TP 15481E
(03/2022)

TERMPOL Review Report for the ENERGIE SAGUENAY Project

1st EDITION

MARCH 2022

Responsible Authority	Approval
The Director General, Marine Safety and Security is responsible for this document, including any changes, corrections, or updates..	**Julie Gascon** **Director General,** **Marine Safety and Security** **Transport Canada** Rogers, Sean Digitally signed by Rogers, Sean Date: 2022.06.29 17:19:49 -04'00' **Signature Date:** _____

Original Release Date: **Revised Date:**

TP 15481E
(03/2022)

DOCUMENT INFORMATION

Title	**TERMPOL Review Report for the ENERGIE SAGUENAY Project**		
TP nº	**145481F**	**Edition**	**RDIMS # 18518181**
Catalogue Nº		**ISBN**	**978-0-660-39021-5**
Author	Marine Safety Executive Secretariat (AMSI) Place de Ville, Tower C 330 Sparks St. 11th floor Ottawa (Ontario) K1A 0N8	**Telephone**	1-855-859-3123 (Toll free) or 613-991-3135
		Email	tc.mssquestions-questionsssm.tc@tc.gc.ca
		URL	http://www.tc.gc.ca/securitemaritime/

TABLE OF AMENDMENTS

Last revision

Next revision

Revision nº	Date of publication	Amended pages	Author(s)	Short description of the ammendment

1.0 FOREWORD

GNL Québec is a Quebec-based liquefied natural gas plant project development, construction, and operation company headquartered in Saguenay in the province of Quebec. The company's mission is to produce liquefied natural gas from a complex supplied with Canadian natural gas and using Quebec hydroelectricity as part of its cooling process.

GNL Québec is developing the Énergie Saguenay Project ("The Project"), which consists of the construction and operation of a natural gas liquefaction complex over a period of 25 to 50 years intended primarily for export ("The Complex "). The Complex will have a nominal annual production capacity of 10.5 Mtpa[1] of GNL. It includes process facilities for liquefying and storing LNG and marine infrastructure for docking tankers and loading the product on board for export.

The Project is located in the industrial-port zone of the Saguenay Port Authority (SPA) in the administrative region of Saguenay–Lac-Saint-Jean (02), within the limits of the borough of La Baie de la Ville de Saguenay. The marine facility of the Project is located in the navigable waters under the jurisdiction of the SPA.

The TERMPOL Review Report for GNL Québec's Énergie Saguenay Project was prepared in consultation with representatives of the following departments and authorities:

- Transport Canada
- Canadian Coast Guard
- Laurentian Pilotage Authority
- Ministère des Transports – Gouvernement du Québec
- Saguenay Port Authority
- Corporation of Lower St. Lawrence Pilots

This report that was produced by the TERMPOL Review Committee (TRC), should not be taken as a statement of government policy nor should it be construed as government endorsement of the report in whole or in part. It only reflects the opinion of the members of the TERMPOL Review Committee.

This report does not relieve GNL Québec and its partners of their obligation to respect the laws and the application of the regulations in force.

DISCLAIMER: The English version is a translation of the original in French. In case of any inconsistency or ambiguity, the French version shall prevail.

[1] Mtpa: Millions of tons per year.

TABLE OF CONTENTS

2.0 SUMMARY

GNL Québec proposes to build a natural gas liquefaction industrial complex in the industrial-port zone of the Port de Saguenay with the aim of exporting 11 million tonnes of liquefied natural gas (LNG) per year from 100% Western Canadian supply sources.

The natural gas will be transported from Western Canada through a 750km gas pipeline to be built. Gazoduq Inc. is the proponent of this new infrastructure.

The marine terminal will have two piers designed to accommodate 165,000 m^3 vessels to 180,000 m^3 capacity. The entire project aims to be up and running in 2026.

It should be noted that only the construction of the maritime terminal is subject to the TERMPOL analysis process, and the construction of the liquefaction complex and the gas pipeline are excluded. The TERMPOL analysis process is a voluntary process to which the proponent has submitted.

The marine terminal and liquefaction complex construction project was subjected to the environmental assessment analysis process of the Impact Assessment Agency of Canada (IAAC) at the federal level. The project was also subjected to an environmental assessment by the Government of Quebec under the Environmental Quality Act, led by the Ministère de l'Environnement et de la Lutte contre les changements climatiques (MELCC). The Bureau d'audiences publiques sur l'environnement, the BAPE, was responsible for consulting the public during this process.

This report contains 29 findings and 56 recommendations to enhance terminal operational safety and marine safety throughout the study area.

The TRC "**recommendations**" are proposed measures to improve safety beyond the regulations in force. As such, they relate to items that the promoter can control. "Findings" are observations made to indicate, reinforce, or comment on the main commitments made by the proponent. They are sometimes used to highlight already applied measures, or to note an item related to a particular program or regulation.

TRC members expect that all the recommendations contained in this report will be implemented.

All TRC findings and recommendations are listed in **Appendix 1**.

3.0 INTRODUCTION

3.1 PROJECT CONTEXTE AND DESCRIPTION

The Project involves the construction and operation over a period of 25 to 50 years of a natural gas liquefaction complex intended primarily for export ("The Complex"). The Complex will have a nominal annual production capacity of 10.5 Mtpa of LNG.

The complex includes liquefaction process facilities, LNG storage and marine infrastructure for the berthing of tankers for LNG loading purposes.

The Project's marine infrastructure, consisting of two piers, is located in the navigable waters of the Saguenay River under SPA jurisdiction.

These GNL Québec marine infrastructures will accommodate three to four tankers with a capacity of 165,000 m^3 to 180,000 m^3 each per week. These vessels will be loaded at a rate of 12,000 m3/hour.

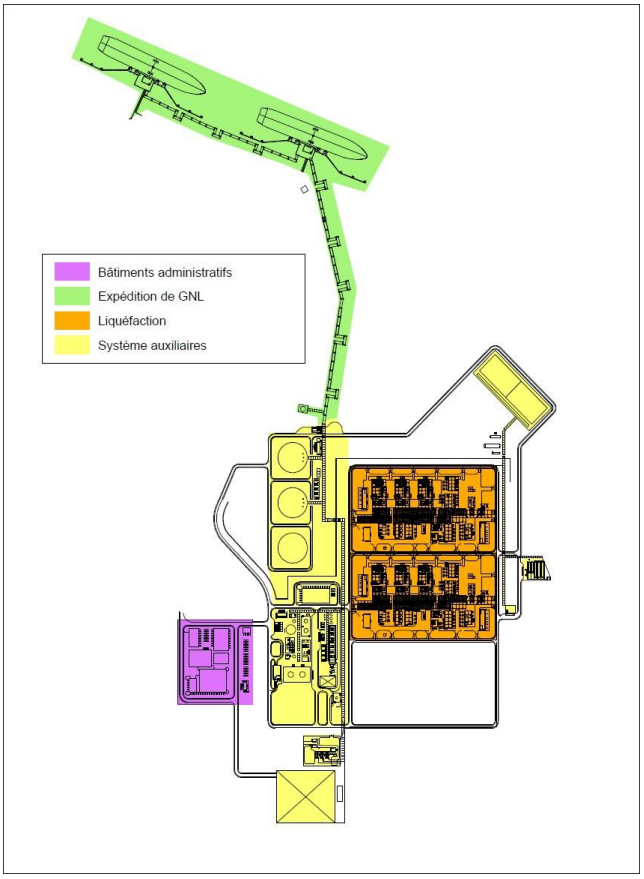


Figure 1 Liquefaction plant and LNG marine terminal

3.2 TERMPOL REVIEW PROCESS

TERMPOL refers to the technical review process for marine terminals and transshipment locations. The TERMPOL guidelines are described in the TERMPOL Review Process, 2019 Edition (TP 743)[2].

TERMPOL is a voluntary review process available to companies (proponents) wishing to construct and operate a marine terminal for the bulk handling of hydrocarbons, chemicals, and liquefied gases. The review focuses on the parts of a project associated with marine transportation when a vessel enters Canadian waters, navigates canals, approaches the docks of a marine terminal, and loads or unloads oil, gas or bulk chemicals.

The objective of this process is to improve proposal items which could, in certain circumstances, compromise the integrity of the vessel's hull and/or the cargo storage system on board during transits or during cargo transfer at the terminal.

As part of the TERMPOL process, the proponent submits TERMPOL studies set out in TP 743 to:

- Highlight the major dangers presented by the proposed operation;

[2] https://tc.canada.ca/en/marine-transportation/marine-safety/termpol-review-process-2019-edition-tp-743-e

- Assess the risks associated with these dangers;
- Determine ways to reduce risks to an acceptable level using best available technologies and practices.

As part of the technical review process, the proponent works with a TERMPOL Review Committee (TRC) chaired by Transport Canada and which is composed of members from federal departments and authorities with relevant expertise or responsibilities.

The TERMPOL Review Committee reviews the proposal and considers the following:

- Studies, surveys, and technical data presented in support of TP 743;
- Current and planned national and international regulations to ensure that vessels are operated safely;
- Current shipping activities along the proposed shipping route.

The proponent considers a range of topics, including the following:

- Navigational safety of the design vessel‘s route(s);
- Services available to help with safe navigation, such as:
    - fixed and floating aids;
    - vessel traffic services; and
    - electronic position tracking systems.
- Requirements for pilotage, tug escort and radio communications along the route(s);
- If the design vessel is well suited to navigating the proposed route(s) and docking at the design vessels’ berth;
- Operational safety of the design vessel’s cargo containment and handling;
- Adequacy of the design vessel’s berth and related terminal service requirements;
- Possible effects of increased shipping activity on regional shipping networks, including fishing, recreational boating and vessels not required to carry an automatic identification system (AIS);
- Concerns related to pollutant cargoes carried by the proponents vessels;
- Risks to communities along the route(s); and
- Marine contingency planning, pollution prevention measures and emergency response.

The committee reviews the TERMPOL submission and delivers a report that includes:

- A summary, analysis, findings, and recommendations; and
- Reports on specific topics, to consider location-specific circumstances.

The success of the TERMPOL Review Committee (TRC) depends on the proponent’s compliance with TP 743 procedures and the quality of the data submitted to the TRC. The proponent is responsible for ensuring that the studies can meet international and industry standards.

The TERMPOL review process does not supersede the safety, security, and environmental requirements of any applicable law or regulation and is not a project approval or rejection process.

For the reader’s benefit and information, GNL Québec's Énergie Saguenay project was subjected to the Impact Assessment Agency of Canada (Agency) assessment process under the *Canadian Environmental Assessment Act, 2012* under Environment and Climate Change Canada. Similarly, this project was also subjected to an environmental assessment by the Government of Quebec under

the *Environmental Quality Act* conducted by the Ministère de l'Environnement et de la Lutte contre les changements climatiques. The BAPE was responsible for public consultation in this process.

An application for approval under the Canadian Navigable Waters Act (CNWA) must be filed with TCMSS before work begins.

This TERMPOL Review Report is not a statement of government policy, or a statement of government endorsement of the project under review. TRP is not a regulatory process, so the report's findings and recommendations are not binding. The proponent may act on any recommendation.

3.3 TERMPOL REVIEW SCOPE

The TERMPOL Review Process (TP 743) specifies the maximum possible scope of assessment of vessel safety and the risks associated with vessel navigation and operation.

After consultation with the TRC, the proponent has opted for the scope that best suits the project taking into account the existing marine transportation activities and particular conditions. This review:

- Focuses primarily on vessel safety and their operation on the shipping routes proposed in the area bounded by:
  - Les Escoumins pilot station;
  - The marine terminal;
  - The Rasades anchorage area.
- Reviews vessel characteristics to be used in the proposed facilities for the project, including the proposed route, seaworthiness, other waterway users, and marine terminal operations associated with project LNG tankers;
- Reviews shipping activities within the context of the current marine regulatory regime, programs, and services; and
- Takes into account new measures that may be in effect once the project begins its activities.

Figure 2 Location of the GNL Québec Énergie Saguenay Project

The assessment provides federal departments, agencies, and the proponent with the opportunity to address new or changed issues, questions, or priorities relating to the marine transportation aspects of the project.

3.4 ÉNERGIE SAGUENAY PROJECT REVIEW METHODOLOGY

On December 21, 2017, GNL Québec officially requested a TERMPOL Review for its natural gas liquefaction complex project located near the Grande-Anse (Port Saguenay) marine terminal facilities of the Administration in the borough of La Baie of the city of Saguenay in Québec.

Following discussions, an agreement was reached between TCMSS Regional Management and the proponent on December 31, 2018.

During 2019, the following studies relating to the TERMPOL review process were filed by the proponent and communicated to TRC members:

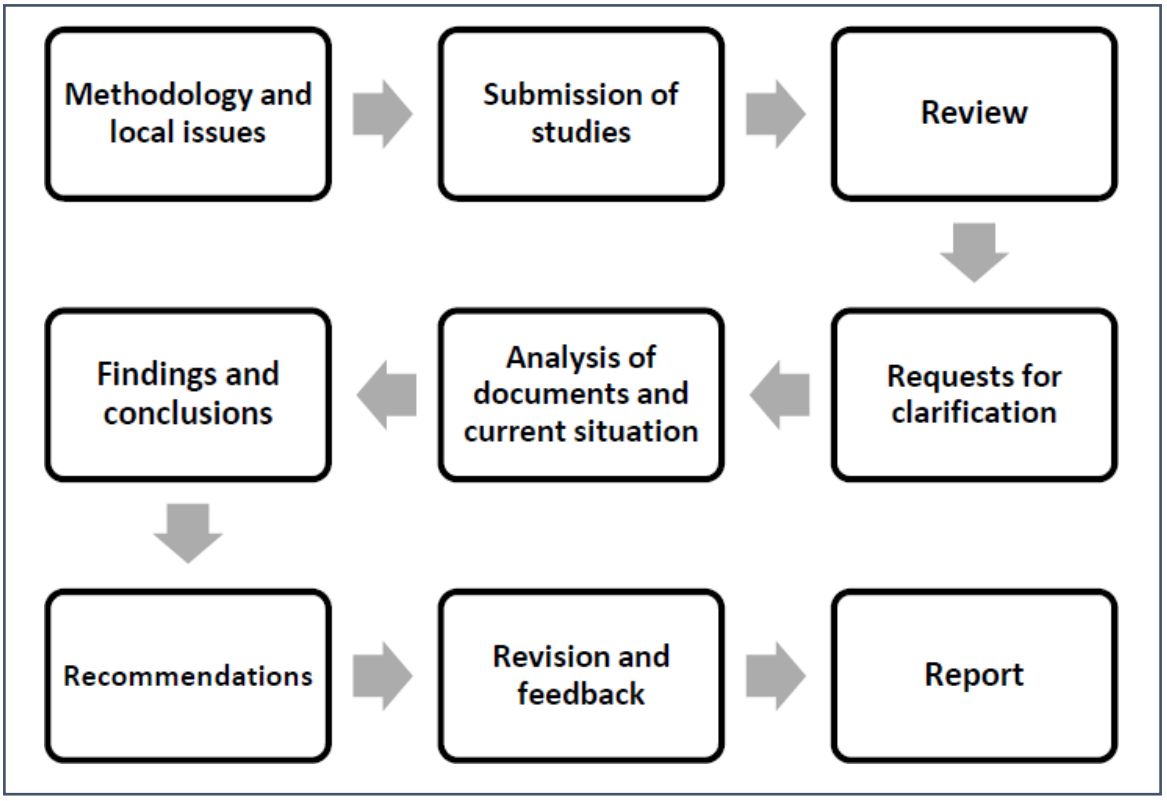
- Introduction
- Marine traffic
- Vessel and navigation
- Terminal and transfer
- Risk analysis
- Manuals

Under the provisions of TP 743, TCMSS has established a TRC[3] (TERMPOL Review Committee) comprising representatives of various departments and agencies below with responsibilities for marine regulations, programs, and services.

- Transport Canada – Marine Safety & Security (TCMSS)
- Saguenay Port Authority (SPA)
- Laurentian Pilotage Authority (LPA)
- Canadian Coast Guard (CCG)
- Ministère des Transports du Québec (MTQ)
- Ministère de la Sécurité publique du Québec (MSPQ)

The analyses, comments, findings, recommendations, and opinions contained in this report are based on the information provided by the GNL Québec proponent and on the documentation and technologies existing at the time of its writing.

[3] https://tc.canada.ca/en/marine-transportation/marine-safety/termpol-review-process-2019-edition-tp-743-e#2


Methodology and local issues
Submission of studies
Review
Requests for clarification
Analysis of documents and current situation
Findings and conclusions
Recommendations
Revision and feedback
Report

4.0 INDIGENOUS COMMITMENT

Prior to each TERMPOL analysis process, the TRC encourages proponents to consult directly with Indigenous groups whose rights may be affected by the project in order to prepare TERMPOL studies.

Although the TERMPOL process is a non-regulatory and voluntary process, proponents initiating this process are invited to implement an information and consultation process with Indigenous community members.

This process provides the opportunity to study important topics of particular interest to the First nations allowing at the same time to appreciate the specific skills of Autochthonous in the field which of course is an addition to the marine safety evaluation.

As proposed by the proponent, the marine terminal site is located on the Nitassinan common (southwestern part) of the three Innu First Nations of Essipit, Pekuakamiulnuatsh of Pessamit, and in Niowentsio, as stated by the Huron -Wendat Nation.

Vessels called to serve this terminal will transit through the exclusive Nitassinan of the Essipit Innu First Nation; the exclusive Nitassinan of the Pekuakamiulnuatsh; the exclusive Nitassinan of the Innu First Nation of Pessamit; the Nitassinan common (southwestern part) of the three Innu First Nations of Essipit, the Pekuakamiulnuatsh of Pessamit; and the Wolastokuk, ancestral territory as stated by the Wolastoqiyik Wahsipekuk First Nation (Maliseets).

As part of this TERMPOL review process, the following First Nations affected by the shipping routes and marine terminal have been invited to participate in this exercise:

- Essipit Innu First Nation;
- Pekuakamiulnuatsh First Nation;
- Innu of Pessamit First Nation;
- Wolastoqiyik Wahsipekuk First Nation (Maliseets); and
- The Huron-Wendat Nation.

4.1 COMMITMENT ACTIONS

In parallel with the TERMPOL process, the project was submitted to both the Bureau d'audiences publiques sur l'environnement (BAPE) and the Impact Assessment Agency of Canada (IAAC) for analysis. During both processes, the above-mentioned Indigenous Nations were invited to express their views on issues relating to their communities.

From the start of the project in 2014, the proponent began to consult with these Indigenous groups[4].

The proponent has kept a log[5] of consultations and discussions on its website on issues and concerns associated with the project that are specific to the Innu First Nations, and that include the communities:

- Pessamit;
- Essipit;

[4] https://iaac-aeic.gc.ca/050/documents/p80115/140891E.pdf
[5] https://energiesaguenay.com/fr/premieres-nations-innues/

- Pekuakamiulnuatsh.

In February 2020, the proponent presented its policy for reducing the impacts of its project on the environment to the First Nation Councils of the Essipit Innus, the Pessamit Innus, and the Pekuakamiulnuatsh. The proponent has confirmed the adoption of its commitment charter for the protection of marine mammals. According to the proponent, this charter of concrete commitments is based on four pillars:

1. The adoption of best practices in marine navigation;
2. The advancement of scientific knowledge and technological innovations, in particular through the establishment of a Sound Savings Program;
3. Raising awareness among users of the fjord;
4. Consultation with local waterway users.

Throughout the TERMPOL review process, the TRC worked with the GNL Québec proponent to ensure that information about its TERMPOL project process is transmitted to First Nations.

In 2021, the TRC made a last survey of the First Nations concerned to inquire about their concerns raised and present them with a summary of the draft TERMPOL report.

Similarly, TCMSS has met with these First Nations on different occasions to provide sufficient marine safety information and explain the TERMPOL review process to enable them to better understand its scope.

4.2 PROJECT CONCERNS

In its correspondence addressed to the proponent in July 2020, the Innu First Nation Council raised questions and issued comments on the project related to:

- The characteristics of goods transported on the Saguenay;
- The density of marine traffic and prospects for marine development;
- Equipment on board vessels and within marine facilities and their safety; and
- Marine navigation and its hazards.

The other First Nations consulted did not raise any issues with the TERMPOL analysis. However, the Innu Nations informed TCMSS that they were withdrawing from the consultation, being unfavorable to the project proposed by GNL Québec.

At the end of the process, a draft version of the recommendations of this report was shared with Indigenous representatives by TCMSS prior to publication.

Finding 1. The GNL Québec proponent has expressed its willingness to consult the First Nations whose rights could be affected by the Énergie Saguenay project in order to discuss specific issues related to marine transport resulting from the project's operations.

Finding 2. In May 2021, through their respective Councils, the Innu First Nations of Essipit, Pekuakamiulnuatsh and Pessamit officially expressed their disagreement with GNL Québec's Énergie Saguenay project. Since then, they have no longer participated in the various initiatives proposed by the proponent as part of the TERMPOL study.

Recommendation 1. TRC members recommend that GNL Québec continue to:

- Consult First Nations during the construction of its facilities and their operations;
- Respond to their concerns; and
- Integrate indigenous knowledge into the completion of the project.

5.0 ANALYSIS

5.1 INTRODUCTION

These TERMPOL analyses focus on the following items:

- Vessels;
- Their shipping routes to or from the terminal; and
- The terminal and the Terminal-Vessel interface.

In terms of operation and safety, the merchant vessels of the world fleet, whatever their type, are governed by national and international practices, rules, conventions, regulations, and laws.

In Canada, the *Canada Shipping Act, 2001* (CSA 2001) governs shipping safety as a whole, and the *Pilotage Act* governs compulsory pilotage areas.

The documents filed by GNL Québec are studied and analyzed to ensure that:

- The proposed safety management system complies with recognized procedures;
- Provisions are made for ongoing audits of the safety and management system;
- The main accident risks relating to the planned operation have been identified; and
- Risks have been assessed and measures have been taken to reduce these risks to an acceptable level using the best practices and available technologies.

Finding 3. TRC members recognize that GNL Québec and the competent authorities will have to discuss the deadlines set for following up on the recommendations described in this report.

Recommendation 2. TRC members recommend that GNL Québec notify the competent authorities if it plans to amend parts of the project, operational criteria, or characteristics, so that authorities can examine the repercussions of the safety amendments, if any.

Recommendation 3. TRC members recommend that GNL Québec, together with the SPA, file the studies relating to terminal operations within six months preceding the start of operations.

5.2 VESSEL INFORMATION

5.2.1 GENERAL

According to the GNL Québec proponent, the terminal will be designed to accommodate LNG tankers with a capacity ranging from 125,000 to 217,000 m3. However, in the operational phase, the terminal will be used by *membrane*-type vessels with a capacity of 178,000 m3, similar to the reference vessel mentioned in appendix 3, the *CASTILLO DE MERIDA*.

The table below presented by the proponent summarizes the main characteristics of the vessels used for the piers' design.

	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Reference/ Vessel
Capacity (m^3)	125,000	145,000	177,000	130,000	165,000	217,000	178,000
Cargo containment	Moss	Moss	Moss	Membrane	Membrane	Membrane	Membrane
Displacement (Tm)	99,800	110,000	128,700	97,600	114,300	148,700	126,004
LO (m)	283	288	300	280	295	315	297
LBP (m)	270	274	286	266	282	303	284
MB (m)	44.6	49	52	41.6	45.1	50	48.7
Moulded depth (m)	25	27	28	27.6	26.2	31.9	27
Loaded draft (m)	10.8	11.5	11.5	11	11.6	12.3	12.4
Ballasted draft (m)	9.35	9.2	9.5	10.1	9.6	10	9.7

LO: Length Overall

LBP: Length between perpendiculars

MB: Moulded breadth

At the request of the GNL Québec proponent, the Centre de simulation et d'expertise maritime de Québec[6] conducted a series of simulations for the completion of this project.

During these navigation simulations, tankers' and tugs' mathematical models were used.

Finding 4. According to the documents presented by GNL Québec, the vessels' mathematical models used, reflect the characteristics of the tankers called upon to use the envisaged facilities.

Recommendation 4. TRC members recommend that GNL Québec use tugs at least of similar power to those used during these simulations.

[6] https://sim-pilot.com/

5.2.2 VESSEL AND SAFE MANNING STANDARDS

5.2.2.1 VESSEL STANDARDS

Part C of Chapter VII of the 1974 SOLAS Convention, as amended with reference to the IGC Code, lays down the rules relating to the construction and equipment of tankers carrying liquefied gases in bulk.

These bulk LNG tankers are designed to keep the cargo in a liquid state under atmospheric pressure, at cryogenic temperatures of -162°C, with no additional cooling required during transport.

These LNG tankers are equipped with several safety devices as well as a double hull added to insulated tanks.

Under the IGC Code, Chapter 19, LNG, which is methane, can only be carried on board Type 2G tankers as shown in the table below.

Product Name	UN number	Ship type	Independent tank type C required	Control of vapour space within cargo	Vapor detection	Gauging	MFAG table number	Special requirements
Methane (LNG)	1972	2G	-	-	Flammable vapor detection	Indirect or closed type	Emergency measures care guide 620	

According to the IGC code, a 2G vessel is a gas tanker vessel intended for transporting products indicated in chapter 19 of this code, which require significant spill prevention measures.

In light of the studies presented by the GNL Québec proponent, vessels called upon to serve its facilities will be type 2G. This 2G indication will appear on their International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk.

5.2.2.1.1 IN-DEPTH VESSEL REVIEW PROCEDURES (INSPECTION)

The table below succinctly summarizes the obligations and responsibilities of the various parties regarding vessel construction and operation.

Organisation	***Responsibility***	***Obligations***

Proponent / Ship owner	Vessel Operation	• Vessel to be built and its characteristics
		  ○ Vessel type
		  ○ Dimensions and characteristics
		  ▪ Length, width, depth on keel, draft, air draft, deadweight / Capacity
		  ○ Propulsion and autonomy

		• Choice of the shipyard (call for tenders)

Classification society, IACS member	Vessel construction and compliance	• Approval of design and construction plans
		• Development of standards and application of existing standards such as ISO and other applicable standards
		• Provisions of relevant international conventions:
		  o SOLAS Convention
		  o MARPOL Convention
		  o International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention)
		  o Maritime Labour Convention (MLC 2006)
		• Approval of equipment and sea trials prior to delivery
		• Issuance of various certificates required on behalf of the flag State
		• Representation of the flag State (Recognized organisation).

Shipyard	Build and delivery of the vessel according to the provisions of the contract	• Vessel construction according to specifications • Vessel equipment according to relevant conventions and standards • Equipment, and testing on land and on board • Sea trials before vessel delivery • Vessel warranty period
Flag State	Ensure that vessel complies with applicable regulation provisions	• Issue certificates • Conduct inspections according to regulations • Vessel registration
Port state	Ensure that vessel complies with applicable regulations and international convention provisions	• Vessel inspection to ensure its compliance with applicable regulations and conventions.

Regarding inspection, merchant ships are periodically inspected by the following organizations in general, and according to various international conventions:

Flag State

The Flag State Vessel Control program is responsible for ensuring that vessels flying its flag are inspected in accordance with national regulations and, for vessels on international voyages, the appropriate international memoranda, conventions, and protocols that the State has ratified, adopted, or acceded to.

Each State maintains an up-to-date registry of its vessels for tracking purposes. In addition, the State is responsible for taking all other steps necessary to give these instruments full and complete effect to ensure that, from a point of view of safety of life and environmental protection, a ship flying the flag of the state is fit for the service intended.

Following the relevant inspections under the legislation of a State and in accordance with the relevant international conventions to which the State is acceded to, exemption, and/or conformity certificates are issued by the Flag State to vessels flying its flag.

Some countries, such as Canada, delegate a certain number of inspections to recognized organizations through Delegated Statutory Inspection Program. Through this type of program, the flag State authorizes these recognized organizations to inspect and issue the relevant certificates on its behalf to vessels.

Classification Society

Classification societies are private organizations that act as recognized organisations. These companies establish and apply technical norms and standards regarding shipbuilding, monitoring, and operating vessel inspection in accordance with the relevant international conventions and issue the required certificates. Classification societies are IACS[7] (*International Association of Classification Societies*) members.

Port State

Port State Control (PSC) is the inspection of foreign ships in national ports to verify that the condition of the ship and its equipment comply with the requirements of international regulations and that the ship is manned and operated in compliance with these rules.

All foreign commercial vessels entering Canadian waters can be inspected under the Port State Control and under the two Memoranda of Understanding signed by Canada, namely the Paris Agreement (*PARIS MOU*[8]) and Tokyo (*TOKYO MOU*[9]).

PSC inspections are conducted at Canadian ports by designated Transport Canada Marine Safety inspectors. A national database of inspections carried out is kept up to date and inspection reports and detention orders are shared with the international databases of the two above-mentioned memorandums of understanding.

In addition to the inspections cited above, the Government of Canada, through the mandate granted to Transport Canada Marine Safety and Security (TCMSS), requires that all foreign tankers, as defined in International Conventions (i.e., oil tanker, NLS tanker, chemical tanker, combination carrier, tank barge, etc., excluding gas tankers (e.g., LNG and LPG) are inspected on their first visit to Canada and at least once afterwards.

[7] https://www.iacs.org.uk/
[8] https://www.parismou.org/
[9] http://www.tokyo-mou.org/

Other Inspection

In addition, tankers are subject to another more detailed inspection called "*Vetting*" by charterers before any contract of carriage in order to ensure the seaworthiness and safety of the vessel in the broad sense. More specifically, in order to identify the risks for the charterer, this inspection organized them and carried out on their behalf, focuses carefully and in more detail on the following points:

- Vessel
  - Hull
  - Machine
  - Equipment
  - Operating procedures
- Management
  - Technical
  - Commercial
- Crewing
  - Crew
  - Training

Recommendation 5. TRC members recommend that GNL Québec establish a "*Vetting*" inspection program for vessels bound for its facilities. This process should be an integral part of the GNL Québec facilities operating manual.

5.2.2.1.2 INSPECTION AND CERTIFICATION OF VESSELS TRANSPORTING LIQUEFIED GAS IN BULK

The International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk should be issued after the initial survey, or a periodic survey to a gas carrier vessel which meets the relevant requirements of the International Code for the Construction and Equipment of vessels carrying liquefied gases in bulk (IGC Code, IMO Resolution MSC.5(48)).

For compliance purposes and in order to maintain the validity of the international certificate of fitness for the carriage of liquefied gases in bulk, any vessel carrying liquefied gases in bulk shall be inspected periodically.

Below are the visits and inspections required to maintain the validity of this certificate:

- An initial visit before the commissioning of the vessel (interim certificate);
- A five-year visit (renewal certificate of aptitude);
- An intermediate visit (between two five-year visits);
- An additional inspection following an accident or any changes that may affect the validity of the certificate;
- Two dry-dock visits every five years. Subject to certain reservations, one of these two visits can be conducted while the vessel is afloat.

In addition to the above-mentioned requirements, any vessel carrying liquefied gases in bulk must also be subject to inspections and visits under the other regulatory provisions regarding cargo ships.

These certificates are issued either by the flag State, or by a classification society (Recognized Organisation) on behalf of the flag State.

5.2.2.1.3 WINTER NAVIGATION IN THE WATERS OF THE GULF AND ST. LAWRENCE RIVER

Regularly each winter, from December to the end of March, Transport Canada Marine Safety and Security implements its winter navigation SW cooling recirculation requirement for the St. Lawrence River and Saguenay Rivers for vessels sailing west of Les Escoumins.

To do this, TCMS monitors vessels heading to the Quebec region and communicates recommendations to them in order to ensure navigation safety and environmental protection. Vessels and their representatives can communicate on this subject at winternav@tc.gc.ca.

Although Transport Canada Marine Safety does not require that vessels traveling up the St. Lawrence River during the winter have an ice class notation issued by the flag state or a recognized classification society, it does require that the master, shipowner, and charterer ensure that the vessel arrives at the planned destination port safely while the safeguard of human life at sea and environmental protection.

To maintain this state of seaworthiness, the vessel must not only comply with the international conventions in force, but also comply with the provisions of the Canada Shipping Act, 2001 and its related regulations.

