the ministère de la Sécurité

1. Major Industrial Accidents Council of Canada, *Lignes directrices sur l'urbanisme et l'aménagement du territoire en fonction des risques,* 1995, 43 p.

2. Ministère du Développement durable, de l'Environnement et des Parcs, *Guide sur l'analyse de risques d'accidents technologiques majeurs*, discussion paper, 2002, 60 p.

publique, the ministère des Affaires municipales et des Régions also refers to these criteria in one of its guides[1] dating back to 1994. In this regard, Environment Canada stated that:

> The MIACC's criteria are the only Canadian criteria to date which have been defined through a members' consensus, i.e. industries, NGOs and various federal and provincial departments. These criteria are valuable and relevant for this circumstance, because no legislation exists at this time.
> (Mr. Robert Reiss, DQ88.1)

The MIACC specified the following criteria for corresponding land uses and occupancies (MIACC, p. 19 et 20[2]):

– For the contour corresponding to 100 deaths for every million years (risk of 10^{-4} per annum), no land use other than industrial shall be allowed.

– For the areas between the risk contours of 100 deaths for every million years and 10 deaths for every million years (between 10^{-4} and 10^{-5} per annum), the uses that require permanent access, the presence of a limited number of people, and permit an easy and timely evacuation are allowed (manufacturing plants, warehouses, etc.).

– For the areas between the contours corresponding to 10 deaths for every million years and one death for every million years (between 10^{-5} and 10^{-6} per annum), the uses requiring permanent access, the presence of a limited number of occupants (offices and other similar commercial companies), and premises which can be easily evacuated, with a low residence density, are allowed.

– For areas beyond contours corresponding to one death for every million years or less (10^{-6} per annum or less) (high-density residential areas), no limit shall be required for land occupancy designations.

In order to put these risk acceptability criteria into perspective, and taking into account social practices and modern lifestyles, the Canadian Society for Chemical Engineering provided some information on risks, both voluntary and imposed. As an example, the individual mortality risk associated with road accidents is estimated at a probability of 109 per million deaths every year. The same risk associated with residential fires is estimated at 7.9 per million deaths per annum. Lastly, the same risk associated with rail transport is estimated at 1.1 per million deaths per annum[3].

1. Ministère des Affaires municipales, *Détermination des contraintes de nature anthropique*, March 1994.
2. *Op. cit.*
3. Canadian Society for Chemical Engineering, *Risk Assessment – Recommended Practices for Municipalities and Industry*, Ottawa, 2004.

In an analysis of risk criteria Elisabeth Paté-Cornell[1] stated that the Norwegian Petroleum Directorate, among others, uses the maximum criterion of 10^{-4} per annum for the collapse of offshore rigs. It is a criterion that is generally used for the assessment of risk to employees. She also stated that the Health and Safety Executive (HSE) of the United Kingdom defines the risk for death of 10^{-6} per annum as the criterion at or below which a risk is deemed insignificant. According to the example of the MIACC's criteria, no mitigation measure or usage limit is required at or below this risk level.

Moreover, for new industrial facilities, the HSE uses an upper limit that is greater than 10^{-5} per annum, and a lower limit of 10^{-6} per annum, with an even more restrictive limit of 3×10^{-7} per annum for areas with populations that deemed sensitive to risk[2]. As for the Netherlands, Paté-Cornell also added that this country uses a maximum individual risk criterion of 10^{-6} per annum for new industrial facilities[3]. The Panel notes that the same criteria are also used by the Canadian Society for Chemical Engineering in its guide[4] of recommended practices for municipalities and industries.

This demonstrates a convergence in normative approaches destined to manage industrial risks in countries with a comparable degree of socioeconomic and technological development. According to these approaches, the results of the quantitative risks analyses for new industrial projects help establishing the exact rank of such projects in terms of their respective relative risks, and, by the same token, their acceptability. The Panel also notes that, to its knowledge, nowhere is the societal management of industrial and technological risks based on an approval or rejection approach of projects proposed, on the basis of the worst consequences which can be attributed to such projects.

Societal risk

Societal risk is defined as the relation between the occurrence frequency of a given accident and the number of people that could be affected by the impact of such an accident (generally death), within a given population. The calculation of such a risk is a complex matter, as it requires specific knowledge of land occupancy and population movement patterns when defining the profile of the exposed population. The societal risk is expressed as an FN curve (Frequency-Number curve), which represents the

1. E. Paté-Cornell, "Quantitative safety goals for risk management of industrial facilities", *Structural Safety*, 13, 1994, p. 145 to 157.

2. HSE, *The tolerability of risk from nuclear power stations*, Her Majesty's Stationery Office, London, 1992.

3. It would be useful to recall that, according to this author, this level of risk corresponds to 1% of the lowest mortality rate observed in industrial countries, the one of girls between 10 and 14 years of age.

4. Canadian Society for Chemical Engineering, *Risk Assessment – Recommended Practices for Municipalities and Industry*, 2004.

probability of an accident which can result in a specific number of deaths (MDDEP, 2002, p. 28[1]).

According to the project's analyses, three ranges of risk correspond to three acceptability levels for societal risks: the area corresponding to a negligible or acceptable risk; the area corresponding to a risk which must be monitored and where a duty to maintain the risk as low as possible; and an area corresponding to an unacceptable risk level. The HSE also uses these three levels to manage industrial risk, by taking into account the principle that the costs of the additional mitigation effort be commensurable with the gravity of the risk apprehended and the societal advantages of the activity concerned (HSE, 1992[2]).

The methodology used

The proponent is of the opinion that the risk assessment of the project is in compliance with the requirements of both levels of government, both for the project's terminal and related land facilities as well as for the LNG tankers. This assessment was also deemed in compliance with the requirements of the European standard BS EN 1473, which regulates activities and facilities that are similar to those of the project. The Panel also notes that the proponent's approach is the same as the methodology used for other land-based LNG terminal projects in North America (Mr. Glenn Kelly, DT1, p. 56; PR3.3.1, C7, p. 7.3).

According to the proponent, the part of the study corresponding to the project's maritime component was also deemed to follow an approach that is both recognized and well within the guidelines of the Society of International Gas Tanker and Terminal Operators (SIGTTO). In the course of the public hearing, many participants expressed concerns that the project wouldn't comply with some SIGTTO recommendations. In this respect, the proponent sent a letter to the SIGTTO's General Manager who, after having analyzed the project, confirmed that it meets SIGTTO's requirements in its approach as regards the assessment and mitigating of risks related to the project's maritime activities, as well as its other facilities. Moreover, the proponent stated that the study had taken into account the local characteristics of the St. Lawrence River, and that it had been based on existing maritime traffic, while taking into account the possible use of larger Qflex LNG tankers (DQ27.29; DA86.1, p. 7 to 9; DQ27.31; PR5.1, p. 1.8-1.10).

1. *Op. cit.*
2. *Op. cit.*

A number of federal departments also commented on the risk assessment approach followed by the proponent. Thus, the Canadian Explosives Research Laboratory (CERL) of Natural Resources Canada was of the opinion that the methodological approach used by the proponent to assess marine risks was acceptable. Environment Canada also stated that that the proponent used a risk analysis method that is generally acknowledged in North America and Europe (DQ65.1, p. 1; DB5).

Regarding the pipeline, the proponent specified that the risk assessment is also in compliance with relevant provincial and federal government requirements. In his opinion, the assessment took into account the requirements of the National Energy Board (NEB). The Board was of the opinion that the proponent's pipeline impact study generally complied with the requirements of the Federal Guideline to submit the project's impact study and those of its filing manual[1] (PR3.4.1, C8, p. 8.2; DB1).

- *Finding — The Panel found that the methodology used by the proponent when assessing individual and societal risks complied with established practices in this field, and that it was accepted by government departments and organizations in charge of regulatory frameworks and follow-ups when assessing the project.*

Participants' concerns

During the hearings, several participants and resource persons questioned the hypotheses used by the proponent in the analysis of accident scenarios that could result in fires, as well as the tools used to carry out these analyses. The criticisms concerned, among others, the size of the breaches taken into account by the proponent, the choice of effect thresholds for thermal radiation, and using steady-state rather than initial spill pools in case of LNG leaks. It should be noted that several of these topics apply accident scenarios both in the seaway as well as on land.

At the request of Transport Canada, and within the scope of its work related to the technical review process of LNG terminals and transhipment sites (TERMPOL), a review of the project's risk analysis was conducted by CERL experts (for the maritime aspect of the project only). Transport Canada specified that the overall CERL concerns would be taken into account when formulating the recommendations for the TERMPOL report (DQ65.1). The TERMPOL report concerning this project was published on May 15, 2007.

1. [On-line: www.neb-one.gc.ca/ActsRegulations/index_e.htm#filing_manual].

Modelling and breach sizes

The analyses to assess consequences performed by Det Norske Veritas (DNV) for the proponent were done with the help of the *PHAST* model that was developed by DNV to simulate the consequences of events and accidents. This model has been validated by the experiences of close to 600 users and clients over more than 15 years[1]. The task of calculating risks attributable to LNG leaks and dispersions on the basis of their probability was done with the help of the *Safeti* software program, a model which was also developed by DNV, whose usage requires the results of the *PHAST* model analysis. In this respect, Environment Canada and the MDDEP specified that the software programs used by the proponent to estimate the consequences and frequency of accident scenarios were recognized and commonly used in this field (DB5; Mr. Pierre Michon, DT12, p. 54).

LNG spills over water that could result in pool fires may be a consequence of breaches made by a collision with an LNG tanker, its grounding or through a deliberate act. When modelling such events, the size of breaches assumed for the analysis is a determining factor when assessing consequences. According to the impact study, breach size selection was specifically based on past events, and after discussions with experts on this subject. Consequently, a 25-cm breach was deemed plausible for a tank puncture, a 75-cm breach as the maximum plausible size for an accident and a 1.5-m breach as the maximum plausible size for the consequence of an intentional act (PR3.3.2, F-2, p. 106 and 107).

Several hearing participants questioned that choice and referred to other studies which used larger breaches, quoting in this respect the study of Sandia National Laboratories (Sandia[2]), conducted for the United States Department of Energy's, a study done by the American Bureau of Shipping (ABS) for the Federal Energy Regulatory Commission (FERC[3]), as well as the risk assessment of the Cacouna Energy LNG terminal project. It should be noted that the latter was carried out by DNV, the same consulting firm which conducted the study of the Rabaska project.

The Sandia study used diameters of 1.1 m and 1.6 m for accidental breaches, and 2.5 m for intentional breaches. The ABS study used diameters of 1 m for relatively long-lasting leaks, and 5 m for shorter-lasting leaks. However, as was specified in that study's summary, the study assessed the potential consequences of large spills

1. Robin Pitblado, John Baik and Vijay Raghunathan, "LNG decision making approaches compared", *Journal of Hazardous Materials 130*, DNV Report, Project no. 700041972006, p. 148 to 154.

2. Sandia National Laboratories, *Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas Spill Over Water*, 2004, 167 p.

3.. Federal Energy Regulatory Commission, *Consequence assessment methods for incidents involving releases from liquefied natural gas carriers, ABS Consulting Inc.*, 2004, 59 p. and Appendices.

without taking into account the causes which could contribute to these spills or even their probability. The scenarios studied in the ABS report are examples of applying various models, and not scenarios which are representative of credible situations likely to be encountered.

Moreover, the MDDEP reported that it uses breaches of 75 cm and 1.5 m for the environmental assessment it is currently conducting on the project (DB96). The CERL was instead of the opinion that a breach of 1.3 m would have been more appropriate in calculating the consequences of an accident scenario involving an LNG tanker. It also believed that a scenario resulting from an intentional act should take into account a breach that is bigger than 1.5 m. To this effect, it underscored the fact that the Sandia and ABS studies took into account breaches that are greater in area, and that a breach of 1.38 m was instead used for this type of scenario to assess the risks of the Cacouna Energy LNG terminal project. The Agence de la santé et des services sociaux de la Chaudière-Appalaches also believed that the breach diameters chosen to establish the scenarios were not the most conservative when compared to scenarios chosen in other projects (DQ65.1, p. 5 and 6; DQ26.1, p. 1).

- *Finding — The Panel found that the models used by the proponent to assess the potential consequences of accident scenarios were recognized especially by Environment Canada as well as by the ministère du Développement durable, de l'Environnement et des Parcs.*

- *Finding — The Panel notes that the proponent had selected three breach sizes for his accident scenarios involving an LNG tanker. In this respect, the Canadian Explosives Research Laboratory of Natural Resources Canada, as well as the Agences de la santé et des services sociaux de la Chaudière-Appalaches and de la Capitale-Nationale were of the opinion that the choices of these breaches were not sufficiently conservative in relation to the accident scenarios selected by the proponent.*

Initial or steady-state spill pools

The consequences of an LNG spill were widely questioned by several hearing participants. They were rather of the opinion that initial spill pools must be taken into consideration when assessing the consequences of an accident scenario, considering the fact that the thermal radiation which is produced from them during the first moments of combustion is more intense than the radiation which is then produced by steady-state pools.

The proponent was of the opinion that, for an analysis which is only based on consequences, the thermal radiation produced by the flames of a steady-state spill pool is the one which should be taken into account to establish the distances required

to protect the public, and consequently, emergency measures (DA63; Mr. Glenn Kelly, DT8, p. 36). In his opinion, this is justified by the longer stability of a steady-state spill pool fire, which would result in the longer exposure of the neighbouring public. In this respect, the MDDEP informed the Panel that the proponent's description of the pool fire phenomenon was satisfactory:

> Considering the very short time span of an LNG initial spill pool and the conditions required for it to be created, the steady-state pool appears to be a more adequate choice than the initial spill pool to assess the consequences and risks associated with a pool fire over water, using the 5-kW/m^2 threshold.
> (Ms. Marie-Claude Théberge, DB96)

The CERL also found that the approach used by the proponent was acceptable in establishing the consequence distances for a 5-kW/m^2 thermal radiation limit on the basis of a steady-state spill pool, given its longer duration and the potentially greater exposure that would ensue for the population. It also mentioned that the proponent took into account both types of spill pools to assess the individual risk isocontours. However, for a 12.5-kW/m^2 thermal radiation level, the Laboratory believed that the initial spill pool should be taken into account to assess the consequences of potentially exposing the population for a short duration (DQ87.1).

The Sandia Laboratory report has also used reference values to analyze risks associated with LNG facilities. In this respect, the Panel is of the view that the conditions and values used by Sandia in order to assess the distances associated with various levels of thermal radiation emitted from a pool fire correspond to a steady-state pool (Sandia National Laboratories, 2004, p. 143).

- *Finding — The Panel takes note of the fact that the Canadian Explosives Research Laboratory of Natural Resources Canada, and the ministère du Développement durable, de l'Environnement et des Parcs deemed acceptable the approach followed in regard to the dimension of the liquefied natural gas pool, and used to assess the consequences arising from accident scenarios with LNG tankers. It also note that the method used is similar to the one used by Sandia National Laboratories.*

The Panel will also consider the distances used by the proponent for a steady-state spill pool in order to assess the population's potential exposure to the consequences of a pool fire, because of the short duration of the initial spill pool and considering the time required for the possible intervention of emergency services.

The effect thresholds associated with thermal radiation

During a fire, the intensity of the thermal radiation emitted diminishes in proportion to the distance with the fire source, and individuals exposed to such radiation are

affected by sensations or burns of varying degrees, according to the distance and length of exposure. For example, after 40 seconds, a person who is exposed to a 5-kW/m^2 thermal radiation[1] level can suffer second-degree burns. When selecting sites for industrial facilities that could be the source of fires, this is the level of radiation used to delimit the area where individuals could suffer serious injuries[2]. A 13-kW/m^2 thermal radiation can result in death after 30 seconds of exposure.

According to the proponent, the exclusion area calculations are based on the Canadian (CSA[3] Z276-01[4]) and US (NFPA[5] 59A-01) standards, which use the 5-kW/m^2 threshold value as exposure criterion for the public, in addition to the 37.5-kW/m^2 threshold value in regard to the integrity of exposed structures. The BS EN 1473 European standard of 1997 takes into account various thermal radiation thresholds which exclude solar thermal radiation. Outside of property limits within urban areas, the standard uses the 5-kW/m^2 threshold to establish exclusion areas for project implementations.

According to the proponent and Natural Resources Canada the CSA Z276-01 standard is currently under review, and the new version slated to be published in June of 2007. According to the proponent, this review will take into account, among other things, the review done in 2006 of the NFPA 59A-01 US standard. Moreover, he believed that this new version will not result in any changes to the exclusion area definition. Lastly, he specified that the final terminal engineering would be made according to the standards in force at the time.

However, for Mannan et al[6], the exposure criteria used in the current approach do not take sufficiently into account more vulnerable individuals (children, the elderly or individuals with a mobility impairment), and do not provide a large enough margin to take into account the consequences of the surprise effect which could prolong the reaction time of some individuals, thereby hampering their ability to look for and find shelter in time[7]. They also referred to the recommendation of the Society of Fire

1. Solar radiation in the month of June is evaluated at about 1 kW/m^2 at noontime (Mr. François Desbiens, DT26, p. 64).
2. 49-CFR-193, *Liquefied Natural Gas Facilities*; Federal Safety Standards [3] and NFPA-59A, *Production, Storage and Handling of Liquefied Natural Gas (LNG) [4]*; 49-CFR-193 Standard is the U.S. federal government regulation, whereas NFPA-59A is an industry consensus standard; EN 1473 for Europe.
3. Canadian Standards Association.
4. Canadian Standards Association, Z276-01, *Liquefied Natural Gas (LNG) – Production, Storage, and Handling*, 2001, 78 p.
5. National Fire Protection Association.
6. Sam Mannan, Jane Y. Wang and Harry H. West, “LNG Safety – An Update on Recent Issues”, *LNG Review*, 2005 [On-line: www.touchoilandgas.com/safety-update-recent-issues-2469-1.html].
7. Aspect covered by several briefs: Agences de santé et des services sociaux de la Chaudière-Appalaches et de la Capitale-Nationale, DM602A, p. 55; Mr. Gaétan Paradis, DM590, p. 4 to 8.

Protection Engineers Handbook on protecting the public from the hazards of exposure to thermal radiation. According to the handbook, the 2.5-kW/m2 value should be chosen as an acceptability criterion to this end[1].

Several departments and organizations were of the opinion that the 5-kW/m^2 criterion is appropriate for assessing public exposure to the effects of thermal radiation during a fire. In a MDDEP manual, the recommended effect threshold to plan emergency measures is 5 kW/m^2 (MDDEP, 2002[2]). Environment Canada and the ministère de la Sécurité publique were also of the same opinion. This value is also used to the same end in the Sandia report (Sandia, 2004, p. 38[3]). Moreover, Mr. Phani Raj conducted tests on LNG fire thermal radiation in October of 2006 on behalf of the US Transport Department and the Distrigas of Massachusetts Corporation. These tests revealed, among other things, that the 5-kW/m^2 value was a prudent value to use as a criterion in regard to public exposure to thermal radiation (DA68; DA69, p. 4; Mr. Glenn Kelly, DT8, p. 99 and 100).

However, the Panel believes it important to take into account vulnerable populations[4] when planning emergency measures. Consequently, it considers it appropriate to take into account thermal radiation levels below 5 kW/m^2 for such planning. In this respect, it notes the recommendation made by the directeurs régionaux de santé publique at the public hearing for the Pipeline Saint-Laurent project regarding the thermal radiation criteria to retain when planning emergency measures. In their view, the risk areas around industrial facilities should be established within the 3-kW/m^2 limit (Agence de la santé et des services sociaux de Montréal, de la Mauricie et du Centre-du-Québec, de la Chaudière-Appalaches and de la Montérégie, DM69, p. 21). For the Panel, this criterion would have the advantage of taking into account in a preventive way the margin for error that is inherent in models used for thermal radiation limits. It would also have the advantage of taking the thresholds proposed by the CRAIM's[5] into account.

- *Finding — The Panel found that the proponent is in compliance with Canadian, US and European standards in regard to the effect thresholds associated with thermal radiation used to establish the separation distances required to ensure public security.*

1. The Society of Fire Protection Engineers, Handbook of Fire Protection Engineering, 2nd Edition, 1995.
2. *Op. cit.*
3. *Op. cit.*
4. These are community elements with a high-density level of occupation, and which may be difficult to evacuate quickly during an emergency, such as hospitals, campgrounds, senior citizens homes, schools, etc.
5. Conseil pour la réduction des accidents industriels majeurs (CRAIM), *Guide for the management of risks of major industrial accidents*, 2007, 436 p.

- *Finding — Like other researchers and specialists, the Panel takes note of the inadequacy of the 5-kW/m^2 criterion, specifically in regard to thermal risks to which more vulnerable populations could be exposed (children, the elderly or individuals with mobility impairment).*

- ***Opinion 9** — The Panel is of the opinion that the planning of emergency measures should take into account a more precise demographic characterization of sensitive elements in the built environment inside the isocontour corresponding to a 3-kW/m^2 thermal radiation criterion.*

Risks related to navigation and the seaway

In this section, the Panel traces the history of accidents related to the transportation of LNG, and examines the TERMPOL process as well as the security measures proposed by the proponent in relation to navigation. It also analyzes the project's possible grounding and collision risks.

History of accidents associated with LNG maritime transport

The history of accidents related to LNG maritime transport is deemed quite reassuring by a great number of specialists and observers. According to Shaw, Baik and Pitblado[1], no LNG tanker has ever suffered significant cargo losses or failure of containment mechanisms when transporting LNG, from the first maritime delivery trip done in 1958 until now. In their view, and based on available data, an industry review demonstrated that at the end of 2004, there had been more than 42,000 maritime trips with cargo, corresponding to 82,000 loading and unloading port operations, which took place without any losses, conflagration or major fires. This represents a total haul of close to 147 million km and a total volume of 3.6 billion m^3 of LNG delivered.

According to the proponent, only eight maritime incidents have resulted in spills over the 40 years of existence of the LNG industry. None of these incidents resulted in any loss of life and were, for the most part, leaks and emissions from small pipes or joints, some of which resulted in material damage due to the cryogenic embrittlement of construction materials. Moreover, over the span of more than 40,000 trips, there have been no reported spills of LNG over water after a collision with or the grounding of an LNG tanker (Mr. Glenn Kelly, DT1, p. 56). According to the proponent's data, two major groundings have occurred in the history of LNG maritime transport, without loss

1. S. Shaw, J. Baik and R. Pitblado, "Consequences of Underwater Releases of LNG", *Process Safety Progress*, vol. 24, no. 3, September 2005.

of cargo. These involved the *El Paso Kayser* in 1979 and the *LNG Taurus* in 1980. The Panel also noted that another grounding occurred more recently, in 2004, to the south of Korea, and the cargo remained intact in this occurrence as well[1].

History of accidents in the St. Lawrence Seaway

According to the impact study, the proponent examined the data of the inquiry reports produced by the Canadian Transportation Safety Board from 1994 to 2002, concerning accidents in the St. Lawrence Seaway, from Cabot Strait to Quebec City. Based on 33 incidents which were deemed relevant to the analysis, the proponent underscored the following:

– There were fourteen groundings out of a total of 33 incidents. No grounding resulted in a shipwreck, but one of them was declared a total loss. This incident was the worst grounding in the list.

– Three ships sank.

– Two leaks or cargo losses occurred, on a barge and a bulk carrier. These events did not result in any pollution.

– Only one collision occurred between two ships - a tanker and its tugboat.

As for ship types, bulk carriers dominated incident statistics between Cabot Strait and Québec City. Between 1994 and 2002, three ships were ice-bound, one of which was grounded. This event was significant because ice is present during one-fourth of the year.

The analysis of the sites where the incidents took place confirmed that there are some places in the seaway which are more at risk than others. For example, île Rouge and the Traverse du Nord are two sites which present relatively higher risks, and the pilot embarking station at Les Escoumins is also an area that was deemed to require special attention. According to the spokesperson of the Corporation des pilotes du Bas-Saint-Laurent, the last grounding which took place in the Traverse du Nord three to four years ago occurred because of a rudder problem.

Lastly, between 1994 and 2002, approximately one third of all accidents occurred inside the piloting area, and two thirds outside of it. However, it is important to note that ferries and fishing boats are never accompanied by pilots from Bas-Saint-Laurent, regardless of the area they navigate in (PR3.3.2, F-2, p. 28 to 30 and Appendix 4).

1. [On line: http://homeland.house.gov/SiteDocuments/20070321152154-52629.pdf].

- *Finding — The Panel found that the data and accident review confirm the fact that the St. Lawrence Seaway can represent a navigation risk in certain locations, especially the Escoumins, île Rouge and the Traverse du Nord sectors.*

The TERMPOL process

The TERMPOL process is managed by Transport Canada, and focuses on the itinerary of a specified reference ship in Canadian territorial waters to reach a berthing wharf at the marine terminal or the proposed transhipment station. More specifically, it is concerned with the cargo handling activities occurring between ships, between a ship and the shore and vice versa. The goal of this process is to reduce as much as possible the consequences of some circumstances which may threaten the integrity of the ship's hull and its cargo storage system, and consequently the environment around the ship. This process is applied to operating security measures concerning the special conditions of the site, the navigation area in question, and related shipping lanes (DB10).

This process was carried out at the proponent's request. The TERMPOL Review Committee is made up of representatives from various federal and provincial departments and organizations, as well as specialized consultants. Its mandate is to assess the risks that the site and operations of an LNG terminal located in Lévis represent to navigation and public security. On May 15, 2007, Transport Canada published a report which comprises its recommendations for this project (DA88).

Grounding and collision risks

In order to assess the risks between the mouth of the Gulf of St. Lawrence (Cabot Strait) and the planned LNG terminal, and in addition to the berthing wharf operations, the proponent divided and analyzed the possible itinerary of LNG tankers according to the characteristics of the following four segments (Figure 7):

– From the mouth of the Gulf of St. Lawrence to Les Escoumins.

– From Les Escoumins (pilot station) to the mouth of the Traverse du Nord.

– From the Traverse du Nord to the embarking site of the river pilots[1], close to Saint-Laurent-de-L'Île-d'Orléans.

– from Saint-Laurent-de-L'Île-d'Orléans to the terminal jetty of the project.

1. A person duly qualified to steer ships into or out of a harbor or through certain difficult waters. [On-line: http://dictionary.reference.com/search?q=PILOT&r=66].

In his analysis, the proponent took into account incidents which could lead to LNG spills during the transit of LNG tankers. To that end, the consequences of accident scenarios deemed to be most likely were considered. According to the analysis, the ship's outer hull would not be breached in the case of a grounding, and even less so for the inner hull, in view of river's sandy bed and the security margin ensured through the proper design and manufacture of the ship hulls and tanks. LNG tankers could therefore face the vagaries of the tides without impact on the inside tanks (Mr. Glenn Kelly, DT3, p. 26 and 27).

