

## 6. COMPARATIVE ANALYSIS OF THE THREE PROPOSED SITES

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### 6.1 COMPARATIVE SITE ANALYSIS OF THE ARCTIC PILOT PROJECT

The current project and the 1980 Arctic Pilot Project (APP) are very similar from the type of facilities and industrial operations required to take place along the St. Lawrence River and Gulf and at the marine terminal. During the 23 years between the assessments of the two projects, technology, standards, regulations and procedures have evolved. With this considerable additional experience, ships used for LNG transport have become standardized and the industry has gathered a lot of navigational experience and operating experience at terminals with these vessels and facilities in all parts of the world, under widely varying climates, including in ice covered waters.

A comparison of the main characteristics of both projects has been presented in Table 2.3 and site evaluation criteria were detailed in Table 2.4.

The evaluation of the 3 sites currently under consideration that was made in 1979 led to the selection of Gros Cacouna for the implementation of a LNG marine terminal. That project has passed the test of the public hearings and received approval by federal and provincial authorities in 1982.

From the data presented in the previous chapters, it can be concluded that Ville Guay offers, in the context of the current project, some significant advantages as to the reliability of the terminal and the economic aspects of the project (construction and operational costs). Regardless of these favorable elements, the project shall not entail risks that would qualify as “unacceptable”. Therefore it is important to understand what was deemed “unacceptable” in 1979 and, even more importantly, explain, if appropriate, how conditions could become “acceptable” in 2003.

On the technical criteria, the issue is the safety of marine operations. Even if the Ville Guay site is situated approximately 4 km east of Pointe-de-la-Martinière studied in the APP project, the bathymetric and other physical site conditions are not significantly different. However, the characteristics of the ships and the operating practices have evolved. The vessels considered today are shorter, and operating practice allows them to navigate in tighter channels and to use smaller turning distances. Therefore, the maneuvering clearances are now greatly reduced, compared to the criteria applicable in 1979. Navigational issues, in the context of the current project and today’s international standards are discussed at some length in the following section 6.2.

On the public safety criteria, the issue is the exposure of populations near the terminal to the risks associated with an accidental release of LNG. The BAPE report describes three approaches to the prevention of marine accidents that might cause LNG spillage: the design and construction of the carriers, the training of crews and vessel movement control. A full risk analysis will have to be carried out during the feasibility study, considering today's ship configurations, LNG technology, design standards, gas dispersion modelling technics, operating practices and industry safety record.

## **6.2 DISCUSSION ON MARINE OPERATIONS**

### **6.2.1 Climatic and hydrodynamic conditions**

An assessment of the various climatic and hydrodynamic conditions presented in Chapter 3 leads to the following conclusions:

- tidal current conditions do not induce any particular difficulties at any of the three sites examined;
- wave conditions are also below operational limits as defined at other LNG receiving terminals (Montoir, Bonny) and are therefore considered acceptable at the three sites under study;
- wind conditions are generally acceptable with respect to operational limits in use elsewhere. However, Gros Cacouna may present more difficult conditions occasionally, specially during winter time: based on statistical data, it is expected that berthing / unberthing operations might be delayed 8 times per year (assuming 1 arrival + 1 departure per week);
- information on visibility conditions presented in Environment Canada's Climatic Charts or web site is to be considered a rough indication only since it is based on a small amount of data of questionable quality. The St. Lawrence River offers generally acceptable conditions for its commercial navigation users. The Gros Cacouna area would appear to be more affected by foggy conditions than the other two sites. However, limited visibility periods would usually last only for relatively short periods of time. For this reason, down time due to visibility conditions is assumed to be in the range of no more than 3-4 days / year;
- The three sites require ice protection dolphins to be included in the design of the dock, to resist similar ice loadings. The construction of a long jetty at Pointe Saint-Denis

would create a large area of stable ice cover and significant changes to the local ice regime:

