1 PROJECT OVERVIEW

The Nisga'a Nation, Rockies LNG Limited Partnership (**Rockies LNG**) and Western LNG LLC (via its subsidiary, Western LNG) (each a Proponent and collectively referred to herein as **the Proponents**), are proposing to jointly develop an energy project, the Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal Project (**the Project**). This section provides information regarding the Project, including its purpose, location, components, activities, workforce requirements, and alternative means of carrying out the Project.

1.1 Project Introduction

The Project is proposed to be a floating liquefied natural gas production, storage and offloading facility (**FLNG**) and marine terminal located at Wil Milit on the northwest coast of British Columbia (**BC**) at the northern end of Pearse Island. The Project site (**Site**) is approximately 15 kilometres (**km**) west of the Nisga'a community of Gingolx, which is also the closest community (Figure 1.1–1). The Project will be located on Category A Land (District Lots [**DL**] 5431 and 7235) owned in fee simple by the Nisga'a Nation and located within the Nass Area, as defined in the Nisga'a Final Agreement (**Nisga**'a **Treaty**), and on an adjacent proposed Water Lot located on Portland Canal at the northern point of Pearse Island. The proposed Water Lot is shown in Figure 1.1–2. The Project includes shipping of liquefied natural gas (**LNG**) along the proposed marine shipping (transit) route between the terminal and the BC Coast Pilots Ltd. boarding location at or near Triple Island and Canada's 12 nautical mile (**nm**) territorial sea limit (**marine shipping route**; Figure 1.1–3).

The name "Ksi Lisims", pronounced as *s'lisims*, means "from the Nass" in the Nisga'a language. Since 2014, the Nisga'a Nation has been working to develop LNG and pipeline facilities in and around the Nass Area. Wil Milit is one of the prospective sites initially proposed by the Nisga'a Nation in a publicly distributed document entitled *Nisga'a Lisims Government – New Available LNG Sites on Canada's West Coast – February 2014*. This Project is the culmination of that work and is a key element of the Nisga'a Nation's economic and social development strategies. It will provide training, jobs and new business opportunities for Nisga'a citizens and other Indigenous Nation communities. Economic development opportunities such as this Project will help promote the continued growth and vitality of the Nisga'a Nation and participating Indigenous nations.

The Project will operate under a governance structure that provides the Proponents with the opportunity for meaningful input into management and operation, enabling the Project to be operated in a manner that is consistent with the Nisga'a Nation's commitment to stewardship of the land. The Project is consistent with the economic development aspirations of the Nisga'a Nation and provincial government LNG development requirements while still meeting the sustainable development objectives of the Nisga'a Nation, BC, and Canada.

Project phases, including the Environmental Assessment Certificate Application (**the Application**) development process, permitting, construction, operation, and decommissioning will be scheduled and completed in coordination and consultation with Nisga'a Lisims Government (**NLG**) and provincial and federal regulatory authorities and informed by Project engineering including pre-front-end engineering design (**pre-FEED**) and **FEED**. Construction of the Project is anticipated to span three to four years. The in-operation lifespan of the Project is anticipated to be a minimum of 30 years, starting in 2028 (i.e., in operation until at least 2058). Table 1.1–1 shows the preliminary Project schedule, based on pre-FEED information.

Table 1.1–1 – Approximate Project Schedule

Project Phase	Period
Environmental Assessment Certificate Application development	Q2 2021 to Q1 2024
FEED	Q2 2023 to Q3 2024
Detailed Engineering	Q2 2024 to Q1 2026
Permitting and environmental management plans	Q2 2023 to Q2 2025
Construction	Q2 2025 to Q4 2027
Commissioning (first FLNG and Onshore Facility)	Q4 2027 to Q1 2028
Operations and maintenance	2028 for a minimum of 30 years (2058)
Decommissioning	Sometime after 2058 when the Project has reached the end of its in-operation life

1.2 Proponent Description

The Proponents for the Project are the Nisga'a Nation, Rockies LNG and Western LNG. These three Proponents have developed and executed a joint development agreement whereby senior personnel from all three organizations jointly manage and control Project activities through a steering committee.

The Nisga'a Nation, as represented by NLG, is a modern treaty nation. The Nisga'a Nation is a party to the Nisga'a Treaty, along with the Government of BC and the Government of Canada. The Nisga'a Treaty is a treaty and land claims agreement within the meaning of sections 25 and 35 of the *Constitution Act*, *1982* (GoCN 1982), and has an effective date of May 11, 2000. NLG identified Wil Milit as a potential site for an LNG facility in 2014.

Rockies LNG is an Alberta-based partnership of Western Canadian natural gas producers including: Advantage Energy Ltd.; Birchcliff Energy Ltd; Bonavista Energy Corporation; Crescent Point Energy Corp.; NuVista Energy Ltd.; Ovintiv Inc.; Paramount Resources Ltd.; Peyto Exploration and Development Corp.; and Tourmaline Oil Corp.

Western LNG ULC, whose primary Canadian office is located in Vancouver, BC, is engaged in the development of North American LNG export facilities with a management team experienced in the development of LNG and related energy infrastructure industries.

The company that will construct, own, and operate the assets of the Project is Ksi Lisims LNG Tolling Limited Partnership (**Ksi Lisims Tolling LP**), and as agreed to by the Proponents, the general partner, Ksi Lisims LNG Tolling GP ULC, will be the designated holder of the Environmental Assessment Certificate, when issued, on behalf of Ksi Lisims LNG Tolling LP. Ksi Lisims LNG Tolling LP and Ksi Lisims LNG Tolling GP ULC are indirect, wholly-owned subsidiaries of Western LNG LLC, and were formed in 2021 for the purpose of undertaking development of the Project.

Development of the Project to date has been undertaken by the Proponents pursuant to a Cooperative Endeavours Agreement that was entered into in 2020. Governance of the Project is by way of a Steering Committee composed of each of the Proponents. This governance structure will continue until commencement of construction of the Project, at which time the Steering Committee will be dissolved and each of the Proponents will become limited partners in Ksi Lisims LNG Limited Partnership, and certain governance rights over the Project will be granted thereto. Ksi Lisims LNG GP ULC, a wholly-owned indirect subsidiary of Western LNG LLC, is the general partner of Ksi Lisims LNG Limited Partnership. During construction and operation, responsibility for compliance with the conditions of the EAC, including development of relevant corporate policies, will be primarily the responsibility of Western LNG LLC.

Each of Ksi Lisims LNG Tolling LP, Ksi Lisims LNG Tolling GP ULC, Ksi Lisims LNG Limited Partnership, and Ksi Lisims LNG GP ULC is headquartered in Vancouver, BC. Proponent contact information and the principal contact person for the Application process are provided in Table 1.2–1.

Table 1.2–1 – Proponent and Contact Information

Project Name	Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal Project
Proponents	Nisga'a Nation, Rockies LNG, and Western LNG
Head Quarter Address	Suite 1600 – 925 West Georgia Street, Vancouver BC V6C 3L2
Email	info@ksilisimslng.com
Proponent Contacts	Mansell Griffin, Director – Lands and Resources, Nisga'a Lisims Government Mansellg@nisgaanation.ca 250.633-3000
	Charlotte Raggett, President and CEO, Rockies LNG craggett@rockieslng.com 403-828-0802
	Sandra Webster, Environmental and Regulatory Affairs, Western LNG 604-265-0700
Principal Contact(s) for the Application	Sandra Webster, Environmental and Regulatory Affairs, Western LNG swebster@ksilisimslng.com 604-265-0700
URL	www.ksilisimslng.com

The Proponents have retained Stantec Consulting Ltd. to manage and prepare the Application. A list of key personnel responsible for preparing the Application, including roles and qualifications, is provided in Appendix C. The contact information for Stantec Consulting Ltd. is provided in Table 1.2–2.

Table 1.2–2 – Environmental Consultant Information

Name of Consultant	Stantec Consulting Ltd.
Consultant Address	500-4515 Central Boulevard Burnaby, British Columbia V5H 0C6
Consultant Contact	Erin Flory, M.Sc., EP Senior Environmental Planner Phone: 587-892-3034 Email: erin.flory@stantec.com

1.3 Project Location

This section provides information regarding the location of Project infrastructure, the marine shipping route, existing land and marine use, and proximity to the Nass Area and neighbouring Indigenous nations. The proposed Project location is in the northwestern coastal region of BC roughly centered at 55°01’26” N and 130°10’49” W, on a site known officially as Wil Milit, a former Indian Reserve located on Pearse Island, within the Nass Area as defined in the Nisga'a Treaty. The Site consists of undeveloped land that, in part, has been logged by the forestry industry and is adjacent to established shipping routes. The nearest regional population centres in BC include Gingolx (located 15 km east) and the other Nisga'a Villages upriver in the Nass Valley, Prince Rupert, Port Edward, Terrace, Kitsumkalum IR 1, Kitselas IR 1, Lax Kw’alaams, Metlakatla, and Stewart, and in Alaska (**AK**) include Hyder, Ketchikan and Metlakatla. The remoteness of the Project Site (**the Site**) makes it an ideal location for the Project because it will result in limited interactions between activities associated with the Project and those of other planned or existing projects. As a result, there will be less potential for cumulative effects on both the biophysical and social environments.

The Project components and activities are to be located on the most northern portion of Pearse Island, on DL 5431 and DL 7235 and in the proposed Water Lot (Figure 1.1–2). The Project’s onshore components are located on Category A Land, as defined in the Nisga'a Treaty, owned in fee simple by the Nisga'a Nation[1]. The FLNGs and marine terminal are located in a proposed Water Lot adjacent to Nisga'a Category A Lands in DL 5431.

The Project is designed to be powered through a connection to the BC Hydro grid; however, if the connection is delayed, there is an alternate Project design that would accommodate a temporary alternative power supply until grid power is available. The conceptual Project layout for the alternate Project design, which

[1] Category A lands are as defined in Appendix D-2 and D-3 of the Nisga’a Treaty. Maps and descriptions of these lands can be found at: https://www.rcaanc-cirnac.gc.ca/eng/1100100031339/1542999965806. Ownership of these lands is fee simple, allowing the owner full use of the land subject only to zoning laws or any covenants on the land.

represents the worst-case layout with respect to marine and land-based infrastructure requirements, is provided in Figure 1.3–1.

District Lots 5431 and 7235 comprise 164 hectares (**ha**) of land with a gentle topographic profile suitable to develop the Project's onshore components. An application to the Ministry of Forests for a Water Lot lease is anticipated prior to making a final investment decision for the Project.

The terrestrial footprint of the Project is estimated to be 43.6 ha, while the marine footprint is estimated to be 19 ha (Figure 1.3–1). The terrestrial Project components include all of the buildings (i.e., control building, administrative building, maintenance workshop and warehouse, permanent workforce accommodations, security office), feed gas receiving facility, electrical substations and electrical distribution systems, water and wastewater treatment plants, backup diesel fuel power generation equipment, diesel fuel storage tanks, monitoring equipment and instrumentation, roads, fencing, a helipad, overburden storage areas, and access roads. The marine Project components include a materials offloading facility (**MOF**), temporary floating worker accommodations, temporary pioneer dock for unloading construction equipment, floating supply and personnel dock, floating tug dock, two FLNG barges and associated jetties, seawater intake structure, wastewater outfall and, if required, temporary power barges.

Liquefied natural gas carriers are anticipated to enter Canadian waters from the west through the 12 nm territorial sea limit, pass through Dixon Entrance north of Haida Gwaii and will pick up BC Coast Pilots at a designated location west of, but near to, Triple Island. Liquefied natural gas carriers will be piloted between Triple Island and the Project's marine terminal by BC Coast Pilots to support the safe inbound and outbound transit of LNG carriers, consistent with applicable marine navigation laws and regulations. With the pilots on board, LNG carriers are anticipated to travel east, south of the Dundas Island group and then travel north through Chatham Sound, Main Passage, through Portland Inlet and then northeast into Portland Canal (Figure 1.1–3). The outbound routine is expected to follow the same marine shipping route. Piloted natural gas liquid (**NGL**) product vessels will call upon the Project's marine terminal to load condensate; these carriers are anticipated to depart following the same route as LNG carriers past Triple Island and then north of Haida Gwaii to open waters.

1.3.1 Past and Present Land, Aquatic, and Marine Use

The Site is in a remote wilderness area and other than some logging several decades ago, has been used primarily by the Nisga'a for domestic purposes. The terrestrial portion of the Site is within the Southern Boundary Ranges Ecosection and the marine waters in the vicinity of the Site are within the Inner Pacific Shelf Ecoregion and North Coast Fjords Ecosection.

In the broader region, coastal logging and associated log storage and transport, mines and associated shipping of minerals out of the port facilities at Stewart, BC, and commercial fishing and processing are the only industrial uses currently operating in this part of coastal BC.

The land and water use of the Project area can be described as generally natural, sparsely populated, with some history of commercial fishing, tourism, and forest harvesting (particularly in decades past). Coastal forest harvesting in the vicinity of the Project has diminished in recent years.

Participation in commercial fisheries by the Nisg̱a'a Nation, area Indigenous nations and non-Indigenous groups supports the local and regional economy. Indigenous nations conduct commercial, recreational, and Indigenous fisheries in Portland Inlet, Portland Canal, Pearse Canal, Nass Bay and Nasoga Gulf. For example, within the Nass Area, harvest by Nisg̱a'a citizens occurs in the general commercial fisheries, Nisg̱a'a commercial fisheries for salmon, and Nisg̱a'a domestic fisheries for food, social and ceremonial purposes. While domestic fisheries do not generate income, they do serve, in addition to food and cultural values, an important economic role in offsetting the cost of food that would otherwise have to be purchased. Commercial fishing in Portland Inlet and at the mouth of the Nass River includes salmon as well as crab. Marine fisheries in the area target a wide range of species including salmon, herring, eulachon, halibut, shrimp, bivalves, and crab. Indigenous fisheries also include the capture of harbour seals and Steller sea lions. Marine plants (algae) are also harvested.

Efforts (e.g., email, phone and virtual meetings) have been made by the Project to contact Indigenous nations and non-Indigenous fishers to better understand their use of Portland Inlet, Portland Canal, Pearse Canal and Nasoga Gulf for commercial, recreational and/or Indigenous fisheries. At the time of this being drafted no responses from non-Indigenous fishers had been received. Information from Indigenous nations is captured in the Nation specific assessments (Sections 11.0 to 19.0). For information on non-Indigenous fisheries see Section 7.11.

The marine waters of the region also serve as navigation routes for the Nisg̱a'a and other Indigenous nations, commercial, industrial, and recreational users connecting Stewart, Hyder, AK, Kitsault, Gingolx, and Laxg̱alts'ap to communities and ports to the south, as well as to international destinations. For centuries, the Nass River was the primary means of connecting Gingolx to the Nisg̱a'a villages upriver. The completion of Highway 113/Nisg̱a'a Highway connecting the Nass Valley to Terrace changed that approximately 20 years ago. There are several watercourses on Pearse Island which flow into Portland Canal through the Site. Full details on the watercourses present on Pearse Island are found in Appendix 7.8A. The field-mapped watercourses can be found in Section 7.08 (Figure 7.08-2).

Maritime-based commercial tourism (e.g., whale watching, bear viewing, pocket cruises, kayak adventures as well as a known fishing lodge on Pearse Canal) and non-commercial recreational users use the Portland Canal, Pearse Canal and Portland Inlet area, primarily in the summer season. These tourism and recreation activities have historically had nearly unhindered and unrestricted access within Portland and Pearse Canals. The Hidden Inlet LLC fishing lodge, located on the west side of Pearse Canal in US waters and approximately 14 km southwest of the Site, is the nearest commercial recreation property to the Site (Figure 1.3–2). Operating out of Gingolx, approximately 15 km east of Wil Milit, Northern Sunrise Charters is a commercial recreation fishing and sight-seeing business that offers guided fishing and wildlife viewing tours. No other commercial recreation enterprises have been identified within 25 km of the Site.