CANADA SHIPPING ACT, 2001[10]	
Tool	***Provisions***
Marine Machinery Regulations (SOR/90-264)[11], SCHEDULEVII, Part I (Article 4) Division IV, Item 1 a)	For ships required to operate in ice-covered waters where ice may choke seawater inlets, maintenance of essential sea-water supply shall be maintained by: • diversion arrangements for heated cooling water from main engine and auxiliary generators overboard discharges back to seawater inlet boxes; Note: Vessels fitted with Exhaust Gas Cleaning Systems (EGCS) will need to ensure that the use of these systems does not negatively impact the required amount of cooling seawater for the main engine and auxiliary generators.
Navigation Safety Regulations, 2020 (SOR/2020)[12], Division 6	Mandatory documents: • the latest annual edition of *Notices to Mariners* published by the Department of Fisheries and Oceans Canada; • the document titled *Ice Navigation in Canadian Waters*, published by the Canadian Coast Guard.

[10] https://laws-lois.justice.gc.ca/eng/acts/c-10.15/
[11] https://laws-lois.justice.gc.ca/eng/regulations/SOR-90-264/page-10.html
[12] https://laws-lois.justice.gc.ca/eng/regulations/SOR-2020-216/

Recommended Documents	Winter Navigation on the St. Lawrence River and the Gulf of St. Lawrence - Practical guide for Marine Engineers and Deck Officers (TP14335), (2009 edition). Winter Navigation on the St. Lawrence River and Gulf of St. Lawrence - Practical guide for Marine Engineers and Deck Officers (TP 14335), (Edition 2011 edition). Available only at winternav@tc.gc.ca

Provisions of certain chapters of the 1974 International Convention for the Safety of Life at Sea (SOLAS)[13]	
Tool	***Provisions***
Chapter 1, Regulation 11	**Maintenance of conditions after survey** The condition of the ship and its equipment shall be maintained to conform with the provisions of the present regulations to ensure that the ship in all respects will remain fit to proceed to sea without danger tot he ship or persons on board
Chapter II-1, Part C, Regulation 26	**Machinery installations / General** 10.Operating and maintenance instructions and engineering drawings for ship machinery and equipment essential to the safe operation of the ship shall be written in a language understood by those officers and crew members who are required to understand such information in the performance of their duties.
Chapter V – Navigation safety Regulation 34	**Navigation safety and avoidance of dangerous situations** 2. The voyage plan shall define a route that: a) takes into account, any relevant ship's routeing systems; b) ensure sufficient sea room of the ship throughout the voyage; c) anticipates all known navigational hazards and adverse weather conditions; and d) takes into account applicable, the marine environmental protection measures and avoids as far as possible, actions and activities which could cause damage to the environment.
Chapter IX – Management for the safe operation of	**Regulation 7 – Shipboard Operations** The company should establish procedures, plans, and instructions, including checklists, as appropriate, for key shipboard concerning the safety of the

[13] http://www.imo.org/fr/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Safety-of-Life-at-Sea-(SOLAS),-1974.aspx

ships (ISM Code)	personnel, ship and the protection of the environment. The various tasks involved should be defined and assigned to qualified personnel. **Regulation 8 - Emergency Preparedness** 1. The company should identify potential emergency shipboard situations and establish procedures to respond to them. 2. The company should establish programs for drills and exercises to prepare for emergency actions. 3. The safety management system should provide for measures ensuring that the company's organization can respond at any time to hazards, accidents and emergency situations involving its ships. **Regulation 10 – Maintenance of the ship and equipment** 1. The Company should establish procedures to ensure that the ship is maintained in conformity with the provisions of the relevant rules and regulations and any additional requirements that may be established by the company.

International Convention for the Prevention of Pollution from Ships (MARPOL)[14] ***Annex VI – Regulations for the prevention of air pollution from ships***	
Tool	***Provisions***
Chapter 2 Regulations 8 & 9	The International Air Pollution Prevention Certificate (IAPPC) and supplement and validity.

Power of new vessels meeting the standards of Appendix VI of the MARPOL Convention

In recent years, the latest generation of vessels must comply with the new requirements relating to Annex VI of the MARPOL Convention regarding the *Regulations for the prevention of air pollution from ships*. Some regulations specifically deal with ships power and the *Energy Efficiency Design Index* (*EEDI*[15]). Currently, to comply with these new provisions relating to air pollution by vessels, their propulsive power could be reduced by approximately 15 to 25% compared to formerly built ships. The direct consequence of these provisions is that some ships with Ice Class notation (e.g., FS A1) have difficulty to deal with ice in the Gulf and River of the St. Lawrence.

[14] http://www.imo.org/fr/about/conventions/listofconventions/pages/international-convention-for-the-prevention-of-pollution-from-ships-(marpol).aspx

[15] https://www.imo.org/en/OurWork/Environment/Pages/Technical-and-Operational-Measures.aspx

Recommendation 6. TRC members recommend that GNL Québec vessels have enough propulsive power and cooling capabilities to face the ice conditions of the St. Lawrence River and the Saguenay River.

Other Considerations for Winter Navigation

The eastern Canadian coast, south of 60° North latitude including the Gulf and the St. Lawrence River is known for its ice conditions in winter. A set of guidelines are published and cited under the title "*Joint Industry/Government Guidelines for the Control of Tankers and Bulk Chemical Carriers in Ice Control Areas in eastern Canada*."[16]

These Guidelines apply to all laden oil tankers and to tankers carrying liquid chemicals in bulk when proceeding through an active Ice Control Zone in Eastern Canadian waters and fishing zones south of 60° North. The Canadian Coast Guard may activate an ice control zone and publish this information through Warnings to Navigation and Notices to Mariners. All ships to which these Guidelines apply should, when proceeding through an active Ice Control Zone, have on board an *Ice Advisor*, who meets the requirements prescribed in the guidelines TP 15163. These guidelines are available on the Transport Canada website.

As part of its TERMPOL analysis exercise, the TRC considers that these guidelines must apply to GNL Québec LNG vessels that are regarded as tankers.

Other Considerations for Winter Operations

In November 2006, Transport Canada published a TERMPOL review report on the LNG terminal project at Gros-Cacouna. This report has covered measures to deal with winter conditions. The paragraph below summarizes these conditions[17].

In Canadian waters in winter, vessels and their equipment can face the harsh weather conditions mentioned below, which can jeopardize shipping.

- *Low ambient temperatures;*
- *Strong winds;*
- *Low seawater temperatures at intake and injection in waters that are brackish and fresh;*
- *Low humidity;*
- *Ice conditions varying from slush to pack ice;*
- *Snow, sleet, and freezing rain;*
- *Haze and overcast skies, particularly at the ice-water interface;*
- *Superstructure icing (ice accretion) when there is a strong and dangerous possibility of rapid and thick icing, which could jeopardize vessel stability caused by sea spray.*

Icing of deck and superstructures

The latest generation vessels built to transit the waters of the Gulf of St. Lawrence are equipped with a "hood" structure overhanging the forecastle and protecting it from freezing sea spray. Hydraulic units will be equipped with a heating system and located in heated spaces.

[16] https://tc.canada.ca/en/marine-transportation/marine-safety/joint-industry-government-guidelines-control-oil-tankers-bulk-chemical-carriers-ice-control-zones-eastern-canada-tp-15163-b-2015
[17] TERMPOL Review Report, Gros-Cacouna LNG Terminal Project, TP 14633E, November 2006

In addition, a low-pressure steam line installed on deck would facilitate de-icing operations on the facilities when required.

Auxiliary machinery exposed on deck

Auxiliary installations and machinery installed on deck such as windlasses, winches, derricks and/or cranes should be hydraulic and capable of operating with hydraulic fluids suitable for the low temperatures to be encountered. Oil recirculation, preheating, and heating systems should be provided for this purpose. Hydraulic units will be equipped with a heating system and located in heated spaces.

Machinery Space

In order to facilitate operations during winter periods, vessel machinery installations should be equipped with:

- *An adequate boiler capable of heating the machinery spaces, engine air intake fans, and the emergency generator, ensuring the steam tracing of the fuel manifold and engine exhaust fans, sea chests, and other premises if required;*
- *a SW cooling recirculation system from the main engine is to be installed to use the waste heat to melt the frazil ice on the low suction seachest when in presence of supercooled fresh water. Frazil ice will change from liquid state to a solid state when in touch with cold metal surfaces and filling the volume of space with slush.*
- *A main cooling water circuit with a cross-connection with the ballast system to allow recirculation in the event of seawater inlet blockage could be an option.*

Other equipment protection required for navigation

The following items must be provided for vessels when navigating in Canadian waters of the Gulf and River of the St. Lawrence during the winter period.

- *Wheelhouse heating to be sufficient to prevent window frosting;*
- *Heating cable for radar antennas*
- *Fog horns with heating cable; and*
- *Protective covers for controls and instruments exposed to the elements.*

Other measures cited

Other wintering measures are as follows:

- *For structures, the steel quality specification conforming to low ambient temperatures;*
- *For exposed sections of the hull, specification of the hull coating providing a low friction coefficient with ice and resistant to ice abrasion;*
- *The design of hull appendage protectors against ice impact such as rudder guards;*
- *Adequate stability in the event of ice accumulation on the open decks;*
- *Any fire main lines to be protected from freezing with adequately placed drains;*
- *Design considerations such as thermal insulation and heated windows for enclosed operational spaces;*
- *Special design provisions for exposed work areas, access and emergency exit routes including those from enclosed spaces on deck; and*
- *Special lighting design considerations to improve visibility in heavy snow and ice conditions.*

Various service circuits

Service circuits must be sufficiently redundant to provide uninterrupted service.

Protection for ice maneuvers

The rudder(s) and steering gear shall withstand ice impact loads in accordance with the requirements of the particular ice rating given by the classification society. Particular attention must be paid to turning and reversing maneuvers in narrow channels, in the presence of ice. Where applicable, bow thruster(s) and steep angle Schilling rudders will be provided to maximize maneuverability while accounting for ice load. The thrusters will be designed to resist ice impact and blockage by ice and frazil.

Recommendation 7. TRC members recommends that GNL Québec apply the proposed measures of the Gros-Cacouna LNG terminal project to the design and operation of its vessels.

5.2.2.1.4 BALLAST WATER MANAGEMENT

The Government of Canada supports effective ballast water management standards aimed at reducing the risk of introducing aquatic invasive species.

Canada established a strong regulatory regime in this regard in 2006, and in 2010 adhered to the International Convention for Ballast Water Control and Management, which requires all vessels traveling between countries to manage their ballast water. The Convention came into effect on September 8, 2017.

Ballast water from any vessel that enters waters under Canadian jurisdiction shall be managed according to the requirements of the *Ballast Water Regulations (SOR/2021-120*) before it can be discharged.

In addition, under the *International Convention for Ballast Water Control and Management,* Canadian ships and foreign ships engaged in international voyages must hold and comply with the *International Ballast Water Management Certificate* as required by the *International Maritime Organization.*

Currently, according to *Ballast Water Regulations (SOR/2021-120*), ballast water is managed by one of the following management processes:

a) Ballast water exchange and salt water flushing;
b) Ballast water treatment;
c) The transhipment in a reception facility of ballast water, or of sediments which come from ballast water, and which have settled by settling at the bottom of the vessel's tanks;
d) Retention of ballast water on board the vessel.

Ships on international voyages using a ballast water management system must continue ballast water exchange and saltwater flushing before sailing in Canadian freshwater areas. The location of freshwater areas are identified in TP 13617-List of Designated Ballast Water and Freshwater Exchange Areas in Canada.[18]

[18] https://tc.canada.ca/en/marine-transportation/marine-safety/list-canada-s-designated-alternate-ballast-water-exchange-area-fresh-waters-tp-13617e-2021

Transport Canada requires that any ship coming from outside the *Canadian Exclusive Economic Zone* produce and submit a ballast water report form before entering into Canadian waters (EEZ). These reports are reviewed by TC Marine Safety Inspectors to determine regulatory compliance. In addition, inspectors from the TC Marine Safety Office may board ships when there are questions about ballast water management, or for in-depth checks when necessary.

As of September 8, 2024, all vessels with a 400 gross tonnage and above will be required to be fitted with a ballast water management system to meet the ballast water quality standard in order to be able to meet compliance with a maximum content of viable organisms (rule D-2 determined by the IMO)[19].

Finding 5. According to the documents presented, and in light of the obligations to install ballast water treatment units on board ships, GNL Québec does not plan to build a reception facility for ballast water, or sediments that come from ballast water and which can be settled by settling at the bottom of the vessel's ballast tanks.

Recommendation 8. In addition to the ballast water and sediment management plan and according to the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention)—TRC members recommend that GNL Québec, also integrate a contingency plan for vessels in order to respond to any failure of the ballast water treatment system on board.

5.2.2.2 CREWED VESSEL STANDARDS

According to regulations, all crewed vessels must operate with a minimum crew as per the document for minimum safe manning. This minimum manning is determined by the flag State of the vessel or its representative and confirmed by the issuance of the document for minimum safe manning valid for a 5-year period. The document for minimum safe manning is based on the following factors:

- The type of vessel;
- The type of propulsion and available propulsion power;
- The type of voyage ;
- The number of passengers;
- Number of primary lifesaving equipment;
- The number and location of muster stations;
- The muster list and emergency duties for designated crew;
- The diameter of the fire hoses and the number of water nozzles used;
- And any special or unusual features of the vessel.

The number of qualified and experienced seafarers necessary for the safety and security of the ship are determined according to IMO resolution A.890(21)[20] which lays down the minimum requirements to be observed, such as:

- Maintain safe navigational watch, engineering watch and radio watch in accordance with regulation VIII/2 of the 1978 STCW Convention, as amended, with appropriate duties related to navigational or deck watchkeeping;
- Mooring and unmooring the vessel safely;

[19] http://www.imo.org/fr/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Control-and-Management-of-Ships%27-Ballast-Water-and-Sediments-(BWM).asp

[20] http://www.imo.org/fr/OurWork/HumanElement/VisionPrinciplesGoals/Pages/PriciplesOnSafeManning.aspx

- Ensure safety-related functions on board a vessel at sea;
- Ensure the functions related to pollution prevention and protection to the environment;
- Maintain all safety systems and ensure cleanliness of all workspaces to minimize fire risk;
- Have a person designated to take charge of medical care on board and is part of their regular duties;
- Guarantee the safety of passengers, crew members, and cargo during the voyage;
- Inspect and maintain the vessel and ensure its structural integrity.

In addition, when required, be able to:

- Operate all watertight closing devices and maintain them in working order, and also deploy an emergency team as identified on the muster list;
- Operate all emergency and fire-fighting equipment and life-saving appliances on board, conduct maintenance work on this equipment (which must be carried out at sea) and carry out fire and boat drills;
- Operate the main propulsion and auxiliary machinery and maintain them in proper working condition.

5.2.2.2.1 TRAINING OF CREW MEMBERS

The training of crew members is governed by the *International Convention on Standards of Training for Seafarers, Certification and Watchkeeping*, known as the STCW[21] Convention.

In addition, regulation V/1-2 of this convention lays down the following mandatory minimum requirements concerning the training and qualifications of masters, officers, and ratings on liquefied gas tankers:

1. *Officers and ratings assigned specific duties and responsibilities related to cargo or cargo equipment on liquefied gas tankers shall hold a certificate in basic training for liquefied gas tanker cargo operations.*

2. *Every candidate for a certificate in basic training for liquefied gas tanker cargo operations shall have completed basic training in accordance with provisions of section A-VI/1 of the STCW Code and shall have completed:*

   2.1. at least three months approved seagoing service on board a liquefied gas tanker and meet the standard of competence specified in section A-V/1-2 paragraph 1 of the STCW Code; or

   2.2. approved basic training for liquefied gas tanker cargo operations and meet the standard of competence specified in section A-V/1-2, paragraph 1 of the STCW Code.

3. *Masters, chief engineer officers, chief mates, second engineer officers and any person with immediate responsibility for loading, discharging, care in transit, handling of cargo, tank cleaning or other cargo-related operations on liquefied gas tankers shall hold a certificate in advanced training for liquefied gas tanker cargo operations.*

[21] http://www.imo.org/fr/OurWork/HumanElement/TrainingCertification/Pages/Default.aspx

4. Every candidate for a certificate in advanced training for liquefied gas tanker cargo operations shall:

4.1. meet the requirements for certification in basic training for liquefied gas tanker cargo operations; and

4.2. while qualified for certification in basic training for liquefied gas tanker cargo operations, have:

4.2.1. at least three months of approved seagoing service on liquefied gas tanker, or

4.2.2. at least one month of approved onboard training on chemical tankers, in a supernumerary capacity, which includes at least three loading and three unloading operations and is documented in an approved training record book taking into account guidance in section B-V/1; and

4.2.3. have completed approved advanced training for chemical tanker cargo operations and meet the standard of competence specified in section A-V/1-1, paragraph 3 of the STCW Code.

The inspection of vessels concerning crew under the PSCPFS program (*Port State Control Program for Foreign Ships*) will cover the following points:

- Document of minimum safe manning according to the SOLAS convention;
- Certification of personnel on board according to the STCW convention; and
- Maritime Labour Convention[22] (MLC) Maritime Labour Certificate and declaration of Compliance.

Recommendation 9. The vessel must be seaworthy and have a sufficient crew, trained, competent and ready to deal with all the situations that the voyage may encounter.

Vessel-specific procedures for winter navigation in the Gulf and St. Lawrence River waters must be on board and must be understood and implemented when the vessel is operating in ice conditions.

The TRC members recommend that GNL Québec ensure that chartered vessels or any vessel serving its facilities comply with all Canadian and international regulations.

5.3 ROUTE INFORMATION

5.3.1 GENERAL

This study focuses on vessel safety and its ship route.

GNL Québec vessels are used to transport LNG from the Saguenay to Europe and/or Asia. According to their voyage plans[23], they will transit through the Cabot Strait or the Strait of Belle Isle.

[22] https://www.ilo.org/global/standards/maritime-labour-convention/lang--en/index.htm

[23] *IMO RESOLUTION A.893(21) - GUIDELINES FOR VOYAGE PLANNING*

The navigation route through the Cabot Strait is open year-round, while the passage through the Strait of Belle-Isle could be problematic in winter due to the presence of ice and is often closed to vessel traffic.

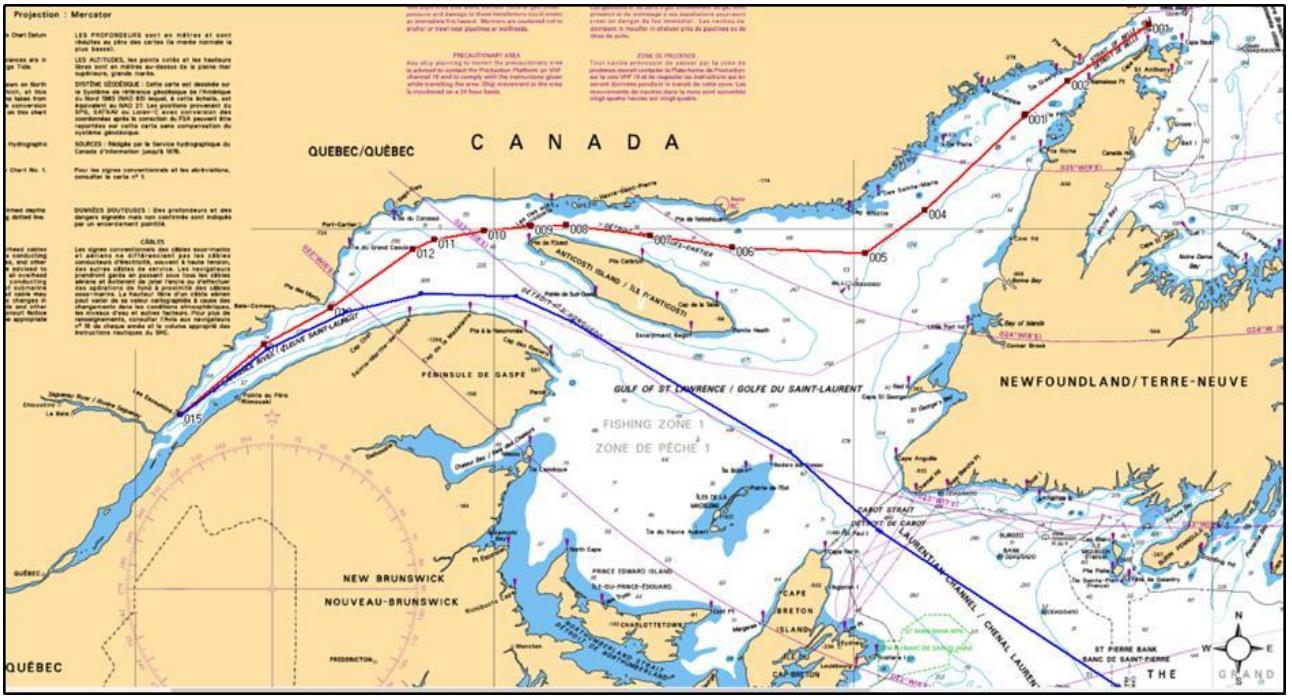


Figure 3 Overview of sea routes between Les Escoumins pilot station and the high seas

In general, in the Gulf of St. Lawrence, vessels will have to use the various traffic separation schemes indicated on the navigation charts and are to report to the MCTS when passing through the various call points. In winter, when required, vessels will have to take the recommended ice routes provided by the Canadian Coast Guard.

Navigation with a licensed pilot is compulsory at all times upstream from the Les Escoumins pilot station. Downstream of this station, in the winter season, some crews unfamiliar with navigating in ice may use or are required to use the assistance of *Ice Advisors*.

> ***Finding 6.*** Currently, access to the Gulf of St. Lawrence from the sea is through the Cabot or Belle-Isle straits. Winter navigation in the Belle-Isle strait could be problematic due to the presence of ice and is often closed due to heavy ice conditions.
>
> ***Recommendation 10.*** TRC members recommend that GNL Québec ensure LNG carriers bound for or departing from GNL Québec facilities use the Cabot Strait during the winter period.

5.3.2 GENERAL ROUTE

The route studied is included in the navigation area extending from Les Escoumins pilot station to the terminal including the Les Rasades anchorage area.

LNG carriers proposed by GNL Québec are the same size as the vessels currently found in the area.

Vessels bound for the Saguenay Energy Terminal will mostly transit through the Cabot Strait. Navigation between the Les Escoumins pilot station and the terminal will be under the guidance of the pilots in accordance with the regulations in force[24]. In winter, navigation in the Gulf of St. Lawrence will be done under the advice of an *Ice Advisor*[25] on board the vessel who is under the responsibility of the master.

The vessel will be in continuous contact with Les Escoumins and/or Port aux Basques MCTS while navigating in waters under Canadian jurisdiction.

In the absence of ice, navigation to the Les Escoumins pilot station from the high seas is done by following traffic separation schemes and by reporting to the designated MCTS at the call points identified on the updated navigation charts.

GNL Québec vessels will not have to pass under a bridge or over a tunnel along this ship route. They may meet vessels at the following crossings:

- North Sydney (N.S) – Port aux Basques / NL (Annual crossing);
- Matane – Baie Comeau and Godbout (Annual crossing);
- Rimouski – Forestville (Seasonal crossing);
- Trois-Pistoles – Les Escoumins (Seasonal crossing); and
- Tadoussac–Baie-Sainte-Catherine (Annual crossing).

According to current practices, these crossings should not be problematic for the passage of GNL Québec vessels.

Passage under Hydro-Québec electrical cables

Currently, vessels of the same dimension as future GNL Québec vessels, transit through the area that passes under these Hydro-Québec's electrical cables and each fall, several cruise ships have an air draft greater than the minimum height of 47m, have proceeded safely. The local pilots have expertise in these passages with vessels that have a high air draft.

The figure below from Sailing Directions ATL 111, 3rd edition (St. Lawrence River, Île Verte to Quebec and Fjord du Saguenay)[26] highlights clearances under the Hydro-Quebec electrical cables at Cap Sainte-Marguerite as well the bathymetric profile.

[24] https://laws-lois.justice.gc.ca/eng/regulations/C.R.C.%2C_c._1268/page-6.html
[25] https://tc.canada.ca/en/marine-transportation/marine-safety/50-ice-advisor
[26] https://www.charts.gc.ca/publications/sailingdirections-instructionsnautiques-eng.html

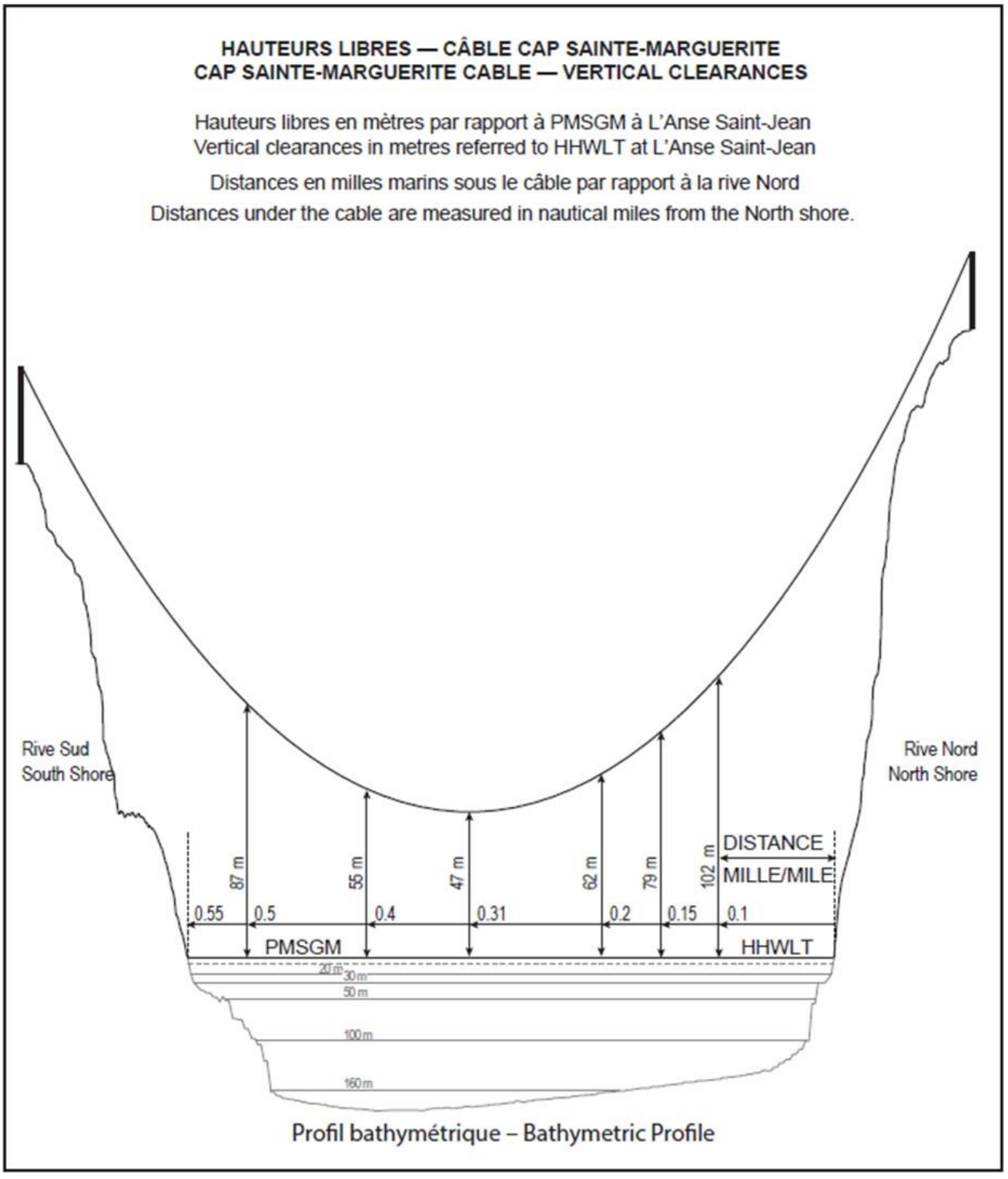


Figure 4: Bathymetric profile and clearances under Hydro-Québec power cables at Cap Sainte-Marguerite.

With this information, vessels with high air drafts should go closer to shore for a better clearance under these cables.

Recommendation 11. In order to ensure and increase the safety of LNG tankers, TRC members recommend that GNL Québec conduct a study to determine the minimum clearance between the mast, and the electrical cables required for its vessels when passing under Hydro-Québec cables at Cap Sainte-Marguerite.

ECAREG– 96 hour prearrival report

The *Eastern Canada Vessel Traffic Services Zone*[27] require masters of vessels bound for Canada to report the following information to ECAREG (Eastern Canada Vessel Traffic Services Zone):

(a) the name of the ship;

(b) the radio call sign of the ship;

(c) the name of the master of the ship;

(d) the position of the ship;

(e) the time the ship arrived at the position;

(f) the course of the ship, if any;

(g) the speed of the ship, if any;

(h) the prevailing weather conditions;

(i) in the case referred to in paragraph (1)(a), the estimated time that the ship will enter the Eastern Canada Vessel Traffic Services Zone;

(j) in the case referred to in paragraph (1)(b), the estimated time that the ship will depart the berth;

(k) the destination of the ship;

(l) the estimated time of arrival of the ship at the destination;

(m) the route the ship intends to take through the Eastern Canada Vessel Traffic Services Zone to arrive at the destination;

(n) the name of the last port of call of the ship;

(o) the draft of the ship;

(p) any dangerous goods, listed by class, or pollutant, that is carried on board the ship or a vessel being towed or pushed by the ship;

(q) [Repealed, SOR/96-215, s. 2]

(r) any defect in the ship's hull, main propulsion systems or steering systems, radars, compasses, radio equipment, anchors or cables;

(s) any discharge, or threat of discharge, of a pollutant from the ship into the water, and any damage to the ship that may result in the discharge of a pollutant from the ship into the water;

(t) the name of the Canadian or United States agent of the ship; and

(u) the date of expiration of a certificate referred to in Article VII of the International Convention on Civil Liability for Oil Pollution Damage, 1969, the International Oil Pollution Prevention Certificate, the International Pollution Prevention Certificate for the Carriage of Noxious Liquid

[27] SOR-89-99.pdf (justice.gc.ca)

Substances in Bulk, the Certificate of Fitness and the Certificate of Compliance, if any, issued to the ship.

> ***Recommendation 12.*** TRC members recommend GNL Québec ensure (in addition to the report required by the *Eastern Canada Vessel Traffic Services Zone Regulations)*, that Masters confirm:
>
> - The vessel has a valid certificate of fitness for type of cargo carried or to be carried;
> - All cargo level, pressure, and temperature indicating devices in each tank are functioning properly;
> - The secondary cargo containment area gas detection system is working properly and is being monitored; and
> - There are no abnormal conditions on board to report, if there are, list these conditions.

> ***Finding 7.*** Currently and according to regulations, in order to inform the authorities and ensure navigation safety, vessel masters are required to report any defects observed on board to the relevant marine communications and traffic (MCTS).
>
> ***Recommendation 13.*** TRC members recommend that GNL Québec ensure the above-mentioned conditions are met so that the vessel can be authorized to continue its voyage to its destination port and that the terminal will be ready to receive it.

Royal Canadian Air Force military exercises

The Canadian Armed Forces has an air base located in the Saguenay region of Quebec, in Bagotville, and hosts CF-18 type fighters. The Saguenay region has occasional aerial exercises with planes flying over the Saguenay River, and sometimes at low altitude.

> ***Finding 8.*** During LNG transport on board vessels, boil-off gases are produced in the tanks. These gases are sometimes released into the atmosphere.
>
> ***Recommendation 14.*** TRC members recommend that LNG Québec tankers refrain from discharging boil-off gases into the atmosphere when pilot boats are approaching and during transit in pilotage waters.
>
> ***Recommendation 15.*** TRC members recommend that GNL Québec communicate recommendation 14 to the vessels serving its facilities. In addition, it is recommended that GNL Québec add the Bagotville air base to its list of parties to be informed in the event of an incident on board its vessels or facilities.

5.3.3 NAVIGABILITY AND VESSEL OPERATION

5.3.3.1 VESSEL REFERENCE

According to the GNL Québec developer, the marine facilities will be built to accommodate LNG tankers with a capacity of 125,000 to 217,000 m3. However, the vessels called upon to serve these installations will have a capacity varying between 165,000 and 180,000 m^3.

