GNL QUÉBEC

ÉNERGIE SAGUENAY PROJECT

SUMMARY OF THE ENVIRONMENTAL IMPACT ASSESSMENT

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GNL QUÉBEC INC.

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FOREWORD

This summary presents in simple and basic terms the main points of the environmental impact statement (EIS) of the Énergie Saguenay project developed by GNL Québec Inc. (GNLQ), presented to the Canadian Environmental Assessment Agency (CEAA) and to the Ministère de l'Environnement et de la Lutte contre les changements climatiques (MELCC).

The reader is invited to refer to the EIS and its appendices, as well as to the document answering the information and clarification requests from the CEAA for the EIA concordance, in order to have access to all information available to this day.

The French version of this updated summary constitutes the official version. In case of conflict of interpretation between the English and French versions, the French version prevails.

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1 INTRODUCTION AND CONTEXT OF THE ENVIRONMENTAL ASSESSMENT

This document is a basic summary of the environmental impact statement (EIS) report of the Énergie Saguenay natural gas liquefaction project (Project) at Grande-Anse (Ville de Saguenay – La Baie Borough), developed by GNL Québec Inc. (GNLQ). GNLQ plans to build and operate over 25 to 50 years a Liquefaction Facility, from which the liquefied natural gas (LNG) will mainly be intended for export.

The Liquefaction Facility will include two natural gas liquefaction units and three LNG storage tanks. Marine infrastructure for loading of the LNG tankers that will transport the LNG are also planned. Hydroelectricity will serve as the energy source to power the Liquefaction Facility, including the liquefaction units, which will allow for a significant reduction of greenhouse gas (GHG) emissions compared to the emissions produced by most natural gas liquefaction facilities of similar capacity in the rest of the world.

This summary is produced in accordance with the Final Guidelines issued by the Canadian Environmental Assessment Agency and the directive received from the Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC). The CEAA will analyze the EIS under the Canadian Environmental Assessment Act (CEAA, 2012) and the MELCC according to the Loi sur la qualité de l'environnement (LQE).

An assessment of the potential effects of the Project within the areas of federal and provincial authorities must be assessed. Governmental bodies will use this EIS to prepare an environmental assessment report on the potential of the project to have effects on areas under federal and provincial authority.

This summary includes the following sections:

1. Introduction and context of the environmental assessment;
2. Overview of the project;
3. Alternative means of carrying out the project that have been evaluated and analysed;
4. Public consultation and participation;
5. First Nations consultation and participation;
6. Summary of the assessment of environmental impacts on valued components, including:
    a. description of the host environment;
    b. anticipated changes to the environment;
    c. anticipated effects on the valued components;
    d. mitigation measures;
    e. significance of residual effects.
7. Surveillance and monitoring programs.

1.1.1 OPPORTUNITY OF A LIQUEFIED NATURAL GAS EXPORT TERMINAL

The objective of the Project is to transform and liquefy Canadian natural gas to allow its economical and safe transportation to world markets. Indeed, when natural gas is cooled to -162 °C, it becomes liquid and can be stored at atmospheric pressure.

LNG occupies 1/600th of the volume of natural gas and thus can be transported more economically over long distances in LNG tankers designed to meet the strict recognized international safety standards. Once delivered, the LNG is warmed and transformed back into natural gas to be distributed for residential, commercial or industrial use. The project will allow liquefaction of approximately 44 million cubic metres per day (Mm³/d) of natural gas. It thus will have a nameplate capacity of 10.5 million tonnes per annum (Mtpa). Under the National Energy Board (NEB) export licence authorisation, the quantity of LNG that can be exported shall not exceed 11 Mtpa, subject to the annual tolerance. In any 12 months period, the quantity of LNG that may be exported may exceed the maximum annual quantity by 15%.

The economic interest of an LNG liquefaction and export facility results from low feedstock natural gas prices and sales into higher value LNG markets. The opportunity for Energie Saguenay is a result of major changes that have occurred on the natural gas market in North America over the past decade. Natural gas production at a highly competitive cost has increased considerably in the United States in the past few years, ensuring that the availability of natural gas in North America henceforth satisfies the projected short, medium and long-term demand. In this context, natural gas production in Western Canada, the majority of which was previously exported to the United States, faces increased competition from American producers, resulting in a significant loss of its historical markets. This saturation and loss of markets for Canadian natural gas producers thus creates production surpluses. GNLQ is creating an opportunity for Canadian producers to reach world markets, after experiencing a 40% decrease of their net exports to the United States over the past decade. This market loss is not coming back. In addition, the TCPL pipeline, a critical piece of strategic Canadian infrastructure, is vastly underutilized, and therefore LNG exports present the only real viable opportunity for Canadian gas markets to recover. The Énergie Saguenay project being hydropower driven offers a solid solution to Canada. Figure 1-1 illustrates the Liquefaction Facility project in the natural gas supply chain to LNG markets.

Simultaneously, world demand for natural gas is experiencing strong growth which experts believe will continue for the following reasons:

- international desire to replace more polluting fossil fuels, such as coal, fuel oil, and diesel fuel oil which – as demonstrated by various independent studies – produce significantly more emissions compared to using natural gas as a fuel;
- economic growth of emerging countries, necessitating increased energy needs for industrial development, as well as for domestic commercial and residential needs (e.g., electricity, heat);
- reduction of the use of nuclear energy in certain countries;
- diversification and search for stability of energy supply for certain countries, particularly in relation to the political instability in certain geographic areas, such as the Middle East or Russia.

According to current estimates[1], the overall demand for LNG thus are expected to nearly double over the next 20 years, going from the current volume of 318 Mtpa to 612 Mtpa by 2035. In this context, the Project seeks to facilitate the export of Canadian gas as LNG from a lower-emissions liquefaction facility to reach world markets, such as Europe, Asia, the Middle East and South America.

[1] Wood Mackenzie Q3-2018.

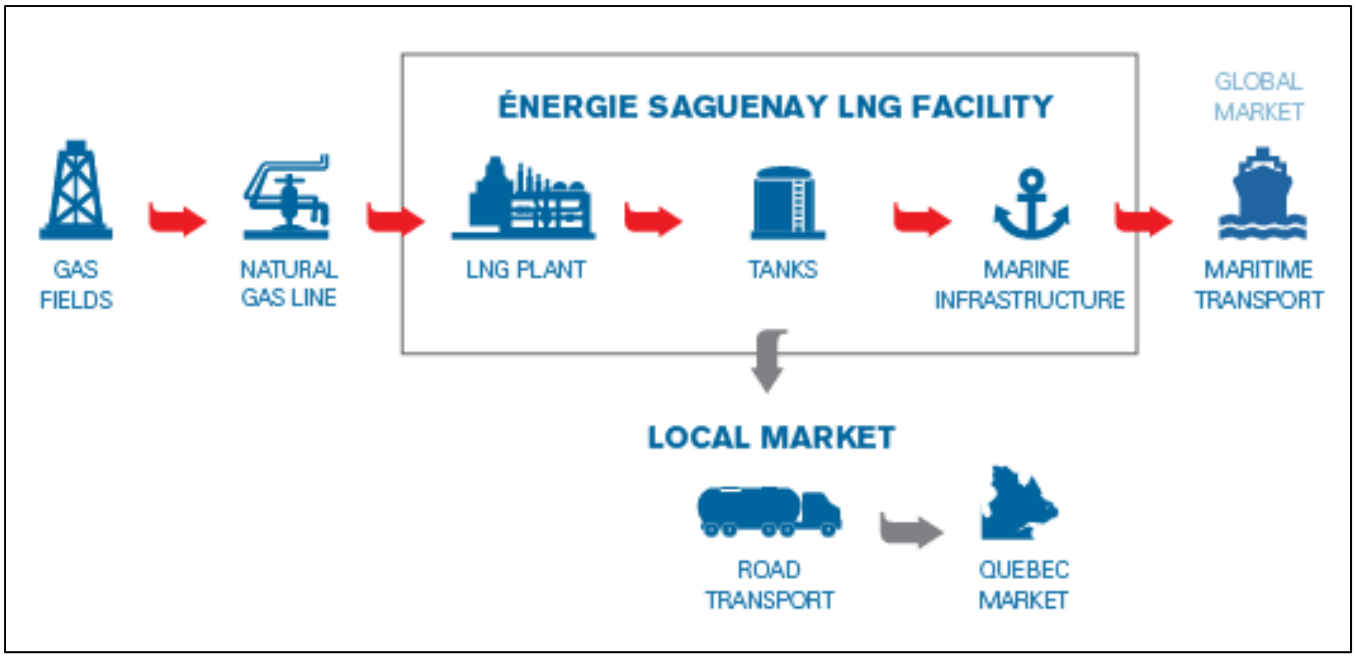


Figure 1-1 Energie Saguenay Project in the natural gas supply chain to global markets

According to the International Energy Agency (IEA), developing economies (led by China, India and other Asian countries) will represent 80% of the increase in natural gas demand by 2040, because natural gas aligns well with key regional policies and priorities, such as the reduction of air pollutant emissions generating smog and GHGs. Natural gas thus helps respond to generalized air pollution concerns.[2]

Furthermore (according to the IEA), the advantage of natural gas over other traditional fossil fuels (e.g. coal and oil) is strengthened by analyzing the emissions of the leading air pollutants: fine particulate matter ($PM_{2.5}$), sulphur oxides (primarily sulphur dioxide - SO_2) and nitrogen oxides (NO_X). These three pollutants directly or indirectly affect air quality through chemical reactions in the atmosphere. An optimum natural gas combustion releases fewer contaminants into the atmosphere.[3]

Due to its Saguenay location, the Project has access to excess renewable, installed hydroelectric capacity Hydro-Québec's system and thus is able to use electric motors rather than large gas turbines to power the liquefaction processes. This opportunity, which is unique in the world for a facility of this scale, although it is built upon proven technology that exists elsewhere in the world, comes with three notable advantages that make the project even more commercially attractive for global consumers of LNG:

- the lowest GHG emissions LNG production in the world (on a per tonne basis);
- stability of production costs due to the stability of the cost of electricity in Quebec, unlike natural gas that is used as the power source for other typical liquefaction projects;
- the certainty of limited exposure to possible carbon taxes (whether in Canada or on the export markets) due to lower GHG emissions compared to global competition.

In this context, GNLQ is now in advanced negotiation with potential LNG buyers for long-term supply contracts.

[2] Outlook for Natural Gas 2017. P. XIII
[3] Outlook for Natural Gas 2017. P. 401

1.1.2 FEASIBILITY OF THE PROJECT;

The following points are the key economic feasibility and viability elements of the Project:

- For the upstream portion of the project, GNLQ has access to a large quantity of natural gas from Western Canada, sold at a highly competitive rate compared to the rest of North America. In terms of natural gas transportation, GNLQ can count on existing transportation infrastructure from Western Canada to Eastern Ontario with significant underutilized capacity that offers good transport cost.
- To complete transport of the natural gas from existing transportation infrastructure in Ontario to the new liquefaction facility, a natural gas pipeline (approximately 750 km) will be built.
- Concerning the Liquefaction Facility, the choice of the site within the Federal Saguenay Port Authority (SPA) land is a key factor in the Project's visibility, particularly due to:
  - availability of skilled workers nearby;
  - adequate existing transportation infrastructure (roads, railways, airport) linking this sector of Ville de Saguenay to the rest of the country;
  - direct access to a deep and wide commercial waterway, usable year-round;
  - availability of abundant hydroelectricity, a reliable, inexpensive and non-polluting energy source with a direct impact on operating costs and the stability of long-term production costs;
  - the proximity of the existing gas transportation pipeline network linking Western Canada to Eastern Ontario.

1.1.3 ANALYSIS OF THE PROJECT LIFE CYCLE

To confirm and validate through analysis the environmental and social benefits of the Project, GNLQ mandated the International Life Cycle Chair (ILC Chair), Principal Research Unit of the International Reference Centre for the Life Cycle of Products, Processes and Services of Montréal (CIRAIG) and the UQAM School of Management (ESG-UQAM) to conduct a comprehensive life cycle analysis (LCA) measuring from the natural gas extraction point to its use in the various target markets.

LCA is a method governed by the International Standards Organization (ISO), which allows assessment of the environmental performance of an activity over its entire life cycle. This is a holistic approach that accounts for extraction and processing of raw materials, manufacturing, transportation and distribution processes, and end-of-life use and management of the product.

The ILC Chair research team therefore compared the Saguenay liquefaction plant, operating on Quebec hydroelectricity, to a conventional liquefaction plant operating on natural gas (self-consumption) located in the Gulf of Mexico. For this purpose, three levels of comparison were assessed:

1. a comparison only of the liquefaction plants with each other;
2. a comparison including the liquefaction plants and the upstream steps (i.e. preliminary work, exploration, extraction, treatment, transport, liquefaction and closure of the natural gas extraction site);
3. a comparison of the life cycle of the LNG used in various target markets.

The main findings of interest of the LCA are as follows:

- The operation of the Saguenay liquefaction terminal allows a reduction of GHG emissions of nearly 84%, compared to a conventional liquefaction terminal located in the Gulf of Mexico, for example.
- The Saguenay liquefaction terminal allows a reduction of GHG emissions of nearly 33%, compared to a conventional liquefaction terminal located elsewhere in the world.

An export scenario has been established by GNLQ market studies and commercial advances on three continents. The scenario established is generally beneficial with a reduction of GHG emissions of -0.278 kg CO2 eq./ kWh of energy generated, equivalent to a decrease of nearly 28 Mt CO2 eq / year depending on the production levels of the Saguenay liquefaction terminal, its markets and uses.

GNLQ is also committed to put all necessary efforts for the operation of a carbon neutral facility and thus be part of solutions for the fight against climatic changes. To achieve this, an agreement was made with the Université du Québec à Chicoutimi Eco-Advisory Research Chair in order to undertake a research project identifying solutions to support the company's work to make the natural gas liquefaction facility operations carbon neutral.

1.2 REGULATORY FRAMEWORK

1.2.1 FEDERAL LEGISLATION

A description of the Project within the meaning of section 8(1) of the CEAA and the Prescribed Information for the Description of a Designated Project Regulations (SOR/2012-148) was filed by WSP on behalf of GNLQ in November 2015. After this filing and after public consultation, the CEAA transmitted final guidelines in March 2016, indicating the federal requirements GNLQ must take into account for the production of its EIS.

The Project is subject to an EIS under the Canadian Environmental Assessment Act (CEAA, S.C. 2012, c. 19, s. 52). Table 1-1 summarizes the triggers of the environmental assessment process for the Project.

Table 1-1 Triggers of the federal environmental assessment process

Triggers of the Énergie Saguenay Project	Regulations Designating Physical Activities CEAA (2012)
Construction of two natural gas liquefaction lines with a nameplate capacity of 10.5 Mt of LNG per year Construction of three LNG storage tanks with an individual capacity of about 200 000 m^3 each, for a maximum storage capacity on the site of 600 000 m^3 of LNG	14 *d)* The construction, operation, decommissioning and abandonment of a new facility for the liquefaction, storage or regasification of liquefied natural gas, with a liquefied natural gas processing capacity of 3,000 t/day or more or a liquefied natural gas storage capacity of 55,000 t or more
Construction of a maritime infrastructure allowing the mooring and loading of up to two LNG tankers with an LNG cargo capacity of up to 217,000 m^3 (approximately 95,000 deadweight tonnage (DWT) of LNG)	24 *c)* The construction, operation, decommissioning and abandonment of a new marine terminal designed to handle ships larger than 25,000 DWT unless the terminal is located on lands that are routinely and have been historically used as a marine terminal or that are designated for such use in a land-use plan that has been the subject of public consultation

1.2.2 PROVINCIAL LEGISLATION

The Project is subject to the regulatory requirements of the Regulation respecting environment impact assessment and review, which involves the production of an EIS, as summarized in Table 1-2. This procedure is administered by the Direction des évaluations environnementales (DÉE) of the Ministère de l'Environnement et de la Lutte contre les changements climatiques (MELCC)[4]. Following the filing of a project notice with the DÉE in August 2015, a specific directive issued by the DÉE, indicating the nature, scope and extent of the EIS, was received by GNL Quebec in December 2015.

Table 1-2 Triggers of the provincial environmental assessment process

Triggers of the Énergie Saguenay Project	Regulation respecting environment impact assessment and review (EQA)
Construction of two natural gas liquefaction lines with a nameplate capacity of 10.5 Mtpa of LNG Construction of three LNG storage tanks with an individual capacity of about 200,000 m^3 each, for a maximum storage capacity on the site of 600,000 m^3 of LNG	*2(j)* the construction of installations for natural gas gasification or liquefaction or the construction of more than 2 km of oil pipeline in a new right-of-way, except conduits for transporting petroleum products under a municipal street; *2(s)* the establishment of one or more reservoirs with a total storage capacity of over 10,000 kl intended to hold a liquid or gaseous substance other than water, food or liquid waste from a livestock operation not referred to in subparagraph o.
Construction of a maritime infrastructure allowing the mooring and loading of up to two LNG tankers with an LNG cargo capacity of up to 217,000 m^3 (approximately 95,000 DPW of LNG)	*2(d)* the construction or enlargement of a port or wharf, or a modification in use of a port or wharf, except in the case of a port or wharf intended for fewer than 100 pleasure or fishing craft.

1.2.3 MUNICIPAL BY-LAWS

The Project must also comply with all the by-laws in force at the level of the municipality affected by the host territory. Ville de Saguenay has the powers of a regional county municipality (RCM) and has by-laws applicable to the Project.

1.2.4 APPLICABLE LAWS AND REGULATIONS;

In addition to the mitigation measures set out in this EIS, the final design of the Project will have to comply with the applicable standards regarding the projected equipment and infrastructure. The preparation of the final plans and specifications shall be within the legal framework of the federal government, the provincial government or Ville de Saguenay by complying with a multitude of laws, regulations, policies and directives.

After obtaining orders from the provincial and federal governments, GNLQ will file applications for authorization and permits for the construction and operation of the Project, which will include the detailed plans and specifications of the infrastructure and other facilities.

[4] MELCC (Ministère de l'Environnement et de la Lutte contre les changements climatiques) since October 2018.

1.3 CONSTRAINTS AND ISSUES IDENTIFIED

Based on the comments from all the consultations conducted on the basis of the presentation of the Project and the Guidelines issued by the CEAA and the MDDELCC directive, the main constraints and issues identified are presented in the following sections.

1.3.1 FIRST NATIONS

Since November 2014, regular consultation meetings have been held with a Project Monitoring Committee, approximately every three months, to offer a discussion platform concerning the issues and concerns of the First Nations that could be associated with the Project. The list of concerns and questions raised to date is presented in Table 1-3. Minutes of these meetings are available on GNLQ's website (http://energiesaguenay.com/en/advisory-committee-lng-facility/).

Table 1-3 Issues, concerns and value add ideas raised by the First Nations

ISSUES	CONCERNS
Economic impact	— Value and benefits of the First Nation workforce
	— Creating business opportunities in the First Nation community
	— Communication methods to reach the First Nation
	— Offering training programs to the members of the First Nation community
Impact on the environment	— Greenhouse gas emissions
	— Gas pipeline: Potential impact on the territory
	— Natural gas source and extraction methods
	— Avifauna
	— Protection of terrestrial sensitive areas
Marine transportation	— Cohabitation with other users and First Nation tourist activities
	— Impact on marine mammals related to marine traffic increase
	— Sea urchin fishing
	— Spill related to marine accident
	— Groundwater contamination
Health Safety and Security	— Health and safety risks for workers and community
Social acceptability	— First Nation consultation process
	— Project justification and sustainability
	— Consideration of cumulative impacts
	— Associated projects (power line, gas pipeline)
	— Respect of engagements
Land Use	— Land occupancy
	— Preserve traditional and actual First Nation activities
Archaeological potential	— Destruction of artefacts and burial sites

1.3.2 LOCAL AND REGIONAL COMMUNITIES

Regular consultations and meetings have been held with an Advisory Committee, which was set up at the beginning of development of the project, in order to discuss issues and concerns of the local and regional communities associated with the industrial facilities in the Port of Saguenay. The list of concerns and questions raised to date is presented in Table 1-4. Minutes of these meetings are available on GNLQ's website (http://energiesaguenay.com/en/advisory-committee-lng-facility/).

Table 1-4 Issues and concerns raised by the community

THEMES	CONCERNS
Economic impacts	– Source of investors
	– Involvement of local businesses
	– Value and benefits of the regional workforce
Impact on the environment	– GHG emissions
	– Integration of sustainable development practices
	– Protection of sensitive environments and interest in the terrestrial ecosystem
	– Source of natural gas and natural gas extraction methods
	– Rehabilitation of the site
Nuisances related to operations	– Integration into the landscape
	– Noise
	– Odours
	– Lights
Nuisances related to construction	– Noise
	– Road transportation
Social acceptability	– Complete and transparent consultative approach
	– Justification of the Project and sustainability
	– Consideration of cumulative impacts
	– Related projects (power line, gas pipeline)
	– Compliance with commitments
Cohabitation of uses (safety/navigation route)	– Collision with other users (sailboats, personal watercraft, fishermen, ocean liner and cargo vessel) – Wake heights (kayak safety, boat masts striking each other in marinas) – Communication of the passage of LNG tankers with other navigators – Speed of LNG tankers
Impact on aquatic fauna (right whale and beluga)	– Collision with marine mammals – Reliable scientific data on the impacts of navigation on mammals: noise, speed – Cumulative effects of the increase in traffic – Increase in marine traffic in the Parc marin – Delinquency of individual users (fisherman, zodiac, pleasure craft)
Spill in case of marine accident	– Dilution in water – Impact on wildlife, flora and the shoreline
Impact on the tourism industry (Parc Aventures Cap Jaseux, kayak, Saguenay Park, etc.)	– Absence of coordinated consultation of the players involved – Reduction of the surplus value of the great outdoors, Fjord trademark
Health, safety and security	– The risk for the health and safety of the population and the workers.

2 OVERVIEW OF THE PROJECT

2.1 LOCATION OF THE PROJECT

The Project is located within the industrially zoned lands of Transport Canada's Saguenay Port Authority (SPA) in the Saguenay–Lac-Saint-Jean administrative region (02), more specifically within the limits of La Baie Borough of Ville de Saguenay. The Project's maritime infrastructures are found in the waterways under the jurisdiction of the SPA. Map 2-1 shows the local and restricted study areas of the Project.