The only historical industrial and commercial transportation into and out of the Portland Canal area has been via commercial vessels going past the Site to the port facilities in Stewart, BC or Hyder, AK or to supply historic fishing lodges, camps, marine log transport (e.g., barged logs from commercial forest harvesting) and potentially whaling stations of years past. Recreational, commercial, and Indigenous fishing vessels also routinely transit this maritime region.

Waterbodies in Wil Milit are shown in Figure 1.1–2. Watersheds in Wil Milit generally flow north into Portland Canal, Pearse Canal, or Whiskey Bay. There is no known surface or groundwater use at Wil Milit except by Indigenous nations who used the Wil Milit area in past years. Infrequent use of Whiskey Bay by other marine users, e.g., as a safe anchorage site, may also be possible.

The Site is a former Indian Reserve (Indian Reserve. No. 43) and is undeveloped. Figure 1.3–3 illustrates the DL boundaries and Figure 1.3–4 illustrate land titles in the vicinity of the Site. It does not have a history of any other development; past use is limited to use by Indigenous nations. The Site DLs, legal description, area and parcel identifier numbers are listed in Table 1.3–1.

Table 1.3–1 – Wil Milit Legal Land Descriptions (Category A Nisga'a Lands)

District Lot	General Land Description	Parcel Identification Number	Legal Description	Area (ha)
DL 7235	Western Lot – on Pearse Canal	024-768-685	District Lot 7235, Cassiar District Plan PRP45454	108
DL 5431	Eastern Lot – on Portland Canal	024-768-693	District Lot 5431, Cassiar District Plan PRP45454	56

Other private land interests in the area surrounding the Site are summarized in Table 1.3–2 and shown in Figure 1.3–4, which illustrates the land titles in the vicinity of the Site. Two traplines intersect with the Site as illustrated in Figure 1.3–5.

Table 1.3–2 – Private Land Interests

	General Area	Parcel Identifier Number	Applicable Survey Plans	Land Title Information
1	Pearse Island	15274713	CG DL 5463 G03506208001 – L 5463 and CG Sketch DL 5463 G03506208099 – L 5463	PS22270 PID 015-274-713
2	Pearse Island	2423130	PCOR02Tr09 – L538	-
3	Pearse Island	2304790	PCOR02Tr09 – L6540	-
4	Pearse Island	24768685	PP15521 – L 7235	PP15521 PID 024-768-685
5	Pearse Island	24768693	PP15522 – L 5431	PP15522 PID 024-768-693
6	Pearse Island	24768561	P03Tu1834 – DL 8069 and PRP45456 – DL 8069	PP15524 PID 024-768-561

Table 1.3–2 – Private Land Interests

	General Area	Parcel Identifier Number	Applicable Survey Plans	Land Title Information
7	Pearse Island	1558040	District Lot 791	Section 17 Land Reserve
8	Pearse Island	2304660	PCOR44Tr14 – L 6539	-
9	Pearse Island	2485950	PCOR43Tr15 – L3955	-
10	Arrandale	10220577	EPC001515.1481153757 – DL 5 and EPC001903.1546039197 – DL 5	TITLE-9143I PID 010-556-729 CA5905553 PID 010-220-577
11	Arrandale	10556729	EPC001515.1481153757 – Plan DD 9143-1 and EPC001903. 1546039197 – Plan DD 9143-1	-
12	Arrandale	No IPIN	EPC001515.1481153757 – DL 198 and EPC001903. 1546039197 – DL 198	-
13	Arrandale	No PIN	EPC001515.1481153757 – DL 689 and EPC001903.1546039197 – DL 689	-
14	Arrandale	90154149	EPC001515.1481153757 – DL 8146 and EPC001903.1546039197 – DL 8146	-
15	Arrandale	90154148	EPC001515.1481153757 – DL 8145 and EPC001903.1546039197 – DL 8145	-
16	Arrandale	10220496	EPC001515.1481153757 – DL 688 and EPC001903.1546039197 – DL 688	CA5905555 PID 010-220- 496
17	Xmaat'in	24928763	P07Tu1867 – DL 7234	PS1111 PID 024-928-763
18	Xmaat'in	24769037	P13Tu1835 – DL 5432	PP15518 PID 024-769-037
19	Xmaat'in	24769126	P14Tu1835 – DL 628	PP15516 PID 024-769-126
20	Xmaat'in	24771449	P15Tu1835 – DL 628A	PP15517 PID 024-771-449
21	Xmaat'in	24768600	P01Tu1836 – DL 627	PP15515 PID 024-768-600
22	Wales Island	7743483	CG DL1387 G02882136001 – L 1387 and CG Sketch DL 1387 G02882136099 – DL 1387	BB1058137 PID 007-743- 483
23	Wales Island	2245480	PCOR28Tr15 – L 6922	-
24	Wales Island	2557780	PCOR28Tr15 – L 7311	-
25	Wales Island	2552490	PCOR28Tr15 – L 7195	-
26	Wales Island	2552360	PCOR28Tr15 – L 7194	-

Table 1.3–2 – Private Land Interests

	General Area	Parcel Identifier Number	Applicable Survey Plans	Land Title Information
27	Wales Island	2486150	PCOR43Tr15 – L 3957	-
28	Wales Island	2486280	PCOR43Tr15 – L 3958	-
29	Wales Island	2486020	PCOR43Tr15 – L 3956	-
30	Somerville Bay	2299230	District Lot 5439	Expired inactive reserve
31	Somerville Island	2389400	District Lot 173A	Crown Grant

NOTE:
-: not applicable

1.3.2 Proximity to Environmentally Sensitive Areas

Figure 1.3–6 shows the locations of key environmental features within Canada that are in the vicinity of the Site, including environmentally sensitive areas such as critical habitat for species at risk, historical occurrences of listed species, old growth management areas, estuaries, Wildlife Habitat Areas, Provincial Parks, Ecological Reserves, Protected Area or Conservation Area. No national or regional parks, Indigenous Protected and Conserved Areas, United Nations Educational, Scientific and Cultural Organization World Heritage Sites, marine protected areas, marine refuges, or ungulate winter range, are within 50 km of the Site.

Environmentally sensitive areas are considered areas of high wildlife value due to their role in key life stages (e.g., nesting, rearing) or sensitive ecosystems (e.g., wetlands). As identified during Site surveys completed between May 2021 and June 2022, environmentally sensitive areas/features in the LAAs and RAAs include:

- Three bald eagle nests in the eastern portion of the Site. Bald eagle nests are protected year-round under the BC *Wildlife Act*
- Nine amphibian breeding sites, which were identified during amphibian surveys and incidental detections within the Terrestrial Wildlife Local Assessment Areas (**LAA**). This includes seven western toad breeding sites. Confirmed amphibian breeding sites are wetlands where amphibian eggs, tadpoles, or juveniles have been detected
- Marbled murrelet critical habitat, which occurs throughout the Terrestrial Wildlife Regional Assessment Area (**RAA**). Project-specific TEM mapping indicates that effective breeding habitat for marbled murrelet is concentrated in the northern, central, and eastern portions of the Terrestrial Wildlife LAA. Marbled murrelets were detected during surveys and incidentally in the Marine Terminal RAA

- Northern goshawk, *laingi* subspecies, which was detected once in the Terrestrial Wildlife LAA. No nests were detected. Effective northern goshawk breeding habitat occurs in several areas of the Terrestrial Wildlife LAA
- Effective western screech-owl, *kenniicottii* subspecies breeding habitat, which occurs throughout the Terrestrial Wildlife LAA. No western screech-owl were detected in the Terrestrial Wildlife LAA
- Effective grizzly bear spring and fall foraging habitat, which occurs primarily in the northern and western portions of the Terrestrial Wildlife LAA. Grizzly bear was observed incidentally four times, including three detections in Whiskey Bay
- Detections of little brown myotis, a federally designated species at risk, at five locations. There are two areas where high levels of bat foraging activity were detected within the Terrestrial Wildlife LAA. No bat roosts or hibernacula were detected
- Ecological communities of conservation concern make up 50.7 ha of the Vegetation and Wetlands LAA (17%) and 83.8 ha of the RAA (14%). Of these, four red- and two blue-listed ecological communities have been documented in the LAA, including upland forest, floodplain forest, swamp forest, and estuarine marsh and meadow ecosystem types
- Old forest (between 250 and 400 years old) covers 141.6 ha (50%) of the Vegetation and Wetlands LAA and 347.1 ha (58%) of the RAA. Very old forest (greater than or equal to 400 years old) was not detected during field studies and not mapped within the RAA
- 12 wetland site series representing five wetland classes are present in the Vegetation and Wetlands LAA and RAA. Ecologically important wetlands total 96.1 ha (34% of the LAA) and 123.3 ha in the RAA (21% of the RAA)
- Biologically sensitive areas observed during marine field studies at the Site included glass sponge reefs (Class Hexactinellida) observed in the northwest side subtidal zone of Pearse Island, several small eelgrass patches (*Zostera* spp.) in the lower intertidal zone of northwest Pearse Island and Whiskey Bay, and a fringing band of bull kelp (*Nereocystis luetkeana*) growing on portions of the exposed rocky shoreline within the northern tip of Pearse Island

The shipping route intersects, or passes in proximity to, several ecologically and biologically significant areas. These areas are defined as having relatively higher ecological or biological significance than surrounding areas (DFO 2004). Additional information on sensitive marine areas can be found in Section 7.9 (Marine Resources). Information regarding important wildlife areas along the marine shipping route (e.g., marine bird colonies) is included in Section 7.7 (Wildlife and Wildlife Habitat). Figure 1.3–7 shows the locations of key environmental features in the vicinity of the shipping route including Marine Protected Areas, Rockfish Conservation Areas, Fisheries and Oceans Canada (**DFO**) Important Areas, Marine Parks, Ecological Reserves, Protected Areas and Conservancy Areas.

1.3.3 Archaeological Setting

The land and marine areas at northern Pearse Island have been inhabited by the Nisga'a people for millennia. There are numerous recorded archaeological sites in this region on the Province's Remote Access to Archaeological Data application and many areas are modeled as having high potential for archaeological sites.

In total during field programs, six archaeological sites were recorded within the Project area that is anticipated to be cleared or have ground disturbance (including terrestrial, intertidal and subtidal areas), all consisting of pre-1846 CMT sites. For additional information see Section 7.15 Archaeological and Heritage Resources.

1.3.4 Federal Lands and Indigenous Territories

The Project is being developed in collaboration with the Nisga'a Nation on a Site located within the Nass Area on Category A lands that are owned and controlled by the Nisga'a Nation. The Nisga'a Nation has constitutionally protected treaty rights and interests within the Nass Area as established in the Nisga'a Treaty (NLG 1999). There are no federal lands within or adjacent to the Site. The nearest federal lands are a fish hatchery approximately 15 km from the Site and First Nation Indigenous Reserve Lands more than 25 km away. The Site is approximately 1.5 km from the international border with the United States.

The traditional territories of Lax Kw'alaams Band, Metlakatla First Nation, Kitsumkalum First Nation, and Kitselas First Nation overlap the Project footprint, and marine shipping (transit) route between the Site and the BC Pilots boarding station at Triple Island (Figure 1.1–3). The materials and supply shipping route from Prince Rupert/Port Edward (to the Site) intersects with the northern extent of Gitxaała Nation and Gitga'at First Nation traditional territories and the open water assessment area (including a portion of the marine shipping route between Triple Island and the 12 nm Canadian territorial sea limit) intersects with the northern extent of Haida Territories, as identified by Haida Nation. The Project footprint and marine shipping route may overlap with Métis Nation British Columbia harvesting areas.

A description of the territories of each of the Indigenous nations and identified overlap with the Project components is provided in Sections 11.0 to 19.0. Maps of the territories of the Indigenous nations engaged on the Project in relation to the Project footprint and marine shipping route are shown on Figure 1.3–8 (note that territory boundaries for Métis Nation British Columbia are not available, however the Proponent understands that Métis Nation British Columbia may have interests near and at the Site and in the marine areas of Portland Inlet and Portland Canal). Table 1.3–3 shows the distances from the Project footprint, marine shipping route, and open water marine shipping route to Indigenous reserves[2]. Information on land and marine uses, and culturally and locally important features of the landscape identified by each Indigenous Nation can be found in the relevant Indigenous interest assessment sections (Sections 11.0 to 19.0). A summary of the Proponent's engagement activities with each Indigenous Nation is provided in their respective Indigenous interest sections (Section 11.0 to 19.0).

[2] Table 1.3–3 is limited to reserves located within 130 km of the identified Project components.

Table 1.3–3 – Distance from the Project Area and Shipping Route to Nearby Indigenous Reserves

Indigenous Reserve	Distance to Project Footprint (km)	Distance to Open Water Marine Shipping Route (km)	Distance to Marine Shipping Route (km)
Lax Kwa'alaams Band			
Alastair 80	117	101	78
Alastair 81	120	101	78
Alastair 82	123	100	78
Bill lake 37	68	50	22
Carmn Creek 38	51	68	37
Channel Islands 33	69	3	15
Dundas Islands 32b	59	<1	23
Dzagayap 73	97	94	68
Dzagayap 74	97	98	71
Ensheshese 13	57	38	19
Ensheshese 53	57	38	19
Gitandoiks 75	99	100	73
Gitandoiks 76	99	101	74
Kasika 36	70	48	19
Kasika 71	94	89	62
Kasika 72	92	89	62
Kasiks River 29	86	82	54
Kateen River 39	46	68	33
Khutzemateen 49	47	62	31
Klakelse 86	109	128	96
Knamadeek 52	53	36	17
Knames 45	27	56	10
Knames 46	27	56	10
Ksagwisgwas 62	77	66	37
Ksagwisgwas 63	85	66	39
Ksames 85	106	121	93
Kstus 83	96	111	83
Kstus 84	92	110	80
Ktamgaodzen 51	46	33	8
Kyex 64	86	63	37
Lachmach 16	80	52	24
Lakgeas 87	121	140	108
Maganktoon 56	30	42	6

Table 1.3–3 – Distance from the Project Area and Shipping Route to Nearby Indigenous Reserves

Indigenous Reserve	Distance to Project Footprint (km)	Distance to Open Water Marine Shipping Route (km)	Distance to Marine Shipping Route (km)
Maklaksadagmaks 41	60	30	6
Meyanlow 58	57	54	32
Ndakdolk 54	59	40	21
Nishanocknawnak 35	65	45	19
Prince Leboo Island 32	80	0	15
Psacelay 77	103	102	76
Salvus 26	94	88	62
Spanaknok 57	61	48	26
Spayaks 60	73	50	20
Tsemknawalqan 79	110	101	76
Wilskakammel 14	64	49	24
Wudzimagon 61	80	51	23
Zayas Island 32a	71	10	30
Birnie Island 18	49	78	8
Burnt Cliff Islands 20	60	45	9
Finlayson Island 19	53	22	2
Far West Point 34	77	1	14
Ksabasn 50	47	32	7
Ksadagamks 43	33	39	4
Ksadsks 44	39	33	5
Lax Kw'alaams 1	52	22	4
Maklaksadagmaks 42	29	43	12
Me-yan-law 47	35	42	6
Spakels 17	32	46	7
Spokwan 48	34	45	8
Toon 15	57	54	33
Tymgowzan 12	44	31	4
Union Bay 31	45	34	8

Table 1.3–3 – Distance from the Project Area and Shipping Route to Nearby Indigenous Reserves

Indigenous Reserve	Distance to Project Footprint (km)	Distance to Open Water Marine Shipping Route (km)	Distance to Marine Shipping Route (km)
Metlakatla First Nation and Lax Kw'alaams Band Co-Managed Reserves			
Khyex 8	90	61	36
Lakelse 25	122	140	109
Meanlaw 24	94	45	22
Red Bluff 88	29	91	15
Willlaclough 6	90	31	6
Tsimpsean 2a	67	23	4.3
Metlakatla First Nation			
Avery Island 92	97	5	10
Rushton Island 90	94	10	5
Grassy Bay	79	36	6
S1/2 Tsimpsean 2	70	23	4
Shoowahtlans (Shawtlans) 4	77	37	6
Tuck Inlet 89	65	64	28
Tugwell Island 21	78	47	8
Wilnaskancaud 3	78	36	6
Kitsumkalum First Nation			
Dalk-ka-gila-quoeux 2	107	139	93
Kitsumkaylum 1	109	138	96
Zimagord 3	109	134	96
Kitselas First Nation			
Chimdimash 2	121	159	107
Chimdimash 2a	122	160	108
Ikshenigwolk 3	126	167	111
Ketoneda 7	121	165	106
Kitselas 1 (Gitaus)	120	154	106
Kshish 4 (includes Kshish 4a)	119	151	105
Kshish 4b	121	152	107
Kulspai 6	118	144	104
Zaimoetz 5	120	150	106
Gitxaała Nation			
Dolphin Island 1	137	42	47

1.4 Project Components

The Project will consist of two FLNGs, each with liquefaction processing units, and a total nominal capacity of 12 million tonnes per annum of LNG. The main refrigerant compressor drives are electric motors. At full build-out, the Project will receive between 1.7 and 2 billion cubic feet per day (Bcf/d) (i.e., 48.1 and 56.6 million m^3 per day) of pipeline grade natural gas. Total gross product storage capacity will be 490,000 cubic metres (**m^3**) of LNG divided between the two FLNGs.