- According to the ice studies (PCAI, 2003), an ice jam in the Quebec City region capable of stopping traffic for a few days would have a recurrence period of once in 20 years. The area where it is likely to occur is located further upstream from the Lévis-Beaumont area, i.e. at the Quebec bridge where the river is narrower, or at the Davie shipyard where there is a sharp change in the direction of the river;
- at Cacouna, a northerly or west-northerly wind can cause ice to remain for some time, forming a belt fringing the Northwest shore of the island, stopping temporarily the net progression of the floating ice. These winds have a frequency close to 40% in January, February and March, but there have been only a few sequences of days of sustained wind from the NW quadrant lasting more than 4 days in the last 50 years. It is not easy to establish down time frequency due to ice conditions. However the frequency of these winds must be taken into consideration in the evaluation of down time since these winds tend to push floating ice towards the south shore of the river. Assuming statistical independence of ship arrivals and departures at the terminal (2 events per week or 26 events during winter), it is believed that 3 or 4 of these events might be delayed;
- From the previous comments, it appears that operational delays can be expected about 14 to 16 times per year at Gros Cacouna, i.e. 8 times due to wind conditions, 3- 4 times due to ice accumulations (caused by northerly or west-northerly winds) and 3 - 4 times due to visibility conditions. A typical duration for these operational interruptions would be one full day;
- An acceptable terminal down time limit will have to be clearly established at the feasibility assessment stage of studies, with respect to climatic and marine conditions. A value of 5% has been proposed by Client as a preliminary guideline for the purpose of the current study. Considering 104 (=52 x 2) annual ship arrivals or departures at the terminal, this reliability target would mean that delays to the berthing / unberthing manoeuvres should be experienced no more than 5 times per year. This value is to be validated by Client;
- based on the data available for this study and on the reliability criterion described above, this target appears achievable at Ville Guay;

- for Gros Cacouna, operational conditions appear to be more restrictive and terminal down time might exceed the target;
- Visibility data will have to be examined at both sites in order to confirm final figures.

### 6.2.2 Pilotage considerations

In order to establish the advantages and disadvantages of each site with respect to the pilotage conditions, three representatives of the Lower Saint Lawrence Pilots Association were consulted in the course of this study, each one having a solid background of at least 25 years of commercial navigation on the Saint Lawrence.

A preliminary consultation was also held with representatives of Transport Canada in order to obtain preliminary comments as to the feasibility of this project and the approval process to be followed to obtain all the required authorizations.

#### 6.2.2.1 General:

- The average commercial traffic on the Saint Lawrence, in the section comprised between Les Escoumins and Quebec City, is in the range of 5 000-7 000 ships per year or 15-20 ships per day in both upstream and downstream directions. Future traffic forecasts indicate limited increases in the number of ships and more important increases in the ship tonnages;
- Anchorage areas were identified by pilots in the vicinity of each proposed site (see figures 5.1b, 5.3 and 5.5). The anchorage areas identified at Ville Guay and Gros Cacouna are already used for this same purpose. No particular constraints are expected at any of the three sites under this aspect;
- Turning areas in front of each proposed berth (see same figures) were also discussed with pilots and appeared to be satisfactory;
- The North Channel situated at the east end of Île d'Orléans is the only section of the seaway where draft and width are restricted. It only affects access to the Ville Guay site. For safety reasons, this portion of the waterway should be considered a one-way channel for the passage of LNG carriers following the TERMPOL guidelines. Considering the typical duration of a passage of 1,5 hrs approximately and the expected frequency of LNG carriers of 1 ship per week, this should not represent a significant constraint to commercial navigation;