A study was conducted in this respect by the Bureau Veritas to assess the resistance of ship structures and the integrity of cargo containment systems when dealing with tides having an amplitude of 6 m. The study concluded that the cases of grounding studied pointed to a significant security margin with respect to the risk of major damage to the structure or damages done to the cargo containment system, including for several tidal cycles (DA13). Moreover, in the event of a spill resulting from this type of accident, then the probability of spontaneous combustion was estimated at 10 percent by the proponent, as the breach would occur underwater.

According to the proponent, only an accident occurring close to the terminal could result in a cloud of gas that could spread over a great distance and reach an area of medium population density. In the event of a collision occurring in the seaway, the probability of instantaneous combustion was estimated at 90 percent, as a major collision would generate sufficient force to create sparks.

Both the proponent and Transport Canada agreed that certain conditions would be required to actually breach the inner tank. These include a speed of eight knots or more for a ship of 50,000 t or more, at 90 ^{o} on the side of the LNG tanker (Mr. Glenn Kelly, DT6, p. 86).

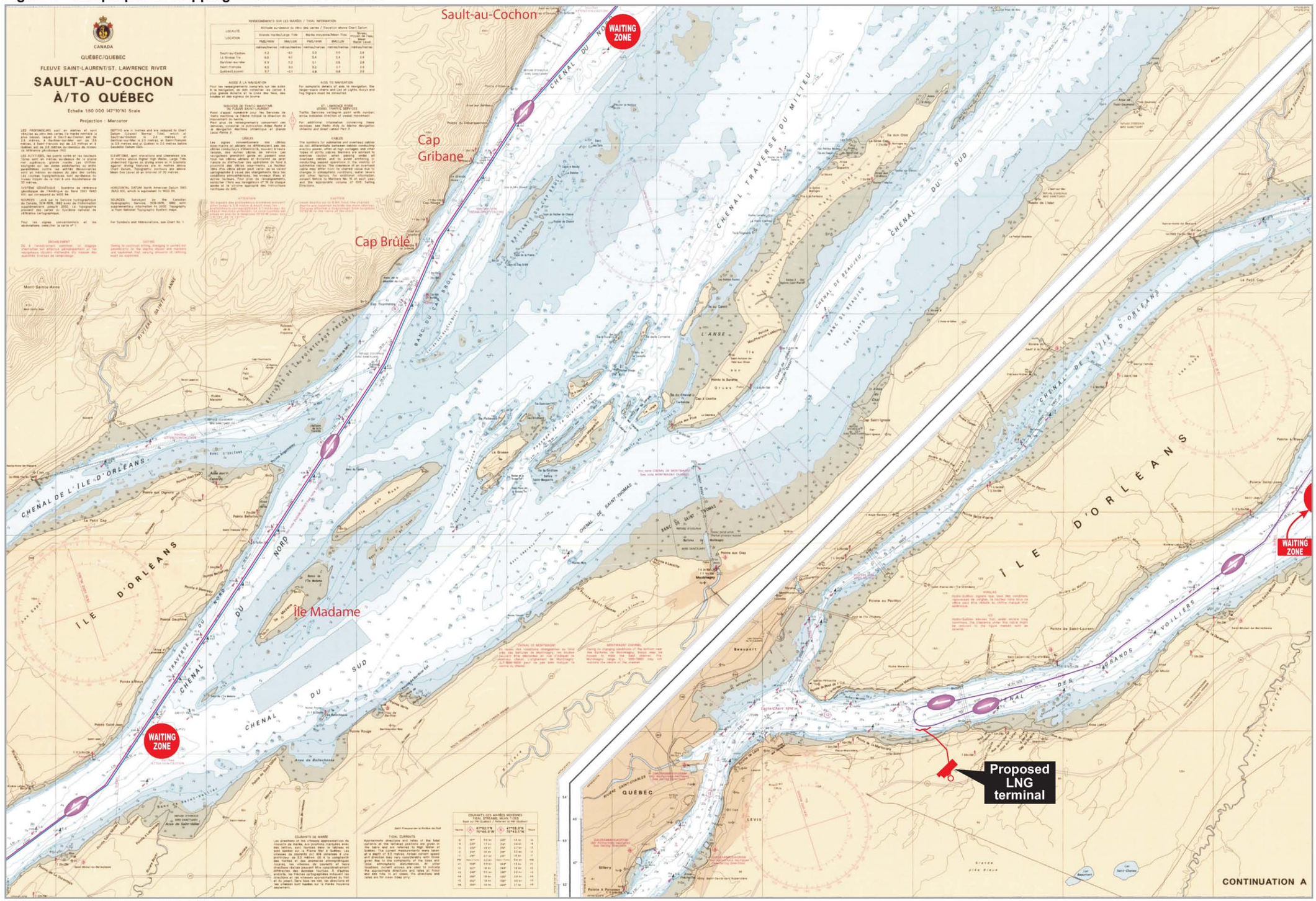
In this respect, the Panel notes that the Sandia National Laboratories report also specified that these same conditions would have to be brought together to breach the inner hull of an LNG tanker (Sandia, 2004, p. 100[1]).

Furthermore, the proponent estimated at 50 percent the probability of a delayed cloud ignition in an inhabited area after a collision or grounding.

During the hearing, many participants expressed doubts regarding LNG tankers ability to safely navigate the St. Lawrence River. Several participants were concerned that an LNG tanker could become grounded in the Traverse du Nord or even in front of île d'Orléans. In this respect, the proponent stated that "even in the worst grounding case scenario, there are techniques which, firstly, allow the ships to float free and secondly, let other ships safely pass by" (Mr. Glenn Kelly, DT6, p. 85).

1. *Op. cit.*

Figure 7 The proposed shipping route for LNG tankers



Sources: adapted from PR3.3.2, Figure 2.1; PR5.1, Figure 22.

The proponent also referred to the simulations of LNG tanker navigation in the Traverse du Nord. He specified that the manoeuvres they would have to accomplish up to the jetty would be the equivalent of those required for oil tankers currently supplying the Ultramar refinery. The Corporation des pilotes du Bas-Saint-Laurent explained that there are already some ships which sail upriver to Montreal, which are comparable in length to the proposed project LNG tankers, and with comparable draughts (Mr. Simon Pelletier, DT22, p. 24). Moreover, Transport Canada and the TERMPOL Review Committee examined the study on traffic integration. According to Transport Canada, the transit conditions of the Traverse du Nord have not yet been established.

The vulnerability of LNG tankers in ice conditions on the St. Lawrence River also worried several participants. In this respect, the Canadian Coast Guard was of the opinion that conditions in the Traverse du Nord do not pose significant problems. According to its representative, the ice tends to take the natural trajectory, which is the channel on the south side, i.e. in the direction of Montmagny.

In terms of comparison, and more specifically with respect to the ice formation close to the proposed maritime facilities, the proponent stated that, all available studies indicate that ice conditions would be similar to those around the Ultramar terminal. As is the case with this terminal, shoreline ice is expected to be further stabilized by the presence of the proposed jetty, as is also the case for the perimeter of the base of the Hydro-Québec towers. Ice is expected to continue to flow easily in the channel in front of the berthing wharf, and it would therefore pose no difficulties to navigation (DQ27.85).

Lastly, the Municipality of Saint-Jean-de-L'Île-d'Orléans was worried about the proximity of its shores to the proposed LNG tankers holding area. According to the proponent, the anchorage point in this area is located at 1,665 m from the pointe Saint-Jean. Moreover, if needed, the holding in this area would last only for a few hours with two pilots on board. In this respect, Transport Canada stated that it does not consider the anchorage area at Saint-Jean-de-L'Île-d'Orléans to be appropriate for LNG tankers. Transport Canada is of the opinion that this area could only be used in exceptional circumstances, in compliance with government authorities, depending upon the existing situation. Moreover, Transport Canada reported that LNG tankers would have to transit in the Traverse du Nord coming or going from the terminal only when it has been established that weather, tidal, ice and traffic conditions allow it. When conditions forbid it, then the LNG tankers will have to wait at the terminal or at anchor in Sault-au-Cochon, Pointe-au-Pic or Les Rasades (DQ66.2).

- *Finding — The Panel found that, subject to the project's authorization, the proponent would have to establish appropriate holding areas for LNG tankers, to the satisfaction of Transport Canada*

Accident scenarios in the seaway and their consequences

The proponent assessed potential consequences of accident scenarios involving the collision or grounding of an LNG tanker by taking into account the nature of the accident which would result in a relatively large breach the LNG tanks aboard. According to his calculations, risk levels would not change much when considering larger ships like the Qflex type. The decreased rate of visits with larger-capacity model would even be a positive factor as it would decrease the frequency of potential accidents. According to the proponent, the increase in consequence extent was also relatively small in view of the fact that the increase in LNG tanker size is due to their larger width and the higher number of tanks, rather than due to an increase in the height of their tanks. According to him, the tank height factor is the main parameter to consider when calculating consequences accidents for different breach sizes (DQ27.61).

Table 7 shows the main results obtained by the proponent for the various accident scenarios retained, for both types of LNG tankers.

During the assessment process to establish the admissibility of the project's impact study, the MDDEP also compared the proponent's results with those of the Sandia study, and concluded that the scenarios used by the proponent were comparable to those used in the Sandia study (Ms. Marie-Claude Théberge, DT4, p. 80).

The point of this exercise for the Panel (the size of the breaches retained, as well as their consequences) was to establish the required security and emergency measures. To the extent that the distances of the consequences of thermal radiation, and to the dispersion of a natural gas cloud are comparable, then they would result in comparable security and emergency measures.

Table 7 Consequences related to maritime accident scenarios

Accident scenarios	Reference LNG tanker (160,000 m^3)	Qflex LNG tanker (216,000 m^3)
250 mm tank breach: the most credible accidental puncture		
Distance from the 5 kW/m^2 level for the steady-state pool	194 m	210 m
Distance from the 5 kW/m^2 level for the Initial spill pool	359 m	390 m
Distance to the flammability limit	330 m	360 m
750 mm tank breach: maximum credible scenario for accidental events		
Distance from the 5 kW/m^2 level for the steady-state pool	450 m	480 m
Distance from the 5 kW/m^2 level for the initial spill pool	870 m	910 m
Distance to the flammability limit	1,000 m	1,100 m
1,500 mm breach: maximum credible scenario for intentional acts		
Distance from the 5 kW/m^2 level for the steady-state pool	790 m	820 m
Distance from the 5 kW/m^2 level for the initial spill pool	1,500 m	1,570 m
Distance to the flammability limit	2,100 m	2,200 m

Source: adapted from PR5.3.2, p. 7.

Sensitive elements of the project's zone

The collision or grounding of a loaded LNG tanker could result in an LNG pool that could ignite, thus producing thermal radiation. In the course of the hearing, many participants expressed concern in regard to the possibility and potential consequences of such an accident occurring in front of île d'Orléans or in the approach area of the proposed terminal.

Regarding the worst-case scenario stemming from an intentional act, the 5-kW/m^2 isocontour would extend to the shore at cap Gribane, at cap Brûlé and to the south shore east of île d'Orléans. However, there are no dwellings or other sensitive community facilities in these sites within the 5-kW/m^2 isocontour. For the maximum scenario in the event of accidents, the 5-kW/m^2 isocontour would never reach the shore. Moreover, the proponent also specified that the distance between an LNG tanker and île-aux-Coudres would be approximately 1.5 km on average, of more than 11 km for île-aux-Grues, and of more than 500 m from île d'Orléans (PR5.3.2, p. 3; PR5.1, p. 3.117 and Figures A-42 to A-46).

Table 8 details a summary of the sensitive elements which would be located within the 5-kW/m^2 limit of impact area in the sectors of the east point of île d'Orléans, of Saint-Laurent-de-L'Île-d'Orléans and of Lévis-Beaumont. These elements are also illustrated in Figure 8.

The proponent identified the sensitive elements in the built environment located within the 1.6-kW/m^2 thermal radiation threshold. His analysis considered a scenario with a breach of 750 mm, representing a distance of 780 m for this radiation level. According to this assessment, these were the places where the 1.6-kW/m^2 isocontour would make land and where the sensitive elements are: the east point of île d'Orléans, the sector of Saint-Laurent-de-L'Île-d'Orléans and the south shore to the right of the jetty (DQ99.1, p. 4 and 5). These sensitive elements are identified in Figure 8. The distance for the accident scenario with a breach of 1,500 mm for a 5-kW/m^2 thermal radiation limit would be approximately 820 m for the Qflex type LNG tanker. The Panel was satisfied with this inventory, but it believes it appropriate that the proponent complete the inventory of these elements by taking into account a 3-kW/m^2 thermal radiation limit for a scenario involving a breach of 1,500 mm and a steady-state spill pool fire, so that this information could be made available when planning emergency measures.

Table 8 Inventory of sensitive elements according to maritime accident scenarios selected

Accident scenarios by LNG tanker type used	Sensitive elements on the east point of île d'Orléans within the 5-kW/m^2 isocontour	Sensitive elements in Saint-Laurent-de-L'Île-d'Orléans within the 5-kW/m^2 isocontour	Sensitive elements in Lévis-Beaumont within the 5-kW/m^2 isocontour
Reference LNG tanker			
250-mm breach/initial spill pool	None	None	None
250-mm breach/steady-state pool	None	None	None
750-mm breach/initial spill pool	See below for the Qflex	See below for the Qflex	See below for the Qflex
50-mm breach/steady-state pool	None	None	None
1,500-mm breach/steady-state pool	39 residences, most of them resort real estate; six trailers on private land; one campground on private land; île d'Orléans campground (155 sites); the auberge Chaumonot (inn); a summer camp (2 service buildings)	108 residences or resort homes, 8 businesses, one marina, one maritime park, 2 inns and lodges, one church, one elementary school	15 permanent residences
Qflex LNG tanker			
250-mm breach/initial spill pool	None	None	None
250-mm breach/steady-state pool	None	None	None
750-mm breach/initial spill pool	63 permanent residences, 7 temporary residences, 9 service buildings, auberge Chaumonot, île d'Orléans campground (155 sites), a summer camp.	207 permanent residences, 11 businesses, one tourist site, one church, one elementary school, 2 inns or lodges, one marina, one maritime park	44 permanent residences
750-mm breach/steady-state pool	None	None	None
1,500-mm breach/steady-state pool	46 residences (most resort real estate); six trailers on private land; one campground on private land; île d'Orléans campground (155 sites); the auberge Chaumonot; a summer camp (main building and 2 service buildings)	136 residences or resort real estate, 10 businesses, one marina, one maritime park, 3 inns and lodges, one church, one elementary school	19 permanent residences

Sources: adapted from PR5.3.2; DQ17.11.

Since an LNG tanker would navigate at some 500 m from île d'Orléans, the closest distance to the shore on its route before arriving at the terminal, a natural gas cloud could theoretically reach certain inhabited areas of the island if the LNG pool would not immediately ignite after a spill. Also, the Panel notes that, with an LNG tanker approaching the planned jetty, a vapour cloud could also reach the shoreline population in certain places in the sector of Lévis-Beaumont, when using breaches of 750 mm and 1,500 mm, assuming a steady-state spill pool and without immediate ignition. In this respect, the proponent stated that such a cloud would spread at relatively low altitude. Should this cloud reach an ignition source, it would ignite and the fire would travel back in the direction of the LNG tanker. Under these circumstances the thermal impact would only be serious for someone within the cloud (Mr. Glenn Kelly, DT3, p. 70 and 75).

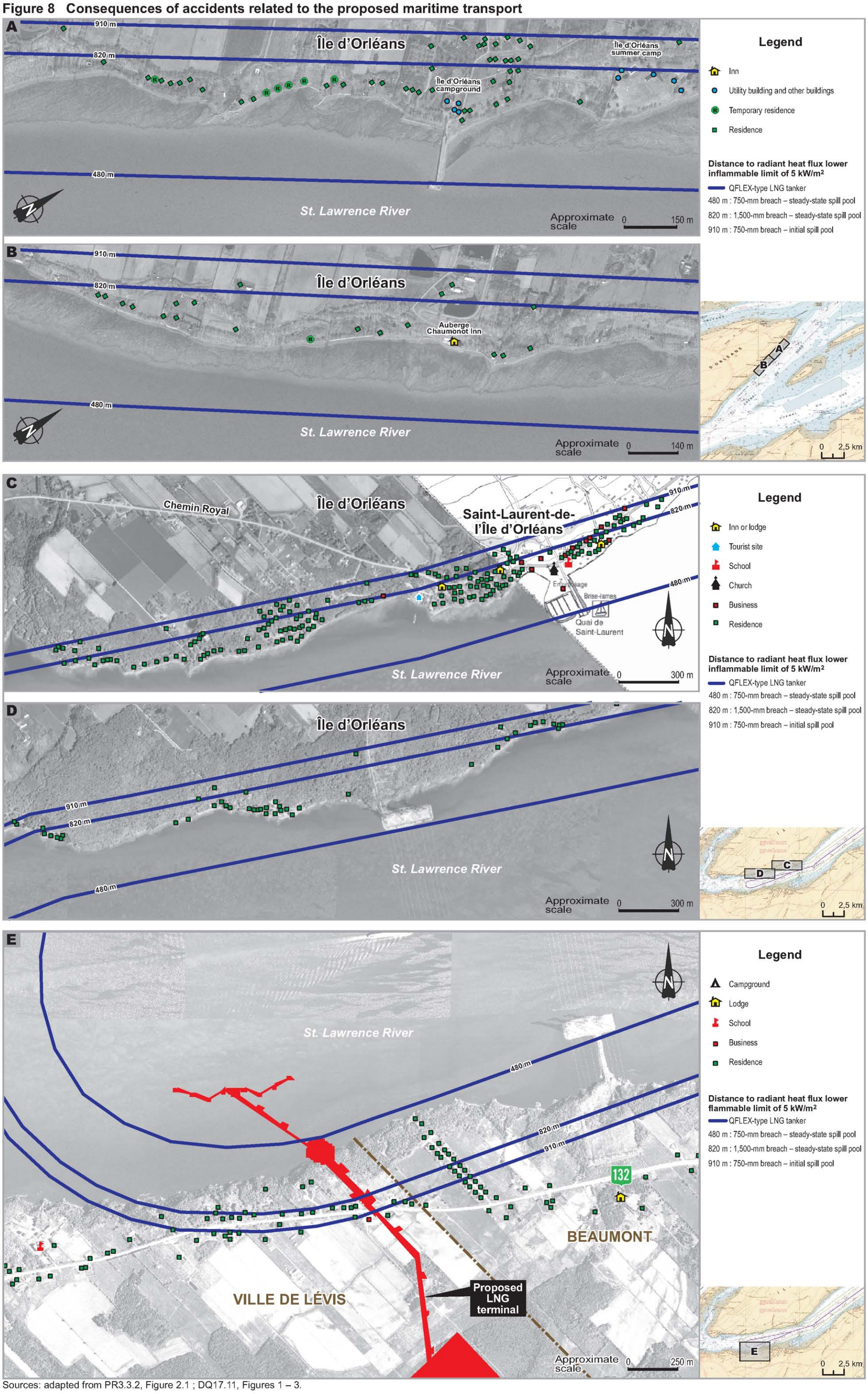
Environment Canada also reported that it couldn't perform the modelling of an accident generating a natural gas cloud which would spread towards the shores of île d'Orléans. However, the Department was of the opinion that the risk was low and that there are chances the cloud would disperse before reaching the shore and would not ignite, depending on wind direction, its force and the possible presence of an ignition source. In the event of a terrorist act or a collision, there would be an ignition source with the resulting quick ignition of gas vapours and therefore, a gas cloud would not spread (Mr. Robert Reiss, DQ75.1)

The CERL was also of the opinion that it was very unlikely a natural gas cloud would separate from its source and travel over a distance that would be greater than the one calculated by the proponent (DQ78.1).

- *Finding — The Panel found that sensitive community elements could be exposed to thermal radiation which could reach 5 kW/m^2 in the sectors of the east point of île d'Orléans, of Saint-Laurent-de-L'Île-d'Orléans and of Lévis-Beaumont, when considering collision or grounding scenarios, and using a steady-state spill pool and a 1,500 mm breach in an LNG tanker tank as modelling criteria.*

- *Finding — The Panel found that in the event of a collision or a grounding of an LNG tanker, a liquefied natural gas vapour cloud could reach certain locations with shoreline populations for île d'Orléans and for Lévis-Beaumont. However, the probability of such an occurrence is low.*

Figure 8 Consequences of accidents related to the proposed maritime transport



Sources: adapted from PR3.3.2, Figure 2.1 ; DQ17.11, Figures 1 – 3.

On-land risks

In this section, the Panel traces the history of accidents at LNG land facilities, examines the security measures planned by the proponent and analyzes the consequences of accident scenarios produced for the terminal and pipeline.

History of accidents at liquefied natural gas land facilities

As is the case with LNG maritime transport sector, the safety record regarding accidents at LNG land facilities (terminals on land, tanks, regasification equipment, etc.) was described as outstanding by a great number of specialists. Thus, Susan Tierney[1] underscored the absence of major accidents at land facilities of LNG terminals in the United States during the past 25 years. According to her, there are currently close to 200 LNG storage and peak-shaving facilities throughout the world, 113 of which are in the United States, including the Gaz Métro facilities which have been in operation in Montreal-East since 1969[2].

The proponent presented a detailed history of accidents related to the processing, storing and transporting of LNG, drawn from various databases. The only accident that affected a population occurred in 1944, in Cleveland, in the United States, and was attributed to the use of inadequate materials in the design and building of the tanks used at the time. More recently, the Skikda accident which occurred in Algeria took place in a liquefaction plant and was deemed to have been caused by an explosion in a boiler. In this respect, the proponent stressed the fact that the project does not involve any liquefaction operations or the use of boilers.

Security measures for land facilities

The proponent plans to integrate security measures in the design, construction and operation of the LNG terminal. Thus, the LNG tanks would be built according to a “full containment” approach, and erected in individual impoundment basins. Impoundment systems would also be set up according to the CSA Z276-01 Canadian standard, and the NFPA-59A-01 US standard. The unloading lines between the wharf and the site would be underground and encased in a concrete caisson with a nitrogen inert atmosphere.

1. Susan F. Tierney, *Report to the Massachusetts Special Commission Relative to Liquefied Natural Gas Facility Siting and Use* [On-line: www.mass.gov/legis/reports/Tierney_Report_to_MA_LNG_Commission_6-30-06_FINAL.pdf].
2. *Gaz Québec*, vol. 14, n° 1, 2006, p. 5.

Exclusion zones would be established in compliance with Canadian, US and European standards currently in force. These areas are established according to minimal distances required between the terminal facilities and occupied or inhabited elements of the built environment that surround it (residences, public assembly buildings, schools, landlots which are amenable for construction, etc.) (Figure 9), i.e.:

– A 500-m radius around the unloading arms of the jetty head.

– A 100-m radius around the impoundment basin of the shoreline facilities.

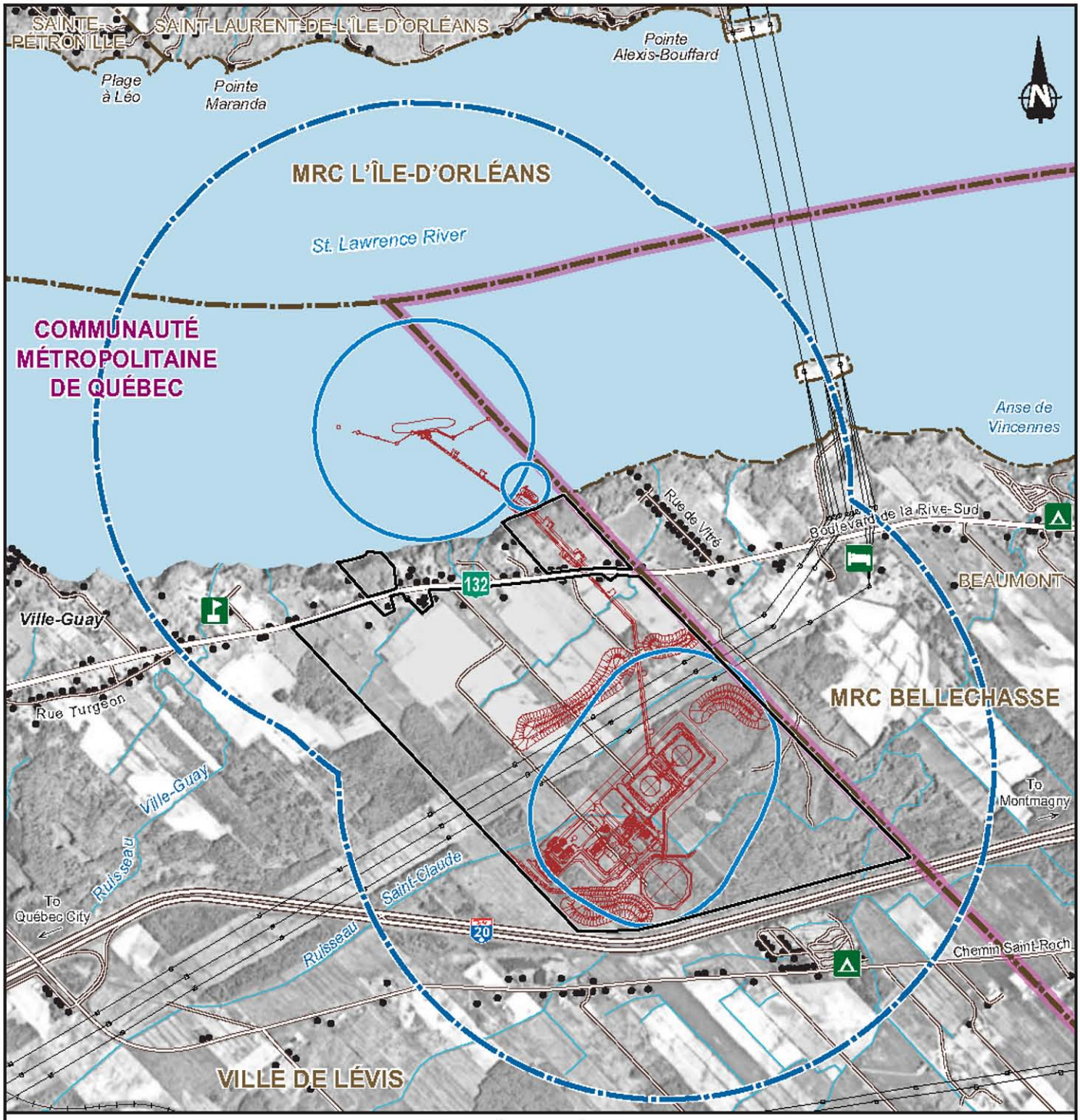
– A 400-m radius around the LNG tanks and process facilities (LNG regasification).

An exclusion zone of 50 m around a berthed LNG tanker or the berthing wharf is also planned for recreational boaters or excursionists. The proponent underscored the fact that this zone would be a preventive measure to avoid the presence of potential flammability sources during cargo transfer operations. According to him, this distance corresponds to the width of a ship, knowing that motorized vessels which are kept away in this manner are also at an elevation which is at least 1 m lower than the ship's bridge, and that natural gas leaks would quickly rise in the air. Lastly, he added that comparable distances are currently in force at the Montoir-en-Bretagne LNG terminal, for example (DQ79.5, p. 1).