Controlled access to the site is planned from a private road connected to Chemin du Quai-Marcel-Dionne. The nearest residences are secondary residences located more than 1 km east of the Project. The nearest permanent residences are located approximately 3 km to the west.

2.2 GENERAL DEVELOPMENT OF THE PROJECT

GNLQ is developing the Project, which consists primarily of the construction and operation for 25 to 50 years of a natural gas liquefaction projected intended primarily for export. The Liquefaction Facility will have a nameplate capacity of 10.5 Mtpa of LNG. It includes process facilities to liquefy and store the LNG and a marine infrastructure for mooring of LNG tankers and loading of LNG.

The basic raw material, natural gas, will come from Western Canada and will be sent to Eastern Ontario via existing gas pipelines. A new gas pipeline, approximately 750 km long with a diameter of 106.7 cm (42 in.), will be built and operated by a third party to link the existing gas pipeline network to the Project site. The operation of the gas fields, the transportation of natural gas to the Project site and marine transportation will be under the responsibility of third parties..

The marine transportation of LNG will be performed by companies specialized in the field. The LNG tankers will transit the Saguenay and St. Lawrence Seaways to deliver LNG to international markets. It is projected that the LNG tankers will make between 150 and 200 trips per year, carrying three to four ship loads of LNG per week.

Hydroelectricity will serve as the energy source to power the facility, including the liquefaction units, which will allow a significant reduction of greenhouse gas (GHG) emissions compared to those produced by most natural gas liquefaction facilities of similar capacity in the rest of the world. The Project will also require the construction of new 345 kV power transmission lines from an existing Hydro-Québec substation in Saguenay region. According to the preliminary studies, this line could be approximately 40 km long and would be built, owned and operated by Hydro-Québec.

Map 2-2 presents the general layout of the facilities and the main components of the Project, including the liquefaction plant, tanks and loading platforms for the LNG tankers. The site will be accessed via a road approximately 4 km long, which will connect to Chemin du Quai-Marcel-Dionne.

2.3 LNG PROPERTIES AND LIQUEFACTION PROCESS

LNG is a colourless and odourless liquid. It is neither toxic nor corrosive and is not persistent in the aquatic or terrestrial environment in case of a spill. Moreover, LNG has very low flammability (its self-ignition temperature is 540 °C) and LNG is not explosive. If an LNG leak occurs, it spreads on the soil or water, forming a liquid "sheet" that rapidly vaporizes when it comes into contact with air, water, or soil. The LNG vapours produced by the sheet lead to formation of a gas cloud, which is dispersed by prevailing winds. These vapors disperse very rapidly if the cloud encounters no hot spot or source of ignition combined with a concentration in the ambient air between 5 and 15%, which would cause its ignition.

The process of liquifying natural involves two steps, treatment of natural gas to remove impurities followed by super-cooling it to turn it into a liquid form. Treatment of natural gas consists of eliminating or reducing to an acceptable level the impurities or trace elements that are undesirable or incompatible with the liquefaction process, either because they can freeze and block the cooling circuits or because they can damage certain liquefaction equipment.

The treated natural gas is then sent to the liquefaction process where it is cooled in two stages to -162 °C through heat exchangers and compressors. As a first step, the natural gas is cooled to about -35 °C using the propane system as a coolant. A mixture of refrigerants is used in a second circuit to continue the cooling and reach a temperature of -162 °C. The proposed facilities will use two liquefaction units, each with a refrigerant system and an air-cooling system.

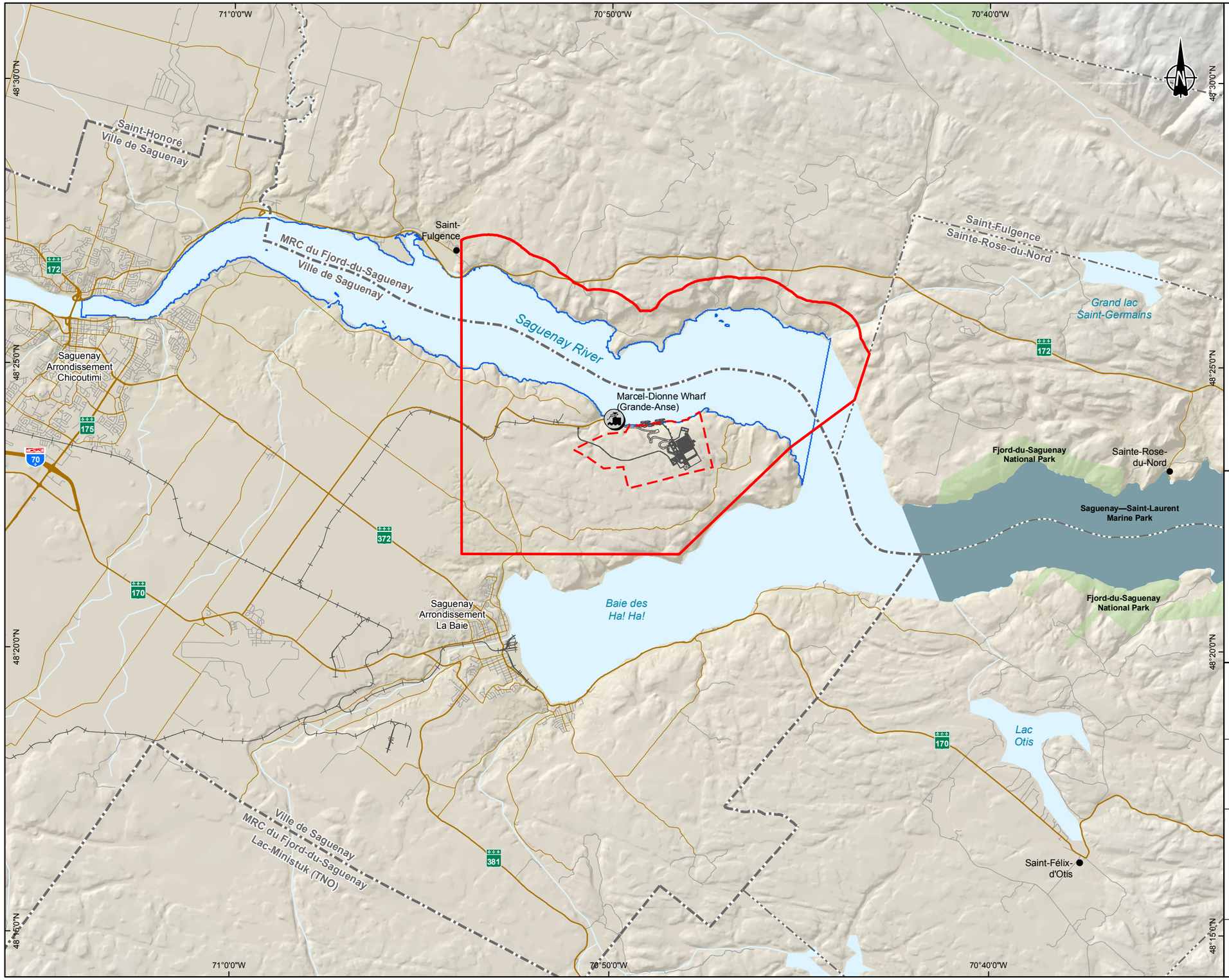
After the purified natural gas is liquefied, the LNG then will be stored on site in full containment tanks. These tanks have the capacity to contain the liquid and vapour in case of a leak, and these tanks are virtually indestructible due to their inherent design which includes an outer shell of approximately meter thick reinforced concrete built around the inner speciality steel tank. The reliability of this type of LNG storage tank, which is the most robust type of storage tank that can be constructed among multiple lesser options, has been proven by their repeated use worldwide over several decades, without incident. The stationary permanent equipment that is part of the Project ends at the loading arms, that are used to transfer the LNG onto ships. The LNG then will be pumped to the loading platforms for loading on LNG tankers.

The LNG is then shipped to export markets in specially designed carriers that maintain the cool temperature required to keep it in its liquid state. Once it reaches its destination, the LNG will be regasified, by allowing it to warm up and expand in a controlled facility to restore it to a gaseous state and allow it to be used by end-users.

The Liquefaction Facility at Saguenay will also be equipped with a boil-off gas management system, ground level process and enclosed marine flares, and utility systems for the production of demineralized water, nitrogen and compressed air. The ground level process and enclosed marine flares are two examples of outcomes following the consultation process.

A conceptual 3D rendering of the liquefaction facilities is presented in Figure 2-1. Figure 2-2 presents the different sectors of the Liquefaction Facility. Finally, Figures 2-3 and 2-4 present the simplified process diagrams describing the main processes involved.

The Liquefaction Facility's equipment will require routine maintenance and servicing according to the manufacturers' recommendations and/or the operating manuals issued and approved for the facility, in order to ensure safe and efficient operations.



Project Component

- Local study area
- Project study area
- Project infrastructure

Limits

- Regional County Municipality (MRC)
- Municipality
- Navigable water under Saguenay Port Authority

Infrastructure

- Marine infrastructure
- Railway

Roads

- Highway
- National road
- Collector road
- Local road

Hydrography

- Stream
- Water body

Protected areas

- National park
- Marine park

GNL Québec — Énergie Saguenay

Projet Énergie Saguenay
Environmental Impact Assessment

Map 2-1
Project Study Key Areas

Sources
BDTQ, MERN Québec, 2012
BDGA, MRN Québec, 2010
Réseau routier : Adresse Québec, 2015
Limites administratives: SDA, MERN, 2015

0 1,25 2,5 km
MTM, zone 7, NAD83

December 2018

Designed by : N. Fortin
Drafted by : J.-M. Tremblay
Verified by : N. Fortin
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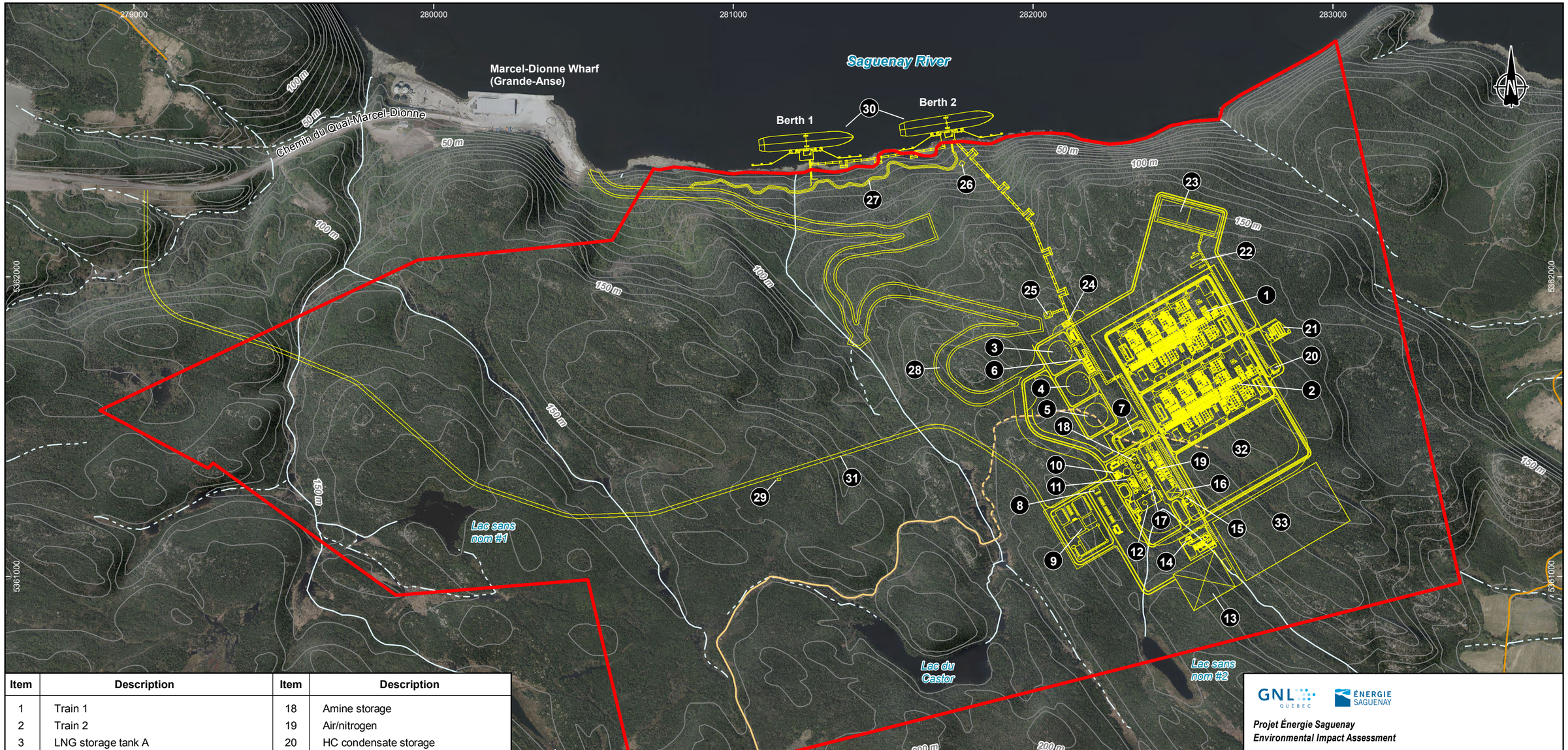

Item	Description	Item	Description
1	Train 1	18	Amine storage
2	Train 2	19	Air/nitrogen
3	LNG storage tank A	20	HC condensate storage
4	LNG storage tank B	21	Refrigerant storage
5	LNG storage tank C	22	Knock out drums
6	Boil off gas compressors	23	Process ground flare
7	Central control room building	24	LNG truck loading (optional)
8	Security building	25	Marine enclosed flare
9	Administrative building area	26	Marine control building
10	Firewater pumps	27	Marine access road
11	Demineralization area	28	Heavy haul road
12	Waste water storage	29	Site access guard house
13	345 kV switch yard	30	LNG loading area
14	Pipeline delivery	31	Site access road
15	Fuel gas heaters and knock out drum	32	Construction laydown
16	Heating medium storage	33	Temporary facilities & laydown area
17	Waste water treatment		

Project Components

- Project study area
- Project infrastructure

Roads

- Collector road
- Forestry road
- Trail

Hydrography

- Perennial stream
- Ephemeral stream

GNL QUÉBEC — ÉNERGIE SAGUENAY

Projet Énergie Saguenay
Environmental Impact Assessment

Map 2-2
General Site Layout

Sources :
BDTQ, 1:20 000, MERN Québec, 2012
BDGA, 1:1 000 000, MERN Québec, 2010
Routes : Adresses Québec, 2015
Orthophoto, Ville de Saguenay, 2016

0 130 260 m
MTM, zone 7, NAD83

April 2019

Designed by : N. Fortin
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Verified by : N. Fortin
161_00666_00_EIRF_c2_2_installationsEN_wspq_190412.mxd

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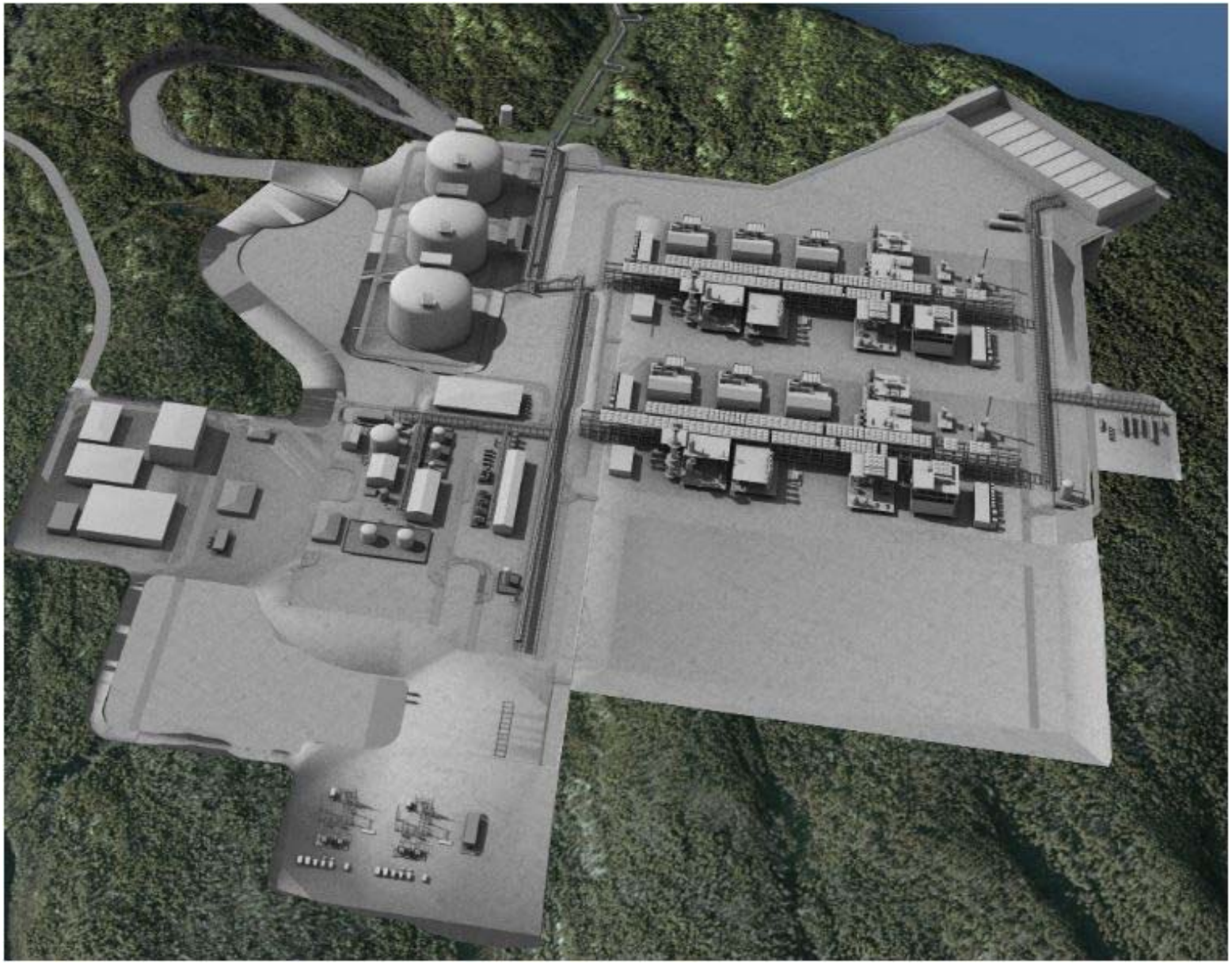