The table below gives the physical dimensions of these vessels:

Capacity (m^3)	**125, 000**	**145, 000**	**177, 000**	**130,000**	**165,000**	**178,817***	**217,000**
Cargo containment	Moss	Moss	Moss	Membrane	Membrane	Membrane	Membrane
Displacement (tm)	99,800	110, 000	128 700	97,600	114,300	126,004	148,700
Overall length (m)	283	288	300	280	295	297	315
Length between perpendiculars (m)	270	274	286	266	282	284	303
Moulded breadth (m)	44.6	49	52	41.6	45.1	48.7	50
Moulded depth (m)	25	27	28	27.6	26.2	27	31.9
Loaded draft (m)	10.8	11.5	11.5	11	11.6	12.4	12.3
Ballasted draft (m)	9.35	9.2	9.5	10.1	9.6	9.7	10

According to the developer, vessels will be under charter contract and specifically built for the LNG Quebec project with the following main characteristics:

- Two independent propulsion engines;
- Two independent propellers;
- Two independent rudders;
- Membrane containment system; and
- Adequate air draft to facilitate transit under cables.

According to the proponent, these vessels will not be equipped with bow thrusters mainly due to the impact on sea speed.

5.3.3.2 SIMULATIONS CONDUCTED

The Maritime Simulation and Expertise Center conducted a series of simulation exercises on behalf of GNL Québec in order to carry out a feasibility analysis. These simulation exercises cover all aspects of marine operations related to navigation safety and LNG Quebec LNG tanker handling, maneuvering, and mooring with tugs.

The purpose of these navigation simulations[28] was to prove the viability of the marine layout, and to demonstrate that vessel manoeuvring in the proximity of the terminal (turning, berthing and departures), and vessel transits of the Saguenay estuary, could be conducted safely, and with the utmost concern for minimising environmental or ecological impact. In all cases, manoeuvring outcomes were analysed to determine if planned vessel movements can be conducted with a degree of manoeuvring control that:

- Adheres with the high level of safety, the risk mitigation policies, and the overall procedural standards maintained by the Corporation of Lower St. Lawrence Pilots (CLSLP); and

[28] *GNL Québec – Énergie Saguenay Full Mission Bridge Navigation Simulation Study, Maritime Simulation and Resource Centre, December 2019*

- Is consistent with internationally accepted practises and safety standards for manoeuvring LNG vessels.

Listed below are the recommendations and observations drawn from the study for the purposes of operational planning and future policy development.

a) *Given that high sided LNG vessels are prone to wind induced rotation and drift; to provide an effective response in the unusual event of a steering or propulsion failure, it is recommended that a stern tethered tug escort policy be planned for the Lower Saguenay and confluence of the Saguenay/St. Lawrence rivers for all LNG vessel transits, in the zone between a line connecting Buoy K54 with Haut-Fond Prince Light (eastern boundary) and Ile Saint Louis (western boundary).*

b) *It is recommended that as operational policy, all arrival and departure transits of LNG vessels at the confluence of the Saguenay and be conducted during identified preferred tidal window periods with a low velocity following tidal current (< 1.5 knots inbound and < 2.5 knots outbound) as this allows the ship to transit at low water speeds yet to retain a ground speed transit that was not too slow.*

c) *Further to item b) above, it was observed that under the aforementioned tidal conditions, and with wind speed of less than 25 knots, that even if the twin screwed LNG vessel suffered a loss of steering and propulsion on a single side (i.e. port side) that an acceptable level of steering and positional control could be maintained with the other (i.e. starboard side), completely redundant steering and propulsion line. Furthermore, the tethered escort would serve as an additional layer of risk mitigation in the very unlikely event of a complete propulsion failure, or in the event that both rudders would fail hard over in the same direction (i.e both rudders jam hard to starboard).*

d) *As a proactive measure to reduce ambient generated water noise, and also to ensure effective tethered escort emergency response, transits of LNG vessels within the segment of the Saguenay entry channel that is bound to the east by a line between Haut Fond Prince Light and Buoy K54, and to the west by a line extending to the north from Pointe Noire, should be conducted with the engine telegraph RPMs set for a water speed of 8 knots or less.*

e) *To ensure that the tethered escort tug can respond effectively to any emergency when transiting under the high voltage cables, the LNG's transit speed through the water should be reduced to 5 knots at least 1000 metres prior to the cable crossing.*

f) *Any tug used to escort an LNG vessel within the identified escort zone should be a purpose design escort tug capable of:*
   1) *conducting tethered transits at speeds up to 11 knots in the prevailing environmental conditions and;*
   2) *be able at transit speeds between 5 and 9 knots to deliver a minimum sustained dynamic line force of at least 90 tonnes (note that this value of 90 tonnes is sustained dynamic line load and not simply static bollard pull).*

g) *With special consideration to tethered tug operations, and the associated wind, current, sea state and seasonal icing/freezing spray conditions, entries into the Saguenay with LNG vessels should not be planned/conducted during periods where wind from the northeast quadrant exceeds 30 knots, or if the significant wave height at the river mouth is greater than 2.5 metres.*

h) *With the open nature of the approach bay at Grande-Anse, the amount of space between the two LNG berths, and the distance from the western berth to the Grande-Anse Terminal, approaches can be conducted in a safe an efficient manner both port and starboard side. Even with vessels at the adjoining terminals, there is ample space for the manoeuvring LNG vessel to maintain a distance of at least 200 metres from any moored vessel.*

i) *Given the predominant outflow nature of the current (easterly direction), with velocities ranging from 0.5 to 2.5 knots in the immediate vicinity of the LNG berth, and the prevailing wind from the northwest quadrant, it is assessed that on a repeat basis, port side arrivals can be conducted in a more efficient and safer manner than starboard side arrivals. It is highly recommended that consideration be given to implementing a policy where port side arrivals are preferred.*

j) *Considering that the nearest safe anchorage by an appreciable distance is upriver from the berth, if a ship is berthed port side at the dock, this would also facilitate emergency/short notice departures when tug resources maybe limited, and for safety purposes, the ship may need to sail.*

It should also be noted that while the allocated time for this analysis did not allow for an exhaustive examination of emergency departures under a full range of environmental conditions, judging on the amount of tug force used during starboard side departures, with the possible exception of the two or three hours each day when the current flow at the berths is relatively light, it is highly unlikely that starboard side departures (even in emergencies) can be conducted without tug assistance.

k) *Provided adequate tug power is used, movements at the terminal can be conducted throughout the full range of the tidal cycle (current conditions). Given the frequency of strong currents at the berth, it is recommended that no movements be conducted when the wind speed is greater than 25 knots from any direction.*

l) *It is recommended that an assist tug policy similar to the following be considered.*

- *For all LNG vessels between 250 and 300 metres LOA:*

  for all moves, a minimum of three (3) tugs, a package which should be comprised of one 90-tonne tug tethered at the stern (possibly the same tug used for escort) and two (2) additional ship assist tugs with a static bollard pull rating of not less than 75 tonnes; and

- *For all LNG vessels between 250 and 300 metres LOA:*

  for all moves, a minimum of four (4) tugs, a package which should be comprised of one 90-tonne tug tethered at the stern (possibly the same tug used for escort) and three (3) additional ship assist tugs with a static bollard pull rating of no less than 75 tonnes.

- *It should also be noted that for any tug equipment whose intended use is strictly for movements at the terminal (i.e. will not be used for high speed transit escort), given that these tugs will be often working at an angle to the current, from a design perspective, it is probably preferred that they do not have a large escort skeg.*

m) *It is recommended that prior to the commencement of operations that the following future simulation work be considered:*

- *Develop detailed hydrodynamic models of the exact tug designs that will be used for both high speed escort, and ship assist operations;*
- *Run an additional simulation session to examine the precise environmental limitations. Knowing the tug's exact hull design and size will support a more accurate analysis of the sea state limitation for the tug to pass its towline, and to effectively work when tethered. Also, considering that hull design can have just as significant effect on the dynamic line forces that a tug can produce at various speeds as that of engine power, this will allow for a more comprehensive assessment of the range of acceptable vessel transit speeds;*
- *Revisit the recommendations of this report for wind limits for movements at the terminal and create a final operation tug matrix for the range of wind and river current conditions; and*

n) *Once final operational procedures are established, conduct a comprehensive educational programme for all pilots and tug masters that will be involved with LNG vessels movements. This training and familiarisation package should include full details on:*
   - *Tug escort policy and procedures in the approach channel to the Saguenay and in the lower Saguenay between Pointe Noire and Ile St-Louis; and*
   - *Familiarisation with movements at the berth and identification of preferred berthing/un-berthing techniques.*

Finding 9. According to the final report of the simulations conducted, ships meeting and overtaking on the Saguenay River were not simulated.

Finding 10. Simulation outcomes conducted on a navigation simulator are conclusive subjected however, to the observations and recommendations mentioned above.

Recommendation 16. In order to ensure navigation safety as a whole on the Saguenay River, TRC members recommend that GNL Québec ensure these observations and recommendations from the simulation be validated in the real live environment and reviewed as necessary before their implementation by the GNL Québec proponent.

5.3.4 ISSUES RELATED TO VESSEL TRAFFIC

The objective of this study is to quantify and describe the movements of commercial ships, ferries, pleasure craft, and others that make up regional vessel traffic.

GNL Québec vessels will have to transit through the Saguenay–St. Lawrence Marine Park; however, this study will be limited to the following areas: Les Escoumins pilot station, the Saguenay River and finally the Rasades anchorage area.

Note of understanding:

- Upbound vessels are vessels that sail up the St. Lawrence River from the open seas;
- Downbound vessels are vessels that sail down the St. Lawrence River bound for the open seas.

Les Escoumins Pilot Station

The Les Escoumins pilot station is a meeting point for all upbound vessels bound for ports upstream from this point, and downbound vessels from these ports.

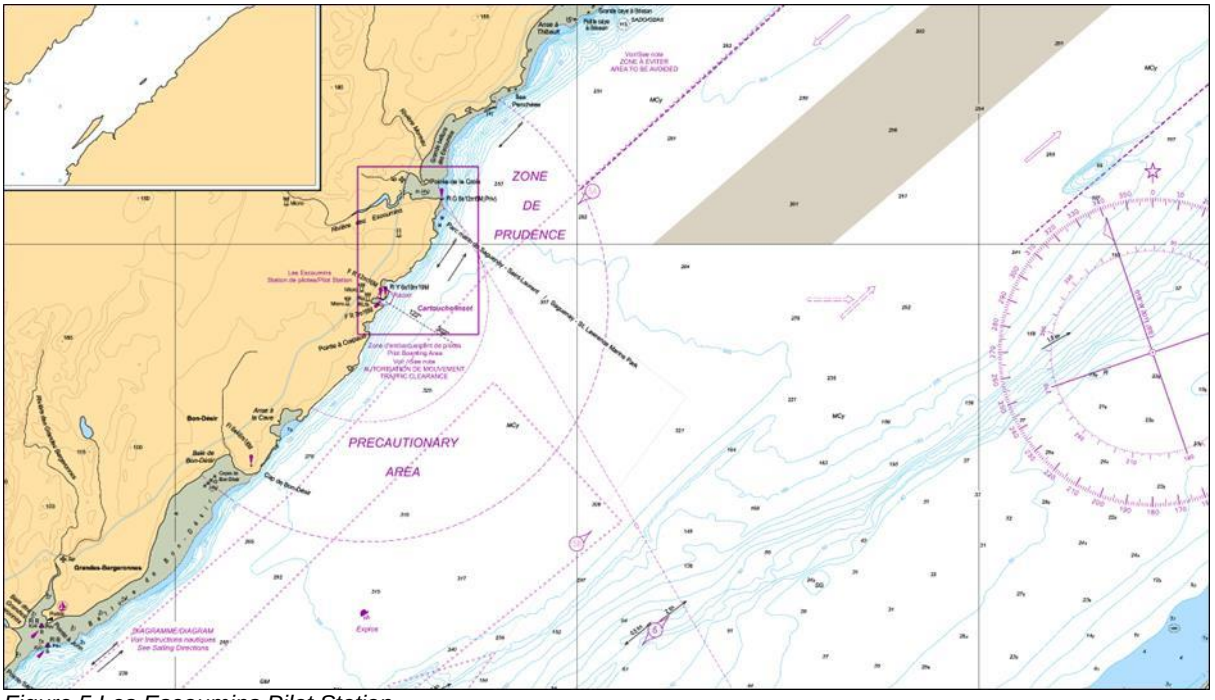


Figure 5 Les Escoumins Pilot Station

While approaching pilot boarding station, vessel speed and heading are adjusted to the prevailing traffic and weather conditions in this precautionary area to allow the safe boarding and un-boarding of pilots assigned by the Laurentian Pilotage Authority (LPA).

According to practices, a clearance shall be given by "Trafic Escoumins" on VHF channel 9 before entering the pilot boarding area. This clearance will not be given until the preceding vessel is clear of this area. The priority is granted to downbound vessels.

The tables[29] below illustrate commercial marine traffic at the Les Escoumins pilot station.

Upbound vessel traffic to the Les Escoumins pilot station						
Calendar years	***2014***	***2015***	***2016***	***2017***	***2018***	***2019***
Upbound vessels from Les Escoumins pilot station to the St. Lawrence River	2,292	2,253	2,177	2,177	2,335	2,325
Upbound vessels from the Les Escoumins pilot station to the Saguenay River	164	174	168	188	195	197
Total	2,456	2,427	2,345	2,365	2,530	2,522
Percentage of traffic from the Saguenay River	6.68%	7.17%	7.16%	7.95%	7.71%	7.81%

[29] Laurentian Pilotage Authority, October 2020

Downbound Vessel traffic to the Les Escoumins pilot station						
Calendar years	***2014***	***2015***	***2016***	***2017***	***2018***	***2019***
Vessels sailing down the St. Lawrence River towards Les Escoumins pilot station	2,315	2,266	2,207	2,175	2,367	2,335
Vessels sailing down the Saguenay River to Les Escoumins pilot station	142	169	146	175	178	196
Total	2,457	2,435	2,353	2,350	2,545	2,531
Percentage of traffic from the Saguenay River	5.78%	6.94%	6.20%	7.44%	6.99%	7.74%

In light of the data in the above tables, the average percentage (from 2014 to 2019) of upbound traffic to the Saguenay River is 7.41%, while the average percentage (from 2014 to 2019) of downbound traffic from the Saguenay River is 6.86%.

According to the documents filed as part of this analysis, the GNL Québec proponent anticipates that three to four tankers will berth the terminal each week for a maximum of 140 to 165 ships per year on the Saguenay River.

In terms of projection, adding a maximum of 165 vessels to the current existing traffic would increase the average percentage of upbound traffic to the Saguenay River by 6.33% and 6.32% for downbound traffic.

Finding 11. Marine traffic management at the Les Escoumins pilot station is under the authority of Marine Communications and Traffic Services (MCTS) / Canadian Coast Guard (CCG).

Finding 12. With the current domestic and international LNG shipping regime, TRC members believe that the additional number of GNL Québec vessels does not have a significant impact on current domestic shipping and marine safety.

Recommendation 17. As with the oil tankers serving Montreal, Sorel, and the St-Romuald refinery, and in order to facilitate the integration of GNL Québec vessels, TRC members recommend that GNL Québec ensure procedures relating to vessel traffic at the Les Escoumins pilot station and its approaches, the convergence point for all commercial vessels, be amended to include the following provisions for LNG Québec LNG tankers:

- Maintain a 1 nautical mile distance from the coast in this area (Les Escoumins pilot station);
- Maintain a ½ nautical mile safety distance from other approaching vessels in this area;
- Keep approaching speed below 6 knots unless otherwise required by pilot in charge.

Finding 13. When approaching pilot stations area, the vessel's engines are running on maneuvering mode. The speed and heading will be adjusted to satisfy traffic and weather conditions prevailing to facilitate pilot transfer.

Recommendation 18. As a preventive measure, TRC members recommend GNL Québec ensure that:

- LNG tankers refrain from releasing cargo evaporation gases into the atmosphere.
- The pilot boat should be allowed to dock with the LNG tanker only after the master has confirmed that there are no flammable or evaporating gases on deck or around his vessel.

Saguenay River entrance

Generally speaking, maritime traffic at the Saguenay entrance is composed, depending on the seasons, of the transit of:

- Commercial vessels
- Ferries
- Pleasure boats

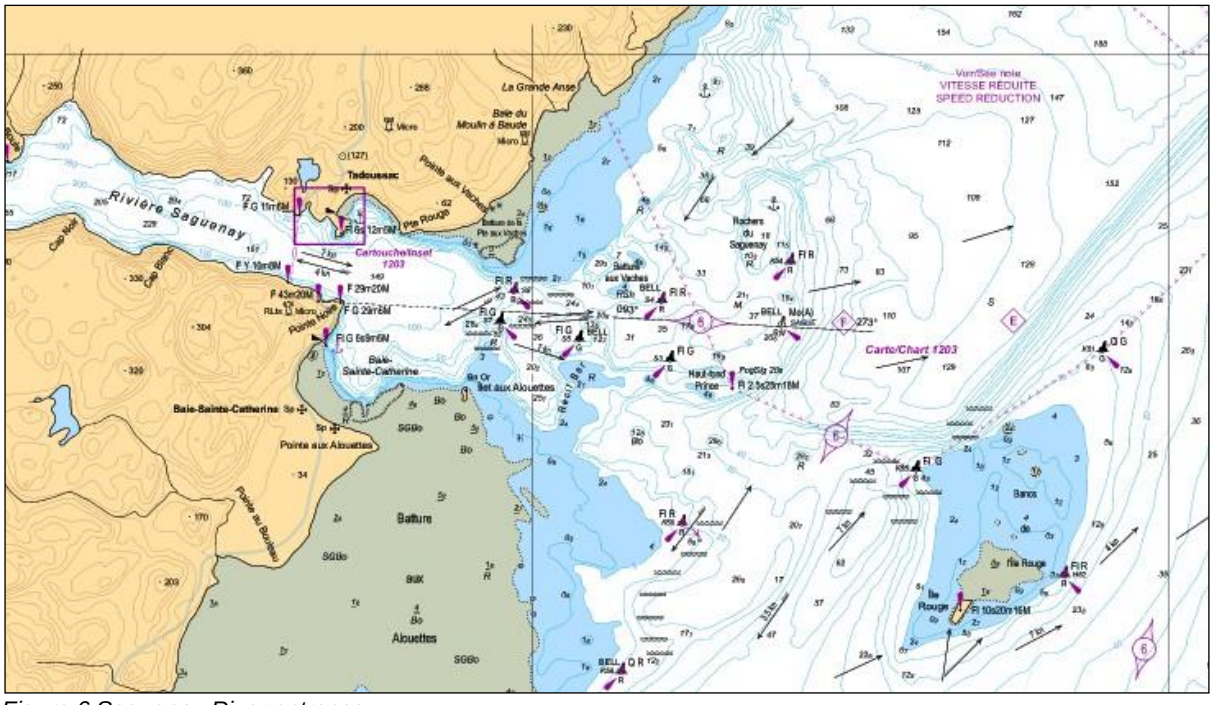


Figure 6 Saguenay River entrance,

Mainly and regardless of the time of year, marine traffic at the Saguenay entrance is represented by the STQ ferries.

Years	***2007 2008***	***2009 2010***	***2010 2011***	***2011 2012***	***2012 2013***	***2013 2014***	***2014 2015***	***2015 2016***	***2016 2017***	***2017 2018***

Number of ferry crossings[30]	40,346	38,604	38,802	38,706	39,442	41,051	42,595	42,759	41,151	41,137
Daily average	110	106	106	106	108	112	116	117	113	113

In light of this data, a meeting between an STQ ferries and an LNG tanker from LNG Québec is more than likely as the LNG tanker transits.

Finding 14. TRC members believe that the traffic procedures between transiting vessels and ferries crossing at the entrance of the river as per *Collision Regulations*[31] provisions are well-established and will be also relevant to LNG carriers as well.

Marine mammal watching activities

In the summer, vessel traffic at the Saguenay entrance is heavy due to pleasure craft, excursion vessels from the marinas of Tadoussac, Baie Ste-Catherine, and whale watching and marine mammals in the region.

The marine mammal watching season in the Saguenay - St. Lawrence Marine Park takes place mainly from May to October.

In 2017[32], there were 6,658 excursions by class 1 license holders, 659 excursions by class 2 license holders, and 2,024 excursions by class 3 license holders, for a total of 9,341 excursions.

Compared to 2007[33], there has been a decrease in the number of excursions by 44.3%. The boats are slightly larger and distributed among fewer companies. The demand (i.e., the number of visitors) is, according to the figures available, relatively stable.

Pleasure craft

The Saguenay - St. Lawrence Marine Park area is very popular with boaters due to tourist attractions such as marine mammals watching and the number of marinas in the area.

[30] Source: STQ, 2007-2008 to 2016-2017 Activity reports
[31] C.R.C.,_c._1416.pdf (justice.gc.ca)

[32] Turgeon, S., 2019. Navigation portrait in the Saguenay–St. Lawrence Marine Park - 2017. Parks Canada.
[33] Turgeon, S., 2019. Navigation portrait in the Saguenay–St. Lawrence Marine Park - 2017. Parks Canada. http://parcmarin.qc.ca/wp-content/uploads/2020/09/PortraitdelanavigationparcmarinduSaguenay-Saint-Laurent-web.pdf

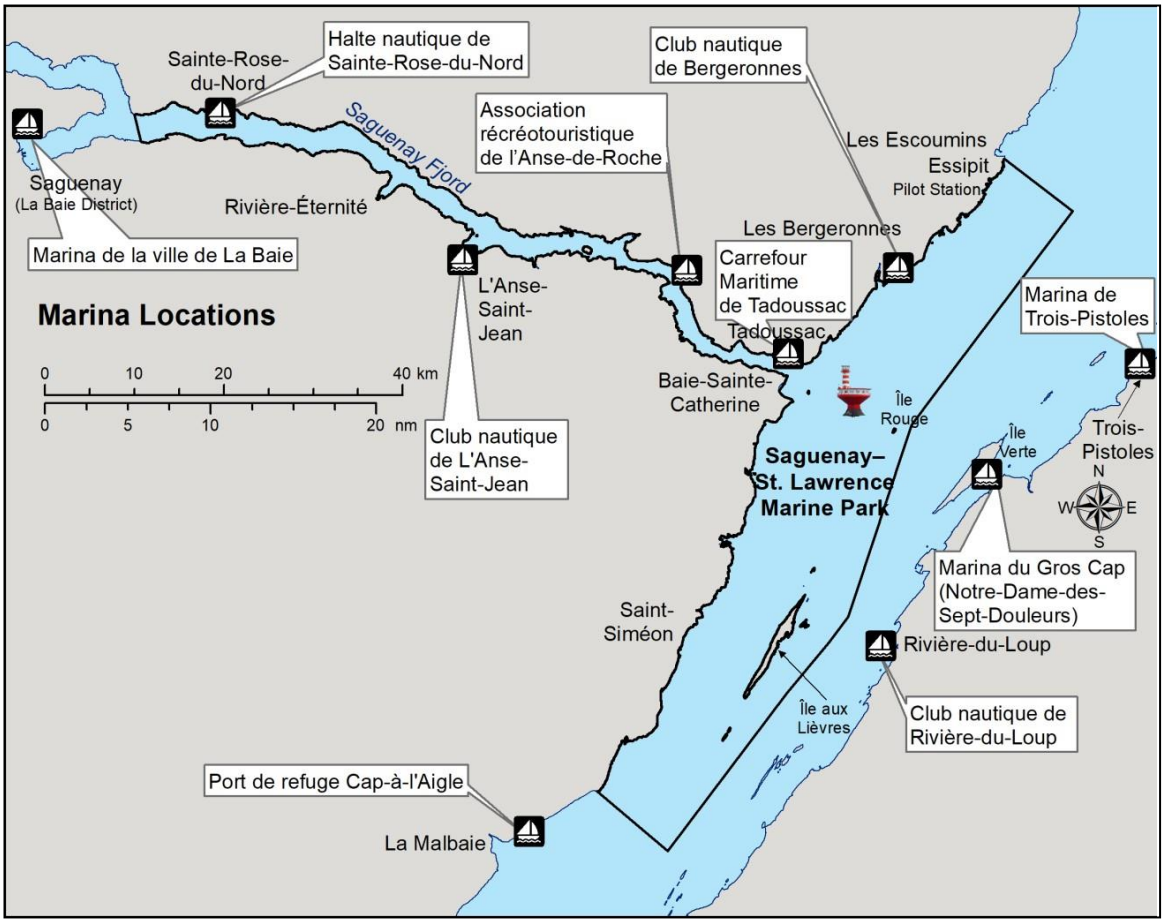


Figure 7 Location of marinas in the Saguenay St. Lawrence Marine Park area, Source: Navigation portrait in the Saguenay - St. Lawrence Marine Park 2017

The figure above shows that the following marinas are located in the path of LNG Québec vessels route:

- Les Bergeronnes
- Tadoussac
- Baie-Sainte-Catherine
- Anse-de-Roche
- Anse-Saint-Jean
- Sainte-Rose-du-Nord
- Saguenay

In 2017, the above-mentioned marinas alone totaled around 183 seasonal pleasure boats.

The Tadoussac and Baie-Sainte-Catherine marinas are located at the Saguenay River entrance.

The TRC work group raised the question caused by high density mixed population of pleasure crafts, cruisers and whale watchers in the vicinity between pilot station, buoy K54 on the East side of the entrance and a straight line drawn between Pointe de l'Islet and Pointe Noire on the West side. In the opinion of the WG, keeping these, a mile or so away from the transiting LNG tankers would be very beneficial to safety of navigation in the area.

Finding 15. Marine mammal watching activities in the Saguenay - St. Lawrence Marine Park during the summer season (May to October) may possibly take place in the path of GNL Québec vessels.

Recommendation 19. TRC members recommend GNL Québec ensure that DNV's analysis include safety zones to be established around GNL Québec, LNG tankers in transit between the Les Escoumins pilot station and the marine terminal, and in consultation with the other stakeholders (GNL Québec, TCMSS, MCTS/CCG, LPA, CLSLP, SPA, Saguenay - St. Lawrence Marine Park, Excursionists, Marinas).

Recommendation 20. TRC members recommend GNL Québec implement a communication plan related to the safety of its LNG tankers intended for other users.

Commercial Navigation

Saguenay River

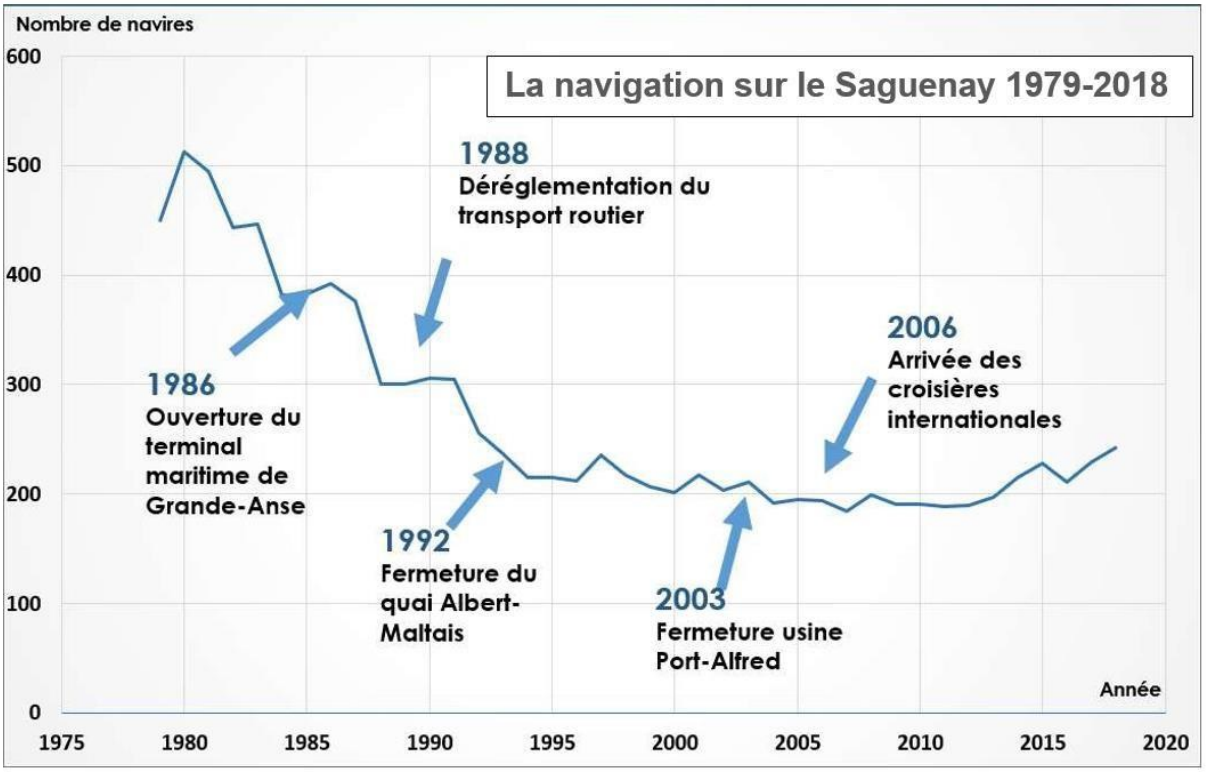


Figure 8 Navigation on the Saguenay 1979-2018, Source SPA

According to the figure above, in 1980, there were more than 500 vessels on the Saguenay River before dropping to less than 200 vessels annually from 2000 and starting to rise again in 2015.

Finding 16. In light of the above data on the evolution of vessel traffic on the Saguenay River from 1980 until the beginning of the 2020s, the addition of 3 to 4 LNG Québec vessels per week would increase vessel traffic without reaching the annual level observed in 1980.

Tug Escort Policy

According to the proponent, historically there has never been an escort service in the Saguenay, however, this practice is common in the LNG industry. For this purpose, scenarios using an escort tug attached by the rear fairlead were evaluated during studies on a navigation simulator for the two sections of the route that are more complex to navigate, namely the Saguenay entrance between buoys S4 and S8 and the passage under the Cap Sainte-Marguerite Hydro-Québec cables.

Based on these scenarios, GNL Québec undertakes to implement a tug escort policy for its vessels in order to reduce the response time in the case of emergency by stabilizing the vessel's course, or to reduce the stopping distance.

This tug escort policy will be implemented in the confluence of the Saguenay and the St. Lawrence rivers in the area between the line connecting buoy K54 to the Prince Shoal lighthouse (eastern limit) and Saint-Louis Island (western limit).