- No particular navigation constraints related to the water depth and/or waterway width have to be considered for Gros Cacouna or Pointe Saint Denis since these sites are located in wider areas of the Saint Lawrence;
- Gros Cacouna has more exposed navigation conditions, particularly in the winter time. During this season, strong prevailing winds from the NW can persist for many days. As a result, high concentrations of ice can accumulate near the south shore, affecting sailing, berthing and holding at the dock. During these severe conditions, more powerful tugboats may facilitate operation; however, some down time should be expected;
- A safety clearance between a LNG ship and other ships during turning and berthing manoeuvres was discussed with pilots. No particular problem was foreseen to ensure safety of all maritime traffic in the area. A safe distance requirement is to be determined at a future stage of the technical studies. Similarly, appropriate navigational aids shall be considered.
- Although no major obstacle was identified during this preliminary assessment by Transport Canada's officers, an in-depth assessment will have to be completed in compliance with TERMPOL review process requirements. This review shall address properly all issues related to the safety of LNG carrier ships and terminal as well as the safety of navigation in general on the Saint Lawrence.

#### *6.2.2.2 The North Channel:*

The North Channel (see Figure 5.1b) is the only stretch of the Saint Lawrence seaway downstream from Quebec City which requires maintenance. It is located at the east end of Île d'Orléans and is 30 km in length, 300 m in width, and dredged to 12,5 m water depth below low tide. It presents some limiting navigation conditions and requires that some particular pilotage rules be followed for the safety of commercial navigation in general. The following information was obtained from pilots:

- 1,5 to 2 hours are usually required for a ship to go through the North Channel, with the possibility of crossing 1 to 3 ships during that passage (if the channel were to be considered a two-way waterway);
- Maintenance dredging is carried out 2 or 3 times a year and consists mainly of removing a few recently formed high spots. Costs for these maintenance operations are supported jointly by Port of Montreal, Port of Quebec and Ultramar;

- Regular bathymetric soundings are also performed at least once a year in the North Channel as part of the maintenance program;
- The presence of 2 pilots on board is compulsory yearlong for tankers over 40 000 DWT and during winter time for bulk carriers over 75 000 DWT. Moreover, a risk assessment study is currently under way and could conclude to similar requirements for passenger ships more than 100 m long and for “slow ships” (defined as ships doing the distance Les Escoumins – Quebec in more than 11 hours. The average duration of this travel is 9,5 hours);
- The required underkeel clearance is 1,5 m in the North Channel;
- The available water depth is considered reduced by 0,5 m during winter in the Channel;
- Visibility conditions: for safety reasons the North Channel is accessed only if the Argentenay alignments (located at the east end of Île d’Orléans) are visible from the channel entrance; this represents a visibility distance of 15 km approximately. Otherwise, ships are anchored at either end of the channel until conditions are deemed acceptable by pilots.

### 6.2.3 Width of channel

Based on recommendations presented in Chapter 2, the minimum channel width should be at least four (TERMPOL) to five (SIGTTO) times the design ship’s breadth allowing for the draught of the design vessel. In two-way channels, the minimum width should be increased to at least seven times (TERMPOL) the design ship’s breadth, again allowing for the draught of the design vessel.

Design guidelines are also suggested by the Permanent International Association of Navigation Congresses (PIANC, 1999). This method, described in Appendix D, takes into account many parameters such as ship manoeuvrability and speed, wind, wave and current conditions, type of payload, distance to shores, etc. Preliminary calculations are presented in Table 6.1 for the two most restrictive portions of the waterway giving access to the Ville Guay site. These are the North Channel, which is considered a one-way section for the purpose of this study, and the narrower portion of the river comprised between the upstream end of the North Channel and the Ville Guay site (see Figure 5.1b). This latter stretch is considered a two-way channel.

The Pointe Saint Denis and Gros Cacouna sites are not submitted to limiting conditions since they are located in much wider areas of the river.

The results of these calculations lead to the following conclusions :

- 1) PIANC recommendations would be more severe than SIGTTO and TERMPOL guidelines;
- 2) For a one-way waterway, the North Channel width (300 m) exceeds the minimum value as calculated according to PIANC recommendations;
- 3) As can be seen on Figure 5.1 b, the minimum width of the waterway section along Île d'Orléans is generally 700 m. This width largely exceeds the 519 m minimum value calculated according to PIANC for two-way traffic;
- 4) As discussed in Section 5.2, the width may reduce under certain sag conditions of the 735 kV power line crossing. The effect of this reduction is believed to be acceptable but would have to be assessed more thoroughly from a pilotage viewpoint.