The Project's FLNGs and onshore components, their configuration, and certain technology selections will be developed during FEED, informed by the Project's engagement with regulatory authorities and Indigenous nations. Available information is shared in the following subsections.

1.4.1 Temporary Construction Components

Temporary Project components and early construction activities may consist of the following:

- An initial temporary pioneer dock (e.g., for unloading construction equipment and supplies)
- Site access trails
- Temporary diesel power generation
- Modular construction offices
- An on-Site concrete batching plant
- Temporary fuel storage areas
- Overburden storage areas
- A temporary floating hotel (floatel) used to house construction workers during the Site preparation and construction phase.
- An offshore anchorage area for construction equipment and supply barges

Other temporary facilities may be incorporated at the Site as determined in FEED.

1.4.2 Onshore Components

Onshore Project components include:

- Natural gas receiving station including:
    - Fiscal metering
    - Pig receiver
- Site natural gas distribution piping
- Electrical substations and Site electricity distribution systems
- Water desalination, potable water treatment and wastewater treatment plants
- Firewater storage, distribution and protection equipment
- Potential surface water stream diversion structure and pumping equipment

- Backup diesel power generation equipment
- Diesel fuel storage tank(s)
- Instrument air and utility nitrogen generation systems
- FLNG cooling systems (closed-loop systems using water as the cooling medium)
- Buildings:
  - Control Building
  - Administrative building (including medical clinic)
  - Maintenance workshop and warehouse
  - Permanent operation accommodations
  - Emergency response building, which may be combined with another building
  - Security office
- Monitoring equipment and instrumentation
- Interconnecting piping and cabling on piperacks
- Connecting roads and security fencing
- Helipad

1.4.2.1 Feed Gas Receiving Facility

The receiving facility will be located onshore at the Site and will connect the Project to the marine segment of the feed gas pipeline. It will include a pig receiver and custody transfer metering equipment to measure the amount of natural gas received at the facility.

1.4.2.2 LNG Process Cooling

The onshore FLNG process cooling system will be a closed loop system using fresh water to cool the refrigerants used in the LNG production process. The source of water and volumes required to fill the system will be determined during FEED.

The cooling medium (water) which is supplied to the heat exchangers on each FLNG is circulated via onshore pumps to air-cooled heat exchangers also located onshore. These air-cooled exchangers use electrically driven fans to blow ambient air across the tubes in the exchangers to cool the water prior to returning it to the FLNGs. The water circulates in a continuous, closed loop from each FLNG to dedicated equipment onshore.

1.4.2.3 Operations accommodations

A permanent on-Site accommodation is planned for the northwest side of the Project footprint, east of Whiskey Bay. The operation accommodation will have space for up to 300 workers at full capacity.

1.4.2.4 Electrical Substations and Site Electricity Distribution Systems

Substations and electricity distribution system will be installed on Site. The Main Substation will receive high voltage (287kV) electrical power from the third-party transmission line and distribute power (at reduced voltages) to smaller substations, the FLNGs, and the plant buildings.

1.4.2.5 Other Components

Other onshore components include a control building, administrative building, a medical clinic (which will be located within one of the other main buildings, such as the administrative building), maintenance workshop and warehouse, emergency response building/area (which may be attached to or within another building) and security office.

Raw water during operation will be obtained primarily through desalination and augmented by rainwater. Raw water will be treated to provide potable water for personnel and the FLNGs, and demineralized water for the power barges (should they be required). The volumes of water required from the various sources to meet system requirements will be determined during FEED; however, if power barges are required it is currently estimated that an average of 25 cubic metres of treated water per hour will be required for operation. Requirements would be less if power barges are not required, or when they are removed from Site when the permanent power grid becomes available.

The desalination system will include a seawater intake station located at the MOF that includes pumps to convey seawater to the desalination plant. The desalination plant will include a treating process to produce demineralized water that will be conveyed by pipe to the power barges (if required), and a reverse-osmosis permeate process will produce polished reverse osmosis (RO) water that will be conveyed by pipe to the firefighting water storage tank, the potable water storage tank, and the FLNGs. Wastewater from the desalination process will be directed to a marine outfall. The wastewater will essentially be concentrated sea water (i.e., total dissolved solids concentration of approximately 91,000 mg/L). Desalination wastewater flow will be approximately 5.4 m^3/hr. If power barges are required, the total desalination wastewater flow will be approximately 11 m^3/hr. The marine outfall will be located at a nominal depth of approximately -30 m chart datum and will have diffusing features to maximize dispersion. Discharged wastewater will comply with the *Environmental Management Act* Waste Discharge Regulation.

Rainwater and surface water (if used) would be treated using the same reverse-osmosis permeate process as seawater. Surface water would be conveyed to the water treatment plant using pipes and pump stations. Rainwater would be collected from the roofs of Project buildings and stored in cisterns for Project use. Based on average rainfall for the region and the area of Project building roofs (Accommodation, Administration and Maintenance/Warehouse) it has been estimated that an annual average of 18,700 m^3 of rainwater could be collected at the Site. Rainwater would be piped from the cisterns to the water treatment plant for processing.

Utilities (including water, instrument air, nitrogen, and power) will be distributed to onshore components and the FLNGs via interconnecting piping and cabling racks.

Facility components will include diesel fuel storage and backup diesel power generation equipment. The backup generators would only operate if the power grid is unavailable and would provide essential power required for safety systems and those needed to support the personnel at Site.

Plant safety and control systems will be located onshore and on the FLNGs, as well as firewater storage, distribution and protection equipment.

1.4.3 Marine Terminal Components

Marine terminal components include:

- Two jetties and platforms, each connecting one FLNG to the shore
- MOF, tug berths and a supply/personnel jetty
- Potential temporary power barges (including an onshore cooling water system)

The minimum required water depth at the marine terminal will be determined during FEED, however, it is not anticipated that dredging will be required.

A Navigational Safety Assessment (**NSA**) is a Project requirement (Appendix E). The NSA is being conducted in two phases, the first phase includes a desktop navigation simulation that assesses the feasibility of the route for the proposed design vessels (see Section 7.11 Marine Use). The second phase of the NSA will be completed during detailed Project planning and will include Full Mission Bridge Simulations that simulate berthing maneuvers for the marine terminal and recommend tug specifications. This work will be completed with inputs from the Pacific Pilotage Authority (PPA) and BC Coast Pilots (BCCP). Berthing tug provisions will be consistent with other certified LNG marine terminals globally, with an appropriate number of tugs assisting during vessel berthing / deberthing and on standby during marine terminal loading operation. The location where tugs will be based will also be determined during detailed Project planning.

The Project will provide the results of Full Mission Bridge Simulations, tug specifications, berthing procedures, and marine terminal operating limits to Transport Canada, the PPA and the BCCP six months before the start of commissioning and operation. Preliminary metocean limits are provided in the Terminal Plans and Cargo Transfer Report (Appendix E).

The marine terminal will include a docking assist system to facilitate in berthing / deberthing of the LNG carriers and NGL vessels. Docking assist systems are standard equipment for marine terminals around the world and provide a visual display of the approach angle and berthing velocities relative to the marine terminal berth structures. This provides pilots with information to assist with the safe berthing of the LNG carriers and NGL vessels. The pilots will also carry portable pilot units (**PPU**) to assist with navigation and berthing operation.

Aids to Navigation will be installed to identify the marine terminal, guide local marine traffic, and assist the BC Coast Pilots during berthing and unberthing the LNG carriers and NGL product vessels. Aids to Navigation will conform to Canadian requirements.

1.4.3.1 FLNG Connecting Jetties and Platforms

Two pile supported jetties and platforms will be constructed to provide safe access from the shore to the FLNGs. The jetties will also support the cooling water piping, potable water piping, feed gas piping, and electrical cabling that supply each FLNG.

1.4.3.2 Material Off-loading Facility

A dedicated MOF will extend from DL 5431 to the proposed Water Lot for the offloading of equipment and supplies, to allow mooring of tugs that are at the terminal to assist with berthing activities, and potentially to secure the temporary power barge(s). The MOF will accommodate roll-on/roll-off equipment to enable the transport of heavy equipment to the Site, as well as more traditional shipping vessels. The proposed location of the MOF is in water shallower than approximately 20 m as informed by available bathymetry. Geophysical marine assessments will inform the MOF and potential temporary power barge berth design.

1.4.4 Floating LNG Processing Units

Liquefaction processing units will be installed on the two FLNGs located at the Site. Each FLNG, including the hull, mooring systems, process facilities, safety systems, LNG storage and off-loading systems, will be designed and constructed in compliance with applicable codes and standards as well as standards of the American Bureau of Shipping Classification Society (where applicable).

Each FLNG will include the following:

- Feed gas pre-treatment systems that include:
    - Acid gas removal unit (AGRU)
    - Dehydration unit
    - Mercury removal unit
- Processing and storage systems including:
    - Multiple liquefaction trains
    - Heavy hydrocarbon removal system
    - Condensate stabilization and storage
    - Refrigerant storage
- LNG storage for a total of 490,000 m^3, divided between the two FLNGs, with the associated LNG transfer pumps
- Mooring systems (e.g., sub-tidal anchors and chains and inter-tidal or onshore piles) for FLNGs

- LNG ship-to-ship off-loading equipment incorporating loading arms with a total capacity of 12,000 m^3/hour per FLNG
- Boil off gas (**BOG**) management – BOG from LNG storage and LNG loading systems will be recompressed and sent back for reliquefication
- Emergency flaring systems
- All utilities (except for the onshore cooling medium loop, potable water, and electrical power) required for FLNG operation

The FLNGs will include several other facilities, including natural gas and LNG transfer piping and interconnection, electric power distribution, fire and gas detection equipment, automated control and safety systems, firewater pumps, and emergency egress facilities.

1.4.4.1 Feed Gas Pre-Treatment

Certain impurities (carbon dioxide [**CO_2**], hydrogen sulfide [**H_2S**], mercury and water) must be removed from the natural gas before it can be introduced into the LNG production equipment. This is due the potential to harm LNG production equipment, LNG carriers, and LNG regasification equipment at customer facilities. The equipment to remove impurities will be on the FLNGs. The configuration of that equipment is expected to consist of:

- **Acid Gas Removal Unit (AGRU)** – removes CO_2 and H_2S from the feed gas and incorporates an amine storage and handling system. Process heat for this system is provided by natural gas fired heaters supplemented by electric heaters that circulate a heating medium in a closed loop on each of the FLNGs
- **Dehydration Unit** – removes trace water content to prevent freezing in the liquefaction trains
- **Mercury Removal Unit** – reduces trace mercury content in the feed gas to meet LNG delivery specifications and protect aluminum equipment from corrosion.

1.4.4.2 LNG Production

LNG is produced using a liquefaction technology that takes a natural gas stream and cools it to cryogenic temperatures (-162°C) at which point the natural gas converts from gas to liquid. The process uses a single mixed refrigerant through a refrigeration loop. The refrigerant is composed of a proprietary mix of hydrocarbons including methane, which is extracted from the incoming gas stream, and nitrogen which is produced by a nitrogen generator located on the FLNGs. The remaining hydrocarbon refrigerants are purchased and delivered to the Site by barge and then stored in dedicated tanks on the FLNGs. Refrigerants are typically shipped in portable tanks specifically designed to transport hydrocarbons. The Proponents expect that these shipments will be transferred to the Project via a port of entry such as the Port of Prince Rupert.

Large, electrically driven compressors are used to compress the mixed refrigerant that is circulated through the refrigeration loop. Refrigerant exiting the compressors requires cooling before it enters a cryogenic heat exchanger. This cooling of the refrigerant takes place in heat exchangers located on the

FLNG. Water is used as intermediate liquid to cool the refrigerant and is circulated to air-cooled heat exchangers located onshore that use electrically driven fans. The refrigerant circulation and the cooling water circulation take place in closed loop systems (i.e., none of the liquid being circulated is exposed to the atmosphere).

Once the refrigerant is cooled onboard the FLNG, it passes through an expansion valve that causes rapid cooling of the refrigerant, to temperatures required to convert natural gas to LNG. The exchange of the cold refrigerant with the natural gas takes place in cryogenic heat exchangers referred to as cold boxes. Within the cold box, heat is transferred from the natural gas to the refrigerant. After a first pass through the cold box, the natural gas stream reaches a temperature at which heavier hydrocarbons liquefy and can be removed from the gas stream. The heavier hydrocarbons are directed to a condensate stabilizer to remove any lighter hydrocarbons from the stream.

Once the heavier hydrocarbons are removed, the natural gas once again enters the cold box, where it is further cooled to -162ºC. At this temperature, the natural gas converts to a liquid and the liquefied natural gas exiting the cold box flows to the LNG storage tanks located in the hull of the FLNG.

1.4.4.3 Condensate Management

The remaining heavy hydrocarbons are called condensate and are a by-product of NGL extraction. The condensate from the liquefaction process is directed to storage tanks located on the FLNGs. Condensate production volumes are dependent on the composition of the feed gas received at the facility.

Condensate will be loaded on a periodic basis (e.g., approximately every 30 to 40 days) onto conventional NGL product vessels. Volumes to be shipped are uncertain at this stage of engineering but a single shipment could be 5,000 m^3 or more. Condensate export will be conducted by third party shippers who will load condensate from the FLNGs; the NGL product vessels are then anticipated to depart following the same shipping route as LNG carriers travelling west past Triple Island, the northern end of Haida Gwaii and into open waters. Based on current planning and design, condensate will not be off-loaded through the Port of Prince Rupert and moved inland by rail.

1.4.4.4 LNG Product Storage and Boil Off Gas Management

LNG will be stored temporarily in tanks located on the FLNGs between LNG carrier loadings. LNG storage capacity at the Site is currently designed for approximately 490,000 m^3 gross capacity and will be contained in multiple tanks located in the hull of the FLNGs. Although the FLNG storage tanks will be insulated, some heat migration into the LNG will occur, producing vapour known as boil-off gas, or BOG. Each FLNG will include electrically driven BOG compressors, which will recompress low-pressure BOG from the LNG storage tanks and reintroduce it to the high-pressure inlet of the liquefaction process.

1.4.4.5 Flares

Emergency flare systems will be located on each FLNG. The following assessments will be completed as part of the flare design:

- Evaluation of the flare radiation with respect to the facility layout
- Estimation of flare sizing considering the process and safety design requirements

Flare sizing and design will be further confirmed during FEED.

1.4.5 Temporary Operational Power Supply

The Project will connect to the BC Hydro grid for renewable power supply. In the event the interconnection to the BC Hydro grid is delayed, the Project proposes to use temporary floating power barges that use natural gas from the feed gas supplied to the Project. Temporary power generation will allow the Project to produce LNG and meet contractual LNG delivery obligations until the BC Hydro grid connection is complete and in operation, after which the power barges will be decommissioned and removed from Site.