The proponent also specified that larger-capacity Qflex LNG tankers would not change the required exclusion zone limits in any way (DQ27.61).

Several participants during the hearing were of the opinion that these zones should be bigger. In this respect, the proponent compared the proposed project exclusion radii with those of other existing LNG terminals, or which are planned, and his conclusion was that the risks and the exclusion areas are of the same magnitude (Mr. Glenn Kelly, DT6, p. 79).

Figure 9 Exclusion zones related to the proposed LNG terminal



Sources: adaped from PR5.1, Appendix A, Figure 40; DQ44.2; regionals maps of the ministère des Affaires municipales et des Régions [On-line (March 22, 2007): www.mamr.gouv.qc.ca/publications/cartotheque/region_03.pdf, region_12.pdf *and* cmquebec.pdf].

Closer to home, the terminal of Canaport in New Brunswick uses a 595-m radius around the LNG tanks. However, contrary to the current project which plans on using full containment tanks, the tanks of that terminal are single wall. The terminals in Freeport and Cameron in the United States have exclusion radiuses of 279 and 283 m respectively around their full containment tanks (DA12, p. S11-4).

Furthermore, the MDDEP was of the opinion that the proponent's analysis of the exclusion zones was acceptable and in compliance with the CSA-Z276 standard (DQ61.1, p. 2). It also recalled that it could recommend, if required, additional security measures beyond those planned by the proponent, should the project be completed.

- *Finding — The Panel found that there are other facilities in the world of the same nature as those of the project, whose exclusion zones are of the same magnitude as those proposed in the project.*

The accident scenarios used and their consequences

The proponent assessed the possible consequences from a collision between a ship and an LNG tanker located at the jetty. He retained four main scenarios for his land facilities. They included fires resulting from an LNG leak out of the largest ESD[1] segment (PR3.3.2, F-1, p. 47); from tank lines; from the unloading line; and from a tank roof. The pipeline was the subject of a separate analysis

The consequences of a collision between a ship and a berthed LNG tanker

To assess the consequences stemming from the most likely accident scenarios for a collision between a ship and an LNG tanker at the jetty, the proponent used breaches of 250 mm, 750 mm and of 1,500 mm. The distances to the 5-kW/m^2 thermal radiation limit, as well as the dispersion distances, were the same as those provided in Table 7.

Table 9 shows the number of residences in the Lévis-Beaumont sector which could possibly be included in the 5-kW/m^2 impact area, should these accident scenarios ever occur.

1. ESD Segment: Emergency Shutdown System.

Table 9 Sensitive elements identified in the Lévis-Beaumont sector within the 5-kW/m2 isocontour for accident scenarios regarding berthed LNG tankers

Accident scenarios according to LNG tanker type berthed	Number of residences within the 5-kW/m^2 isocontour
Reference LNG tanker	
1,500-mm breach (steady-state pool)	13
750-mm breach (initial spill pool)	26
750-mm breach (steady-state pool)	None
Qflex type LNG tanker	
1,500-mm breach (steady-state pool)	19
750 mm-breach (initial spill pool)	28
750 mm-breach (steady-state pool)	None

Source: adapted from PR5.3.2, p. 3.

The proponent also carried out an inventory of sensitive elements which could be found within the 1.6-kW/m^2 thermal radiation limit. The analysis was based on 250-mm and 750-mm breaches and steady-state spill pool conditions. The results indicate that up to twelve permanent residences would be included within this isocontour for the accident scenario using a 750-mm breach (DQ99.1, p. 3). While it was satisfied with this inventory, the Panel also believes it relevant that a complementary analysis of sensitive elements which could be found within the 3-kW/m^2 thermal radiation limit, using a 1,500-mm breach, be carried out by the proponent so that this type of information (public assembly areas, schools, etc.) is made available when planning emergency measures.

Several participants expressed concern over the proximity of the Sainte-Famille School in Lévis to the project's facilities. The school would be located approximately 1 km from the jetty and 2 km from the tanks. The Panel notes that the school would be located outside of the 5-kW/m^2 thermal radiation limit of the impact area, but would lie within the 1.6-kW/m^2 limit (at 1,330 m for the Qflex) in the event of an intentional act. The school would also be inside the lower flammability limit in terms of gas cloud propagation for scenarios using 750-mm breaches (at 1,100 m). Canadian and U.S. standards require a minimal distance of 310 m between educational institutions and the centre of LNG tanks. The distance between the closest tank centre and the school is approximately 2 km, which is close to seven times the minimal distance required by applicable standards.

In the event that a natural gas cloud would disperse without immediate ignition, then this cloud could ignite later on upon coming into contact with an ignition source, thus resulting in a fire. In such a case, then the distance to the lower flammability limit for accident scenarios using a 750-mm breach would be 1,100 m. In the case of an intentional act, ignition would be immediate and the natural gas cloud would not be dispersed (PR5.3.2, p. 7).

- *Finding — The Panel found that, in the case of the worst-accident scenarios involving a berthed LNG tanker with a 1,500-mm breach, it would be possible for individuals to be inside the impact area of a fire fuelled by a liquefied natural gas pool in the Lévis-Beaumont sector.*

- ***Recommendation 5*** *— The Panel recommends that, when planning emergency measures, the proponent should provide Environment Canada and the ministère du Développement durable, de l'Environnement et des Parcs with an analysis of sensitive elements when considering an accident scenario for a berthed LNG tanker, on the basis of criteria using a 1,500-mm breach, a steady-state pool and a 3-kW/m^2 thermal radiation threshold.*

Accident scenarios for land facilities

According to the MDDEP, the accident scenarios considered by the proponent in regard to land facilities are acceptable, and the impact study provided sufficient information for the Ministry to continue its environmental assessment of this aspect (Mr. Pierre Michon and Ms. Marie-Claude Théberge, DT4, p. 65 and 79). Table 10 details the main results of these four scenarios.

The proponent identified the sensitive elements within the 1.6-kW/m^2 thermal radiation isocontour. According to the analysis, no residence or other sensitive element would be found within this thermal radiation limit, regardless of the accident scenarios considered (DQ99.1, p. 3).

The proponent also assessed the possibility of an accident occurring at the terminal's facilities that could affect the pipeline's integrity; according to him, this type of event is unlikely, if not impossible (DQ17.3).

Table 10 Consequences of accident scenarios considered for on-land environments

Accident scenario description	5-kW/m^2 thermal radiation isocontour	Distance to the flammability limit
LNG leak occurring in the biggest ESD segment in the impoundment basin of the processing area	60 m	35 m
LNG leak from tank lines towards the impoundment basin of the tanks area	60 m	35 m
LNG leak from an unloading line towards the impoundment basin of the shoreline facilities or the impoundment basin of the jetty head	60 m	35 m
Leak from an LNG tank roof (fire across the entire tank diameter, i.e. 90 m)	320 m	600 m

Sources: adapted from PR5.3.2, p. 7; PR3.3.2, F-1, p. 76 to 81.

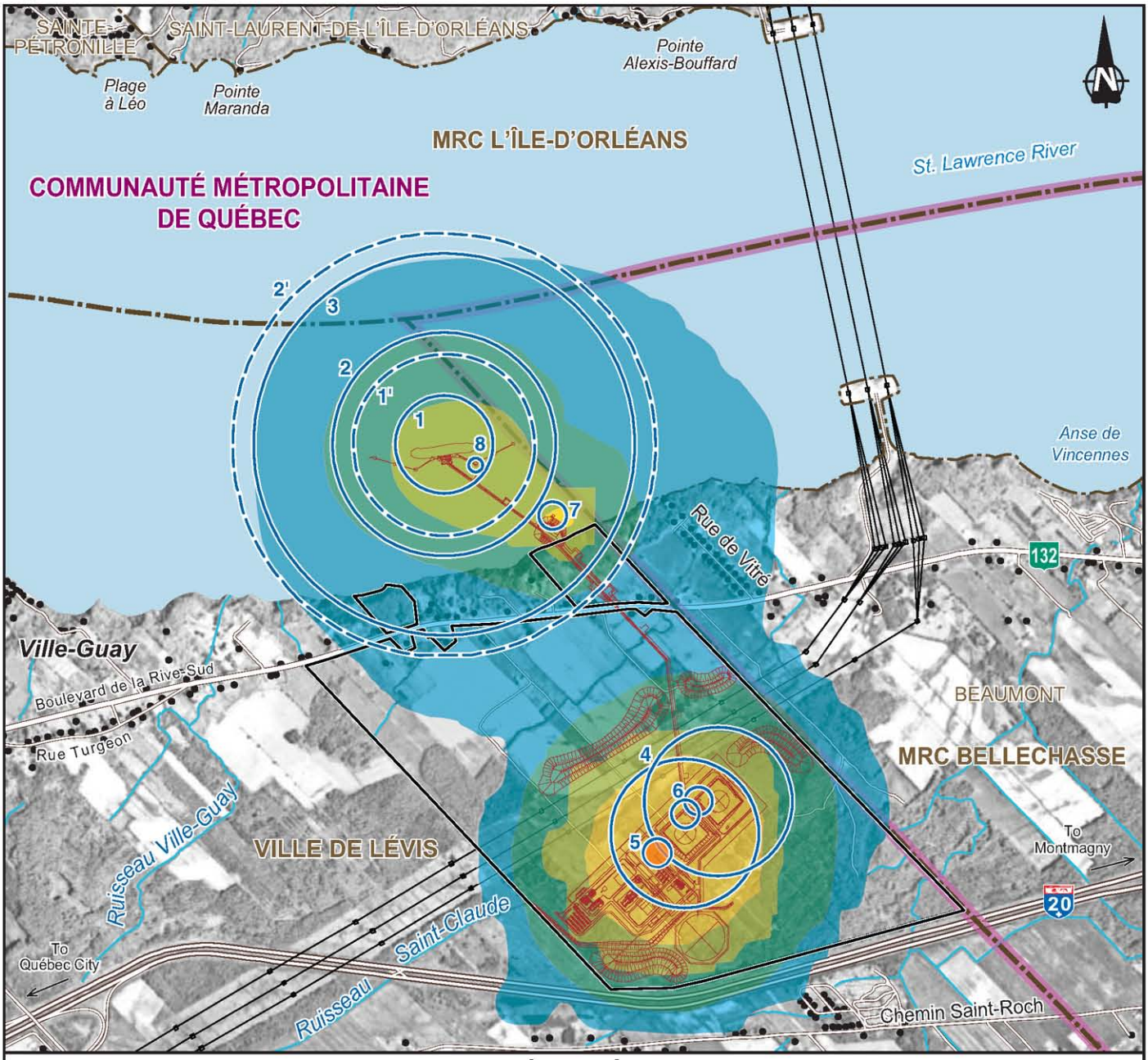
The individual risk associated with land facilities

Individual risks were assessed according to the consequence, the frequency of occurrence of the accident considered, and the probability that someone could suffer serious injuries. These risks were expressed in the form of isocontours which included all the accident scenarios retained for the LNG facilities, including a berthed LNG tanker, but excluding the pipeline, as it was analyzed separately.

The areas where the risk is deemed unacceptable were located within the 10^{-4} isocontour, which corresponds to an event occurrence frequency of once every 10,000 years. According to analysis, there are no homes or any areas inhabited at all times within this limit. The analysis also established that, with the exception of three residences, the buildings would be located in an area where the risk of death is lower than once every million years ($<10^{-6}$) (Figure 10).

According to the analysis, the individual risks for excursionists and kayakers who might be close to the LNG terminal's facilities would be in the order of 10^{-6} to 10^{-7} per annum, which corresponds to an occurrence once every million to ten million years (DQ27.56). Moreover, the proponent reported that using bigger LNG tankers would not modify the individual risk curves calculated (DQ27.61).

Figure 10 Consequences of accidents and individual risk related to the proposed LNG terminal



Legend

- Proposed LNG terminal
- Land subject to option to buy
- Accident scenario (5-kW/m^2 isocontours)
  1. Qflex-type LNG tanker tank - 250-mm diameter breach – steady state pool (210 m)
  1' Qflex-type LNG tanker tank - 250-mm diameter breach – original pool (390 m)
  2. Qflex-type LNG tanker tank - 750-mm diameter breach – steady state pool (480 m)
  2' Qflex-type LNG tanker tank - 750-mm diameter breach – original pool (910 m)
  3 Qflex-type LNG tanker tank - 1,500-mm diameter breach (deliberate act) - steady state pool (820 m)
  4 LNG storage tank roof fire (320 m)
  5 Process area impoundment basin (60 m)
  6 Tank area impoundment basin (60 m)
  7 On-shore facilities impoundment basin (60 m)
  8 Jetty head impoundment basin (30 m)

Individual risk level

- 10^{-3}/year (one occurrence every 1,000 years)
- 10^{-4}/year (one occurrence every 10,000 years)
- 10^{-5}/year (one occurrence every 100,000 years)
- 10^{-6}/year (one occurrence every 1,000,000 years)
- 10^{-7}/year (one occurrence every 10,000,000 years)

- Residence
- Communauté métropolitaine de Québec limit
- MRC and equivalent territory limit
- Municipality limit

Approximate scale 0 600 m

Sources: adapted from PR5.1, Appendix A, Figure 39; PR5.2.1, Figure 12; regionals maps of the ministère des Affaires municipales et des Régions [On-line (March 22, 2007): www.mamr.gouv.qc.ca/publications/cartotheque/region_03.pdf, region_12.pdf *and* cmquebec.pdf].

- *Finding — The Panel notes that the results of the individual risk analyses carried out by the proponent indicate that the land would be used in compliance with the Major Industrial Accidents Council of Canada criteria for land designation and use. The Panel also notes that these criteria were recognized by departments from the two levels of government and that they were consistent with the approach used elsewhere in the world in regard to the siting of industrial facilities.*

The pipeline

In this section, the Panel traces the history of accidents related to pipelines, examines the security measures proposed by the proponent and analyzes the consequences of the accident scenarios considered.

History of accidents linked to pipelines

The proponent reviewed previous accidents involving pipelines using several sources, including reports from the Canadian Transportation Agency. Based on this review, a summary was produced for of accidents which have occurred in North America and Canada in the past 25 years.

The NEB also evaluated the number of pipeline ruptures per year in order to assess the security level of federally regulated oil and gas pipelines. The study covered intervals of twenty, ten and five years, and considered rupture causes, ignition, deaths, injuries, pipeline age, internal inspections and the security interventions carried out by the Board. Forty-six ruptures occurred over a twenty-year period, twenty-three over a ten-year period and seven over the five-year period, for the 43,000 km of regulated pipelines.

Study results showed that the average time elapsed between the building of a pipeline and a rupture was of twenty-eight years. Moreover, during the past twenty years, pipeline ruptures resulting in three deaths and other injuries were due to fires breaking out during the rupture of pipelines and high-pressure steam lines. The main causes of ruptures were, in order of importance: external corrosion, cracks by corrosion under tension and damages caused by third parties. Lastly, the number of ruptures has decreased during the past ten years, as well as their consequences on security (DQ64.1; DQ17.15).

Moreover, the proponent provided accident data on the gas distribution network in Quebec for the past ten years. No data was available for all of Canada. The information given indicated that there were fourteen accidents, five of which resulted in an explosion. Of these, two events resulted in a total of four deaths. Actions performed by third parties on the network were the cause of most of these accidents.

The security measures planned for the pipeline

The safety measures planned for this project would be taken into account for the design, construction and operation of the pipeline with the aim to prevent, detect and control any event which could occur in relation to the pipeline and to mitigate its consequences, if required. These measures would be based on risk analysis, and would especially take into consideration the most likely cause of accidents, i.e. the accidental breakage of the line caused by excavation work. Some of these measures are:

– The line would be placed in a 23-m right-of-way that would meet the NEB's standards to border or cross the electric right-of-way.

– All work performed less than 30 m from the right-of-way would have to be declared.

– Block valves would be placed at both ends, as well as in the middle of the pipeline, for emergency shutdowns.

– Additional security measures would be implemented in the site's slump areas.

To that effect, the ministère de la Sécurité publique specified that it would continue its review to assess the need for additional pipeline security measures. However, in its opinion, barring exceptional circumstances, the guarantees provided by the proponent were satisfactory, said guarantees specifying compliance with Canadian standards, participation in the Comité mixte municipal-industries (CMMI), and the possible compliance of the emergency measures plan with the MDDEP's guidelines. Moreover, the MDDEP specified that the CSA-Z662-03[1] standard does not make any provision for exclusion zones:

> […] depending on the proximity of some buildings, the use of various classes of pipes, or the deeper burial of the pipeline in the ground. This has an effect of decreasing the probability or frequency of occurrence of a major accident, without necessarily changing the consequences of such an accident. Implementing a 23-m right-of-way for a pipeline also aims to decrease the probability that a major accident will occur, by protecting it from an accidental rupture. In spite of the measures which could decrease the frequency of accidents, keeping residences away from the pipeline route remains an essential criterion to consider when selecting the pipeline route.
> (DQ61.1, p. 2)

The ministry is slated to examine the situation of the closest buildings in order to assess the opportunity of planning special mitigation measures for them.

1. Canadian Standards Association (2005). Z662-03, Oil and Gas Systems, 439 p.

The accident scenarios considered and their consequences

Among the main aspects which governed the route's development, the proponent mentioned the intention to avoid as much as possible the high-density population areas. He detailed the consequences of three possible pipeline accident scenarios, i.e. the complete rupture of the buried line, a medium leak in the buried line, and the complete rupture of a line aboveground. Table 11 and Figure 11 detail these outcomes. Considering the population's density in certain places along the pipeline's retained route, the Panel included the potential consequences associated with thermal radiation thresholds that are greater than 5 kW/m^2 in its analysis.

Table 11 Consequences of the pipeline's three accident scenarios

Accident scenarios	Distance to the 5-kW/m^2 thermal radiation threshold	Distance to the 12.5-kW/m^2 thermal radiation threshold	Distance to the 37.5[1]-kW/m^2 thermal radiation threshold	Distance to the lower flammability limit
Complete rupture of the buried line	730 m	522 m	356 m	141 m (127 m aboveground)
Medium leak of the buried line	22 m	11 m	A few metres	8 m (3 m aboveground)
Complete rupture of a line aboveground	510 m	430 m	367 m	353 m (30 m aboveground)

1. Threshold value for structural damage to buildings and equipment caused by thermal radiation exposure and used as a criterion to locate them.

Sources: adapted from PR5.3.2, p. 7 and Appendix H, p. 39 and 40.

The sensitive elements of the host environment

According to the proposed route, several sensitive elements could be inside various impact areas corresponding to thermal radiation thresholds of 37.5, 12.5 and 5 kW/m^2, depending on their position with respect to various project pipeline segments. Table 12 summarizes them.

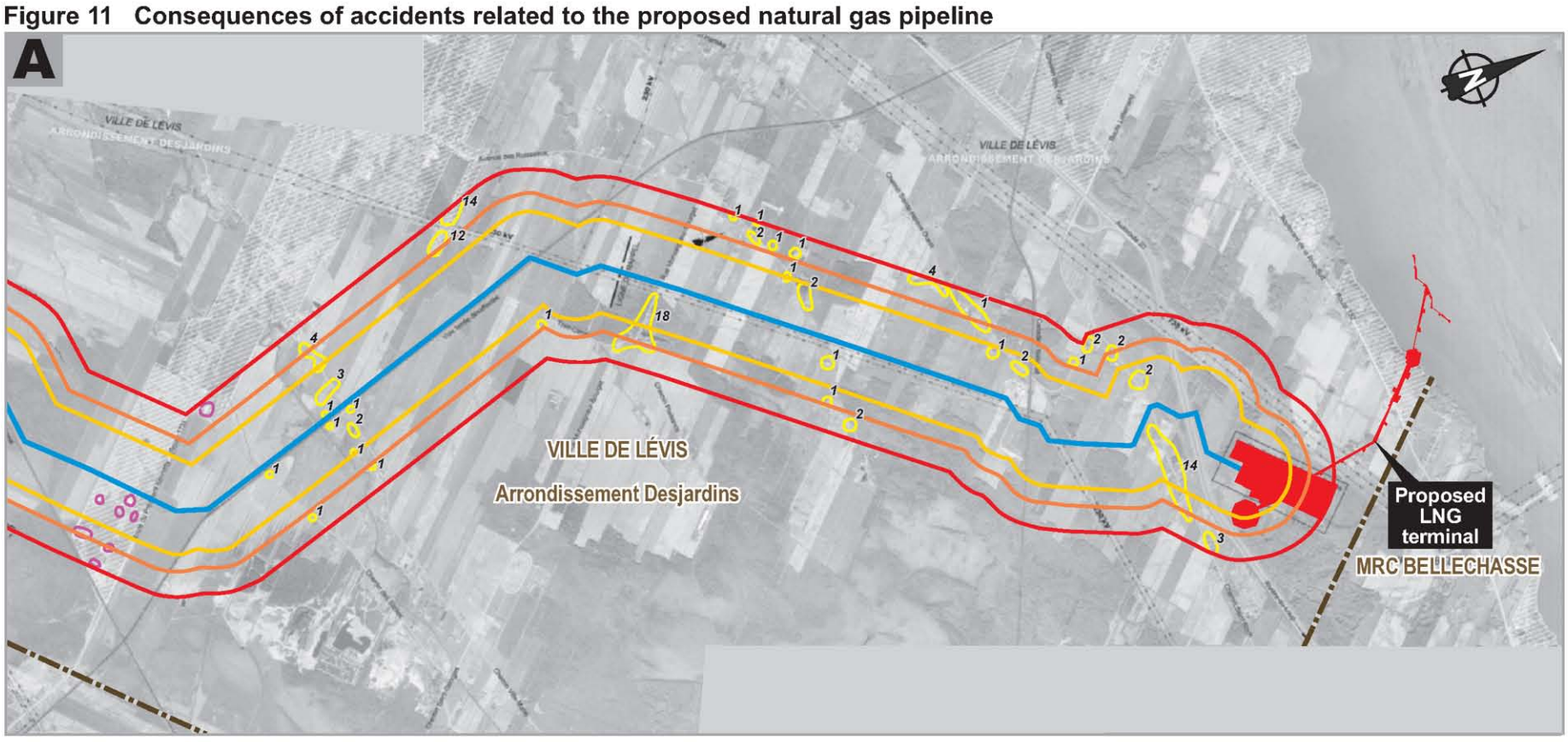
In light of the summary of sensitive elements identified, the Panel noted the presence of a campground that could be located in the 5-kW/m^2 impact area should the pipeline rupture. In answer to a question from the Panel, the proponent also provided an analysis of sensitive elements in the 1.6-kW/m^2 thermal radiation impact area, which represents a 1,070-m radius from both sides of the proposed pipeline's right-of-way.

In his opinion, there would be no school, hospital or public assembly places within this isocontour (DQ99.1, p. 1).

According to the proponent, a fire at the pipeline could spread towards the terminal's facilities, in the event of a leak igniting close to the terminal's connection point. Yet the facility which would be the closest to the pipeline is the metering station. The distance between this station and the pig launching station would be approximately 120 m. Only a major leak or a pipeline rupture could have an impact on this metering station or other equipment nearby. According to the proponent, the probability of a pipeline accident spreading towards the metering station was less than 10^{-5} per annum. This probability was even lower for other terminal facilities located further away. As for the tanks, a pipeline accident could not reach them given the distance separating the pipeline from the tanks. According to the proponent, should a leak occur in the pipeline close to the terminal's connection point, it would be detected and isolated very quickly (the block valve at the terminal connection would be equipped with an automatic shutoff mechanism activated by a pressure drop). This would reduce the potential for damages to the terminal's facilities. Lastly, terminal operators would intervene quickly and use the terminal's stationary or mobile firefighting equipment to protect the terminal's equipment if necessary (DQ17.3).

- *Finding — The Panel found that, in the event of a pipeline rupture, individuals could be located inside an impact area lying between the 5 and 37.5 kW/m^2 thermal radiation limits. However, in light of the history of accidents associated with pipelines in Canada, the Panel estimate the probability of such an accident occurring to be low.*

Figure 11 Consequences of accidents related to the proposed natural gas pipeline



Sources: adapted from PR3.1, Figure 2.1; PR5.2.1, Figure 14; DQ44.6, Sheets 1 à 5; regionals maps of the ministère des Affaires municipales et des Régions [On-line (May 2, 2007) : www.mamr.gouv.qc.ca/publications/cartotheque/region_03.pdf *and* region_12.pdf].

Table 12 Summary of sensitive elements at distances of 356 m, 522 m and 730 m from the proposed pipeline's right-of-way for a scenario involving the complete rupture of the buried line

Segment		37.5-kW/m^2 isocontour (356 m-radius)				12.5-kW/m^2 isocontour (522-m radius)				5-kW/m^2 isocontour (730-m radius)			
Location	Approximate length (km)	Residences	Industries	Businesses	Others	Residences	Industries	Businesses	Others	Residences	Industries	Businesses	Others
Terminal's land facilities/south of rue Monseigneur-Bourget	6.0	24	0	0		41	0	0		69	0	0	
South of rue Monseigneur-Bourget /east of chemin Pénin	9.8	25	5	0		32	7	0		70	9	0	
East of chemin Pénin/east of Robert-Cliche Expressway (73)	9.3	22	0	0	Bush camp Les Composts du Québec	55	0	0	Bush camp Les Composts du Québec	93	0	0	Bush camp Les Composts du Québec Centre national de conduite d'engin de chantier
East of the Robert-Cliche Expressway (73)/north of the Hydro-Québec high-voltage line	9.0	20	0	0	0	52	0	0		103	1	0	0
North of the Hydro-Québec high-voltage line)/ TQM Pipeline's network	8.0	32	0	1	0	80	0	2	du Cap Sugarshack	167	0	2	Campground
Total	42.1	123	5	1	2	260	7	2	2	502	10	2	4

Source: adapted from DQ44.6.