Figure 2-1 3D visual presentation of the liquefaction facilities

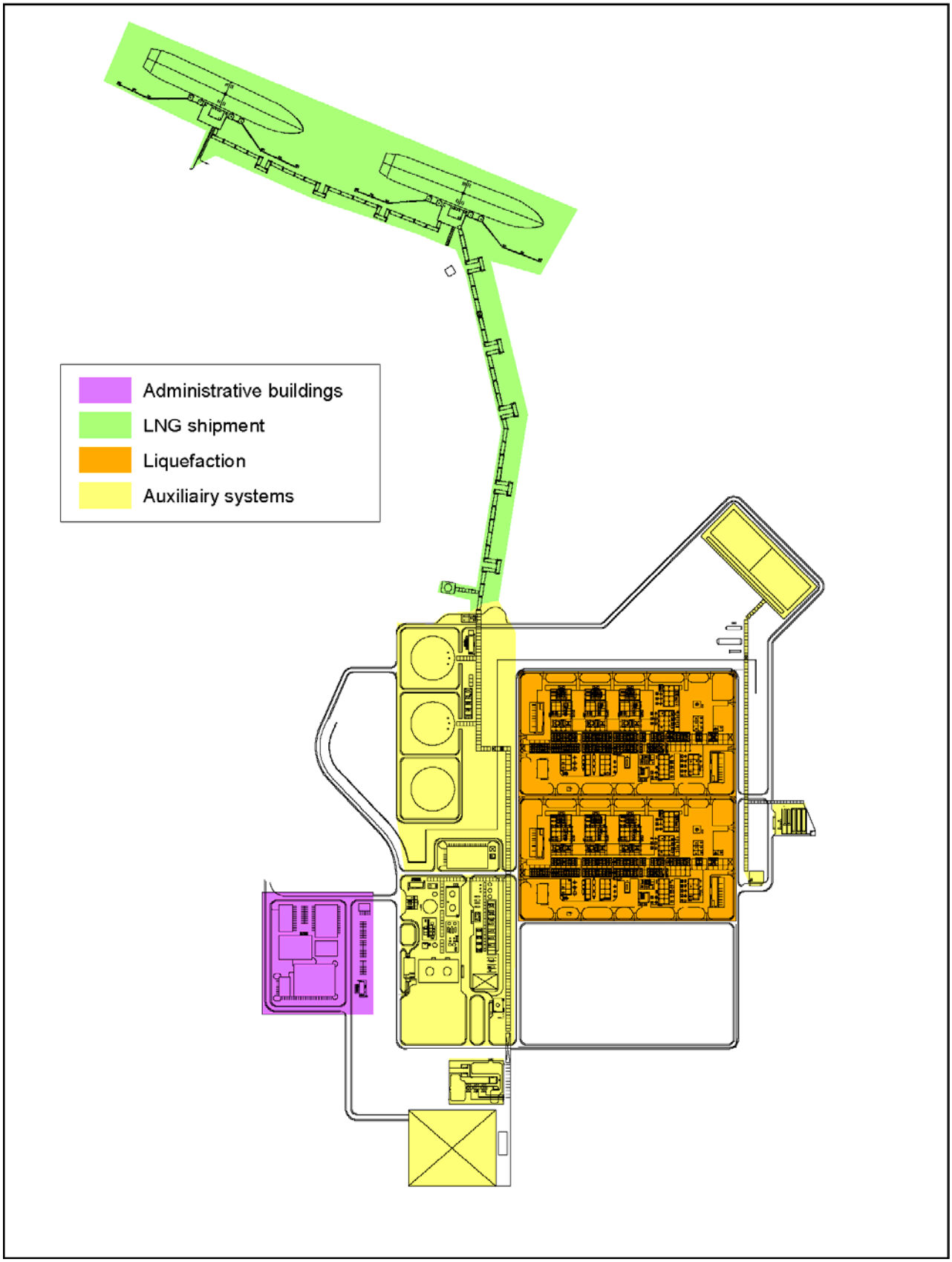


Figure 2-2 Main sectors of the liquefaction facilities

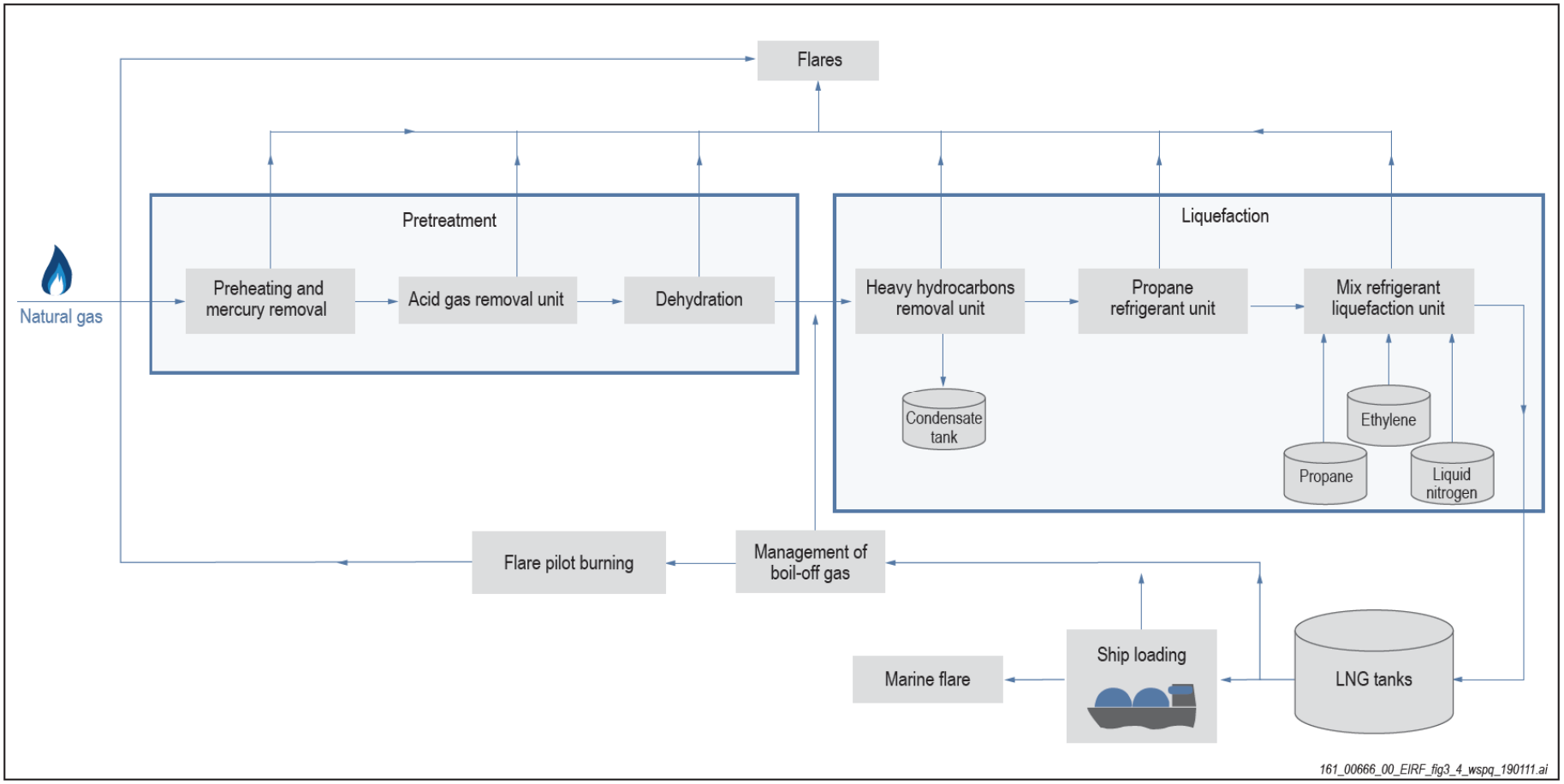


Figure 2-3 LNG production process diagram

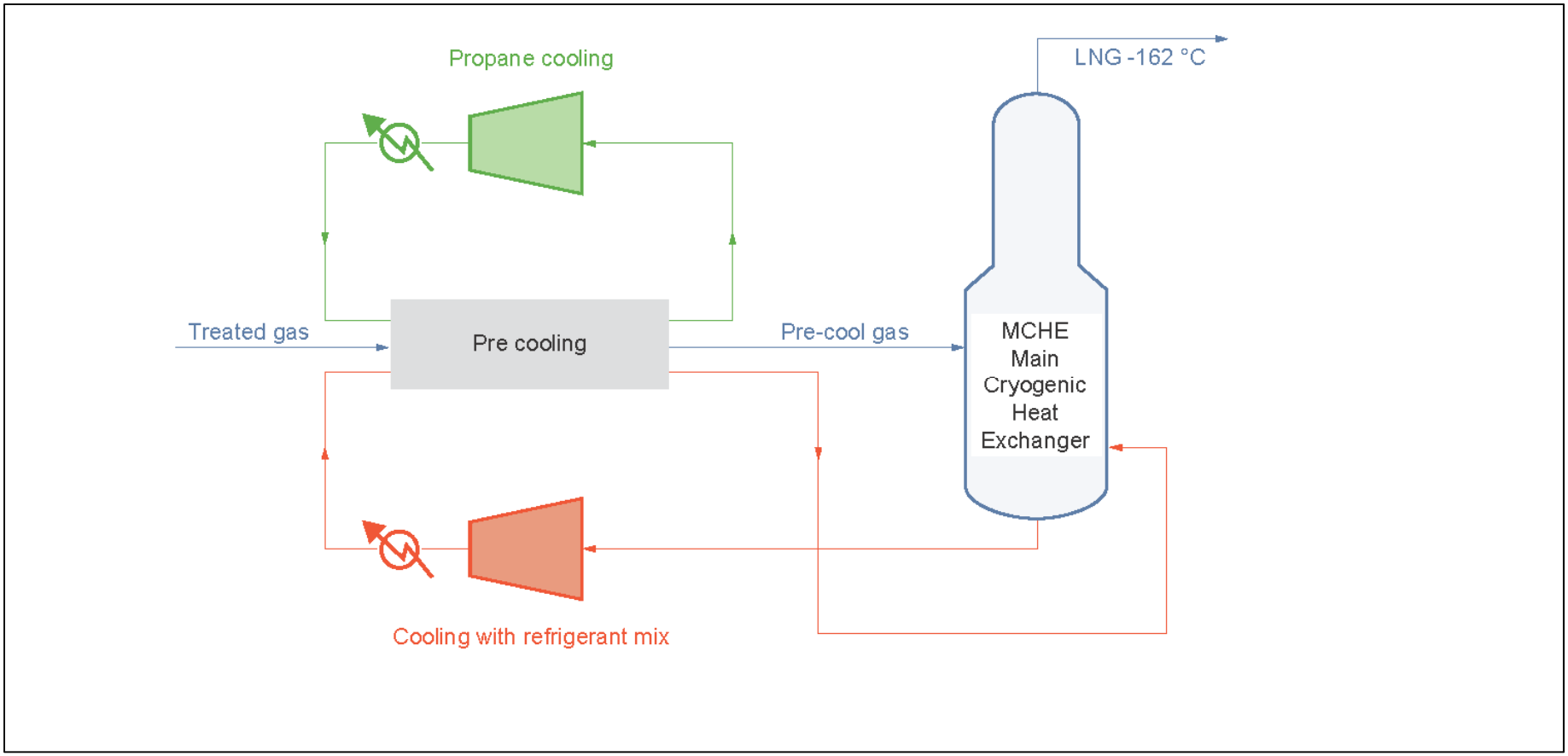


Figure 2-4 Simplified schematic of the liquefaction process

2.4 MARINE INFRASTRUCTURE

LOADING PLATFORMS

The loading platforms are designed to support the LNG loading arms, piping, a gangway with its catwalk for access to the vessels, LNG tanker mooring structures, firefighting equipment and lighting systems. Each platform is equipped with a zone surrounded by a low wall under the loading arms and associated equipment to contain any potential LNG spill.

Each platform will be approximately 46 m wide (along the Saguenay River) and 35 m deep. The platform will be built in reinforced concrete and supported by vertical steel pipe piles embedded in bedrock. They will be attached to the shore by a reinforced concrete platform that will allow access for operation and maintenance vehicles and emergency vehicles.

DOLPHINS

A series of dolphins will be installed at each platform to allow berthing and mooring of the LNG tankers and control their position parallel to the shore. Each platform will have four berthing dolphins and six mooring dolphins, and the dolphins will be connected by a series of catwalks as described below.

CATWALKS

All the dolphins will be connected to each other and to the platform by catwalks. These catwalks, approximately 1.2 m wide, will be built of steel material and equipped with slip-resistant mesh floors, hand railings and lighting for safety purposes. The catwalks are supported by the dolphins.

LNG LOADING

The LNG will be transferred from the tanks to the loading platforms by three pumps installed in each tank. Two LNG storage tanks at a time can be used for loading. The pumping capacity of each pump will be 2,000 m^3/h to obtain a loading rate of 12,000 m^3/h to the LNG tankers when the six pumps are used simultaneously. At this rate, the average loading time of the LNG tankers will be around 13 to 15 hours for LNG tankers with an LNG cargo capacity ranging from 160,000 m^3 to 180,000 m^3. The overall laytime at berth may vary depending on various operational conditions.

The LNG will be loaded onto the LNG tankers by means of loading arms installed on each loading berth. There will be four of these arms, two arms for loading LNG, one arm for vapour return to the process plant, and one hybrid arm that will serve either need but that will also act as a backup arm in case of inoperability, maintenance shutdown, or failure of one of the other arms. The loading rate of each arm will be 4,000 m^3/h, in order to achieve the total rate of 12,000 m^3/h.

LNG TANKERS AND TRANSPORTATION

The largest available LNG tankers that could use GNLQ infrastructures, with an LNG cargo capacity of 217,000 m^3, will not constitute the majority of the LNG tankers that will visit the site for loading. In general, the cargo capacity of the LNG tankers expected at the GNLQ marine infrastructures will vary primarily between 160,000 and 180,000 m^3. The dimensions of these vessels range between 290 m and 300 m long, approximately 45 m to 50 m wide, with a laden draught of approximately 12 m. Three to four LNG tankers per week will transit the waterways and call on GNLQ's facilities.

The LNG is transported onboard LNG tankers at ambient pressure, at a temperature of -162 C, in four or five tanks, depending on the type of tank ship. The temperature is maintained in these tanks by thermal insulation. It is estimated that 0.15% of the total volume of LNG returns to the gaseous state per day of transport. For most of the recent LNG tankers, this gas is consumed fuel for propulsion and power generation needs of the LNG tanker, with a limited amount of onboard stored diesel fuel as a back up source of fuel.

Another specification of the LNG tankers is that they are double-hulled, which limits the probability that an onboard storage tank will be punctured in case of accident. The internal tanks themselves have a double barrier filled with nitrogen gas, intended to prevent any reaction with atmospheric oxygen. It should be noted that no material loss of LNG containment has been recorded in 80,000 global cargo shipments in more than 50 years.

Navigation in the waters of the Estuary and Gulf of St. Lawrence is rigorously controlled. Also, the maritime route that will be taken in these waters to export the LNG produced at Grande-Anse by GNLQ is the same as the route currently taken by all types of vessels departing for or arriving from the Atlantic and ascending the river to ports and other destinations within Québec or Montréal. GNLQ is working closely with both, the Maritime simulation and resource center and the pilots to model and simulate all aspects of the transit, berthing and departure of the LNG tankers, including tug assists, for the purpose of ensuring safety and training pilots and tug operators. GNLQ anticipates that three or four LNG tankers will be supplied every week at the marine facilities of the Liquefaction Facility, for a total of 150 to 200 LNG tankers per year transiting the Saguenay River and in the Estuary and Gulf of St. Lawrence.

2.5 INFRASTRUCTURE AND SUPPORT FACILITIES

SUPPLY OF DRINKING WATER AND PROCESS WATER

The supply of drinking water and process water to the liquefaction facility will be provided by Ville de Saguenay. The needs for drinking water, i.e. water intended for human consumption and for sanitary facilities, are estimated at approximately 1.3 m^3/h to satisfy the needs of approximately 300 employees at the site while in operation. The process water is mainly used for the acid gas removal unit. An estimated volume of 27.5 m^3/h is required for production of demineralized water, which will then be used for pretreatment (acid gas removal) of the natural gas.

WASTEWATER MANAGEMENT

A volume of approximately 13 m^3/h of water from the demineralization unit will be conveyed to a demineralized reject water tank. Part of the water may be reused as utility water and for fire protection system tests. Reject water that is not reused in the facility will be directed to the storm drainage system of the industrial-port zone. The quality of the water released will be monitored regularly to ensure compliance with all applicable release standards.

Rainwater and snow melt will flow into culverts along the slopes developed on the site. Most of the raw materials handled are in gaseous form and liquid products will be stored on weather-protected leakproof slabs equipped with retention basins. The water that might accumulate there will be directed to a contaminated water tank, if required. There is thus very little risk of contamination of precipitation and runoff water.

Sanitary discharge water will be sent to an autonomous treatment unit or to a treatment facility that will be built and operated by the SPA or Ville de Saguenay.

SITE ACCESS ROAD

The site will be accessed via a secured asphalt-paved road approximately 4 km long, which will connect to Chemin du Quai-Marcel-Dionne. The Liquefaction Facility will be accessed from the west side, where a safety station will ensure control of site entries and exits. The access road to the GNLQ facilities will be handled by the Saguenay Port Authority (SPA) in its entirety since it will be used by future users of the industrial port zone. The portion between the safety station and the liquefaction facility will be under the responsibility of GNLQ (see Map 2-2).

POWER SUPPLY

The liquefaction facility will use hydroelectricity as its energy source, which will reduce the plant's environmental impact. The site will be supplied with power from the Hydro-Québec grid. The total power required is estimated at 550 MW during full operating conditions. A main electrical substation with transformers will be erected at the southwestern limit of the facility on a concrete slab.

This electrical equipment will be designed in accordance with Hydro-Québec standards that are based on established applicable electrical codes and standards. Permitting and construction of the 345 kV power transmission lines is a related project being pursued by Hydro-Québec. In case of a partial or total power cut, nine emergency generators distributed around the site will provide essential power to safely shutdown of the liquefaction facility.

NATURAL GAS SUPPLY

The liquefaction facility will be supplied with natural gas from Western Canada via the existing pipeline network to Eastern Ontario. A new gas pipeline approximately 750 km long and 106.7 cm (42 in.) in diameter will have to be built to transport natural gas from Ontario to the Project site. Construction of this gas pipeline is also a related project under the responsibility of a third party, Gazoduq Inc. As the preferred route is not yet chosen, GNLQ cannot indicate the exact pipeline right-of-way. Considering the configuration of the facilities, we can assume that the pipeline will arrive from the west or south of the site.

TRUCK LOADING STATION

Throughout consultations, even prior to the filing of the project notice, the possibility of loading LNG trucks at the site was raised on several occasions. GNLQ has therefore planned the implementation of a truck loading area in the design of its facilities for third parties to use for distribution.

2.6 ECONOMIC IMPACTS

The Liquefaction Facility represents an investment of nearly CAN $ 7.8 billion (excluding contingencies) and provides for the creation of approximately 4,000 direct jobs during peak periods during the construction phase and close to 2,000 indirect jobs at the same time. During the operations phase, 250 to 300 direct jobs and approximately 1,000 additional indirect jobs will be created in Quebec, jobs that must extend over a period of about 25 to 50 years. The majority of the direct benefits will materialize in the Saguenay-Lac-Saint-Jean territory.

Economic spin-offs throughout Quebec are also expected. The added value generated (economic spin-offs) by the liquefaction facility is estimated to be CAN $ 2.6 billion for construction (duration of approximately 57 months including land preparation work) and CAN $ 828 million annually during operations.

2.7 WORK SCHEDULE

The development and construction phase of the liquefaction facility will begin when the ministerial order and the required government authorizations are obtained. A period of approximately 57 months including land preparation work will be required for this phase of the Project. The operation of the first train of the facility is scheduled for the second half of 2025. The main steps of performance of the Project are presented in Table 2-1.

Table 2-1 Schedule of completion of the project's main milestones

MILESTONE	PROJECTED COMPLETION DATE
Obtaining environmental authorizations	2020
Deforestation	2021
Site preparation and development	2021
Construction – Concreting work	2022–2025
Construction – Framing, piping, mechanical and electrical work	2022–2025
Construction – Marine infrastructure	2022–2024
Construction – Architectural work	2025
Commissioning of train 1	2025
Operation of train 1	2025
Commissioning of train 2	2025–2026
Operation of train 2	2026

3 ALTERNATIVE MEANS OF CARRYING OUT THE PROJECT

3.1 ALTERNATIVE LOCATIONS

The choice of a site for the establishment of a natural gas liquefaction plant accompanied by transhipment marine infrastructures depends on the favourable combination, on the same site, of a certain number of social, environmental and economic factors. Before choosing an optimum site for the implementation of the LNG plant, GNLQ therefore conducted a comparative analysis of different potential sites.

3.1.1 ALTERNATIVE SITES

GNLQ completed an analysis that began with fourteen potential sites that was narrowed down to three before finally choosing the final site. The criteria used to preselect the three most promising sites were obstructions as regards: a law or regulation forbidding industrial construction, a major patrimonial value, a major ecological value and/or land use.

To analyze the possible alternatives for an appropriate site to deploy the Project, GNLQ benefited from the results of several previous analyses conducted concerning other LNG regasification projects including marine terminals, namely the Rabaska (Lévis-Beaumont), Énergie Cacouna (Gros Cacouna) and Énergie Grande-Anse (Ville de Saguenay) projects. These three projects, no longer being pursued, were located on the shores of the St. Lawrence Estuary or the Saguenay River. Of all the sites studied, the Grande-Anse site is the most attractive for this project. This site was chosen by GNLQ for the following reasons:

- The site is within an established industrial zone and is vast and conducive to additional industrial development, and the Saguenay Port Authority (SPA) is capable of making a large enough area available to GNLQ to allow the safe operation of a natural gas liquefaction plant, and also accommodate its development.
- Most of the site is wooded and only a small portion has been developed, namely the area near the marine platforms and its road access. Major construction work is foreseen at the upper portion of the approach route (Marcel-Dionne Wharf Lane) where a new railway unloading system, sheds and a conveyor will be built to transship iron ore from the BlackRock mining project, to a pig iron and ferrovanadium processing plant. The project has been authorized by government decree (Quebec) on April 30, 2019.
- The site is part of a regulated zone assigned to industrial and/or port development and within established federal port property with controlled access. Because there are no roads to the project site, access is limited and the zone remains little used by the public. Farther west, the land is zoned agricultural. There are few or no residential or sensitive uses that could come into conflict with the activities related to the project.
- The existing port infrastructure offers water with a natural depth of 10 to 15 m very close to the shoreline. The shore is also generally very steep in this sector. This situation has the advantage of allowing the use of very short jetties and avoid dredging.

- Maritime traffic to the Port Saguenay sector and the Rio Tinto port facilities located in the Saguenay Bay area has considerably decreased in recent years, from more than 600 vessels in the 1970s to less than 200 ships a year in 2010, while the existing facilities currently on the Saguenay waterway have the capacity of accommodating over 400 commercial vessels per year. An LNG export project with a nameplate capacity of 10.5 Mtpa would be able to accommodate 150 to 200 LNG tankers per year.
- The low ambient temperatures favour greater efficiency of the process.
- The availability of existing related essential infrastructure required for the project (port, railway, drinking water, sanitary water, etc.), the secure supply of electricity at a competitive price, and the nearby presence of a pool of skilled labour are also advantages that influenced the choice of the Grande-Anse site for the development of the project.

3.1.2 MARINE INFRASTRUCTURE VARIANTS

SITES CONSIDERED FOR MARINE INFRASTRUCTURE

The proposed marine infrastructure is typical for natural gas liquefaction facilities and will be located on the south shore of the Saguenay River. Two marine infrastructure site options were studied, a first option located approximately 250 m east of the existing Grande-Anse terminal and another located approximately 1.3 km east of these same facilities, in a sector called Anse à la Puce. These two sites are within the industrial-port zone managed by the Port of Saguenay.

The preliminary technical analyses performed for these two sites present favourable environmental conditions (current, ice regime, etc.) to ensure the safety of LNG tanker loading operations and navigation. However, at the site adjacent to the Grande-Anse terminal, the topography is steeper and the cryogenic pipeline would practically double in length, increasing the costs substantially.

The Anse à la Puce site offers more manoeuvring room for the LNG tankers and, since it is farther from the Grande-Anse terminal, will limit the impact on port activities. Thus, the option chosen for the location of the projected terminal is the one located near Anse à la Puce.

ANALYSIS AND SELECTION OF THE WHARF TYPE

A firm specializing in design of port facilities analyzed different types of platforms that could meet the needs of the Project. In their preliminary design study of marine infrastructure, the firm evaluated and compared four potential options:

- concrete caissons;
- steel cells (sheet pilings);
- anchored steel cells;
- on piles.

The platform on piles represents the most practical and most commonly used layout for LNG loading sites and the one that will have the least impact on marine fauna. This option was chosen by GNLQ. The piles are less influenced by the sector's environmental conditions (waves, current, etc.). No dredging and blasting is required, which thus limits the noise and vibration disturbances of terrestrial and aquatic fauna during construction. The piles use less surface on the seabed than caissons or cells, which greatly reduces the impact in both the intertidal and subtidal environments. Thus, the aquatic fauna will be able to occupy the space under the platform once it is built, which would not be possible with the other options. Maintaining the free passage of water under the platform also avoids altering the local hydrosedimentary dynamics. This concept allows minimal intervention in the habitat, maintenance of a natural shore and harmonization of infrastructure design with the local topography.