The Project's temporary power barges will incorporate a high-efficiency gas fired power plant design that uses both gas and steam turbine equipment.

The temporary power barges will be designed to the following criteria:

- Natural gas fired (no backup fuel oil)
- On-Site fuel gas compression will not be required because the gas pressure of the arriving natural gas pipeline will be in the order of 70-80 bar gauge, which is higher than the required turbine fuel gas inlet pressure. Fuel gas pressure will be reduced to suit gas turbine fuel gas pressure requirements
- Fuel gas conditioning such as dew point control and filtration will be required to meet the gas turbine equipment manufacturer's fuel specification requirements
- The gas fired power plant uses both gas-fired turbines and steam turbines to generate power. Hot exhaust gas from the gas turbines is used to boil demineralized water; the resulting steam is used to drive the steam turbines and produce power. The steam circulates to a condenser, which is a heat exchanger that returns the steam to a liquid state for recirculation in the closed demineralized water loop. Cooling water from a closed loop, onshore system is used as the heat transfer medium in these condensers. The use of the waste heat from the gas turbines to produce steam and generate additional electricity is more efficient (and results in lower greenhouse gas (**GHG**) emissions) than power generation solely using gas turbines.

The temporary power barges will be designed with operating capabilities so that the facility can start-up and operate if the connection to the BC Hydro grid is delayed. However, parallel operation of the temporary power barges with electricity sourced from the BC Hydro grid is not planned. Upon connection to the BC Hydro grid, the temporary power barges will no longer be required.

The Project's temporary power barge generation facilities will be designed to comply with the Canadian Electrical Code - Part 1, Canadian Standards Association C22.1-12 with Standards Association amendments. In addition, the temporary power barge(s) will be designed to meet Canadian safety standards along with all applicable laws and regulations.

1.4.6 Third-Party Components

The Project will be supplied with natural gas via a third-party pipeline and with electricity via a third-party transmission line. Third party marine shippers will own, insure, and operate the LNG carriers and NGL product vessels calling on the Project.

1.4.6.1 Pipeline

Ksi Lisims LNG Limited Partnership has entered into an agreement with TC Energy to conduct work on the Prince Rupert Gas Transmission (**PRGT**) project, to preserve the regulatory permits, prepare amendments for a potential delivery point to the Site, and develop work plans for the next phase, subject to further agreements being entered into. The PRGT project holds an EAC (#E14-06) that remains valid through November 25, 2024. The PRGT EAC allows for transportation of pipeline grade natural gas from the Western Canadian Sedimentary Basin to the District of Port Edward by an approximately 900 km long natural gas transmission pipeline, traversing both land and marine routes. The PRGT project's EAC is explicit in stating that the pipeline is approved to only transport sweet natural gas. TC Energy would be responsible for obtaining any additional regulatory approvals as well as potentially constructing, operating, and owning this pipeline.

To accommodate an amended marine pipeline route with a delivery point at the Site, an amendment to the PRGT EAC would be necessary. While specific details regarding TC Energy's efforts and the timeline for the EAC amendment were not known at the time of writing (October 2023) it is expected that the amended route will consist of two shorter subsea pipelines diverging from the currently approved route and terminating at the Site. Potential effects associated with the amended route would likely be either similar or less adverse to what was concluded in EAO's Project Assessment Report for the marine portion of the pipeline (BC EAO Nov. 12, 2014). Existing marine EAC requirements for the marine environment are expected to address potential effects as documented in the EAO's Assessment Report including, but not be limited to, the following:

- Alteration of marine habitat:
  - Nearshore habitat has a potential to be affected where the pipeline makes landfall at the Site. Potential effects may include alteration of subtidal and intertidal habitats through burial of the pipeline,
  - Offshore mud substrate are abundant, the subsea pipeline would result in an increase in hard substrate on the seabed which is expected to be colonized by marine invertebrates and fish

- Potential disturbance or harm of marine species:
  - During construction it is expected that mobile marine species would be temporarily displaced
  - During pipeline burial activities harm or mortality of less mobile or infaunal species may occur
  - Pipeline burial activities are also expected to result in increase temporary total suspended solids, however levels are expected to drop rapidly with increase distance from construction.
  - Construction activities may result in a temporary increase in underwater noise levels that could result in changes in fish and marine mammal behaviour. Sounds levels may exceed thresholds for behavioural response but are not expected to exceed thresholds for harm or injury to marine mammals
- Potential alteration to marine use:
  - Construction activities may result in a short-term effect on marine use as vessels may need to transit around construction vessels and their safety zones
  - During operation, the pipeline will be buried or have rock protection in shallow waters. Exposed sections of the pipeline will be designed to withstand impacts from fishing gear and the pipeline will be marked on navigation maps

While there are potential socio-economic effects associated with construction of the pipeline section that would connect to the Site, it is unlikely that there would be any additional affects as a result of the amended pipeline (i.e., when compared to construction of the currently approved route), especially when considering the shorter route length compared to what has been approved in PRGT's existing EAC.

The PRGT Project and proposed marine route amendment have been included in the Project cumulative effects assessment for all Valued Components (VCs).

1.4.6.2 Transmission Line

A third party will undertake the design, routing, development, construction, operation and seek regulatory approval of a transmission line that would begin at a new BC Hydro substation in the New Aiyansh area and then travel through the Nass Valley primarily on Nisga'a Lands (as defined in the Nisga'a Treaty) to ultimately arrive at the Site.

The total length of the transmission line is approximately 95 km, with an assumed average width of 45 m and a voltage rating of 287 kilovolts. This voltage is below the environmental assessment triggers for electricity projects in the Reviewable Projects Regulation (GoBC 2019) under the *BC Environmental Assessment Act* (**BC EAA**) and the Physical Activities Regulation (GoCN 2019) under the *Impact Assessment Act* (**IAA**).

The transmission line from Nisga'a Lands to the Site (approximately 35 km) is included in the Application as a Project assessment area (the Transmission Line Assessment Area) that encompasses the likely transmission line route options (see Figure 1.4-1). See Section 6 for additional information regarding the inclusion of the Transmission Line Assessment Area and relevant VC sections for the assessment of transmission line works and activities within the designated Transmission Line Assessment Area (see Section 7).

The majority of the transmission line, i.e., the portion outside of the Transmission Line Assessment Area, is expected to be located on Nisga'a Land. The Nisga'a Nation intends to undertake a lead role in the assessment of the transmission line on Nisga'a Lands under Chapter 10 – *Environmental Assessment and Protection* of the Nisga'a Treaty and will be responsible for granting the land authorizations for the required right-of-way. The third-party provider will be responsible for applying for all necessary authorizations for the interconnection (including Crown authorizations for areas not on Nisga'a Lands).

Potential effects associated with the transmission line through Nisga'a land between New Aiyansh substation and the Transmission Line Assessment Area encompasses a range of considerations, but not be limited to the following:

- Alteration of surface water and fish habitat:
    - Construction activities may lead to short-term changes in surface water quality, such as increased levels of total suspended solids
    - Riparian vegetation removal and installation of temporary or permanent watercourse crossings or culverts may alter fish habitat.
- Change in vegetation and wetland:
    - Site preparation and clearing may affect wetland and plant species of interest, including plant species of conservation concern, botanical and cultural forest products, and invasive species.
- Disturbance to wildlife and alteration of wildlife habitat:
    - Construction activities may result in loss or alteration of wildlife habitat due to vegetation clearing and Site preparation activities
    - Wildlife behaviour may be influenced from sensory disturbance caused by light and noise effects associated with construction activities
    - Construction activities may increase risk of injury or mortality for wildlife species.

- Effects on local communities
  - Construction of the transmission line is expected to provide economic opportunities for the local community and different levels of government through direct and indirect employment and revenue (i.e., taxes)
  - Local and regional labour dynamics may experience temporarily shifts during construction, potentially leading to increased competition for labour among businesses
  - Transportation infrastructure, local accommodation, and emergency response availability may be temporarily affected during construction

The Proponents are engaging with BC Hydro to support the identification of required system upgrades and associated timeline for the delivery of the required power for the Project to a new substation in the vicinity of the New Aiyansh substation. BC Hydro electrical system enhancements are anticipated to include upgrades to existing BC Hydro substations and upgrades to existing power line corridors. There is potential that the system upgrades may be more intensive and require additional time to complete, which could delay access to grid power. In the event of a delay in connection to the BC Hydro grid, the Project will be powered by temporary alternative sources (i.e., power barges) (see Section 1.4.5 and1.9.3).

Electrification of the Project is not only a requirement to achieve emission targets, but it is also one of the key features of the Project for its investors and customers. The Proponents anticipate that an electricity supply agreement with BC Hydro will be one of the requirements for reaching a positive financial investment decision (**FID**) and commencing construction on the Project. The requirement for grid electricity supply by BC Hydro is consistent with the First Nation Climate Initiative's (**FNCI**) policy and blueprint for net-zero LNG development on the northwest coast of BC. Further, the interconnection transmission line is expected to provide the opportunity for additional power supply to enable improved electricity reliability in Nisga'a communities.

1.4.6.3 Marine Shipping

For the purposes of the assessment, the Proponents have defined the primary shipping routes anticipated for the Project as (see Figure 1.1–3):

- Marine shipping (transit) route – the route LNG carriers and NGL product vessels are expected to travel to/from the Site. This route is discussed/assessed as two routes:
  - Open water marine shipping route – identified travel route between the 12 nm Canadian territorial sea limit to the BC Pilots boarding station at Triple Island
  - Marine shipping route – identified travel route between Triple Island and the Site
- Materials and supply shipping route – two routes identified for the transport of materials, equipment, supplies, etc. and including personnel:
  - Between Prince Rupert/Port Edward and the Site
  - Between Gingolx and the Site

These routes are also discussed in Section 6.0 and Appendix E (the Navigation Safety Assessment).

LNG carriers, NGL product vessels, and tugboats will be owned, insured, and operated by third parties. The present estimate of LNG shipments per year is between 140 and 160, depending on the size of the LNG carriers used and the total LNG produced by the Project. LNG carriers calling upon the Project's terminal will normally range in size from 140,000 to 185,000 m^3. The typical method of LNG storage utilized by the LNG carriers will be LNG Spheres (such as those on Moss LNG carriers) or membrane tank systems. The facility will also be designed to receive larger LNG carriers with a nominal capacity up to 217,000 m^3. The design draft of these LNG carriers range from 11.4 m to 12.5 m when the LNG carriers are fully loaded. NGL product vessels are expected to call on the terminal 8 to 12 times per year and are anticipated to have a nominal capacity range of 5,000 to 30,000 m^3. All vessels are anticipated to follow the same marine shipping route (see Figure 1.1–3).

LNG carriers will comply with applicable federal and International Maritime Organization requirements and other applicable classification rules, international requirements and guidelines including:

- International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code, 1986)
- International Convention on Load Lines (LL, 1966)
- International Convention for the Safety of Life at Sea (SOLAS, 1974)
- International Convention for the Prevention of Pollution from Ships (MARPOL, 1973)
- Society of International Gas Tanker and Terminal Operators (SIGTTO, 1979)
- Oil Companies International Marine Forum guidelines (OCIMF, 1970)
- American Petroleum Institute guidelines (API, 1919)

To address marine safety and potential marine accidents and malfunctions, a Navigation Safety Assessment has been conducted as part of the Application. See Sections 1.4.3 and 9.0 for more information on the NSA.

Third-party tugboats will be used to safely assist berthing and unberthing LNG carriers and NGL product vessels. Tugboat moorage at the Site or at a nearby location (e.g., Gingolx harbour) will be determined during FEED and informed by the Project's engagement with regulatory authorities and local Indigenous communities.

LNG carriers and NGL product vessels are anticipated to enter Canadian waters from the west through Dixon Entrance, north of Haida Gwaii, and will pick up a BC Coast Pilot at a designated location west of, but near to, Triple Island. LNG carriers will be piloted between Triple Island and the Project's marine terminal by BC Coast Pilots to support the safe inbound and outbound transit of LNG carriers, consistent with applicable marine navigation laws and regulations.

With the pilots on board, LNG carriers will travel east, south of the Dundas Island group and then travel north through Chatham Sound, Main Passage, through Portland Inlet and then northeast into Portland Canal (Figure 1.1–3). The Project's marine shipping route and procedures for LNG carriers was informed by engagements with BC Coast Pilots, analyses and engagements with Indigenous communities, government agencies and stakeholders.

1.5 Project Activities

This section provides an outline of the expected activities that will take place during each phase of the Project.

1.5.1 Project Activity Updates

Table 1.5–1 provides an overview of Project activities and/or components that have advanced in design since submission of the Detailed Project Description.

Table 1.5–1 – Summary of Project Updates and Changes from the Detailed Project Description

Detailed Project Description Activity or Component	Updated Activity or Component	Rationale and Engagement Consideration
Not included in Project in DPD	Assessment of the portion of the third party owned transmission line that lies between Nisga'a Lands and the Site.	Consideration of this portion of the transmission line is based on feedback received during engagement with Indigenous Nations, the EAO and the Agency
Not included in Project in DPD	Assessment of the open water marine shipping route	Consideration of the portion of the marine transit route between Canada's territorial sea limit and the BC Pilot boarding station at Triple Island was added based on feedback received during engagement with Indigenous Nations, the EAO and the Agency
Not included in Project in DPD	Expansion of the Wildlife and Wildlife Habitat regional assessment area to include all of Pearse Island	Expanding the regional assessment area was made at the request of Environment and Climate Change Canada
Not included in Project in DPD	Expansion of the Wildlife and Wildlife Habitat regional assessment area to include Highway 113/Nisga'a Highway/ Nisga'a Highway between Gingolx and Highway 16	Expanding the regional assessment area was made at the request of Kitsumkalum First Nation
Not included in Project in DPD	Marine mammal survey area expanded to include Chatham Sound	Expanding the survey area was made at the request of various Indigenous Nations

Table 1.5–1 – Summary of Project Updates and Changes from the Detailed Project Description

Detailed Project Description Activity or Component	Updated Activity or Component	Rationale and Engagement Consideration
Not included in Project in DPD	Access road to the mooring anchors	On-going access to the mooring anchors is required for maintenance purposes
Not included in Project in DPD	Overburden areas for storage of excavated Site materials (i.e., organic top layer)	Long-term storage of organics and any soils
Not included in Project in DPD	Access road to the overburden site on DL 7235	Required for transport of materials from the sites of the land-based infrastructure and the largest overburden storage area
	Use of clear span bridges or arch culverts to cross all freshwater streams	Clear span bridges and arch culverts have a reduced impact on freshwater fish and freshwater fish habitat than other forms of crossing
LNG storage capacity on each FLNG vessel was 225,000 m^3	LNG storage capacity increased to 245,000 m^3 per FLNG	Increase provides additional storage space to support periodic tank inspections or if the LNG carrier is delayed because of poor weather or something similar. The change does not change LNG production rate.
Not included in Project in DPD	On-Site medical facility with two medical personnel, at least one of whom will be a nurse practitioner and/or paramedic.	Health and medical services limitations in the region, including shortages of family doctors and exceedance of emergency room and ambulance service capacity were identified during engagement. In response, the Proponents have committed to on-Site medical services that are beyond basic requirements

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1.5.2 Site Preparation and Construction

Construction will begin after all applicable regulatory requirements are satisfied and a positive FID is made. Detailed engineering and construction of the FLNGs is planned to begin shortly after FID. Construction at the Site is expected to take approximately three to four years and the facility is expected to begin commissioning as early as late 2027.

Site construction work is currently proposed to occur approximately ten hours per day, six or seven days per week, safety and weather permitting. Construction crews and staff will work at the Site on a rotational basis that will be specified in plans to be developed during a later phase of the Project.