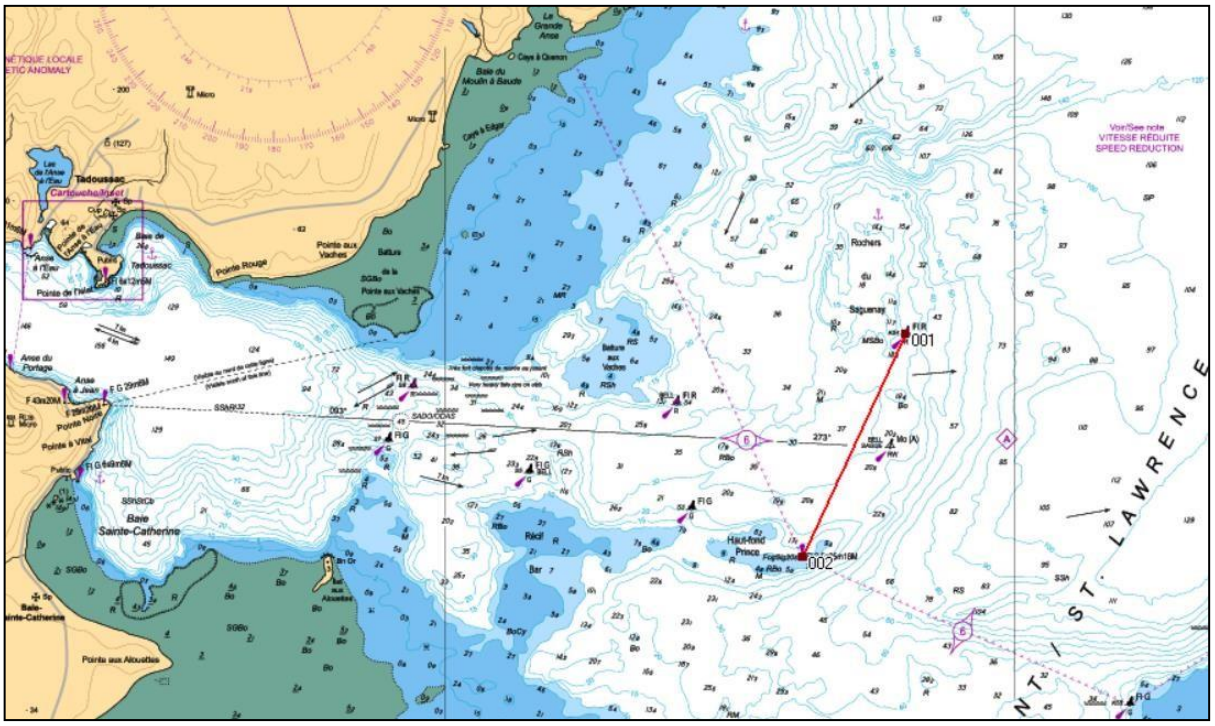


Figure 9 Eastern limit of escort towing area

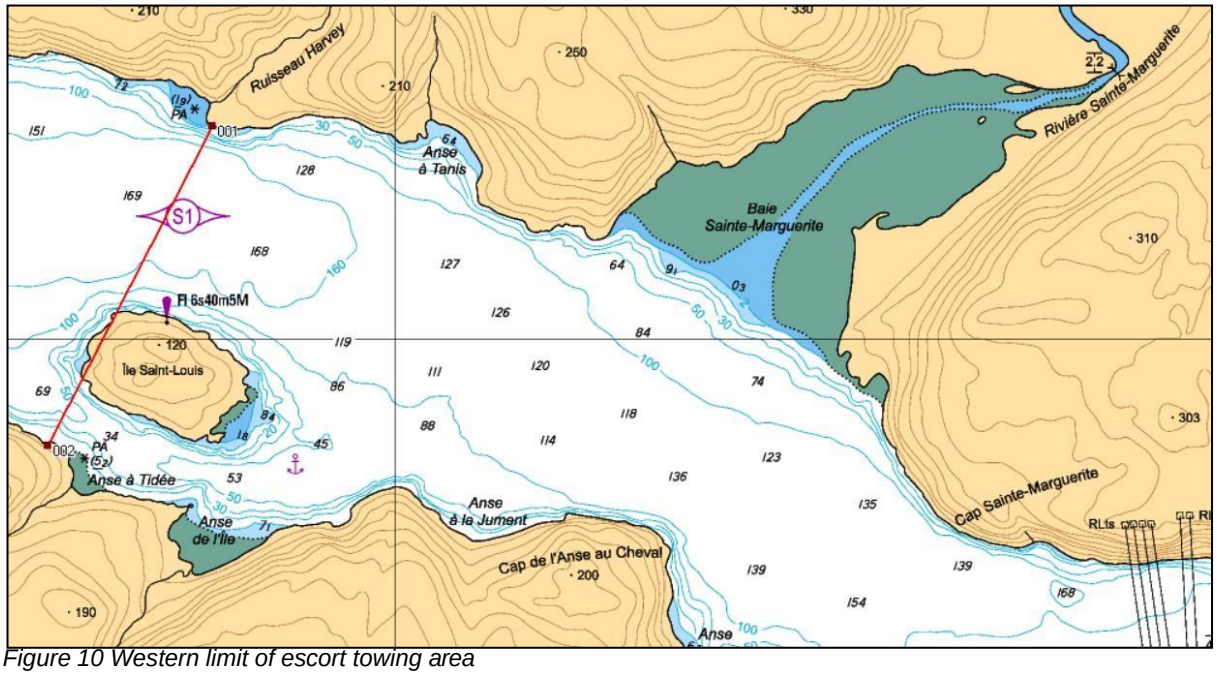


Figure 10 Western limit of escort towing area

According to the GNL Québec proponent, any tug used to escort an LNG vessel within the identified escort zone should be a purpose design escort tug capable of:

- Conducting tethered transits at speeds up to 11 knots in the prevailing environmental conditions; and
- Being able to sustain a dynamic force of at least 90 tonnes at transit speeds between 5 to 9 knots (note that this value is sustained dynamic line load and not simply static bollard pull).

Finding 17. TRC members believe that the implementation of the tug escort policy would improve the navigational safety in the designated area.

Recommendation 21. TRC members recommend that GNL Québec ensure towing and escort procedures take into account the risks of grounding or collision due to the loss of maneuvering or propulsion capacity of the LNG tanker.

In addition, the tug should be fitted with a tensiometer if the load on the towing line is likely to exceed the allowable value during towing operations[34].

Currently, there is no classification standard for tug vessels operating in LNG terminals. However, depending on their crewing, a minimum of equipment should be provided on board in order to ensure the safety of crew members in case of an LNG leak during escort operations, arrival or departure maneuvers.

[34] ISO 28460 Standard Petroleum and natural gas industries — Installation and equipment for liquefied natural gas — Ship-shore interface and port operations

Recommendation 22. TRC members recommend that GNL Québec tugs, based on their crewing, be equipped with:

- An on-demand positive pressure navigation bridge, the autonomy of which shall be determined after evaluation;
- Gas detectors with alarms and pre-alarms;
- O_2 and CO_2 monitoring systems;
- Emergency Escape Breathing Devices (EEBDs) of at least 30-minute capacity for each crew member;
- Exhaust pipes with spark arresters.

Recommendation 23. TRC members recommend that, GNL Québec ensure, tug crew members be trained in LNG shipping and the risks associated with it, in addition to the regulatory required training.

Under-Keel Clearance

According to documents submitted before us by the 'project promoter / developer or proponent' the under-keel clearance considered for the purpose of the TERMPOL study, would be equal to 15% of the ship's maximum draught. This figure would allow among other things, for bodily sinkage due to dynamic motions under which vessels are subjected.

Similarly, the 15-meter isobath was used for the analysis of the available under-keel clearance, both at the terminal and for navigation, thus enhancing the safety margin.

Below is the proponent's recommendation for under-keel clearance:

It is recommended to study the height and frequency of the waves during northeast wind events at the Saguenay River entrance, in order to anticipate the rolling and bottom contact of the ship and to determine a limit for the passage of ships.

It is recommended to implement an operational policy where all transits at the confluence of the Saguenay are done during periods of low tidal current speeds (< 1.5 knots in and < 2.5 knots out), allowing the vessel to transit at low speed (on the water) while maintaining an adequate movement speed.

Considering the recommendation above, it is advised to determine a passage window according to the height of the tide, in concert with the APL and the CPBSL, in order to maximize the under-keel clearance and the use of the current.

Recommendation 24. TRC members recommend that GNL Québec's considerations pertaining to transits at the confluence of the Saguenay River be incorporated into the design plan in order to improve the GNL Québec tankers navigation safety and recommend that the outcomes thereof be available before the arrival of these vessels.

Ships meeting and Overtaking on the Saguenay River

Once the marine facility is operational, GNL Québec tankers will have to meet other vessels in transit on the Saguenay River such as:

- Cruise ships heading to or from the International Cruise Terminal - Quai de Bagotville. These cruises take place regularly in summer and autumn;
- Bulk carriers bound for or coming from Port-Alfred; and

- Cargo vessels to or from the Marcel-Dionne dock (Grande-Anse). These vessels occasionally carry class 1 cargo according to the IMDG (International Maritime Dangerous Goods) code.

In order to improve collision avoidance, the proponent suggest meeting distances between vessels doing reciprocal courses as well as overtaking and taken vessels be adjusted according to relative speed of both vessels.

Relative speed	***Minimum crossing distance***
Greater than 35 knots (Head-on situation)	0.75 nautical mile
Between 25 and 35 knots	0.5 nautical mile
Less than 25 knots	0.25 nautical mile

The proponent in it's collisions analysis for the area, only considered hypothesis of a 90° impact. Whereas, for the majority of the transit other than the entrance or the Saguenay River, meeting situations are mostly reciprocal or nearly parallel courses. The relative motion of both vessels (combined) would give us a resulting speed between 20 and 30 kts. approx. Experiences to this day, tend to demonstrate that these collisions often occur to angles much smaller causing lengthwise damages to both vessels.

> ***Recommendation 25.*** TRC members recommend that GNL Québec ensure collisions involving two vessels other than perpendicularly with relative speed of 20 kts also be studied.

In addition to GNL Québec's Énergie Saguenay project in the area, other industrial projects could be developed such as the marine terminal on the north shore of the Saguenay (Arianne Phosphate) and the BlackRock Metals project. Once operational, these marine facilities would increase marine traffic on the Saguenay River.

The Marine Terminal construction project on the north shore of the Saguenay near the municipality of Sainte-Rose-du-Nord was assessed by the IAAC (formerly the Canadian Environmental Assessment Agency). With respect to cumulative effects related to marine navigation in the Saguenay River, in its decision statement issued under section 54 of the Canadian Environmental Assessment Act, 2012[35], IAAC raised the following conditions:

> *11.1 The Proponent shall participate, at the request of relevant authorities, in regional initiatives related to the monitoring, assessment or management of cumulative environmental effects, including cumulative environmental effects on beluga (Delphinapterus leucas) caused by commercial navigation on the Saguenay River, likely to result from the Designated Project in combination with other physical activities that have been or will be carried out, should there be any such initiative(s) during construction or operation of the Designated Project.*
>
> *11.2 The Proponent shall implement any mitigation measure that is technically and economically feasible or follow-up program identified through any regional initiative*

[35] https://www.iaac-aeic.gc.ca/050/documents/p80103/125803E.pdf

referred to in condition 11.1 and which is under its responsibility pertaining to cumulative environmental effects on beluga (Delphinapterus leucas) caused by commercial navigation on the Saguenay River.

In a different study, sponsored by other federal entities, involving navigation of post-Panamax in the St. Lawrence River, a working group issued guidelines for wide beam and long vessels transiting between Ile-aux-Coudres and Montreal. These guidelines are published as VN-301(1)[36] and govern the vessel traffic in the area.

Finding 18. It is believed that the guidelines referred to in pub. VN-301 has greatly contributed to maintain an efficient management of these new wide beams and long vessels streaming the River from Ile-aux-Coudres right up to Montreal.

Recommendation 26. If a working group to address the Saguenay challenges is formed, similar to the one which promote safe management of new over size vessels transiting up the St. Lawrence, the TRC members recommend that GNL Québec participate actively in this working group.

Recommendation 27. TRC members recommend that GNL Québec include the voluntary measures already in place in the region in their procedures and that GNL Quebec collaborate with working groups such as G2T3M and other environmental cells gravitating in the protection of aquatic species world in connection with speed and underwater noise in the area.

Anchoring Areas

As the project has been presented by the proponent, the terminal will have two piers. As a result, vessels will not have to anchor outside their docks. Nevertheless, vessels sometimes resort to anchoring for unforeseen reasons and for variable durations depending on the contingency.

The Quebec Region Standing Committee on Navigation Safety has created a working group to study anchoring on the St. Lawrence River. This group, made up of TCMSS, CCG-MCTS, DFO-CHS, LPA, CLSLP, CPSLC, QPA, TRPA and the MPA, has listed all the mooring points located between Montreal and the Rasades area with their specificities and characteristics as well as the characteristics of the vessels called upon to use these mooring points.

[36] https://www.notmar.gc.ca/publications/annual/section-c/c27a-en

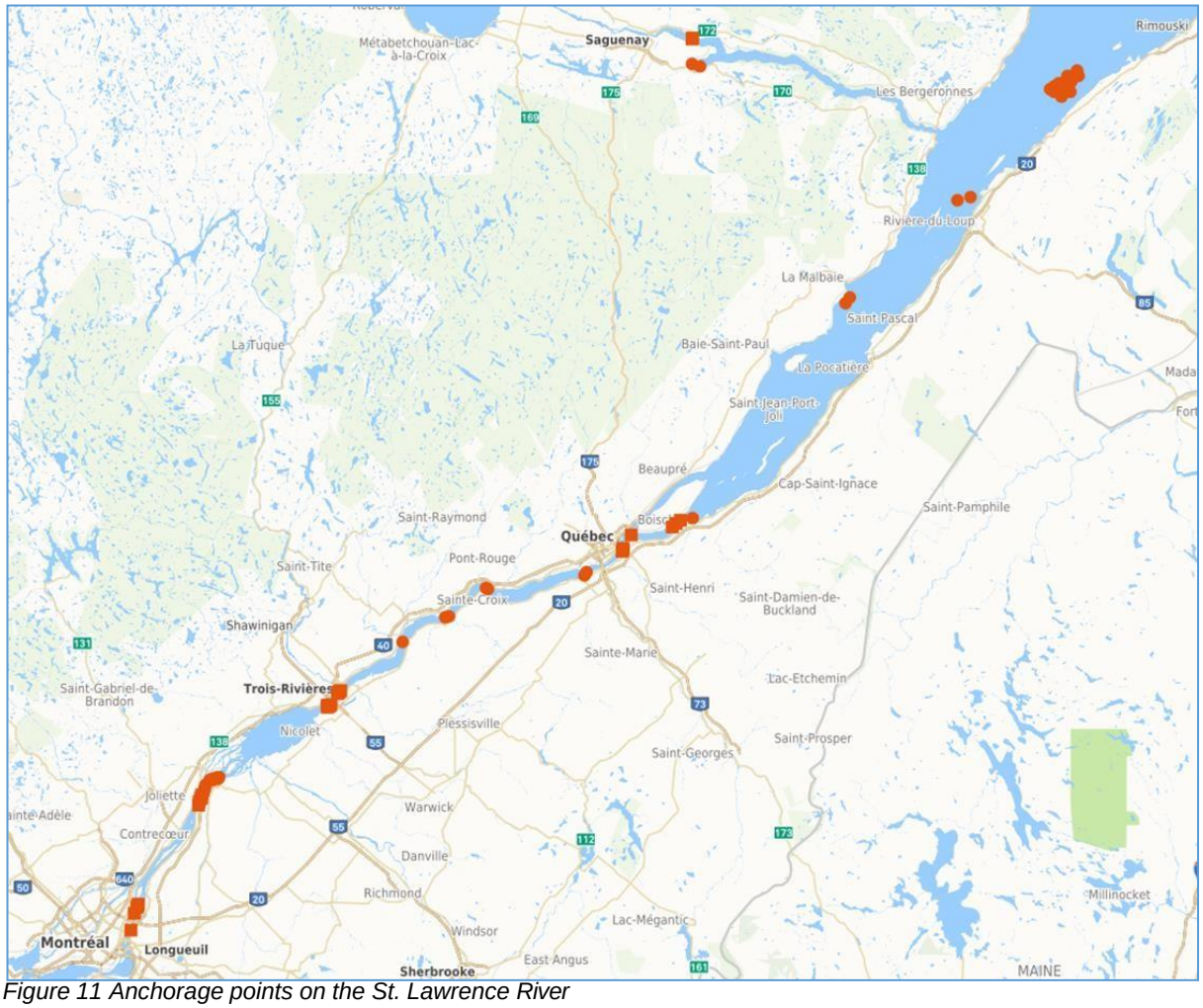


Figure 11 Anchorage points on the St. Lawrence River

In this Termpol report, the mooring points to be considered are the points that GNL Québec vessels will probably have to use for the following reasons:

- Navigation equipment or engine failure;
- Adverse weather conditions;
- Obstruction to navigation;
- Any other reason requiring a waiting time.

Îles des Rasades area

The Îles des Rasades area has around fifteen anchorage points for various types of vessels and of different size.

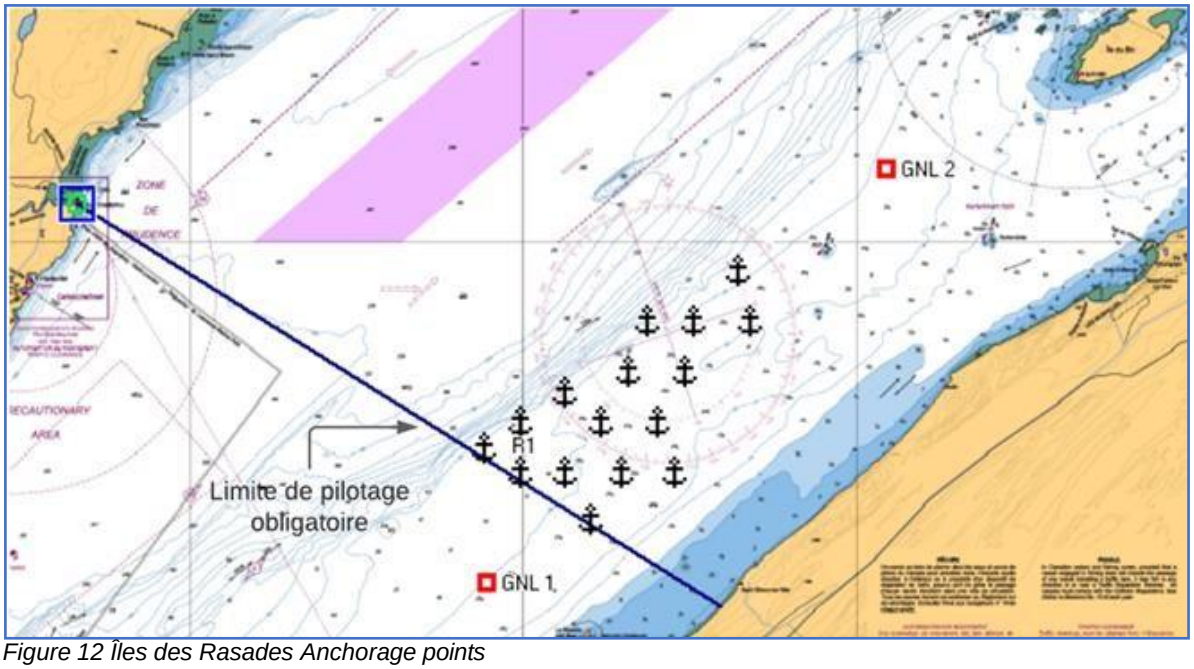


Figure 12 Îles des Rasades Anchorage points

The Iles des Rasades anchorage area has the following characteristics:

Characteristics of anchorage points	
Swing circle	Variable
Type of bottom	(Sand) (S), (Gravel) (G)
Services	• Pilot boat nearby (Les Escoumins pilotage station); • Radar coverage (anchorage monitoring from the MCTS center in Les Escoumins); • MCTS: AIS monitoring.
Maximum overall length (LOA)	All
Maximum overall width (BOA)	All
Maximum draft	All
Vessel type	All types (tanker, bulk carrier, chemical tanker, etc.)
Unladen / laden vessel	Yes / Yes
Duration	Any duration

Finding 19. The anchorage points in the Îles des Rasades area on the map above are close to each other. Consequently, this would not allow the addition of a safety and exclusion distance around an LNG tanker without affecting the other points and the vessels anchored there.

Recommendation 28. In order to minimize and reduce the risk of collision at anchorage, TRC members recommend that GNL Québec ensure two anchorage points be added in the Îles des Rasades area, away from other points. These two points must be identified and dedicated exclusively to LNG tankers. One point inside the compulsory pilotage area, and another outside it.

Recommendation 29. TRC members recommend that GNL Québec request to have these two points identified on the nautical chart and the anchoring sheets. (See table and figures below):

<table>
<tr><th colspan="4">Coordinates of anchorage points for LNG tankers at Îles des Rasades</th></tr>
<tr><td></td><td>Latitude</td><td>Longitude</td><td>Observations</td></tr>
<tr><td>Outside the compulsory pilotage area</td><td>48° 21’.5 N</td><td>068° 59’.1 W</td><td rowspan="3">Away from vessel traffic and other anchorage points.
Possibility of having significant safety and exclusion distances.
Adequate depth (20 to 40 meters).
Good anchoring behaviour, adequate bottom (sand).
Pilot boat nearby (Les Escoumins pilot station).
Radar coverage (anchoring monitored from the MCTS centre in Les Escoumins).
MCTS: AIS monitoring.</td></tr>
<tr><td rowspan="2">Inside the compulsory pilotage area</td><td>48° 13’.3 N</td><td>069° 11’.1 W</td></tr>
<tr><td colspan="2">or at the discretion of the pilot in charge.</td></tr>
</table>

Recommendation 30. Based on the anchoring practices of the Canaport LNG marine facility, TRC members recommend that GNL Québec establish a minimum exclusion and safety distance of 1.5 nautical miles around GNL Québec vessels anchored at these points.

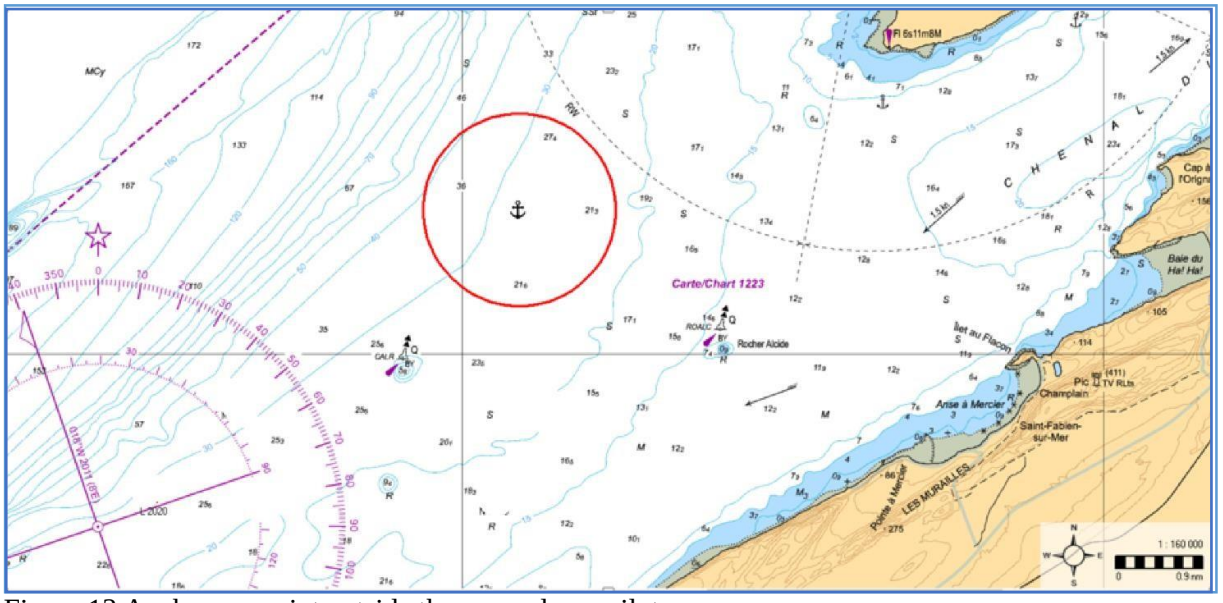


Figure 13 Anchorage point outside the compulsory pilotage area

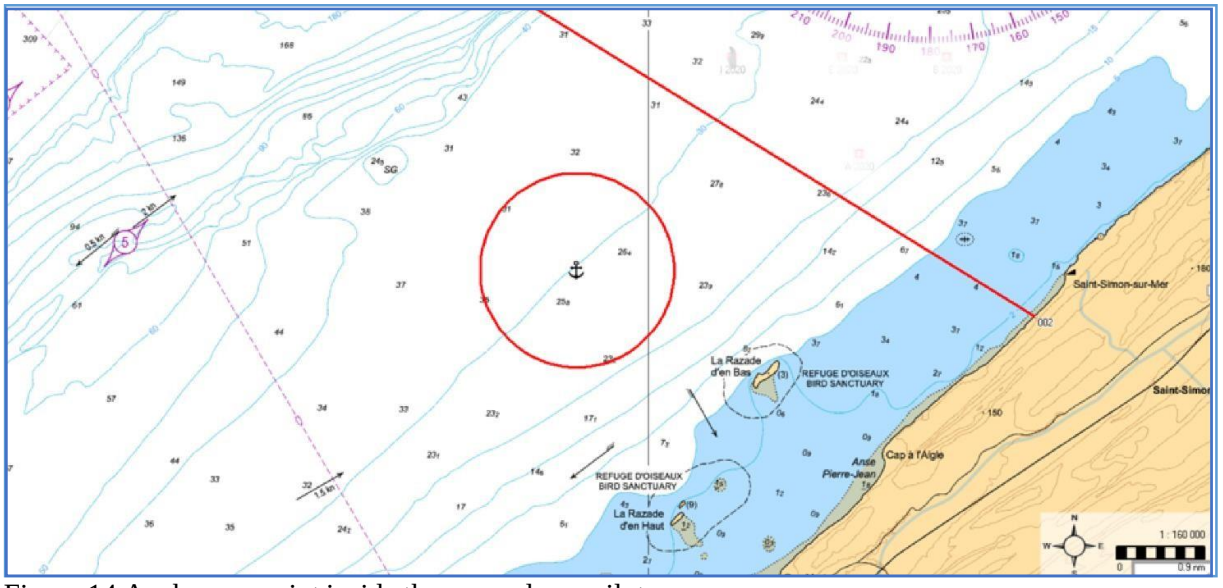


Figure 14 Anchorage point inside the compulsory pilotage area

5.4 TERMINAL OPERATIONS

5.4.1 MARINE TERMINAL

Location

According to the GNL Québec proponent, the terminal is located in the industrial-port area of the Saguenay Port Authority (SPA) in the Saguenay – Lac-Saint-Jean administrative region, within the limits of the borough of La Baie of the city of Saguenay. Maritime infrastructure is located in navigable waters under the jurisdiction of the SPA.

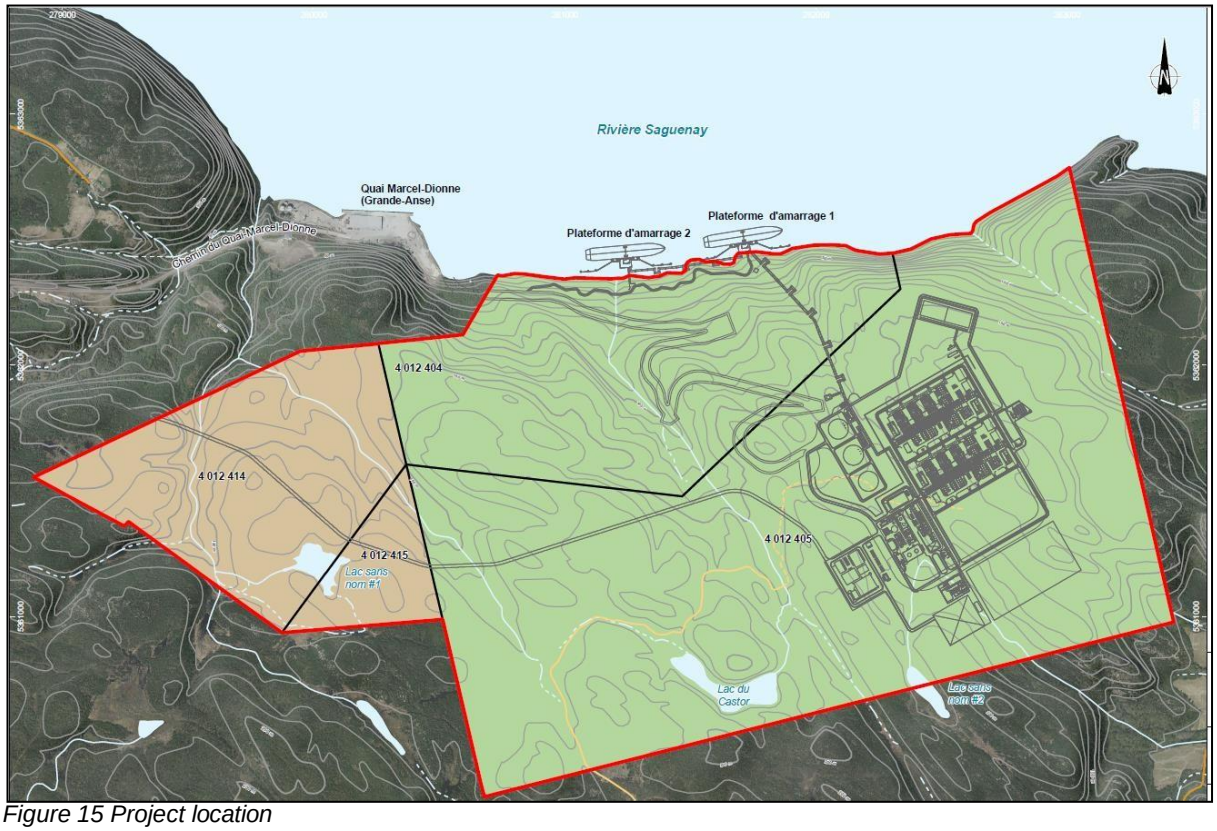


Figure 15 Project location

The marine terminal has two piers, each 360 meters long, offering a spacing of 157 meters between the vessels that dock there with a minimum depth of 15 meters.

The centre of the pier coordinates in MTM zone 7 NAD 83 provided by the proponent in certain documents are:

- Pier 1: E. 281 716.0, N. 5 362 485.5
- Pier 2: E. 281 245.5, N 5 362 424.5

The table below gives the conversion of these coordinates into latitude and longitude commonly used in the maritime field.

Geographical coordinates of GNL Québec piers		
Piers	Latitude	Longitude
Pier 1	48° 24' 02’’.16 N	070° 48' 43’’.20 W
Pier 2	48° 24' 00’’.36 N	070° 49' 04’’.80 W

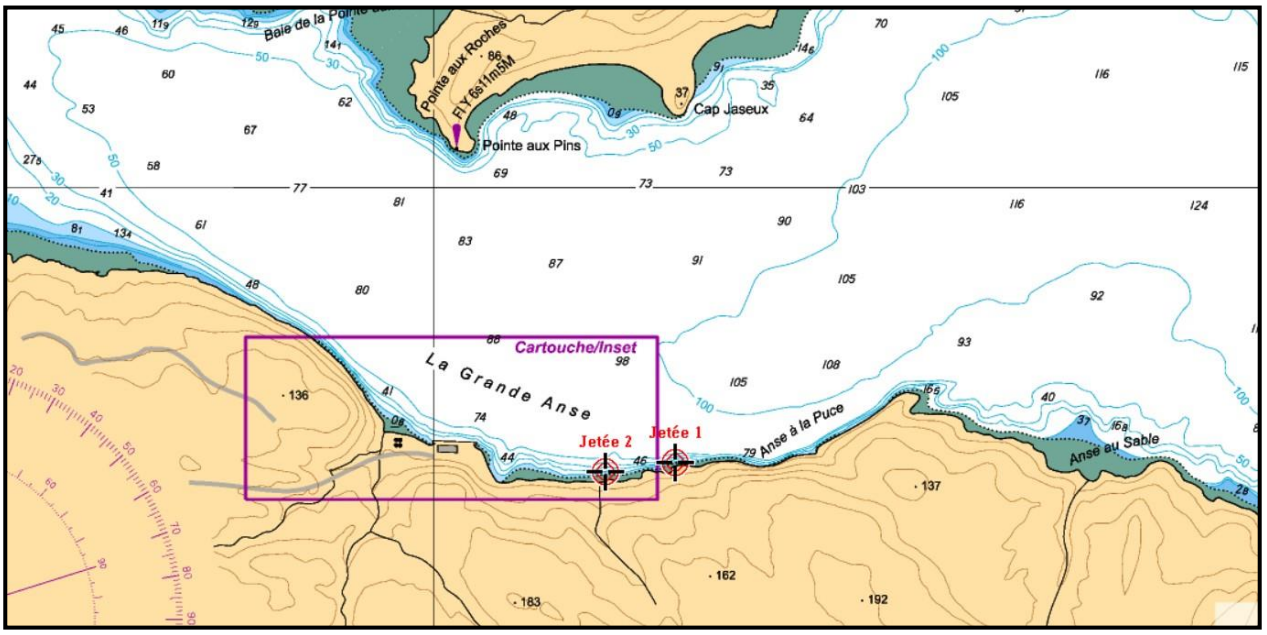


Figure 16 Location of piers on the nautical navigation chart (SHC map, 1202 Cap Éternité to Saint-Fulgence)

> ***Finding 20.*** Certain geographic coordinates provided by the proponent are in a format not used in maritime navigation.
>
> ***Recommendation 31.*** TRC members recommend that GNL Québec ensure all geographical coordinates provided for navigators and for maritime purposes be provided in latitude and longitude in the format: Deg, Min, Sec (Latitude: DD° MM' SS", Longitude: DDD° MM' SS"). Similarly, elevations and depths to be provided in meters.

Loading platforms

According to the GNL Québec proponent, the loading platforms will be designed to mainly support:

- LNG loading arms;
- Pipes;
- A turret with its gangway to safely access;
- Firefighting equipment; and
- Lighting systems.

Their design will also provide the necessary room for parking and maneuvering vehicles for maintenance personnel, or a mobile crane. Each platform shall have an area surrounded by a low wall under the loading arms and connection equipment to contain any LNG spillage.

Each platform will be approximately 46 meters wide (along the Saguenay River) and 35 meters deep and will be at an elevation of +13 meters *Chart Datum* (CD) in order to have the required clearance for larger tankers at all times.