3.1.3 LIQUEFACTION PROCESS ALTERNATIVES

To choose a natural gas liquefaction process, GNLQ considered the two most common processes in the industry:

- the propane pre-cooled mixed refrigerant process (C3MR) of Air Product and Chemical Inc. (APCI);
- the Optimized Cascade® process of Conoco Phillips.

Considering the similarity of the two liquefaction processes with regard to their effects on the valued components of the environment, the high efficiency of the APCI process, and the fact that the technology is well known and is standard in the industry with a proven track record on many previous plants, the C3MR process has been selected by GNLQ.

3.1.4 COMPRESSOR ALTERNATIVES

The liquefaction process requires nearly 44 MW of power per Mtpa of LNG produced, which is mainly required to run the refrigerant compressors. Most LNG plants in the world run on turbines powered by natural gas. A certain number of plants also use steam turbines and finally, a very small number, approximately 1%, run on electricity.

One of the factors that supported the choice of the site of Liquefaction Facility for the Énergie Saguenay project is the accessibility of hydroelectricity in Quebec and the many advantages of its use. The choice of compressors driven by electric motors is the most appropriate option in Quebec, due to the fact this option does not generate any direct greenhouse gas emissions and is also a less costly and a more reliable option. This choice will allow the development of a liquefied natural gas facility with the world's lowest carbon footprint (per tonne of LNG produced).

3.1.5 LNG STORAGE ALTERNATIVES

GNLQ compared three types of tanks for storing LNG at atmospheric pressure on its site - single containment, full containment and membrane. Given the different possible solutions, a full containment tank was chosen for LNG storage at the GNLQ Liquefaction Facility, because this type of tank represents the best and safest technology available. One of the major advantages of this technology is protection of the tank's contents against impacts and against the effects of a fire near the tank.

3.1.6 FLARE TYPE ALTERNATIVES

As a result of a comparative analysis, GNLQ has opted to use ground flares for the warm and cold flares for the process and an enclosed fare for the marine flare. Although these choices are not the most economical, the many discussions and concerns raised with the different stakeholders concerning the visual appearance of the facility, particularly of the flares, supported the final decision. Thus, the chosen option(s) will have a clearly lower visual impact on the neighbouring communities compared to traditional elevated flares.

3.1.7 INFRASTRUCTURE LAYOUT ALTERNATIVES

In December 2013, GNLQ entered into an agreement with the SPA on lands with a total area of 243 ha within the industrial-port site. The configuration and characteristics of the land under option were reviewed in relation to the engineering requirements and the variants under study.

This led GNLQ to consider a greater land area farther to the east in order to optimize the general arrangement of the project's facilities. Thus, a total of 628 ha is currently under agreement with the Port of Grande-Anse.

The fieldwork performed in the context of the baseline studies made it possible to characterize the physical and biological environment of the territory under option and led to optimization of the infrastructure layout.

- The Liquefaction Facility has been positioned in the eastern part of the property to reduce impact on wetlands and water environments, which are more numerous in the western sector.
- The location chosen for the GNLQ industrial site minimizes the volume of backfill and excavation material and thus reduction of the disturbances and nuisances associated with machinery and blasting.
- The site's natural topography will allow integration of the different components of this facility to limit the impact on the landscape. Indeed, it will be possible to take advantage of the difference elevations of the terraces and position the equipment on these different terraces to reduce the visual impact, while preserving an optimum footprint.
- The structure supporting the cryogenic pipeline linking the tanks to the LNG loading platforms largely follows a natural slope, thus limiting the landscaping work that would have been required and preserving the natural appearance of the cliff.
- The bedrock is outcropping or very close to the surface in the entire eastern sector of the site, thus ensuring very good support for the foundations of the heavier elements on the site, such as the LNG storage tanks.
- The topography of the chosen site also allowed the tanks to be positioned 20 m lower than the LNG production units. Moreover, the LNG tanks were oriented in a north-south direction. This layout allows reduction of their total visual impact on the landscape for the neighbouring communities.
- The positioning of the liquefaction units on this site allows the use of a relatively flat area, thus limiting earthworks. They were also oriented to favour the circulation of hot air in the air coolers, which are oriented east-west, by using the east-west prevailing winds.

3.1.8 ALTERNATIVES FOR LNG TRANSPORT AND TANK SHIP LOADING

TRANSPORT

The LNG produced by GNLQ will be exported to markets such as Europe, Asia, the Middle East and South America. For this reason, marine transportation remains the only possible option, using LNG tankers.

LOADING

Loading of the LNG tankers depends on a combination of safe and time-proven technical means from special loading arms to LNG tankers dedicated to these technologies. These means include multiple safety systems. There are few or no alternatives.

4 PUBLIC CONSULTATION AND PARTICIPATION

An advisory committee was set up at the beginning of the Project's development to discuss the issues and concerns associated with the natural gas liquefaction facility at the Saguenay industrial-port site. The committee is composed of various stakeholders: GNLQ as well as representatives of municipalities, citizens, First Nations, tourism groups, environmental groups and social and economic groups.

Since 2015, several meetings have been held to present the Project and its operation, gather and consider the concerns, and to answer questions. The reports from the discussions can be consulted on the website: http://energiesaguenay.com/en/advisory-committee-lng-facility/.

This participatory approach supports and is integrated directly into the environmental assessment of the Project, with the objective of minimizing the environmental impacts and the nuisances using optimization, appropriate mitigation, and compensatory measures developed in concert with the community stakeholders. Moreover, it enables the stakeholders to remain informed of the subsequent monitoring and surveillance phases of the operating activities, and compliance with environmental, economic and social commitments.

GENERAL APPROACH

The Rio Declaration on Environment and Development affirms that: "Environmental issues are best handled with the participation of all concerned citizens, at the relevant level."[5]

The participatory approach was designed to involve local communities at an early stage in the development of the Project, while respecting the good practices promoted and the guidelines issued by the CEAA and the MDDELCC directive. The purpose of this approach is to influence the Project's development in real time by integrating, when possible, mitigation measures and undertakings to respond to the concerns and suggestions expressed by the community stakeholders. This approach is divided into four phases, as illustrated in Figure 4-1.

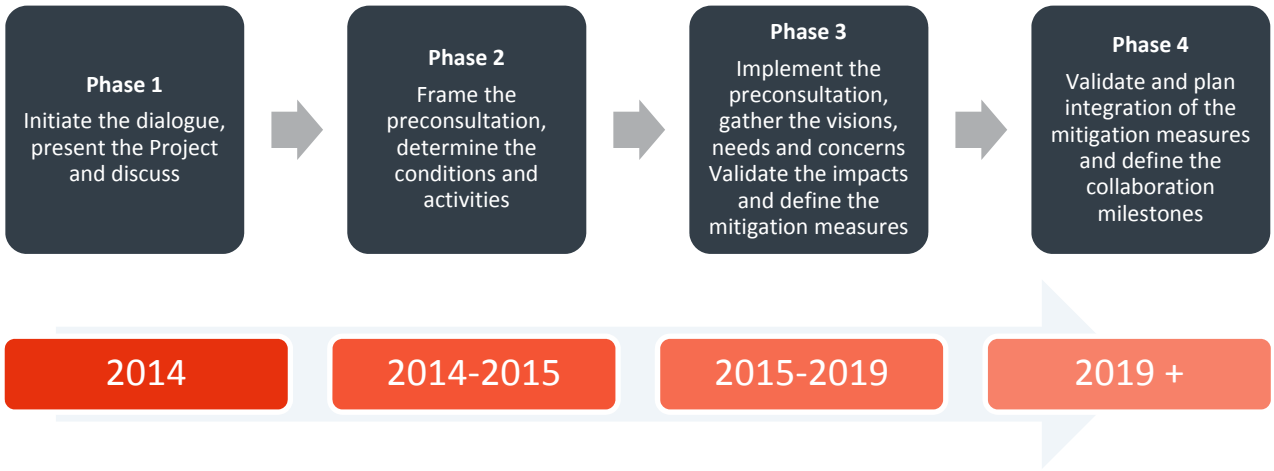


Figure 4-1 Phases of the Project information and participation approach (2014-2019+)

[5] Rio Declaration, UN Doc. A/CONF.151/26/Rev.1 (1992), Principle 10.

At the initiative of the government, an interdepartmental committee was set up for the project. The exchange of strategic information and collaboration with senior levels of government began in 2014, with a view to laying the groundwork for a harmonious and effective development of the project. This Committee is composed of representatives and senior civil servants from different Quebec government departments and bodies closely concerned by the Project.

EXPECTATIONS AND CONCERNS EXPRESSED

With the assistance of the reports of discussion activities on the Project and the consultative approach, an inventory of concerns could be established. Table 4-1 presents a summary of the concerns grouped by issue that were identified during the discussion activities, in order to deliver an overall picture of the themes addressed.

Table 4-1 Summary of concerns identified in Phase 2 grouped by issue

Issues	Summary of concerns	Number of interventions related to the issue	%
Economic impacts	Source of investors, involvement of local businesses, value and benefits of the regional workforce.	44	20
Impact on the environment	GHG emissions, farmland, terrestrial ecosystems, shale gases and site rehabilitation.	41	18
Marine transportation	Increase in marine traffic, cohabitation with other users, the Marine Park, aquatic fauna.	36	16
Harmonious integration	Integration into the landscape, cohabitation with recreational tourism activities, noises, odours and lights.	34	15
Social acceptability	Quality of the consultative approach, sustainability of operations, justification of the Project in a climate warming context, consideration of the cumulative impacts in the impact assessment, compliance with undertakings by the initiator.	30	14
Health and safety	The risks for health and safety of the population and the workers.	22	10
Construction	Nuisances during construction.	15	7
	Total	**222**	**100**

In accordance with the consultations conducted during Phase 2, the proponent set up a follow-up committee with the First Nations in November 2014 and, in September 2015, an advisory committee on the natural gas liquefaction facility. GNLQ also proposed to set up, in due course, a third committee dealing with aspects related to maritime transport. Accordingly, in May 2018, GNLQ began a series of consultations and meetings with socio-economic stakeholders from various sectors interested in the issue of maritime transport and its impacts: tourism, Fjord riverside municipalities, environmental groups, users of the Fjord and scientists and experts located in the Saguenay-Lac-Saint-Jean and Côte-Nord territories. Figure 4-2 shows the composition of the advisory committees that has been validated with local stakeholders

Accounting for the interests expressed and continuous improvement in the project

The results of the approach presented above led GNLQ to improve and modify its Project and directly integrate these changes through this impact assessment. Optimizations thus were made to the Project's technical concept and the location of the infrastructure and equipment by the project promoter. Concerns raised also led to commitments made by GNLQ.

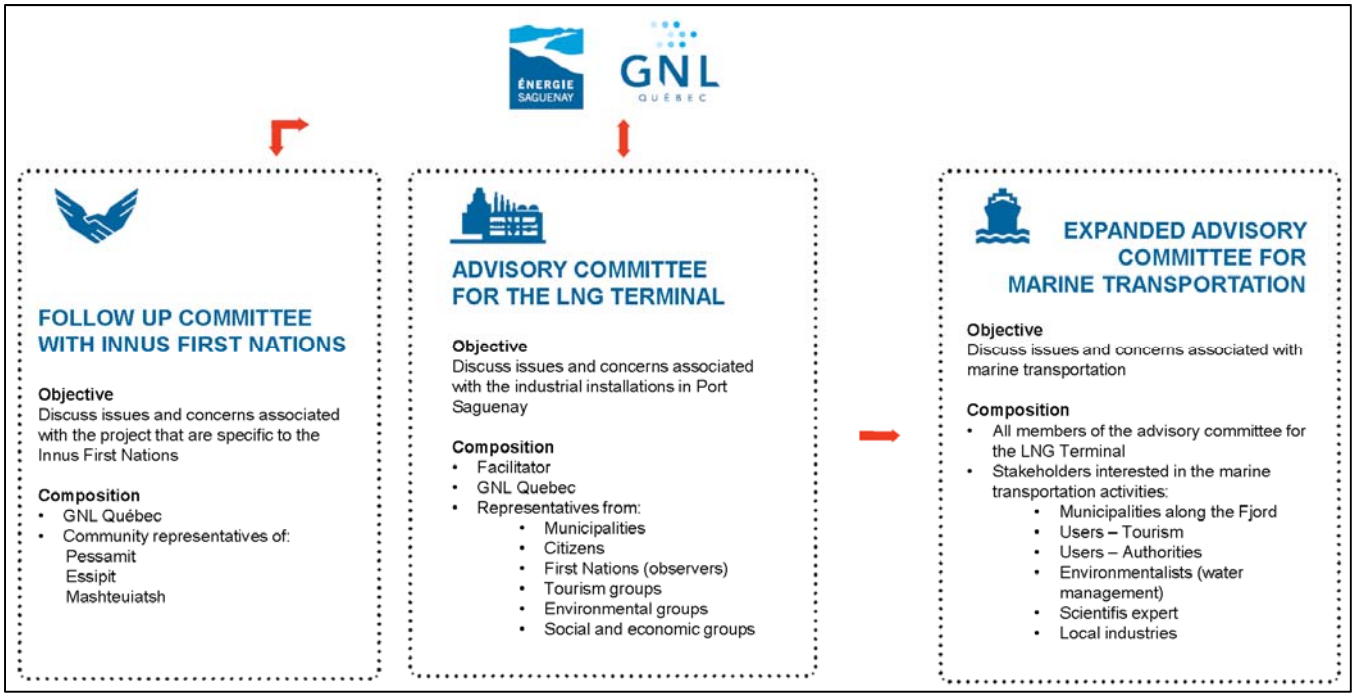


Figure 4-2 Diagram of committees of GNLQ's information and participation approach for the Énergie Saguenay project

NEXT STEPS OF THE CONSULTATION APPROACH SCHEDULED BY THE DEVELOPER

In the context of the preconsultation process on the impact assessment, GNLQ undertook to continue its communication and consultation efforts with the various stakeholders associated with the Project. Thus, the consultation approach on the impact assessment will continue beyond the initial submission of this assessment to the government authorities. The consultations to come will take the form of theme workshops with the Advisory Activity, consultation activities with the general public, and meetings with the stakeholders interested in the results of the assessment currently under review.

5 CONSULTATION AND PARTICIPATION OF FIRST NATIONS

To encourage the social acceptability of the Project, and thus its sustainability, GNLQ, from the outset of the Project, consulted with and encouraged the First Nations to express their points of view, their concerns and their suggestions for improvements. A Project Monitoring Committee was therefore established with the First Nations. This Committee is composed of representatives of GNLQ and the Pessamit, Essipit and Mashteuiatsh communities. The Committee's objective is to bring together the various stakeholders of these communities and offer a discussion platform concerning the issues and concerns that could be associated with the Project. Since November 2014, regular consultation meetings have been held, approximately every three months. The reports from the meetings can be consulted online at the following link: http://energiesaguenay.com/en/advisory-committee-lng-facility/.

Thus, the three Innu communities of Mashteuiatsh, Essipit and Pessamit, as specified in the 2016 CEAA Final Guidelines, have been consulted, since the Project touches a territory jointly claimed by these communities, the Nitassinan Section South West. Communications were also held in 2016 between GNLQ and the Huron-Wendat Nation. However, in response to a change in the CEAA guidelines regarding First Nation consultations (August 2018), GNLQ initiated formal steps with the Huron-Wendat Nation. Communications are thus underway between GNLQ and the Huron-Wendat Nation since October 2018 to discuss potential modes of participation in the project, to consult them on the impact study and to document the concerns of their members regarding their uses of the land and the resources as well as their interests in the Project study area. The basic description and the evaluation of the potential effects on the Huron-Wendat Nation will be the subject of a complementary report, appended to the concordance document, that they will enhance during the next months.

The consultations with the First Nations took place in two stages: prior to the filing of the project notice and during the completion of the impact study. The purpose of the consultations initiated by GNLQ is to ensure the full participation of First Nations in the environmental assessment process. GNLQ made sure to explain its Project and its components and take into account the expectations and concerns of First Nations

CONSULTATIONS UPSTREAM FROM THE IMPACT ASSESSMENT

GNLQ initiated the consultation and dialogue with the Innus in June 2014 through letters, calls and meetings, before the public disclosure of its Project. The three communities then expressed the intention to work jointly for the development phase of the Project. Thus, in November 2014, GNLQ set up a Monitoring Committee including two members of each of the three communities and representatives of GNLQ. The Committee's first meetings explained the Project and the key development phases. The First Nations were able to express their opinions and issues and ask their questions.

GNLQ then drafted its Project description, which was discussed in committee. GNLQ was therefore able to include certain First Nations concerns in its Project description, particularly by expanding its study area to the St. Lawrence River in order to include the sea urchin fishing area used by the Innu community of Essipit.

The parties also worked on deployment of a collaboration agreement, which was signed publicly on May 26, 2015, in the presence of several stakeholders and local media. The collaboration agreement includes the deployment of a process by which GNLQ consults the First Nations during the Project planning phase to account for their interests, their concerns and their Indigenous rights or treaty rights in order to accommodate them, whenever possible, and improve the Project on this basis.

One of the principle objectives of this agreement is also to allow fair participation of the First Nations in the economic impacts, depending on their competencies and the Project's needs, particularly in matters of jobs and contracts.

Parallel to the GNLQ consultations, the CEAA consulted the First Nations on the Project description and on the preliminary guidelines. Comments were made by the three Innu communities and the Huron-Wendat Nation on the preliminary guidelines.

CONSULTATIONS CONDUCTED IN THE CONTEXT OF THE IMPACT ASSESSMENT

Innu First Nations

After receiving the final guidelines in March 2016 and signing the collaboration agreement in April 2016, and up to September 2018, the Monitoring Committee set up with the Innu First Nations met 13 times. The progress of the Project and the latest developments in the communities were the core subject of all the meetings. The Innus were able to ask their questions and express their concerns and expectations. Sometimes experts were invited to the Committee meetings to offer presentation on certain topics of interest.

In 2015, GNLQ mandated a specialized firm to conduct a study on knowledge and use of the territory (SAURT study). This study was carried out with the collaboration of resources of the communities of Essipit, Pessamit and Mashteuiatsh as well as a consulting anthropologist. This study sought to enable GNLQ to give more consideration to Indigenous rights and to traditional and contemporary knowledge in the zone affected by the Project, from the perspective of improvement of the Project and through an approach of concerted action, collaboration and concrete communications.

GNLQ intends to hold open house-type consultations and information days within the three Innu communities to present the entire Project and discuss accommodation measures envisioned.

Huron-Wendat Nation

Initial discussions were also held between GNLQ and the Huron-Wendat Nation in 2016 in response to the adjusted guidelines. However, in 2018, the Huron-Wendat Nation informed the CEAA that it wanted to be informed more and consulted in the context of projects located within the limits of the traditional territory ("Nionwentsïo") they claimed. The CEAA adjusted its guidelines in 2018 and the Huron-Wendat Nation joined the consultation process in the fall of 2018 as part of the environmental assessment process. As part of the responses to the information and clarifications requested by the CEAA for the concordance of the EIA, the Huron-Wendat Nation validated new information about its community, including the effects of changes to the environment and their use of the territory. They will enhance this information in the coming months.

6 ASSESSMENT OF THE ENVIRONMENTAL EFFECTS ON THE VALUED COMPONENTS

6.1 ANTICIPATED CHANGES TO THE ENVIRONMENT

The anticipated changes to the environment correspond to the forecasts of possible changes to the environment following the implementation of the GNLQ Énergie Saguenay project, before a detailed description of the host environment and a formal assessment of the effects are produced. Several of these anticipated possible changes are highlighted in the CEAA guidelines. These changes partially coincide with the concerns and issues raised by the First Nations and the local and regional communities. Finally, the experts' opinion allowed anticipation of the main changes in the environment resulting from the Project at the very beginning of the EIS.

Table 6-1 presents the anticipated changes to the environment which were given special attention during the drafting of the EIS, including the field inventories.

Table 6-1 Anticipated changes to the environment

Environment	Anticipated change	Environment	Anticipated change
Physical	Atmospheric Air quality Greenhouse gases (GHG) Ambient sound level Night lighting Watercourses and Saguenay Physicochemical Hydrodynamics Erosion Sedimentological regime Subaquatic noise	**First Nations**	Common uses of lands and resources for traditional purposes Socioeconomic conditions Economic impacts Natural heritage Cultural heritage Archaeological potential Human health Marine transportation Social acceptability
Biological	Riparian, terrestrial and wetland environments Bird habitat Special status species and species at risk habitats Plant habitat Wildlife habitat Fish habitat Marine plants	**Local and regional communities**	Sanitary and socioeconomic plans Resources used for recreational or commercial purposes Beluga and Right whale Spill in case of marine accident Human health Visual environment Sound environment Land use Navigation Natural and cultural heritages

6.2 ANTICIPATED AND RESIDUAL EFFECTS ON THE VALUED COMPONENTS

6.2.1 ANTICIPATED EFFECTS ON THE VALUED COMPONENTS

After determining the valued components (VC), and once the description and analysis of these components were completed, the probable environmental effects were assessed conservatively to know whether a more thorough analysis was required.

In the absence of substantial interaction, the probable environmental effects are considered insignificant and no subsequent analysis is necessary. The anticipated changes do not have repercussions when the potential effects are nil due to the application of usual practices or regulations that impose strict standards. While the interactions can still cause significant effects on the environment, these probable effects are then addressed in more detail with the determination of the significance of the residual effects. If the interactions are uncertain, the conservative approach chosen requires a more thorough analysis.

The sources of probable effects on the environmental components are the work and activities necessary to build, operate, maintain and dismantle the projected infrastructure. They also account for the presence and operation of this infrastructure. The assessment of the sources of effects thus seeks to determine all the elements of the Project that could have an impact on the environment. Potential interactions between key Project activities and valued components are presented in Annex 6-1 of the EIS.

6.2.2 MITIGATION MEASURES

The mitigation measures and the compensation programs that are technically and economically feasible can mitigate the negative environmental effects of the project. These mitigation measures (Appendix 15-1 of the EIS) are integrated into the analysis of the residual effects on the valued components (Section 6.2.3).