Construction activities will occur predominantly during daylight hours, while some limited activities, such as testing, may occur at night. The construction schedule will be planned to consider environmental work windows (e.g., bird nesting periods) as feasible and applicable.

1.5.2.1 Onshore Facilities Construction Sequence and Activities

Upon mobilization of the onshore construction contractor, the general sequence of activities will consist of development of a beachhead, access to Site locations via roadways, development of laydown areas to service material storage, blasting and earthworks to level elevations, construction of permanent roadways, installation of foundations, equipment and piping modules staging and installation, and completion of electrical and instrumentation systems:

1) Early Works and Temporary Facilities:
    a) Early tree clearing
    b) Establishment of a pioneer dock and floatel
    c) Clearing, grubbing and grading for temporary / construction roads
    d) Placement of temporary facilities (offices, power generation, etc.)
    e) Clearing, grading and preparation of early laydown areas
2) Site Preparation:
    a) Clearing and blasting
    b) Removal of overburden and transport of same to storage areas
    c) General grading to rough elevations
    d) Grading and installation of permanent roadways
    e) Installation of surface water diversion structure(s) (if used for construction water)
3) Middle Phase Construction Activities:
    a) Formwork and placement of cast-in-place concrete foundations
    b) Placement of precast concrete structures
    c) Installation of underground piping and cabling
    d) Backfill, compacting and grading to final elevations
    e) Installation of permanent equipment
    f) Installation of steel piperack modules, steel structures and interconnecting piping

g) Installation of large electrical equipment (such as transformers) and pre-fabricated electrical substations
h) Installation and finishing for permanent, architectural buildings
i) Installation of perimeter fencing
j) Installation of Site water treatment for industrial and domestic use (includes potable water storage)

4) Final Phase of Construction Activities:
a) Electrical, instrumentation and telecommunications cabling installation and terminations
b) Installation of Site automation and safety system junction boxes, marshalling cabinets, and operator consoles
c) Installation of telecommunications and security systems
d) Complete tie-ins to the third-party electrical power transmission line
e) Complete tie-in to the third-party feed gas pipeline
f) Completion of plant permanent roads
g) Completion of piping and equipment insulation and heat tracing
h) Touch up painting and surface treatments (where required)

The following sections provide further details on some of the major construction activities listed above.

1.5.2.1.1 Early Works

1.5.2.1.1.1 Pre-Construction Activities

Pre-construction activities are defined as activities that must be completed as a predecessor to installation of permanent works. The first item that will be completed as a pre-construction activity prior to the main construction contractor mobilizing for Site preparation is tree clearing. The scope of the tree-clearing contractor will include stump removal to minimize the amount of remaining clear/grub required during Site preparation. Disposition of felled trees will be determined after further consultation with Project stakeholders.

1.5.2.1.1.2 Pioneer Dock

A pioneer dock shall be established to support commencement of the onshore construction activities. The pioneer dock is envisioned to be a floating barge that is spudded in place to allow marine vessels to offload materials, personnel and equipment for Site preparation and other early construction activities.

The pioneer dock will be floated to the Site via a tug and secured on the shore by spuds that provide a stable foundation. The location will likely be just north or south of the MOF; the final location will be chosen during detailed engineering, after Site investigations have been completed and the construction contractor has developed detailed execution plans. The pioneer dock will be sized to provide temporary Site access for all equipment, materials, personnel, and other deliveries required to support the construction schedule prior to completion of the material offloading facility (MOF).

Construction equipment offloaded onto this dock will range from all-terrain vehicles (ATVs) and light trucks to containers and storage space for early provisions, as well as the heavier construction equipment and supplies needed to begin Site preparation, road grading, and rock blasting.

1.5.2.1.1.3 Temporary Road Development

Clearing and levelling for construction roads and access trails from the pioneer dock to the location of the MOF will be one of the earliest construction activities. Secondary roadways will be developed to the locations selected for the concrete batch plant, the rock crusher(s), and the overburden storage area(s).

1.5.2.1.1.4 Temporary Facilities

Following completion of temporary construction roads, suitable areas will be cleared and prepared for temporary construction offices and utilities, including installation of temporary generators.

During this phase of the Project, construction personnel will reside in a floating accommodation commensurate with the headcount required to support these early activities.

1.5.2.1.2 Site Preparation, Earthworks and Blasting

Once temporary facilities are established, earthworks and Site preparation will commence. It is during this period that the blasting activity will take place. The locations and sizes of charges to be used will be calculated during detailed engineering.

A location for a rock crusher (or crushers) will be established on the footprint to disposition the blasted rock.

Overburden that has been cleared from the footprint and found to be unusable as backfill will be transported and placed in prepared areas where it will be stored for the life of the facility.

General grading will commence using heavy earthmoving equipment to prepare the Site to rough grade elevations. Sloped area and swales to account for stormwater drainage (and retention, if appropriate) will be established.

The rights of way for permanent plant roads will be graded to elevation and prepared with a base layer. Culverts and stream crossings (e.g., bridges) will be installed during this phase. These roads will be utilized for construction until being finalized during later stages of the Project.

Freshwater will be required for construction of the Project, and it is anticipated that on-Site water sources will be used. Details regarding the pumps, intake infrastructure, and the location of the intakes will be included in the *Water Sustainability Act* Section 10 Water Use permit application that will be submitted to the BC Energy Regulator. It is anticipated that the pumps will be located near access road crossings. Water withdrawals would only occur during the construction phase. During construction water would be pumped and stored for use as needed year-round. The physical footprint of the intakes and pumps used to withdraw water will be small (i.e., < 10 m^2).

1.5.2.1.3 Middle Phase of Construction Activities

The middle phase of construction activities occurs after the completion of Site preparation and construction of roadways. Installation of foundations to support installation of process equipment, buildings, structures, piperacks and all other permanent components occurs during this phase.

1.5.2.1.3.1 Concrete Foundations

Foundations for major equipment, pipe racks, buildings and structures are envisioned to be cast-in-place using concrete prepared at a batch plant (or plants) established at the Site shortly after Site preparation is completed. Aggregate and other materials (such as reinforcing bars, anchor bolts, etc.) required for the concrete foundations will be imported to the Site on barges, although excavated rock crushed at the Site will be evaluated to determine if some (or all) of it is appropriate for use as aggregate.

Precast concrete shapes will be evaluated during detailed engineering for use in place of cast-in-place structures. These concrete shapes would be produced at existing, permitted facilities in the region and imported to the Site on marine vessels. Use of precast concrete shapes, where feasible, will reduce the required construction workforce at the Site. Piles may be required; as such, pile driving may be completed as necessary.

1.5.2.1.3.2 Underground Piping and Cabling

In conjunction with installation of foundations, underground piping, and cabling (electrical and telecommunications) will be installed in open excavations or trenches.

1.5.2.1.3.3 Backfill to Final Elevations

Areas where foundations and installation of underground piping has been completed will be backfilled, compacted and brought to final elevation using earthmoving equipment. Stormwater drainage features (such as ditches) will also be finalized.

1.5.2.1.3.4 Installation of Equipment, Pipe racks and Steel Structures

Major equipment to be installed at the onshore facility include:

- Dry Air Cooling Towers (for the FLNGs' and power barges' cooling water systems)
- Cooling water pumps and drums
- Water treatment (including desalination) and wastewater treatment equipment and enclosures
- Storage tanks (firewater, potable water, raw water (including rainwater), diesel)
- Instrument air and utility nitrogen generation equipment
- Firewater pumps
- Emergency generators

Once foundations are in place, process and utility equipment will be transported from barges and/or the laydown area to each foundation via cranes and large flatbed trucks as identified in the equipment spreads. Large, heavy equipment or equipment modules may be transported directly from roll on / roll off marine barges via self- propelled modular transporters (**SPMTs**).

Piping and cable trays will be transported to the Site in pre-assembled pipe rack modules that will be transported from marine barges to their foundations via flatbed trucks or SPMTs, depending on the size and weight of the respective modules.

Interconnecting piping will be delivered to the Site in prefabricated spools and then installed (via welding or bolting) along with inline piping components such as valves and instruments.

1.5.2.1.3.5 Installation of Electrical Equipment and Substations

Electrical infrastructure installed at the onshore facility will include a main substation, area substations and transformers as required to distribute electricity to onshore users as well as to the FLNGs.

The main substation will receive 287kV electrical power from the third-party transmission lines that connect to BC Hydro's power grid. Transformers at the main substation will reduce the voltage before the electricity is distributed via switchgear and electrical cabling to area substations and to the FLNGs.

The main substation and the area substations will be prefabricated to the extent practicable and will likely arrive at the Site as prefabricated enclosures with all interior electrical equipment (switchgear, motor starters, uninterruptable power systems, etc.) installed and wired at the factory prior to shipment.

Prefabricated substations and outdoor electrical equipment will be transported from marine vessels to their foundations via flatbed trucks or SPMTs, depending on the size and weight of the respective components.

1.5.2.1.3.6 Architectural Buildings

Architectural Buildings at the onshore facility are comprised of those buildings normally occupied by personnel during operation. These buildings include the Central Control Building, an administration building, a warehouse / maintenance building, a security building, the accommodations building and, potentially, security guardhouses.

Materials of construction and specifications for each building will be determined during detailed engineering.

Construction methodology may vary for each building but will likely include a mixture of Site-erected (stick built) construction as well as installation of prefabricated building modules.

1.5.2.1.4 Final Phase of Construction Activities

Once equipment, pipe rack modules, and buildings have been installed on foundations, the final phase of construction activities can be initiated. Some overlap between middle and final phase activities will occur as areas of the Site progress and are completed at different rates.

1.5.2.1.4.1 Installation of Cabling

Electrical, instrumentation and telecommunications cables and wiring will be installed in cable trays, trenches, conduits and (potentially) on overhead lines to provide electrical power to users and to connect control, safety and communications systems and field devices.

1.5.2.1.4.2 Site Automation and Safety Systems

An integrated control and safety system will provide centralized control of all plant operating and safety systems, not only for the onshore facility but also for the FLNGs.

Field control and safety devices at the onshore facility and on the FLNGs will be wired to local area junction boxes installed around the facility. Signals are conveyed from the junction boxes via fiber optic cables or multi-conductor instrument cables to the Central Control Building via cable trays, trenches, or conduits.

Marshalling cabinets, servers and operator workstations will be installed in the Central Control Building. These components contain the hardware and software necessary to safely and efficiently operate the facility and will be tested at the factory prior to being shipped to the Site.

1.5.2.1.4.3 Painting and Insulation

It is anticipated that equipment, piping and other components (including prefabricated modules) will be painted off-Site, at their manufacturing facility, to the extent practicable. Touch-up painting will occur at the Site in accordance with applicable codes and standards.

Similarly, piping in modules will be insulated (if necessary) to the extent practical at the factory. Loose or interconnecting piping and equipment will be insulated at the Site. Thermal insulation at the onshore facility will predominantly be for the purposes of providing freeze protection for piping and equipment in water systems (potable, firewater, cooling water, etc.).

1.5.2.1.4.4 Connections to Plant Interfaces

Physical connections to the key plant interfaces, the third-party power transmission line(s) and the third-party feed gas pipeline, will occur during the final phase of construction activities. These connections will be accomplished via detailed procedures established and agreed between the parties.

Physical connection to the third-party pipeline will be accomplished via a bolted or welded connection at the battery limit of the facility.

Physical connection to the third-party transmission lines will be accomplished by terminating incoming conductors on electrical equipment at the main substation.

1.5.2.1.5 Construction Workforce Accommodation and Transportation

Construction worker access to the Site is anticipated to be via marine vessels originating from Gingolx or Prince Rupert/Port Edward.

The construction workers are expected to be housed in a floatel within the proposed Water Lot in Portland Canal. The floatel will provide self-contained electrical power, communications, potable water supply and waste containment systems. Sewage and grey water would be stored in tanks and then barged away for disposal at a suitable sewage treatment facility.

During early works, the floatel will likely be sized to fit a smaller crew and will be anchored near, or moored to, the pioneer dock. As crew sizes increase, a larger floatel will be obtained and moored to either the personnel dock or the MOF.

Barged water will be used during early months of construction; however, to accommodate long term construction water needs the Project may use surface water, rainwater or desalinated sea water. During construction, there will be no on-Site effluent discharge into the marine environment unless there is a water treatment facility on the floatel that would enable discharge of treated effluent.

1.5.2.1.6 Waste Management during Construction

Waste and effluents generated over the life of the Project will be managed, stored, and shipped to approved disposal locations on the BC mainland and in compliance with the applicable NLG, provincial and/or federal regulatory requirements and guidelines.

Potential solid wastes generated during construction and the management of theses wastes is provided in Table 1.5–2.

Table 1.5–2 – Solid Waste Management

Solid Waste	Management	Disposal Site
Biomass waste (e.g., from land clearing and grubbing)	Storage on-Site	On DL 5431 or 7235 in a designated area
Excavated overburden, organic material (e.g., peat) and large boulders	Storage on-Site for eventual reclamation	On DL 5431 or 7235 in a designated area
Construction wastes (wood, scrap metal, concrete, etc.)	Collection and storage on-Site, barged to mainland and to a suitable, permitted disposal site	To be identified on the BC mainland
Solid domestic wastes (e.g., from accommodation, offices, workshop, warehouse)	Contained and secured from wildlife Barged to mainland and to a suitable, permitted disposal site (landfill)	To be identified on the BC mainland
Regulated hazardous materials (e.g., used oil, solvents, etc.)	Hazardous wastes contained, manifested, secured, and barged to the mainland and then moved by truck to permitted hazardous materials disposal sites Hazardous wastes managed as per regulation	To be identified at an approved hazardous waste disposal site(s) on the BC Mainland

Management of liquid wastes derived during construction are summarized in Table 1.5–3.

Table 1.5–3 – Liquid Waste Management

Liquid Waste	Management	Disposal Site
Sanitary wastewater (e.g., from the floatel)	Managed and contained within the floatel, then pumped into suitable storage facilities and barged to the BC mainland and to a suitable, receptive and permitted wastewater treatment facility	A permitted wastewater treatment facility on the mainland BC mainland to be identified
Sanitary wastes from construction site (e.g., portable toilet facilities)	Portable toilet facilities (e.g., port-a-potties) management by pump/transfer onto barges, taken to wastewater treatment facilities on the mainland	A permitted wastewater treatment facility on the mainland BC mainland to be identified
Stormwater	Managed during construction to prevent sediment laden stormwater from entering streams and marine areas Procedures (e.g., silt fencing, temporary stormwater storage ponds, etc.) to be documented in a construction Stormwater Management Plan that will require NLG review and approval	Construction stormwater management plans to be developed prior to commencement of Site preparation

Hazardous wastes will be managed, stored and then shipped to a licensed hazardous waste facility and will be disposed of appropriately to meet the requirements of the *Environmental Management Act*. Hazardous waste generated during construction and operation are expected to be managed in a similar fashion. Details are summarized in Table 1.5–4.

Table 1.5–4 – Hazardous Waste Management

Hazardous Waste	Management	Disposal Site
Waste lubricating oils	Contained and shipped to appropriate BC mainland disposal facilities as per BC Hazardous Waste Management framework and Regulations	To be identified on the BC mainland
Spent solvents		
Mercury removed during the feed gas treatment process (contained in "beds")	Spent mercury beds are typically contained safely and then shipped back to the manufacturer for re-furbishing	Not applicable – returned to manufacturer
Wastewater treatment facility biological sludge	Managed, shipped and disposed of at a suitable, receptive facility on the BC mainland	To be identified on the BC mainland
Waste catalyst and absorbents	Contained and shipped to appropriate BC mainland disposal facilities as per BC Hazardous Waste Management framework and Regulations	To be identified on the BC mainland

1.5.2.2 Marine Facilities Construction

1.5.2.2.1 Scope of Marine Facilities

The following components will be designed and installed by a marine construction contractor:

- Material Offloading Facility (MOF)
- Trestle and Platform for FLNG #1
- Trestle and Platform for FLNG #2
- Personnel Dock
- Mooring Anchors for the FLNGs

It is anticipated that the MOF will be almost exclusively built via marine rigs, and the perimeter will be built of a "combi-wall" - a combination of driven piles and sheet piles set in between. A final determination on methodology will be established during detailed design, but it is expected that these activities will be accomplished from marine rigs. The MOF will then be completed by filling it with crushed rock from the land side using heavy construction equipment.