- ***Opinion 10*** *— To plan emergency measures regarding the pipeline, the Panel is of the opinion that the proponent should pay special attention to public gathering places such as campgrounds in the impact area within the 3 kW/m^2 thermal radiation limit.*

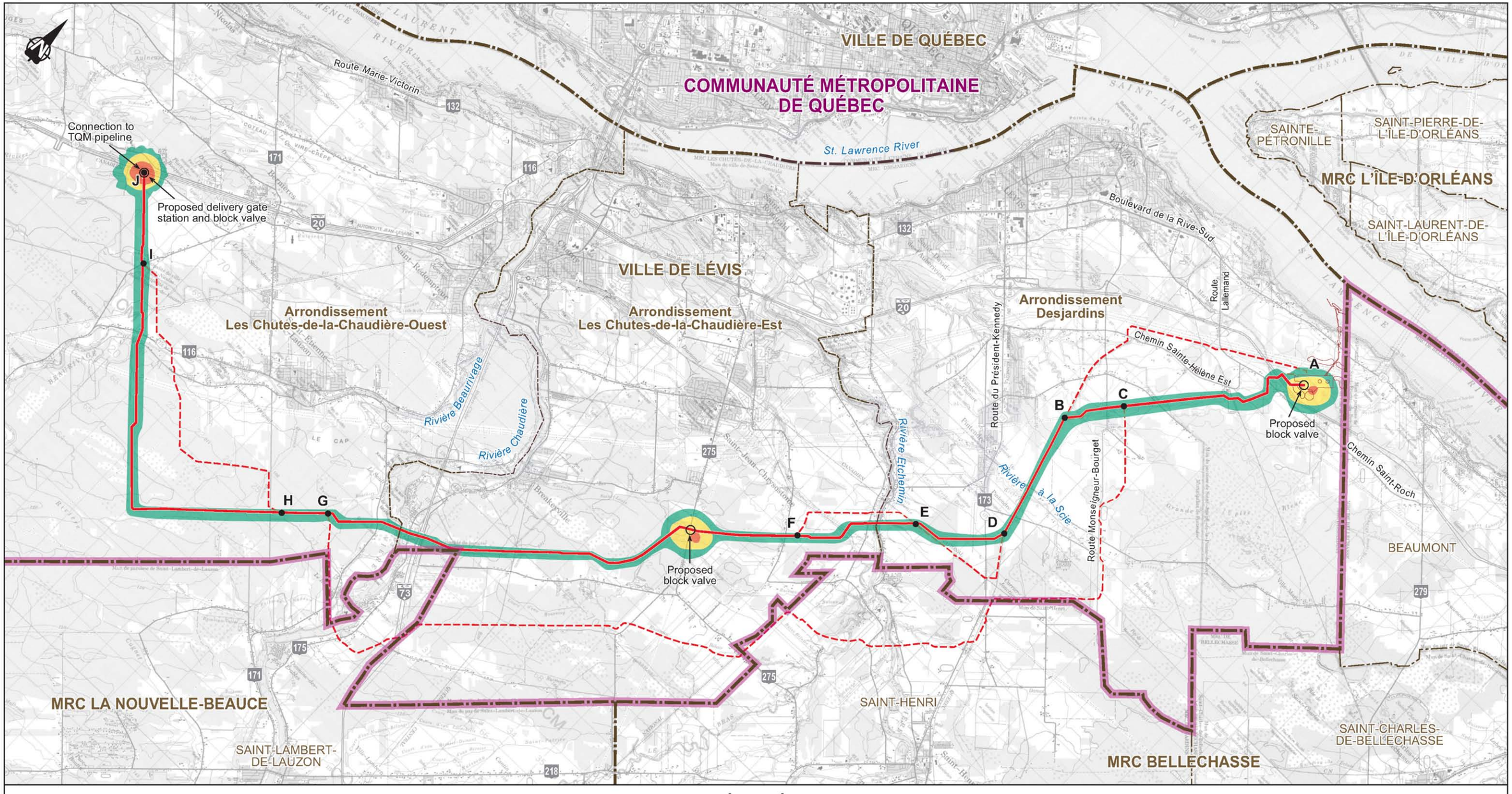
Assessing the risk associated with the pipeline

According to the proponent, the analysis performed demonstrated that estimated risks were in compliance with the acceptability criteria established by regulatory organizations throughout the world for oil and gas facilities, process plants, transportation equipment and ports. Moreover, they would comply with the MIACC's previously specified criteria. According to these criteria, the maximum acceptable risk level for the public is 10^{-4} per annum, i.e. an occurrence every 10,000 years. Results demonstrated that risk levels would be acceptable even for someone who would be permanently above the buried pipeline (Figure 12). The risk would be negligible for anyone who would be 100 m from the pipeline at all times, which means that the return period is greater than 10 million years.

However, in the perimeter around the switching station located halfway of the proposed pipeline, as well as at the connection points between the LNG terminal and the TQM Pipeline, the individual risk level increases. This localized increase is related to the frequency of leaks stemming from the presence of elements such as valves and flanges. However, according to the analysis made, this risk would always be below the 10^{-4} per annum limit, and as such was deemed acceptable even for these areas. Moreover, the proponent was of the opinion that the risk impact for major infrastructures and the community's sensitive elements was located within the acceptable range, as the return period is beyond the 10,000 year limit.

Besides, there are currently two projects under consideration which could be built close to the pipeline planned by the proponent. These are the pipeline project linking the Cacouna LNG terminal to Saint-Nicolas and the Pipeline Saint-Laurent oil pipeline project linking Lévis and Montreal-East. In answer to a question from the Panel, the proponent assessed the total individual risk for someone permanently in proximity to these three pipelines, should they be realized and supposing that they would be built in parallel. The proponent stated that his calculations were conservative, and that the NEB, which must approve both pipelines, would require a common infrastructure for the gas transiting from Rabaska and Cacouna, that is to say only one pipeline, not two (DQ44.5, p. 1).

Figure 12 Individual risk related to the proposed natural gas pipeline



Legend

Project

- Proposed LNG terminal (approximate localization)
- Preferred route for the proposed natural gas pipeline
- Alternate route not retained

Individual risk level

- 10^{-5}/year (one occurrence every 100,000 years)
- 10^{-6}/year (one occurrence every 1,000,000 years)
- 10^{-7}/year (one occurrence every 10,000,000 years)

Limits

- Communauté métropolitaine de Québec
- MRC and equivalent territory
- Municipality
- Borough (arrondissement)

Approximate scale 0 2 km

Sources: adapted from PR3.3.2, Figure 2.1; PR3.4.1, Figure 8.3; PR3.4.2, Appendix C, Figure 1; regionals maps of the ministère des Affaires municipales et des Régions [On-line (March 22, 2007): www.mamr.gouv.qc.ca/publications/cartotheque/region_03.pdf, region_12.pdf *and* cmquebec.pdf].

The results indicated that building three structures in parallel would slightly increase the level of risk for individuals living around them. However, the total individual risk curve remained below the maximum acceptability limit of 10^{-4} per annum and would meet the MIACC's criteria at all times. However, the proponent specified that his results would only be valid if effective measures were taken to avoid the spreading of any accident from one worksite to another. He believed that the most effective protection would be to implement a distance of 12 m or more between the sites and that this is the minimal distance used for the TransCanada gas transport network loop. In this respect, he specified that the separation distance required between the project's pipeline and Ultramar's pipeline would be of 20 m, "which represents a very safe distance that ensures no chain-reaction accidents will occur should there be a breakage on either line" (DQ58.8).

- *Finding — The Panel notes that the analysis results of the project for individual risks associated with the pipeline project indicated a land use that complied with the criteria of the Major Industrial Accidents Council of Canada. This would be the case even if the project's pipeline linking the Cacouna LNG port to Saint-Nicolas, as well as the Pipeline Saint-Laurent oil pipeline linking Lévis to Montreal-East, were realized in proximity to the project under review.*

- *Finding — The Panel notes that every project component, as well as its characteristics, is part of the liquefied natural gas transport and regasification industries which has a history of industrial security that has been free of major accidents for close to 50 years.*

- ***Opinion 11** — The Panel is of the opinion that the risk assessment carried out for the project was methodologically in compliance with industry and standard practices, which are recognized in the field. The conclusions of this assessment were also compatible with the known history of the liquefied natural gas industry regarding security, for both the maritime and on-land aspects. On this basis, the Panel deems the risks associated with the project to appear acceptable.*

The seismic risk

The proponent submitted a preliminary local seismic study report and other related technical reports. Based on these reports, he also committed himself to considering a seismic scenario in his emergency plan and to building the tanks according to the BS EN 1473 standard, with a return period of 5,000 years, which was deemed as acceptable by Natural Resources Canada. According to this department, the seismic study produced for this project was acceptable (DQ87.2).

- *Finding — The Panel noted that Natural Resources Canada deemed the seismic analysis produced for the project to be satisfactory.*

Other opinions regarding security

Some hearing participants[1] were of the opinion that the proponent had minimized his project's risks and consequences for the population. In order to correctly assess the proponent's conclusions, some participants referred to other studies which had analyzed the potential hazards of building LNG terminals, including the one proposed for this project.

In his report, James A. Fay, from the Massachusetts Institute of Technology, was of the opinion that the standards of the Canadian Standards Association (CSA-Z276-01) are not restrictive enough, and that danger areas related to the thermal radiation produced after LNG spills could extend to a distance of 4 km from the source. In his opinion, the danger areas dealing with flammable vapours could be extended further, i.e. over a distance of approximately 6 km from the spill site. He also thought that, in the event of spills from an LNG tanker in transit, the danger areas linked to the thermal radiation and flammable vapours would cover both of the river's shores, up to a distance where the river's width would exceed 12 km (DB16.1). However, the Panel noted that Fay did not use the same parameters as the proponent (thermal radiation threshold and flammability limit) to reach these conclusions. Furthermore, no probability was associated with the accident scenarios to which he referred.

The opinion of Jerry Havens, from the Chemical Engineering Department of the University of Arkansas, was also reported. He was of the opinion that a major LNG spill could occur after an intentional act. He explained that a natural gas vapour cloud could travel up to approximately 4.8 km. He also believed that in the event of a pool fire fuelled by an LNG spill, the entire LNG tanker could be in flames. In his opinion, the thermal radiation generated by a pool fire could be felt up to approximately 1.6 km (DC17). For this case also, the Panel noted that it was not able to compare these results with those of the proponent, because of missing data on the parameters used and the probabilities associated with the accident scenarios considered.

James E S Venart, from the Mechanical Engineering Department of the University of New Brunswick, also studied safety issues associated with the potential construction of the LNG terminal project at Lévis. He was of the opinion that the proponent's risk

1. Among others: Coalition Rabat-joie, DM377; Ms. Louise Maranda, DM596; Mr. Sylvain Castonguay, DM578.

assessment wasn't sufficiently conservative, and that the site chosen was inappropriate (Coalition Rabat-joie, DM606).

Moreover, the Stabilis firm was mandated by the advisory committee of the Municipality of Beaumont in 2004 to model a major accident in an LNG storage tank, specify the consequences of a major pipeline rupture, and illustrate the consequences of a major accident with an LNG tanker. In light of the document submitted, the Panel noted, among other things, that the models performed by the firm took into account different parameters than those used in the proponent's risk assessment.

Lastly, industry representatives noted, once again, the major differences between the conclusions of such studies on the separation distances required to ensure public security from thermal radiation. As such, the AES Sparrow Point LNG project workgroup (Baltimore) pointed out the fact that the distance which corresponds to a radiation intensity of 5 kW/m^2 had been assessed respectively at 1,617 feet (493 m) (Quest), 1,650 feet (503 m) (Lehr), 3,630 feet (1,106 m) (Fay, March 2003 report), and 4,257 feet (1,298 m) (Koopman, Vallejo project[1]).

- *Finding — The Panel notes the divergence of views among expert opinions submitted at the hearing and the risk analyses results of the proponent. It also found that the criteria upon which these analyses were based were different.*

Facility safety and the terrorist threat

During the hearings, several participants expressed concerns regarding the vulnerability of the proposed facilities with respect to possible terrorist attacks, and other deliberate acts of sabotage.

However, deliberate acts against LNG tankers and terminals which could have impacts on the security and the environment are governed in Canada, *inter alia*, by the *Marine Transportation Security Act* (S.C. 1994, c. 40) and the Marine Transportation Security Regulations [SOR/2004-144]. Under these regulations, an LNG tanker and terminal must have an approved safety plan.

In this respect, the proponent submitted a preliminary portuary security plan to Transport Canada, which concluded that the contents of this plan complied with the outline of the Marine Transportation Security Regulations. However, Transport Canada underscored the fact that the official approval of the safety plan will be based

1. Baltimore County Liquefied Natural Gas, Task Force, AES Sparrows Point LNG Mid-Atlantic Express, Project Presentation, September 5, 2006.

on an assessment of risks and vulnerability as defined in articles 317 and 321 of these regulations.

- *Finding — The Panel notes that the proponent submitted a preliminary safety plan with Transport Canada, and that its contents was deemed in compliance with the regulations in force.*

The threat of a terrorist attack

The concerns regarding the vulnerability of LNG facilities to possible intentional acts of sabotage do not represent a new phenomenon. Such concerns date back to the mid-1970s, a period during which the first LNG terminal projects were built in the United States[1].

In the political and security climate that arose in the wake of September 11, 2001, the possibility of other attacks targeting industrial facilities which could release large quantities of energy or toxic substances close to urban centres became a cause for great concern in the United States. It was after these attacks that U.S. authorities required exceptional Coast Guard escort measures for the LNG tankers sailing in the port of Boston, and to the LNG terminal of Distrigas at Everett, in Massachusetts (Mr. John F. Hanlon, DT29.1, p. 8).

Since then, LNG facilities have been the subject of many analyses and studies from government authorities, research centres and large insurance companies. One of these studies[2] concluded that full containment tanks, like those planned for this project, were unattractive targets considering the methods often used in terrorist attacks (explosive charges, missiles, plane crashes) and given the difficulty of undermining the structural integrity of these tanks. The study recommended not to build such facilities close to large urban centres whenever possible, and also recommended separating, when possible, the maritime facilities from the tank area, as the latter were deemed to be relatively more vulnerable.

A report from the United States Congressional Research Service underscored the fact that no LNG facility has been a target of a terrorist attack up to now. However, the report noted that pipelines and oil facilities have already been the targets of these types of attacks throughout the world[3]. Quoting the Federal Energy Regulatory

1. Peter van der Linde and Naomi A. Hintze, Time Bomb. *LNG: The Truth about our Newest and Most Dangerous Energy Source* , Doubleday & Company, Garden City, New York, January 1978.
2. C. Southwell, *An Analysis of the Risks of a Terrorist Attack on LNG Receiving Facilities in the United States*, University of Southern California, November 9, 2005 [On-line: www.usc.edu/dept/create/assets/001/50799.pdf].
3. Paul W. Parfomak and John Frittelli, *Maritime Security: Potential Terrorist Attacks and Protection Priorities*, CRS Report for Congress, January 9, 2007.

Commission (FERC), the report added that integrated security and safety measures specific to the LNG facilities were more reliable than those of dangerous chemical product facilities and other high-risk industrial infrastructures that receive little public attention, according to the report.

During a forum that was organized by the FERC on LNG facilities security, the former Director of the Central Intelligence Agency (CIA) an advisor on national security, stated that terrorism represented a real threat to the United States, but that an attack against an LNG facility would be unlikely. In his opinion, terrorists were more interested in targets which offer a high potential of damages, and an LNG tanker does not have such a potential, compared to other targets and methods which could result in much greater human and economic losses[1]. This opinion was shared by one of the authors of the report from Sandia Laboratories.

The OECD Maritime Transport Committee (MTC) was also of the opinion that LNG industry marine and land facilities represented, through their robust design and inherent security measures, unattractive targets for terrorist groups[2].

In addition, three terrorist attacks have taken place in recent years in countries that have LNG facilities: Indonesia, Spain and the United Kingdom. These three attacks, the largest outside of Iraq and Afghanistan since September 11, 2001, suggest that the target choice for an attack depends on considerations other than the inherent level of hazard of facilities such as those of the LNG industry.

Lastly, the United States Coast Guard ordered the suspension of activities at the Everett LNG terminal, close to the port of Boston, after the September 11, 2001 attacks. Concluding an absence of risks and hazards justifying this suspension, it authorized a resumption of port operations on October 16th of the same year[3]. After this decision, the City of Boston applied for an injunction with the Federal Court, asking for terminal operations to be halted, on the basis of the risks and hazards that the terminal represented for the city[4]. The Federal Court judge rejected the City's

1. Susan F. Tierney, *Report to the Massachusetts Special Commission Relative to Liquefied Natural Gas Facility Siting and Use*, Boston, Massachusetts, June 30, 2006; G. Woo, *A Terrorism Risk Analyst's Perspective on Tria*. *Risk Management Solutions* [On-line: www.rms.com/Publications/RiskAnalystPersectiveTRIA_WooForCongress.pdf].
2. Organisation for Economic Co-operation and Development, *Maritime Transport Committee, Security in Maritime Transport: Risk Factors and Economic Impact*, Paris, July 2003 [On-line: www.oecd.org/dataoecd/19/61/18521672.pdf].
3. [Online: www.eia.doe.gov/emeu/cabs/chrn2001.html].
4. [Online: www.kslaw.com/library/pdf/GreenfieldLNGTerminals.pdf].

application, concluding that there was a lack of information and facts substantiating the existence of a credible threat[1].

- *Finding — The Panel notes that no liquefied natural gas land facilities or LNG tanker have been the subject of terrorist attacks in close to 50 years, even in countries where such facilities are found and which have recently suffered large-scale terrorist attacks.*

- ***Opinion 12** — The Panel is of the opinion that the structural characteristics of liquefied natural gas land facilities and LNG tankers, as well as their inherent security measures, make them little vulnerable as targets for terrorist groups, and less likely to offer the consequences usually sought in terms of damages, visibility and socio-political impacts.*

Emergency measures planning

In spite of adequate overall risk management, there will always be a residual risk, and a chance event could occur, requiring an immediate and adequate intervention. To this end, the emergency measures plan anticipates interventions to be implemented during emergency situations, such as a dangerous substance spill, an explosion, a fire, a natural disaster, etc. (CRAIM, 2007).

Moreover, the Panel noted that the proponent submitted a preliminary emergency measures plan to the City of Lévis. This plan is currently being analyzed by the Service de sécurité d'incendie for its subsequent approval by the City council (DB114).

Besides, the proponent specified that each LNG tanker would have, among others, an emergency measures plan and a specific plan against pollution from hydrocarbons. These elements would be submitted for a yearly review and to inspections. In this respect, the Canadian Coast Guard specified that ships must report any event, as well as any incident or accident regarding marine traffic occurring in Canada. This process was presumed to be under review, jointly with the ministère de la Sécurité publique, to disseminate this type of information on the municipal level, or even to encourage its activation, if necessary (Mr. Martin Blouin, DT11, p. 72).

- *Finding – The Panel noted that the proponent submitted a preliminary emergency measures plan to the City of Lévis.*

1. Mark Clayton, "LNG: A Prized Energy Source, or Potent Terror Target? Push to build LNG terminals is under fire", *The Christian Science Monitor*, April 6, 2004; Gemma Aymonne Heddle, *Sociopolitical Challenges to the Siting of Facilities with Perceived Environmental Risks*, M.Sc Thesis, Massachusetts Institute of Technology, June 2003 [On-line: http://sequestration.mit.edu/pdf/heddle_thesis.pdf].

The Comité mixte municipal-industriel and the public advisory committee

Should his project be completed, the proponent should join the Comité mixte municipal-industriel (CMMI) of Lévis. This committee is composed of representatives from departments, ministries and organizations such as Environment Canada, the MDDEP, the Agences de santé et des services sociaux as well as the ministère de la Sécurité publique. Among others, the CMMI would be responsible for assessing the communication plan for emergency situations, as well as implementing the means retained for this purpose, six months before the start of the project's operation. Communication actions on security would also be taken by the public advisory committee, which would be formed as soon as the terminal was built. It would include representatives from the proponent, elected officials, authorized agents for representative groups and for citizens of Lévis, Beaumont and île d'Orléans (DB28; City of Lévis, DM315, p. 11; DQ17.9). Besides, the ministère de la Sécurité publique found that such a joint collaboration between the major stakeholders was appropriate (Mr. Romain St-Cyr, DT12, p. 82). In this respect, the Panel believed it necessary for the proponent to implement a yearly information mechanism to provide the project's operational security report, for individuals who could be affected by accidents involving the project's facilities.

In other respects, the MRC de Bellechasse expressed its wish to take part in, and name to the CMMI a person representing its territory (DM560, p. 8). In this respect, the Panel believed that representatives from the MRC de L'Île-d'Orléans should also sit on this committee as some sectors of its territory could be affected by consequences stemming from a major accident with an LNG tanker in transit close to the shores, even though the Panel assessed the probability of such an event as low.

- ***Opinion 13*** *— The Panel is of the opinion that, should the project be implemented, the Comité mixte municipal-industriel of the City of Lévis should offer representatives of the MRC de L'Île-d'Orléans and of the MRC de Bellechasse the possibility of taking part in the committee's proceedings.*

- ***Recommendation 6*** *— Should the project be implemented, the Panel recommends that the proponent set up a yearly public information mechanism regarding the project's operational security report, for individuals who could be affected by accidents involving the project's facilities.*

Protection against fires

The City of Lévis specified that the risk coverage plan, whose project was approved in 2004, will allow in 2011 to efficiently cover the needs created by the project's

presence and operations, and noted that the plan would meet fire protection needs in training, prevention and response time. For its part, the Municipality of Saint-Charles-de-Bellechasse specified that, should the project get the green light, it would have to take the City of Lévis plan into account to ensure greater consistency during interventions. It was also of the opinion that there should be talks with the municipalities involved on the availability and relevance of current intervention equipment, to be able to face emergency situations associated with the LNG terminal facilities (DM315, p. 9; DM99, p. 3).

The proponent planned on creating his own fire brigade. Moreover, he made a commitment to the effect that the project never be a financial burden for the municipality and its citizens. He would therefore cover additional costs for fire security, public security and emergency measures planning. To this effect, the City of Lévis did specify that should these facilities begin operations before 2011, then it expected the proponent to cover these expenses (Ms. Danielle Roy-Marinelli, DT16, p. 29). For its part, the MRC de Bellechasse was of the opinion that financial compensation should be given to the Municipality of Beaumont, if additional equipment is purchased to ensure the security of its territory (DM560, p. 8).

- *Finding – The Panel found that, if required, the proponent committed to paying additional costs incurred by the City of Lévis for fire security, public security and emergency measures planning.*

- ***Opinion 14 –*** *The Panel is of the opinion that, should additional needs for fire security, public security and emergency measures planning prove necessary for the Municipality of Beaumont, the proponent must cover these costs.*

The intervention capacity of health services

Some participants[1] at the hearing were worried about the capacity of health services to deal with a possible accident at the LNG terminal's facilities or related infrastructures. To this effect, the public health management of Chaudière-Appalaches and of the Capitale-Nationale specified that every department or organization had the responsibility of one or several missions which meet the major needs of the population in emergency situations. The primary goal of the health mission of the ministère de la Santé et des Services sociaux is to preserve the life, health and well-being of individuals before, during and after a public welfare emergency.

1. Among others: Ms. Renée Dupuis, DM191, p. 3 and 4; Mr. Louis Duclos, DM458, p. 8.

To this end, the Chaudière-Appalaches and the Capitale-Nationale regions have already had for several years an emergency measures plan, and the pre-hospital emergency services are closely associated with every link of the intervention chain, including the triggering of an alarm for an extreme situation. These plans are currently being reviewed and their update is due shortly. Moreover, for the Chaudière-Appalaches region, the emergency network's response capacity could be adjusted for the arrival of a new industry east of Lévis, even if this industry presented particular risks:

> The fact that the planned terminal's location is not very far from Expressway 20 and Highway 132, both major road arteries, represents a facilitating factor in terms of emergency responses. Moreover, the Agence de la santé et des services sociaux de la Chaudière-Appalaches has already finalized some agreements with hospitals in the Capitale-Nationale region, including the Centre hospitalier de l'Enfant-Jésus regarding serious burn victims and trauma cases.
> (DM602, p. 57)

The Capitale-Nationale region also has a response structure within its health mission, to cover its territory. However, the situation of île d'Orléans is particular, because of longer response time, as there are neither ambulance attendants nor first responders on the island, and also considering the island's sole access to it. In this respect, both agencies believed that:

> […] if the Rabaska project is completed, then the health mission will have to assess more precisely how the emergency teams will be able to assist île d'Orléans citizens, and provide, with other missions and their adjoining collaborators, for a plan that can meet the specific aspects of identified risks.
> (Ibid.)

- *Finding — The Panel notes that the ministère de la Santé et des Services sociaux will assess the particular situation of île d'Orléans with respect to its emergency needs if the project is completed.*

Chapter 6 Social acceptance of the project

Between fairness and solidarity

The Panel was in a position to take the full measure of the extent of opposition to the project in the area under consideration. This included the genuine concerns and anxieties noted among many citizens about their security, their quality of life and the value of their assets in relation to the project's potential risks. The Panel also observed concerns among many residents of Lévis, Beaumont and île d'Orléans regarding the possible impacts of the project on the area's landscape and the region's cultural heritage. By the same token, the Panel also took note of the widespread support, both regionally and nationally, for the project on account of its economic benefits for the majority. As far as its compatibility with the character of the area chosen for its construction is concerned, the Panel was able to fully assess reservations expressed by participants both from the south shore and île d'Orléans.

Once all of this is taken into account, the obvious dilemma related to the project is echoed in the two values entrenched in Quebec's *Sustainable Development Act, namely,* fairness and solidarity. Opposition by a majority of the community living in proximity to the project is mainly based on apprehension about risks and the fact that they would be the first to bear the brunt of potential consequences. From this standpoint, an argument based on the principle of fairness would support giving predominant weight to this community's position in regard to the acceptability of the project.

However, extending this approach on a society-wide basis would have the disadvantage of making the conduct of public affairs difficult, if not impossible. This is because the significance of socioeconomic activities (facilities and institutions) to the greater public interest could outweigh local or regional resistance.

By the same standard, national, regional and local support for the project derives its legitimacy from the advantages anticipated in terms of employment, spin-offs, and economic development. From this viewpoint, the principle of solidarity could be invoked in support of the project. That said, applying the principle of solidarity must also take into account the principle of fairness in regard to specific regional and local interests and concerns.

It is certainly not possible to ensure equal sharing of the advantages and disadvantages of a project at all times and in the society as a whole. But in a

democratic society, there is always a duty to seek the fairest distribution of advantages and disadvantages in time and space. The State, as guardian of the public interest, bears ultimate responsibility for this. Its prerogatives naturally include the arbitration needed to reach a final decision on location of projects and the conditions to put in place in their regard.

The perception of risk

Project-related risk constitutes a major factor in the apprehensions and opposition expressed by a majority living near the project. During the public hearings, it became obvious that there was a major gap between the quantitative analyses of risk carried out by the proponent and the perception of the same risk by many participants. While the results of the analyses present the project's inherent risk as negligible or acceptable, a number of participants considered it unacceptable or intolerable.

This is neither a new nor unusual situation. For the past 30 years, polarization around risks linked to industrial projects has accounted for some major social and community cleavages in modern democratic societies. Such polarization is especially obvious with projects perceived as high-risk, such as nuclear reactors and liquid natural gas terminals. Thus, the Panel viewed exploring this aspect of the project as especially relevant.

Apprehension of risk and its manifestations

It is noted and often mentioned that society is tolerant to highway fatalities. However, if the number of accidental deaths over a single year was to occur in one place in one fell swoop, this tolerance would be strikingly diminished or non-existent. Similarly, society is less tolerant of accidental or intentional loss of life affecting a large number of people with bonds between them, than when it happens to the same number of people who are not linked in some way.