GNLQ initially used an approach geared to avoidance and source reduction of the effects. Whenever possible, the design of the Project was modified and positioning of certain infrastructures was optimized to limit the effects at the source. When the principles of avoidance and source reduction of the effects have been applied, the inevitable habitat losses may be the object of compensatory measures to create or improve equivalent habitats.

The following sections give an overview of these mitigation measures for the construction, operation and closure phases. The mitigation measure overview has been added to the EIA summary.

OVERVIEW OF MITIGATION MEASURES PROPOSED DURING THE CONSTRUCTION PHASE

A start-up meeting at the site will aim at raising workers' awareness concerning their obligations. They must comply with applicable legal requirements and mitigation measures. An appropriate surveillance will ensure that they respect their obligations.

Excavation work will be carried out so that runoff water will contain only a minimum of suspended particulate matter before its discharge to ditches and, then, towards to hydrographic network. Depending on the case, methods to control suspended matter emissions, such as sedimentation ponds, dikes, sediment barriers and traps or slope stabilization, will be used. These structures will be inspected and cleaned as needed.

Dust suppressant will be used, as required, on the traffic lanes at the industrial site, the access road to the site and the parking lot, to prevent as much as possible fugitive emissions of dust related to vehicle traffic.

Vehicle and equipment maintenance will generally be performed outside the site. The fuel supply will be off-site, or with adequately equipped service trucks if needed at the site, more than 60 m from the water, if possible. A pan will be placed under the transfer points during refueling to prevent any dripping on the ground.

A spill contingency plan will be implemented as part of the emergency measure plan to structure interventions and limit risks and damage to the environment. All employees and suppliers will receive training to this effect.

Spill kits will be available in vehicles and machinery that will operate on-site and at various locations on the site to facilitate the spill management. The kits will include a sufficient quantity of absorbent materials and sealed containers to recover petroleum products and other hazardous residual materials.

Identified and dedicated containers will be installed for the recovery of various materials and construction waste. Containers will be transported regularly to authorized recycling, recovery or landfill sites. Residual hazardous materials (used oil, used filters, etc.) will be stored in appropriate containers suitably identified and disposed of by a specialized firm.

Stripping, clearance, excavation, backfilling and leveling of the work areas will be limited to a minimum to respect the natural topography and thus prevent erosion and suspended particle emissions in runoff waters.

As for construction work in the marine environment, including the installation of piles and their covers, bubble curtains could be used to reduce the spread of underwater noise, if the results of underwater sound monitoring recommend it.

For barge equipment, a retention tank is provided to prevent spills in the aquatic and terrestrial environments.

Marine mammal monitoring will be conducted during the marine infrastructure construction phase to ensure a safe environment for marine mammals.

Major noisier construction work will be carried out mainly from 7 a.m. to 7 p.m., Monday to Friday.

A shuttle service will be offered for the workers to reduce the number of vehicles on the site.

The emission of light to the sky will be limited by using luminaires that produce a sober and uniform lighting that will meet the real lighting needs. Luminaires will not produce any emission of more than 90 degrees.

OVERVIEW OF MITIGATION MEASURES PROPOSED DURING THE OPERATION PHASE

A spill contingency plan will be implemented as part of the emergency measure plan to structure interventions and limit risks and damage to the environment. All employees and suppliers will receive training to this effect.

Any contaminant spills will require immediate action to contain and recover the products. Contaminated soils must be removed and disposed of in an authorized site and a characterization must be carried out according to the terms of the MELCC's Soil Protection and Contaminated Sites Rehabilitation Policy.

Petroleum products (hydrocarbons) will be handled to prevent and control leaks and spills. Hydrocarbon absorbent products will be kept at all times in the petroleum product storage area or at the places they are used.

Whenever possible, abrasives will be used instead of fluxes in winter, and when necessary, water will be used as a dust suppressant instead of a chemical solution.

Hazardous materials will be managed in accordance with the Regulation respecting hazardous materials (L.R.Q., c. Q-2, r. 15.2) according to a management system independent of that applied to residual materials. If required, the recovery will be done by a specialized company. All hazardous materials will be stored in a designated place and protected from the weather by a waterproof membrane waiting for their loading and transport. The hazardous materials storage area will be located far from vehicle traffic and within a reasonable distance of drainage ditches or sumps and any other sensitive element, and at a minimum distance of 60 m from all watercourses.

Residual materials will be placed in containers provided for this purpose or will be stored temporarily in a place designed to limit the risk of release into the environment. The various categories of residual materials will be managed separately, involving the recovery and daily transportation of household residual materials by workers.

Cans or containers containing hydrocarbons or other hazardous products will be placed more than 60 m from the banks of watercourses and waterbodies, and will be stored in a bin or between berms with the capacity to recover 110% of stored reserves.

A retention basin will be built under the diesel tanks supplying the generators of the site to recover any oil product resulting from a possible spill or leakage of the tanks.

A characterization of the groundwater environmental quality will be carried out on all the areas on the site where activities likely to have contaminated the groundwater will have taken place. In the event that groundwater is contaminated in some areas, measures would be taken to restore the groundwater environmental quality in this area.

Lighting will be planned to provide a level of light required for worker safety and safety while minimizing light output.

No hydrocarbon ship refueling will be carried out from the loading platforms.

The emission of light to the sky will be limited by using luminaires that produce a sober and uniform lighting that will meet the real lighting needs. Luminaires will not produce any emission of more than 90 degrees.

OVERVIEW OF MITIGATION MEASURES PROPOSED DURING THE CLOSURE PHASE

A start-up meeting at the site will aim at raising workers' awareness concerning their obligations. They must comply with applicable legal requirements and mitigation measures. An appropriate surveillance will ensure that they respect their obligations.

A characterization of the environmental quality of soils will be carried out on all areas of the site where activities likely to have contaminated soils will have taken place. In the event that contaminated soils are discovered, a rehabilitation of the site would be carried out.

The circulation of trucks and other vehicles will be via existing access roads. Proper signalling will be used as the site approaches. During the course of the work, public roads used by transport vehicles or machinery may be cleaned to remove any accumulation of loose materials or other debris.

Riparian strips deteriorated by the work will be restored, to reproduce the natural shore of the watercourse or waterbody.

Dust suppressant will be used, as required, on the traffic lanes at the industrial site, the access road to the site and the parking lot, to prevent as much as possible fugitive emissions of dust related to vehicle traffic.

Vehicle and equipment maintenance will generally be performed outside the site. The fuel supply will be off-site, or with adequately equipped service trucks if needed at the site, more than 60 m from the water, if possible. A pan will be placed under the transfer points during refueling to prevent any dripping on the ground.

A spill contingency plan will be implemented as part of the emergency measure plan to structure interventions and limit risks and damage to the environment. All employees and suppliers will receive training to this effect.

Spill kits will be available in vehicles and machinery that will operate on-site and at various locations on the site to facilitate the spill management. The kits will include a sufficient quantity of absorbent materials and sealed containers to recover petroleum products and other hazardous residual materials.

Hazardous materials and petroleum products (hydrocarbons) will be stored and handled to prevent and control leaks and spills.

Identified and dedicated containers will be installed for the recovery of various materials and construction waste. Containers will be transported regularly to authorized recycling, recovery or landfill sites. Residual hazardous materials (used oil, used filters, etc.) will be stored in appropriate containers suitably identified and disposed of by a specialized firm.

At the end of work, the work areas will be cleared of all equipment or materials. The site will be remediated to prevent the generation of materials that could leach in watercourses (soil regaling and loosening, slope softening, soil stabilizing). Revegetation will stabilize soils and prevent them from leaching to streams. Abandoned road segments or roads could, however, be preserved and maintained by the APS.

Major noisier construction work will be carried out mainly from 7 a.m. to 7 p.m., Monday to Friday.

The emission of light to the sky will be limited by using luminaires that produce a sober and uniform lighting that will meet the real lighting needs. Luminaires will not produce any emission of more than 90 degrees.

At the end of the work, all buildings connected to the plant and not useful for a future project, equipment, materials, temporary installations, waste, scraps and debris will be transferred off site and properly disposed of according to the regulations in force.

6.2.3 DESCRIPTION OF THE VALUED COMPONENTS AND RESIDUAL EFFECTS

The construction and operation of the Project is inevitably accompanied by certain impacts on the host environment, particularly on the following Valued Components (VC):

PHYSICAL COMPONENTS

- Unconsolidated deposits, soil, sediments, current, ice, water in the terrestrial environment, water in the marine environment, groundwater, air quality, GHG, noise in the terrestrial environment, subaquatic noise, ambient light.

BIOLOGICAL COMPONENTS

- Terrestrial and riparian vegetation, marine vegetation and intertidal seagrass beds, plankton, benthic and nektonic invertebrates (freshwater and marine), fish (freshwater and marine), marine mammals, birds, terrestrial fauna.

HUMAN COMPONENTS

- Current regional use of land and the Saguenay river, human health, visual, cultural and natural heritage, use of the territory and its resources by First Nations, cultural heritage (First Nation)

For the components that were judged to have significant interactions with the Project, a more thorough assessment was conducted to determine the significance of the residual effect.

The residual effects of the Project on the valued components account for the application of the mitigation measures. These effects may be significant or insignificant, accounting for the following criteria:

- scope (intensity), including the notions of the ecological and social contexts, the frequency of the effects and their reversibility;
- geographic extent;
- duration;
- the environmental standards, guidelines or objectives.

This assessment is detailed in the sections that follow. Tables 6-2 to 6-4 at the end of Section 6.2 present a summary for each valued component allowing a clear understanding of the analysis performed.

6.2.3.1 PHYSICAL ENVIRONMENT

UNCONSOLIDATED DEPOSITS

Within the Project implementation zone, the unconsolidated deposits are thin and have little diversity. Approximately 35% of the study area is barren of sediments and exposes rugged and fractured bedrock. The dominant deposit corresponds to thin till (< 1 m), which covers 53% of the sector near the Project insertion area (Map 6-1). In the terrestrial environment, despite the steep slopes along the Saguenay, few signs of instability were observed. There are stress zones associated with potential landslides, but no Project infrastructure is located in these sectors. The sediments that occupy the coastal plateau are essentially till covered with a more recent layer of fine alluvium. The average thickness of this deposit ranges between 1 and 2 m and can be up to 20 m.

Along the restricted study area, the shore is relatively poor in unconsolidated sediments, which suggests that most of the regular sediment transport passes through the deeper zones of the Saguenay. Thus, the impact of littoral drift on sediment dynamics seems low in the sector targeted for the marine infrastructures. The coarsest particles are taken over by ice progression or spring floods due to melting snow and ice, while the fine particles are transported by wave and tidal action.

The Project's effect on unconsolidated deposits will primarily be manifested during the construction phase, when several activities, particularly deforestation and excavation, could favour the erosion processes. However, the deployment on the site of many mitigation measures that have proved their effectiveness on previous projects can limit the residual effect to a low level (insignificant effect). The other two phases (operation and closing) will have a more limited residual effect on this component (very low), which thus will also be insignificant.

SOIL

The site has remained wooded since 1964 and the only activities performed there have been the development of some forest roads and all-terrain vehicle (ATV) trails to gain access for collection of environmental data and engineering inputs. The results obtained after soil sampling established that the initial quality of the site's soil is lower than the generic criteria "A" of the MDDELCC Intervention Guide - Soil Protection and Contaminated Sites Rehabilitation.

In all phases of the Project, certain activities could favour soil contamination, particularly after an accidental spill of hydrocarbons or other hazardous materials from vehicles or machinery used on the Project site. However, several mitigation measures will be deployed to limit this risk. Moreover, in the event of an accidental spill, measures will be implemented quickly to contain the soiled area and proceed with its cleanup. Thus, the residual effect of this component is considered very low (insignificant) for all phases of the Project.

SEDIMENTS

Sediments in the terrestrial environment have shown some exceedances for certain metals, which very likely reflects a high natural content. The environmental quality of sediments in the marine environment is generally good. The results are therefore consistent with the regional reality and present some exceedances, particularly for certain PAH compounds and certain metals, probably related to historical regional industrial activities.

In the terrestrial environment, the Project's potential effects on sediments are mainly related to the construction and closing work. The activities in the operating phase cause no significant disturbance. However, with the planned mitigation measures, protection of terrestrial sediments and the means of intervention provided in case of a spill, the Project's effects on this component are significantly reduced. Indeed, for all phases of the Project, the significance of the effects on the sediments in the terrestrial environment was assessed as very low and insignificant. With respect to marine sediments, the risk of contamination is more associated with the operational phase, while LNG tankers and supporting vessels (such as tug boats) will circulate regularly around new marine infrastructures. The residual effect for this phase is classified as low to medium (not significant) while it will be low (not significant) during the construction phase (no closure phase since marine infrastructures will remain in place).

CURRENTS

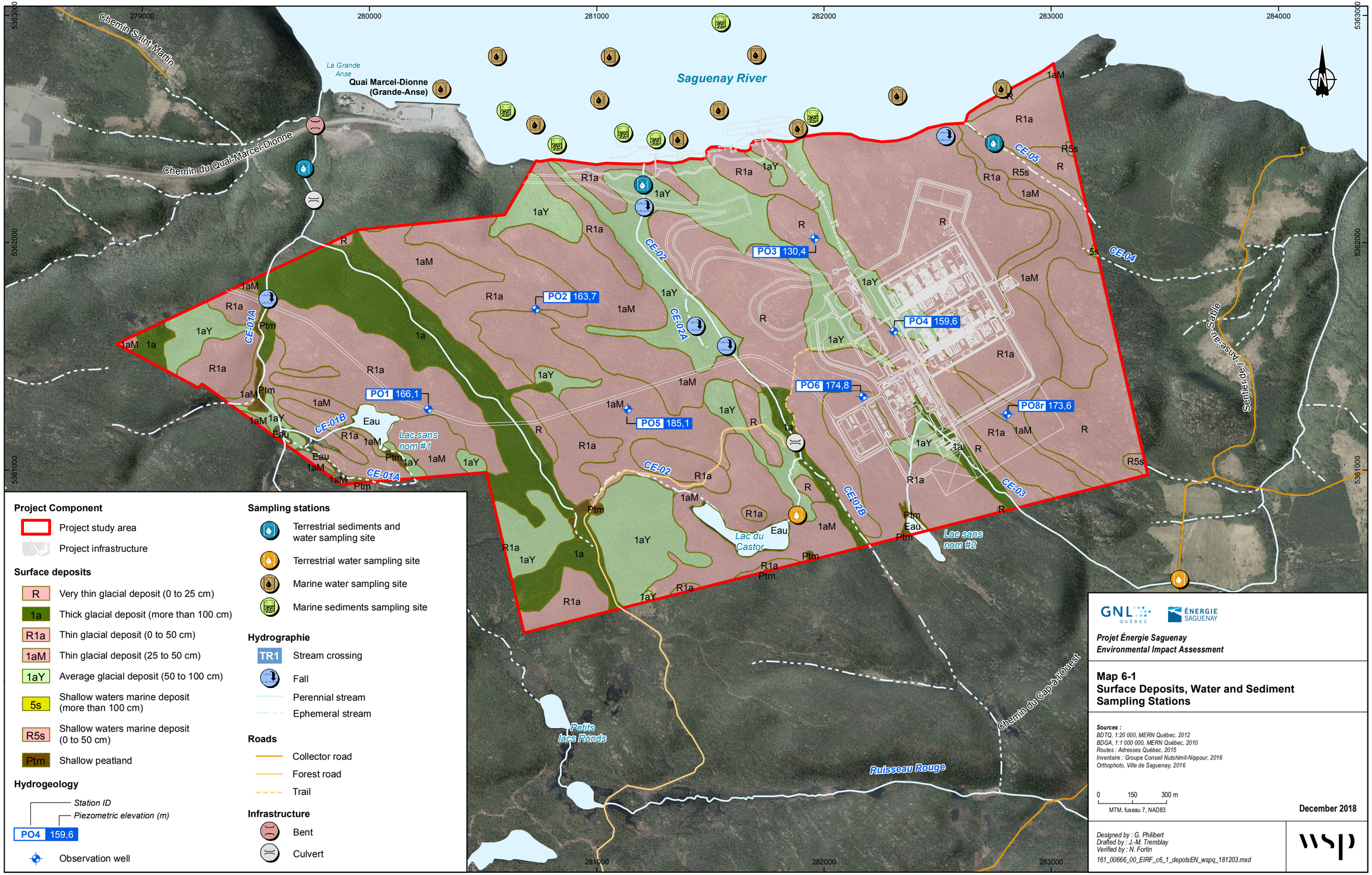
The tidal range is relatively large in the fjord, with a mean of nearly 4 m. Under spring tide conditions, this tidal range is around 6 m in the study sector. The surface currents and general circulation at the Project site are dependent on the tidal range, the tidal phase and the streamflow of the Saguenay River. The strongest currents occur at the ebb of spring tides, especially when the streamflow is strong. The waves are mostly generated by the wind, which typically comes from the northwest.

Given the great depth and width of the Saguenay, the work will have a minimal effect on water circulation in the construction phase. In the operating phase, the presence of new marine infrastructures will change the morphology of this portion of the shore, but no significant effect is anticipated on the currents and the morphological evolution of the shore. The residual effect of the Project is therefore considered low (insignificant) for these two phases.

ICE

In general, the Saguenay River is periodically iced over between December and March and typically free of ice between April and November. The evolution of the extent, thickness and movements of the ice cover may vary from year to year, influenced by the prevailing winds, the severity of the winter temperatures and snowfalls. Wind conditions are the main factor leading to severe ice conditions at the site planned for the construction of loading platforms. However, the currents do not seem to play a major role in the creation of severe ice conditions there.

In the construction and operating phase, the dynamics and the type of ice present during the winter will be altered due to the presence of marine infrastructure, as well as the presence in the sector of vessels, including icebreakers and support vessels such as tug boats. The Project's residual effect is considered medium (insignificant).



Project Component

- Project study area
- Project infrastructure

Surface deposits

- R — Very thin glacial deposit (0 to 25 cm)
- 1a — Thick glacial deposit (more than 100 cm)
- R1a — Thin glacial deposit (0 to 50 cm)
- 1aM — Thin glacial deposit (25 to 50 cm)
- 1aY — Average glacial deposit (50 to 100 cm)
- 5s — Shallow waters marine deposit (more than 100 cm)
- R5s — Shallow waters marine deposit (0 to 50 cm)
- Ptm — Shallow peatland

Hydrogeology

Station ID
Piezometric elevation (m)
PO4 159,6
Observation well

Sampling stations

- Terrestrial sediments and water sampling site
- Terrestrial water sampling site
- Marine water sampling site
- Marine sediments sampling site

Hydrographie

- TR1 — Stream crossing
- Fall
- Perennial stream
- Ephemeral stream

Roads

- Collector road
- Forest road
- Trail

Infrastructure

- Bent
- Culvert

GNL QUÉBEC — ÉNERGIE SAGUENAY

Projet Énergie Saguenay
Environmental Impact Assessment

Map 6-1
Surface Deposits, Water and Sediment Sampling Stations

Sources :
BDTQ, 1:20 000, MERN Québec, 2012
BDGA, 1:1 000 000, MERN Québec, 2010
Routes : Adresses Québec, 2015
Inventaire : Groupe Conseil Nutshimit-Nippour, 2016
Orthophoto, Ville de Saguenay, 2016

0 150 300 m
MTM, fuseau 7, NAD83

December 2018

Designed by : G. Philibert
Drafted by : J.-M. Tremblay
Verified by : N. Fortin
161_00666_00_EIRF_c6_1_depotsEN_wspq_181203.mxd

wsp

WATER IN THE TERRESTRIAL ENVIRONMENT

The analyses indicate that the watercourses sampled present good water quality in general, with slight exceedances at some stations of the aquatic life protection criteria concerning phosphate, aluminum, copper, iron and lead contents. However, the aluminum content measured probably reflects a high natural content.

The Project's potential effects on surface water are mainly related to the construction and closing work. The activities in the operating phase cause no significant disturbance. These activities can favour the suspension of fine particulate matter in the watercourses or their contamination in case of an accidental spill. However, with the mitigation planned measures for protection of surface water and the means of intervention provided in case of a spill, the residual effect on this component is considered very low (insignificant) for all phases of the Project.

WATER IN THE MARINE ENVIRONMENT

The analytical results obtained concerning the water quality of the study area, established from the samples collected in the marine environment, indicate a generally good water quality. The exceedances of the aquatic life protection criteria for aluminum concentrations seem to be in line with the regional context.

Conversely to the effects on water in the terrestrial environment, the operating phase will involve the greatest risks for water quality in the marine environment. Indeed, the traffic of vessels during this phase and the risk of spills near the marine infrastructures will translate into a low to medium (insignificant) residual effect, while the residual effect is considered very low (insignificant) in the construction phase.

GROUNDWATER

A basic composition of the groundwater quality of the study site was produced. All of the results obtained are lower than the surface water resurgence (SWR) criterion of the MDDELCC Intervention Guide, except for the natural barium, manganese and copper contents. The results obtained also made it possible to determine the hydrogeological characteristics of the site.

During the three phases of the project, various activities that could affect soil or surface water quality are also likely to have an effect on groundwater. This is particularly the case for risks of accidental spills, although their impact will be greatly reduced by the application of many mitigation measures. For this component, the residual effect is considered medium (insignificant) for the three phases of the Project.

AIR QUALITY

The nearest industrial activities are located 2 km west of the site envisioned. These are the Grande-Anse port facilities on the south shore of the Saguenay River. Other Rio Tinto port facilities are located in the Baie des Ha! Ha!, approximately 8 km east of the study site. The Grande-Anse and Rio Tinto terminals are therefore the only sources of air contaminants identified nearby. Due to the Project's location, air quality in the sector is considered very good.

The three phases of the Project are accompanied by a potential effect on this component due to the air pollutant emissions resulting from the use of vehicles and certain operations at the plant.

Mitigation measures will be implemented to reduce the airborne suspension of dust particles during the construction phase. Scenarios modelling the atmospheric dispersion of contaminants were completed for the operating phase. They confirm compliance with the air quality criteria. The residual effect on this component is considered medium for the three phases of the Project.