The other components of the Marine Facilities will be installed using a mix of marine and travelling pile placement equipment. The marine contractor will supply all materials, equipment, and labour. They will procure pipe piles and precast concrete shapes, transport materials to Site and provide engineering, installation and supervision services.

1.5.2.2.2 Marine Construction Activities

1.5.2.2.2.1 Drilling Scope

Initially, drilling for piles for the marine trestles will commence from the land or marine side to place piles close by the shoreline and establish a base for the traveller crane to mount. Marine-based drilling may be executed in parallel with traveller crane drilling.

1.5.2.2.2.2 Piling Scope

Steel tubular piles will be supplied fabricated and coated ("ready for use").

The marine contractor will drive the permanent piles for the MOF, trestles, platforms and personnel dock using one, or both, of two methods:

- Driving from a pile supported, movable platform ("Traveller")
- Driving from a floating platform ("Marine Barge")

Piling installation will utilize a combination of vibrating hammers (vibro-hammer), impact hammers (hydraulic or diesel), and drilling equipment. Pile driving will start with a vibratory hammer if overburden depths allow, followed by drilling and an impact hammer for the final distance.

Generally, hours for pile driving will be limited to between 7:00 a.m. and 7:00 p.m. Piling activities have been assumed to occur seven days per week with some allowance for mechanical repairs and other impacts to the schedule.

The marine contractor will develop detailed method statements and execution plans during detailed engineering.

A description of the typical marine pile installation methods expected for this Project is as follows.

1.5.2.2.2.3 Traveller Piling Installation

A Traveller is typically used in the intertidal zone where insufficient draft is available for a marine pile driving barge. Figure 1.5–1 depicts an example of installation of marine piles utilizing a Traveller execution approach.

The Traveller is a stable, movable platform, which can operate unaffected by water depth, waves and tides. It may run on rails, supported on the permanent piles, and typically is designed to carry the piling crane, piling hammers, piling guides, and support equipment.

Generally, the Traveller consists of a movable steel support structure that is supported on two support rails with piling guides at the front and/or on the sides. The support rail beams are placed on top of pile plugs that are supported on the previously installed permanent piles. A fixed base crane is positioned on the traveller platform together with other equipment and containers if required. The crane handles the steel piles and piling hammers/drilling equipment. The traveller is advanced on rollers in increments using jacks connected to the traveller main girder and to cradles clamped to support beams.

Three to five piles may be installed at each traveller position depending on the set up before the traveller is advanced forward to the next grid.

1.5.2.2.2.4 Marine Pile Installation

Marine barge piling installation is used where sufficient water depth is available for floating operation of the barge equipment. The marine contractor will include in his method statement clear steps to offload piles, upend piles, guide, drill, vibrate and/or hammer piles. Figure 1.5–2 depicts an example of installation of marine piles utilizing a barge execution approach.

Pile driving via marine piling barges is proposed for the MOF due primarily to little development of the landside scope during the early stages of the Project. Additionally, pile driving using marine barges is envisioned for the access platforms at each FLNG, for marine piles at the Personnel Dock and for FLNG mooring anchors that are outside the intertidal zones.

1.5.2.2.2.5 Structure and Topsides

Topside structures and sections (beams, decks, etc.) installed on the marine piles will utilize precast concrete shapes to the extent practicable.

Once the marine piles are installed, the erection of precast concrete elements and in-situ concreting works can commence. Precast sections will be installed on the marine piles using crane barges. Each crane barge will be moored against the trestle and platform on barge spuds and/or temporary piles. The crane barge may also be used as storage barge of precast shapes when required.

Concrete for in-situ casting will be limited in quantities to the extent practicable and will be supplied from the onshore batch plant.

A typical marine structure installation sequence is as follows:

1. Installation of precast corbel (furnished with access brackets and pile plug reinforcement)
2. Placing plug in-situ concrete up to corbel level
3. Erection of precast beams
4. Placement of beam connection reinforcement
5. Installation of beam connection formwork
6. Placing stitch in-situ concrete up to beam level
7. Placement of precast panels
8. Grouting of precast panels
9. Fixing deck reinforcement
10. Placement of precast or in-situ concrete deck panels in stages

1.5.2.3 Commissioning Activities

Commissioning documents, including test plans, test procedures and checklists, will be prepared well in advance of the commissioning phase.

Upon mechanical completion of each portion of onshore facility, pre-commissioning activities can then commence.

For mechanical systems, pre-commissioning activities consist of cleaning and flushing of pipes, pressure testing, and leak testing. Rotating equipment, such as a pumps, will be rotated for the first time on-Site to verify current draw, pressure, and flow rates. There may be an initial run-in period of motors and pumps to verify vibration and heating/cooling.

For electrical systems, pre-commissioning activities include wiring continuity and communication checks, and control loop checks.

Modules and prefabricated substations will be pre-commissioned to the extent practicable at the factory.

Water required for hydrotesting will be stored in temporary tanks and re-used to the extent practicable. Hydrotest water will be treated in accordance with regulations.

Following completion of pre-commissioning, commissioning can begin. Mechanical commissioning includes confirmation of proper functionality of mechanical systems prior to introduction of process fluids, followed by introduction of fluids to confirm operation.

Electrical and instrument system commissioning consists of pre-energization safety checks followed by energization. Field devices are verified to be correctly reflected on human machine interface (HMI) screens, and end-to-end communications are verified for accuracy.

System commissioning will begin once all mechanical, electrical and instrument commission has been completed. During this stage, electrical and mechanical equipment in discrete systems work together for the first time. Auxiliary systems are brought online followed by major systems, and interfaces are verified for all equipment.

1.5.2.4 Schedule of Construction Activities

Site construction activities shall commence following receipt of required regulatory approvals. Construction and commissioning activities are anticipated to last three to four years, after which commercial operation of the first FLNG will begin. See Figure 1.5–3.

1.5.3 Operation

The Project is designed to operate 24 hours per day, 365 days per year. During the operation phase, LNG and NGL will be produced, stored, and shipped. The Project is expected to operate for a minimum of 30 years.

Key operation activities include the following:

- Procurement of labour, goods, and services
- Workforce management, including transportation, and lodging
- Natural gas receiving, pre-treatment, liquefaction, storage and offloading of LNG and NGL products (condensate) at the FLNG barges (includes storage of NGLs and refrigerants)
- Loading of LNG carriers and NGL product vessels
- Marine shipping and transportation from Prince Rupert/Port Edward, Gingolx, and other ports to the Site:
    - Storage, handling, and transport of supplies and materials to the Site
    - Operation (by third parties) of LNG carriers and NGL product vessels along the marine shipping route between the Project's marine terminal and the 12 nm limit of Canada's territorial sea
- Land transportation of workforce to Gingolx or Prince Rupert/Port Edward
- Facility and Infrastructure operation and maintenance
    - Monitoring of safety, security, and emergency response systems
    - Routine inspections and maintenance including:
    - Planned maintenance and inspection of equipment to enable safe and reliable operation
    - Inspections to ensure the facility is meeting permit requirements
    - Site maintenance activities (drainage systems, and roads etc.)
    - Inspection and maintenance of safety, civil structures and environmental monitoring devices

- Process control systems monitoring
- Supporting infrastructure

- Temporary on-Site power generation on barges (if necessary)

Natural gas pre-treatment, liquefaction, storage, and offloading will occur on the FLNGs. LNG carrier and NGL product vessels will moor directly to the FLNGs, and product will be transferred via ship-to-ship loading systems. Marine shipping will occur on a continual basis (see Section 1.4.6.3 for further detail on shipping) throughout operation. Transportation of workforce will occur on a regular, scheduled basis as workers are brought to Gingolx or Prince Rupert/Port Edward and then transported to Site via marine vessels. Facility and infrastructure operation and maintenance and waste management will occur within the terrestrial and marine Project footprint, throughout the operation phase of the Project.

1.5.3.1 Waste Management during Operation

Solid waste generated over the life of the Project will be recycled or reused where possible. Where not possible, waste will be managed, stored, and shipped to approved disposal locations on the BC mainland and in compliance with the applicable NLG, provincial and/or federal regulatory requirements and guidelines. Planning for disposal of solid waste will include discussions with the regional landfill owner. A summary of potential solid wastes generated during operation, and the management of theses wastes is provided in Table 1.5–5.

Table 1.5–5 – Solid Waste Management

Solid Waste	Management	Disposal Site
Solid domestic wastes (e.g., from accommodation, offices, workshop, warehouse)	Contained and secured from wildlife Barged to mainland and to a suitable, permitted disposal site (landfill)	To be identified on the BC mainland
Paper/cardboard waste (from administration and packaging)	Store and barge to suitable recycling facilities on the BC mainland	To be identified on the BC mainland
Wood and scrap metal originating from maintenance activities	Collection and storage on-Site, barged to BC mainland and to a suitable, permitted disposal site	To be identified on the BC mainland
Regulated hazardous materials (e.g., used oil, solvents, etc.)	Hazardous wastes contained, manifested, secured, and barged to the mainland and then moved by truck to permitted hazardous materials disposal sites Hazardous wastes managed as per regulation	To be identified at an approved hazardous waste disposal site(s) on the BC Mainland

The Project will be supported by a wastewater treatment plant designed to meet relevant components of the Municipal Wastewater Regulation and the federal Wastewater Systems Effluent Regulations. A summary of sanitary and other liquid wastes derived during Project operation is provided in Table 1.5–6.

Table 1.5–6 – Liquid Waste Management

Liquid Waste	Management	Disposal Site
Sanitary wastewater (e.g., from permanent accommodations, offices, warehouse, workshop, etc.)	Managed and transferred via Project onshore piping to wastewater treatment facility (at Site)	Discharge, under permit, of wastewater meeting water quality thresholds into the marine environment of Portland Canal
Stormwater from upland areas	Managed as per facility stormwater management engineering (e.g., ditches, catchment basins, etc.)	Disposal, under permit of stormwater meeting water quality thresholds into the marine environment of Portland Canal
FLNG units deck wash and stormwater discharges	Managed as part of the FLNG wastewater management treatment system	Disposal, under permit, of wastewater meeting water quality thresholds into the marine environment of Portland Canal
Brine from desalination facilities	Discharged through piping to the marine environment	Discharge, meeting water quality thresholds, into a deep ocean location (e.g., Portland Canal)

Hazardous waste generated during operation are expected to be managed in a similar fashion as in construction with the exception of those summarized in Table 1.5–7.

Table 1.5–7 – Hazardous Waste Management

Hazardous Waste	Management	Disposal Site
Mercury removed during the feed gas treatment process (contained in “beds”)	Spent mercury beds are typically contained safely and then shipped back to the manufacturer for re-furbishing	Not applicable – returned to manufacturer
Wastewater treatment facility biological sludge	Managed, shipped and disposed of at a suitable, receptive facility on the BC mainland	To be identified on the BC mainland
Waste catalyst and absorbents	Contained and shipped to appropriate BC mainland disposal facilities as per BC Hazardous Waste Management framework and Regulations	To be identified on the BC mainland

1.5.4 Decommissioning and Reclamation

The eventual decommissioning of the Project or extension of operating life (after a minimum of 30 years) is described in general terms at this time. It is anticipated that decommissioning planning will result in the development of a decommissioning plan in consultation with the Nisg̱a'a Nation, incorporated in part into the land lease and proposed Water Lot sublease from the NLG and into engagements with applicable regulatory authorities (such as the British Columbia Energy Regulator). Decommissioning is expected to take approximately one year and require a relatively small workforce. Specifically, it may include:

- Moving the FLNGs to a Canadian or foreign shipyard for re-furbishing or salvage
- Dismantling and/or recycling ancillary facility equipment and infrastructure
- Re-purposing onshore Project infrastructure to another NLG authorized use
- Transporting and disposal or recycling of equipment and materials
- Reclaiming the anthropogenically altered portion of the onshore and marine areas to restore ecological values and function as required in the lease with the NLG
- If no longer needed, third-party pipeline provider purging their buried sub-sea floor pipelines of residual natural gas and leaving in place
- If no longer needed, third-party transmission provider discontinuing power transmission from the BC mainland

Upon decommissioning of the Project, the area may be restored as required by NLG and/or per the applicable agreements with the Nisg̱a'a Nation and as prescribed in operating permits.

1.6 Workforce Requirements

The Project will create jobs, contracting, and other economic opportunities for the Nisg̱a'a Nation, neighbouring Indigenous nations, local communities, businesses and the region, consistent with the BC government's conditions for LNG development. The number of on-Site construction workers will vary between construction and operation. It is also anticipated that peak numbers may be up to 800 construction workers. It is anticipated that certain specialized trades and expertise for LNG construction and operations may need to be sourced from elsewhere in BC, Canada or internationally. Construction workforce planning and estimates will be developed during FEED. Construction activities will be conducted by third parties under contract to the Proponent, who will maintain care and control of all construction activities including implementation of workforce commitments made through Agreements with Indigenous Nations.

The Project's construction workforce will be hired by the Project's construction contractor(s) and will be housed at the Site on rotational shifts. Construction worker access to the Site will be by vessel originating from Gingo̱lx or Prince Rupert/Port Edward. Logistics, policies and procedures for contractors and workers will be clear and as seamless as possible around transitions from the Site to Terrace and back.

Due to the remoteness of the Site, the construction workers are expected to be housed in a floatel within the proposed Water Lot in Portland Canal. The floatel would provide self-contained electrical power, communications, potable water supply and waste containment systems. Sewage and grey water would be stored in tanks and then barged away for disposal at a suitable sewage treatment facility or treated by suitable equipment located on or near the floatel. The floatel will be connected to shore via a personnel dock or the MOF.

Construction is currently proposed to occur six or seven days a week, with ten-hour days for crews. As each contractor will be responsible for their own crews, the actual number of days per week is not yet determined. It is expected that construction contractors will schedule their personnel on a rotational basis commensurate with typical work practices on remote projects in the region. The construction process will be managed in a way to ensure project stability and continuity of work as certain trades finish a project segment and different trades come in to start the next segment.

During operation, Site workers will be housed in permanent housing on-Site. Similar to construction, workers will access the Site by vessel from the mainland (e.g., from Gingolx or Prince Rupert/Port Edward). As the Project is designed to operate 24 hours a day, 365 days a year, some personnel will be required to work shifts. All shifts and work rotation schedules during construction and operations will be compliant with the provincial *Employment Standards Act* (GoBC 1996) and *Workers Compensation Act* (GoBC 2019b).

During operation, the permanent workforce is estimated to be between 150 to 250 at the Site and 50 to 100 at other offices within BC. There will be a consistent level of employment during operation. Workforce during decommissioning is expected to be relatively small compared to the construction phase.

Expected workforce requirements for the Project based on the National Occupational Classification system and timelines for employment opportunities are presented in Section 7.10 (Employment and Economy). These will be refined and disaggregate as FEED progresses and as new data becomes available (e.g., BC Labour Market Outlook 2023).

In addition to direct Indigenous and non-Indigenous employment with the prime contractor and other contractors on the Site, the Proponents recognize and will encourage the indirect employment of Indigenous peoples through procurement of services and supplies from subcontractors and businesses operated by Nisga'a Nation and the participating Indigenous nations.