Some studies also point out that even when considerable loss of life is involved, the same level of aversion does not occur for activities resulting from the exercise of free will as for those where people are subjected to outside events, even when the latter have fewer consequences. The same tendency is observed for familiar risks in comparison to new risks[1]. Studies also show that natural disasters do not cause as much indignation as accidents attributable to human activities.

1. M. Finucane, *Improving quarantine risk communication: Understanding public risk perceptions*, (report No. 00-7) Decision Research: Eugene, Orégon, 2000, p. 31.

By the same token, the public intuitively focuses on the serious consequences of a potential accident rather than on the fairly abstract likelihood of it happening. Contrary to other quantifiable aspects of the natural and social order with which we are familiar – measuring and quantification of which immediately imply accuracy and certainty – the idea of probability has an elusive aspect to it: although it is quantifiable, quantification in no way eliminates its inherent uncertainty.

Risk and the project

Debate and controversy surrounding the location of LNG facilities in Quebec, Canada, the United States, and Western Europe take place in an atmosphere of polarization between two interpretations of the concept of risk: one that is scientific, rational and objective; and one that is subjective and hypothetical. It certainly is legitimate for project supporters to cite the security of LNG, which has been exempt of major accidents for over 40 years. It is equally legitimate for citizens, especially those who live near the proposed project facilities, to worry about the possible consequences of potential accidents that could upset their lives.

If it were a matter of a project using facilities and techniques never before used, and giving equal weight to both “rationales” just described regarding risk, the Panel would have drawn its inspiration from the precautionary principle in a restrictive sense. As it turns out, the whole LNG industry security profile shows few major incidents and documented accidents. In point of fact, such a good showing paradoxically becomes an added source of uncertainty in the development of models to quantify risk related to this industrial sector. Thus, on one hand, there are uncertainties and gaps in information about quantification of potential risk and, on the other hand, an industry-wide security profile based on more than 40 years of land and sea operations.

In the present situation and in the final analysis, the Panel considers it logical and reasonable to rely in its deliberations on the LNG industrial history in relation to safety. Thus, in the area of industrial and technological risk, such an historical background favours the project’s safety.

- ***Opinion 15 —*** *The Panel is of the view that in the area of risk, the safety history of the liquefied natural gas industry weighs in favour of the project’s safety.*

The social impacts

Where the local community is concerned, the project’s economic impact would translate into job creation, improved income, the supply and maintenance of public

services and infrastructures, as well as the development of knowledge with possible creation of a natural gas research chair. At the same time as there are these beneficial economic spin-offs for the whole community, negative social repercussions will affect the population near the proposed facilities. According to participants in the hearings, and health professionals and public health representatives from la Chaudière-Appalaches and la Capitale-Nationale, the project would have some social impacts on the population living nearby. The proponent, however, is of the view that as the project becomes more familiar and its advantages more concrete, the tensions surrounding it would be mitigated.

MDDEP ministerial guidelines issued for the impact statement suggested evaluating "the social impacts of the project as a whole, i.e. its effects on the population itself and its composition, quality of life, and community relations such as lifestyle changes or relocation of individuals and activities etc." This would determine appropriate measures to mitigate the impacts. The federal guidelines from the CEAA relate to those from the MDDEP without adding any details on social impacts, with the exception of instructions in case of possible expropriation. The guidelines suggest that "the proponents shall explain how (criteria, parameters used) financial compensation will be negotiated and who will be responsible for this process. They shall also describe the recourse available to owners in case of a disagreement[1]."

According to the proponent, members of the public raised the project-related social impacts during the information and consultation meetings that the proponent held between 2004 and 2005. The proponent also explained that "as the project evolved, Rabaska developed a position that took the form of formal commitments in regard to the project's social impacts." According to the impact assessment, financial compensation for residents within a radius of 1.5 km is the main mitigation measure proposed by the proponent. To this end, the proponent made the following commitments to citizens living within a 1.5- km radius of the facilities (PR3.2, p. 5.12, 5.23 and 5.24):

– To financially compensate any property owner for whom the resale value of his property could diminish because of the project on the basis of fair market value.

– To compensate any property owner who does not want to stay near the facilities by reimbursing all costs related to the sale of his or her present property, the cost of buying a new property and moving costs.

1. Canadian Environmental Assessment Agency, *Guidelines for the Preparation of the Environmental Impact Statement of the Rabaska Project*, p. 11 [On-line, May 7, 2007): www.ceaa.gc.ca/050/DocHTMLContainer_e.cfm?DocumentID=6854&SrchPg=2].

– To negotiate an agreement guaranteeing the maintenance of the market value of all property within a radius of 1.5 km of the facilities with property owners who wish to stay, but who fear that their property might lose its value over the long term because of the project.

– To fully compensate all property owners for insurance premium increases caused by building the project in the region.

♦ *Finding — The Panel takes note of the proponent's commitment to mitigate the project's social impacts through a program of financial compensation for residents living within 1.5 km of the proposed facilities.*

Impacts of a psychosocial nature

A psychosocial impact can be defined as a state of distress, of dysfunction, or incapacity manifested through a wide range of psychological, social and behavioural problems[1]. Taylor *et al*. (1991)[2] explains in greater detail what is meant by psychosocial impacts by classifying them according to three levels:

– Impacts on individuals of an emotional or sleep-related nature (distress, anger, problems sleeping, anxiety, depression, etc.).

– Impacts on individuals and their social networks, such as tensions and family divisions, interpersonal conflicts, social isolation etc.

– Impacts on the community that can translate into stigmatization, divisions, and inter-community tensions.

The project impact statement did not deal specifically with psychosocial impacts and was not required to do so by ministerial guidelines. Still, the Agences de la santé et des services sociaux de la Chaudière-Appalaches and de la Capitale-Nationale carried out a survey in 2006 among 406 citizens, 201 of whom lived within a radius of 2.5 km of the project facilities. The survey results indicated "some fears among certain residents […] as well as tensions related to differences of opinion about the project. Such a situation could, in all likelihood, bring about problematic psychosocial situations, especially among citizens living in the immediate neighbourhood of the project." In this regard, participants in the public hearings said they had lived through or observed the manifestation of symptoms among their peers possibly related to

1. S.J. Elliot *et al*., "Modelling psychosocial effects of exposure to solid waste facilities", *Social Science and Medicine*, 37(6), September 1993, p. 791-804.

2. S.M. Taylor *et al*., "Psychosocial impacts in populations exposed to solid waste facilities", *Social Science and Medicine*, 33(4), July 1991, p. 441-447.

impacts of a psychosocial nature. Still others feared the emergence of psychosocial problems among those living near the project, if it goes ahead.

Social research studies, based on the life experience of residents living near facilities considered risky, have established a link between the perception of risk and certain social and psychological consequences arising from controversial projects or accidents. The *Comité de santé environnementale du Québec* adds that "anxiety constitutes one of the most frequent disruptions in mental health among populations in proximity to a facility or site that they view as risky or undesirable, and some psychosocial impacts can be imputed to these"[1]. From this perspective, the survey conducted by the *Agences de la santé et des services sociaux* claims that 59% of those surveyed, who live within the 2.5-km perimeter of the proposed project, say that they feel "enough" or "a lot" of fear related to the project (DB97, p. 17).

Although of a different nature, the rehabilitation and construction of the storage facilities for the Gentilly 2 nuclear power station is an example of a project where the public perception of the risk involved and the associated psychosocial impacts were assessed in an impact study (BAPE Report 207). Moreover, other recent projects, such as the site of a sanitary landfill or an aluminium smelter, were also the objects of assessments and follow-up on psychosocial impacts by professionals[2]. According to Howe, "the public's perception of risk can be positively influenced through efficient communication (about risk)[3]."

The proponent made a commitment to inform the public and the authorities in advance about any activity likely to cause inconvenience in the surrounding area by posting signs and issuing news releases. The proponent also made a commitment to maintain a climate favourable to good relations with the different communities. During the operation of the LNG terminal, an oversight committee is planned that would stay abreast of activities to ensure that they are running smoothly and, where necessary, suggest improvements. Beyond this, the proponent will hold two crisis simulations annually. One would be theoretical, "a table top exercise", the other would be more practical, a full simulation involving regional authorities responsible for security. Regular follow-up with media would ensure that the project maintains its community commitment. Also, the proponent would hold an annual open house at its facilities. (PR3.2, p. 5-6 and 5.7).

1. Comité de santé environnementale du Québec, *Introduction à l'évaluation des impacts sociaux*, drawn from a series of introductory texts on the assessment of health impacts of major projects, Québec, 1993, p. 15.
2. N. Caron and M. Simard, Groupe de recherche et d'intervention régionale, Programme de recherche sur la modélisation du suivi des impacts sociaux du mégacomplexe industriel d'Alcan à Alma, Université du Québec à Chicoutimi, 2001 [On-line: www.uqac.uQuébec.ca/~msiaa/Rapport%20Final/francais/html/Annexes/Annexe%2011.pdf].
3. H.L. Howe, "A comparison of actual and perceived residential proximitv to toxic waste sites", *Archives of Environmental Health*, 43 (6), November and December 1988, p. 415-419.

- ***Recommendation 7 —*** *The Panel recommends that the Canadian Environmental Assessment Agency and the ministère du Développement durable, de l'Environnement et des Parcs give greater weight to psychosocial impacts in the guidelines that they issue for projects that present potential risks for neighbouring communities aiming at a better assessment of this category of impacts.*

Chapter 7 Impacts on the inhabited area and human activities

Noise

Measuring noise and its effects on health

The sound level is adjusted to an average value, the equivalent sound level (L_{eq}) for a given time period, of either 1, 12, or 24 hours. It is measured in decibels A (dBA), a logarithmic scale adapted to human sound perception. For the human ear, a change would be perceptible starting at 3 dBA.

Chronic exposure to noise can bring on minor emotional symptoms, alterations in the performance of daily tasks, and sleep disturbance[1]. A number of participants in the public hearings made the point that the effects of environmental noise on health have been scientifically documented and include an increase in cardiovascular disease, temporary or permanent hearing loss, sleep disruption, learning problems, etc.

Criteria, guidelines and regulation

The World Health Organization suggests limiting noise within a home to less than 45 dBA to allow communication[2]. It also stipulates that maintaining sleep demands a limit on noise of 30 dBA in the bedroom and less than 45 dBA outside the home during the night. Finally, an outdoor sound level of 55 dBA, day or night, would correspond to a strong disturbance while one of 50 dBA would be a moderate disturbance.

The MDDEP applies criteria for the category of projects that corresponds to industrial activities not subject to noise regulations during the construction and operation phases. These criteria are different for the construction and operation periods and presented below.

During construction, in the evening (7 p.m. to 10 p.m.) and the night (10 p.m. to 7 a.m.), any equivalent noise level over an hour ($L_{eq\ 1\ h}$) must be equal or inferior to

1. S.A. Stansfeld, “Noise, noise sensitivity and psychiatric disorder: Epidemiological and psychophysiological studies”, *Psychological Medicine* - Monograph Supplement No. 22, 1992, p. 1-44.
2. On-line (April 30, 2007): www.who.int/docstore/peh/noise/bruit.htm].

the highest of the following sound levels, 45 dBA ($L_{eq\ 1\ h}$) or the level of initial ambient noise if it is more than 45 dBA. During daytime, (7 a.m. to 7 p.m.), the equivalent noise level ($L_{eq\ 12\ h}$) must be equal to or less than the highest of the following sound levels, 55 dBA or the level of initial ambient noise if it is more than 55 dBA. In exceptional circumstances, a departure from this could be allowed during the day or evening ($L_{eq\ 3\ h}$ of 55 dBA from 7 p.m. to 10 p.m.), but none would be acceptable at night.

For the operation phase, according to the MDDEP criteria applicable to sources of sound in proximity to rural homes, the equivalent hourly sound levels ($L_{eq\ 1\ h}$) must not exceed 40 dBA at night (7 p.m. to 7 a.m.) and 45 dBA during the day (7 a.m. to 7 p.m.), or the initial ambient sound level if it is higher than these criteria. The proponent estimates that the applicable noise level at the property limits of the new proposed facilities would correspond to a $L_{eq\ 1\ h}$ of less than 70 dBA. In regard to noise outside homes, the proponent will follow the MDDEP guidelines. The proponent also stated that these limits could be replaced by the initial level of ambient noise, if it is higher, which conforms to the MDDEP approach.

In the city of Lévis, zoning by-law no. 234, section 3.3, states that at the limit of the area, there should be “no noise more intense than average intensity for the level of noise around the street and passing traffic.” In terms of the maximum intensity permitted, the proponent states that the criteria used do not correspond to current practice, but that it would correspond to a L_{eq} of 65 dBA at the limit of the area, and do not offer any adjustment for the construction period. For its part, the municipality of Beaumont does not deal with noise in its by-laws.

The current sound environment

The proponent measured the ambient sound level, prior to project execution. This initial sound environment was measured using sound samples from 23 different locations. Of these 23 measuring stations, only one was located on île d’Orléans, the proponent considering this location to be representative of the quiet areas on the southern part of the island. Moreover, the measuring station locations were chosen to represent sensitive areas where noise is concerned (residential areas) and to take existing noise conditions for all the planned project building sites. Measurements of sound levels were taken over 20-minute periods and extrapolated to 60 minutes as the sound level was stable ($L_{eq\ 1\ h}$: hourly average), day (7 a.m. to 7 p.m.) and night (7 p.m. to 7 a.m.). In order to take major noise sources into account as well, samples were taken continuously over 24 hours in proximity to Highway 132 and Expressway 20. The measurements were taken using state-of-the-art rules applicable to both distances and climatic conditions (PR3.3.1, p. 2.116; PR5.1, p. 3.63).

According to the proponent, the measured sound levels ($L_{eq\ 1\ h}$), varied between 40 and 62 dBA during the day and between 33 and 58 dBA at night in the inhabited areas. Rue Vitré is the quietest spot at night. Traffic not only on Highway 132 and Expressway 20, but also on the rue de l'Anse (western access to Expressway 20) and Lallemand Road (eastern access to Expressway 20) and the chemin Saint-Roch is the main cause of noise. Some other selected noise sources were itemized, but without influencing hourly measurements.

According to the proponent, the sound climate are already disturbed in the zone considered for the gas pipeline area by industrial activity, an airport, railways, Expressway 20 and several stretches of road.

- *Finding — The Panel notes that the present sound environment occasionally exceeds the criteria set by the ministère du Développement durable, de l'Environnement et des Parcs close to the main roadways on the basis of Leq 1 h. The rue Vitré area is described as quiet at night.*

Noise impact related to the LNG terminal

Noise impact during construction

Projected sound levels during construction and operation were calculated using the method described in the standard ISO 9613-2. This makes it possible to predict sound level in weather conditions that are favourable to the spread of noise, such as a carrying wind (i.e., from the source toward the receiver) or with a moderate temperature inversion like that which commonly occurs at night. The method takes into account the sound power, the dampening effect of obstacles (buildings, drop in terrain level, etc.), geometric dispersion, absorption by air, ground effects and reflection off surfaces. (PR3.3.1, p. 6.89).

The main sound impacts during terminal construction would be due to machinery on the building site – mechanical shovels, cement mixers, cranes, and trucks, as well as pile driving at the jetty. In the main, these activities would be spread out over about 24 months, including slowdowns and halts during winter periods. Construction of LNG storage tanks would be carried out continually 24 hours a day while pile driving for construction of the jetty would take place only during the day (PR3.3.1, p. 4.103, 4.104 and 6.95).

Over and above the noise impacts of trucks on the site, the noise impacts of trucks moving along public arteries near the site, either Lallemand Road, rue de l'Anse, or Highway 132, were also assessed. Along with construction site noise, the intensity of noise effects from truck traffic on public arteries was described as average (*ibid.*, p. 6.99-6.101; PR5.1, p. 2.7).

In order to mitigate the increase in noise and vibrations on Highway 132, on Lallemand Road, and rue de l'Anse early on, the proponent had thought of building a temporary access road to the site from Expressway 20. Following the agreement reached between the proponent and the City of Lévis in July 2006, the City planned to build an access road to the proposed facilities from Lallemand Road, and the option of access to the construction site from Expressway 20 was abandoned. The proponent took the view that this new access would eliminate almost all of the construction-related traffic on Highway 132 and Lallemand Road, except for the part of Lallemand Road located between Expressway 20 and the new access road (PR3.1, p. 4.20; PR5.2.1, p. 3-3).

In regard to pile driving, this would go on for three years, which, according to Health Canada, is too long to be considered temporary. Each one of the 350 piles would require average driving of an hour and drilling lasting from one to 10 hours. According to the proponent's timetable, three barges would carry out the work simultaneously from May to December 2007, from April to December 2008, and from April to August 2009. Work would be carried out from 7 a.m. to 7 p.m. five days a week and, in exceptional circumstances, until 10 p.m.

It is anticipated that MDDEP criteria will be exceeded during the day in four locations: three on rue de Vitré and one at 950, Domaine des Pêches. In this regard, the Directors of Public Health for de la Chaudière-Appalaches and de la Capitale-Nationale expressed their concern that noise generated during the project construction phase could negatively affect the quality of life and, potentially, the health of persons living in the neighbouring residential district through sleep disruption, for example. (PR3.3.1, p. 6.96-6.97; DM602, p. 77-78 and Appendix 2).

Among other things, the proponent plans to install anti-noise protection around motors to mitigate noise impacts and limit, to the extent possible, those activities generating the most noise to the period between 7 a.m. and 7 p.m. and also plans recourse to noise-abatement walls as needed, in keeping with Health Canada's suggestion. Trucks would be equipped with variable pitch back-up alarms to limit noise at night without harming worksite safety. A follow-up program is also planned to sample sound at 11 measuring stations to make sure that the MDDEP noise criteria are respected. Finally, the proponent plans financial compensation for residents who must move away temporarily because noise levels are exceeded during construction.

- *Finding — The Panel finds that the project construction phase could cause the noise criteria, on the basis of Leq 1 h, set by the ministère du Développement durable, de l'Environnement et des Parcs to be exceeded, a situation that could last for three years. The Panel takes note that the proponent proposes financial compensation for temporary moves by residents who might be affected by noise levels that exceed these criteria during the construction phase.*

- ***Recommendation 8 —*** *Beyond the measures proposed by the proponent for the purpose of noise mitigation, the Panel recommends that the proponent avoid, as much as possible, the execution of noisy work between 7 p.m. and 7 a.m., and that the work schedule be planned on the basis of this consideration.*

- ***Recommendation 9 —*** *The Panel recommends that the proponent take steps to prevent exceeding the criteria of the ministère du Développement durable, de l'Environnement et des Parcs by reducing the number of noise events and their intensity at the source. When that is not enough, the proponent should reduce the spread of residual noise by taking effective anti-noise measures, or by planning measures to compensate residents.*

Noise impacts during operation

During operation, the main noise impacts caused by land facilities will be due to boil-off gas compressors, vaporizers, nitrogen production units, send-out pumps, transformers, and the flare stack. At the jetty, these impacts will come from booster pumps, transformers, berthed LNG tankers and tugs.

The proponent estimates that the MDDEP's noise criteria will be met during these activities. This assessment takes current noise sources in the area under study into account, such as Highway 132 and Expressway 20, which in themselves are not negligible. It also takes into account the plan for a concealing berm, intended to mitigate the project's visual impact, and which will have the added effect of mitigating noise. As it turns out, such a berm would encroach on a peat bog in the area being considered for land facilities, an issue that will be discussed further in the report.

Noise impacts from the natural gas pipeline

Although operation of equipment could lead to an increase in ambient noise, the main noise impacts will occur during the construction phase.

Machinery noise could disturb two urbanized areas affected by the natural gas pipeline project: the Pintendre industrial area (Borough of Desjardins) where an underground crossover is planned beneath the property of Pintendre Autos Inc.; and in the Chutes-de-la-Chaudière-Est borough area, which lies between the rivière Chaudière and Expressway 73.

The proponent would take measures to mitigate the effects, such as limiting the hours of work, planning construction activities so as to minimize their duration, equipping machinery with properly functioning mufflers, as well as limiting heavy vehicle traffic on public arteries. These measures are part of the industry's standard operating procedures to significantly limit the impacts of such projects.

- ***Opinion 16 —*** *The Panel is of the opinion that the proponent will take the necessary steps to limit the impacts of noise in residential areas during construction and operation of the gas pipeline.*

Air quality

In order to protect the environment and the health of populations exposed to air pollution, two sets of standards were defined by organizations responsible for air quality control. On one hand, there are emission standards to limit the amount of air pollutants from a point source and, on the other, air quality standards for ambient air to control pollution levels in the air that we breathe, a significant determinant of well-being and health.

The nature and quantity of contaminants emitted will vary depending on the project phase. First, it is a matter of construction of the jetty and the land facilities over a two-year period, then of their operation over a minimum of 45 years. Air pollutants related to the project will be added to those already present in the ambient air to attain a level likely to have human health impacts (DB85, p. 1). This is why the Panel not only examined project-related pollution emissions, but also their cumulative effects.

Atmospheric emissions

Airborne pollutants exist in the form of gases and particulate matter (PM). Dust particles are classified according to size rather than chemical composition. Total PMs present a varied particle size analysis with diameters ranging between 0.1 and 100 µm. Particles are classified as breathable when their diameter is equal to or inferior to 10 µm (PM_{10}), but can be sub-divided into fine particulate with a diameter equal to or less than 10 micrometres and very fine with a diameter equal or less than 2.5 µm ($PM_{2,\ 5}$), the latter being able to more easily reach the pulmonary alveoli (DB85, p. 1).

The main air quality indicators subject to provincial standards and national objectives by virtue of their impact on health are the PM_{10} and $PM_{2.5}$. In Canada, the $PM_{10,}$ and most especially the $PM_{2.5}$, are considered “toxic” within the meaning of Section 64 of the *The Canadian Environmental Protection Act* (CEPA 1999, Ch. 33). The proponent’s analysis assessed the project’s impact on concentrations of nitric oxide and nitrogen dioxide (NO and NO_2), sulphur dioxide (SO_2), carbon monoxide (CO) and some volatile organic compounds (VOC) in the area affected by the project.

The regulatory framework

The project's impact on air quality is assessed by taking the concentration of a pollutant that is present in the environment referred to here as "baseline". The maximum cumulative concentration for each contaminant in a given location is obtained by adding the anticipated contribution from construction site activities or terminal operation to the present level.

The proponent's impact statement compared the predicted concentrations during construction and operation of the LNG Terminal to the standards set by Quebec's existing *Regulation respecting the Quality of Atmosphere* (RQA) [Q-2, r. 20] and *Draft Air Quality Regulation* (PRAA), published November 16, 2005 in the *Gazette officielle du Québec* but which still has not been enacted by the government.

The federal government submitted a bill, entitled *Canada's Clean Air Act, to* set national objectives for air pollutants and greenhouse gases to reduce risks to health and the environment (DB37). In regard to human health, a document from Health Canada and Environment Canada, published in 1998 and entitled *National Ambient Air Quality Objectives for Particulate Matter* recommends 25 µg/m³ for PM_{10} and 15 µg/m³ for $PM_{2.5}$ on average over a 24-hour period (DB60, p. 22). However in 2000, the Canadian Council of Ministers of the Environment (CCME) set a maximum pan-Canadian standard for $PM_{2.5}$ of 30 µg/m³ in ambient air (maximum over 24 hours). This value was set as an interim benchmark by the MDDEP and subsequently as a standard by the PRAA[1].

Current air quality

In Quebec, a network of air quality monitoring stations allows the MDDEP to oversee air quality in certain regions. It must be noted, however, that there are no such stations in the area of the proposed LNG terminal or even in the city of Lévis. To make up for this absence of data, the proponent, in consultation with the MDDEP picked monitoring stations in the existing network judged to be representative of the area where the project will be built.

In order to establish the best baseline for the Lévis area for all the contaminants referred to in the impact statement, the proponent used data gathered from the closest monitoring stations located in urban, rural, and industrial settings. Three stations were chosen in the city of Québec: the Des Sables station, located in the urban and industrial areas of the Limoilou district, which measures SO_2, NO_2, CO and

1. Ministère du Développement durable, de l'Environnement et des Parcs, *Critères de qualité de l'air*, fiches synthèses [On-line (January 22, 2007): www.mddep.gouv.qc.ca/air/criteres/fiches.pdf].

$PM_{2.5}$; and two stations in urban residential districts, Saint-Charles-Garnier (O_3 and $PM_{2,5}$) and De l'Église (TPM). Two other stations were included: one in a forest setting, Notre-Dame-du-Rosaire (TSP, $PM_{2.5}$ and O_3); and the other in an agricultural area, Saint-François-de-L'Île-d'Orléans (O_3).

- *Finding — The Panel notes that the current air quality in the proposed project development area has not been caracterized. Rather, it was estimated using data gathered at monitoring stations operated by the ministère du Développement durable, de l'Environnement et des Parcs in the city of Québec and surrounding areas.*

Project impact on air quality

The proponent simulated by computer the project's contribution to concentrations of contaminants in the air using atmospheric dispersion models recognized by the MDDEP. These models integrate data relevant to the characteristics of emission sources, meteorological data, traffic movements, and the characteristics of receptors, i.e. points on the ground where the concentration of pollutants is calculated using computerized mathematical models. The main goal of the simulations is to predict that concentrations of pollutants emitted by one or several new sources will not exceed standards, if the project is completed.

Construction phase

The proponent identified the main sources for emission of airborne pollutants on the construction site and around it during the anticipated two years of construction, i.e. 2007 and 2008. The proponent retained the following sources: exhaust gases from vehicles and machinery, dust rose by transportation traffic on the roads, whether paved or not, the handling of backfill material and excavation by blasting for land facilities and the utility corridor leading to the jetty; and, finally, cement mixing plants on the construction site itself.

According to the impact statement, the results obtained are based on the assumption that construction site machinery will run continually at full capacity during the life of the construction site , and that the maximum number of vehicles going to the site on an access road via Lallemand Road will be attained every day. As a precautionary measure, the modelling are based on the highest reference thresholds and take into account meteorological conditions most unfavourable to the atmospheric dispersion of pollutants. The projected maximum concentrations in the ambient air, if the construction of the proposed facilities proceeds, are presented in Table 13. The computer model data for the home closest to the construction site show that cumulation of maximum concentrations of pollutants during construction and contaminants in the air (baseline) would respect the RQA and the PRAA standards.