GREENHOUSE GASES (GHG)

GHG emissions related to construction of the terminal are estimated at 98 kT (thousand tonnes) of CO_2eq over a period of approximately 57 months (including land preparation work). During the Project's operation, the direct GHG emissions would be an average of approximately 453 kT CO_2eq/year. This represents 0.55% of the total emissions on the provincial scale.

The residual effect of the Project on GHG emissions is considered moderate and therefore not significant for the construction, operation and closure phases. For each of these phases, environmental monitoring will quantify the actual GHG emissions and report emissions required by the provincial and federal levels of government. GNLQ is already working on ways to further reduce its GHG footprint. As a reminder, the GNL produced by this project will allow for the displacement of more polluting fossil fuels such as oil and coal and therefore helping reduce significant amount of GHG generated outside Quebec.

NOISE IN THE TERRESTRIAL ENVIRONMENT

Sound measurements in the Project's neighbouring environment confirmed ambient noise levels between 24 dBA and 53 dBA at night and between 27 dBA and 53 dBA during the day.

The use of heavy equipment, off-road trucks, drills, crushing equipment, generators and compressors required for site preparation and construction of the Liquefaction Facility will generate noise during construction. The operation of the liquefaction equipment will produce noise during the operation.

The assessment of the Project's effects on this component considered the federal and provincial legislation. Sound simulations during the construction and operating phases were performed. The results obtained show that the sound levels calculated are compliant with the MELCC and Health Canada criteria.

For the three phases, the residual effects will be low (insignificant) because all the sound criteria are respected. Several mitigation measures are also planned during the construction and closing phases, when noisier equipment will be used.

SUBAQUATIC NOISE

Several subaquatic noise measurements were taken in the Saguenay River, particularly to establish the baseline state of the ambient subaquatic sound at the marine infrastructures and in the shipping corridor. In addition to varying during the year according to the ice and nautical activities, the ambient sound can fluctuate on an hourly and daily basis according to the total marine traffic (not just marine traffic related to the Project) and the tide.
In the absence of noise sources of anthropogenic origin, the ambient noise is essentially due to turbulence created by the combination of tide, waves and currents, as well as the flow of water.

The most intense subaquatic noises are associated with the construction phase, particularly drilling and vibratory pile driving. Several mitigation measures then will be deployed, particularly to minimize the effects of this work on aquatic fauna and marine mammals. Acoustic monitoring is also planned and additional measures could be deployed in the event that subaquatic noise during construction generates exceedances of the safety thresholds for marine mammals.

In the operating phase, traffic of vessels near the marine infrastructures will also affect the ambient subaquatic noise to a lesser degree. In the construction phase, the residual effect on this component is considered medium (insignificant), while it will be very low (insignificant) in the operating phase.

AMBIENT LIGHT

The Project sector is located in a low-light sector relative to the brightness of the sky; this zone is relatively far from the influence of Ville de Saguenay. The project sector currently generates little intrusive light toward the receiving stations, which are classified in a low-light zone. The rare light sources came from riparian residences on the Saguenay River, Port of Saguenay facilities or lamp standards on the roads already in place. At the Project site, in the terrestrial sector, no intrusive light was measured. At the current Project site, no visible light is found, regardless of the point of view, but several artificial light-emitting sources are present on the south shore of the Saguenay.

The Project's main effects on this component are associated with the presence of new artificial light sources in the operating phase, which will affect the quality of the nocturnal landscapes in the sector. To a lesser degree, the work associated with the construction and closing phases will also have an effect on nocturnal light. Accounting for the planned mitigation measures, the residual effect of the Project is considered medium (insignificant) in the operating phase and low (insignificant) for the construction and closing phases.

6.2.3.2 BIOLOGICAL ENVIRONMENT

TERRESTRIAL AND RIPARIAN VEGETATION

The project is found in the balsam fir-yellow birch bioclimatic domain. The plant cover of the study area corresponds primarily to coniferous or mixed forest stands that are young (21 to 40 years) or mature (41 years and over). Forty wetlands of five distinct types have also been inventoried, mainly including open and wooded peat bogs and shallow water areas (Map 6-2). The wetlands are concentrated in the central and southern portions of the study area. The northern portion, including the shores of the Saguenay is not conducive to wetlands (rugged terrain). The inventories produced did not identify forest stands of phytosociological interest in the study area, or special status plant species or invasive exotic plant species.

The Project's main effect on vegetation and wetlands corresponds to the loss of plant cover necessary for the development of the site. This effect will be manifested effective from the construction phase. The residual effect of this transformation is considered medium (insignificant) for the terrestrial vegetation, but strong for the wetlands. The residual effect associated with the loss of wetlands thus will be significant. However, these losses will be compensated as required by the regulation. The other residual effects that could occur on this component during the different phases of the Project (e.g. risk of contamination, risk of introduction of invasive species) will translate into a residual effect ranging from very low to medium (insignificant) after application of the many mitigation measures.

MARINE VEGETATION AND INTERTIDAL SEAGRASS BEDS

Six intertidal seagrass beds with a total area of approximately 1,800 m^2 were identified during the field inventories conducted in 2016, including three with an area of less than 1 m^2. The three main seagrass beds, respectively 34,303 and 1,479 m^2, were monospecific and composed of Baltic rushes. The permanent encroachment on the vegetation caused by the installation of the marine infrastructures would be around 14 m^2. The work did not identify any mature macrophytic algae bed directly within the study area. However, green algae beds were observed, most often in the sectors weakly exposed to the current or in interstices.

In the construction phase, the residual effect on this component is considered very low to low (insignificant), while it will be low to medium (insignificant) in the operating phase. Circulation of LNG tankers and support vessels and loading operations then will be the main activities that could affect this component. In the closing phase, no activity is likely to disturb the marine vegetation and the intertidal seagrass beds, since the maritime infrastructures will remain in place.

PLANKTON

The phytoplankton of the Saguenay are mainly composed of freshwater species and weakly represented by euryhaline and marine species due to the influence of the surface freshwater body coming from Lac Saint-Jean and Lac Kénogami and the Saguenay tributaries. On the scale of the study areas, zooplankton mainly consist of copepods. Considering the high variability of the conditions prevailing in the Saguenay Fjord and its impact on the plankton communities, no measurable effect on this component is expected in the course of the Project.

BENTHIC AND NECTONIC INVERTEBRATES (FRESHWATER)

The results show that the watercourses inventoried are poor in benthic organisms, both in terms of abundance (between 55 and 100 organisms per m^2) and diversity (maximum of three taxa per station).

The Project's effect is considered very low to medium (insignificant) in the construction phase and very low to low (insignificant) for the operating and closing phases. Several mitigation measures governing the performance of the work will help minimize the effects on the host environment, including the freshwater benthic and nectonic invertebrates.

BENTHIC AND NECTONIC INVERTEBRATES (MARINE)

The conditions prevailing in the intertidal zone of the study area are not conducive to colonization of the environment by epibenthic organisms. Thus, the abundance and diversity of organisms in this zone are clearly reduced compared to other intertidal environments of the Saguenay. In the subtidal zone, the inventory of benthic and nectonic invertebrates conducted based on recorded video sequences allowed identification of the richest zones in the study area. The richest sectors are found along the very steep rock wall in the eastern half of the study area, approximately 20 to 70 m deep.

In the construction phase, the perceived effects on this component are related to the encroachment of infrastructure on the habitat, environmental emissions of suspended particulate matter and an accidental spill of hydrocarbons or hazardous materials into the environment. The residual effect is considered very low to low (insignificant). Concerning the risks of an accidental spill in the operating phase, they mainly result from the traffic of vessels in the waters of the Saguenay and loading of LNG aboard the vessels. The residual effect during the operating phase is considered low to medium (insignificant).

FISH (FRESHWATER)

The watercourses of the limited study area generally present a low to zero potential for fish, particularly due to obstacles preventing fish from migrating into these watercourses from the Saguenay. Only the downstream portion of a stream (CE-01) presents interesting feeding potential for the brook trout (presence confirmed), but an impassable drop at Chemin du Quai-Marcel-Dionne renders the upstream portion of the watercourse inaccessible to fish. No other watercourse in the restricted study area contains fish.

The main effects on this component result from the risks of accidental spills of hydrocarbons or other hazardous materials. Particularly accounting for the many mitigation measures that will seek to minimize these risks and the low to zero potential of the watercourses in the Project sector for fish, the residual effect is considered very low (insignificant) for the three phases of the Project.

279000
280000
281000
282000
283000
5362000
5361000
281000

Chemin Saint-Martin
La Grande Anse
Marcel-Dionne Wharf (Grande-Anse)
Saguenay River
Anse à la Puce
Chemin du Quai-Marcel-Dionne
A
H3
TR6
TR5
CE-01
CE-02
CE-03
CE-04
MH3
MH11
MH13
MH6
MH12
MH14
TR4
CE-02A
MH38
MH33
MH2
CE-01A
TR1
MH4
MH7
MH40
MH1
MH15
MH36
MH8
TR3
MH39
MH5
Lac sans nom #1
TR2
MH32
MH22
MH25
CE-01B
MH9
MH16
MH24
MH23
MH31
MH35
MH37
MH17
CE-02
CE-02B
MH10
MH18
MH34
MH19
MH26
MH27
MH30
Lac du Castor
MH29
Lac sans nom #2
MH20
MH28
MH21
CE-01A

A
Saguenay River
H4
H1
H5
H2
H6
0
30 m

Project Component
- Project infrastructure

Roads
- Forest road
- Trail

Infrastructure
- Bent
- Culvert

Aquatic Habitat & Hydrography
- Fish habitat
- Fall
- TR1 Stream crossing
- Perennial stream
- Ephemeral stream

Vegetation
- Vegetation study area

Forest cover
- Mature softwood forest
- Mix mature forest
- Young softwood forest
- Young mix forest

Wetlands
- MH1 Wetland complex
- Shallow water
- Marsh
- Shrub swamp
- Treed swamp
- Bog peatland
- Open peatland
- H1 Intertidal grass bed

Homogeneous Segments
- Cascade
- Channel
- Channel/Cascade
- Channel/Cascade/Dam
- Anastomosed channel
- Waterfall
- Pond/Dam
- Pond/Meander
- Meander

Wildlife with Special Status
- Canadian warbler potential habitat

GNL QUÉBEC
ÉNERGIE SAGUENAY

Projet Énergie Saguenay
Environmental Impact Assessment

Map 6-2
Potential Effets on Vegetation, Aquatic Habitat and Wildlife with Special Status

Sources :
BDTQ, 1:20 000, MERN Québec, 2012
BDGA, 1:1 000 000, MERN Québec, 2010
Routes : Adresses Québec, 2015
Inventaire végétation : Groupe Conseil Nutshimit-Nippour, 2016
Orthophoto : Ville de Saguenay, 2016

0 125 250 m
MTM, zone 7, NAD83

December 2018

Designed by : M.-H. Brisson et J. Malouin
Drafted by : J.-M. Tremblay
Verified by : N. Fortin
161_00666_00_EIRF_c6_2_effets_bioEN_wspq_181203.mxd

wsp

FISH (MARINE)

The Saguenay accommodates 70 to 80 fish species, some of them freshwater and others marine. The freshwater fish in the fjord represent approximately 16% of all the species inventoried, compared to 62% for marine fish. The migratory species, whether anadromous or catadromous, account for 22% of all ichthyofauna species. The typical freshwater species are mainly present in the first 20 metres of the water column from the surface, while the marine fish are more inclined to use the deep salt water of the fjord. The characterization of the Project study area allowed approximately 110 fish observations, essentially at depths between 50 and 100 m.

The Project should not induce any significant geomorphological or hydrological change that could affect the fish habitat in the marine environment. However, the construction will encroach on an underwater area of 243 m². The work will also affect fish due to suspended particulate matter and subaquatic noise emissions and the risks of accidental spills. However, several mitigation measures are provided to minimize these effects. For example, although no blasting is required in the Saguenay River or in any water environment, GNLQ undertakes to comply with the guidelines for the use of explosives in or near Canadian fisheries waters, including setback distances between the detonation center of a confined explosive and fish habitat or a confirmed spawning ground to meet the protection criteria. The residual effect during construction will therefore be low (insignificant). In the operating phase, the effects are mainly associated with the risk of accidental spills (LNG loading activities and circulation of vessels) and the presence and circulation of vessels in the waters of the Saguenay. The residual effect is considered low to medium for this phase (insignificant).

MARINE MAMMALS

The different information sources consulted reveal that the upstream portion of the Saguenay is essentially frequented by two marine mammal species, the beluga and the harbour seal. The beluga, considered to be an endangered species by the federal authorities and a threatened species by the provincial authorities, mainly frequents the downstream portion of the Saguenay as far as Île Saint-Louis in summer. This portion of the Saguenay is part of the essential habitat of the species, which begins approximately 59 km downstream of the Project. Some occasional beluga observations have already been reported in the upstream portion of the Saguenay, near the Project site, but the presence of the species there is materially rarer. As for the harbour seal, it assiduously frequents a greater portion of the Saguenay and several individuals have been observed during various fieldwork conducted near the Project site.

In the construction phase, the possible effects on marine mammals mainly concern the risks of disturbance by subaquatic noise generated by drilling and vibratory pile driving, the risks of collision with marine mammals related to the presence of vessels or barges, and the risks of accidental spills of hydrocarbons or other hazardous materials. These same risks also continue in the operating phase due to the circulation of vessels and their presence at the maritime infrastructures. Accounting for the planned mitigation measures, namely a marine mammal monitoring during the loading docks construction phase, the residual effect will be low to medium (insignificant) in the construction phase and very low to medium (insignificant) in the operating phase.

BIRDS

The data analyzed from all information sources and the field inventories show 132 bird species potentially present in the regional study area on an annual basis. Exhaustive inventories were conducted in the study sector in 2016. The inventories identified 100 species belonging to 31 families. A total of 77 species (22 families) were observed in the breeding period, 44 species (20 families) in the spring migration period and 24 species (12 families) in the fall migration period.

Nineteen (19) bird species with federal or provincial special status may use the sector. Only two of these species were noted during field inventories in the migration period and three other species during the nesting season. These include golden eagles and bald eagles observed during spring migration, and peregrine falcons, evening grosbeaks, and Canada warblers identified during the breeding season.

The activities affecting this component are habitat losses, disturbance, collision risks and spill and habitat contamination risks. These effects could affect two special status species in particular, the Canada warbler and the evening grosbeak. The assessment of the residual effects of the activities related to the Project on all avifauna specifies shows very low to medium and insignificant residual effects for all phases of the Project. Regarding special status species and their habitat (primarily the Canada warbler), low to medium and insignificant effects were assessed for all phases of the Project.

TERRESTRIAL FAUNA

The study area is frequented by diverse terrestrial fauna typical of the region. The representatives of the local large fauna potentially present in the study area are moose, white-tailed deer and black bear, while several small fauna species and micromammals (rodents and insectivores) are also reported. Seven chiropteran species (bats), including six with special status, complete the picture for mammals, while the presence of 11 amphibian and reptile species is also denoted in the restricted study area or nearby. For these, no special status species was observed during the inventories and it is very unlikely that they would be present in the area.

In the construction phase, site preparation will result in a habitat loss for terrestrial fauna, a disturbance, an increased collision and mortality risk, suspended particulate matter emissions in the freshwater aquatic habitat (herpetofauna habitat) and a risk of accidental spills. In the operating phase, traffic and maintenance on access roads will also increase the risks of spills, suspended particulate matter emissions into the aquatic habitat and the collision and mortality risk with terrestrial fauna. A disturbance caused by nocturnal artificial light is also possible, as well as an increased risk of accidental spills of hazardous materials. For the closure plan, the work could cause the same effects as in the construction phase, except for habitat loss. In short, accounting for the planned mitigation measures, the residual effects on this component are considered very low to medium (insignificant) in the construction phase and very low to low (insignificant) for the other two phases.

6.2.3.3 LOCAL AND REGIONAL COMMUNITIES

CURRENT REGIONAL USE OF LAND AND THE SAGUENAY RIVER

The Project site is completely located in the La Baie Borough of Ville de Saguenay, within the Federal Saguenay Port Authority land and extends south and east of the Grande-Anse Marine Terminal. Map 6-3 presents the use of land and resources in the Project's local study area.

The nearest permanent single-family residences are located on the south shore of the Saguenay, approximately 3 km west, on the way to Chemin Saint-Martin. Several other single-family homes border this road. Chalets are located more than 1 km east of the Project on the south shore of the Saguenay. Two chalets are present on the shore of Grand Lac, located approximately 4 km south of the Project site. The residences on Route de l'Anse-à-Benjamin are located more than 6 km from the Project site. Some residences are associated with farming operations. Various buildings are found along Chemin du Quai-Marcel-Dionne, on the SPA lands.

Projet Énergie Saguenay

Map 6-3
Land Use and Zoning

Sources

BDTQ, MERN Québec, 2012.
BDGA, MRN Québec, 2010
Tenure, RDE, 2017-03
Roads, Adresse Québec, 2015 ; GCNN, 2016
Constraint zones, MAMOT; MSP; MTMDET; 2017
Land use, zoning and town boundary, Ville Saguenay, 2017
ACOA, MFFP, 2015
Administrative boundaries, SDA, 2015
Navigable waters under Saguenay Port Authority, Port de Saguenay, 2015
Lots boundaries. Infolot, 2017

File: *161-00666_c2SE_tenureAffZona_170619.mxd*

0 350 700 m

MTM, fuseau 7, NAD83

Realisation : Groupe conseil Nutshimit-Nippour

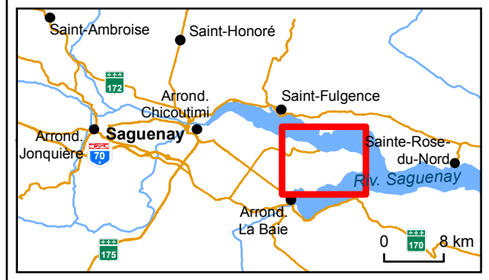
December 2018

GROUPE CONSEIL Nutshimit-Nippour

WSP

GNL QUÉBEC

ÉNERGIE SAGUENAY



Tenure

- Public
- Private
- Mixed

Land Use

- Protected farming
- Dynamic farming
- Viable farming
- Forest
- Rural housing
- Industrial
- Industrial planning scheme
- Port
- Recreational

Constraint Area

- Area at risk of ground movement

Protected Area

- Water fowl gathering area

Boundaries

- Project study area
- Local study area
- Navigable waters under Saguenay Port Authority
- Municipal zoning (2 270)
- Recreational area on private land
- Town boundary
- Regional county municipality
- Lot (4 012 405)

Infrastructure

- National road
- Collector road
- Grande-Anse maritime terminal
- Forest road
- Trail

SOCIOECONOMIC CONDITIONS

In 2016, Ville de Saguenay and its La Baie Borough, where the Project site is located, had a total population of 145,949 people. For the different territorial entities that overlap the local study area, the labour market structure was mainly oriented to the tertiary sector (commercial activities, utilities, etc.), similar to the situation prevailing in the province as a whole. The activities of the secondary sector (processing of raw materials) and primary sector (agriculture and natural resources harvesting) ranked second and third respectively. Due to the benefits generated by the Project for this component (economy and employment) at both the local and regional levels, the expected effect is positive and the assessment of the residual effect is not required.

LAND USE

Construction in the local study area is low density, although single-family residences, farm buildings and chalets are found there, particularly along Chemin Saint-Martin, Chemin Saint-Joseph and Route de l'Anse-à-Benjamin, in the southern portion of the local study area.

Parc Aventures Cap Jaseux and Véloroute du Fjord du Saguenay are the two main tourist traffic generators in the local study area. Several other recreational tourism activities are practiced there, particularly nautical or aquatic activities (pleasure boating, beach and swimming, sea kayaking), wildlife-related activities (fishing and sport hunting, wildlife observation), motorized excursions (snowmobile and ATV) and non-motorized excursions (cycling, hiking and horseback riding). Various commercial activities are also practiced there, including agriculture, forestry and surface mining. However, these activities are conducted outside the restricted study area.

In the Project's expanded study area, Saguenay–St. Lawrence Marine Park -Laurent is a national marine conservation area that seeks the protection and conservation of the ecosystems of part of the waters of the Saguenay Fjord and the St. Lawrence Estuary.

There are various commercial wharves in the local and expanded study area: the wharf of the Grande-Anse Marine Terminal, the Bagotville Wharf (cruise ships) and the wharves of the Port-Alfred port facilities belonging to Rio Tinto. Several industrial enterprises, importing and exporting cargo by sea, are present on the shore of the Saguenay River. Commercial navigation on the Saguenay decreased from an annual average of approximately 300 vessels in the early 1990s to an average of approximately 200 vessels since the early 2000s.

According to Marine Outlook of Fisheries and Oceans Canada (DFO), and the data disseminated by the Port of Saguenay, approximately 200 merchant marine vessels, 30 cruise ships and 1,000 commercial excursion craft passed through the Saguenay annually in 2010, excluding the activities of Société des traversiers du Québec (STQ) at the mouth of the Saguenay, which continue year-round (approximately 40 000 trips annually).

During the construction phase of the Project, the potential effects include temporary modification of certain hunting activities, periodic disturbances of kayaking and pleasure boating activities, and cohabitation of recreational and residential traffic with Project traffic. No effect is expected on drinking water systems and wells. Anticipated effects will continue during the operating phase only for boating activities, due to the increase in marine traffic related to the Project's activities and necessary safety and security zones. During the closing phase, the effects will be similar to those associated with the construction phase. For the three phases of the Project, the residual effect on this component is considered low (insignificant).

HUMAN HEALTH

In the environmental health field, cardiorespiratory diseases linked to poor air quality, infectious problems or poisoning related to water quality, and prevention of cancers or poisoning of environmental original are the main health problems that direct the interventions of the Centre intégré universitaire de santé et de services sociaux du Saguenay−Lac-Saint-Jean (CIUSSS).

Air quality, due to the Project's location in an undeveloped and remote sector, is currently considered very good. The sound climate is relatively calm with measured ambient noise levels between 24 dBA and 53 dBA at night and between 27 dBA and 53 dBA during the day. For ambient light, the south shore presents a much brighter landscape than the north shore due to the presence of many artificial light-emitting sources related to the boroughs, the port facilities and lamp standards. Water quality in the Project study area is qualified as good.