The platforms will be constructed of reinforced concrete and supported by vertical steel posts embedded in the rock. A total of approximately 35 posts varying between 1.2 and 1.5 meters in diameter will be used to support the platforms. The rear of the platforms along the bank are out of the water and rest directly on the bank. The platforms will be attached to the shore by a reinforced concrete pontoon that will allow access to maintenance vehicles and emergency vehicles.

In order to resist ice loads and protect the posts, a reinforced concrete wall will be built along the perimeter of the platforms down to -0.5 meters CD, the lowest level of low tides.

Finding 21. In Canada, CAN/CSA-Z276-18 (Liquefied Natural Gas (LNG): Production, Storage and Handling) applies to the:

- a) design;
- b) location;
- c) construction;
- d) operation and
- e) Maintenance of facilities for the liquefaction of natural gas and facilities for the storage, vaporization, transfer, handling, and truck transport of LNG. It also contains requirements for the training of personnel.

For facilities used for loading and/or unloading LNG from ships, this standard contains requirements for the piping that connects the loading/unloading arms and the storage tank as well as the piping fittings on the dock and pier.

This standard does not apply to LNG transport by vessel.

Recommendation 32. TRC members recommend that GNL Québec ensure the LNG loading procedures be developed and harmonized with the CAN/CSA-Z276-18 standard.

Recommendation 33. TRC members recommend that GNL Québec ensure the facility designs are certified by a third party specialized in the LNG liquefaction, storage, and handling before the start of operations.

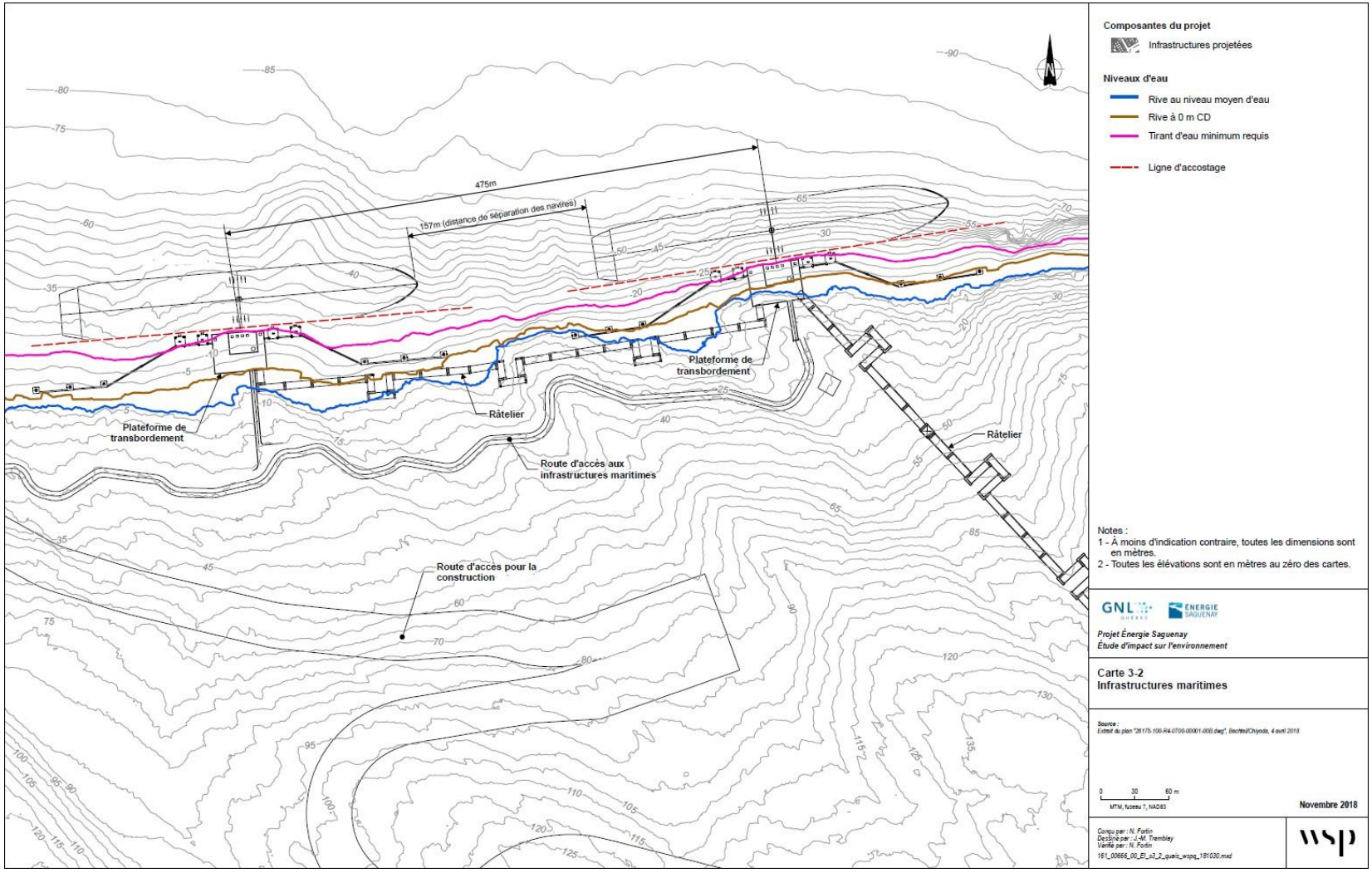


Figure 17 Maritime facilities

5.4.2 ANCHORING AND MOORING

5.4.2.1 VESSEL'S ARRIVALAND DEPARTURE MANEUVERS

Chapter IX of the *International Convention for the Safety of Life at Sea* (SOLAS Convention) requires compliance with the ISM (*International Safety Management*) Code. The purpose of the ISM Code is to provide an international standard for the safe management and operation of ships and for pollution prevention.

Under ISM code, Chapter 7 (*Development of plans for shipboard operations*), The Company should establish procedures, plans and instructions, including checklists as appropriate, for key shipboard operations concerning the safety of the personnel, ship and protection of the environment. The various tasks should be defined and assigned to qualified personnel. These shipboard procedures are compiled in the *Ship Safety Management Manual* (SMM) of the safety management system of which ship's arrival and departure procedures form part.

In addition, according to the provisions of IMO resolution A.893(A), the need for voyage and passage planning applies to all vessels. A pier-to-pier voyage plan shall be developed based on Safety Management System Manual provisions. Ship's arrival and departure procedures are part of voyage planning.

Following numerous incidents relating to the mooring of tankers (oil, chemical and gas tankers), in its latest version MEG4 (*Mooring Equipment Guidelines*), the *Oil Companies International Marine Forum* (OCIMF) has introduced new guidelines and practices for the safe mooring of tankers and gas carriers within port terminals by developing a *Mooring System Management Plan (MSMP*).

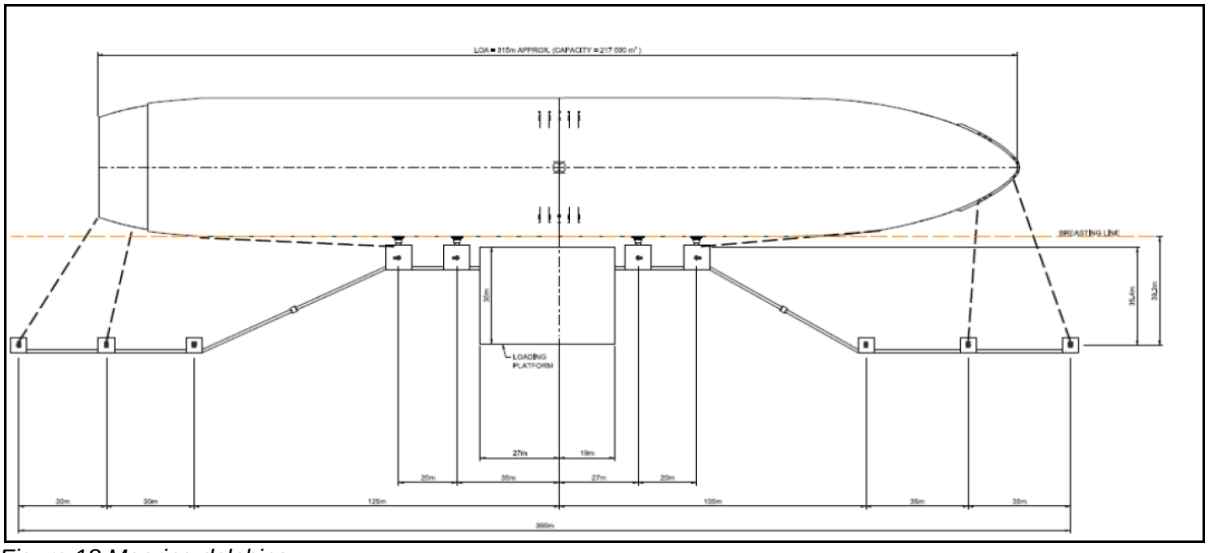


Figure 18 Mooring dolphins

Recommendations for Movements/Manoeuvres at the Terminal

As part of the project development, in particular the design of the maritime terminal, the proponent has mandated the maritime simulation and expertise center (CSEM) to conduct a series of transit simulations including Movements/Manoeuvres at the Terminal. Below are the recommendations for these maneuvers.

Recommendations for arrival maneuvers

With the open nature of the approach bay, and the amount of space between the two LNG berths, and the space from the western berth to the Grande-Anse Terminal, approaches can be conducted in a safe an efficient manner both port and starboard side. Even with vessels at the adjoining terminals, there is ample space for the manoeuvring LNG vessels to maintain a distance of at least 200 metres from any moored vessel.

Given the predominant outflow nature of the current, with velocities ranging from 0.5 to 2.5 knots in the immediate vicinity of the berth, and the prevailing wind from the northwest quadrant, it is assessed that on a repeat basis, port side arrivals can be conducted in a more efficient and safer manner than starboard side arrivals. It is highly recommended that consideration be given to implementing a policy where port side arrivals are preferred.

Recommendations for departure maneuvers

The factors mentioned in the item above are equally applicable to departure manoeuvres. Additionally, considering that the nearest safe anchorage (by a considerable distance) is upriver from the berth, if an LNG vessel is berthed port side at the dock, this would facilitate emergency/short notice departures where a pilot may not be available, and tug resources maybe limited. It should also be noted that while the allocated time for this analysis did not allow for an exhaustive examination of conducting emergency departures under a full range of environmental conditions. However, judging on the amount of tug force used during starboard side departures, with the possible exception of the two or three hours each day when the current flow at the berths is relatively light, it is highly unlikely that starboard side departures can be conducted without tug assistance.

According to the proponent:

- Comprehensive mooring plans will be established for each vessel under “normal operations” and “storm” scenarios. These plans will be based on modeling using "Optimoor" software (or equivalent) carried out by the operator or its shipping agent and approved by the terminal, which will ensure that sufficient personnel are available on the piers to respond any need.
- Regardless of the results of the Optimoor analysis, a minimum of 16 mooring lines must be used.
- All mooring cables must be fitted with synthetic mooring tails that comply with OCIMF guidelines, i.e., a length of 11 meters and a breaking strength of 125% of the resistance of the cable to which they will be attached.
- A mooring load monitoring system is installed on each pier. The system makes it possible to monitor the tension in the moorings in real time and to transmit the information to the maritime operations control room and to the vessel through the pilot's portable unit. The voltage can thus be maintained in the optimum range depending on the conditions.

Finding 22. Vessel mooring is a collaborative operation between:

- The Master of the vessel;
- The mooring pilot;
- Towing services;
- The marine terminal.

Recommendation 34. TRC members recommend that GNL Québec ensure the mooring plans within the terminal are:

- Developed in accordance with the provisions of OCIMF and PIANC (*Permanent International Commission for the Navigation Congresses*[37]);
- Developed taking into account the particularities of the terminal's two piers;
- Communicated to pilots, tug, and mooring services.

Recommendation 35. TRC members recommend that GNL Québec ensure all mooring bollards being installed on the dock are remote automatic release.

Navigation Aids

According to the documents submitted by the proponent as part of this analysis, it would not be necessary to install navigation floating aids due to the depth available around the two piers. However, the following lights will be installed on the piers in order to determine the ship's heading and position in relation to the piers (distance and angle at docking):

- Centre yellow flashing navigation light;
- Four blue lights, either at the outer corners of the platform and at the end mooring dolphins.

These lights will be activated on demand by the pilots in charge of maneuver operations using VHF signals. In addition, to facilitate these operations, the proponent plans to install the following equipment for the use in the maritime operations control room:

- A Marine Environmental Monitoring System (MEMS) that provides information on:
  - Wind speed and direction;
  - Air temperature;
  - Water temperature and salinity;
  - Humidity;
  - Barometric pressure;
  - Visibility;
  - Current speed and direction;
  - Tide height;
  - Wave profile; and
  - Lightning detection.
- A Docking Aid System (DAS) on the mooring dolphins of each pier using a dual laser system with a large digital display board installed on the pier to determine:
  - Distance from the dock;
  - Approach sea speed.

Currently, a review of navigation aids is underway on the Saguenay River. Since the Énergie Saguenay Project facilities would be built on land owned by the Saguenay Port Authority, navigational aids at the terminal would be governed by *Private Buoy Regulations*[38].

---

[37] Aspects Affecting the Berthing Operations of Tankers to Oil and Gas Terminals, PIANC, MarCom Working Group 116.

[38] SOR-99-335.pdf (justice.gc.ca)

Given the proximity of the aforementioned areas of responsibility, the Canadian Coast Guard invites the proponent to contact them to carry out a collaborative analysis of navigation aid systems required for the project in the event of its implementation.

Finding 23. According to the mandate assigned to Canadian Coast Guard (CCG) by the federal government, they are responsible for the Canadian Aids to Navigation System in waters under Canadian jurisdiction.

Recommendation 36. Given the proximity of the aforementioned areas of responsibility, TRC members recommend that GNL Québec carry out a collaborative analysis of navigation aid systems required for the project in the event of its implementation.

Recommendation 37. TRC members recommend that GNL Québec ensure all the equipment and navigation aids be developed and installed in accordance with the provisions of IALA (International Association of Marine Aids to Navigation and Lighthouse Authorities) and the Canadian Coast Guard.

Use of tugs during ship's arrival and departure Maneuvers

Following the simulations of mooring and departure maneuvers carried out at the *Maritime Simulation and Expertise Centre* (CSEM), the proponent plans to use the assistance of tugs for these maneuvers according to the following guidelines:

- For tankers with an overall length between 250 and 300 meters:
- 3 tugs will be used either:
  - 1 tug with a bollard power of 90 tons, attached to the stern;
  - 2 tugs with a bollard pull of 75 tonnes.
- For tankers with an overall length overall of more than 300 meters:
- 4 tugs will be used either:
  - 1 tug with a bollard power of 90 tonnes;
  - 3 tugs with a bollard power of 75 tonnes.

Tugs will be used within a minimum radius of 1 nautical mile from the piers and will be designed to work in ice conditions (terminal water operations and icebreaking).

Finding 24. Most marine terminals regulate the use of tugs during arrival and departure operations; however, current regulations do not govern such operations.

Recommendation 38. Although the use of tugs during arrival and departure operations is not governed by regulations, TRC members recommend that GNL Québec include tug operations in the Port Operations Manual as an additional safety contribution.

5.4.2.2 SINGLE POINT MOORING

Single point mooring (SPM) consists of mooring the vessel to a single point. Generally, a floating buoy anchored offshore is used as a mooring point to allow tanker loading/unloading operations. These operations are carried out in areas where there are no oil handling facilities. As part of the GNL Québec project, all ship loading operations will be done at the dock and there will be no single point mooring operation.

5.4.2.3 EMERGENCY ANCHORAGE

In the event of special circumstances requiring the stoppage of operations and an early departure from the dock, the vessel is to proceed to the designated emergency anchorage. The nearest safe anchorage is upstream of the dock. An LNG carrier berthed on the port side would facilitate emergency or short-notice departures, in the event that the pilot is unavailable and towing resources are limited.

This emergency anchorage would allow a swing circle with a diameter equivalent to two and a half times (2.5X) the length of the vessel.

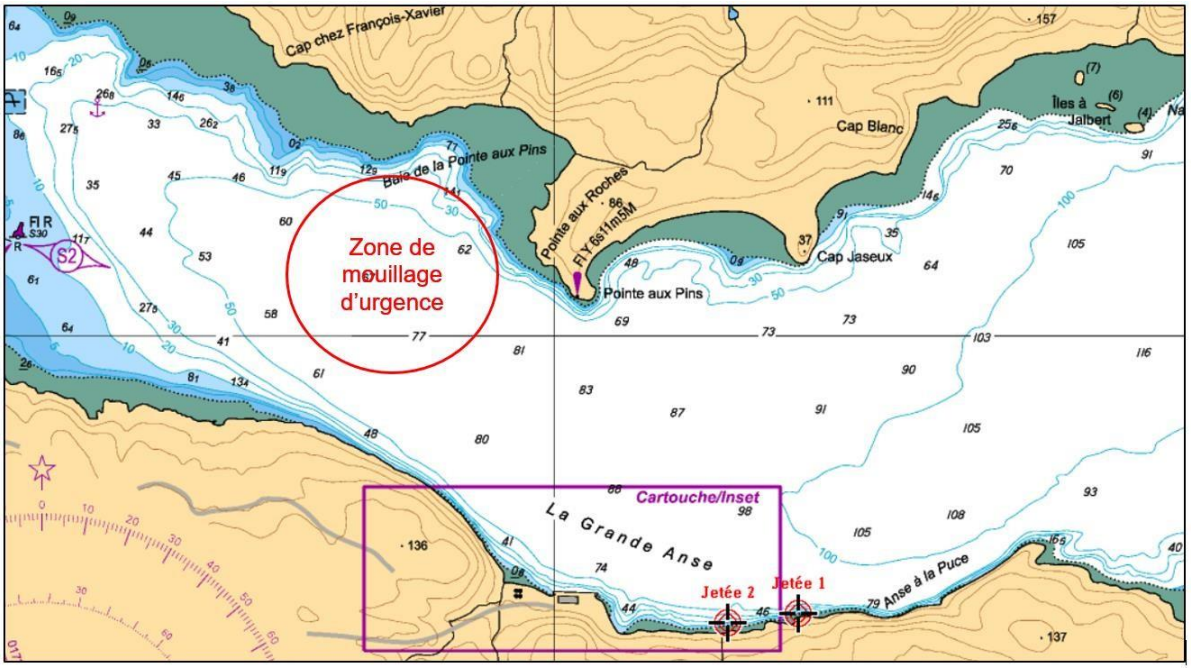


Figure 19 Emergency anchorage area

> ***Recommendation 39.*** TRC members recommend that GNL Québec also ensure an emergency anchorage area be documented in the Port Operations Manual, communicated to all marine stakeholders and subject to safe exclusion distance analysis.

5.4.2.4 DE-ICING OF FACILITIES

According to the proponent,

- Vessels used during the ice season will be required to have Lloyd's Register, DNV 1A certification[39] or an equivalent
- All vessels passing through the Saguenay in winter are escorted by a Canadian Coast Guard icebreaker except for a few rare ice-classed vessels;
- It is recommended to plan an escort policy having a tug attached by the stern fairlead at the entry of the Lower Saguenay and its confluence with the St.

[39] https://www.dnv.com/about/maritime/index.html

Lawrence in an area located between the line connecting buoy K54 to the Prince Shoal lighthouse (eastern limit) and Île Saint-Louis (western limit)."

According to current observations in the area, vessels with the "1A - Difficult Ice Conditions" certification have the capacity to transit in ice fields that can be up to 0.8 meters thick, often ice in the navigation route for the Saguenay River can be up to 1 to 2 meters thick. During ice season, Class 1A vessels generally require the assistance of an icebreaker.

Finding 25. Currently, the information necessary for the CCG to include the GNL Québec facilities in its planning for icebreaking operations is not available.

Recommendation 40. Regarding icebreaking, TRC members recommend that GNL Québec:

- Have tugs that are classed 1A;
- Have tugs that will escort the tankers during transits and be assigned for icebreaking around the pier areas; and
- Share the movement of its vessels with the Canadian Coast Guard during the icebreaking season.

5.4.3 CARGO HANDLING OPERATIONS

According to the proponent, even if the terminal is designed with two piers, the loading of ships with LNG cargoes will only take place at one pier at a time, i.e., there will be no simultaneous loading on both piers at any time.

According to the proponent, a total of six pumps will be used for loading LNG, i.e., three pumps in each storage tank. Each pump is fitted with a remote-controlled flow control valve and an automatic check valve. The loading will be done by a loading line with the three loading arms.

LNG is loaded at a maximum rate of 12,000 m^3/hour and a minimum temperature of -165°C. With this flow, LNG Québec vessels will have to stay a minimum of approximately 15 hours at the dock.

Below are the operational parameters for docking/undocking and transhipment operations, according to the wind conditions which have been established by the proponent and which are to be included in its operations manual.

Operational status according to wind conditions	
Wind speed	*Operational status*
Less than 25 knots (46.3 km/h)	Terminal in normal operation
Between 25 and 35 knots (64.82 km/h)	No docking or undocking. If a download is in progress, it can continue.
35 knots	Loading operations stopped. The transfer arms are disconnected and locked.

More than 35 knots, but forecast less than 50 knots (92.6 km/h)	The vessel remains moored. Move to storm position (if necessary) and deploy additional mooring lines.
Forecast for more than 50 knots	The vessel must sail and leave the terminal.

SIGTTO is an international organization bringing together maritime terminals handling liquefied gases and maritime transporters of these gases. Its mission is to promote safety and environmental protection and the operation of terminals for liquefied gases.

Through this organization, industry participants can share their experiences, solve common problems, and establish criteria for best practices and acceptable standards.

Recommendation 41. TRC members recommend GNL Québec incorporate the tests and procedures for pre-loading ships with LNG cargo into the installation's operating manual.

In addition, checklists for operations relating to preloading, loading, and the near completion of the loading should be developed with the vessels.

GNL Québec should also incorporate the practices and safety checklists described in the latest version of the SIGTTO publication titled "Liquefied Gas Handling Principles on Ships and in Terminals" into its operational procedures.

Recommendation 42. In terms of safety in the operation and maintenance of liquefied natural gas terminals, TRC members recommend that GNL Québec ensure training for terminal personnel involved in GNL Québec transhipment operations be developed and implemented in accordance with the provisions of standards:

- OCIMF[40] (*Oil Companies International Marine Forum*)
- CSA Z276-18
- NFPA 59A

Vapor Return Line

In the plans submitted by the proponent, a vapor return line is planned to be installed on both piers.

In the liquefied gas loading shipping industry, a vapor return line is always installed. This line is used to collect cargo vapors inside ship tanks and return them ashore for treatment.

Recommendation 43. As the liquefaction plant is planned to be located at a certain elevation to the transshipment marine terminal, TRC members recommend GNL Québec study the capacity of the vapor return line and assess the need to install a compression system to facilitate the return of vapors to the liquefaction plant.

[40] *Marine Terminal Operator Competence and Training Guide (MTOCT), (OCIMF).*

Quai Marcel-Dionne Operations (Grande-Anse)

Currently, the Quai Marcel-Dionne (Grande-Anse), which is not very far from the future GNL Québec facilities, accommodates vessels transporting class 1 cargo according to the IMDG (International Maritime Dangerous Goods) code.

In order to comply with regulations and be able to handle this type of cargo, a permit is periodically issued to the SPA (Saguenay Port Authority) under the *Explosives Regulations, 2013* (SOR/2013-211). Such a permit must be reassessed before the start-up of the GNL Québec facilities, if applicable.

5.4.4 PORT INFORMATION BOOKLET

As part of the TERMPOL analysis, the proponent presented the port information booklet in draft form, which is a preliminary version, intended for terminal users and the crew of vessels bound for the terminal, or to their maritime agents to ensure adequate preparation and coordination of communications and operations.

Some of the provisions it contains, as well as certain laws or regulations, could change or evolve during the construction phases and the implementation of terminal operating procedures.

This booklet will cover the following items:

- *Introduction*
  - *Subject*
  - *Terminal location*
  - *Capacity*
  - *Terminal plans*
  - *Time zone*
  - *Notifications*
- *Environmental characteristics*
  - *Water depth*
  - *Weather*
  - *Ice*
  - *Tides, currents, and waves*
- *Regulations and standards*
  - *Federal regulations*
  - *Marine mammal preservation areas*
  - *Ice navigation requirements*
  - *Pilots and Ice Advisors*
  - *Terminal standards and practices*
- *Navigation*
  - *Navigation routes*
  - *Transit Speed*
  - *Escorts and tugs*
  - *Anchorages*
  - *Navigation aids*
- *Docking and Undocking*
  - *Operation Limits*
  - *Docking*

- *Undocking*

- *Available services available*
  - *General*
  - *Health and hospital care*
  - *Petroleum products*
  - *Provisions*
  - *Water*
  - *Wastewater and residual materials*
  - *Repair and maintenance*
- *Terminal Access*
- *Communications*
  - *General*
  - *Arrival time requirements*
  - *Checklist*
  - *Pre-arrival*
  - *Communications at the dock: normal operations and emergency situations*

Recommendation 44. TRC members recommend that GNL Québec present the final version of the port information booklet to the TRC at the latest six months before the commissioning of the terminal. This version will be amended as necessary.

5.4.5 TERMINAL OPERATING MANUAL

As part of the TERMPOL analysis, the proponent submitted a draft *Terminal Operations Manual*, which is a preliminary version. In its final version, the operations manual includes all the procedures necessary for the safe operation of the terminal, including inspections and preventive maintenance. Before the end of terminal construction, it is difficult to establish these procedures since they are dependent on the equipment implemented and whose operation may vary depending on the source and the manufacturer.

Below, the outline of the terminal operating manual submitted by the proponent:

- *Inspection, testing, and preventive maintenance of equipment*
- *Pre-transhipment procedures*
  - *Purging, degassing, and putting pipes under inert atmosphere*
  - *Cooling and circulation test*
- *Vessel-terminal connections: Communication and chain of command*
  - *Loading arm*
  - *Vessel-terminal link and communications*
- *Handling*
  - *Loading*
  - *Emergency stops*
- *Security measures and emergency procedures*
  - *Monitoring*

- *Alarms and triggering emergency measures*

The complete operating manual will be submitted in its final version no later than six months before the commissioning of the terminal.

> ***Recommendation 45.*** TRC members recommend that GNL Québec submit the final version of the operations manual to the TRC no later than six months before the commissioning of the terminal.

5.5 RISK ASSESSMENT AND EMERGENCY PLANNING

5.5.1 RISK ASSESSMENT

As part of the TERMPOL analysis process and according to TP 743, the proponent will have to:

- Analyze the risks to navigation and operations that may result from the spillage of pollutants and harmful and potentially dangerous substances en route at a terminal or at a transshipment site;
- Assess the planned methods of mitigating these risks. These risks usually arise from one of the following:
  - A collision between two vessels;
  - Grounding;
  - A collision between a vessel and a fixed object;
  - An incident relating to improper cargo transfer;
  - A fire or explosion;
  - Breach of hull.

RISK ANALYSIS

In terms of risk analysis related to maritime navigation, the proponent conducted a hazard identification process called *HAZID* (*Hazards Identification*) which made it possible to retain the following items as sources of danger:

Product transported

The assessment of risks related to maritime transport and the handling of bulk LNG cargoes is based on the physico-chemical properties of this cargo.

LNG Properties

For purposes of transport by vessel, liquefied gases are obtained by two physical and thermodynamic processes derived from the ideal gas law, or ideal gas equation by increasing the pressure, or by lowering the temperature.

In the case of LNG, which mainly consists of methane (CH_4), this is obtained by lowering the temperature to approximately – 160°C, which makes it possible to reduce 600 m^3 of gas to its gaseous state to 1m^3 of LNG to its liquid state at atmospheric pressure. This becomes advantageous for maritime transport.

- **Chemical composition**

Chemically, LNG is mainly methane (CH4) composed of carbon and hydrogen (1 carbon atom for 4 hydrogen atoms). LNG is odourless, colourless, non-corrosive, and non-toxic.

For consumption and safety purposes, and since natural gas basically has no smell, an odorous substance is added to it to help detect leaks. This substance, mercaptan, gives off a strong smell like rotten eggs.

- **Flammability**

LNG in its liquid state is not flammable, however, when it evaporates and changes to a gaseous state, these gases become flammable when they occupy between 5% and 15% of the volume of the space and when subjected to an ignition source.

LNG Flammability		
Less than 5%	Non-flammable	Mixture too lean
Between 5% and 15%	Flammable	Adequate mixture
More than 15%	Non-flammable	Mixture too rich

- **Auto-flammability**

The auto-flammability temperature is around 595°C. The risk of auto-flammability is then very low and should be ruled out.

- **Explosiveness**

As LNG is transported on board vessels under atmospheric pressure (not compressed), the risk of explosion is eliminated.

In the event of a breach in the transport tanks and LNG spillage, LNG quickly turns into gas. This rapid phase change could lead to weak, dry, and cold explosions without combustion phenomena.

These explosions, due to the rapid phase transition due to the change in temperature and the passage from the liquid state to the gaseous state, are accompanied by a sudden increase in the total volume occupied by LNG and can then generate a shock wave.

- **Cryogenics**

As LNG is charged at very low temperatures, i.e., - 162°C, it freezes everything that comes into contact with it, hence the use of certain metal alloys that can withstand these low temperatures and the requirement for specialized personal protective equipment to staff.

- **Asphyxiation**

Accumulation of flammable vapor in a confined, unventilated space results in lack of oxygen which can cause asphyxiation and even increase the risk of flammability.

Depending on its concentration, LNG can also cause human behavioural changes, nausea, and vomiting. In high concentrations, it can lead to death.

Recommendation 46. TRC members recommend that GNL Québec evaluate the safety hazards pertaining to the marine terminal work environment and consider the following LNG risk components:

- Flammability and auto-flammability
- Explosiveness
- Cryogenics
- Asphyxiation

5.5.1.1 COLLISION AND GROUNDING

According to documents filed by the proponent, global collision frequency amounts to 6.7 x 10^{-3}/year, which represents one collision per 150 years. The probability of collision specific to the area under study is 3.5 x 10^{-7}/MN/year.

Similarly, global grounding frequency is 2.8 x 10^{-3}/year, which is one grounding every 350 years. The collision probability specific to the area under study is 2.9 x 10^{-7}/MN/year.

According to the analyses conducted by the proponent, failure probability during a collision at the dock is set at 9 x 10^{-6} vessel passages for narrow estuaries, which represents 3.6 x 10^{-5}/year for 200 vessel passages per year.

Finding 26. TRC members believe that collision risks are present on approach to the terminal and at the Saguenay entrance, while grounding risks are present at the Saguenay entrance over a distance of about 4 nautical miles. However, collision risks cannot be ruled out on the Saguenay River when there are meeting / overtaking with other vessels.

Similarly, TRC members believe that that the presence of pilots on board vessels navigating in the area, their training, and the use of escort tugs by GNL Québec vessels, will have significantly decreased collision and grounding risk.

The documents submitted by the proponent do not currently deal with grounding and collision incident management operations in Canadian waters and, in particular, in the study area. The management of exceptional maritime incidents is done according to established procedures involving several authorities, organizations, the master of the ship and the ship's management company, who are responsible for the implementation of their intervention plans.

Recommendation 47. TRC members recommend that GNL Québec develop maritime incident management plans, including salvage plans to deal with these possible events.

5.5.1.2 FIRE AND EXPLOSION

LNG vapor fires occur when the concentration of vapor in the atmosphere is between 5% and 15% following a spill. During the combustion of these LNG vapors, there is formation of a pool fire and very intense heat emissions, which requires remote fire prevention and firefighting equipment and/or systems. LNG installations and vessels are not subject to the phenomenon of explosive expansion of vapors of a boiling liquid called BLEVE (*Boiling Liquid Expanding Vapor Explosion*).

Even if in its documents filed for TERMPOL analysis, the proponent analyzed the worst scenarios based on breaches followed by fire, nevertheless, particular attention should be paid to small, sustained leaks. These can create large clouds of vapor that can spread in the facility within a few minutes, creating a flammable area.

The extent of this area depends on:

- the flow rate of the leak;
- the topography and location of the leak site; and
- weather conditions.

The flammability depends on:

- Concentration of gas vapors; and
- Availability of an ignition source.

Areas or premises on the terminal, likely or capable of finding retention of LNG vapors, should be avoided, and to be designed in such a way as to prevent this type of retention.

In terms of fire prevention and firefighting, equipment and/or systems shall be provided to prevent, control, and handle emergency situations. The terminal should be equipped with the following items.