Despite this last comment, we may conclude that the existing waterway offers safe navigation conditions under the most stringent international specifications applicable today.

**Table 6.1 – Preliminary determination of minimum waterway width in the narrowest portions of the St. Lawrence waterway (according to PIANC)**

Criterion	North Channel (exposed waterway, one-way, no crossing allowed)			Between North Channel and Ville-Guay (sheltered waterway, two-way, crossing allowed)		
Manoeuvrability	fair	1 x 1,5 B	1,5 B	fair	2 x 1,5 B	3,0 B
Velocity	High (> 12 kn)	1 x 0,1 B	0,1 B	Medium (8-12 kn)	2 x 0,0 B	0,0 B
Prevailing cross wind	Low (< 15 kn)	1 x 0,0 B	0,0 B	Low (< 15 kn)	2 x 0,0 B	0,0 B
Cross current	Low ( 0,2-0,5 kn)	1 x 0,1 B	0,1 B	Low ( 0,2-0,5 kn)	2 x 0,1 B	0,2 B
Longitudinal current	High (>3,0 kn)	1 x 0,1 B	0,1 B	Medium (1,5-3,0 kn)	2 x 0,1 B	0,2 B
Waves	3 m > Hs > 1 m	1 x 2,0 B	2,0 B	Hs < 1 m	2 x 0,0 B	0,0 B
Navigation Aids	Good	1 x 0,1 B	0,1 B	Good	2 x 0,1 B	0,2 B
Sea bottom Type	granular	1 x 0,1 B	0,1 B	granular	2 x 0,1 B	0,2 B
Waterway depth	< 1,25 x draft	1 x 0,2 B	0,2 B	< 1,25 x draft	2 x 0,2 B	0,4 B
Risk due to type of payload	High	1 x 1,0 B	1,0 B	High	2 x 0,8 B	1,6 B
Crossing distance	No crossing	1 x 0,0 B	0,0 B	With Medium ship speed	2 x 1,4 B	2,8 B
Distance to shores	Mild waterway slopes	1 x 0,7 B	0,7 B	Steep shores, presence of infrastructures	2 x 1,0 B	2,0 B
Minimum channel width required	5,9 B = 5,9 x 49 = 289 m			10,6 B = 10,6 x 49 = 519 m		

B : breadth of design ship = 49 m

### 6.3 COMPARATIVE ANALYSIS OF THE CURRENT PROJECT

Tables 6.2 a and 6.2 b present, in a summarized format, a comparative analysis of the 3 sites, considering all technical, public safety and environmental aspects described previously. The socio-economic issues are not discriminating and are therefore not detailed in the tables. These issues shall however be fully addressed in the impact assessment studies of the project, during the feasibility stage.

In Tables 6.2 a and b, the most significant positive points (advantages) are highlighted in light shaded areas whereas the most significant drawbacks are in darker shaded areas.

The Ville Guay site appears to be the one that offers the most interesting conditions as a whole:



- being located close to the Port of Quebec, an area where there are already intensive navigation activities all year round, it is an area for which pilots consulted in the course of this study have shown good knowledge and have expressed positive opinions;
- the icebreaking and tugboating services are close at hand in Quebec City, since this is the Canadian Coast Guard's regional base and Ocean Group's headquarters. This appears to be an important advantage since these services are essential to ensure the reliability and effectiveness of commercial maritime operations in general;
- the general climatic and hydrodynamic conditions make this site more sheltered than the others;
- it is also the preferred site from an environmental viewpoint;
- it is the site for which both construction and operational costs are the lowest;
- the main concern about this site is the public perception relative to the safety of neighbouring populations close to an LNG operation. We understand that an in-depth risk assessment study will be carried out by experts as part of the feasibility analysis.