As the Proponents are a newly formed entity, workplace policies and programs have not yet been developed. Once FID is determined, workplace policies and programs will be advanced, and are expected to include:

- Establishment of a human resources department
- Development of a human resource framework, which will include job descriptions, benefits packages (e.g., retirement savings plan, group insurance benefit plans), personnel assistance programs, salary bands
- Employee assistance programs and benefits including career planning, personnel counselling, family support, transition planning, pension plan and group insurance benefit plans

- Workplace policies and programs including codes of conduct, workplace safety programs and cultural training and awareness programs (for all employees and contractors on Site)
- Identification of third-party and Proponent training programs and/or opportunities
- Development of hiring policies and processes including equity and diversity and support for underrepresented groups
- Development of a plan that addresses GBA Plus and diversity, equity and inclusion
- Development of procurement process and policies and contractor selection processes
- Training and information sessions for bidders and awardees

The workforce requirements and above strategies will be guided by the development and implementation of a comprehensive Project workforce strategy informed by the Proponents, participating Indigenous nations, the prime contractor and local community stakeholders.

1.7 Project Purpose and Need

1.7.1 Evolution of the Project

At the turn of the millennium, the Nisga'a Nation's four villages and three urban locals came together to sign the Nisga'a Final Agreement (**the Treaty**) with the BC and Canadian governments. The Treaty, BC's first modern treaty, was celebrated as a landmark step toward reconciliation and equality. The Treaty establishes a constitutional right for the Nisga'a people to self-govern, recognizes Nisga'a lands, and opens the door for economic initiatives (including the development of the Nisga'a Nation's natural resources). Over twenty years later, the Nation has made significant progress but has yet to realize the full benefits enabled through the development of their land and resources.

Since the effective date of the Nisga'a Treaty (April 27, 1999), the Nisga'a Nation has sought economic development opportunities that will provide a higher quality of life for Nisga'a citizens. With this objective in mind, the Nisga'a Nation has pursued an LNG facility for nearly a decade. The Project will advance the Nisga'a Nation's goal of economic self-determination by providing economic opportunities for the Nisga'a Nation, meaningful employment and contracting opportunities for Nisga'a citizens, as well as increased economic opportunities for other Indigenous nations, BC, Alberta and Canada.

The Project would have a transformative impact, not just for the Nisga'a Nation, but for Indigenous people across BC's northwest. The Nisga'a Nation is a founding member of the First Nations Climate Initiative (**FNCI**), an Indigenous-led collaborative forum dedicated to fighting climate change while also alleviating First Nations poverty, restoring ecosystems in traditional territories, and enabling Indigenous people to become leading players in a decarbonized economy. FNCI has presented a 30-year vision for northwest BC that supports a transition to a net-zero economy through industry electrification, nature-based climate solutions, carbon sequestration initiatives, hydrogen infrastructure and renewable energy generation. LNG export facilities such as the Ksi Lisims LNG Project are the cornerstones of this plan because they stimulate infrastructure investment such as electrical transmission, encourage innovation and mark a new standard for cleaner energy development, and plant seeds of prosperity for the entire region.

It is critical for the Nisga'a Nation that their LNG project have the smallest environmental footprint possible. British Columbia has already established itself as a centre of excellence for low-emission LNG. The projects that have been under development over the past decade are the lowest-emission LNG export facilities on earth, and by a wide margin. Ksi Lisims LNG will take the innovations introduced by these projects and set a new bar. The Project is designed to run on electricity from day one of operation. By using BC's renewable hydroelectricity, the Project will reduce emissions by 85 per cent, and will be net-zero in 2030.

The Nisga'a Nation has attracted highly credible and experienced co-developers, Rockies LNG and Western LNG, each of which bring a unique skill set to the Project. The Nisga'a Nation will host the facility on their fee-simple, Category A land, and provide governance and environmental oversight. Rockies LNG is a consortium of upstream natural gas producers that together produce one third of the natural gas extracted from the Western Canadian Sedimentary Basin. Western LNG is a Houston-based company with deep experience in the development and operation of LNG facilities.

The Proponents are committed to developing a Project that balances the need to build a strong local economy in northwestern BC with protecting the environment. From a regional environmental perspective, the Project is targeting net-zero LNG production by using renewable electricity. The Project will not only help meet the increasing global demand for low-carbon LNG, but can also help to displace the use of higher emission energy sources such as coal.

The Project creates additional access to global markets for the export of Canadian natural gas, which will help mitigate risk caused by North American market fluctuations while contributing to economic development by improving energy security in those global markets.

The key Project benefits are summarized in Table .

Table 1.7–1 – Ksi Lisims LNG Project Benefits

Potential Benefit	Description
Nisga'a Nation economic reconciliation and self-determination	The Nisga'a Nation see the Project as an opportunity for economic reconciliation. The Project will provide substantive direct and indirect economic development for the Nisga'a Nation and its citizens. By providing training, education, employment and contracting opportunities for unemployed and underemployed Nisga'a citizens, the Project will reduce employment barriers and promote economic self-determination.
Economic opportunities for other Indigenous nations	The Project and supporting infrastructure will provide direct and indirect economic opportunities to other Indigenous nations. Such opportunities could include education, skills training, employment and contracting opportunities for Indigenous citizens and entrepreneurs.
Economic diversification in northwest BC and BC in general	The Project will provide direct and indirect benefits including local employment, contracting and procurement. The Project will provide economic diversification, complementing other BC based developments.

Table 1.7–1 – Ksi Lisims LNG Project Benefits

Potential Benefit	Description
Direct and indirect economic benefits to Canada	The Project will provide tax revenue that will support Indigenous, provincial and federal objectives to improve health, education, transportation infrastructure and other social benefits. In addition to tax revenue, the Project will also result in billions of direct capital expenditures within BC.
Improved access to global markets for Canadian natural gas	The Project will enable the export of Canadian natural gas to serve the growing global demand for responsible and reliable natural gas.
Provide lower carbon intensity Canadian natural gas	LNG exported from the Project will have lower GHG emissions intensity than LNG from other exporting projects, which will help to mitigate global GHG emissions.
Social, economic, and environmental benefits globally through provision of reliable, lower-carbon, and cost-effective LNG	Energy demand is growing globally. Canadian LNG serves as a responsible, reliable and cost-effective fuel that supports energy security in global markets and can improve quality of life, while supporting the transition away from more carbon intensive forms of energy, such as coal.

The Project serves four foundational purposes, which are described further in the following sections:

- Create economic self-determination for Nisga'a the Nation and improve the quality of life for Nisga'a citizens
- Create direct and indirect economic benefits for other Indigenous nations, BC, Alberta, and Canada
- Enable the export of clean and reliable Canadian natural gas to markets outside of North America
- Provide a lower carbon intensive energy source to meet growing global energy demands and support lower GHGs.

1.7.2 Nisga'a Nation Economic Self-Determination

The Nisga'a Nation is a self-governing Indigenous Nation on the west coast of BC. The Nisga'a Treaty provides the Nisga'a Nation with constitutionally protected rights and legislative jurisdiction that can facilitate the construction and operation of projects on or near Nisga'a Lands.

The Nisga'a Nation, like most rural Indigenous communities, struggles with consistently lower employment and labour force participation rates compared to other communities in the region. Currently, a number of employment barriers exist for Nisga'a citizens living on Nisga'a Lands including geography, low population density, and jobs which are typically lower income, lower skilled, and more vulnerable to economic downturns. The direct and indirect economic benefits provided by the Project will reduce social and economic disparities, improve the quality of life for all Nisga'a citizens, and enable the Nisga'a Nation to pursue economic self-determination. An important benefit for the Nisga'a is that many of these opportunities would be located close to and in local Indigenous communities, enabling Indigenous workers to remain close to their communities, families, and cultures.

The Project will not only directly provide meaningful employment and contracting opportunities on or near Nisga'a Lands, it is also expected to result in indirect benefits such as improved marine emergency response in the vicinity of the Site as well as training and capacity building opportunities for Nisga'a citizens and Nisga'a entrepreneurs.

1.7.3 Direct and Indirect Economic Benefits to Other Indigenous Nations, BC, Alberta and Canada

The Project will provide direct and indirect benefits to other Indigenous nations in the region including economic benefits that could help to alleviate poverty and unemployment within those Indigenous communities.

Energy projects of the scope and scale of the Project, as well as their supporting infrastructure, support Indigenous and non-Indigenous employment during construction and operation. This employment leads to increased worker training, offering the opportunity for better paid employment in the construction and energy sectors. Growth in local and regional businesses is also anticipated to support the goods and services needs of the Project and people working on the Project. The Project social benefits will include higher household income resulting from stable jobs. The economic benefits flowing into the broader region are determinants of health that will enhance community well-being (Section 7.13).

Development of new regional infrastructure incidental to the Project (e.g., a new third-party natural gas transmission pipeline, a new third-party electrical transmission line connected to renewable electricity, as well as new marine support infrastructure to support safe navigation) is expected to bring economic opportunities to both Indigenous and non-Indigenous communities and businesses during construction and through operation.

The Project is expected to create significant revenue for BC, Alberta, and Canada. The Proponents have completed a detailed economic benefits analysis of the direct, indirect, and induced economic benefits to BC, Alberta, and Canada as part of the Application (see Section 7.10). At this preliminary stage, the Project has estimated its economic impacts based on the Conference Board of Canada's *A Rising Tide: Economic Impact of B.C.'s Liquified Natural Gas Industry* (2020). Based on the Project's size and scope, the study suggests approximately $2.5 billion in annual gross domestic product, 21,000 employment opportunities, and $890 million in annual provincial and federal tax revenues will be generated in Canada over the construction and operating life of the Project.

Project generated jobs and procurement would benefit Canada's economy. Government revenues generated by the Project could support spending priorities, such as health care, education, infrastructure as well as emission reduction initiatives and renewable developments. Depending on the electricity supply scenario, construction-phase expenditures are estimated to result in 3,055-3,275 full-time equivalents of direct employment in BC, generating $366-$393 million in labour income and operation expenditures will create an estimated 465-945 full-time equivalents of direct labour and $53-$109 million in labour income annually in BC. Depending on electrification scenario, Project construction is estimated to result in 2,495-2,725 full-time equivalents of indirect labour with $170-$185 million in labour income and 1,885-2,035 full-time equivalents of induced labour, with $94-$101 million in labour income in BC and operation expenditures are predicted to result in 280-785 full-time equivalents of indirect labour with

$16-$49 million in labour income and 245-545 full-time equivalents of induced labour with $12-$27 million in labour income in BC. Depending on electrification scenario, total gross domestic product contributions from Project construction are estimated at $1.0-$1.1 billion in BC and during operation, $125-$515 million in annual gross domestic product contributions are estimated in BC. Total (direct, indirect, and induced) modelled taxes arising from expenditures made in BC during construction are estimated at $242-$270 million, comprised of $76-$86 million in federal government taxes, $166-184 million in provincial taxes, and $890,000-$970,000 in municipal taxes. Total modelled annual taxes arising from expenditures made in BC during operation are estimated at $26-$84 million, comprised of $11-$23 million in federal government taxes, $15-$60 million in provincial taxes, and $215,000-$1.1 million in municipal taxes. Additional details regarding Project economic and employment benefits are provided in Section 7.07.

1.7.4 Export Opportunities for Canadian Natural Gas

Demand for natural gas, particularly in Asia, is expected to grow (Shell 2021). Global LNG prices hit record high levels in Q4 2021, and demand is expected to nearly double in the next twenty years (Shell 2021). The Project will provide Canadian natural gas producers with access to the growing markets, allowing for market diversification and helping to mitigate impacts of North American market fluctuations, and will provide foreign countries with opportunities to meet climate change targets with a lower-carbon energy source.

1.7.5 Provision of Lower Carbon Intensity Energy

The Project has the potential to support the Nisga'a Nation and other Indigenous Nation's goals of responding to climate change while allowing for economic development. The Nisga'a Nation are founding members of the FNCI. FNCI (2022) is an Indigenous led policy initiative focused on assisting Canada, BC, Alberta, and Indigenous nations in meeting international, national, provincial and Indigenous Nation objectives to address global climate change due to GHG emissions. A major policy initiative of FNCI is the promotion of net-zero LNG as a transition step to the low carbon economy of the future while supporting "economic self-determination and restoration of traditional territories". It is important to the Nisga'a Nation that this Project work towards net-zero LNG production that is consistent with FNCI objectives. The Project is working towards this objective by:

- Using renewable hydroelectricity from BC for the liquefaction process
- Using Canadian natural gas with lower life-cycle emissions as the LNG feedstock
- The adherence of upstream natural gas production to strong Canadian upstream GHG and methane emission regulations

The Project is expected to have the lowest GHG emission profile of any LNG facility in the world. For example, the Project estimates its emission intensity including those from upstream production and pipeline transport of natural gas, the liquefaction process, and shipping from the Site to an Asian port to be approximately one fifth of a comparable project on the US Gulf Coast (Roman-White et.al. 2021). The Project is an opportunity to meet growing global natural gas demand with LNG that is produced with lower GHG emission intensity versus other global projects. The Project will have a substantially lower well-to-port emissions intensities versus comparable projects on the US Gulf Coast with between 0.86–1.29 tonne of carbon/tonne of LNG lower. At full production that results in an emission reduction of 10–15 million tonnes of CO_2e per year. This represents a global environmental benefit when growing demand is met with Canadian LNG and a clear illustration of the risk of global carbon leakage if the Project is not built in Canada.

The export of LNG will serve to provide access to lower-carbon, reliable energy not just for electrical generation but, also as an energy source to power other sectors such as industry, residential and transportation (Shell 2021). LNG enables countries to reduce dependence on coal while being cost -effective enough for developing nations to grow electric generation capacity in a sustainable way, which has significant economic benefits and improvements to quality of life. Further, LNG complements the increased deployment of renewable power generation by managing intermittency without the need for costly battery storage, allowing for countries to transition to lower carbon fuel sources sooner.

1.8 Alternatives to the Project

A number of land-based LNG export facilities have been proposed for the Prince Rupert area, however, the only viable alternative to the Project would be an LNG facility at a different location in Nisga'a Nation territory with a different proponent collaboration structure, or a different Nisga'a led economic opportunity on Nisga'a Lands, that could contribute to the primary objectives of the Project. While sites were considered at Observatory Inlet, Dogfish Bay and Nasoga Gulf, no alternative to the Project has been identified that is both technically and economically feasible and would fulfil the Project's primary objective for economic development opportunities that will provide a higher quality of life for Nisga'a citizens. A project outside of Nisga'a Lands would not contribute to economic development opportunities for Nisga'a citizens.

By choosing to use FLNGs, the facility can be sited remotely. This is a significant distinguishing factor for the Project. The Nisga'a Nation identified several potential locations for an LNG facility, ultimately selecting Wil Milit, a former Nisga'a Nation reserve at the northern tip of Pearse Island. Wil Milit was chosen because of its proximity to established shipping routes, its distance from residential communities for safety, and to eliminate any potential impact on traditional marine harvests.

1.8.1 Consideration of Sustainability Principles

Per the requirements presented in the Application Information Requirements (**AIR**) and following the sustainability principles laid out in the Practitioner's Guide to Federal Impact Assessments under the Impact Assessment Act, the sustainability principles were considered in reviewing alternatives to the Project as outlined below.

Principle 1: Interconnectedness and interdependence of human-ecological systems

The Nisga'a Nation is a founding member of the Indigenous led FNCI. The FNCI is a policy initiative that is focused on not only self-determination objectives, including economic self-determination, but also with the objective to address global climate change due to GHG emissions.

In identifying an LNG project for development, the Nisga'a Nation will provide the opportunity for economic prosperity to their community while providing a solution to a global problem. As identified by the FNCI, LNG is part of the solution to replace carbon intensive thermal coal with natural gas in places like China, Japan and Korea. The northwest coast of BC is geographically well-placed because it is relatively close to both Asian markets and supplies of natural gas from the Western Canadian Sedimentary Basin.

Principle 2: Well-being of present and future generations

The Nisga'a Nation first showed their support for the development of an LNG project on the northwest coast of BC in 2014. Since that time, the Nisga'a Nation have been actively pursuing opportunities to develop an LNG project that would provide opportunities for jobs, training, new businesses, and revenues towards the goal of economic prosperity. Equally important; however, is the prudent use of lands and resources.