- *Finding — The Panel finds that the concentration of air contaminants expected in inhabited areas during the two years that the LNG terminal will be under construction will meet the standards of the Regulation respecting the Quality of Atmosphere and the Draft Air Quality Regulation.*

Table 13 Maximum concentrations of air contaminants calculated at the most exposed residence during the two years of the LNG terminal's construction

Contaminant µg/m³	Year 1 (2007)			Year 2 (2008)			Period	Standard	
	BL[1]	Constr.[2]	Total[3]	BL[1]	Constr.[2]	Total[3]		RQA	PRAA
Carbon monoxide (CO)	17,000	248	17,248	17,000	248	17,248	1 hr.	34,000	34,000
	9 100	50	9 150	9 100	108	9 208	8 hr.	15 000	12 700
Sulphur dioxide (SO_2)	107	30	137	107	51	158	1 hr.	1,310	276[4]
	73	5	78	73	9	82	24 hr.	288	288
	7.3	0.3	7.6	7.3	0.7	8	1 yr.	52	52
Nitrogen dioxide (NO_2)	152	172	324	152	179	331	1 hr.	414	414
	90	29	119	90	44	134	24 hr.	207	207
	29	2.7	32	29	3	32	1 yr.	103	103
Total particulate matters (TPM)	14	14	105	91	29	120	24 hr.	150	–
	1	1	35	34	2.7	37	1 yr.	70	–
Fine particulates ($PM_{2,5}$)	20	5	25	20	7	27	24 hr.	–	30

1. Baseline: Maximum values in the ambient air at the Des Sables monitoring station for contaminants in gaseous form (CO, SO_2 and NO_2) and at the De l'Eglise station for TPM from 2001 to 2003. For $PM_{2.5,}$ the baseline is that specified by the MDDEP (PR5.1, QC-78 and Appendix H of the PRAA).
2. Construction.
3. Sum of maximum concentrations in the ambient air and of expected concentrations during construction based on the assumption that they occur simultaneously.
4. 525 µg/m³ over 4 minutes, i.e. the equivalent of 276 µg/m³ on an hourly basis, applying the formula to this effect contained in Appendix H of the PRAA.

Sources: adapted from PR5.2.1, QC-62s2 et QC-72s2, Tables 3 et 6; *Regulation respecting the Quality of Atmosphere* and *Draft Air Quality Regulation.*

The Agences de la santé et des services sociaux de la Chaudière-Appalaches and de la Capitale-Nationale believe that the risks of inhaling dust will be reduced by development of the planned access road to the terminal from Lallemand Road, along with strict application of the mitigation measures proposed by the proponent, including frequent applications of dust suppressants and the use of low sulphur diesel fuel (0.05% wt) (DM602, p. 42).

- *Finding — The Panel notes the measures planned by the proponent aimed at reducing air contaminants that could be emitted on a temporary basis by the LNG terminal construction site, including development of access to the construction site via Lallemand Road.*

Operation phase

Operation of the LNG terminal is likely to result in the emission of pollutants resulting from the use of natural gas in the burners of the LNG vaporizers. There also could be other less significant or intermittent emission sources such as diesel firewater pumps and emergency generators, the flare stack and fugitive natural gas emissions. Adding to this would be the occasional presence of an LNG tanker (one day out of six), mainly at the time of its unloading, and of tugs needed for berthing or setting off. The project's expected air emissions are listed in Table 14.

Table 14 Expected air emissions from operation of the LNG terminal and the jetty with LNG tankers and tugs

Sources	Carbon monoxide (CO)	Nitrogen oxides((NOx)	Total particulate matter (TPM)	Fine particulates ($PM_{2,5}$)	Sulphur dioxide (SO_2)	Volatile organic compounds (VOCs)
LNG vaporizers (t/yr)	90	66	3.8	3.8	3.4	5.4
Flare (t/yr)	19.8	3.6	0	0	0.17	0
Fire pumps (t/yr)	0.15	0.69	0.05	0.04	0.01	0.05
Emergency generators (t/tr)	0.44	2.04	0.16	0.13	0.03	0.16
LNG tankers and tugs (t/yr)	21	106	2.7	2.1	63	2.7
Total (t/yr.)	**131**	**179**	**6.6**	**6.1**	**67**	**8.3**

Source: adapted from PR5.1, Appendix H, and Table H.6.

Table 15 shows modeled maximum concentrations of contaminants outside the project's property limits during jetty and land facility operation. On examining the results in the table, the Panel notes that the anticipated addition of air emissions from terminal operation would result in values well below RQA and PRAA standards, except for the maximum sulphur dioxide content of 275 µg/m³. This value would come close to the ambient air quality standard on an hourly basis set at 276 µg/m³ in the PRAA. Such a situation could arise among Ville-Guay sector homes built on the cliff along Highway 132, near the jetty.

Table 15 Maximum concentrations of air contaminants outside project property limits during LNG terminal operation

Contaminant	Terminal and jetty with LNG tanker and tugs			Time period	Standard	
	Baseline[1] (µg/m³)	Operation[2] (µg/m³)	Total[3] (µg/m³)		RQA (µg/m³)	PRAA (µg/m³)
Carbon monoxide (CO)	17,000	746	17,746	1 hr.	34,000	34,000
	9,100	222	9,322	8 hr.	15,000	12,700
Sulphur dioxide (SO_2)	107	168	275	1 hr.	1,310	276[4]
	73	40	113	24 hr.	288	288
Nitrogen dioxide (NO_2)	152	191	343	1 hr.	414	414
	90	i46	136	24 hr.	207	207
	29	1.4	30.4	1 yr.	103	103
Total particulates matter (TPM)	91	9.4	100,4	24 hr.	150	–
	34	0.40	34.4	1 yr.	70	–
Fine particulates ($PM_{2.5}$)	20	7.5	27.5	24 hr.	–	30
Benzene	5	0.02	5.02	24 hr.	–	10
Formaldehyde	10	0.61	10.61	4 min	–	37

1. Baseline: maximum values measured in the ambient air for contaminants in gaseous state at the Des Sables station (CO, SO_2 and NO_2) and for TPM at the De L'Église station from 2001 to 2003. For $PM_{2.5}$, the baseline is that specified by the MDDEP (PR5.1, QC-78 and Appendix H of the PRAA). For benzene and formaldehyde, the baseline corresponds to levels that are typical semi-urban areas of Québec.
2. Maximum values calculated within the modelling range, but outside the property limits. These values coincide with the residential district north of Highway 132 at the top of the cliff.
3. Total: sum of maximum concentrations in the ambient air during operations based on the assumption that they occur simultaneously.
4. 525 µg/m³ over 4 minutes, i.e. the equivalent of 276 µg/m³ on an hourly basis, applying the appropriate formula contained in Appendix H of the PRAA.

Sources: adapted from PR3.3.1, table 6.2; PR5.1, Appendix H, Table H.8; PR5.2.1, QC-69s2; *Regulation respecting the quality of the atmosphere* and *Draft Air Quality Regulation*.

Sulphur dioxide (SO_2)

The addition of SO_2 to the ambient air during terminal operation, especially when an LNG tanker is present, could result in air quality standards being exceeded. The risk would specifically affect homes located in areas overlooking the jetty and LNG tanker stacks. Those living by the shore would mainly be exposed to SO_2 when unfavourable weather conditions put them in the plume of fumes from auxiliary generators evacuated through the LNG tanker stacks. These electrical generators feed the unloading pumps and the LNG tankers when they are berthed at the jetty.

In the impact statement, a first modelling predicted a maximum value of 774 µg/m³ of SO_2 based on running diesel generators containing 2% sulphur. Such a level of SO_2 corresponds to a level that would exceed by two or three times the proposed PRAA standard of 276 µg/m³. In order to respect the hourly standard at all times, the proponent, at the request of the MDDEP, carried out a second simulation based on a maximum sulphur content of 0.5% in the diesel fuel. This would allow reduction of the project's maximum contribution to an addition of 168 µg/m³ of SO_2 into the ambient air of the Ville-Guay sector to reach 275 µg/m³, or only 1 µg/m³ under the standard proposed by the PRAA.

- *Finding — The Panel notes that diesel fuel containing 0.5% sulphur, the use of which is planned for the LNG tankers' auxiliary generators, would be an added source of sulphur dioxide (SO2) emissions in the Ville-Guay residential neighbourhood. As an effect, the predicted maximum concentration for the area overlooking the terminal jetty would only be 1 µg/m³ under the hourly standard of 276 µg/m³ outlined in the Draft Air Quality Regulation.*

Therefore, the proponent is of the view that diesel fuel containing a maximum sulphur content of 0.5% wt would allow the PRAA hourly standard to be met at all times. The proponent committed to powering LNG tanker auxiliary generators with fuel containing a maximum of 0.5% sulphur. To achieve this, the proponent made sure that the LNG tankers would be supplied with diesel fuel containing 0.5% sulphur and plans to submit a follow-up program for SO_2 in the ambient air to be applied prior to and during the first few years of operations. In Health Canada's view this must be a condition of operation for the project (DB104, p. 10).

The panel notes that diesel fuel with ten times less sulphur (0.05% wt), which is generally used to fuel the motors vehicles is available on the market.[1] For the Panel, the use of low-sulphur diesel fuel would result in a significant reduction of SO_2 emissions. Given the narrow difference between the expected maximum concentration of SO_2 and the hourly standard, it is important in the Panel's view for the proponent to supply the LNG tankers with diesel fuel with sulphur content that guarantees that regulations are met when the proposed terminal is in operation.

- ***Recommendation 10 —*** *If the project is authorized, the Panel recommends that the proponent take the steps necessary to ensure that sulphur dioxide emissions from the project meet the standards applicable in Quebec, especially in the part of Ville-Guay that overlooks the jetty. This should include the use of diesel fuel containing the lowest amount of sulphur.*

1. Petro-Canada [On-line (March 29, 2007): http://retail.petro-canada.ca/en/independent/2060.aspx].

Long-term cumulative impacts

In the absence of air quality data for the city of Lévis, the Panel is not in a position to assess the applicability of baseline thresholds established from the Des Sables station for the area affected by development of the LNG terminal. Also, municipal authorities have indicated that they want to develop agri-food "Cold-processing industries" near the proposed terminal. The arrival of these industries, along with the possible establishment of enterprises drawn by the availability of natural gas, could lead to added emissions of air pollutants.

The LNG terminal would be located in the Windsor-Quebec corridor, which is already heavily affected by the long-distance movement of air pollution from major industrial centres on the Great Lakes and in Quebec. According to the Agences de la santé et des services sociaux de la Chaudière-Appalaches and de la Capitale-Nationale, 11 industries emit significant quantities of pollutants within Lévis territory. Among these, the Ultramar refinery is the major local source of atmospheric emissions.

Like some other semi-urban areas in the Windsor-Quebec corridor, which are affected by long-distance pollution although they have no heavy industry, the populations of these areas are nevertheless exposed to various forms of pollution from agricultural, urban sources, as well as from local and interregional transportation, all of which contribute to degradation of local air quality.

In the view of the Agences de la santé et des services sociaux de la Chaudière-Appalaches and de la Capitale-Nationale, the absence of monitoring stations in the Lévis area hinders obtaining "a realistic portrait" of baseline thresholds for the different air contaminants. Where Health Canada is concerned, the default reference threshold set at 20 µg/m³ ($PM_{2.5}$) for fine particulates "is plausible, but remains a theoretical assessment that could only be validated through direct sampling" (DQ38.1, p. 1).

The project's impact statement offers a certain number of hypotheses about inputs for the atmospheric dispersion models used. The MDDEP is of the opinion that the predicted concentrations are acceptable to the extent that the parameters of the modelling are representative of the situation predicted. It is worth noting that it is not the ministry's responsibility to validate the emission rates used in the modelling of the effects of air pollution expected from the project.

For these reasons, the Panel feels that a margin of error exists for the predicted concentration of pollutants, the magnitude of which is difficult to quantify without an adequate knowledge of the real operating conditions.

- ***Recommendation 11 —*** *The Panel recommends that the proponent ensure a proper follow-up, after reaching agreement with the ministère du Développement durable, de l'Environnement et des Parcs with the purpose of assessing the true level of additional air pollutants from the project compared to existing levels within the area currently retained for the planned project.*

Air quality follow-up

The Panel concludes that it is important that an overview of the quality of ambient air be established for inhabited areas during LNG terminal operation so as to protect human health and not to harm the margin of manoeuver needed for new developments in this area. To this end, the Panel supports the recommendations made by Health Canada and the *Agences de la santé et des services sociaux de Chaudière-Appalaches* and *de la Capitale-Nationale* to carry out an air quality follow-up in the residential areas closest to the proposed terminal facilities. (DB104, p. 10; DM602, p. 74).

On one hand, such oversight would make it possible to more accurately assess the project's relative influence on degradation of air quality by the addition of air pollutants, such as sulphur dioxide, and, on the other hand, to determine the remaining margin of manoeuvre for future development of this part of Lévis. This follow-up approach would definitely allow identification of future at risk contaminants and suggest the needed steps for control measures at the source to maintain a healthy air quality environment for the surrounding population.

- ***Recommendation 12 —*** *The Panel recommends that the ministère du Développement durable, de l'Environnement et des Parcs add a new sampling station to its network to show air quality in Lévis. If the project goes ahead, the Panel recommends that the proponent establish a monitoring station in the inhabited area between the jetty and Highway 132 together with the ministry.*

- ***Recommendation 13 —*** *The Panel recommends that the data collected from air quality samples taken at the monitoring station operated by the proponent in the inhabited area most exposed to the project's emissions be analyzed in concert with the ministère du Développement durable, de l'Environnement et des Parcs. Sources of recurring exceedances that go beyond the Québec standards in force must be corrected to the ministry's satisfaction.*

Maritime navigation

Many citizens expressed concern about the potential impact of the specific conditions applicable to transportation of liquefied natural gas, mainly on the flow of ship traffic

and the economic consequences that could result. According to the proponent, existing and future ship traffic would not be affected by the presence of LNG tankers. In the proponent's view, ship traffic could increase considerably without decreasing the speed of its flow given the current low level of ship traffic and modern methods of traffic management. By the same token, a traffic study conducted by the *Corporation des pilotes du Bas-Saint-Laurent* set out to demonstrate that LNG tankers could integrate easily and without problem with existing traffic, both in terms of the capacity to accommodate this traffic and the risk of delay for ships moving in the system at the same time as LNG tankers (DA5, p. 4).

Moreover, the Quebec Port Authority (QPA) was of the opinion that the presence of the LNG terminal would not cause any particular problems in terms of maritime navigation in the port, taking into accout the actual level of maritime activities. According to QPA data, the number of ships in transit in the port, taking all types into account, went from 950 to over 1,200 for the period 2001-2006, representing a 25% increase. The QPA is equally of the opinion that the traffic generated by the project would be marginal. This is the case when the 24,000 ferry crossings are taken into account between the Québec City and Lévis, the numerous ships in transit that pass in front of the city of Québec to ports upriver or downriver, and the movement of Canadian Coast Guard vessels, independent of the special measures that would be applied for the arrival of LNG tankers.

- *Finding — The Panel notes that the addition of LNG tankers would not represent a major change to the present ship traffic profile on the St. Lawrence River.*

The proponent stated that LNG tankers would adapt to existing traffic (Mr. Glenn Kelly, DT11, p. 44-46). The proponent suggested application of certain conditions, within the framework of the TERMPOL process, for passage in the Traverse du Nord to the east of île d'Orléans, such as not allowing any encounter between LNG tankers and other ships during the time it takes to navigate this passage, which could last, on average, about an hour and a quarter. LNG tankers proceeding upstream should pass between ships going downstream while tankers moving downriver should pass between ships going upstream. At the hearing, the proponent explained that in the event that a ship had to wait before going through the Traverse du Nord in one direction, it would be up to the LNG tanker to wait, thereby giving priority to the passage of other ships. However, the proponent explained that once engaged in the Traverse du Nord, the LNG carrier would have priority, either in finishing the trip to the jetty or in going downriver (M. Glenn Kelly, DT11, p. 46). The study by the Corporation des pilotes du Bas-Saint-Laurent concluded that on the basis of tides and the minimum draft needed for passage by LNG tankers, restrictions on movements in the Traverse du Nord would be rare.

The channel at the level of île aux Coudres is also considered as a narrow passage that sometimes necessitates special navigation procedures. The proponent suggested that the LNG tanker take the île aux Coudres turn alone, without two-way traffic, and that it wait or slow down before taking the île aux Coudres turn, if another ship is present, thereby having no effect on traffic flow in the opposite direction (*ibid.*, p. 44).

Consequently, waiting areas were identified for LNG tankers in the event of restrictions on navigation. In the case of normal anchorage, either anchorage anticipated because of announced wind or visibility conditions, three areas were designated between the Cabot Strait and Quebec City: to the west of île Rasade Nord-Est outside the ice season, Pointe-au-Pic, and Sault-au-Cochon. As Figure 7 shows, the proponent also proposed a temporary anchorage upriver from the Traverse du Nord, more specifically southwest of the île Madame reef, 1 665 metres east of Pointe Saint-Jean, as a waiting area for the Traverse du Nord channel. Transport Canada, nevertheless, made it known that anchoring at that spot would only be permitted in exceptional circumstances, considering that an LNG tanker should transit through the Traverse du Nord, either going to or coming from the terminal, only when it is established that weather, tide, ice and traffic conditions allow it. When conditions do not allow it, the tanker must wait at the terminal or one of the anchorages at Sault-au-Cochon, Pointe-au-Pic or île Rasade Nord-Est (DQ66.2). Thus, detailed planning, based on conditions and traffic, will be the determining factors to allow the passage of LNG tankers through the Traverse du Nord area without causing delays for other ships in transit.

- *Finding — The Panel takes note of the fact that the proponent is committed to adapting to existing traffic and that in the event of restrictions on passage in the Traverse du Nord area or at the île aux Coudres turn, the LNG tankers would plan their movements so as not to cause major delays for other ships.*

Movement of LNG tankers under Hydro-Québec transmission lines

On arrival and departure, LNG tankers must pass under Hydro-Québec's high voltage transmission lines located 1,4 km downstream from the terminal and which cross the St. Lawrence River at that point. According to Hydro-Québec, for safety reasons the clearance needed between the lines and the water level should be 52 m under normal conditions. Nevertheless, the clearance could be insufficient for the passage of LNG tankers on certain occasions, such as extreme ice accumulation during the winter, for

example[1]. Under these conditions, it could happen that ship traffic might have to be restricted for the time needed to take corrective measures (DQ31.1, p. 2; DQ12.1, p. 2).

According to the proponent, the types of tankers in question are those with membrane tanks and a capacity of 160 000 m³ with overhead clearance of less than 44 m and Qflex model tankers, which are planned to supply the terminal during the winter would be constructed following specifications that include an overhead clearance allowing them to pass under the lines during the winter. In regard to LNG tankers using spherical tank technology, which might supply the terminal on an occasional basis, they would not be used in winter as they are not adapted to winter conditions. The proponent noted that ships having overhead clearances higher than those of the tankers, such as the Queen Mary II, which has an overhead clearance of 63 m, go under the lines by sailing closer to the shore where water depth permits and the lines are much higher. Nevertheless, we point out that the navigable channel under the Hydro-Québec lines has a width of 915 m and that the proponent has made a commitment to keep a minimum distance of 500 m between LNG tankers and île d'Orléans (PR5.1, p. 1.2; DQ69.1. p. 1 and 2). The Panel therefore understands that these factors will be taken into consideration in the case of restrictions on the movement of LNG tankers under Hydro-Québec's lines.

- ***Recommendation 14 —*** *The Panel recommends that the proponent establish a procedure for communications on conditions governing the clearance of transmission lines and the measures to be taken for passage of LNG tankers in the case of restrictions on overhead clearance under the line, and that this be done after agreement with Hydro-Québec, Transport Canada and the Canadian Coast Guard.*

Recreation and tourism activities

According to the proponent, a limited number of pleasure crafts cross the river in a north-south direction between Ville Guay and île d'Orléans. Consequently, the proponent did not see the utility of controlling pleasure craft traffic around LNG tankers, except when the tankers are berthed at the jetty. During those times, pleasure crafts and tour boats must come no closer than 50 m from a berthing area (DQ27.60, p. 2).

To ensure the safe passage of small non-motorized boats, the proponent plans to develop a marked passage under the jetty between two support trestles, which would be accessible at both high and low tides, without being too far from shore. The City of

1. By way of example an accumulation of 1 and 1.5 inches of ice on the cables could reduce the respective overhead clearance to 52 m and 43 m (DQ69.1; DQ31.1).

Lévis apparently has also negotiated the development of land facilities with the proponent for times when passage is not possible due to a tanker's presence at the jetty. On this point, Transport Canada has said no craft will be authorized to pass when an LNG tanker is berthed at the jetty (DQ27.55; DM315, p. 18; DQ40.1; DQ45.1).

- ***Opinion 17 —*** *The Panel is of the opinion that the presence of the LNG terminal is not likely to have a significant impact on the movements of non motorized crafts.*

On another issue, the proponent made a commitment to develop extra trails that could make use of the wooded area south of the terminal to improve the network of skiable trails between Lévis and Beaumont, once construction is finished. The proponent also made a commitment to develop, on both sides of Highway 132, passages that would allow drivers of all-terrain vehicles and snowmobiles to safely cross the tunnel linking the shore facilities to the terminal's land facilities (PR3.3.1, p. 2.98-2.99; PR6, p. 200).

Chapter 8 Impacts on the natural environment

In the current chapter, the Panel first considers the project's impacts on wooded areas, wetlands and water environments. Then, it analyzes the project's impacts on fish and their habitat as well as on avian fauna. Finally, the Panel examines the project's impacts on protected plant species.

Project impacts on wooded areas

According to information communicated by the proponent, building the various components of the project would require the deforestation of nearly 105 hectares (ha) of wooded areas. This corresponds to approximately 50 ha for the terminal and 55 ha for the natural gas pipeline.

Wooded areas in the terminal area

Table 16 provides the expected deforestation and reforestation measures in the area of the proposed terminal's land-based facilities. Figure 13 illustrates the areas covered.

Table 16 Overall planned deforestation and reforestation in the terminal area (ha)

	Hardwood	Mixedwood	Peat-bog	Plantation	Total
Deforestation	-5.3	-12.2	-5.7	-26	-49.2
Large-scale reforestation[1]				10	10
Small-scale reforestation[2]				18	18
Total (net loss)					**-21.2**

1. Between 3 and 4-m high for hardwood trees or between 2 and 2.5-m high for conifers.
2. Naturalization with 20 to 30-cm high shoots.

Sources: adapted from PR5.1, p. 2.123; DQ44.3, p. 1 and 2; DQ62.1, p. 3; DQ79.8, p. 1; DM315, p. 50; DA55.

The aim of the ministère des Ressources naturelles et de la Faune du Québec (MRNF)'s guidelines for the preservation of wildlife habitats is to preserve both the land and its features. In order to mitigate the impacts of expected deforestation in the

terminal area, the proponent plans to reforest 10 ha and to reseed 18 ha of the territory, for a total compensation of 28 ha. Once this area is subtracted from the deforested area, i.e. 49.2 ha, the net loss of the wooded area will be 21.2 ha.

Furthermore, the agreement, concluded between the proponent and City of Lévis, specifies that large-size seedlings of indigenous species will serve in the reforestation of concealment berms (DM315, p. 50). The proponent plans to follow-up on the reforested or reseeded areas during the first two years and, where the planted tree survival rate would be less than 90 percent, the areas would be reforested or reseeded with appropriate seedlings. The MRNF also suggests the reforestation of the banks of the two creeks[1], which run north of Hydro-Québec's power lines (DB30). Spanning a minimal width of 30 m across the creeks, this reforestation would cover 7.7 ha. The strip width should also take into account the agricultural environment's value (DQ62.1).

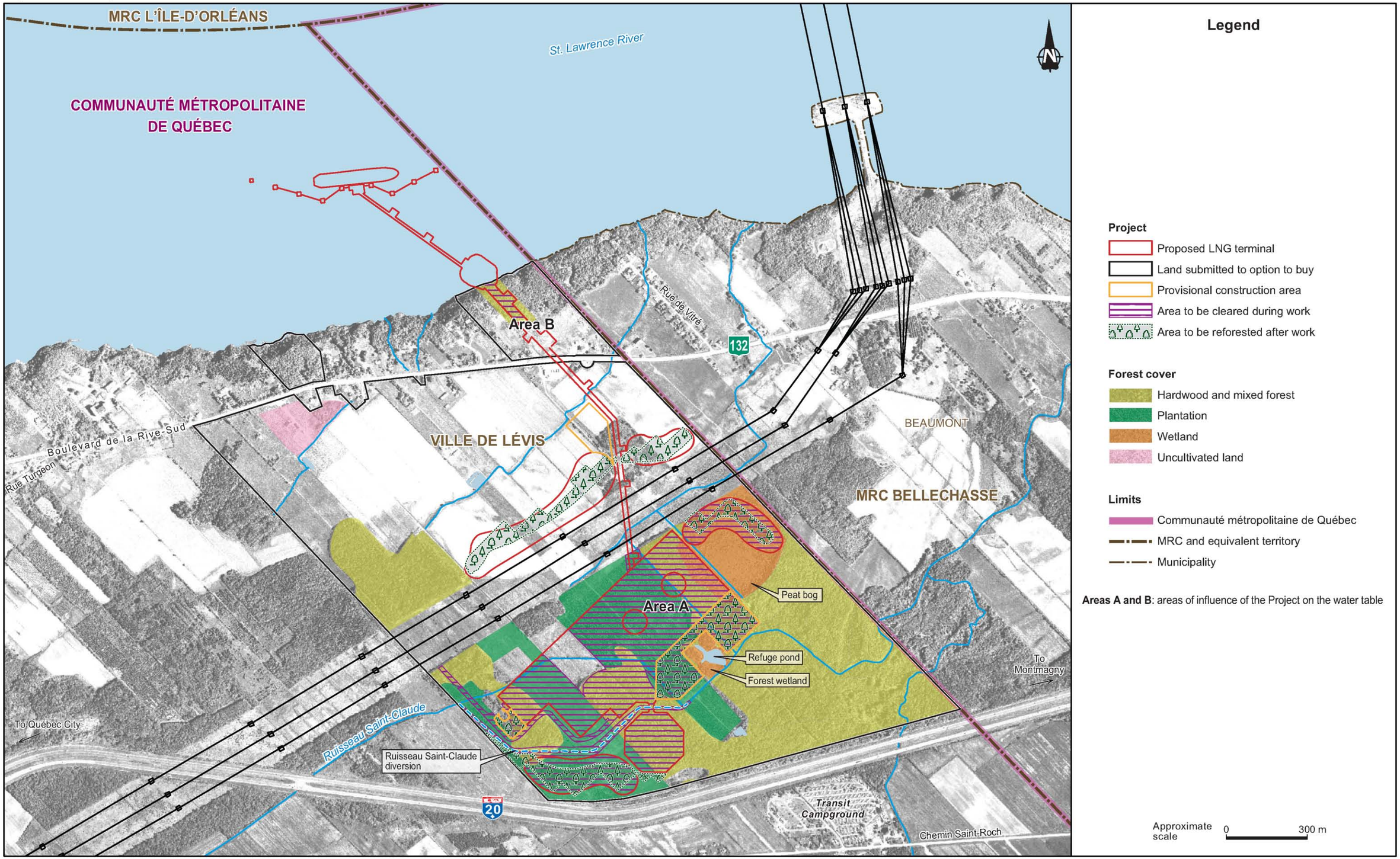
- ***Recommendation 15 —*** *In order to avoid a net loss of wildlife habitats, the Panel recommends that the proponent prepare a compensation plan for deforested areas located in the terminal area and in areas of similar value, to the satisfaction of the ministère du Développement durable, de l'Environnement et des Parcs (MDDEP) and the ministère des Ressources naturelles et de la Faune.*

As shown in Table 16, the project would entail the loss of 26 ha of plantations on some 50 ha of deforested areas. These plantations were developed since 1994 with the support of the Quebec government's Programme d'aide à la mise en valeur des forêts privées., The MRNF considers them to be productive woodlands since most of these plantations are ten years old or more. The ministry is of the opinion that the size of trees in some conifer and maple plantations slated for deforestation would enable them to be transplanted along the creeks whose banks have been suggested for reforestation (DQ62.1, p. 2).