- Detectors for:
  - LNG leaks
  - Temperature
  - Smoke
  - Flames
- Emergency control stations:
  - Emergency telephone
  - Alarm trigger
- Fire fighting and control equipment

Finding 27. According to the literature, the risks of fire and explosion are low in this LNG shipping industry, which spares no effort in terms of prevention. As a result, the consequences of fire are considered as minimal.

Recommendation 48. In terms of fire-fighting equipment in the terminal, TRC members recommends that GNL Québec apply at a minimum, the application of the provisions of standard NFPA 59A (Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)).

This standard provides minimum requirements for fire protection, safety and other related requirements for the location, design, construction, safety, operation, and maintenance of liquefied natural gas (LNG) plants).

5.5.1.3 ALERT AND EMERGENCY MEASURES MANAGEMENT:

As part of the alert and emergency measures management process in Quebec (RAA, Warning and Alert Network), the Canadian Coast Guard has developed a provincial operational procedure for issuing alerts during maritime events occurring in the Quebec region, and which may endanger the safety or health of residents, or which may have repercussions on the environment.

In 2011, as part of the BAPE hearings on the environment regarding the effects related to the exploration and extraction of natural resources on groundwater in the Magdalen Islands, particularly those related to the exploration and gas operations, the Canadian Coast Guard (CCG), the Ministry of Sustainable Development, Environment and Parks (MDDEP), and the Ministry of Public Security (MSP) jointly produced a document on an operational procedure for the “alert” component of a maritime intervention.

The procedure[41] specifies which departments and organizations are involved in the provincial alert structure and how they would be alerted.

The documents submitted by the proponent do not deal with the integration of the current project into the Warning and Alert Network during maritime incidents, accidents, or occurrences.

Recommendation 49. Despite the low probability of maritime accidents and incidents, TRC members recommend that GNL Québec develop a detailed alert and emergency management plan covering the transit of vessels from the Canadian Exclusive Economic Zone (EEZ) to the Port of Saguenay.

- This plan should identify all possible events (related to navigation, operations, and the structural state of vessels), and consider local conditions likely to influence responses, identify risks and impacts, and describe the emergency measures, and the procedures it will implement in order to:
  - Take charge of the situation;
  - Minimize the risks for the crew, responders, population, essential structures, and environment; and
  - Remedy the situation.
- This plan would serve to guide the coordination of the various responders during an incident and demonstrate the proponent's understanding of its roles and responsibilities in Canada. If necessary, the proponent can contact Canadian Coast Guard.

Recommendation 50. The Saguenay River has specific environmental and socio-economic sensitivities depending on the different sections. TRC members recommend that GNL Québec:

- Develop a local risk analysis in detail by identifying the impacts and repercussions that the maritime incidents described in the alert and emergency measures management plan would have on the environment and local citizens.
- Specify the mitigation measures in the analysis that the proponent intends to implement in order to adequately respond to each of the identified risks.

Recommendation 51. In the event that a GNL Québec vessel loses its manoeuvre resulting in a drift and/or grounding, TRC members recommend that GNL Québec identify measures to be implemented, including:

- Taking charge of the situation;
- Minimizing risks for the population, essential structures, the environment; and
- Remedying the situation.

5.5.1.4 MARINE SECURITY

This report does not address issues of terrorism and malicious acts against GNL Québec facilities or its vessels.

As a reminder, under the *Marine Transportation Security Act* and the *Marine Transportation Security Regulations*, the proponent must develop a security plan for its facilities. This plan must be submitted to Transport Canada, Marine Security for approval.

[41] https://archives.bape.gouv.qc.ca/sections/mandats/nappes_phreatiques_%C3%AEles-de-la-madeleine/documents/DB52.2.pdf

5.5.2 METHODS PROVIDED FOR RISK REDUCTION

In terms of risk prevention, although the construction of this type of facility must meet all regulatory standards and requirements, the proponent shall undertake to build facilities according to the following design criteria:

- Stability: remain stable within the design range of loading conditions;
- Strength: withstand maximum design loading conditions;
- Usability: remain usable throughout the expected lifetime; and
- Durability: ease of maintenance and repair at minimum lifetime costs.

In addition, under existing standards for this type of facility, those of GNL Québec will be equipped with all gas leak detection, fire detection and fire-fighting equipment.

It is important to note that even if the risks associated with an LNG spill are not zero and the consequences can be significant, they can be mitigated by implementing effective measures to reduce the possibility of any spills and also to minimize the result/impact if a spill is to occur. To achieve this, safety and security plans are mandatory components of LNG risk management.

Currently, and according to the documents submitted by the proponent, the operational procedures have not yet been developed. Nevertheless, they must include the suspension of loading operations, or resuming LNG loading, or not allowing to start operations for the following reasons:

- Loss of communications between the vessel and the terminal;
- Any request to stop loading operations from the vessel/terminal;
- Reaching operational limits imposed by weather conditions;
- Unsatisfactory ballast conditions, or questionable stability conditions;
- Loading or reloading plan not followed;
- During personnel transfer operations using workboats;
- Unavailability of firefighting tugs;
- Situations foreseen by terminal/port procedures; and
- Any condition that may have a negative impact on terminal safety and security, vessel, and environmental protection.

A functional and emergency stop signal must be available and accessible at all times within the installation and on board the vessel. In addition, the following items should be taken into consideration for the temporary suspension of loading operations if required:

- Presence of lightning;
- Equipment failure;
- Broken mooring; and
- LNG Spill (overflow / overflow of the ship's tanks), or any other product;

In terms of safety, the documents submitted by the proponent does not deal with exclusion zones around the vessel when it is sailing upstream from the Les Escoumins pilot station.

Currently, Canada has no regulatory provisions for exclusion zones around ships carrying liquefied gas cargoes. The United States has binding provisions in its legislation.[42] The US requires each terminal in American waters and each ship carrying liquefied gases to or from these terminals to adopt an exclusion area.

[42] *33 CFR Part 165 - REGULATED NAVIGATION AREAS AND LIMITED ACCESS AREAS*

Currently, the only marine liquefied gas handling facility in Canada that has implemented exclusion zones as safety measures is Canaport in New Brunswick.

Safety measures required at Canaport LNG in Port Saint John include[43] :

- A security screening of the ship's crew by Transport Canada;
- Assistance by tethered tug;
- A security perimeter of 0.5 nautical miles (925 m) around the LNG tanker navigating in the port;
- Prohibition of anchoring within 1.5 nautical miles (2.7 km) of an LNG tanker; and
- The ban on overtaking an LNG tanker circulating in the port.

Maritime traffic is prohibited within a radius of 0.3 nautical miles (620 m) from the centre of the terminal when LNG unloading operations are in progress, with the exception of tugs and service vessels assisting the unloading.

Internationally, the ISO 28460 standard (*Petroleum and natural gas industries — Installations and equipment relating to liquefied natural gas — Ship-to-shore interface and port operations*) deals with this exclusion zone around the vessel as follows:

> ``*A moving safety zone shall be established around the transiting LNGC, into which no unauthorized traffic shall be allowed to enter. The purpose of this zone is to protect the vessel from marine hazards (collision, grounding) while in transit. The dimensions and shape of this zone and the necessity for escort vessels shall be determined by a risk assessment and/or local requirements, giving, as a minimum, consideration to traffic type, movement and density, channel dimensions, tidal factors and meteocean factors''.*

As part of the evaluation of this project by the IAAC, the proponent recently contracted the DNV[44] firm to improve the quantitative maritime risk analysis carried out by Tetratech. The mandate was granted to DNV and consists of:

- Updating incident risk levels based on international, regional, and local data;
- Updating the maritime risk assessment in consideration of the best practices required in other LNG terminals, Canadian and international, and the specific characteristics of LNG carriers;
- Updating the risk assessment at the terminal;
- Assessing the consequences of product spills following a fire; and
- If necessary, make recommendations to reduce the risks.

The DNV study will enhance the Tetratech study submitted as part of this assessment, in particular, by detailing incident causes that could lead to the worst-case scenarios, already analyzed by Tetratech. GNL Québec undertakes to incorporate any additional mitigation recommendations resulting from DNV's analysis into the prevention measures already presented to the IAAC, and any additional mitigation recommendations from the DNV analysis.

> ***Finding 28.*** Many LNG marine terminals, and vessels to or from these terminals adopt exclusion distances. These distances are either assessed according to the navigation area or required by regulatory provisions.

[43] https://clearseas.org/en/gnl/
[44] https://www.dnv.com/about/maritime/index.html

Recommendation 52. TRC members recommend that GNL Québec carry out an analysis of the terminal and vessels regarding exclusion areas.

Recommendation 53. TRC members recommend that GNL Québec prepare a communication plan for vessels near exclusion areas around its facilities and vessels;

Communications at the Terminal

According to documents filed by the proponent, a "vessel-terminal link" provides the required communication between the vessel and the terminal during vessel loading operations. The communications system will be accessible from the Marine Control Room as well as the Main Operations Control Room. The link system includes the following items:

- Telephone system (public and direct lines);
- Emergency shutdown system (ESD); and
- Mooring load monitoring system.

Finding 29. Although the proponent did not highlight it in his studies, the communications equipment used in the gas terminals for operations is of an intrinsic type and is listed in the operational booklet.

Recommendation 54. Regarding equipment and communications, TRC members recommend that GNL Québec implement the following practices, and include them in the port booklet when a vessel is at dock during loading:

- The vessel's MF/HF radio equipment must be switched off;
- The vessel's fixed VHF radio equipment must operate at its minimum power of 1w (watt) or less;
- Portable VHF and/or UHF radio equipment (vessel/terminal) must operate at their minimum power of 1w (watt) or less;
- The vessel's AIS equipment must be switched off;
- The shutdown of the vessel's satellite communications in the event of an LNG spill, emergency, or any situation requiring it;
- Vessel radars must be off during loading operations; and
- Any necessary maintenance on the communications equipment on site must be authorized by the terminal and performed outside the loading periods.

5.5.3 EMERGENCY PLAN

For the purposes of the TERMPOL analysis, the proponent presented a table of contents of the preliminary version of the emergency measures plan (EMP) in his submitted documentation. It should be noted that this EMP will have to be developed in its operational version before commissioning the installations.

When developing this EMP, the following aspects should be considered:

- Spill or fire of the cargo on board a vessel at dock and fire on board the vessel not associated with the cargo;
- Spill or fire of the cargo during loading; and
- Spill or fire of cargo not associated with the load.

In addition, this EMP must be shared with local authorities in charge of the interventions and updated periodically.

Drills for the implementation of this EMP are to be scheduled according to a schedule developed under the *Environmental Emergency Regulations* (SOR 2019/51)[45].

The documents submitted by the proponent briefly outline the safety plans and the emergency measures plan for the marine facilities and the vessel. However, procedures should be developed in accordance with the industry provisions for:

- Arrivals and departures;
- Emergency appliances and devices;
- Loading;
- Loading stoppage in case of emergency and resuming operations;
- Emergency towing / moving[46] of the vessel from the dock following incidents to be defined;
- Management of evaporation gases and "Roll-Over"; and
- Ship-to-ship cargo transfer operations.

Although the management of GNL Québec vessels can be done by a third party, the proponent should require LNG tankers bound for its facilities to develop incident management and response plans[47] based on the following scenarios for the area upstream of the Les Escoumins pilot station:

- Collision and grounding;
- Flooding of cargo holds or adjacent buffer spaces (cofferdam);
- Leak in the cargo containment system;
- Rupture of cargo piping and cargo leakage;
- Release of the cargo (LNG) safety valve;
- Fire in areas not designated for cargo;
- Fire following cargo leakage; and
- Fire in the compressor or engine room.

Recommendation 55. TRC members recommend that GNL Québec ensure the provisions of these emergency plans developed by the vessel are harmonized with the provisions of the terminal where applicable.

Recommendation 56. TRC members recommend that GNL Québec submit the emergency measures plan in its final version to the TRC at least six months before the start of operations.

[45] *Environmental Emergency Regulations, 2019 (justice.gc.ca)*
[46] *Support Craft at Gas facilities. Principles of Emergency Response and Protection Onshore - SIGTTO*
[47] *Guide to Contingency Planning for the Gas Carrier Alongside and within Port Limits, (ICS/OCIMF/SIGTTO) / Contingency Planning and Crew Response Guide for Gas Carrier Damage at Sea and in Port Approaches, (ICS/OCIMF/SIGTTO).*

5.6 LNG OIL SPILL PREPAREDNESS AND RESPONSE

5.6.1 SPILL MITIGATION AND MITIGATION MEASURES

The LNG shipping industry places great emphasis on spill prevention measures by adopting legislation, codes, standards, industry guidelines, and best practices.

However, in LNG spill response, emphasis is to be placed on:

- Protection of human life (public and workers) and thereafter;
- Property protection (marine facility and vessel); and
- Environnemental Protection.

To do this, beyond the structural measures which include all prevention systems such as LNG leak detectors, thermal detectors, emergency shutdown systems, and fire systems, establishment of the following measures would mitigate the consequences of these spills:

- Safety and security perimeter around the vessel and marine facilities;
- Coordination of emergency plans between the vessel and marine facilities;
- Coordination of interventions with the CCG and other local authorities; and
- Evacuation plans.

5.6.2 RESPONSE ORGANIZATION

LNG carriers and liquefied gas handling facilities are not required to have an agreement with a response organization such as SIMEC (*Eastern Canada Response Corporation*), unlike oil handling facilities.

Currently, ROs (response organizations) are accredited to respond to oil spills and refer to petroleum products list in Appendix 1 of MARPOL as a reference.

5.6.3 LNG SPILL PREPAREDNESS AND RESPONSE REGULATIONS AND FRAMEWORKS[48]

The Emergency Management Act[49] outlines the responsibilities of the federal government and Public Safety Canada during an emergency. Public Safety Canada is responsible for:

- Leading emergency management in Canada by coordinating emergency management activities among government institutions, provinces, and any other pertinent entities
- Establishing policies, programs, and other measures for emergency management plans
- Providing advice to government institutions on the subject

Federal agencies provide assistance in the event of a spill, with a designated lead for every type of environmental emergency. Section 180(1) of the CSA, 2001[50], along with the Oceans Act[51], make the CCG the lead federal response agency responsible for ensuring an appropriate response is

---

[48] *TERMPOL Review Report for the Kitimat LNG Project*
[49] *E-4.56.pdf (justice.gc.ca*
[50] C-10.15.pdf (justice.gc.ca)
[51] O-2.4.pdf (justice.gc.ca)

provided either by the responsible party (or polluter) or by the CCG to all vessel-source and unknown source pollution incidents in waters under Canadian jurisdiction.

When the polluter is known and is willing and able to respond, the CCG will advise the polluter of its responsibilities under the CSA, 2001. However, in cases where the polluter is unknown, unwilling, or unable to respond, the CCG will assume the overall management of the incident. In all cases, CCG Environmental Response will ensure an appropriate response.

5.6.4 VESSEL OBLIGATIONS

TC's mandate is to ensure that vessels comply with all the obligations that apply to them according to their categories and under the various applicable conventions and Acts. In addition, TC ensures that in terms of management for the safety of vessel operation, the vessel holds a valid copy of the certificate of compliance (DOC) issued to the company (owner) and a Safety Management System certificate (SMSC) under SOLAS 1974, Regulation IX/4, ISM Code.

Chapters 7 and 8 of the ISM Code provide the following provisions:

- ***7 Onboard Operations***

  The company should establish procedures, plans, and instructions, including checklists, as appropriate, for the main operations on board that relate to the safety of personnel and the vessel and the protection of the environment. The various tasks involved should be defined and assigned to qualified personnel.

- ***8 Preparedness for emergency situations*** *(IMO, Resolution A.1072 (28) adopted on December 4, 2013, REVISED GUIDELINES FOR A STRUCTURE OF AN INTEGRATED SYSTEM OF CONTINGENCY PLANNING FOR SHIPBOARD EMERGENCIES)*

  8.1 The Company should identify potential emergency shipboard situations and establish procedures to respond to them.

  8.2 The Company should establish programs for drills and exercises to prepare for emergency actions.

  8.3 The safety management system should provide for measures ensuring that the Company's organization can respond at any time to hazards, accidents and emergency situations involving its ships.

5.6.5 INTERNATIONAL CONVENTION ON LIABILITY AND COMPENSATION FOR DAMAGES ARISING FROM CARRIAGE OF HAZARDOUS AND POTENTIALLY HAZARDOUS SUBSTANCES BY SEA, 2010 (HNS CONVENTION, 2010)[52]

The HNS Convention aims to ensure prompt and effective compensation for damage to persons and property. It also covers the cost of clean-up operations and economic losses related to the transport by sea of harmful and potentially dangerous substances.

According to the *International Oil Pollution Compensation Funds*, however, several States have continued their efforts to implement the *Convention on Hazardous and Hazardous Substances* in their national legislation and it is hoped that new states may ratify or accede to the protocol in the years to come. In 2020, Germany, Belgium, France, and the Netherlands all made progress towards

[52] The Convention - HNS Convention

joining or ratifying the *Convention on Hazardous and Hazardous Substances*. Korea has also made progress.

On April 23, 2018, Canada ratified the *Convention on Hazardous and Hazardous Substances*, but this convention is not yet in force. To come into effect,

- At least twelve states must ratify the convention;
- At least four of these States must have a registered vessel tonnage of at least two million GT; and
- Have declared, during the previous calendar year, a minimum of 40 million tonnes of HNS in bulk likely to give rise to contributions to the general account.

The Convention will come into effect 18 months later. Currently, there are five State Parties: Norway, Canada, Turkey, Denmark, and South Africa.

Bill C-3 (*Safeguarding Canada's Seas and Skies Act*) received Royal Assent on December 9, 2014. This Bill made amendments to the *Marine Liability Act*[53] which aims to implement a comprehensive and effective liability and compensation regime for damage caused by the transport by sea of harmful and potentially dangerous substances. Most of the amendments to the *Marine Liability Act* will come into effect when the *Convention on Hazardous and Hazardous Substances* comes into effect internationally.

[53] M-0.7.pdf (justice.gc.ca)

6.0 CONCLUSION

Unlike other regulatory processes to which GNL Québec's Énergie Saguenay project is subject, the TERMPOL review process is voluntary and reviews the marine safety and accident prevention regime in order to achieve acceptable risk levels, consistent with Canada's regulatory regime and marine safety standards, as well as industry best practices.

As part of this TERMPOL review, the proponent filed studies as required by TP743. However, some of his studies will have to be improved in order to clarify certain points relating to navigation safety.

This entire TERMPOL review report is based on the documents submitted by the proponent, the procedures, and standards in effect, as well as on findings to propose a set of mitigation measures in the form of recommendations with the aim of improving the safety items identified for LNG shipping in pilotage waters and the marine terminal of GNL Québec. The implementation of these recommendations will help the proponent to improve the navigation safety of its vessels as well as their operations.

When the Énergie Saguenay project, which GNL Québec plans to develop and operate, has been completed, it will be in operation for a period of 25 to 50 years and will have a capacity of 10.5 Mtpy of LNG. This facility, located in the industrial-port zone of the Saguenay Port Authority (SPA) in the administrative region of Saguenay–Lac-Saint-Jean (02), within the limits of the borough of La Baie de la Ville de Saguenay and whose maritime infrastructures are located in the navigable waters under the jurisdiction of the SPA, will be built and operated in accordance with the provisions of the CSAZ276 standard and other engineering codes and relevant industry practices.

The proponent has submitted all required documents as part of this TERMPOL review process with the exception of the Port Information Booklet, Terminal Operations Manual, and Emergency Response Plan. These documents, once completed and available in their final version, will be submitted to the TRC at least six months before the start of operations. If necessary, the observations and recommendations formulated by TRC members will be revised.

The proponent also submitted his commitments and policies regarding risk mitigation related to future activities such as:

- Escort and standby towing policy;
- The waiting management policy during loading operations;
- Participation in working groups aimed at improving operations related to regional maritime activities and adherence to the recommendations of these groups; and
- Consultation and engagement with Indigenous groups affected by the proponent’s activities.

TRC members believe that the current regulatory regime and the provisions of international conventions governing maritime navigation would make it possible to adequately monitor maritime operations related to this project.

Furthermore, reports from BAPE public hearings and the Impact Assessment Agency of Canada (IAAC) will enhance and improve this project.

If aspects related to this project and which have been the subject of this TERMPOL analysis were to be changed by the proponent, the TRC would have to revise the findings and recommendations of this report.

7.0 APPENDICES

7.1 APPENDIX 1

LIST OF FINDINGS AND RECOMMENDATIONS

Report Chapter	***Findings***	***Recommendations***
4.0 INDIGENOUS COMMITMENT	***Finding 1.*** The GNL Québec proponent has expressed its willingness to consult the First Nations whose rights could be affected by the Énergie Saguenay project in order to discuss specific issues related to marine transport resulting from the project's operations. ***Finding 2.*** In May 2021, through their respective Councils, the Innu First Nations of Essipit, Pekuakamiulnuatsh and Pessamit officially expressed their disagreement with GNL Québec's Énergie Saguenay project. Since then, they have no longer participated in the various initiatives proposed by the proponent as part of the TERMPOL study.	***Recommendation 1.*** TRC members recommend that GNL Québec continue to: • Consult First Nations during the construction of its facilities and their operations; • Respond to their concerns; and • Integrate indigenous knowledge into the completion of the project.
5.1 Introduction	***Finding 3.*** TRC members recognize that GNL Québec and the competent authorities will have to discuss the deadlines set for following up on the recommendations described in this report.	***Recommendation 2.*** TRC members recommend that GNL Québec notify the competent authorities if it plans to amend parts of the project, operational criteria, or characteristics, so that authorities can examine the repercussions of the safety amendments, if any. ***Recommendation 3.*** TRC members recommend that GNL Québec, together with the SPA, file the studies relating to terminal operations within six months preceding the start of operations.

	Finding 4. According to the documents presented by GNL Québec, the vessels' mathematical models used, reflect the characteristics of the tankers called upon to use the envisaged facilities.	***Recommendation 4.*** TRC members recommend that GNL Québec use tugs at least of similar power to those used during these simulations.
5.2.2.1.1. In-Depth Vessel Review Procedures (Inspection)		***Recommendation 5.*** TRC members recommend that GNL Québec establish a "*Vetting*" inspection program for vessels bound for its facilities. This process should be an integral part of the GNL Québec facilities operating manual.
5.2.2.1.3 Winter navigation in the waters of the Gulf and the St. Lawrence River		***Recommendation 6.*** TRC members recommend that GNL Québec vessels have enough propulsive power and cooling capabilities to face the ice conditions of the St. Lawrence River and the Saguenay River.
		Recommendation 7. TRC members recommends that GNL Québec apply the proposed measures of the Gros-Cacouna LNG terminal project to the design and operation of its vessels.
5.2.2.1.4 Ballast water management	***Finding 5.*** According to the documents submitted and considering the obligations to install ballast water treatment units on board ships, GNL Québec does not plan to build a reception facility for ballast water, or sediments that come from ballast water and that have settled at the bottom of the vessel's ballast tanks.	***Recommendation 8.*** In addition to the ballast water and sediment management plan and according to the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention)—TRC members recommend that GNL Québec, also integrate a contingency plan for vessels in order to respond to any failure of the ballast water treatment system on board.

5.2.2.2.1. Training of crew members		***Recommendation 9.*** The vessel must be seaworthy and have a sufficient crew, trained, competent and ready to deal with all the situations that the voyage may encounter. Vessel-specific procedures for winter navigation in the Gulf and St. Lawrence River waters must be on board and must be understood and implemented when the vessel is operating in ice conditions. The TRC members recommend that GNL Québec ensure that chartered vessels or any vessel serving its facilities comply with all Canadian and international regulations.
5.3 Route information	***Finding 6.*** Currently, access to the Gulf of St. Lawrence from the sea is through the Cabot or Belle-Isle straits. Winter navigation in the Belle-Isle strait could be problematic due to the presence of ice and is often closed due to heavy ice conditions.	***Recommendation 10.*** TRC members recommend that GNL Québec ensure LNG carriers bound for or departing from GNL Québec facilities use the Cabot Strait during the winter period.
		Recommendation 11. In order to ensure and increase the safety of LNG tankers, TRC members recommend that GNL Québec conduct a study to determine the minimum clearance between the mast, and the electrical cables required for its vessels when passing under Hydro-Québec cables at Cap Sainte-Marguerite.
5.3.2 General Route		***Recommendation 12.*** TRC members recommend GNL Québec ensure (in addition to the report required by the *Eastern Canada Vessel Traffic Services Zone Regulations)*, that Masters confirm: • The vessel has a valid certificate of fitness for type of cargo carried or to be carried; • All cargo level, pressure, and temperature indicating devices in each tank are functioning properly; • The secondary cargo containment area gas detection system is working properly and is being monitored; and

		• There are no abnormal conditions on board to report, if there are, list these conditions.
	Finding 7. Currently and according to regulations, in order to inform the authorities and ensure navigation safety, vessel masters are required to report any defects observed on board to the relevant marine communications and traffic (MCTS).	***Recommendation 13.*** TRC members recommend that GNL Québec ensure the above-mentioned conditions are met so that the vessel can be authorized to continue its voyage to its destination port and that the terminal will be ready to receive it.
	Finding 8. During LNG transport on board vessels, boil-off gases are produced in the tanks. These gases are sometimes released into the atmosphere.	***Recommendation 14.*** TRC members recommend that LNG Québec tankers refrain from discharging boil-off gases into the atmosphere when pilot boats are approaching and during transit in pilotage waters. ***Recommendation 15.*** TRC members recommend that GNL Québec communicate recommendation 14 to the vessels serving its facilities. In addition, it is recommended that GNL Québec add the Bagotville air base to its list of parties to be informed in the event of an incident on board its vessels or facilities.
5.3.3.2 Simulations conducted	***Finding 9.*** According to the final report of the simulations conducted, ships meeting and overtaking on the Saguenay River were not simulated. ***Finding 10.*** Simulation outcomes conducted on a navigation simulator are conclusive subjected however, to the observations and recommendations mentioned above.	***Recommendation 16.*** In order to ensure navigation safety as a whole on the Saguenay River, TRC members recommend that GNL Québec ensure these observations and recommendations from the simulation be validated in the *real live* environment and reviewed as necessary before their implementation by the GNL Québec proponent.
5.3.4 Issues related to vessel traffic	***Finding 11.*** Marine traffic management at the Les Escoumins pilot station is under the authority of Marine Communications and Traffic Services (MCTS) / Canadian Coast Guard (CCG).	***Recommendation 17.*** As with the oil tankers serving Montreal, Sorel, and the St-Romuald refinery, and in order to facilitate the integration of GNL Québec vessels, TRC members recommend that GNL Québec ensure procedures relating to vessel traffic at the Les Escoumins pilot station and its approaches, the

	Finding 12. With the current domestic and international LNG shipping regime, TRC members believe that the additional number of GNL Québec vessels does not have a significant impact on current domestic shipping and marine safety	convergence point for all commercial vessels, be amended to include the following provisions for LNG Québec LNG tankers: • Maintain a 1-nautical mile distance from the coast in this area (Les Escoumins pilot station); • Maintain a ½ - nautical mile safety distance from other approaching vessels in this area; • Keep approaching speed below 6 knots unless otherwise required by pilot in charge
	Finding 13. When approaching pilot stations area, the vessel's engines are running on maneuvering mode. The speed and heading will be adjusted to satisfy traffic and weather conditions prevailing to facilitate pilot transfer.	***Recommendation 18.*** As a preventive measure, TRC members recommend GNL Québec ensure that: • LNG tankers refrain from releasing cargo evaporation gases into the atmosphere. • The pilot boat should be allowed to dock with the LNG tanker only after the master has confirmed that there are no flammable or evaporating gases on deck or around his vessel.
	Finding 14TRC members believe that the traffic procedures between transiting vessels and ferries crossing at the entrance of the river as per *Collision Regulations*[54] provisions are well-established and will be also relevant to LNG carriers as well.	
	Finding 15. Marine mammal watching activities in the Saguenay - St. Lawrence Marine Park during the summer season (May to October) may possibly take place in the path of GNL Québec vessels.	***Recommendation 19.*** TRC members recommend GNL Québec ensure that DNV's analysis include safety zones to be established around GNL Québec, LNG tankers in transit between the Les Escoumins pilot station and the marine terminal, and in consultation with the other stakeholders (GNL Québec, TCMSS, MCTS/CCG, LPA, CLSLP, SPA, Saguenay - St. Lawrence Marine Park, Excursionists, Marinas).

[54] C.R.C.,_c._1416.pdf (justice.gc.ca)

		Recommendation 20. TRC members recommend GNL Québec implement a communication plan related to the safety of its LNG tankers intended for other users.
	Finding 16. In light of the above data on the evolution of vessel traffic on the Saguenay River from 1980 until the beginning of the 2020s, the addition of 3 to 4 LNG Québec vessels per week would increase vessel traffic without reaching the annual level observed in 1980.	
	Finding 17. TRC members believe that the implementation of the tug escort policy would improve the navigational safety in the designated area.	***Recommendation 21.*** TRC members recommend that GNL Québec ensure towing and escort procedures take into account the risks of grounding or collision due to the loss of maneuvering or propulsion capacity of the LNG tanker. In addition, the tug should be fitted with a tensiometer if the load on the towing line is likely to exceed the allowable value during towing operations[55].
		Recommendation 22. TRC members recommend that GNL Québec tugs, based on their crewing, be equipped with: • An on-demand positive pressure navigation bridge, the autonomy of which shall be determined after evaluation; • Gas detectors with alarms and pre-alarms; • O_2 and CO_2 monitoring systems;

[55] ISO 28460 Standard Petroleum and natural gas industries — Installation and equipment for liquefied natural gas — Ship-shore interface and port operations

		• Emergency Escape Breathing Devices (EEBDs) of at least 30-minute capacity for each crew member; • Exhaust pipes with spark arresters. ***Recommendation 23.*** TRC members recommend that, GNL Québec ensure, tug crew members be trained in LNG shipping and the risks associated with it, in addition to the regulatory required training.
		Recommendation 24. TRC members recommend that GNL Québec's considerations pertaining to transits at the confluence of the Saguenay River be incorporated into the design plan in order to improve the GNL Québec tankers navigation safety and recommend that the outcomes thereof be available before the arrival of these vessels. .
		Recommendation 25. TRC members recommend that GNL Québec ensure collisions involving two vessels other than perpendicularly with relative speed of 20 kts also be studied.
	Finding 18. It is believed that the guidelines referred to in pub. VN-301 has greatly contributed to maintain an efficient management of these new wide beams and long vessels streaming the River from Ile-aux-Coudres right up to Montreal	***Recommendation 26.*** If a working group to address the Saguenay challenges is formed, similar to the one which promote safe management of new over size vessels transiting up the St. Lawrence, the TRC members recommend that GNL Québec participate actively in this working group. ***Recommendation 27.*** TRC members recommend that GNL Québec include the voluntary measures already in place in the region in their procedures and that GNL Quebec collaborates with working groups such as G2T3M and other environmental cells gravitating in the protection of aquatic species world in connection with speed and underwater noise in the area.
	Finding 19. The anchorage points in the Îles des Rasades area on the map above are close	***Recommendation 28.*** In order to minimize and reduce the risk of collision at anchorage, TRC members recommend that GNL

to each other. Consequently, this would not allow the addition of a safety and exclusion distance around an LNG tanker without affecting the other points and the vessels anchored there.

Québec ensure two anchorage points be added in the Îles des Rasades area, away from other points. These two points must be identified and dedicated exclusively to LNG tankers. One point inside the compulsory pilotage area, and another outside it.

Recommendation 29. TRC members recommend that GNL Québec request to have these two points identified on the nautical chart and the anchoring sheets. (See table and figures below):

Coordinates of anchorage points for LNG tankers at Îles des Rasades

	Latitude	Longitude	Observations
Outside the compulsory pilotage area	48° 21'.5 N	068° 59'.1 W	• Away from vessel traffic and other anchorage points. • Possibility of having significant safety and exclusion distances. • Adequate depth (20 to 40 meters). • Good anchoring behaviour, adequate bottom (sand).
Inside the compulsory pilotage area	48° 13'.3 N	069° 11'.1 W	
	or at the discretion of the pilot in charge.		