Gros Cacouna could also be an acceptable choice, although it presents some disadvantages:

- the tugboating service is complicated and expensive, due to the distance between Gros Cacouna and Quebec City where the closest tugboat fleet is based. The preliminary calculations presented in Chapter 5 demonstrate the very important effect of this distance on regular service cost. The reliability and flexibility of the tugboating service can also be affected.

As an alternate approach, a dedicated fleet of 4 tugboats exclusively to servicing the LNG vessels may be acquired. However the acquisition costs are very high, on the order of \$ 15 M per unit, for a total of about \$ 60 M. Adding the operating costs of a dedicated fleet for only one LNG vessel arrival per week, this solution appears to be non viable;

- icebreaker assistance may also necessitate longer delays; despite regular trips to Cacouna, as required by current traffic requirements, icebreakers do not maintain a permanent presence there;
- climatic conditions may be somewhat more restrictive, from an operational viewpoint, than the Ville Guay conditions. Based on a preliminary assessment of the various data available, and assuming 104 ship arrivals / departures at the terminal per year, delays in berthing /

unberthing manoeuvres would be expected approximately 14 to 16 times per year due to strong wind, ice accumulations or poor visibility conditions.

This preliminary evaluation of climatic conditions could be determined more accurately, at the feasibility stage, by including refraction effects in a complete wave climate analysis, by assessing more thoroughly the ice dynamics issue and by conducting an extensive study of all available Environment Canada's datasets on visibility distances (these are not readily available and would have to be purchased from Environment Canada).

A value of 5% for acceptable downtime has been used as a preliminary guideline in the current study. Based on this value, Gros Cacouna would hardly meet the reliability target of the marine terminal;

- construction and operational costs are significantly higher than at Ville Guay.

As to the Pointe-Saint-Denis site, it is obviously the least interesting on all aspects.

#### **6.4 COMMENTS ON THE ENVIRONMENTAL ASPECTS**

Table 6.2 b presents the advantages and disadvantages of each of the proposed sites for the installation of the LNG tanker terminal with respect to environmental concerns. The comparative analysis focused on the real loss of habitat. The next stages will involve validating the scope of habitat loss, negotiating and obtaining authorization from the relevant authorities and identifying contamination risks for known habitats.

The Ville Guay site emerges as one of the preferred alternatives, especially with regard to the biophysical environment since there is no major habitat loss, no legal wildlife habitats, stable riverbanks, neutral sediment balance, and less risk of sediment contamination than in middle estuary. However, assessments of the landscape values, specifically by environmental groups (GIRAM), could pose stumbling blocks for the project, even though the special land uses of the site will be preserved. Local residents may well object to the project particularly if expropriations are required. The insular community of Ile d'Orléans, which is very protective of its landscape, could also raise objections. Moreover, the fact that the site borders on an ecologically valuable territory in the Bellechasse RCM leads us to believe that there would have to be negotiations/discussions with RCM authorities.

Gros Cacouna also ranks as a preferred site but its strengths and weaknesses are opposite to those of Ville Guay. It is rich in terms of its biophysical environment, particularly in the salt marsh area at the southeast end of Gros Cacouna Island, not very far from where the target site is

located. The local residents have been waiting for a project of this type for some time, so they would almost certainly support the project to install the LNG tanker terminal. The Gros Cacouna sector has been subject to a number of anthropogenic disturbances since 1965, including backfilling of intertidal marshes, dredging, etc. Cliff materials from its western section are used for the production of cement by Ciment Québec. The bird populations in the sector have therefore already been somewhat affected by human activities. Given the island's maximum elevation of 89 m, the tanks would more than likely be hidden from residents on the south part of the island, hence integrating the project with the landscape would be less of an issue. The marine terminal project would be consistent with land use on the island, and would not lead to any loss in intertidal zones or fish habitats.

This site has a considerable number of significant wildlife species (to be considered in the development of the emergency plan). The intertidal marshes are the most significant environmental component on the site, but no marsh areas will be lost because the project will be carried out in deep water.