The Project is compliant with all the environmental standards issued by the federal and provincial government institutions. Thus, the residual effect on the human health component is considered low and insignificant for all phases of the Project.

VISUAL

The combination of the geomorphological aspects of the territory (terrain, plant cover, lacustrine area, etc.) and human activities (agglomerations, infrastructure, land use, etc.), which have gradually transformed the landscape over time, allows the subdivision of the landscape study area into 19 homogeneous landscape units, determined according to the combination of common biophysical and anthropogenic features. These units are grouped into 5 types: river landscape, urban landscape, industrial landscape, agricultural and agroforestry landscape and forest landscape. The Project site is part of an industrial, equipment and utilities landscape unit.

The Project's effect on the visual environment will depend on the observer's positioning and the landscape unit affected. We should mention in this regard that the landscape units associated with the Saguenay River are characterized by a higher value than the other units. Nonetheless, for the three phases of the Project, the residual effect on this component is considered medium (insignificant). However, for the Parc Aventures Cap Jaseux site, the residual effect is strong (significant) during the construction phase and at the beginning of the operation phase at which point, the vegetation growth around the installation will reduce the visual impact.

NATURAL HERITAGE

For the natural heritage, apart from the forest massif and the wetlands, no natural area or site strictly bounded and valued from the point of view of science, conservation or natural beauty is contained within the Project site. It is important to consider that the regional county municipalities of Fjord-du-Saguenay, La Haute-Côte-Nord and Charlevoix-Est, the Innu

First Nations, the Huron-Wendat First Nation and other regional partners, such as the regional tourism associations (RTA), wished to register the Saguenay Fjord on the list of UNESCO World Heritage Sites. The project site is, however, located in an industrial zone and this sector was not included within the UNESCO application area. Regarding the cultural heritage, the spaces around the main lakes of the zone within which the Project will be inserted have high archaeological potential.

Apart from the forest massif and the wetlands, none of the attractions recognized by Ville de Saguenay in terms of natural heritage is reported in the restricted study area. The work nonetheless could affect the cultural heritage by disturbing the soil in place. To limit this potential effect, archaeological inventories will be produced before the start of the construction phase in the zones with high archaeological potential that are at risk of being disturbed by the Project. With these measures, the Project's residual effect on cultural heritage is estimated to be low (insignificant). No effect is expected on the built heritage.

6.2.3.4 FIRST NATIONS

ANCESTRAL TERRITORY

The Project site is located at the northwestern limit of the territory designated by the Agreement-in-Principle of General Nature (EPOG), namely the southwestern part, with an area of 21,106 km^2 and agreed on March 31, 2004, between the First Nations of Mamuitun and Nutashkuan, the Gouvernement du Québec and the Government of Canada. The status of the southwestern part is defined as being of common interest among the First Nations communities of Pekuakamiulnuatsh (Mashteuiatsh), Essipit and Pessamit, confirmed by the Ministère de l'Énergie et des Ressources Naturelles (MERN) in May 2014.

Apart from the southwestern part, the local study area is superimposed, on the north shore of the Saguenay, on the Nitassinan territory of Mashteuiatsh, which extends over 79,062 km^2 around Lac Saint-Jean and on both sides of the Saguenay River. The Huron-Wendat Nation also informed GNLQ that the Énergie Saguenay project is located in the Nionwentsïo, the customary territory of the Huron-Wendat Nation on which it asserts its rights from the Huron-British Treaty of 1760. The Nionwentsïo Office of the Huron-Wendat Nation plans to submit a complementary study which will deal with the historical occupation of the territory by the Huron-Wendat as well as the contemporary occupation and use of the region's resources near the Project. This information will be used to evaluate the impacts of the Project on the rights of the Huron-Wendat Nation, on its customary territory and on its contemporary activities.

SOCIOECONOMIC CONDITIONS

The Innu nations has over 16,000 members divided among nine villages. The Innu communities are very different from each other, both for their geographic location and size, and their socioeconomic development. Their main economic activities include stores, businesses, outfitters and activities related to hunting, traditional fishing and commercial fishing (salmon rivers).

The Huron-Wendat First Nation is landlocked by the Loretteville neighbourhood of Ville de Québec; it has a population of 2,134 Wendake members. To make effective participation possible in the various projects or work, certain structures have been developed, such as the following three national enterprises: S.D.W (Société en commandite), Otera (environnement) and Wendake Construction. In addition, tourism makes a very important economic contribution to this community.

USE OF THE TERRITORY AND ITS RESOURCES

According to the information collected, the Innus of Pessamit, Essipit and Mashteuiatsh do not seem to use the site and the immediate vicinity of the Énergie Saguenay project.

The analysis of the data shows that no significant effect is expected. However, the Innus use the sector at the mouth of the Saguenay to fish for sea urchins and snow crabs and to conduct marine mammal watching cruises. The residual effect of the Project on the use of the territory and resources by the First Nations will be low (insignificant) for the three phases of the project.

The Huron-Wendat Nation also informed GNLQ that the Énergie Saguenay project is located in the Nionwentsïo, the customary territory of the Huron-Wendat Nation on which it asserts its rights from the Huron-British Treaty of 1760. The baseline description and the assessment of potential effects on the Huron-Wendat Nation were addressed in a complementary report, which is appended to the concordance document, and this report will be enhanced by them. As a matter of fact, the Nionwentsïo Office of the Huron- The Wendat Nation will have the mandate to prepare a complementary study which will deal with the historical occupation of the Huron-Wendat area and the use of the project. This information will be used to evaluate the impacts of the Huron-Wendat Nation Project on its rights and its current activities.

CULTURAL HERITAGE

The archaeological potential of the restricted study area was assessed considering several variables, particularly resulting from its natural features, the past anthropogenic impacts and the eventual presence of known archaeological sites nearby. The study of archaeological potential showed that most of the restricted study area is offers low archaeological potential.

During the construction phase, the work could cause cultural heritage loss or destruction by disturbing the soil and sediments in place. To limit this potential effect of the Project, archaeological inventories will be produced before the start of this phase in the zones identified with high archaeological potential that are at risk of being disturbed by the Project. With these measures, the Project's residual effect on cultural heritage is estimated to be low (insignificant).

Table 6-2 Assessment of the Project's residual effect on the components of the physical environment

Criteria	Unconsolidated deposits and their stability			Unconsolidated deposits and sediment dynamics			Soil			Sediments in the terrestrial environment			Sediments in the marine environment		
Project phases	**Construction phase**	**Operation phase**	**Closing phase**	**Construction phase**	**Operation phase**	**Closing phase**	**Construction phase**	**Operation phase**	**Closing phase**	**Construction phase**	**Operation phase**	**Closing phase**	**Construction phase**	**Operation phase**	**Closing phase**
Overall environmental value	Medium	Medium	Medium	Low	Low	N.A.	High	High	High	Medium	Medium	Medium	Medium	Medium	N.A.
Degree of disturbance	Low	Low	Low	Low	Low	N.A.	Low	Low	Low	Low	Low	Low	Low	Low	N.A.
Scope	Medium	Low	Low	Low to medium	Low	N.A.	Low	Low	Low	Low	Low	Low	Low	Medium	N.A.
Extent	Spot	Spot	Spot	Spot	Spot	N.A.	Spot	Spot	Spot	Spot	Spot	Spot	Spot	Local	N.A.
Duration	Short	Short	Short	Short/Medium	Long	N.A.	Short	Short	Short	Medium	Medium	Medium	Medium	Short to long	N.A.
Probability of occurrence	Low to medium	Low	Low	Low/Medium	Medium	N.A.	Medium	Low	Medium	Medium	Low to high	Medium	Low	Low	N.A.
Residual effect	Low	Very low	Very low	Very low to low	Low	N.A.	Very low	Very low	Very low	Very low	Very low to low	Very low	Low	Low to medium	N.A.
Significance of residual effect	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	N.A.	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	N.A.
	Currents			**Ice**			**Water quality in the terrestrial environment**			**Water quality in the marine environment**			**Underground water quality**		
Overall environmental value	Low	Low	N.A.	Medium	Medium	N.A.	Medium	Medium	Medium	Medium	Medium	N.A.	High	High	High
Degree of disturbance	Medium	Medium	N.A.	Medium	High	N.A.	Medium	Low	Medium	Low	High	N.A.	Medium	Medium	Medium
Scope	Low	Low	N.A.	Medium	Medium	N.A.	Low	Low	Low	Low	Medium	N.A.	High	High	High
Extent	Spot	Spot	N.A.	Spot	Local	N.A.	Spot	Spot	Spot	Spot	Local	N.A.	Spot	Spot	Spot
Duration	Long	Long	N.A.	Long	Long	N.A.	Short	Short	Short	Short	Short to long	N.A.	Short	Short	Short
Probability of occurrence	High	High	N.A.	Medium	High	N.A.	Medium	Low	Medium	Low	Low	N.A.	Medium	Low	Medium
Residual effect	Low	Low	N.A.	Medium	Medium	N.A.	Very low	Very low	Very low	Very low	Low to medium	N.A.	Medium	Medium	Medium
Significance of residual effect	Insignificant	Insignificant	N.A.	Insignificant	Insignificant	N.A.	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	N.A.	Insignificant	Insignificant	Insignificant
	Air quality			**Greenhouse gas**			**Noise and vibrations in the terrestrial environment**			**Subaquatic noise**			**Ambient light**		
Overall environmental value	High	High	High	N.A.	N.A.	N.A.	High	High	High	High	High	N.A.	Medium	Medium	Medium
Degree of disturbance	Low	Low	Low	Low	Medium	Low	Low	Low	Low	Medium	Low	N.A.	Low	Medium	Low
Scope	Medium	Medium	Medium	Low	Medium	Low	Low	Low	Low	Medium	Low	N.A.	Low	Medium	Low
Extent	Spot	Spot	Spot	Local	Local	Local	Local	Local	Local	Local	Spot	N.A.	Local	Local	Local
Duration	Medium	Long	Medium	Short	Long	Short	Medium	Long	Medium	Short	Short	N.A.	Medium	Long	Medium
Probability of occurrence	Medium	High	Medium	High	High	High	High	High	High	High	Low	N.A.	High	High	High
Residual effect	Medium	Medium	Medium	Medium	Medium	Medium	Low	Low	Low	Medium	Very low	N.A.	Low	Medium	Low
Significance of residual effect	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	N.A.	Insignificant	Insignificant	Insignificant

Table 6-3 Assessment of the Project's residual effect on the components of the biological environment

Criteria	Terrestrial and riparian vegetation			Wetlands			Marine vegetation and intertidal seagrass beds			Plankton			Benthic and nectonic invertebrates (freshwater)		
Project phases	**Construction phase**	**Operation phase**	**Closing phase**	**Construction phase**	**Operation phase**	**Closing phase**	**Construction phase**	**Operation phase**	**Closing phase**	**Construction phase**	**Operation phase**	**Closing phase**	**Construction phase**	**Operation phase**	**Closing phase**
Overall environmental value	Medium	Medium	Medium	High	High	High	Medium	Medium	N.A.	N.A.	N.A.	N.A.	Medium	Medium	Medium
Degree of disturbance	Low to medium	Medium	Low to medium	Low to medium	High	Medium to high	Low	Low to medium	N.A.	N.A.	N.A.	N.A.	Medium	Low to medium	Low to medium
Scope	Low to medium	Medium	Low to medium	Medium to high	High	Medium to high	Low	Low to medium	N.A.	N.A.	N.A.	N.A.	Low to medium	Low to medium	Low to medium
Extent	Spot to local	Spot	Spot	Spot	Spot	Spot	Spot to local	Local	N.A.	N.A.	N.A.	N.A.	Spot	Spot	Spot
Duration	Short to long	Short to long	Short to long	Short to long	Short to long	Short to long	Short to long	Short to long	N.A.	N.A.	N.A.	N.A.	Short to long	Short to long	Short to long
Probability of occurrence	Low to high	Low	Low to high	Low to high	Low	Low to high	Low to high	Low	N.A.	N.A.	N.A.	N.A.	Low to high	Low	Low
Residual effect	Very low to medium	Low	Very low to low	Low to high	Medium	Low to medium	Very low to low	Low to medium	N.A.	None	None	None	Very low to medium	Very low to low	Very low to low
Significance of residual effect	Insignificant	Insignificant	Insignificant	Insignificant and significant*	Insignificant	Insignificant	Insignificant	Insignificant	N.A.	None	None	None	Insignificant	Insignificant	Insignificant
	Benthic and nectonic invertebrates (marine)			**Fish (freshwater)**			**Fish (marine)**			**Marine mammals**			**Birds**		
Overall environmental value	Medium	Medium	N.A.	Medium	Medium	Medium	Medium	Medium	N.A.	High	Medium	N.A.	Medium	Medium	Medium
Degree of disturbance	Low	Medium	N.A.	Low to medium	Low to medium	Low to medium	Low	Low to high	N.A.	Medium	Medium	N.A.	Low to medium	Low to medium	Low to medium
Scope	Low	Medium	N.A.	Low to medium	Low to medium	Low to medium	Low	Medium	N.A.	Medium	Low to medium	N.A.	Low to medium	Low to medium	Low to medium
Extent	Spot to local	Local to regional	N.A.	Spot	Spot	Spot	Spot to local	Local to regional	N.A.	Spot to local	Spot to local	N.A.	Spot to local	Spot to local	Spot
Duration	Short to long	Short to long	N.A.	Short to long	Short to long	Short to long	Short to long	Short to long	N.A.	Short to medium	Short to long	N.A.	Short to long	Short to long	Short
Probability of occurrence	Low to high	Low	N.A.	Low	Low	Low	Low to high	Low to medium	N.A.	Low	Low	N.A.	Low to high	Low to high	Low to high
Residual effect	Very low to low	Low to medium	N.A.	Very low to low	Very low to low	Very low to low	Low	Low to medium	N.A.	Low to medium	Very low to medium	N.A.	Very low to medium	Very low to low	Very low to low
Significance of residual effect	Insignificant	Insignificant	N.A.	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	N.A.	Insignificant	Insignificant	N.A.	Insignificant	Insignificant	Insignificant
	Terrestrial fauna (general)			**Terrestrial fauna (special status species)**											
Overall environmental value	Medium	Medium	Medium	High	High	High									
Degree of disturbance	Low to medium	Low to medium	Low to medium	Low to medium	Low to medium	Low to medium									
Scope	Low to medium	Low to medium	Low to medium	Low to high	Medium to high	Low to medium									
Extent	Spot	Spot	Spot	Spot	Spot	Spot									
Duration	Short to long	Short to long	Short to long	Short to long	Short to long	Short to long									
Probability of occurrence	Low to high	Low to medium	Low to medium	Low	Low to medium	Low									
Residual effect	Very low to medium	Very low to low	Very low to low	Very low to medium	Low to medium	Very low to low									
Significance of residual effect	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant									

*Based on type of activity

Table 6-4 Assessment of the Project's residual effect on the components of the human environment

Criteria	Local and regional communities Land use			Local and regional communities Human health			Local and regional communities Visual			Local and regional communities Natural and cultural heritage		
Project phases	**Construction phase**	**Operation phase**	**Closing phase**	**Construction phase**	**Operation phase**	**Closing phase**	**Construction phase**	**Operation phase**	**Closing phase**	**Construction phase**	**Operation phase**	**Closing phase**
Overall environmental value	Medium	Medium	Medium	High	High	High	High	High	High	High	N.A.	N.A.
Degree of disturbance	Medium	Medium	Medium	Low	Low	Low	Low	Low	Low	Low	N.A.	N.A.
Scope	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	N.A.	N.A.
Extent	Spot	Spot	Spot	Spot	Spot	Spot	Local	Local	Local	Spot	N.A.	N.A.
Duration	Short to long	Short to long	Short to long	Short to long	Short to long	Short to long	Long	Long	Long	Long	N.A.	N.A.
Probability of occurrence	Medium	Medium	Medium	Low	Low	Low	High	High	High	Low	N.A.	N.A.
Residual effect	Low	Low	Low	Low	Low	Low	Medium	Medium	Medium	Low	N.A.	N.A.
Significance of residual effect	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	N.A.	N.A.
	First Nations **Use of the territory and its resources**			**First Nations** **Cultural heritage**								
Overall environmental value	High	High	High	High	N.A.	N.A.						
Degree of disturbance	Low	Low	Low	Low	N.A.	N.A.						
Scope	Medium	Medium	Medium	Medium	N.A.	N.A.						
Extent	Spot	Spot	Spot	Spot	N.A.	N.A.						
Duration	Short	Long	Short	Long	N.A.	N.A.						
Probability of occurrence	Low	Low	Low	Low	N.A.	N.A.						
Residual effect	Low	Low	Low	Low	N.A.	N.A.						
Significance of residual effect	Insignificant	Insignificant	Insignificant	Insignificant	N.A.	N.A.						

Human health risks (First Nations). The remoteness of the First Nation communities as well as the apparent absence of use or limited use in the limited or local study areas for cultural, subsistence or other purposes means that no significant effect is expected on their health in these areas. This component will not be affected during the construction, operating and closing phases in the limited and local study areas.

Socioeconomic profile. Due to the benefits generated by the Project, mainly related to employment and the local and regional economy, the expected effect is positive. The assessment of the residual impact is therefore not required.

6.3 NAVIGATION

The project will induce changes to navigation, in the project enlarged study area, in the navigation corridor for tankers on the St. Lawrence, from the eastern limit of the Nitassinan of the Essipit First Nation, and on the Saguenay until the project site. The CEAA guidelines specifically called for a description of the navigation associated with the Project and an assessment of the effects.

The eastern limit of the Nitassinan of the Essipit First Nation is at the mouth of the Portneuf River, near the municipality of Portneuf-sur-Mer, some 70 km north-east of Tadoussac , at the Saguenay mouth. The Saguenay Fjord, which flows into the St. Lawrence Estuary at Tadoussac, is 105 km long, making it one of the world's longest fjords. It is generally between 1 and 3 km-wide, but it locally exceeds 4 km in width at the coves and bays. The Saguenay is bounded by steep rock walls translating into very craggy shores. However, they lessen as they approach the upstream end of the expanded study area, near Saint-Fulgence.

6.3.1 PROFILE OF NAVIGATION

CURRENT NAVIGATION

Several types of navigation are practiced in the enlarged study area: commercial navigation, tourist navigation (cruises and excursions), pleasure navigation, passenger transport navigation (ferries) and service navigation. In the St. Lawrence Estuary, GNL tankers will follow a navigation corridor already heavily used by commercial shipping (nearly 10, annual crossings). The biggest vessels that frequent the Saguenay are commercial vessels and cruise ships. These two types of vessels also have the special feature of generally navigating a long section of the Saguenay, between its mouth and the Saguenay agglomeration.

The Saguenay waterway allows commercial vessels and cruise ships to reach the various port facilities of the only regional port, the Port of Saguenay, from the St. Lawrence. These facilities including four main wharves located on the south shore of the North Arm of the Saguenay and the back of Baie des Ha! Ha!. The Powell and Duncan Wharves located in Baie des Ha! Ha! are the property of Rio Tinto Aluminium, while the Agésilas-Lepage Wharf (Baie des Ha! Ha!) and Marcel-Dionne Wharf (North Arm of the Saguenay) are operated by the Saguenay Port Authority (SPA).

Over the last few decades, navigation on the Saguenay first declined sharply between 1970 and 1990 and then more gradually between 1990 and 2007, mitigated somewhat with the increase in cruise ships during that period. Between 2004 and 2016, approximately 60% of the vessels taking the Saguenay were bulk carriers of different sizes. Nearly 20% were general cargo vessels, 10% were tankers and nearly 7% were cruise ships. The cargo transported by the commercial vessels is varied and includes industrial salts, liquid pitch, coal, fluorspar and aluminum.

As for cruise ships, their navigation of the Saguenay has grown substantially over the past ten years, with the development of the cruise terminal at Agésilas-Lepage Wharf and the development of reception services. Including both commercial navigation and cruise ships, an average of 450 vessel movements (225 return trips) was recorded between 2004 and 2016. Vessels navigate the Saguenay year round, but the winter months (January to March) are the least busy. Conversely, September and October are the busiest months. However, in comparison with other waterways of comparable size in the rest of the world, traffic on the Saguenay remains low. Indeed, between 2004 and 2016, no vessel movements were recorded on 35% of the days, while one or two vessel movements were recorded on 30% and 20% of the days respectively. On the other hand, fewer than 2% of the days were characterized by five vessel movements or less.

Concerning commercial tourist excursions by boat, particularly including marine mammal watching excursions, they include a wide variety of boats and are responsible for dense local traffic in the Saguenay St-Laurence Marine Park. Commercial excursions are heavily concentrated in the sector at the mouth of the Saguenay and in the St Lawrence Estuary, in the sector between Tadoussac and Les Bergeronnes. However, this type of navigation is relatively rare in the Saguenay upstream from the mouth. Conversely, pleasure navigation is relatively dense in the Saguenay, between Baie Éternité and the mouth, but is composed of small craft. Commercial tourist excursions and pleasure navigation are mainly concentrated in the summer time. In 2007, these two navigation categories were responsible for approximately 1, 000 movements and 9,000 movements respectively in the SSLMP.

At the mouth of the Saguenay, Société des traversiers du Québec (STQ) operates a ferry service that links the North Shore region to the rest of Quebec via Route 138. Two vessels are used year-round, while a third is added during the summer season. The three vessels currently used are approximately 80 m long. The service is offered day and night, and the daily number of crossings ranges between 85 and 130 depending on the time of year. A total of approximately 40,000 crossings are thus made on an annual basis, allowing the passage of some 1.5 million passengers and 800,000 vehicles. Each crossing covers a distance of approximately 1.5 km between Baie-Sainte-Catherine and Tadoussac.

Finally, service navigation includes Canadian Coast Guard vessels, research vessels, surveillance vessels and pilot boats. This last category represents most of the approximately 3 500 annual movements estimated in the SSLMP in 2007 for this type of navigation. However, these movements are concentrated in the Les Escoumins sector, in the St. Lawrence, over 30 km from the mouth of the Saguenay.