		• Pilot boat nearby (Les Escoumins pilot station). • Radar coverage (anchoring monitored from the MCTS centre in Les Escoumins). • MCTS: AIS monitoring.
		Recommendation 30. Based on the anchoring practices of the Canaport LNG marine facility, TRC members recommend that GNL Québec establish a minimum exclusion and safety distance of 1.5 nautical miles around GNL Québec vessels anchored at these points.
5.4.1 Marine Terminal	***Finding 20.*** Certain geographic coordinates provided by the proponent are in a format not used in maritime navigation.	***Recommendation 31.*** TRC members recommend that GNL Québec ensure all geographical coordinates provided for navigators and for maritime purposes be provided in latitude and longitude in the format: Deg, Min, Sec (Latitude: DD° MM' SS", Longitude: DDD° MM' SS"). Similarly, elevations and depths be provided in meters.
	Finding 21. In Canada, CAN/CSA-Z276-18 (Liquefied Natural Gas (LNG): Production, Storage and Handling) applies to the: a) design;	***Recommendation 32*** TRC members recommend that GNL Québec ensure the LNG loading procedures be developed and harmonized with the CAN/CSA-Z276-18 standard.

	b) location; c) construction; d) operation and e) Maintenance of facilities for the liquefaction of natural gas and facilities for the storage, vaporization, transfer, handling, and truck transport of LNG. It also contains requirements for the training of personnel. For facilities used for loading and/or unloading LNG from ships, this standard contains requirements for the piping that connects the loading/unloading arms and the storage tank as well as the piping fittings on the dock and pier. This standard does not apply to LNG transport by vessel.	
		Recommendation 33 TRC members recommend that GNL Québec ensure the facility designs are certified by a third party specialized in the LNG liquefaction, storage, and handling before the start of operations.
5.4.2.1. Vessel's arrival and departure maneuvers	***Finding 22.*** Vessel mooring is a collaborative operation between: • The Master of the vessel; • The mooring pilot; • Towing service; • The marine terminal.	***Recommendation 34.*** TRC members recommend that GNL Québec ensure the mooring plans within the terminal are: • Developed in accordance with the provisions of OCIMF and PIANC (*Permanent International Commission for the Navigation Congresses*[56]); • Developed taking into account the particularities of the terminal's two piers; • Communicated to pilots, tug, and mooring services.

[56] Aspects Affecting the Berthing Operations of Tankers to Oil and Gas Terminals, PIANC, MarCom Working Group 116.

		Recommendation 35. TRC members recommend that GNL Québec ensure all mooring bollards being installed on the dock are remote automatic release.
	Finding 23. According to the mandate assigned to Canadian Coast Guard (CCG) by the federal government, they are responsible for the Canadian Aids to Navigation System in waters under Canadian jurisdiction.	***Recommendation 36.*** Given the proximity of the aforementioned areas of responsibility, TRC members recommend that GNL Québec carry out a collaborative analysis of navigation aid systems required for the project in the event of its implementation. ***Recommendation 37.*** TRC members recommend that GNL Québec ensure all the equipment and navigation aids be developed and installed in accordance with the provisions of IALA (*International Association of Marine Aids to Navigation and Lighthouse Authorities*) and the Canadian Coast Guard.
	Finding24. Many marine terminals regulate the use of tugs during arrival and departure operations; however, current regulations do not govern such operations.	***Recommendation 38.*** Although the use of tugs during arrival and departure operations is not governed by regulations, TRC members recommend that GNL Québec include tug operations in the Port Operations Manual as an additional safety contribution.
5.4.2.3 Emergency anchorage		***Recommendation 39.*** TRC members recommend that GNL Québec also ensure an emergency anchorage area be documented in the Port Operations Manual, communicated to all marine stakeholders and subject to safe exclusion distance analysis.
5.4.2.4 De-Icing of Facilities	***Finding 25.*** Currently, the information necessary for the CCG to include the GNL Québec facilities in its planning for icebreaking operations is not available.	***Recommendation 40.*** Regarding icebreaking, TRC members recommend that GNL Québec: • Have tugs that are classed 1A; • Have tugs that will escort the tankers during transits and also be assigned for icebreaking around the pier areas; and • Share the movement of its vessels with the Canadian Coast Guard during the icebreaking season.
5.4.3 Cargo handling operations		***Recommendation 41.*** TRC members recommend GNL Québec incorporate the tests and procedures for pre-loading ships with LNG cargo into the installation's operating manual.

		In addition, checklists for operations relating to preloading, loading, and the near completion of the loading should be developed with the vessels. GNL Québec should also incorporate the practices and safety checklists described in the latest version of the SIGTTO publication titled "*Liquefied Gas Handling Principles on Ships and in Terminals*" into its operational procedures.
		Recommendation 42. In terms of safety in the operation and maintenance of liquefied natural gas terminals, TRC members recommend that GNL Québec ensure training for terminal personnel involved in GNL Québec transhipment operations be developed and implemented in accordance with the provisions of standards: • OCIMF[57] (*Oil Companies International Marine Forum*) • CSA Z276-18 • NFPA 59A
		Recommendation 43. As the liquefaction plant is planned to be located at a certain elevation to the transshipment marine terminal, TRC members recommend GNL Québec study the capacity of the vapor return line and assess the need to install a compression system to facilitate the return of vapors to the liquefaction plant.
5.4.4 Port Information Booklet		***Recommendation 44.*** TRC members recommend that GNL Québec present the final version of the port information booklet to the TRC at the latest six months before the commissioning of the terminal. This version will be amended as necessary.

[57] *Marine Terminal Operator Competence and Training Guide (MTOCT), (OCIMF).*

5.4.5 Terminal Operating Manual		***Recommendation 45.*** TRC members recommend that GNL Québec submit the final version of the operations manual to the TRC no later than six months before the commissioning of the terminal.
5.5.1 Risk Assessment		***Recommendation 46.*** TRC members recommend that GNL Québec evaluate the safety hazards pertaining to the marine terminal work environment and consider the following LNG risk components: • Flammability and auto-flammability • Explosiveness • Cryogenics • Asphyxiation
5.5.1.1 Collision and Grounding	***Finding 26.*** TRC members believe that collision risks are present on approach to the terminal and at the Saguenay entrance, while grounding risks are present at the Saguenay entrance over a distance of about 4 nautical miles. However, collision risks cannot be ruled out on the Saguenay River when there are meeting / overtaking with other vessels. Similarly, TRC members believe that that the presence of pilots on board vessels navigating in the area, their training, and the use of escort tugs by GNL Québec vessels, will have significantly decreased collision and grounding risk.	
		Recommendation 47. TRC members recommend that GNL Québec develop maritime incident management plans, including salvage plans to deal with these possible events.

5.5.1.2 Fire and Explosion	***Finding 27.*** According to the literature, the risks of fire and explosion are low in this LNG shipping industry, which spares no effort in terms of prevention. As a result, the consequences of fire are considered as minimal.	***Recommendation 48.*** In terms of fire-fighting equipment in the terminal, TRC members recommends that GNL Québec apply at a minimum, the application of the provisions of standard NFPA 59A (Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)). This standard provides minimum requirements for fire protection, safety and other related requirements for the location, design, construction, safety, operation, and maintenance of liquefied natural gas (LNG) plants.
5.5.1.3. Alert And Emergency Measures Management		***Recommendation 49*** Despite the low probability of maritime accidents and incidents, TRC members recommend that GNL Québec develop a detailed alert and emergency management plan covering the transit of vessels from the Canadian Exclusive Economic Zone (EEZ) to the Port of Saguenay. • This plan should identify all possible events (related to navigation, operations, and the structural state of vessels), and consider local conditions likely to influence responses, identify risks and impacts, and describe the emergency measures, and the procedures it will implement in order to: - Take charge of the situation; - Minimize the risks for the crew, responders, population, essential structures, and environment; and - Remedy the situation. • This plan would serve to guide the coordination of the various responders during an incident and demonstrate the proponent's understanding of its roles and responsibilities in Canada. If necessary, the proponent can contact Canadian Coast Guard.

		Recommendation 50. The Saguenay River has specific environmental and socio-economic sensitivities depending on the different sections. TRC members recommend that GNL Québec: • Develop a local risk analysis in detail by identifying the impacts and repercussions that the maritime incidents described in the alert and emergency measures management plan would have on the environment and local citizens. • Specify the mitigation measures in the analysis that the proponent intends to implement in order to adequately respond to each of the identified risks. ***Recommendation 51*** In the event that a GNL Québec vessel loses its manoeuvre resulting in a drift and/or grounding, TRC members recommend that GNL Québec identify measures to be implemented, including: • Taking charge of the situation; • Minimizing risks for the population, essential structures, the environment; and • Remedying the situation.
5.5.2. Methods Provided for Risk Reduction	***Finding 28.*** Many LNG marine terminals, and vessels to or from these terminals adopt exclusion distances. These distances are either assessed according to the navigation area or required by regulatory provisions.	***Recommendation 52.*** TRC members recommend that GNL Québec carry out an analysis of the terminal and vessels regarding exclusion areas. ***Recommendation 53.*** TRC members recommend that GNL Québec prepare a communications plan for vessels near exclusion areas around its facilities and vessels.
	Finding 29. Although the proponent did not highlight it in his studies, the communications equipment used in the gas terminals for operations is of an intrinsic type and is listed in the operational booklet.	***Recommendation 54.*** Regarding equipment and communications, TRC members recommend that GNL Québec implement the following practices, and include them in the port booklet when a vessel is at dock during loading:

		• The vessel's MF/HF radio equipment must be switched off; • The vessel's fixed VHF radio equipment must operate at its minimum power of 1w (watt) or less; • Portable VHF and/or UHF radio equipment (vessel/terminal) must operate at their minimum power of 1w (watt) or less; • The vessel's AIS equipment must be switched off; • The shutdown of the vessel's satellite communications in the event of an LNG spill, emergency, or any situation requiring it; • Vessel radars must be off during loading operations; and • Any necessary maintenance on the communications equipment on site must be authorized by the terminal and performed outside the loading periods.
5.5.3 Emergency Plan		***Recommendation 55.*** TRC members recommend that GNL Québec ensure the provisions of these emergency plans developed by the vessel are harmonized with the provisions of the terminal where applicable. ***Recommendation 56.*** TRC members recommend that GNL Québec submit the emergency measures plan in its final version to the TRC at least six months before the start of operations.

7.2 APPENDIX 2

LIST OF DOCUMENTS SUBMITTED FOR TERMPOL REVIEW

Appendix 2 List of documents submitted for Termpol review

- Introduction
- Study on maritime traffic
- Study on route analysis, approach characteristics and seaworthiness
- Special study on under-keel clearance
- Study on transit times and delays
- Study of accident data
- Vessel characteristics
- Site plans and technical data
- Cargo transfer and transhipment systems
- Channels, maneuvers, and mooring
- Mooring procedures and arrangements
- Single point mooring procedures and arrangements
- Risk analysis and risk reduction methods
- Port information booklet
- Terminal operating manual
- Emergency response plan
- Harmful and potentially dangerous substances

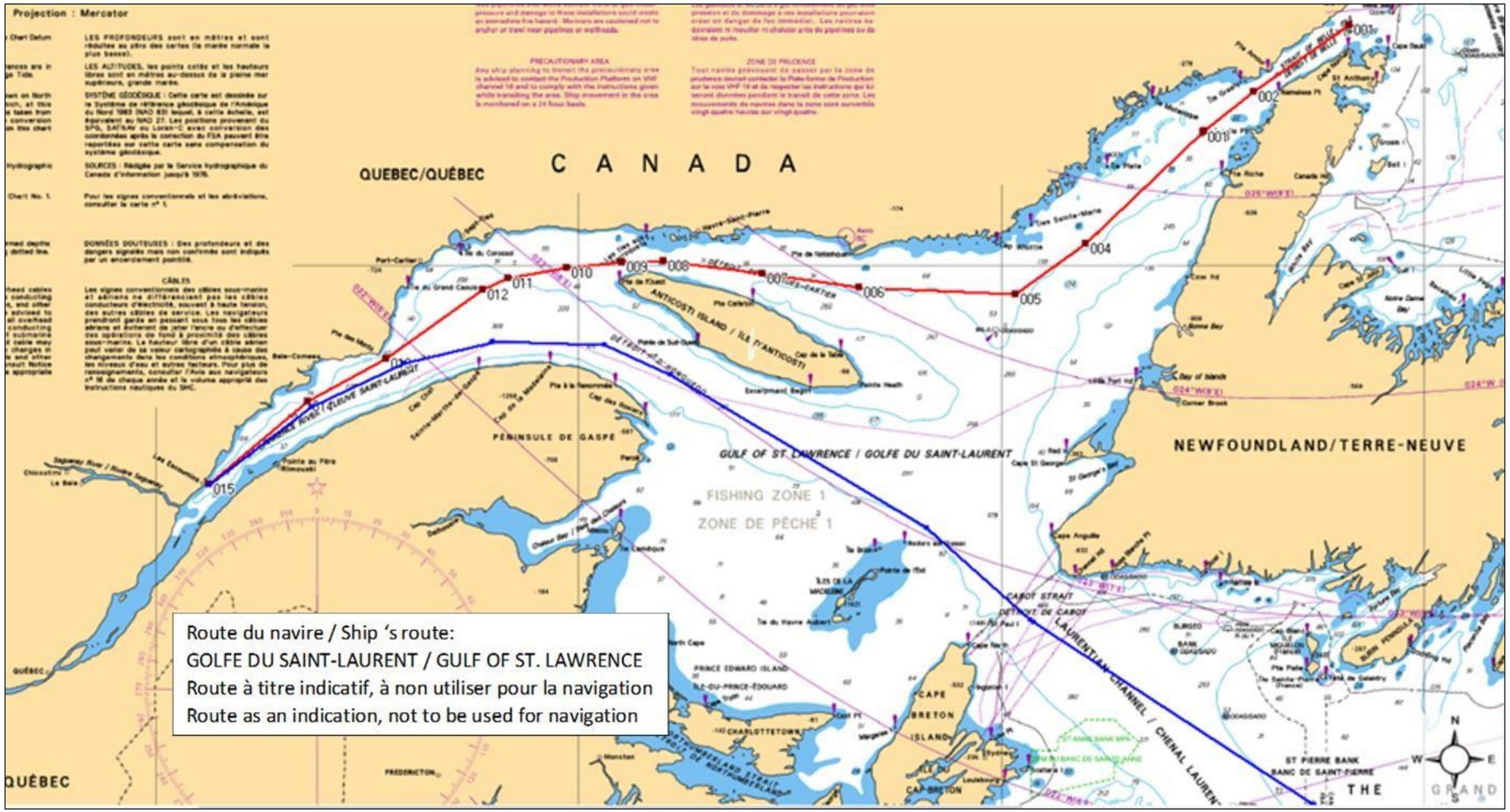
7.3 APPENDIX 3

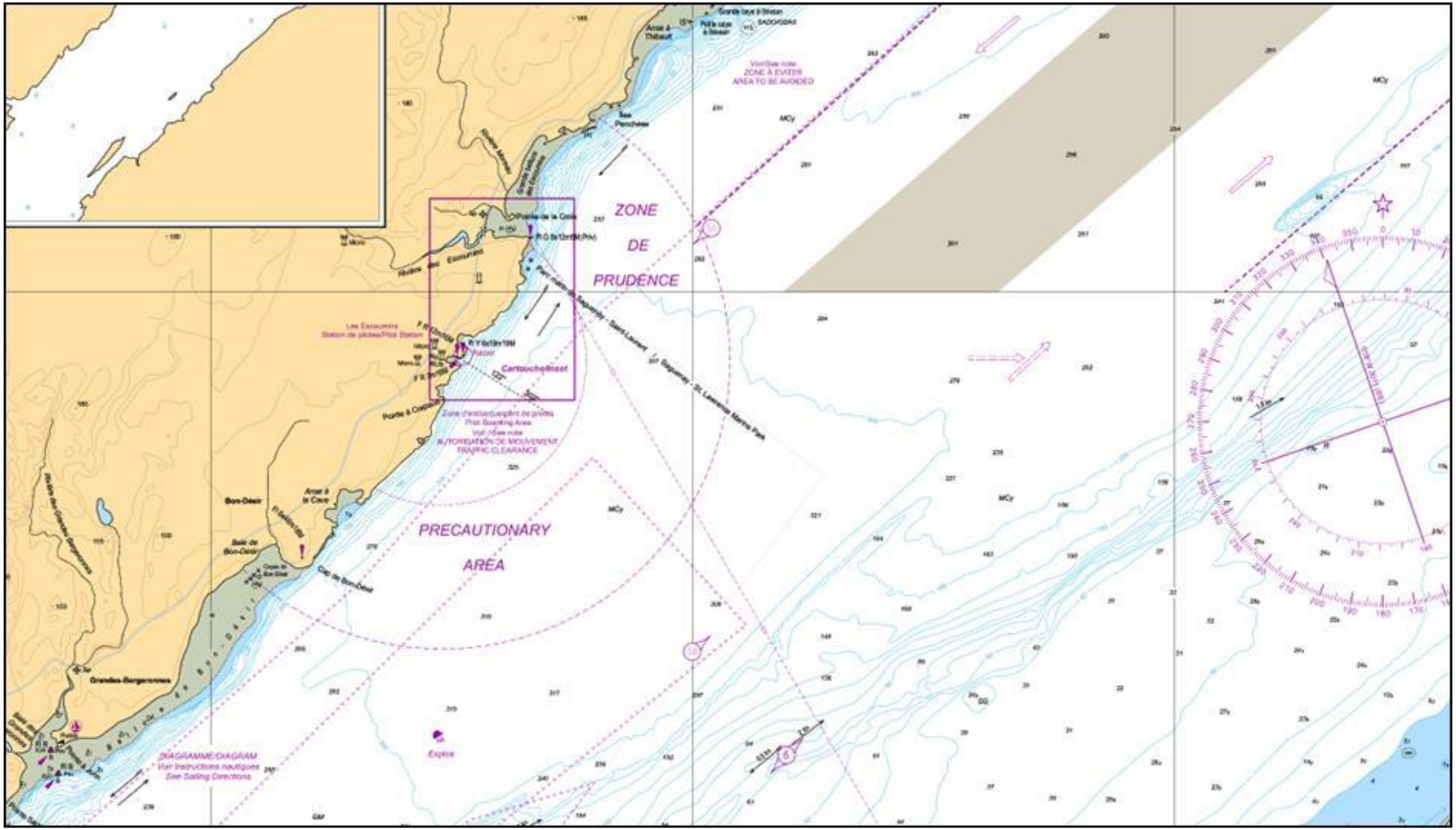
VESSEL(S) REFERENCE

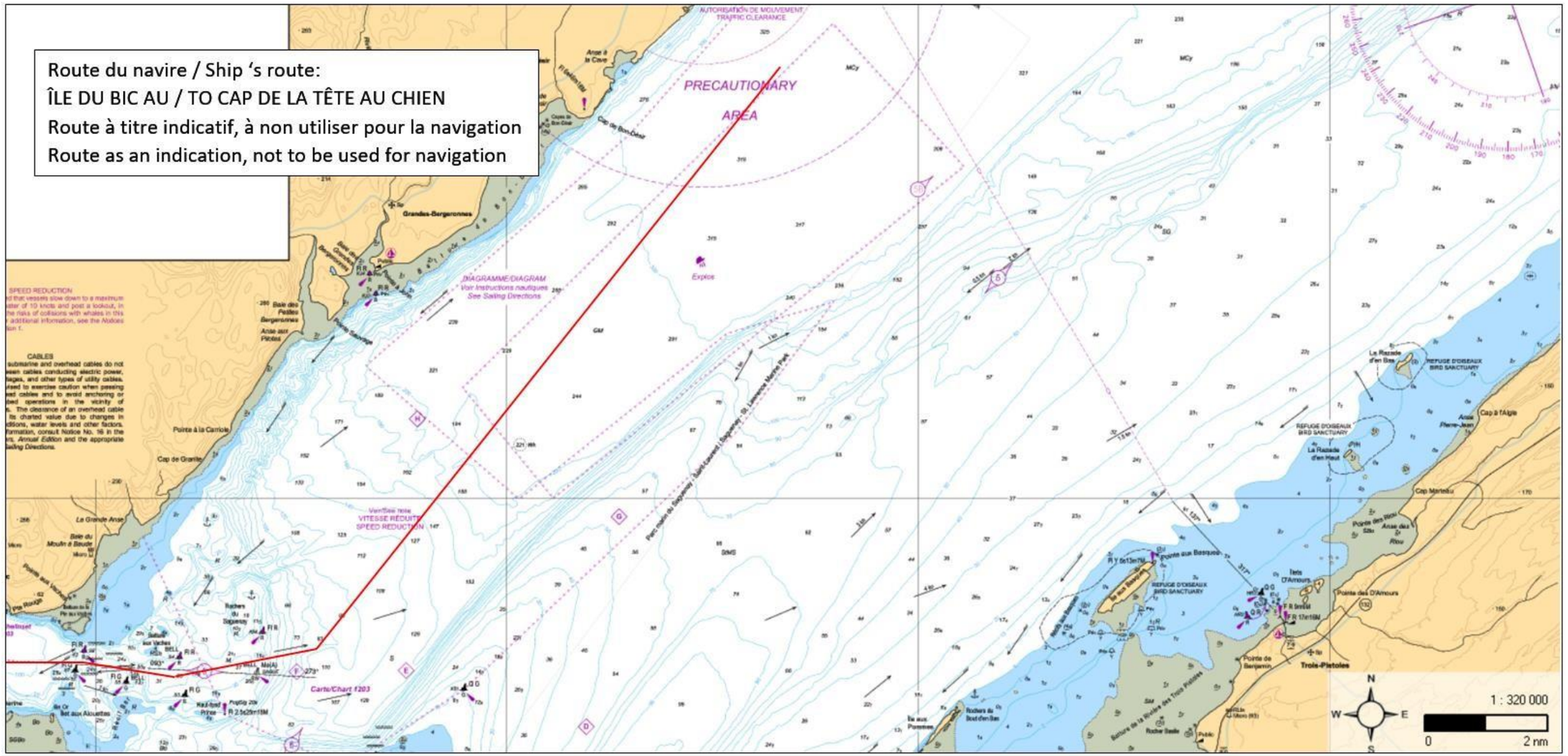
Main characteristics of reference vessel (CASTILLO DE MERIDA)	
Overall length	296.98 meters
Length between perpendiculars	284.00 meters
Moulded breadth	48.70 meters
Moulded depth on main deck	27.00 meters
Moulded depth on upper deck	35.60 meters
Maximum draft	12.424 meters
Deadweight	93,100 tonnes
Gross tonnage	126,004 barrels
Net tonnage	37,801 barrels
Main engines (02)	MITSUI-MAN B&W 7G70ME-C9.2-GL Maximum power in continuous service: 17180 kW x 70.0 / min Normal rated power: 14260 kW x 65.8 / min
Speed	Sea speed 19.5 knots (approx.) at maximum draft Trial speed 21.5589 knots
Classification symbols and annotation	+100A1, Liquefied gas tanker 2G Vessel, Methane (LNG) Membrane tanks Maximum vapor pressure 0.25 Bar Cargo temperature – 163°C

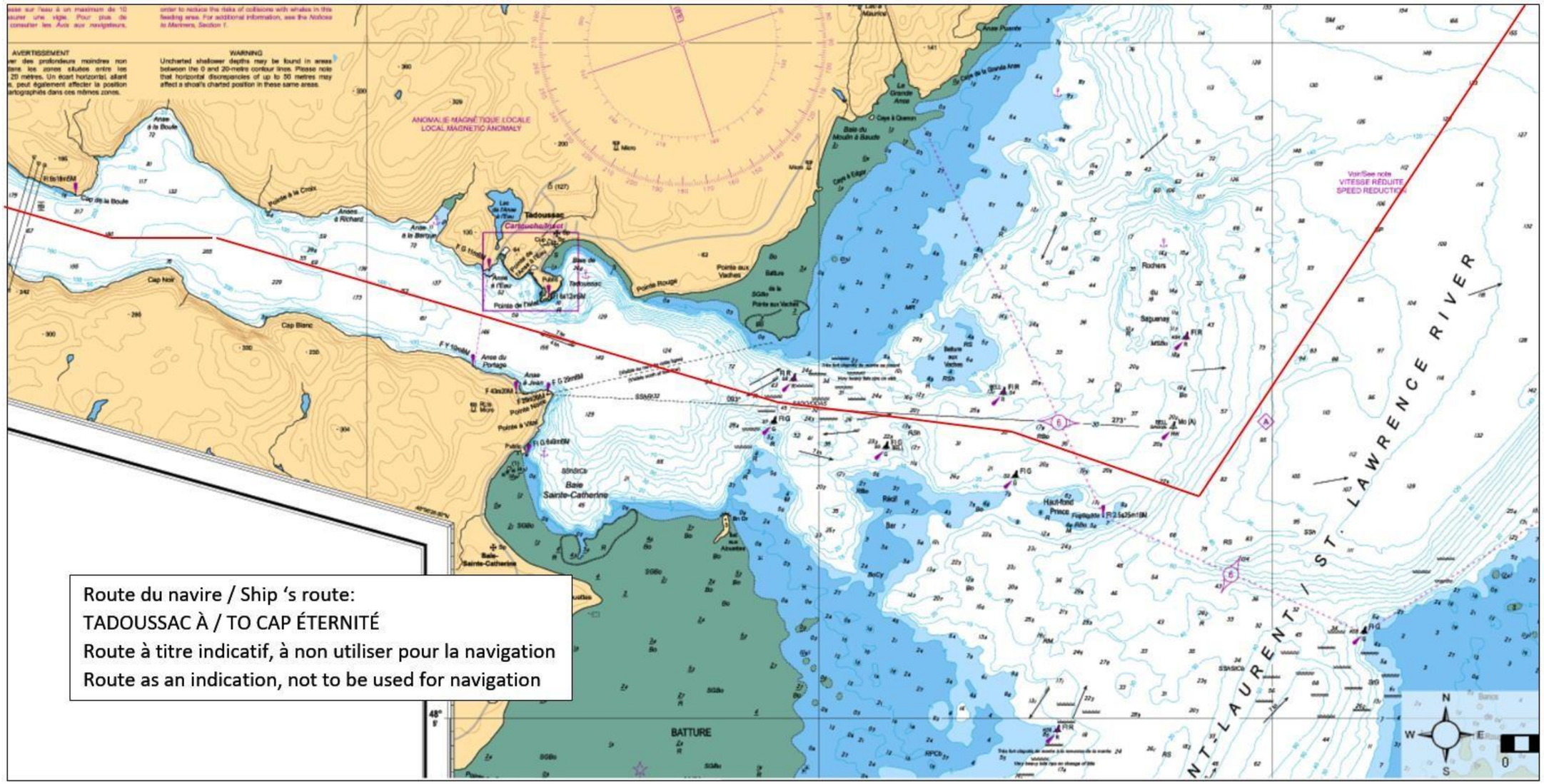
7.4 APPENDIX 4

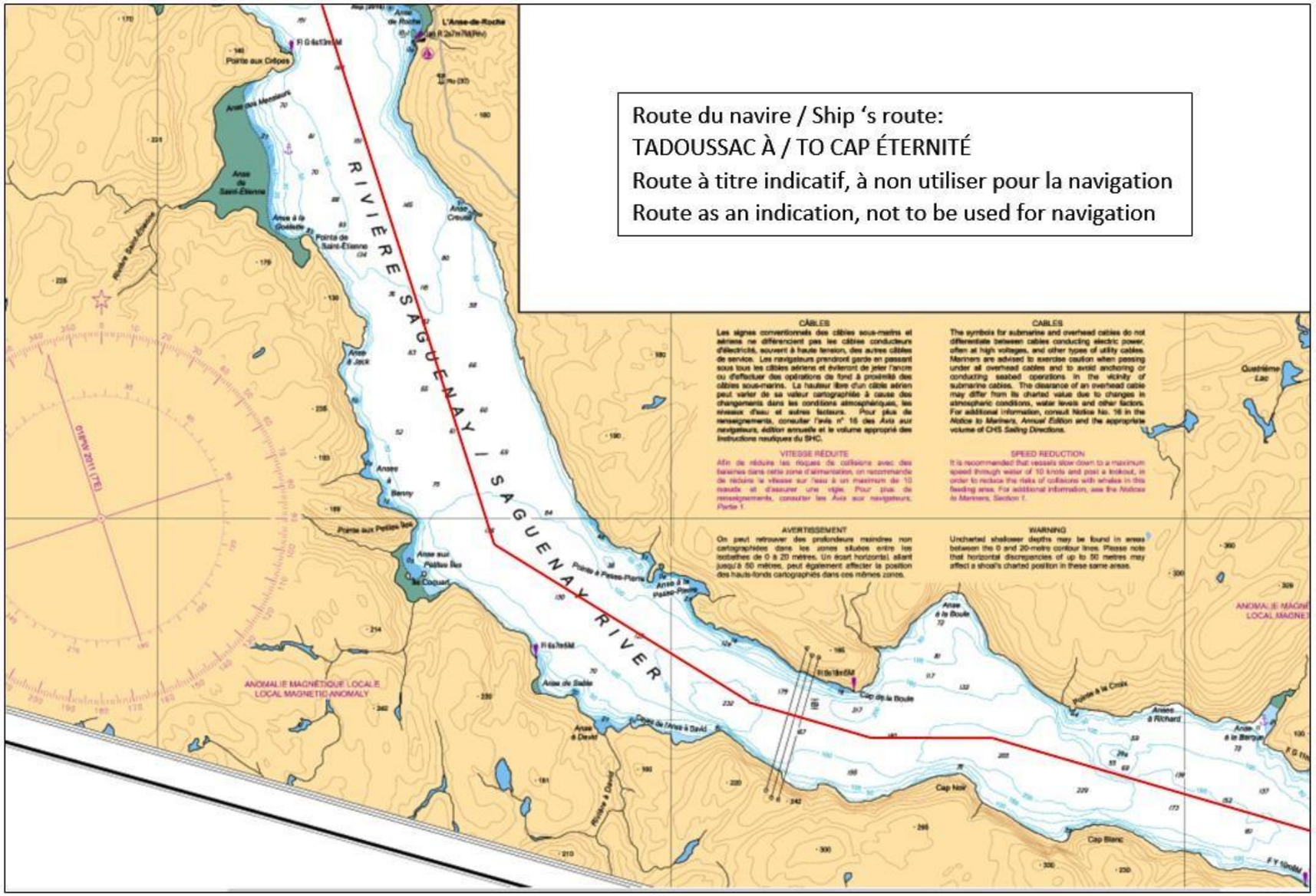
PROPOSED SEA ROUTES

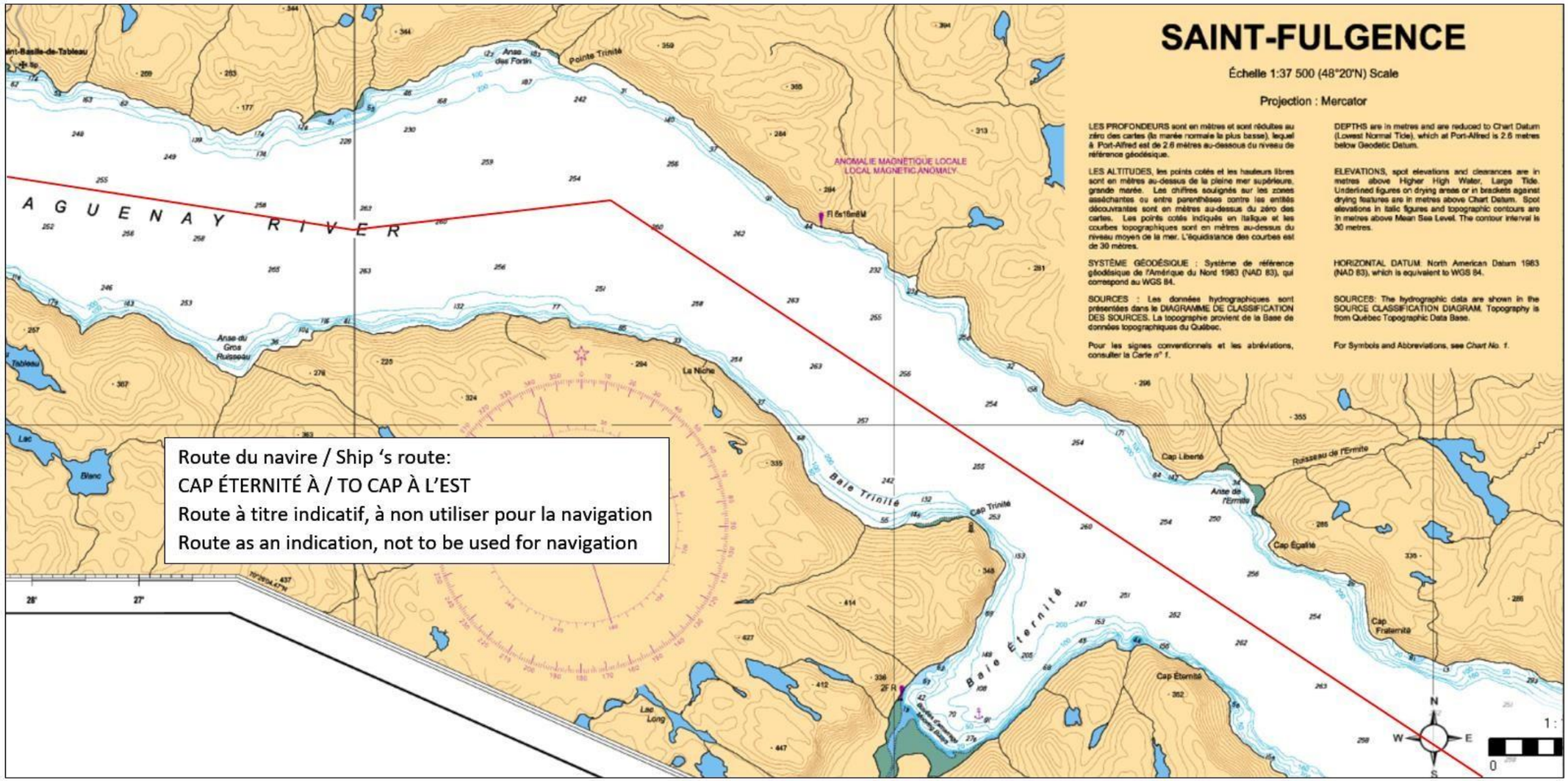

Projection : Mercator
C A N A D A
QUEBEC/QUÉBEC
NEWFOUNDLAND/TERRE-NEUVE
GULF OF ST. LAWRENCE / GOLFE DU SAINT-LAURENT
FISHING ZONE 1
ZONE DE PÊCHE 1
ANTICOSTI ISLAND / ÎLE D'ANTICOSTI
PÉNINSULE DE GASPE
CABOT STRAIT
DÉTROIT DE CABOT
LAURENTIAN CHANNEL / CHENAL LAURENTIEN
PRINCE EDWARD ISLAND
ÎLE-DU-PRINCE-ÉDOUARD
CAPE BRETON ISLAND
CAP-BRETON
ST PIERRE BANK
BANC DE SAINT-PIERRE
Route du navire / Ship 's route:
GOLFE DU SAINT-LAURENT / GULF OF ST. LAWRENCE
Route à titre indicatif, à non utiliser pour la navigation
Route as an indication, not to be used for navigation