The Pointe-Saint-Denis ranks as the least desirable. It is a site of considerable esthetic and ecological interest. There is no significant environmental advantage associated with this site, just the higher turbidity levels associated with the silt plug in the river estuary, which would be an advantage for the dredging operations (dredging requirements would have to be confirmed). There is concern that the type of substratum present will cause river erosion problems.

The Pointe-aux-Iroquois and Pointe-aux-Orignaux sites have intact intertidal marshes and are recognized as vulnerable wildlife concentrations areas (high to advanced level). As noted earlier, building the terminal at this location would require building a 3 km long pier. An area used intensively by belugas is located 2 km from the site, hence the risk of disturbance is significant.

Moreover, this marine structure would disturb the bucolic nature of the countryside where there are many summer cottages. There are a number of established eel fishing sites in the sector; hence the activities of some fishermen would be disrupted. These are concerns that could well lead to the local residents' objecting to the installation of the LNG terminal.

TABLE 6.2 (a) - COMPARATIVE ANALYSIS OF SITES UNDER STUDY - TECHNICAL ASPECTS

		Ville Guay		Pointe-Saint-Denis		Gros-Cacouna	
		advantages	drawbacks	advantages	drawbacks	advantages	drawbacks
Physical conditions	Topography		High cliff (70 m) along the river	Flat landscape		Flat landscape, existing plateau for land-based facilities	
	Bathymetry	-15 m water depth approximately 250-300 m from shoreline			Very mild slope on tidal flat; 3 km to reach -15 m at low tide	-15 m water depth approximately 200 m from shoreline	
	Waterway		Due to its width, the North Channel is a one-way waterway	No restrictions to access the site		No restrictions to access the site	
Climatic and hydrodynamic conditions	Winds	Less severe condition among three sites, somewhat protected			Conditions unknown to pilots		Strong wind from NW during winter months. May create difficult navigation conditions at terminal (wind + ice). Wind conditions may cause occasional delay to berthing / unberthing operations (8 times per year expected).
	Waves	Not an issue, relatively protected			Conditions unknown to pilots		Longer 7-8s period waves may cause occasional adverse conditions for unloading operations
	Tidal currents	Low current velocities		Low current velocities		Low current velocities	
	Ice	Dynamic tidal currents help clear the ice; conditions similar to Ultramar-30 yrs successful operating experience; active icebreaker maintenance near Quebec			Little knowledge of conditions; higher probability for batture floe impact	Ice generally cleared by tidal currents; Some operating experience due to occasional presence of CCG	Ice may accumulate along shore under sustained NW wind. Delay to berthing / unberthing operations expected 3-4 times per winter season.
	Visibility		Fog may cause delay to berthing / unberthing manoeuvres 1-2 times per year		Fog may cause delay to berthing / unberthing manoeuvres 2-3 times per year		Fog may cause delay to berthing / unberthing manoeuvres 3-4 times per year
	Navigation conditions	Pilots have good knowledge of navigation conditions in Port of Quebec area.			Conditions unknown to pilots		Pilots express some concerns for occasional severe ice/wind combination with wind from NW
	Port terminal	Geotechnical	Adequate bearing capacity for gravity type structure (caissons)			Bearing poor to fair, Requires pile foundation.	Fair bearing capacity for gravity type structure (caissons)
Seismicity		Moderate seismic exposure; less severe condition among the 3 sites			Very severe seismic exposure		Severe seismic exposure
Port Infrastructure			Proximity of power line crossing		Very costly due to geotechnics, seismicity and length of access jetty		More costly than Ville Guay due to more severe seismic condition
Public Safety	Risk Assessment	(to be carried out)		(to be carried out)		(to be carried out)	
Cost	Studies, permitting, engineering, construction supervision	\$ 3,75 M			\$ 7 M		\$ 4 M
	Construction (CAPEX)	\$ 49 M			\$ 128 M		\$ 55 M
	Operations (OPEX)	\$ 7,2 M / yr.			\$ 11,1 M / yr		\$ 11,3 M / yr