- ***Opinion 18 —*** *Considering the biological quality of the plantations affected by the project and the fact that they benefited from public funding, the Panel believes that the proponent should find ways to compensate the public funds invested in these plantations, subsequent to an agreement with the ministère des Ressources naturelles et de la Faune.*

1. These unidentified creeks are mentioned in document PR3.3.1, p. 2-22 and appear on map 1 of document PR3.3.2, appendix C-2. They are identified as R-01 and R-02 in document DB31.

Figure 13 Biological environment in the area of the proposed LNG terminal



Sources: adapted from PR3.3.2, Figure 2.8; DA55, Figures 1 and 2; DQ62.1, p. 4; regionals maps of the ministère des Affaires municipales et des Régions [On-line (March 22, 2007): www.mamr.gouv.qc.ca/publications/cartotheque/region_03.pdf, region_12.pdf *and* cmquebec.pdf].

Pipeline right-of-way

The proponent does not plan to offer any compensation for the loss of 55 ha of woodland habitats caused by the construction of the pipeline, a position he justifies by the absence of special forest ecosystems affected by that component of the project. The proponent also maintains that, from a wildlife habitat standpoint, the route designed to have minimal impact for most sections of the pipeline was chosen, aside from the H_{South}-I stretch. However, the MRNF notes that the wildlife inventories carried out by the proponent have focused almost exclusively on the chosen trajectory. On that basis, it is difficult to know if, amongst other options available, the chosen route is the one with the least impact on wildlife. (Figure 14) (PR5.1, p. 3.134; PR6, p. 72).

Along the H_{South}-I stretch of the pipeline, the presence of a 90 year-old stock as well as maple stocks and wetlands was noted. However, the will to meet up with Hydro-Québec's rights-of-way and the one planned for the Saint-Laurent pipeline has been favoured over these components in the natural environment (PR5.2.1, p. 3-58 to 3-62). Indeed, the pipelines proposed for both this project and that of Ultramar (Saint-Laurent pipeline) would be set up in the same right-of-way whenever possible, so as to limit the total rights-of-way widths and to avoid creating two openings close to each other on the territory (DB46, p. 1).

Cumulative effects

Commissioning the terminal would require two other projects whose implementation is not the responsibility of the proponent. The first is the setting up of two distribution lines each supported by four towers for the power supply of the terminal. However, the exact location of these installations and their impact on wooded areas have yet to be determined. The proponent believes indeed that Hydro-Québec is responsible for assessing the environmental effects of that part of the project. The second project is the building of an access road via Lallemand Road., which is the responsibility of the City of Lévis.

Assuming the project is carried out, these two related projects would become necessary and, therefore, ''reasonably foreseeable'', as defined by the Canadian Environmental Assessment Agency[1]. Their impacts would thus add to those of the initial project in regard to some valued ecosystem components for which residual impacts are expected, such as on wildlife habitats.

1. Canadian Environmental Assessment Agency [On-line (February 27, 2007): www.ceaa-acee.gc.ca/013/0002/cea_ops_e.htm; www.ceaa-acee.gc.ca/013/0001/0004/index_e.htm; www.ceaa-acee.gc.ca/013/0001/0008/guide1_e.htm].

- ***Recommendation 16 —*** *The Panel recommends that the proponent assess the cumulative environmental effects of the two projects related to his own, i.e. the two power distribution lines and the access road leading to the terminal as regards the extent of deforestation required.*

Project impacts on water environments

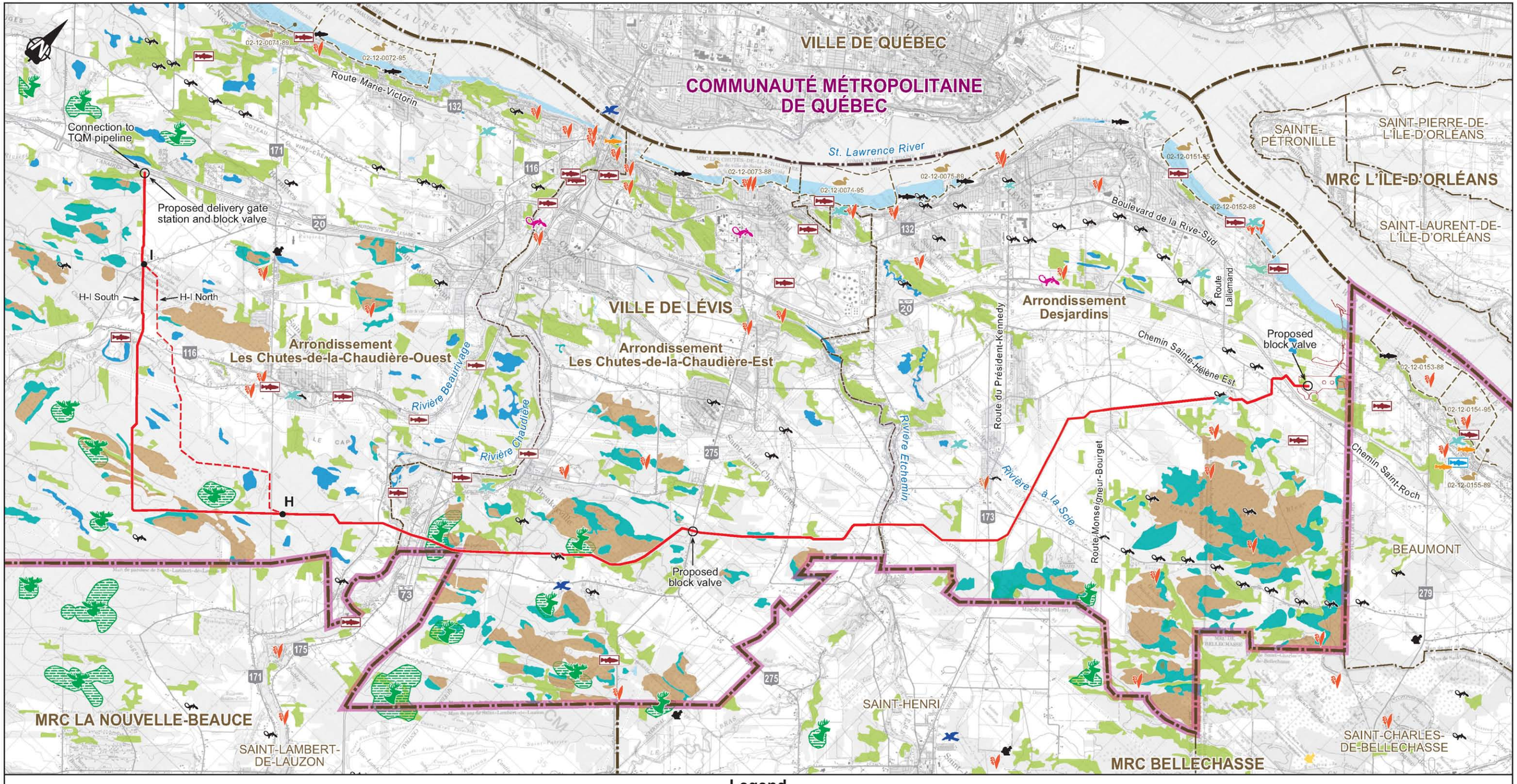
Hydrology of the ruisseau Saint-Claude

The ruisseau Saint-Claude (Figure 13) is the main creek likely to be affected by the construction of the terminal. A 955-m long segment of the western branch of the creek would be diverted to bypass the facilities to the south. A new 975-m long bed would be excavated to bypass the terminal to the west and to the south. The proponent is of the view that these changes would not modify the remainder of the hydrographic basin feeding this portion of the ruisseau Saint-Claude and would not significantly modify its hydrology. Further downstream of the portion to be diverted, the basins excavated to receive the storage tanks would intercept part of the local groundwater at an estimated 0.007 m^3/s flow rate in permanent regime. The proponent plans to discharge this water into the ruisseau Saint-Claude, whose mean flow rate is at an estimated 0.40 m^3/s, 6 m^3/s during the annual high water period and 0.02 m^3/s during low flow periods. In the latter case, a slight increase would occur, due to the planned discharge (PR3.3.1, p. 2.22, 2.23 and 6.29; PR5.1, p. 3.39 to 3.40).

The MRNF said it was concerned by the impact of the groundwater drawdown on the refuge pond located south-west of the creek and suggested that the pumped water be discharged partly into the ruisseau Saint-Claude and partly into the refuge pond to preserve these two ecosystems (DQ62.1). Moreover, the proponent suggested different solutions to maintain an acceptable water balance in the ruisseau Saint-Claude during the construction and operation phases of the terminal. However, no information was provided on the impacts that interruption or abandonment of terminal operations would have on the management of the ruisseau Saint-Claude flow rate. Since the solutions put forward involve management of the flow rate, questions persist in regard to the maintenance of an acceptable flow rate in the ruisseau Saint-Claude when this pumping would be interrupted due to an operational shutdown.

- ***Recommendation 17 —*** *The Panel recommends that the proponent develop a management plan that would ensure the maintenance of an acceptable flow rate in the ruisseau Saint-Claude and the integrity of the refuge pond. This management plan should be to the satisfaction of Fisheries and Oceans Canada, the ministère du Développement durable, de l'Environnement et des Parcs and the ministère des Ressources naturelles et de la Faune, and should cover the terminal construction, operation and abandonment phases.*

Figure 14 Biological environment in the area of the proposed natural gas pipeline



Legend

Project
- Proposed LNG terminal (Approximate localization)
- Preferred route for the proposed natural gas pipeline
- Alternate route not retained

Vegetation
- Forest stand
- Swamp*
- Marsh* (shallow water)
- Treed bog*
- Peat bog*

Legally protected habitat
- Wildlife habitat
- Fish habitat (fry rearing area)
- Fish habitat (spawning ground)

Non-legally protected area
- Deer yard
- Moose yard

Species with special legal status
- Nesting site for bird species at risk
- Bird
- Fish
- Amphibian or reptile
- Rodent
- Cougar
- Floral essence

Species without special legal status
- Fish
- Amphibian or reptile
- Rodent

Limits
- Communauté métropolitaine de Québec
- MRC and equivalent territory
- Municipality
- Borough (arrondissement)

* Information mapped within the limits of the Ville de Lévis

Approximate scale 0 2 km

Sources: adapted from PR3.3.2, Figure 2.1; PR3.4.2, Appendix A, Figures 7 and 8; PR3.4.2, Appendix C, Figure 1; DB46, map 2; regionals maps of the ministère des Affaires municipales et des Régions [On-line (March 22, 2007): www.mamr.gouv.qc.ca/publications/cartotheque/region_03.pdf, region_12.pdf *and* cmquebec.pdf].

Impact of storage tank installation

The MRNF is concerned about the physicochemical quality of the groundwater likely to be pumped during the digging of basins required to install storage tanks and then, to keep them dry during project operations. This concern is due to the high concentration in iron and manganese. The temperature and quality of these waters is also a cause of concern for Fisheries and Oceans Canada (DFO) which is of the view that these should respect the Environmental Discharge Objectives[1] (EDO) so as not to affect fish habitat. Both ministries believe that a system such as a settling tank should be set up to capture pumped water before it is discharged in the local environment (DQ5.1, p. 4; DQ62.1).

Water discharge from vaporizers

While the terminal is in operation, regasifying LNG would require vaporizers discharging water in the St. Lawrence River at an approximate rate of 0.003 m^3/s. At an average of 30°C, the temperature of this discharge would be several degrees higher than that of the surrounding environment, which varies between 20°C in the summer and 1°C in the winter[2]. Although at this stage of the project the proponent has not determined the outfall location of vaporizer discharges, he nevertheless believes that the temperature increase due to the discharge would be barely noticeable starting at 25 m from the discharge point and that installing a diffuser would not be necessary.

The Canadian Council of Ministers of the Environment (CCME) has communicated a provisional recommendation with regard to the temperature of the water discharged in a water body. Based on this recommendation, human activities must not cause a variation of more than 1°C of the ambient marine and estuarine water temperatures in a given point, and the maximum rate of any anthropogenic thermal variation should not exceed 0.5°C per hour (CCME, 1996).

According to the MDDEP's surface water quality criteria, anthropogenic temperature increase must not modify the water temperature to the point of causing a foreseeable displacement or modification of present or potential aquatic populations. Also, it must not alter certain localized sensitive areas such as a spawning ground, nor kill organisms living close to a discharge site. Moreover, the environment must not

1. Calculation and interpretation of the Environmental Discharge Objectives (EDO) for contaminants in the aquatic environment [On-line (March 31, 2007):www.mddep.gouv.qc.ca/eau/oer/Calcul_interpretation_OER.pdf].
2. Shipboard Thermosalinographs [On-line (March 31, 2007): www.osl.gc.ca/tsg/index-e.html].

undergo significant temperature changes like the one that would be caused, for instance, by the sudden stop of a thermal discharge during the cold season[1].

- ***Recommendation 18 —*** *Should the project be carried out, the Panel recommends that the proponent take measures to reduce the temperature of vaporizer discharge before it reaches the river so as to minimize the impacts on fish habitat.*

Furthermore, the effluent from the vaporizers would contain nitrite, nitrate and sodium carbonate. Among these compounds, only nitrite and nitrate are covered by surface water quality criteria. According to the proponent's estimates, the chronic toxicity criterion for nitrites, calculated based on the MDDEP's Environmental Discharge Objectives, would be exceeded only in a temporary and localized way. For this reason, the proponent believes that vaporizer discharge would not have any significant impact on fish habitat (PR3.3.1, p. 6.34; PR5.1, p. 3.67 and 2-74).

Vaporizer discharge should also comply with subsection 36 (3) of the *Fisheries Act* (R.S.C. (1985), c. F-14), which prohibits the deposit of deleterious substances for the fish or substances which represent an acute lethality for the latter. In that regard, Environment Canada recommends adding biological tests to the effluents follow-up program in order to assess their harmfulness.

- ***Recommendation 19 —*** *The Panel recommends the characterization of vaporizer discharge as well as a periodical follow-up of its compliance with the Environmental Discharge Objectives and toxicity tests on aquatic life, to the satisfaction of Environment Canada and the ministère du Développement durable, de l'Environnement et des Parcs.*

Hydrostatic tests on the pipeline

Hydrostatic tests on the natural gas pipeline pipes before their commissioning would require pumping water from bodies of water or waterworks. Discharging the water could affect the hydrology of the receiving body of water and may produce suspended particulates.

The proponent plans to take energy dissipation measures during the discharge phase to prevent soil erosion. He also plans to set the pumping and discharge rates so as not to modify stream uses (PR5.1, p. 2.93). No information has been communicated on the bodies of water that could be thus pumped, based on the maintenance of an acceptable flow rate for the protection of aquatic life.

1. [On-line (March 31, 2007): www.mddep.gouv.qc.ca/Eau/criteres_eau/critere_s2.htm#température].

- ***Recommendation 20 —*** *The Panel recommends that, subject to an agreement with Fisheries and Oceans Canada and the ministère des Ressources naturelles et de la Faune, the proponent determine the water supply sources for the hydrostatic tests on the pipeline pipes and this, at the environmental assessment phase. This choice should comply with the minimum ecological instream flow regimes of the bodies of water concerned. If needed, mitigation or compensation measures should be taken to reduce impacts on fish habitat.*

Potable water wells

The analysis of the project's impacts on groundwater was conducted by delineating two areas likely to be affected, namely LNG tanks (area A), where an excavation exceeding 10 m would be planned, and the access road to the jetty (area B), which should be excavated in rock north of Highway 132. These areas are shown on Figure 13. Aside from the potential impact on surface water, the groundwater body drawdown could affect potable water well levels belonging to residents in the area.

According to the proponent, the aquifer of the basement rock supplying the residents has only limited natural protection. Only the residents living west of the junction between Lallemand Road and Highway 132 and those living on rue Jean-de-Brébeuf are served by the aqueduct and the sewer, while the others rely on individual installations. The proponent has defined a perimeter of influence where the wells would be likely to undergo a drawdown exceeding 0.5 m. The perimeter covers approximately 4.5 km^2.

The groundwater drawdown in area A would be caused by excavation of the access road to the jetty, including the dynamiting of part of the cliff. According to the proponent's analyses, the water level in the wells of some twenty residences could be influenced by the drainage of the access road to the jetty.

In area B, the groundwater body drawdown would be caused by excavation for the tanks and pumping to keep their bases dry during the operation phase. In the tank basin drainage influence perimeter, well levels of some fifteen residences could experience a drawdown less than 1 m. The same would apply to the Transit campground located south of Expressway 20 (DA22.1, p. 13).

The proponent has conducted a preliminary characterization of some of the residents' wells. A more comprehensive inventory as well as a complete portrait of the groundwater physicochemical and bacteriological quality would be established once the project is authorized. The proponent committed to following-up on groundwater in order to ensure that the project does not jeopardize either the availability or the quality of groundwater for present and future users.

- ***Recommendation 21 —*** *Noting the fact that the proponent committed himself to producing an inventory of the wells located within the influence perimeter where they would be likely to undergo a drawdown exceeding 0.5 m, the Panel recommends that wells be inventoried and groundwater characterized before construction work begins. Characterizing the groundwater would enable to establish its current physicochemical and microbiological quality to better assess the potential impacts of construction and operation of the terminal.*

The proponent also agreed to replace or deepen individual wells or to modify the pumping equipment if it were shown that terminal activities would reduce access to the groundwater. He is also ready to set up a water treatment system or to dig a new well should the water become contaminated. Moreover, according to the agreement reached with the City of Lévis, a water supply system would be implemented to supply the residences along Highway 132 as of the first year of work. The proponent would assume the costs up to $5 million.

- ***Opinion 19 —*** *Although the project may have impacts on groundwater, the Panel believes that it is not likely to cause significant adverse environmental effects on the ability to meet the potable water supply needs of citizens living within the influence perimeter. This takes into account the mitigation, compensation and follow-up measures that would be implemented by the proponent.*

Wetlands

Until a policy governing wetlands is adopted, the MDDEP has provided guidelines for authorizing work on wetlands in Quebec. According to these guidelines, any area loss must be minimized and compensated on a pro rata basis for the ecological value of the environment affected. That applies to an ombrotrophic or minerotrophic peat bog[1], to a peat bog exceeding 10 ha and which possesses a hydraulic link with a stream or where the presence of protection-status species is confirmed (DB74, p. 1 to 6; DA86.2, p. 108; Comité pour la conservation des tourbières de Lévis, DM521, p. 55 to 61).

The peat bog and its surroundings

At the proposed site of the liquefied natural gas terminal, an ombrotrophic peat bog of 11.6 ha[2] is present between Expressway 20 and the power line, and a moist forest

1. Peat bog fed exclusively by direct water precipitation (G. Lamoureux, *Plantes sauvages des lacs, rivières et tourbières – Guide d'identification Fleurbec*, Groupe Fleurbec, 1987, 400 p.).
2. In DA86.2, p. 118, the proponent mentions that the peat bog area covers 9 ha but, by adding the areas of potential losses presented in DA55.3, it amounts rather to 11.2 ha, value which was retained by the Panel for its analysis.

zone borders a refuge pond located between the peat bog and the ruisseau Saint-Claude. During the construction period, drainage and backfilling work of 5.69 ha of the peat bog are planned to build a concealment berm. The proponent's visual simulations show that building such a berm would moderately reduce the visual impact of the facilities for users of Highway 132, without entirely concealing the tanks from their view. Given the peat bog's ecological value and the importance of this component of the natural environment from a sustainable development perspective, its conservation should be ensured (DA55.3; DQ58.4, p. 1 to 5).

During terminal operation, pumping water drained by the tank basins could have an effect on peat bog drainage if a hydraulic link exists between the surface water and the groundwater body under the peat bog. However, this hydraulic connection remains to be confirmed by additional hydrogeological studies. Furthermore, Fisheries and Oceans Canada and the MRNF have voiced their concerns regarding the potential existence of a hydraulic link between the peat bog, the refuge pond and the ruisseau Saint-Claude. They also expressed concern regarding the potential consequences of the peat bog drainage on the flow rate of these streams and on fish habitat (DQ5.1, p. 6; DQ6.1, p. 4; DQ62.1).

The proponent suggested some mitigation measures linked to the pumping of groundwater, such as the injection of bentonite along a trench to create a hydraulic barrier between the peat bog and the basin. He also suggested that pumped water be discharged towards the peat bog. As for the moist forest bordering the refuge pond, the proponent plans to maintain a minimum 20-m buffer zone during construction work.

- ***Recommendation 22 —*** *Noting the mitigation measures put forward by the proponent, the Panel recommends that the latter conduct additional geological studies in order to confirm the groundwater behaviour and the existence of potential links between the groundwater body, the peat bog located north-east of the site, the refuge pond and the ruisseau Saint-Claude.*

- ***Recommendation 23 —*** *The Panel recommends that the peat bog be preserved from backfilling by removing the planned concealment berm from the project. The Panel also recommends that any residual loss be compensated, in compliance with the guidelines provided by the ministère du Développement durable, de l'Environnement et des Parcs, to authorize work on an ombrotrophic or minerotrophic peat bog.*

Pipeline route

The area being studied for the pipeline route includes numerous wetlands, mainly natural peat bogs which occupy between 10% and 15% of this region's surface area. In general, the different alternatives avoid wetlands or bypass them on the sidelines

except for the H-I stretch, where the alternative chosen by the proponent passes through the centre of the Saint-Étienne-de-Lauzon peat bog. Whereas for most of the analysis criteria, the H_{North}-I alternative of that stretch displays the highest tally and seems to be the preferred alternative, this alternative crosses a large forest property belonging to the Stadacona Corporation. Its representatives have informed the proponent that they anticipated operational inconveniences associated with the presence of the pipe and the regular crossing of heavy vehicles above the right-of-way. To facilitate planning of the Stadacona Corporation's forest lands operation, the proponent chose the alternative H_{South}-I (Figure 14).

Work on the pipeline in wetlands could cause habitat losses for protected species. No comprehensive inventory has been conducted in the Saint-Étienne-de-Lauzon peat bog to confirm the presence of amphibians or plants with a protection status. The proponent acknowledged that the impacts on wetlands would be considerable but believed that applying the same mitigation measures as those planned for wooded areas would reduce these impacts. Yet he specified that installing a pipe in a wetland would require several technical adaptations, such as constructing an access road using a bridging to enable equipment circulation, setting up saddle weights (concrete weights) on the pipe to keep it in place, and applying various water control measures. In this regard, the MDDEP expressed concern over the absence of information on this subject in the proponent's documents (PR6, p. 159).

- ***Recommendation 24 —*** *The Panel recommends that the proponent study the possibility of modifying the H-I stretch of the route for the pipeline to avoid the Saint-Étienne-de-Lauzon peat bog. If avoiding it is impossible, the Panel recommends that the proponent conduct the required inventories, assess the potential use of this sector by protected animal and plant species and analyze the work's impacts on wetlands. If necessary, mitigation, compensation and follow-up measures should be planned, in compliance with the guidelines of the ministère du Développement durable, de l'Environnement et des Parcs for work to be authorized on wetlands.*

Fish and their habitats

In Quebec, fish habitat is protected under the *Fisheries Act*, the *Act respecting the conservation and development of wildlife* (R.S.Q., c. 61.1) and the *Regulation respecting wildlife habitats* [C-61.1, r-0.1.5] enacted under this Act. The project includes work that would cause the disruption or destruction of fish habitat, especially during the construction of the jetty and rock platform in the St. Lawrence River. On land, the diversion of a creek and numerous river crossings by means of open trenches and the crossing of three major creeks or rivers by directional drilling are planned – for the rivières Etchemin, Chaudière and Beaurivage.

Between Quebec City and Lévis, the river's brackish waters shelter some 80 fish species including anadromous fish[1] such as the rainbow smelt, the Atlantic sturgeon, the American shad and the Atlantic tomcod, a catadromous species[2], the American eel, estuarine fish such as the smooth flounder and the blackspotted stickleback, as well as fish more often associated with freshwater environments like the northern pike, the yellow perch and the yellow walleye (PR3.3.1, p. 2.59).

Of the species present in the area under study, the rainbow smelt (south population) and the American shad are designated as vulnerable under Quebec's *Act respecting threatened or vulnerable species* (R.S.Q., c. E-12.01), whereas the lake sturgeon and the Atlantic sturgeon are species likely to be designated as threatened or vulnerable. Pursuant to Canada's *Species at Risk Act* (S.C. 2002, c. 29), the Committee on the Status of Endangered Wildlife in Canada (COSEWIC)[3] finds the status of the northern brook lamprey and the American eel of special concern. Finally, the striped bass is under study to be listed as a species extinct in the country[4]. The American shad, the rainbow smelt and the striped bass are all subject to a joint recovery plan between the two levels of government.

The jetty sector is a fry-rearing area for the Alewife, the American shad, the northern sucker, the white sucker, the white perch, the rainbow smelt and the yellow perch. Potential American shad spawning grounds have been recorded south of the île d'Orléans. After spawning, some of the shad migrate back to the sea, mostly through coastal waters on the south shore. The crossing of shad larvae lasts from July to September and would be further concentrated in July (PR3.3.1, p. 2.66-2.67).

As for the rainbow smelt, recent data reveal a considerable and unexpected natural production of larvae in the river, in the Beaumont area. To specify the potential impacts of the construction of a jetty, Fisheries and Oceans Canada asked the proponent to produce an inventory in spring 2007 and to verify the presence of larvae and juveniles. At the time of submitting its report, the Panel had not received from the proponent the results of the additional inventories requested by government authorities.

1. Describes a migratory aquatic species, of fish generally, which, during its biological cycle, leaves the sea and returns to freshwater.
2. Used to describe fish migrating down rivers to spawn in the sea.
3. [On-line (March 22, 2007): www.cosepac.gc.ca].
4. [On-line (March 9, 2007): www.sararegistry.gc.ca].

Fish habitats in the St. Lawrence River

In the river, the construction of a jetty would cause the permanent loss of nearly 1.1 ha of fish habitat, including approximately 1.08 ha in the intertidal zone[1] and 0.02 ha in the sublittoral zone[2]. Fisheries and Oceans Canada believes that this would constitute a destruction of fish habitat under the *Fisheries Act*. The habitat that would be destroyed presents an average to high vulnerability. In the lower half of the intertidal space[3], dense aquatic-grass beds are present, serving various biological functions for several fish species (DQ5.1, p. 1 to 4).