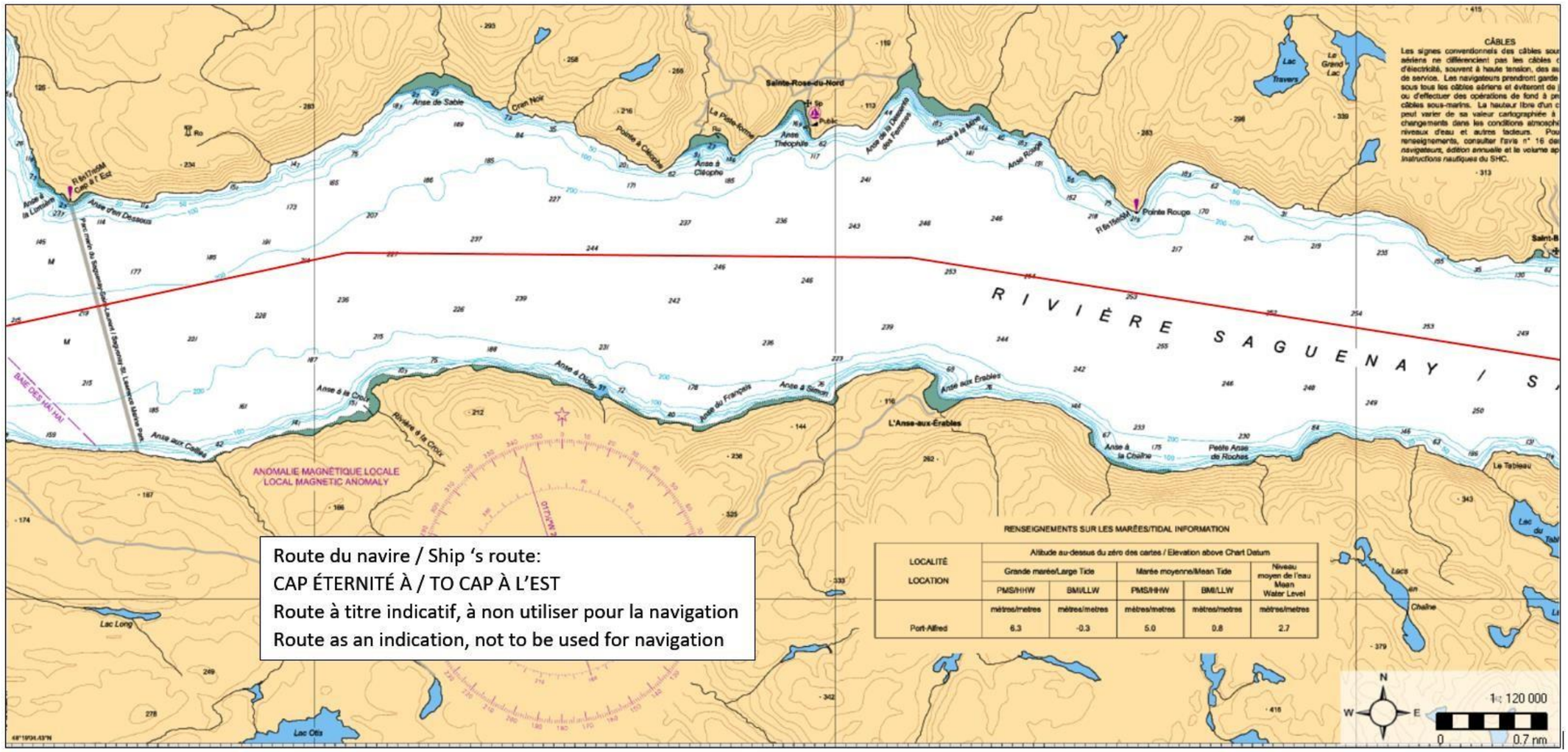

ZONE
DE
PRUDENCE
PRECAUTIONARY
AREA
Bon-Désir
Grandes-Bergeronnes
Cap de Bon-Désir
Cartouche/Inset

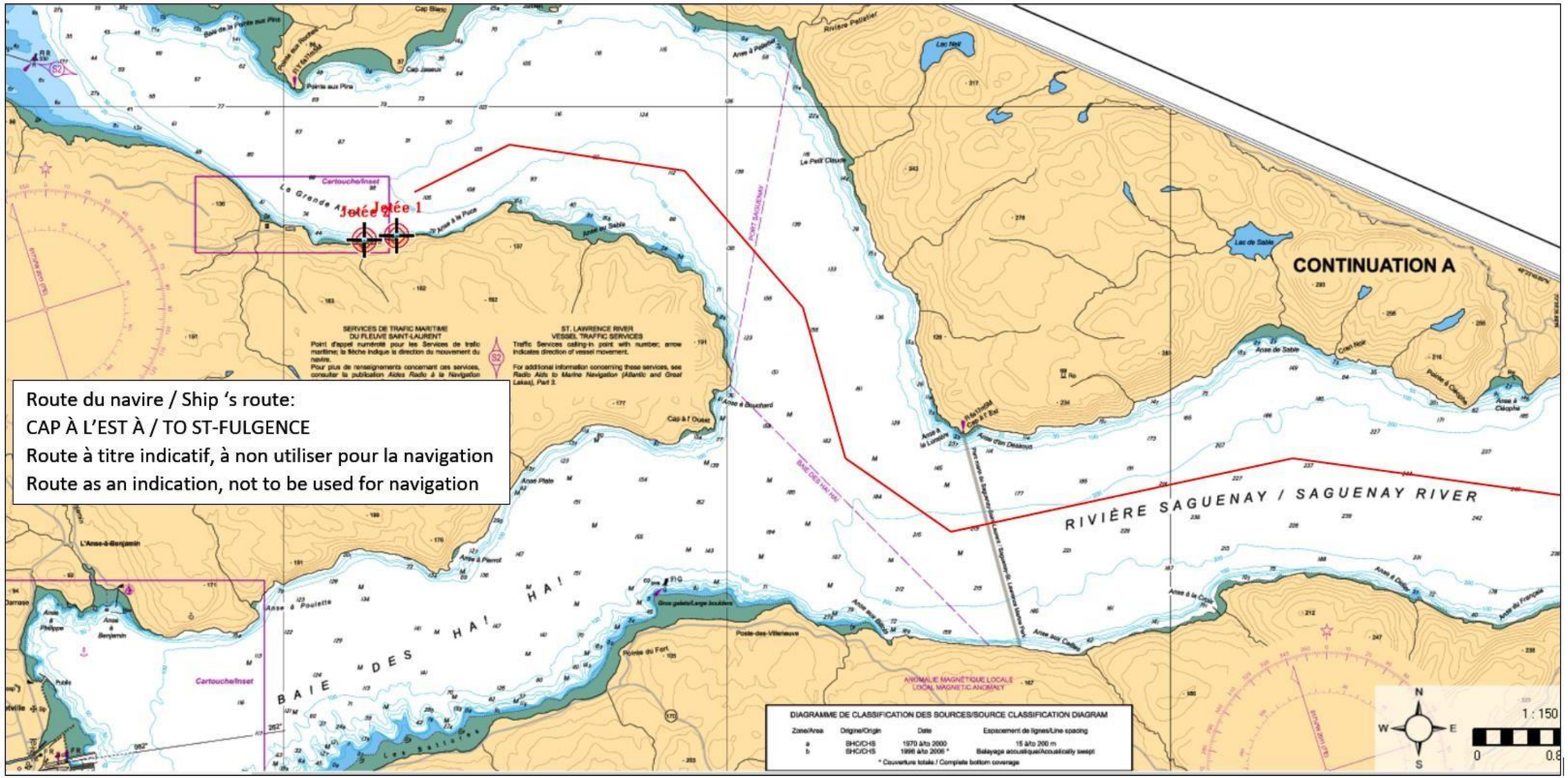

Route du navire / Ship 's route:
ÎLE DU BIC AU / TO CAP DE LA TÊTE AU CHIEN
Route à titre indicatif, à non utiliser pour la navigation
Route as an indication, not to be used for navigation
PRECAUTIONARY
AREA
DIAGRAMME/DIAGRAM
Voir Instructions nautiques
See Sailing Directions
Carte/Chart 1203
1 : 320 000
0
2 nm


Route du navire / Ship 's route:
TADOUSSAC À / TO CAP ÉTERNITÉ
Route à titre indicatif, à non utiliser pour la navigation
Route as an indication, not to be used for navigation
WARNING
Uncharted shallower depths may be found in areas between the 0 and 20-metre contour lines. Please note that horizontal discrepancies of up to 50 metres may affect a shoal's charted position in these same areas.
ANOMALIE MAGNÉTIQUE LOCALE
LOCAL MAGNETIC ANOMALY
Tadoussac
Cap de la Boule
Cap Noir
Cap Blanc
Baie Sainte-Catherine
BATTURE
ST. LAWRENCE RIVER
VITESSE RÉDUITE
SPEED REDUCTION


Route du navire / Ship 's route:
TADOUSSAC À / TO CAP ÉTERNITÉ
Route à titre indicatif, à non utiliser pour la navigation
Route as an indication, not to be used for navigation
RIVIÈRE SAGUENAY I SAGUENAY RIVER
CÂBLES
Les signes conventionnels des câbles sous-marins et aériens ne différencient pas les câbles conducteurs d'électricité, souvent à haute tension, des autres câbles de service. Les navigateurs prendront garde en passant sous tous les câbles aériens et éviteront de jeter l'ancre ou d'effectuer des opérations de fond à proximité des câbles sous-marins. La hauteur libre d'un câble aérien peut varier de sa valeur cartographiée à cause des changements dans les conditions atmosphériques, les niveaux d'eau et autres facteurs. Pour plus de renseignements, consulter l'avis n° 16 des Avis aux navigateurs, édition annuelle et le volume approprié des Instructions nautiques du SHC.
VITESSE RÉDUITE
Afin de réduire les risques de collisions avec des baleines dans cette zone d'alimentation, on recommande de réduire la vitesse sur l'eau à un maximum de 10 nœuds et d'assurer une vigie. Pour plus de renseignements, consulter les Avis aux navigateurs, Partie I.
AVERTISSEMENT
On peut retrouver des profondeurs moindres non cartographiées dans les zones situées entre les isobathes de 0 à 20 mètres. Un écart horizontal allant jusqu'à 50 mètres, peut également affecter la position des hauts-fonds cartographiés dans ces mêmes zones.
CABLES
The symbols for submarine and overhead cables do not differentiate between cables conducting electric power, often at high voltages, and other types of utility cables. Mariners are advised to exercise caution when passing under all overhead cables and to avoid anchoring or conducting seabed operations in the vicinity of submarine cables. The clearance of an overhead cable may differ from its charted value due to changes in atmospheric conditions, water levels and other factors. For additional information, consult Notice No. 16 in the Notice to Mariners, Annual Edition and the appropriate volume of CHS Sailing Directions.
SPEED REDUCTION
It is recommended that vessels slow down to a maximum speed through water of 10 knots and post a lookout, in order to reduce the risks of collisions with whales in this feeding area. For additional information, see the Notices to Mariners, Section I.
WARNING
Uncharted shallower depths may be found in areas between the 0 and 20-metre contour lines. Please note that horizontal discrepancies of up to 50 metres may affect a shoal's charted position in these same areas.
ANOMALIE MAGNÉTIQUE LOCALE
LOCAL MAGNETIC ANOMALY
Pointe aux Cèpes
L'Anse-de-Roche
Anse des Merciers
Anse de Saint-Étienne
Anse à la Goélette
Pointe de Saint-Étienne
Route Saint-Étienne
Anse Creuse
Anse à Jack
Anse à Benny
Pointe aux Petites Îles
Anse aux Petites Îles
Le Coquart
Pointe à Petes-Pierre
Anse à la Passe-Pierre
Anse du Sable
Anse à David
Route à David
Anse à la Boule
Cap de la Boule
Pointe à la Croix
Anse à Richard
Anse à la Barque
Cap Noir
Cap Blanc
Quatrième Lac
CHART 2011 (TE)


SAINT-FULGENCE
Échelle 1:37 500 (48°20'N) Scale
Projection : Mercator
LES PROFONDEURS sont en mètres et sont réduites au zéro des cartes (la marée normale la plus basse), lequel à Port-Alfred est de 2.6 mètres au-dessous du niveau de référence géodésique.
DEPTHS are in metres and are reduced to Chart Datum (Lowest Normal Tide), which at Port-Alfred is 2.6 metres below Geodetic Datum.
LES ALTITUDES, les points cotés et les hauteurs libres sont en mètres au-dessus de la pleine mer supérieure, grande marée. Les chiffres soulignés sur les zones asséchantes ou entre parenthèses contre les entités découvrantes sont en mètres au-dessus du zéro des cartes. Les points cotés indiqués en italique et les courbes topographiques sont en mètres au-dessus du niveau moyen de la mer. L'équidistance des courbes est de 30 mètres.
ELEVATIONS, spot elevations and clearances are in metres above Higher High Water, Large Tide. Underlined figures on drying areas or in brackets against drying features are in metres above Chart Datum. Spot elevations in italic figures and topographic contours are in metres above Mean Sea Level. The contour interval is 30 metres.
SYSTÈME GÉODÉSIQUE : Système de référence géodésique de l'Amérique du Nord 1983 (NAD 83), qui correspond au WGS 84.
HORIZONTAL DATUM: North American Datum 1983 (NAD 83), which is equivalent to WGS 84.
SOURCES : Les données hydrographiques sont présentées dans le DIAGRAMME DE CLASSIFICATION DES SOURCES. La topographie provient de la Base de données topographiques du Québec.
SOURCES: The hydrographic data are shown in the SOURCE CLASSIFICATION DIAGRAM. Topography is from Québec Topographic Data Base.
Pour les signes conventionnels et les abréviations, consulter la Carte n° 1.
For Symbols and Abbreviations, see Chart No. 1.
AGUENAY RIVER
ANOMALIE MAGNÉTIQUE LOCALE
LOCAL MAGNETIC ANOMALY
Route du navire / Ship 's route:
CAP ÉTERNITÉ À / TO CAP À L'EST
Route à titre indicatif, à non utiliser pour la navigation
Route as an indication, not to be used for navigation
Pointe Trinité
Anse des Portin
Anse du Gros Ruisseau
La Niche
Baie Trinité
Cap Trinité
Cap Liberté
Ruisseau de l'Ermite
Anse de l'Ermite
Cap Égalité
Cap Fraternité
Baie Éternité
Cap Éternité
Lac Long
Lac Blanc
N
S
E
W


Route du navire / Ship 's route:
CAP ÉTERNITÉ À / TO CAP À L'EST
Route à titre indicatif, à non utiliser pour la navigation
Route as an indication, not to be used for navigation
RIVIÈRE SAGUENAY / S
Sainte-Rose-du-Nord
L'Anse-aux-Érables
Pointe Rouge
Anse de Sable
Anse à Cléophe
Anse à la Mine
Anse Rouge
Anse à la Croix
Anse du Français
Anse à Simon
Anse aux Érables
Anse à la Chaîne
Petite Anse de Roches
Anse aux Cailles
Anse à la Lumière
Anse d'en Dessous
Crien Noir
Pointe à Cléophe
Rivière à la Croix
ANOMALIE MAGNÉTIQUE LOCALE
LOCAL MAGNETIC ANOMALY
BAIE DES HA! HA!
Lac Long
Lac Otis
Lac Travers
Le Grand Lac
Le Tableau
Lac du Tableau
Lacs
Chaîne
CÂBLES
RENSEIGNEMENTS SUR LES MARÉES/TIDAL INFORMATION
LOCALITÉ / LOCATION
Altitude au-dessus du zéro des cartes / Elevation above Chart Datum
Grande marée/Large Tide
Marée moyenne/Mean Tide
Niveau moyen de l'eau / Mean Water Level
PMS/HHW
BMI/LLW
PMS/HHW
BMI/LLW
mètres/metres
mètres/metres
mètres/metres
mètres/metres
mètres/metres
Port-Alfred
6.3
-0.3
5.0
0.8
2.7
N
W
E
1 : 120 000
0
0.7 nm


Route du navire / Ship 's route:
CAP À L'EST À / TO ST-FULGENCE
Route à titre indicatif, à non utiliser pour la navigation
Route as an indication, not to be used for navigation
CONTINUATION A
RIVIÈRE SAGUENAY / SAGUENAY RIVER
BAIE DES HA! HA!
Jetée 1
Jetée 2
Cartouche/Inset
SERVICES DE TRAFIC MARITIME DU FLEUVE SAINT-LAURENT
ST. LAWRENCE RIVER VESSEL TRAFFIC SERVICES
DIAGRAMME DE CLASSIFICATION DES SOURCES/SOURCE CLASSIFICATION DIAGRAM
1 : 150

7.5 APPENDIX 5

GLOSSARY

Canada's Oil Spill Preparedness and Response Regime – Transport Canada is the federal regulator responsible for the Regime, which is based on a partnership between government and industry. Under this regime, TC sets the guidelines and regulatory framework for marine oil spill preparedness and response.

CCG – Canadian Coast Guard: A Special Operating Agency within Fisheries and Oceans Canada (DFO), the CCG is responsible for services and programs that directly contribute to the safety, protection, and accessibility of Canada's waterways.

CEAA 2012 –*Canadian Environmental Assessment Act* (2012): CEAA 2012 and its regulations provide the legal framework for federal practice in environmental assessment for most parts of Canada prior to entry into force of the *Impact Assessment Act* passed in 2019.

Classification society – Classification societies are recognized organizations with expertise in establishing and applying technical norms and standards for the construction and operation of merchant vessels.

CLSLP – Corporation of Lower St. Lawrence Pilots: The CPBSL's primary mission is to ensure, in the public interest, the safe conduct of ships between Quebec City and Les Escoumins, including the Saguenay River.

CSA 2001 – *Canada Shipping Act 2001*: CSA 2001 is the primary legislation governing the safety of shipping and recreational boating, as well as the protection of the marine environment.

DFO – Fisheries and Oceans Canada: federal department responsible for safeguarding Canadian waters and managing Canada's fisheries and oceans resources.

ECCC – Environment and Climate Change Canada: federal department with a mandate to preserve and improve the quality of the natural environment, conserve renewable resources, forecast weather conditions, and issue weather warnings, enforce legislation on boundary waters, and coordinate environmental policies and programs.

HNS Convention - *2010 International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Hazardous Substances by Sea*: the HNS Convention was adopted in May 1996, in London, by an international conference organized by the International Maritime Organization and it is based on the very successful model of the *Civil Liability Convention* and the *Fund Convention*, which deals with pollution damage resulting from persistent oil spills from tankers. Like the original compensation regime for oil pollution damage, the HNS Convention aims to establish a two-tier regime for compensation paid following incidents at sea relating in this case to harmful and potentially dangerous substances such as chemicals.

IAAC – Impact Assessment Agency of Canada formerly known as the Canadian Environmental Assessment Agency, the agency applies the *Canadian Environmental Assessment Act*, 2012 (CEAA 2012) for designated projects filed prior to the coming into force of the *Impact Assessment Act* (IAA). It is responsible for managing the environmental assessment process for projects in which an environmental assessment may be required.

IGC Code - International code for the construction and equipment of vessels carrying liquefied gases in bulk (International Gas Carrier Code): adopted by the IMO under chapter VII of the SOLAS convention, the purpose of the code is to provide an international standard for the safety of bulk shipping of liquefied gases.

IMO – International Maritime Organization: As a specialized agency of the United Nations, IMO is the global authority responsible for setting standards for the safety, security, and environmental performance of international shipping.

ISM Code – International Safety Management Code: The ISM Code is an international standard for the safe operation of ships and the prevention of pollution. Chapter IX of the *International Convention for the Safety of Life at Sea* (SOLAS Convention) requires compliance with the ISM Code.

ISPS Code – International Ship & Port Facility Security Code: adopted by the International Maritime Organization (IMO) (Chapter XI of the SOLAS Convention), the primary objective of the ISPS Code is to establish an international maritime security framework to prevent and detect threats and take appropriate measures against security incidents.

LNG – Liquefied Natural Gas: liquefied natural gas (LNG) is a natural gas mainly composed of methane (CH4) cooled to -162°C, brought from the gaseous state to the liquid state to reduce its volume (600 times less) for storage and transportation reasons. LNG is a clear, transparent, odourless, non-corrosive and non-toxic liquid. It is stored and transported, under atmospheric pressure in a virtually impenetrable double tank.

LPA – Laurentian Pilotage Authority: the LPA has the mandate to operate, maintain and manage an efficient pilotage service in Canadian waters of the Laurentian region for navigation safety west of Les Escoumins.

Maritime traffic network – network comprising various types of vessels used for different purposes, using various waterways giving access to marine terminals, or transhipment sites located in waters under Canadian jurisdiction.

MARPOL Convention – *International Convention for the Prevention of Pollution from Ships* (MARine POLlution): the MARPOL Convention, with its appendices and successive amendments, adopted under the aegis of the IMO, has as its main objective to deal with technical measures to prevent pollution, in particular through vessel design and equipment.

MCTS – Marine Communications and Traffic Services: Within the CCG, MCTS provides communications and traffic services to the marine community. MCTS is a maritime collection and diffusion of navigation information.

MELCC – Ministère de l'Environnement et de la Lutte contre les changements climatiques contributes to the sustainable development of Québec by playing a key role in the fight against climate change, the protection of the environment and the conservation of biodiversity, for the benefit of current and future generations.

MPA – Montreal Port Authority

MTQ – Ministère des Transports, Government of Quebec, is responsible for actively contributing to the prosperity of Quebec and its territories. Through the importance it places on sustainable mobility, the Department ensures the development of efficient and safe transportation systems.

MTSA – *Maritime Transport Security Act*: among other things this law regulates security issues with regard to, on the one hand, vessels, persons on board, the handling of goods, vessel supply and their access and, on the other hand, terminals, and port facilities.

OHF – Oil handling facilities: facility, in particular an oil port terminal, where operations are carried out or will be carried out for the loading or unloading of oil in all its forms – in particular crude oil, fuel oil, sludge, residues hydrocarbons and refined products — on or from a vessel.

Operator – person, company or group authorized by the SPA to use the new marine facilities proposed under the project.

Project – Marine terminal, or transshipment site that a proponent proposes to build, modify, or recommission.

Proponent – person, company, or group proposing the construction, modification, or recommissioning of a marine terminal or transshipment site. As part of this project, GNL Québec is designated the proponent.

PSCP – Port State Control Program: PSCP is a vessel inspection program whereby foreign ships entering the waters of a sovereign state are screened and inspected to ensure compliance with major international maritime conventions.

Reference vessel(s) – the class or classes of vessels that the proponent intends to use to transport cargoes subject to the TERMPOL review process, or vessel prototype to use marine terminals or proposed transhipment sites.

RO – Response Organization: An organization accredited by the Marine Safety Directorate of Transport Canada to respond to pollution incidents under the provisions of the *Canada Shipping Act, 2001* (CSMA 2001).

SIRE - The SIRE program (*Ship Inspection Report Program*): is a unique oil tanker risk assessment tool, useful for charterers, ship operators, terminal operators, and government agencies regarding tanker safety.

SMM – Safety Management Manual: safety manual developed by companies and intended for personnel in order to effectively apply safety and environmental protection policies.

SMS – Safety Management System: SMS enables companies to identify, assess, and mitigate safety risks. The ISM Code requires the establishment of an SMS and the development of an SMM (safety management manual).

SOLAS Convention – *International Convention for the Safety of Life at Sea*: the SOLAS Convention, with its successive amendments, adopted under the aegis of the IMO, has as its main objective to establish minimum construction, and operating standards for commercial vessels to ensure the safety of crews, passengers, and vessels.

SPA – Saguenay Port Authority: A leading player in the regional economy, the Port of Saguenay provides services and infrastructures that promote trade and industrial development, while respecting the environment and its communities.

TC – Transport Canada: federal department responsible for transportation policies and programs.

TCMSS – Transport Canada Marine Safety and Security: TCMSS is responsible for developing, maintaining, and implementing an effective and efficient regulatory regime, promoting education and awareness, and ensuring compliance and enforcement.

TP 743 – TC publication titled TERMPOL Review Process.

TRC – TERMPOL Review Committee: the TRC is made up of representatives from various departments, and agencies with responsibilities for marine regulations, programs, and services.

TRP – TERMPOL Review Process: The Technical Review Process for Marine Terminals and Transshipment Sites, is a federal government initiative that assesses the safety and risks associated with the movement of oil and chemical tankers carrying liquefied gases to, from, and near marine terminals in Canada.

TRPA – Trois-Rivières Port Authority.

TSB – Transportation Safety Board of Canada: The Transportation Safety Board of Canada (TSB) is an independent agency that works to make transportation safer by investigating occurrences in the means of marine, pipeline, rail, and aerospace transportation.

Waters Under Canadian Jurisdiction – Canadian waters and waters located in the exclusive economic zone (EEZ) of Canada.

2000 Protocol on Preparedness, Response and Cooperation Against Pollution Incidents by Harmful and Hazardous Substances (OPRC-HNS Protocol) – Like the OPRC Convention, the OPRC-HNS Protocol aims to establish national preparedness and response systems and to provide a global framework for international cooperation in responding to serious marine pollution incidents or risks. Parties to the OPRC-HNS Protocol are required to establish measures to respond to pollution incidents, either nationally, or in cooperation with other countries. Vessels are required to have a shipboard pollution emergency plan to implement with incidents involving noxious, and potentially hazardous substances.

7.6 APPENDIX 6

BIBLIOGRAPHY

Consequence Assessment Methods for Incidents Involving Releases from Liquefied Natural Gas Carriers, Prepared by: ABSG Consulting Inc / Federal Energy Regulatory Commission (FERC), May 2004

Tanker Safety Guide, Liquefied Gas, Second edition 1995, International Chamber of Shipping

https://www.tc.gc.ca/fra/securitemaritime/processus-examen-termpol-edition-2019-tp743f.html

British Standard, BS EN 14773:20, Installation and equipment for liquefied natural gas — Design of onshore installations,

Guide d'analyse et de gestion des risques d'accidents industriels majeurs à l'intention des municipalités et de l'industrie, CRAIM (Conseil pour la réduction des accidents industriels majeurs)

Liquefied Natural Gas Safety Research, Report to Congress May 2012, United States Department of Energy, Washington, DC 20585

IMO, MSC 83/INF.3, Formal Safety Assessment, Liquefied Natural Gas (LNG) Carriers, Details of the Formal Safety Assessment, July 2007

Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water, Sandia Report, 2004

https://sim-pilot.com/

https://www.iacs.org.uk/

https://www.parismou.org/

http://www.tokyo-mou.org/

https://laws-lois.justice.gc.ca/fra/lois/c-10.15/

https://laws-lois.justice.gc.ca/fra/reglements/DORS-90-264/page-10.html#h-911576

https://laws-lois.justice.gc.ca/fra/reglements/DORS-2020-216/

http://www.imo.org/fr/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Safety-of-Life-at-Sea-(SOLAS),-1974.aspx

http://www.imo.org/fr/about/conventions/listofconventions/pages/international-convention-for-the-prevention-of-pollution-from-ships-(marpol).aspx

https://www.imo.org/en/OurWork/Environment/Pages/Technical-and-Operational-Measures.aspx

http://www.imo.org/fr/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Control-and-Management-of-Ships%27-Ballast-Water-and-Sediments-(BWM).aspx

https://www.ilo.org/global/standards/maritime-labour-convention/lang--en/index.htm

https://laws-lois.justice.gc.ca/fra/reglements/DORS-89-98/page-1.html

https://tc.canada.ca/en/marine-transportation/marine-safety/joint-industry-government-guidelines-control-oil-tankers-bulk-chemical-carriers-ice-control-zones-eastern-canada-tp-15163-b-2015

Rapport d'examen TERMPOL, Projet de terminal méthanier à Gros-Cacouna, TP 14633F, Novembre 2006

IMO Resolution A.893(21) - Guidelines for voyage planning

GNL Québec – Énergie Saguenay, Étude réalisée sur simulateur complet de navigation, Centre de simulation et d'expertise maritime, Septembre 2019

Trafic maritime à la station de pilotage des Escoumins 2014 -2019, Administration de pilotage des Laurentides, Octobre 2020

STQ, Rapports d'activités 2007-2008 à 2016-2017

Turgeon, S., 2019. Portrait de la navigation dans le parc marin du Saguenay–Saint-Laurent - 2017. Parcs Canada.

http://parcmarin.qc.ca/wp-content/uploads/2020/09/Portraitdelanavigation2017parcmarinduSaguenay-Saint-Laurent-web.pdf

Norme ISO 28460 Industries du pétrole et du gaz naturel — Installations et équipements relatifs au gaz naturel liquéfié — Interface navire-terre et opérations portuaires

Aspects Affecting the Berthing Operations of Tankers to Oil and Gas Terminals, PIANC, MarCom Working Group 116.

Marine Terminal Operator Competence and Training Guide (MTOCT), (OCIMF).

https://www.notmar.gc.ca/publications/annual-annuel/section-c/c27a-fr.php

https://archives.bape.gouv.qc.ca/sections/mandats/nappes_phreatiques_%C3%AEles-de-la-madeleine/index.htm

33 CFR Part 165 - Regulated navigation areas and limited access areas

https://clearseas.org/fr/gnl/

https://laws-lois.justice.gc.ca/fra/reglements/DORS-2019-51/index.html

Support Craft at Gas facilities. Principles of Emergency Response and Protection Onshore - SIGTTO

Guide to Contingency Planning for the Gas Carrier Alongside and within Port Limits, (ICS/OCIMF/SIGTTO) / Contingency Planning and Crew Response Guide for Gas Carrier Damage at Sea and in Port Approaches, (ICS/OCIMF/SIGTTO).

Rapport d'examen TERMPOL visant le projet Kitimat LNG, Transports Canada, 2018

https://www.hnsconvention.org/fr/la-convention/

Handbook of Liquefied gas, Saeid MokhatabJohn Y. MakJaleel V. ValappilDavid A. Wood, Oct 2013