PROJECTED NAVIGATION

In the short term, the increase in commercial and cruise navigation on the Saguenay, from the St. Lawrence, will mainly depend on Rio Tinto's activities and the development of the cruise ship market. The medium and long-term evolution of commercial navigation depends on the global economic climate and its impact on the resource sector and therefore is difficult to anticipate precisely. Considering that the GNLQ project could require between 150 to 200 LNG tankers per year and also considering the other potential major projects in the region, particularly the Port of Saguenay (including the marine terminal on the north shore) and BlackRock Metals projects, marine traffic in the enlarged study area could amount to 625 to 675 vessels annually by the 2027-2030 horizon, which is equivalent to the level experienced during the 1970s.

It is anticipated that the other types of navigation on the Saguenay will remain stable, except for passenger transport navigation (ferries), which is likely to decrease slightly during summer peak periods due to the commissioning of two new ferries with a larger capacity than the current ferries. They will be 92 m long and will be able to accommodate nearly 50% more vehicles aboard compared to the current ferries. They will be fueled by liquefied natural gas (LNG) to reduce their emissions. Their commissioning is scheduled for 2018 and 2019.

6.3.2 EFFECT OF THE GROWTH OF MARINE TRANSPORTATION RESULTING FROM THE PROJECT

The growth of commercial navigation in the enlarged study area resulting from the Project is inevitably accompanied by certain impacts on the host environment, particularly on the following Valued Components (VC):

- Shore stability
- Water quality
- Ambient subaquatic sound

- Shoreline vegetation
- Aquatic fauna
- Marine mammals
- Waterfowl
- Saguenay – Saint-Laurent Marine Park
- Residents and users
- First Nations uses

However, the following factors contribute to limit the scope of the residual effects on the VC:

- the Saguenay and St. Lawrence waterway is a considerable body of water due to their width, depth and flow;
- the Project will induce a relatively small increase in commercial navigation, namely on the Saguenay (approximately one trip per day), which is the equivalent of three to four vessels per week;
- LNG tankers traveling between Les Escoumins and the proposed LNG marine infrastructure will operate as much as possible at a maximum speed of 10 knots, safety permitting;
- several laws, regulations and standards govern navigation and transport of hydrocarbons, contributing to minimize certain environmental effects. Moreover, the CPBSL pilots who are aboard commercial vessels using the Saguenay and the St. Lawrence are aware of the good practises to be implemented to reduce these effects;
- certain characteristics of LNG tankers are likely to favor a reduction of the underwater noise they emit when moving;
- certain measures aimed at the maintenance of ships or the design of some of their components also make it possible to reduce noise emissions;
- GNLQ will conduct, as far as possible, maintenance of the liquefaction equipment during the summer period, thus reducing navigation during this period when the beluga whale frequents the Saguenay.

Thus, the increase in navigation in the enlarged study area resulting from the Project will result in a low degree of disturbance for the VC. Although each VC has great environmental value, the intensity of the effect is medium in each case. The extent of the effects on the biophysical components is spot to local, while it is regional for the components of the human environment. The probability of occurrence is generally considered low, except in the case of the ambient subaquatic sound and water quality which will be affected respectively by noise emissions of ship engines and the federally regulated release of oily water. In this context, the residual effect will be low to medium for the different VC (insignificant residual effect). Table 6-5 presents the synthesis of the apprehended effects on the VC that could be affected by the increase in navigation.

Table 6-5 Synthesis of foreseeable environmental effects of the increase in navigation on VC

Valued component of the environment (VCE)	Intensity	Extent	Duration	Probability of occurrence	Residual effect	Significance of residual effect
Shore stability	Medium	Spot	Long	Low	Low	Insignificant
Water quality	Medium	Spot	Long	High	Medium	Insignificant
Ambient subaquatic sound	Medium	Local	Short	High	Medium	Insignificant
Shoreline vegetation	Medium	Spot	Long	Low	Low	Insignificant
Aquatic fauna	Medium	Local	Long	High	Medium	Insignificant
Marine mammals	Medium	Local	Long	High	Medium	Insignificant
Waterfowl	Medium	Spot	Long	Low	Low	Insignificant
Saguenay – Saint-Laurent Marine Park	Medium	Regional	Long	Low	Medium	Insignificant
Residents and users of the St. Lawrence	Medium	Regional	Long	Low	Medium	Insignificant
First Nations uses	Medium	Regional	Long	Low	Medium	Insignificant

6.3.3 *RISKS ASSOCIATED WITH THE GROWTH OF MARINE TRANSPORTATION RESULTING FROM THE PROJECT*

The risks associated with the worst marine incident or accident scenarios were the subject of a qualitative analysis, accounting for the probability of occurrence of the different accident scenarios and the severity of the consequences for the biophysical and human environments. The following scenarios were considered:

- Major LNG spill (Saguenay mouth);
- Major LNG spill when berthing or during loading manoeuvres;
- Major fuel spill (Saguenay mouth);
- Major fuel spill when berthing;
- Spill of a hazardous substance after a collision with another merchant vessel (liquid pitch, coal, calcium fluoride or caustic soda);
- Spill of another (non-hazardous) substance after a collision with another merchant vessel.

Among the potential causes of accidents, a collision between two vessels is probably the one with the greatest risk of causing a large-scale spill of hydrocarbons or other hazardous substances. An allision between a vessel and a fixed element (e.g. rock walls, wharf), a grounding, a fire or an explosion, or a major equipment failure could also potentially be the origin of a spill in the enlarged study area.

However, such accidents are very unlikely, particularly due to the regulatory governance of marine navigation and hydrocarbon transport. It should be noted that the regulations and the standards in force are intended, in particular, to avoid a major accident involving a vessel or vessels. If the ship involved or the Canadian Coast Guard deems that the spill can not be contained, then the Eastern Canada Response Corporation (ECRC) will be called. The latter will contact Environment and Climate Change Canada to obtain a modeling of the accident to assess the product dispersion and identify the presence of sensitive environments.

Among the practices contributing to minimize the accident risk, it is notable that tugboats regularly assist vessels during their manoeuvres and that the commercial vessels using the Saguenay and the St. Lawrence are piloted by pilots who are very familiar with the special features of this waterway. The fact that the Saguenay and the St. Lawrence are a relatively wide and very deep waterway that is relatively little used by commercial navigation also contributes to reduce the accident risk considerably. Finally, the LNG tankers are double hulled, greatly reducing the risk of an accident leading to a spill even in the event of significant damage to the outer shell. Thus, in the improbable contingency that a major accident damaged the hull of a vessel, the environmental consequences probably would be much less than the worst-case scenarios evoked, due to this special design.

Thus, accounting for the low projected traffic increase, the accident risks with major environmental consequences are considered possible but with very low probability. If a large-scale spill were nonetheless to occur, the environmental consequences for the biophysical and human environments could be low, medium or high depending on the nature of the spilled product and the location of the accident. A major hydrocarbon spill could potentially be very serious, both for the biophysical and human environments, and have regional consequences. Nonetheless, due to the very low probability of occurrence of such an event, the risk level is considered medium. This level is considered acceptable, but the different measures specifically intended to reduce the probability of occurrence of accidents must be continuously given attention to ensure that they remain effective.

At this stage of the project, no further risk reduction measures are recommended, since adequate measures are already provided for in the various regulations and standards in force and that there will be constant radio communication with the Vessel Traffic Services of the Canadian Coast Guard. In addition, GNLQ has volunteered to complete the TERMPOL process. This process, which looks at the navigation safety, will be conducted by a group of government experts from Transport Canada. Thus, the recommendations that will be made during the TERMPOL analysis process will also make it possible to specify the particular measures to be put in place, if necessary.

6.4 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Extreme and exceptional weather conditions, changes in local conditions, fires, and earth movements, including seismic activities, are situations that pose certain risks to the Project. Among the natural disaster risks, earthquakes are to be distinguished from events related to weather conditions. Contrary to weather events, earthquakes are much less predictable.

Triggered global warming induces changes in atmospheric pressure patterns and in the hydrological cycle. These global changes can result in regional and local changes.

According to the forecasts produced by Ouranos, the Centre-du-Québec region in which the project is inserted will be affected by an average temperature increase that could reach 2.6 to 5.0 °C by the 2050 horizon for the most pessimistic scenario. This increase will be particularly notable in winter. An increase in the number of frost-free days is forecast, and in the duration of heat waves. A 9% to 17% increase in the annual mean precipitation is forecast in 2050, accompanied by an increase in the quantity of precipitation on the rainiest days.

6.4.1 EXPECTED CHANGES

CLIMATE CONDITIONS

For the Project region, the number of days of abundant rain in 2100 compared to the number in 2000 is expected to increase between four and 10 days per year according to the climate warming scenario used. For the Project, within a short and medium-term horizon, these forecasts can be considered as part of the natural climate variability for which the infrastructure will be designed. The intensity of storms historically experienced in Quebec should not change in the future to the extent of requiring specially adapted construction standards. No consequence is foreseeable concerning the rise in sea level, at least in the short or medium term. The ice cover could be less extensive and thinner and could last a shorter time, thus improving navigation conditions. Compliance with construction codes and standards should be able to respond to the expected fluctuations and changes and these climate variables should have no effect on the environment.

FIRES

The Project is located in an industrial-port zone on the shore of the Saguenay with heavy forest cover. The sector is therefore at risk of an eventual fire that could threaten the facilities and cause environmental damage. The Port of Saguenay, through its environmental management program, will implement fire prevention measures. In addition, the Emergency Preparedness Plan (EPP) will contain conditions for response in case of fire threatening the facilities. It is therefore considered that the risk of damage caused by a forest fire is insignificant.

SEISMIC ACTIVITIES

Eastern Canada is located in a stable continental region of the North American Plate, resulting in relatively low seismic activity. The study region nonetheless is part of the most active seismic zone in Eastern Canada.

Within a 50 km radius around the Project site, 64 earthquakes were recorded between 1985 and 2015, with magnitudes ranging between 0.5 and 5.9 (9 earthquakes felt). The most powerful was the 5.9 earthquake that occurred on November 25, 1988. The epicentre of this earthquake was located south of the municipality of Laterrière, approximately 34 km from the Project site.

The Project site is not conducive to floods or landslides, which means that the only risks during an earthquake are related to the vulnerability of the facilities. The buildings and facilities will be constructed in accordance with the National Building Code of Canada, which establishes standards for each seismic zone to ensure that the buildings withstand the seismic overloads, as well as rigorously adhering to the Quebec Construction Code, Chapter I of which, Building, deals with the para-seismic standards in force in Quebec. There is reason to believe that an eventual earthquake would not have significant effects on the Project's infrastructure and that the probability of an effect on the Project is therefore low.

6.4.2 SURVEILLANCE AND MONITORING

Surveillance of the environmental effects of the Project is not required. However, the risks of occurrence of events that may be the cause of eventual effects on the environment will be developed as needed, and they will be established through the environmental management procedures and the alert measures in case of an extreme event, such as a storm or a fire, for example. Table 6-6 presents a synthesis of the potential environmental effects on the Project.

Table 6-6 Synthesis of potential environmental effects on the Project

Event or situation	Long-term risk (> 26 years)	Mitigation measure	Effect
Rain or snow storms, extratropical hurricanes	Low, foreseeable event	Compliance with the Construction Code for Building	Insignificant
Winds	Low, higher in winter, but surrounded by uncertainty, foreseeable event	Application of the navigation rules in the Port of Saguenay	Insignificant
Fog	Low, within natural variability, event difficult to predict	Application of the navigation rules in the Port of Saguenay	Insignificant
Rising sea level	Low, conditions foreseeable in the long term	The location of the liquefaction facility in elevation in relation to the Saguenay protects the facilities against the effects of enhancement	Nil
Ice cover and floating ice	Low within short-term natural variability, foreseeable conditions	Application of the navigation rules in the Port of Saguenay	Insignificant or positive (long-term navigation facility)
Fires	Low, unpredictable event	Environmental management program, monitoring of fire danger conditions	Insignificant
Seismic activities	Low, unpredictable event	Construction of facilities according to the region's paraseismic standards	Insignificant

6.5 EFFECTS OF ACCIDENTS AND FAILURES

The risks of potentially hazardous events at the Liquefaction Facility that can have effects on the human components and the environment exist in the context of the Project. The question of accidents and failures arises when referring to events that occur independently of an activity or normal conditions of performance of a project.

The first line of defense against accidents and failures is the application of the existing best practices in environmental protection, health and safety. The Liquefaction Facility will be built according to applicable safety standards and in accordance with the requirements of CSA Z276-18 *Liquefied natural gas (LNG) – Production, storage and handling.*

Accidents and potential failures are associated with risks for which the probabilities of occurrence are never zero. Despite prevention, if such events occur, it is then important to be able to minimize the effects on people and the environment by the planning and design of effective mitigation measures and by implementing an emergency preparedness plan (EPP) in order to protect Project personnel, surrounding local communities, the environment, and Project facilities.

6.5.1 METHODOLOGY

The approach used meets the requirements of the major technology risk analysis guide entitled: "Analysis of risks of major technological accidents" and meets the main recommendations of the "Technology Accident Risk Management Guide". Major Reduction Council. The first steps are to identify the sensitive elements of the environment and the external hazards related to the activities, infrastructures or equipment present on the site as well as to establish a history of accidents occurring on similar sites. Subsequently, risk-related accident scenarios are developed.

In subsequent steps, the potential consequences of the scenarios are identified and the probabilities of occurrence are estimated. The safety measures to be put in place (including training) are also determined to eliminate or reduce the risk of accidents.

6.5.2 FINDINGS

The sensitive elements of the environment that must be considered are those that could be affected by a major accident occurring on the Project site, due to their proximity. This primarily involves the local population, public places, infrastructure and sensitive or protected environmental elements.

The dangers have been identified according to:

- external dangers of natural origin (earthquake, flood, unstable ground, exceptional weather conditions);
- external dangers of anthropogenic origin (air transportation, marine infrastructure, industries);
- dangers related to the activities on the site (infrastructure in the terrestrial environment, infrastructure in the marine environment, used hazardous materials, transport of products).

A qualitative assessment as well as two quantitative ones were carried out. They showed the following results:

- HAZID (Hazard Identification) Workshop: identified the main accident scenarios, as well as the preventive measures to be implemented, in order to keep the risk as low as possible;
- Quantitative Risk Assessment - Terrestrial Environment:
  - the probable consequences of a technological accident at the Liquefaction Facility and involving LNG do not go beyond the limits of property boundaries;
  - The risk to the public in all areas surrounding the Liquefaction Facility meets the criteria for acceptability set by the Major Industrial Accidents Council of Canada (MIACC).
- Quantitative Risk Assessment - Marine Environment:
  - Whether at berth or in navigation, the scenario leading to the largest radius of impact is a 1,500 mm diameter leak on a ship's tank with a fire in an area where there is essentially water. The impact radius is then estimated at 915 m for attaining the thermal radiation of 5 kW / m^2.
  - the criteria of acceptability established by the MIACC are respected on the entirety of the route taken by the tankers serving the maritime facilities of the Énergie Saguenay Project.

It should be noted that the probability of a collision of an LNG tanker is one over 150 years and such event does not imply necessarily damages, leaks or other incident.

Finally, a preliminary emergency plan was developed. It will be updated before the construction phase. A risk management program including management, monitoring, control and training procedures will also be put in place.

6.6 CUMULATIVE EFFECTS

The assessment of the cumulative effects focuses on the valued components (VC). These refer to the components of the natural and human environments that could be altered or affected significantly by the project and that are valued by specialists or by the populations concerned.

In the context of the Liquefaction Facility at Grande-Anse, this valuation is expressed most often through concerns collected and integrated into the EIS. The assessment of the cumulative effects also requires that these VC have a real potential for cumulative effects with other projects or actions.

The VC for which the Project could cause cumulative effects, in addition to those of other regional projects, both in terms of the location of the liquefaction plant and its loading platforms, or its navigation activities, are as follows:

- water quality (marine);
- greenhouse gases (GHG);
- ambient light emissions;
- fish (marine);
- marine mammals;
- special status species;
- migratory and non-migratory birds;
- land use (local and regional communities);
- visual landscapes;
- First Nations.

The analysis of the cumulative effects on the valued components chosen considers all the current or potential activities, depending on the spatial and temporal limits chosen for each VC. Table 6-7 identifies the VC related to the issues and presents the indicators chosen for the assessment of the cumulative effects.

Table 6-7 Valued components related to the chosen issues and indicators

Issues	Valued component (VC)	Indicators
Degradation of water quality in the marine environment	Water quality (marine)	– Increase in contaminants in the water due to effluent
Degradation of air quality and impact on climate change	Greenhouse gases (GHG)	– Increase in GHG emissions
Loss of tranquillity	Ambient light at night	– Increase in brightness
Contamination of fish species and increase in mortality	Fish (marine)	– Alteration/disturbance of the habitat of certain species – Encroachment on water bodies
Contamination of mammals and disturbance of individuals	Marine mammals	– Contamination of the food chain – Reduction of habitat quality – Reduction of visitation by certain species
Contamination of individuals and disturbance	Special status species	– Reduction of habitat quality – Area of the territory affected
Habitat reduction or disturbance	Migratory and non-migratory birds	– Decrease in the number of breeding pairs
Disturbance of activities related to land use (mainly tourism)	Land use (local and regional communities)	– Accessibility of the territory
Disturbance in a significant tourism context	Visual landscapes	– Reduction of landscape quality
Disturbance of way of life	First Nations	– Reduction of access to the territory – Trapping grounds affected

The analysis of the cumulative effects did not lead to the addition of new mitigation measures or additional monitoring measures regarding what was presented in the EIS. The detailed analysis of anticipated effects on the valued components chosen determined that the Project would have no significant cumulative impact with the other activities and projects envisioned in the region. Table 6-8 summarizes the overall effect on the valued components chosen for the analysis of the cumulative effects.

Table 6-8 Summary of cumulative effects

Valued component of the environment	Residual effect (Significance)
Water quality (marine)	Medium (insignificant)
Greenhouse gases (GHG)	Medium (insignificant)
Ambient light	Medium (insignificant)
Fish (marine)	Low (insignificant)
Marine mammals *-Seal* *-Beluga*	 Low (insignificant) Medium (insignificant)
Special status species (apart from beluga) *- Canada warbler* *- Evening grosbeak* *- Bats* *- Eastern painted turtle* *- Lumpfish*	 Medium (insignificant) Medium (insignificant) Medium (insignificant) Medium (insignificant) Medium (insignificant)
Migratory and non-migratory birds	Low to medium (insignificant)
Land use (local and regional communities)	Low (insignificant)
Visual landscapes	Medium (insignificant)
Indigenous peoples	Medium (insignificant)
First Nations *- Innu First Nation of Essipit* *- Innu First Nation of Pessamit* *- PekuakamiulnuatshFirst Nation* *- Huron-Wendat Nation*	 Medium (insignificant) Medium (insignificant) Medium (insignificant) Medium (insignificant)

7 SURVEILLANCE AND MONITORING PROGRAMS

The Environmental and Social Management Program (ESMP) of the Énergie Saguenay natural gas liquefaction project will include all the environmental surveillance and monitoring programs that will be implemented during the different phases of the Project. When necessary, these programs will be adjusted and modified to adapt, as applicable, to new or unexpected elements, and to allow improvements during deployment of various elements of the Project.

The main objective of this ESMP is to ensure protection of the environment and optimum social acceptability of the Project. It also the objective of ensuring that, in the long term, the operations of the Project and the related activities do not harm the natural and human environment. This ESMP allows GNLQ to:

1. maintain compliance with Canadian environmental legislation;
2. minimize environmental cleanup costs;
3. maintain sustainable operations and reduce costs and expenses for the users;
4. favour due diligence.

In environmental matters, GNLQ will be responsible for ensuring that all environmental and social undertakings and standards will be implemented by all the parties who will be involved in the work, including the service providers and the subcontractors.

A mechanism for receiving and managing complaints from the public will be deployed by GNLQ. The procedure that will be applied to complaints management will ensure receipt, analysis and action in response to the complaints received within a reasonable time.

7.1 ENVIRONMENTAL SURVEILLANCE PROGRAM

The Environmental Surveillance Program (ESP) will deal with the different phases of the Project (construction, operations and closing), to ensure the work on the site runs smoothly and to limit the environmental impacts. The purpose of this program is to recognize the integration of the mitigation measures put forward during the Project's environmental assessment process and compliance with the legislation and regulations to which the Project is subject.

Before any construction, a team of experienced inspectors will be formed under the supervision of the person responsible for environmental surveillance, to ensure adequate surveillance of the performance of the work. Also, the responsibilities of the owner and contractor during construction (for example, Project Manager, HSSE Manager, Environmental Officer, Site Manager, subcontractors) will be determined.

During the operating phase, an inspection program will be implemented to ensure adequate surveillance of the various devices and infrastructures on the plant and terminal site. Equipment will be inspected periodically to identify any potential defects and to schedule and perform adequate preventive maintenance.

The closing of the site must also be the object of environmental management. Measures similar to those provided in the construction phase will be applied according to the work that will be done.

7.2 SPECIFIC ENVIRONMENTAL MANAGEMENT PROGRAMS

Specific environmental management programs will be applied during the different phases of the Project to ensure that it will be constructed, operated and closed according to the good environmental practices in force. The objectives of the environmental management programs are to:

1. protect the valued environmental and socioeconomic components in the Project sector during construction;
2. provide strategies to meet the requirements described in the environmental permits and authorizations obtained in the context of the Project;
3. reduce or eliminate any environmental liabilities.

In addition to the general aspects of environmental management, preliminary ESMPs were developed for specific sensitive environmental components that require more consideration and attention, namely:

1. air quality;
2. surface water and groundwater quality;
3. management of lighting and ambient light;
4. monitoring of sound and vibrations;
5. control of subaquatic noise;
6. biological monitoring, including:
    a. protection of vegetation and plant recovery;
    b. surveillance of marine mammals;
    c. monitoring of compensatory measures;
    d. other wildlife monitoring or observations of interest.
7. Heritage and archaeological vestiges;
8. residual and hazardous materials;
9. social management;
10. accidental spills;
11. emergency preparedness.

Specific preliminary environmental management programs include the applicable environmental practices that will be followed in accordance with the federal and provincial regulations.

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