According to Fisheries and Oceans Canada, backfill work, pile driving and use of barges could cause an increase in suspended matter (SM) in water and an increase in underwater noise level. The proponent created a model of the noise produced by the pile-driving work. Based on the results, these would risk injuring the fish located within a radius of approximately 10 m around each pile and this, for about one hour per day for the duration of the work. Fry and juveniles would be most likely to be affected by pile driving. However, Fisheries and Oceans Canada believes that appropriate mitigation measures such as restriction periods would decrease the risks of fish injuries during pile driving.

The increase in SM and underwater noise could also harm the migration of fish such as the American shad, the Atlantic sturgeon and the American eel, as well as rainbow smelt larvae, given their high concentration in the area under study during summertime. However, since the proponent has planned a work break between 7 p.m. and 7 a.m., Fisheries and Oceans Canada believes that nocturnal migratory species will suffer less disruption. If night-work was to be carried out, Fisheries and Oceans Canada believes that the proponent should set restriction periods to ensure fish crossings, in particular of the American shad and the Atlantic sturgeon. Lastly, pumping water from the St. Lawrence River for hydrostatic tests and for fire hydrants and potable water needs, as well as pumping ballast water by the LNG tankers, would risk causing the pumping of larvae and juvenile fish, including the rainbow smelt (DQ5.1, p. 2 and 3).

- ***Recommendation 25 —*** *The Panel recommends that, additional measures be taken when a spawning area for the rainbow smelt is present in the jetty area in order to avoid disrupting the species, to the satisfaction of Fisheries and Oceans Canada and the ministère des Ressources naturelles et de la Faune.*

1. Below the mean higher high water level.
2. Used to describe the underwater level corresponding to the distribution of permanently immersed animal and plant species or species that tolerate a short immersion.
3. Region located between mean high and mean low tide levels.

Fish habitat in a lotic environment[1]

The LNG terminal construction would require a 1620 m^2 backfill causing the loss of a 955-m long segment of the ruisseau Saint-Claude's western branch. Fisheries and Oceans Canada believes that this backfill would cause the loss of fish habitat as described by the *Fisheries Act*. This loss has nevertheless been deemed acceptable given the low vulnerability of this habitat and the development of a new route which should enable to reach the zero net habitat loss objective. According to Fisheries and Oceans Canada, plant stabilization of the berms and the addition of gravel and pebble substrates would allow creation of a fish-friendly environment (PR3.3.1, p. 6.29; DQ5.1, p. 1 to 3).

As regards pipeline construction, numerous stream crossings would be necessary, involving generally the open trench method. Mitigation measures could reduce the impacts on fish habitat during the work.

For the rivières Etchemin, Chaudière and Beaurivage, the geotechnical surveys conducted until now point to favourable conditions for the directional drilling technique to cross them. The proponent has also considered the scenario of a crossing by way of an open trench in case of drilling failure. Despite the mitigation measures suggested by the proponent, Fisheries and Oceans Canada and the MRNF believe that the risk for fish habitat remains equally high. For them, the open trench technique should be considered only as a last resort option. Its use should be coupled with special compensatory measures. It will be noted that in 2002 the Atlantic salmon was reintroduced to the rivière Etchemin and many restoration efforts are currently being deployed on the entire drainage basin. Fry rearing and spawning areas have also been noted near the pipeline crossing sites for each of the three rivers concerned (DQ34.1, p. 2; DQ35.2, p. 1 and 2).

Furthermore, in the Saint-Laurent pipeline project, which also involves crossing these three rivers upstream of the proposed pipeline for the project, the technical studies have demonstrated that directional drilling could not be used for the rivière Etchemin crossing in the route alternatives analyzed so far. The proponent did not rule out analyzing other route alternatives[2]. Cumulative impacts on fish habitat could occur should both pipeline projects take place simultaneously – an issue which the proponent did not address in his impact study (DQ54.1, p. 2; PR5.1, p. 2.105).

1. Used to describe freshwater ecosystems (streams, rivers, lakes, etc.) in which water circulates and is renewed fairly quickly.
2. Ultramar ltée, *Étude d'impact sur l'environnement*, vol. 1, May 2006, p. 5 to 27; vol. 7, November 2006, p. 2 to 4.

- *Finding — The Panel notes that, in cases where directional drilling would prove to be impossible for the pipeline crossing under the rivières Etchemin, Chaudière and Beaurivage, the open trench method would have impacts on fish habitat. This method would be authorized only as a last resort by Fisheries and Oceans Canada and the ministère des Ressources naturelles et de la Faune and by means of the necessary compensation measures.*

- ***Recommendation 26 —*** *The Panel recommends to the ministries concerned to keep in mind the technical feasibility of the directional drilling as a criterion in the final choice of a pipeline route for the rivières Etchemin, Chaudière and Beaurivage crossings.*

Fish habitat compensation

Fisheries and Oceans Canada has evaluated the potential impacts of the work on the St. Lawrence River. The department believes that the project would cause the destruction of approximately 12,620 m^2 of fish habitat, the deterioration of approximately 16,000 m^2 of habitat and a three-year long disruption caused by SM and noise during construction. This habitat loss, deemed acceptable by Fisheries and Oceans Canada, should nevertheless be compensated in order to respect the zero net loss principle, in compliance with the *Policy for the Management of Fish Habitat*.

- ***Opinion 20 —*** *Insofar as fish habitat losses or disruption caused by the project are compensated and by means of the appropriate mitigation measures, the Panel believes that the project is not likely to cause any significant environmental impacts on fish habitat.*

- ***Recommendation 27 —*** *The Panel recommends that the proponent's compensation project for fish habitat losses and disruptions be submitted to Fisheries and Oceans Canada within the present environmental assessment.*

Avian fauna

According to the proponent's analyses, none of the 73 bird species inventoried in June 2005 in the proposed terminal and jetty area would be either at risk in Canada or threatened, vulnerable or likely to be designated as such in Quebec. Seven rare or threatened species have however been observed by amateur ornithologists in the area under study. Among the species inventoried by the proponent, 64 are breeding species in the terminal area. Environment Canada indicates, however, that no protected species has been confirmed to be breeding in the area under study.

Along the proposed pipeline route, 103 of the 116 species observed in June 2005 are breeding birds. On the other hand, no nesting location for precarious-status species has been recorded in the proposed pipeline right-of-way. The proponent's inventories have nevertheless confirmed that the northern goshawk – a priority species designated as such because it is located at the top of the food web[1] – would breed in the right-of-way. The proponent has planned to validate the use of the nesting location and, if needs be, to resort to appropriate mitigation measures.

According to the proponent, the main impacts of the terminal construction work and pipeline operation would be the loss and fragmentation of potential habitats. The proponent believes that 546 breeding couples would be affected by the deforestation work in the terminal area. In the case of the pipeline, deforestation would take place on a 23-m long strip corresponding to the right-of-way width.

Scheduled deforestation work could also cause habitat losses for migratory birds. In order to mitigate the anticipated impacts, various measures have been suggested by the proponent. For instance, these would include conducting deforestation, inasmuch as possible between September 1st and April 1st, i.e. outside of the nesting period, this condition being subject to a waiver should the work time frame require it (PR3.3.1, p. 6.59; PR3.4.1, p. 7.62; PR5.1, p. 2.35). As for the pipeline, the proponent would conduct the deforestation outside the bird nesting periods (PR5.1, p. 2.40).

The federal *Migratory Birds Regulations* (C.R.C., c. 1035) prohibits "disturb[ing], destroy[ing] or tak[ing] a nest, nest shelter […] or an egg of a migratory bird […] except under authority of a permit therefore". Environment Canada[2] deems that the ''most efficient measure to comply with this regulation would be to avoid migratory bird nesting periods during the deforestation work''. In fact, the proponent has invoked this measure several times, in particular to mitigate the effects on small mammals and herpetofauna (PR3.4.1, p. 7.51 and 7.65).

- ***Recommendation 28 —*** *The Panel recommends that Environment Canada and the ministère des Ressources naturelles et de la Faune ensure the effectiveness of the mitigation measures suggested by the proponent with regard to avian fauna.*

Protected plant species

With the exception of aquatic species, protection measures set out in Canada's *Endangered Species Act* apply only to floristic species on federal lands, on a national

1. [On-line (April 3rd, 2007): www.cws-scf.ec.gc.ca/publications/eval/mig/index_e.cfm].
2. [On-line (March 9, 2007): www.ceaa.gc.ca/050/documents_staticpost/ceaaref_3971/R-0119.pdf].

historical site for instance. Therefore, this federal law does not apply to the lands covered by the project.

In Quebec, the term ‘‘designated species’’ includes any species designated as ‘‘threatened’’ or ‘‘vulnerable’’ under the *Act respecting threatened or vulnerable species*. A species is designated as threatened when it is in an extremely precarious situation, when the situation will permanently worsen if no initiative is taken to counter this precariousness and when its extinction is apprehended in a more or less short term. A vulnerable species is one whose survival is precarious even if its extinction is not apprehended. However, a regressive evolution of its population or the degradation of its habitats risks occurring if no measure is taken to ensure species survival[1].

The *Act respecting threatened or vulnerable species* guarantees complete protection to floristic species designated as threatened or vulnerable, by prohibiting among others the destruction of a specimen of theses species. According to the MDDEP, the presence of a few individuals of a threatened or vulnerable species would not suffice in itself to prohibit a project from taking place or to order its cessation. For instance, the law would allow displacing a population of such a species to avoid its destruction, taking into account the project’s impacts, the legal status of the plants targeted and their conservation value (DQ73.1, p. 2). However, one participant is opposed to such an action:

> A great number of conservation organizations are opposed to it as a compensation measure and consider that the preservation of an endangered species cannot be dissociated from that of its habitat […] The few studies that have evaluated the success rate of such a compensation measure reveal in fact more failures than successes […] The Advisory committee on threatened or vulnerable flora considers therefore that the relocation of a threatened species does not represent an acceptable compensation measure.
> (Ms. Gisèle Lamoureux, DT34, p. 59 and 60)

The Act also seeks to protect the habitats of floristic species identified in the *Act respecting threatened or vulnerable species* [E-12.01, r.0.4], by prohibiting in particular any activity likely to modify the ecological processes specific to them. Here again exceptions are proposed, including for activities authorized by the Minister of Sustainable development, Environment and Parks or by the government (DQ73.1, p. 2).

1. J. Labrecque and G. Lavoie, *Les plantes vasculaires menacées ou vulnérables du Québec*, ministère de l’Environnement, Direction du patrimoine écologique et du développement durable, Québec, p. 10-11.

Inventories conducted

The proponent conducted vegetation inventories between August 18, 2004 and May 25, 2006. These have enabled identification of ten protected plant species in the area under study (Table 17). The results also illustrate a degree of variability from one year to another. The period during which the inventories were conducted as well as greater sampling effort are arguments put forward by the proponent to explain the variation in abundance noticed among rare plants.

Table 17 Protected plant species inventoried in the areas under study

Common name ***Latin name***	**General location**	**Status in Canada**[1]	**Status in Quebec**[2]
Fringed gentian, Victorin variety *Gentianopsis procera* subsp. *macounii* var. *victorinii*	Jetty	Threatened	Threatened
Spotted water-hemlock, Victorin variety *Cicuta maculata* var. *victorinii*	Jetty	Of special concern	Threatened
Wild leek *Allium tricoccum*	North of Highway 132		Vulnerable
Two-leaved toothwort *Cardamine diphylla*	North of Highway 132		Vulnerable
Eaton's beggartick *Bidens eatonii*	Jetty		LDTV[3]
Sticky willowherb, naked seed variety *Epilobium ciliatum* var. *ecomosum*	Jetty		LDTV
American bugleweed, Saint-Laurent variety *Lycopus americanus* var. *laurentianus*	Jetty		LDTV
Platanthera blephariglottis, blephariglottis variety *Platanthera blephariglottis* var. *blephariglottis*	Pipeline right-of-way		LDTV
Water-smartweed, foreshores variety *Polygonum punctatum* var. *parvum*	Jetty		LDTV
Southern wild rice, dwarfed variety *Zizania aquatica* var. *brevis*	Jetty		LDTV

1. Government of Canada [On-line (February 22, 2007): www.registrelep.gc.ca/default_e.cfm].
2. Government of Quebec [On-line (February 22, 2007): www2.publicationsduQuebec.gouv.qc.ca/dynamicSearch/telecharge.php?type=3&file=/E_12_01/E12_01R1.HTM]
3. Likely to be designated as threatened or vulnerable.

Sources: adapted from: PR3.3.1, p. 2.42; PR3.4.1, p. 7.13.

Jetty and shore facility area

Table 17 shows the presence of two designated species in the projected jetty area and maritime facilities: the fringed gentian, Victorin variety, and the spotted water-hemlock, Victorin variety. Given their protected status, these two species, which are found in similar habitats, receive special attention here.

It must also be said that five species recorded on the list of species likely to be designated as threatened or vulnerable by the government of Quebec have been noticed in the jetty area. Two aquatic-grass beds housing several of these rare plants have been identified near the proposed shore facility (PR3.3.1. p. 2.42 and 6.41).

- *Finding — The Panel notes that the jetty area represents a zone of interest from a floristic standpoint, sheltering seven species of precarious-status plants, two of which are designated as threatened, pursuant to the* Act respecting threatened or vulnerable species.

The fringed gentian, Victorin variety, and the spotted water-hemlock, Victorin variety are found only in Quebec and are endemic species of the St. Lawrence riverine estuary. Labrecque and Lavoie (2002, p. 17)[1] believe that ‘‘endemic species of restricted distribution certainly represent the most interesting and most important group from a conservation standpoint since they are the ones most bound to disappear from the planet’’.

A vegetation community containing five seedlings of gentian has been inventoried near the potential rock platform, whereas more than 1000 water-hemlock individuals have been inventoried near the projected jetty area site (PR5.2.1, p. 3-67; Ms. Gisèle Lamoureux, DM686, p. 16 to 23). According to Environment Canada[2], habitat destruction would be the main limiting factor for the gentian and the water-hemlock[3]. Noting that the proponent has planned the shoreline crossing of small craft when crossing under the jetty is not allowed, the Panel sees here a factor risking the destruction of gentian and water-hemlock habitats.

- ***Recommendation 29 —*** *Given the protection statuses of the fringed gentian, Victorin variety, and the spotted water-hemlock, Victorin variety and the threat facing their habitats, the Panel recommends that the proponent take measures to protect the individuals of theses species and their habitats if he develops a crossing over the bank for small craft. These measures should be implemented following an agreement with the ministère du Développement durable, de l’Environnement et des Parcs.*

1. *Op. cit.*
2. Environment Canada [On-line: www.speciesatrisk.gc.ca/search/speciesDetails_e.cfm?SpeciesID=267].
3. Environment Canada [On-line: www.speciesatrisk.gc.ca/search/speciesDetails_e.cfm?SpeciesID=268].

According to the proponent, the jetty construction and especially construction of the rock platform would cause the destruction of approximately 0.22 ha of potential habitat for the seven protected species present in this area. Taking into account the coastal areas generally occupied by theses species, tidal levels associated with them and topography, the proponent assessed the habitat loss for these seven species to be 1,430 m^2. For the gentian and the water-hemlock only, the loss would be 173 m^2 (DQ86.2, p. 191).

One participant also pointed out that calculation of the size of the disrupted area must take into account the rock platform and work area, and also the sedimentation area and erosion zone. In this regard, the proponent foresees that the rock platform constructed on the shoreline, which would extend approximately 100 m into the river, could slightly modify the local hydrodynamics and the sediment dynamics on a small portion of the foreshore. Thus, a low accumulation of sediments would have to be foreseen upstream of this structure but its precise assessment would be difficult. The proponent evaluated that the length of this structure could extend up to 100 m on both sides of the structure (PR3.3.1, p. 6.35; DQ86.2, p. 195; Ms. Gisèle Lamoureux, DT34, p. 55; DM686, p. 18, 21 and 29).

- *Finding — The Panel notes that the construction of the project's shore facility would cause a habitat loss for seven protected plant species, two of which are designated as threatened under the* Act respecting threatened or vulnerable species.

The proponent suggested various measures to mitigate the impacts on precarious-status species. For example, he suggests marking out aquatic-grass beds located near work areas and prohibiting heavy equipment from circulating within or near these areas. The proponent also committed himself to protecting entirely the shores facing his properties which would not have been modified by the work so as to encourage the colonization of rare plants (PR5.2.1, p. 3.67; PR3.3.1. p. 6.42). The type of protection foreseen by the proponent and its details are not yet known. Nevertheless, the Panel notes that several measures could be implemented, including the establishment of a perpetual conservation easement of floristic habitats[1].

Nevertheless, the proponent raises the possibility that the proposed measures may not be fit to protect aquatic-grass beds during work. He suggests then that the seedlings of precarious status species be transplanted by a qualified botanist to a favourable habitat located nearby. A transplantation and follow-up protocol would be submitted to the MDDEP for approval and an annual follow-up report would be submitted to them for an estimated five-year period (PR5.2.1, p. 3.67; DQ86.2, p. 198).

1. Environment Canada [On-line (April 4, 2007): www.qc.ec.gc.ca/faune/pde-egp/definition_e.asp]; ministère du Développement durable, de l'Environnement et des Parcs [On-line (April 4, 2007): www.mddep.gouv.qc.ca/biodiversite/prive/programme/index.htm].

The MDDEP points out that, on this matter, transplantation is not a measure to favour and must only be considered as a last resort.

- ***Recommendation 30 —*** *Considering the rich floristic quality of jetty area, the Panel recommends that the proponent compensate for the loss of protected species habitat for the entire area affected by the work. These measures should be assessed following an agreement with the ministère du Développement durable, de l'Environnement et des Parcs.*

- ***Recommendation 31 —*** *The Panel recommends that the ministère du Développement durable, de l'Environnement et des Parcs see to it that appropriate measures be taken to ensure the protection of individuals belonging to these protected species and their habitats. Transplantation should be considered only as a last resort.*

Land-based facilities area

During the inventory conducted by the proponent, nine colonies of two-leaved toothwort were recorded north of Highway 132, in the proposed area for the installation of the utility corridor. Although no colony was recorded in the proposed infrastructures' right-of-way, two colonies were reported to live directly on the latter's edge. This species does not have any protection status at the federal level but has been designated as vulnerable in Quebec in 2005.

To avoid disrupting or destroying the two-leaved toothwort's colonies, the proponent agreed to conduct further checks during the construction phase, to mark out the areas to avoid and to prohibit equipment from crossing these areas.

- ***Recommendation 32 —*** *The Panel recommends that the ministère du Développement durable, de l'Environnement et des Parcs ensure that the proponent performs new inventories during the construction of facilities to ascertain the absence of two-leaved toothworts in the areas covered. In the case where two-leaved toothwort individuals would be recorded in the work area and transplantation would be the only conceivable option, the Panel recommends that the proponent develop a follow-up program to verify the success of the transplantation.*

The wild leek does not have any protection status at the federal level but the species is designated vulnerable in Quebec. According to the Centre de données sur le patrimoine naturel du Quebec (CDPNQ), designating this species as vulnerable would mainly serve to forbid its sale and harvesting in great quantities (DQ43.1, p. 3).

The proposed deforestation area for the terminal includes a micropopulation estimated at some 180 to 200 seedlings based on a transplantation performed by the owner during the past years. Such a population of less than 1,000 seedlings is not

considered viable by Nantel *et al*. (1996). For its part, the CDPNQ considers that a population of two-leaved toothworts is of low quality if it is below 5,000 bulbs. In these conditions, the project would not have considerable negative effects on this species.

Pipeline right-of-way

The Platanthera blephariglottis, blephariglottis variety, has no status at the federal level but is likely to be designated as threatened or vulnerable in Quebec. This species of the orchid family[1] is found in open and semi-open areas of the peat bogs and would be relatively common in the area under study (PR3.3.1, p. 2.57; PR3.4.1, p. 7.13). It is the only protected plant species noted in the pipeline right-of-way during the inventories. It was observed in six locations along the proposed right-of-way, totalling 281 individuals (PR3.4.1, p. 7.14). Furthermore, the proponent indicated that modifying the pipeline's route would limit transplantation to some thirty individuals rather than the 281 recorded during the inventories (PR5.2.1, p. 3.67; DQ86.2, p. 198).

The proponent suggested transplanting, in comparable adjacent environments, all the individuals inventoried on the areas covered by the work. For its part, the MDDEP points out that the success rate of the transplantation of threatened seedlings is low and that this would especially be the case for orchids. However, the Ministère does not have any data pertaining to transplantation techniques for the platanthera and anticipated success rates.

- ***Recommendation 33 —*** *Given the absence of data regarding the success potential of the transplantation of Platanthera blephariglottis, blephariglottis variety, the Panel recommends that the proponent develop a follow-up program following an agreement with the ministère du Développement durable, de l'Environnement et des Parcs.*

Environmental monitoring and follow-up

The proponent committed himself to implementing an environmental monitoring plan during the terminal construction to ensure compliance with government requirements and to assess the environmental effects of the construction activities. This plan would focus on the quality of surface water and groundwater, on the ambient noise and the use of agricultural lands.

During terminal operation, the proponent plans to establish an Environmental Management System (ISO 14001-2004) in order to determine the impact of his

1. NatureServe Canada [On-line (February 26, 2007): www.natureserve.org/explorer/].

activities on the environment, to verify the effectiveness of mitigation measures and to take corrective action if needed.

The follow-up program included in this environmental management system would focus on multiple aspects of terminal operation. A Public Advisory Committee, composed of elected members, representative groups and representatives of the proponent, would be set up during the construction phase and would pursue its activities during the operation phase. A follow-up report would be periodically submitted to the MDDEP to take note of the environmental management plan results.

- ***Recommendation 34 —*** *Noting that the proponent has planned to set up a Public Advisory Committee to conduct the follow-up on the project's environmental impacts, the Panel recommends that the entire set of mitigation measures be monitored. The proponent should also establish a liaison committee with the population in the area to ensure appropriate management of the disturbances during work, following an agreement with the City of Lévis, neighboring municipalities and community organizations.*

Conclusion

In conclusion of its mandate, and in regard to the energy context of the project, the Joint Review Panel underscores the existing consensus that accessible reserves of natural gas in the western Canadian sedimentary basin are declining and could be exhausted within nine or 10 years. The Panel also points out that other Canadian reserves are not accessible to the North American gas pipeline network. Moreover, the Panel stresses the emphasis placed by the government's energy strategy on the role of natural gas in Quebec's economic and industrial development, and recognizes that the project's gas supply would strengthen its energy security. This added contribution could lead to a relative reduction in the price of natural gas in the Quebec market. Beyond this, the Panel recognizes the project's importance in terms of investment and economic benefits at the regional level.

The Panel concludes that there are two major contentious issues related to the project. These are the risks associated with it, and the integration of its port and shore facilities into the zone under development. These two issues have a major influence on the social acceptability of the project within the community.

From the methodological standpoint, the Panel is of the opinion that the project's risk assessment conforms to current established practices in the field. The assessment's conclusions are also in keeping with the known historical record of the liquefied natural gas chain security in both its maritime and land-based facilities. From the standpoint of security, the Panel is of the view that the assessment meets state-of-the-art standards and that risks associated with the project seem acceptable. Given the proximity of facilities to inhabited areas, and on the basis of a preventative approach, the Panel deems it advisable for emergency measure planning for the project to be established and applied on the basis of a criterion of thermal radiation of 3 kW/m^2.

In regard to the project's integration into the area, the Panel notes that it conforms to the City of Lévis' land use planning and development plan which calls for industrial and harbour development. However, due to its very nature, the project would diverge from the VilleGuay district's current land uses.

The Panel is also of the view that the project's port facilities, as well as the building of the access road to the jetty through the cliff, would alter the quality of the Beaumont shore's landscape. If the project is authorized, the Panel recommends that the proponent take all measures necessary to ensure the best possible integration of port and shore facilities with the landscape during the current environmental assessment process.

In order to optimize the potential for related development, the City of Lévis should maintain industrial zoning of lands adjoining the project, if authorised, that would be conducive to the development of cold-processing industries in that area. The city should also request the Commission de protection du territoire agricole du Québec to exclude these properties, along with those needed for the possible completion of the project, from the permanent agricultural zone.

The Panel takes note that the project would contribute to an increase in Quebec's carbon dioxide emissions. Nevertheless, it is of the view that there is no contradiction between this eventuality and the goals of Quebec's 2006-2012 action plan for climate change, given that the increase could be compensated for by reductions of these emissions in other areas of activity. In this regard, the Panel takes into account the substitution of fuels with higher carbon content by the extra supply of natural gas from this project. In the Panel's opinion, the emission charges set out in the 2006-2012 action plan could strengthen the possibility of such beneficial substitutions.

The Panel recognizes that during the construction phase, the project could exceed noise criteria set by the ministère du Développement durable, de l'Environnement et des Parcs. However, the proponent has offered financial compensation for temporary moves by residents who might be affected.

In terms of impact on air quality, the Panel notes that the use of diesel fuel containing 0.5% sulphur by LNG carriers' auxiliary generators would be an added source of sulphur dioxide emissions in the residential neighbourhoods of Ville-Guay. The effect would be that the maximum concentration predicted for the area above the jetty, based on the proponent's air quality modelling, would only be 1 µg/m³ under the hourly standard set in the *Projet de règlement sur l'assainissement de l'atmosphère*. The Panel recommends that samples taken at the proponent's monitoring station be analyzed in concert with the ministère du Développement durable, de l'Environnement et des Parcs. When standard limits are exceeded, the situation should be corrected to the department's satisfaction.

The Panel recommends that the proponent prepare a surface water management plan, to the satisfaction of governmental authorities concerned, that would ensure maintenance of an acceptable flow rate in the ruisseau SaintClaude and protect the refuge pond's ecological integrity.

The Panel is of the view that the proponent should avoid any encroachment on peat bogs in the area set aside for land facilities, even at the cost of cutting back on the effectiveness of measures designed to mitigate the project's visual impacts. The Panel is also of the view that any residual losses in these areas should be compensated on the basis of guidelines set forth by the ministère du Développement durable, de l'Environnement et des Parcs. Beyond this, the proponent should study the possibility of changing the gas pipeline's route to skirt the Saint-Étienne-de-Lauzon peat bog.

Given the protected status of plant species inventoried on the projected site for shore facilities, and as their habitats could be threatened, the Panel is of the opinion that the ministère du Développement durable, de l'Environnement et des Parcs should ensure that measures are applied to protect individuals of these species and their habitats.

Finally where the requirements of the *Canadian Environmental Assessment Act* are concerned, the Panel concludes that the project is not likely to cause significant adverse environmental effects. Such a conclusion is conditional to the implementation of mitigation and compensation measures and follow-up put forth by the proponent, as well as those proposed by the Panel.

Executed in the city of Québec,

BAPE Panel	Joint Review Panel
Qussaï Samak, Chair	Qussaï Samak, Chair
Jean Paré, Panel Member	Jean Paré, Panel member
	Jean-Philippe Waaub, Panel member

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