significant advantage  
 significant drawback

Table 6.2 (b) - COMPARATIVE ANALYSIS OF SITES UNDER STUDY - ENVIRONMENTAL ASPECTS

		Ville Guay		Pointe-Saint-Denis		Gros-Cacouna		
		advantages	drawbacks	advantages	drawbacks	advantages	drawbacks	
Physical environment	riverbank erosion	stable profile			potential erosion		crumbly cliff	
	sediment quality	no accumulation of contaminated sediment			possible accumulation of contaminated sediments due to high turbidity of water in this region		possible accumulation of contaminated sediments due to high turbidity of water in this region	
	riparian vegetation	limited development	established grass beds located + 6.0 km upstream (<*)	the main recognized salt marshes are at least 15 km away	presence of intact salt marshes in coves (*)	northwestern section has no intertidal marshland	presence of continuous salt marsh with considerable ecological value; marsh to be protected according to UQCN	
Biological environment	fish				Ouelle River only salmon river in middle estuary (7 km)	no spawning sites north of island		
	migration		eel and shad		eel and shad		eel and shad	
	fry rearing		6 species in western end of study sector (some 2 km upstream)					
	spawning		potential sites for three species 2.5 km and 6.5 km upstream, potential of Lallemand Stream 3 km upstream		rainbow smelt and herring in Ouelle River (7 km upstream)	no spawning site on north shore of island		
	marine mammals	no use			area used intensively by belugas 2 km opposite; seal ledge 10 km downstream (*)		area used intensively by belugas 2 km away; one of the main seal ledges in the middle estuary 2 km away; upstream limit of minke whale	
	birds		study sector is not a IBA, nor a concentration area for at risk waterfowl (closest such site is 6 km away)	IBA 6.5 km upstream		concentration site for vulnerable wildfowl (high and superior value); colony site 9 km downstream (*); 1 trip per wk should have little effect		exceptionally rich bird fauna (IBA) for 2 km of sea and 10 km stretch along shoreline; concentration site for vulnerable waterfowl (high to superior value); northwestern cliffs shelter colonies of black guillemot (*)
				staging area for migratory birds 2 km downstream				
	rare or threatened plant species		7 species 3 km upstream 3 species at Anse-aux-Sauvages (6.5 km upstream)	no occurrences according to CDPNQ in study sector or in the vicinity			Mention of rare plant species to northeast (1 km away)	
	rare or threatened wildlife species			potential rainbow smelt spawning sites 2.5 (Lallemand Stream) and 6.5 km upstream				Presence of rare and at risk bird species (*); 1 trip per wk should have little effect
				actual rainbow smelt spawning sites from 7 km downstream				
			river edge is migration corridor for eel and shad		eel and shad		eel and shad	
land use	industrial port land use for Desjardins RCM	ecological use for neighbouring RCM				respect for special land use in western part of island	main part of wildlife area	
Human Environment	historical/archaeological elements		eel weir				presence of prehistoric archeological sites on Gros-Cacouna Island. Any discoveries of archeological remains must be reported immediately.	
	proximity to water intakes and municipal outfalls	present 7 km to west						
	acceptability for local population		GIRAM defines landscape as highly sensitive		several eel weirs; concern about negative impact on fishers	people waiting for such a project for a long time; a number of existing anthropogenic disturbances	several eel weirs; many recreational, educational and ecological activities associated with area	
	integration with landscape		must not disturb general landscape, which is defined as exceptional for the neighbouring RCM		undisturbed bucolic landscape	Cacouna Island would hide tanks; central area of island has been subject to numerous anthropogenic disturbances		
	project's socio-economic effects	industrial-port development considered priority for regional economic development				project will represent major economic growth for the region		
	REPORT	+			-	±		

significant advantage

significant drawback

\*: anticipated habitat loss