Principle 3: Positive effects and reduce adverse effects of the Project

In identifying the Project location, the Proponents, in particular Nisga'a Nation, chose a site that is both remote and undeveloped to minimize potential cumulative effects while still being in proximity to existing shipping lanes for large shipping vessels. The remoteness of the Project and the commitment to construct components of the Project in off-Site shipyards (e.g., FLNGs) will also reduce social impacts on nearby communities by minimizing the size of the construction workforce and by lodging the workforce in on-Site accommodation throughout Project construction and operation. Limiting land-based infrastructure allows for less disturbance of the local environment and greater potential for restoration following decommissioning.

It is critical for the Nisga'a Nation that the Project have the smallest environmental footprint possible. BC has already established itself as a centre of excellence for low-emission LNG. The projects that have been under development over the past decade are the lowest-emission LNG export facilities in the world. The Proponents will take the innovations introduced by these projects and set a new bar. The Project is designed to run on electricity from day one of operation. By using BC's renewable hydroelectricity, the Project will reduce emissions by 85 per cent, and will be net-zero in 2030.

The Project's environmental performance is further improved by the use of floating LNG barges (FLNGs). By housing liquefaction technology aboard two specially designed barges, the Project will reduce its land footprint by approximately 90 per cent compared to land-based facilities with a comparable throughput. Support infrastructure will be located on shore, freeing up space to produce 12 million tonnes of LNG per year. At full build out, Ksi Lisims LNG will be the largest FLNG in the world.

Principle 4: Precautionary principle and uncertainty and risk of irreversible harm

Based on Nisga'a Nation ownership of the Site and limited overlap with other users, the chosen location presents a unique location to develop an industrial project. This, together with the relatively small terrestrial footprint, means that biophysical impacts at the Project Site are largely limited to the Project footprint and residual effects on the greater ecosystem are limited.

The remote location is also a gamechanger in terms of minimizing or eliminating the potential for negative impacts on communities. To avoid impacts on local housing costs and supply, childcare, and healthcare, construction and operations workers will be housed at the Site. Personnel facilities will include a medical centre staffed by healthcare professionals.

1.9 Alternative Means of Carrying out the Project

The alternative means identified in this section are some of the preliminary considerations that have been and continue to be evaluated for carrying out the Project. Iterations of the Project with respect to design and siting will continue to be evaluated by the Project team, particularly as FEED progresses.

Alternative Project designs that were considered in the Application are summarized in Table 1.9–1. Further detail regarding the feasibility and the environmental, economic, social, cultural and health risks, uncertainties and benefits of these alternative means are provided in the following subsections.

Table 1.9–1 – Overview of Alternative Means Considered for the Project

Project Component	Alternatives Considered	Document Section
Site Access and Transportation to Site	▪ Transport of goods and personnel to Site via road and marine vessel	1.9.1.1
	▪ Shipping routes for LNG and NGL via Route A, Route B or Route C	1.9.1.2
Site Layout	▪ Floating versus a land-based LNG facility	1.9.2.1
	▪ Construction of dedicated LNG carrier berths (independent of the FLNGs) or use of Ship to Ship mooring at the FLNGs	1.9.2.2
Site Energy Sources	▪ Potential use of electrical generation from temporary power barges using either once-through seawater cooling, evaporative cooling, or air cooling systems	1.9.3
Transmission Line	▪ Aerial, subsea, and terrestrial options for construction of the third-party transmission line between the Project and Nisga'a Lands (as defined under the Nisga'a Treaty)	1.9.4
Water Supply	▪ Water sourced from local surface water, groundwater (well), rainwater or desalination of seawater	1.9.5
Waste and Wastewater Management	▪ Management of solid and hazardous wastes during the construction and operation is described in Sections 1.5.2.1.6 and 1.5.3.1, respectively. No alternative means are evaluated.	1.9.6.1
	▪ Options for management of non-process sanitary wastewater include gravity sewers, force mains and septic tanks.	1.9.6.2
	▪ Stormwater design	1.9.6.3
Construction Alternatives	▪ Crew accommodations options at Site include onshore construction camp or on floating vessels (‘floatel’).	1.9.7.1
	▪ Construction of free span bridges or culverts over watercourses and drainages within the Site.	1.9.7.2
	▪ Preliminary options for cut, fill and overburden planning	1.9.7.3
	▪ Schedule options	1.9.7.4

Evaluation of these alternative designs and means has involved and will involve the following criteria for purposes of making the final Project design and siting decisions:

- Technical and economic feasibility:
  - Use of best available technology (BAT), where appropriate
  - Technical requirements including uncertainties
  - Capital cost
- Environmental, Social, Cultural, Health and Indigenous Considerations
  - Limiting environmental effects including those associated with GHG and other air emissions, water use and other potential biophysical effects (e.g., terrestrial or marine footprint)
  - Potential effects to species at risk as per the *Species at Risk Act*
  - Potential social, cultural and health effects
  - The rights or interests of Indigenous nations
  - Feedback received during consultation and engagement
- Where there are changes to the health, social, cultural or economic conditions that have the potential to result in disproportionate effects, based on Gender-Based Analysis Plus (GBA Plus) these are discussed.

The alternatives analysis was informed by publicly available information and feedback as available for each alternative. Where knowledge shared by Indigenous Nations is available to inform the analysis of alternatives this is noted. There are no known studies or plans drafted by a government in respect to the region that would inform the alternatives analysis.

For the preferred alternative, rational is provided for the selection based on the criteria listed above and consideration of the sustainability of the selected alternative.

The Project Proponents have proceeded from pre-FEED to FEED; design is progressing and is influenced by not only process requirements and efficiency, but also feedback received during engagement.

1.9.1 Site Access and Transportation to Site

1.9.1.1 Transportation of Goods and Personnel to Site

Options for transportation of goods and personnel to Site are limited due to the location of the Project in a remote, water or air access only, area of northwest BC. Options considered and being carried forward are summarized in Table 1.9–2.

Table 1.9–2 – Options for Transportation of Goods and Personnel to Site

Commodity	Point of Initiation	Transport Step 1	Transport Step 2
Personnel	Gingolx (Nisga'a workers)	Marine Vessel to Site	-
	Terrace: ▪ Non-local workers (via Northwest Regional Airport) ▪ Local and regional workers personal travel to point of initiation	Highway 113/ Nisga'a Highway/ Nisga'a Highway to Gingolx (approximately 168 km)[1]	Marine Vessel to Site (approximately 19 km)[2]
		Highway 16 to Prince Rupert/ Port Edward (approximately 143 km)[3]	Marine Vessel to Site (approximately 110 km)[4]
		Seaplane or Helicopter to Site	-
	Prince Rupert/Port Edward: ▪ Non-local workers (via Prince Rupert Airport) ▪ Local and regional workers personal travel to point of initiation	Transport to vessel departure site in Prince Rupert/Port Edward	Marine Vessel to Site (approximately 110 km)[4]
Goods	Terrace	Highway 113/ Nisga'a Highway/ Nisga'a Highway to Gingolx (approximately 168 km)	Barge or Marine Vessel to Site (approximately 19 km)
		Highway 16 to Prince Rupert/ Port Edward (approximately 143 km)	Barge or Marine Vessel to Site (approximately 110 km)
	Prince Rupert/Port Edward	Transport to vessel departure site in Prince Rupert/ Port Edward	Barge or Marine Vessel to Site (approximately 110 km)
	Overseas or southern ports (e.g., Vancouver, USA)	Barge or Marine Vessel to Site	-

NOTES:

[1] Assume approximately 2.5 hours of travel time between Terrace and Gingolx (land)

[2] Assume approximately 0.5 hours of travel time between Gingolx and Site (marine)

[3] Assume approximately 1.5 hours of travel time between Terrace and Prince Rupert/Port Edward (land)

[4] Assume approximately 3 hours of travel time between Prince Rupert/Port Edward and Site (marine)

Table 1.9–3 provides a summary of potential economic, environmental, cultural and social factors that were considered related to personnel and goods transportation options. The primary route for transport of goods and personnel originating in Terrace is anticipated to be via Highway 113/Nisga'a Highway to Gingolx and via marine vessel from Gingolx to Site. This route is preferred because it is considered the safest and most economical due to the shorter and more protected marine transport route (approximately 0.5 hours versus 3 hours). The shorter route should also result in lower potential environmental effects due to a decreased potential for wildlife interactions, including interactions with species at risk, and GHG emissions and fewer potential interactions with marine use, particularly fishing activities, which was a key concern identified by Indigenous nations. From a safety perspective the shorter route will be particularly beneficial during inclement weather. Engagement with potentially affected Indigenous Nations identified concerns with safety along Highway 113/Nisga'a Highway due to Project related increases in traffic as well as potential impacts to highway infrastrcuture. In addition to mitigations identified in section 7.12 (Infrastructure and Services, efforts will be made to address these concerns through the completion of a transportation assessment that meets guidelines drafted by the Ministry of Transportation and Infrastructure with an objective of identifying ways of improving areas of concern along the highway.

It is anticipated that many personnel will originate from the Terrace area and/or can easily travel to the Terrace area. However, where personnel originate from Prince Rupert, they may either be transported to Terrace to join the preferred route to Site via Gingolx or may go directly from Prince Rupert/Port Edward to Site by marine vessel. Goods originating in Prince Rupert/Port Edward will likely be transported via barge or small marine vessel to Site rather than going through Gingolx. The option ultimately selected will depend on the origin and number of personnel, origin and nature of goods, frequency of travel and weather conditions.

Seaplanes and helicopters will not be used as a mode of transportation for personnel; however, they may be used in the event of a medical emergency.

Engagement with Indigenous Nations identified concerns with increased traffic along Highway 113/ Nisga'a Highway and increased vessel traffic along Portland Inlet. To better understand traffic management along Highway 113/Nisga'a Highway the Proponents have committed to completing a transportation assessment that meets the requirements of the Ministry of Transportation and Infrastructure. Concerns related to increased vessel traffic along Portland Inlet would be addressed by using the transportation route based out of Gingolx as opposed to Prince Rupert/Port Edward. No concerns related to transportation to Site were identified by the public.

Neither option is anticipated to result in disproportionate effects, based on GBA Plus.

Table 1.9–3 – Technical, Economic, Environmental and Social Factors for the Consideration of Personnel and Goods Transportation Options

Factor	Terrace to Gingolx to Site	Terrace to Prince Rupert to Site
General Description		
Description	▪ Shortest overall distance to Site (approximately 187 km) with the most protected marine transportation route (approximately 19 km)	▪ Slightly shorter terrestrial route (approximately 143 km), but more exposed and longer marine transit route (approximately 110 km)
Technical and Economic Feasibility		
Use of BAT	▪ Not applicable	▪ Not applicable
Technical Requirements, and Uncertainties	▪ Enhanced cell coverage likely required ▪ Some additional infrastructure improvements may be required in Gingolx to support such transport ▪ May require upgrades to Highway 113/ Nisga'a Highway/Nisga'a Highway	▪ Land transport is on busier highways
Capital Cost	▪ Will require purchase or contracting of marine vessel(s) ▪ Infrastructure improvements (if required)	▪ Will require purchase or contracting of marine vessels of similar size or larger than what would be required from Gingolx
Environmental, Social, Cultural, Health and Indigenous Interest Considerations		
Environmental Effects	▪ Risk of collision with animals both on land and at sea ▪ The portion of Highway 113/Nisga'a Highway from New Aiyansh to Gingolx parallels the Nass River, an important salmon and eulachon river ▪ Risk of road closures due to snow, downed trees or flooding on Highway 113/Nisga'a Highway ▪ The shorter total distance (approximately 187 km) of this route will result in lower GHG emissions than the alternate route (approximately 253 km)	▪ Risk of collision with animals both on land and at sea ▪ Highway 16 parallels the Skeena River, an important salmon river ▪ Risk of road closures due to flooding on Highway 16 ▪ The longer total distance (approximately 253 km) of this route will result in higher GHG emissions than the alternate route (approximately 187 km)

Table 1.9–3 – Technical, Economic, Environmental and Social Factors for the Consideration of Personnel and Goods Transportation Options

Factor	Terrace to Gingolx to Site	Terrace to Prince Rupert to Site
Species at Risk (as per SARA)	▪ Vehicle and vessel collisions with wildlife can result in harm or death of the animal ▪ Potential for a vehicle collision with grizzly bears or western toads crossing Highway 113/ Nisga'a Highway ▪ Potential for a vessel collision with killer whales, harbour porpoises, humpback whales, fin whales and Steller sea lions	▪ Vehicle and vessel collisions with wildlife can result in harm or death of the animal ▪ Potential for a vehicle collision with grizzly bears or western toads crossing highway 16 ▪ Potential for a vessel collision with killer whales, harbour porpoises, humpback whales, fin whales and Steller sea lions ▪ Potential for a vessel-wildlife collision is moderately higher along this route due to the longer distance and it traverses through areas with higher numbers of marine mammals
Social, Cultural, and Health Effects	▪ Limited cell phone coverage and weather conditions can make this a more dangerous route ▪ Capacity of emergency services to respond in event of emergency is limited because these services are overburdened and underserviced ▪ Traffic counts are low (annual average of between approximately 100 and 250 depending on highway segment) and do not appear to be increasing, suggesting there should be some capacity for additional traffic ▪ Total travel time expected to be approximately 3 hours	▪ Capacity of emergency services to respond in event of emergency is limited because these services are overburdened and underserviced ▪ Traffic counts are much higher than along Highway 113/Nisga'a Highway (annual average of 1350 in 2021) and is showing a slow increase over the past decade. ▪ Total travel time for this route expected to be approximately 4.5 hours
Indigenous Interests and Rights	▪ Potential interaction with marine fishing and recreational vessels ▪ Animal collision, such as with moose, could impact subsistence hunting	▪ Potential interaction with marine fishing and recreational vessels ▪ Animal collision, such as with moose, could impact subsistence hunting
GBA Plus	▪ No disproportionate effects on sub-populations and/or groups	▪ No disproportionate effects on sub-populations and/or groups

Table 1.9–3 – Technical, Economic, Environmental and Social Factors for the Consideration of Personnel and Goods Transportation Options

Factor		Terrace to Gingolx to Site	Terrace to Prince Rupert to Site
Consultation and Engagement Feedback		▪ Concern related to increased traffic on Highway 113/Nisga'a Highway/Nisga'a Highway	▪ Concern related to increased vessel traffic from the Port of Prince Rupert/Port Edward as well as vessel traffic within Portland Inlet
Sustainability	Human-ecological systems	▪ Increased traffic volumes have the potential to result in wildlife being exposed to increased interactions with vehicles and sensory disturbance	▪ Increased traffic volumes have the potential to result in increased interactions with wildlife ▪ Longer marine route represents increased use of marine environment
	Well-being of generations	▪ Improvements to the road would result in increased safety and could improve access during inclement weather (e.g., during a snow event) ▪ Increased use of Highway 113/Nisga'a Highway could result in an adverse effects on Nisga'a communities due to increased traffic, and improved access to non-residents.	▪ Increased use of Highway 16 could result in an adverse effect on existing and future users of the highway due to increased traffic
	Enhance positive and reduce adverse effects	▪ Represents the shorter route to Site due to a shorter marine route; thereby reducing adverse effects such as emissions, marine mammals/vessel interactions, sensory disturbance, and impacts on marine use (e.g., fishing) ▪ Improvements to Highway 113/Nisga'a Highway to accommodate Project activities will benefit highway users particularly near Gingolx	▪ Represents the longer route to Site, due to a longer marine route; thereby resulting in greater adverse effects associated with emissions, marine mammals/vessel interactions, sensory disturbance, and impacts on marine use (e.g., fishing) ▪ Increased use of Highway 16 could result in an adverse effect on users of the highway due to increased traffic
	Precautionary principle, uncertainty and risk	▪ There are no likely effects associated with this route option that would result in irreversible harm	▪ There are no likely effects associated with this route option that would result in irreversible harm

1.9.1.2 Shipping Routes for LNG and NGL

Alternate shipping routes are assessed in the Marine Route report completed as part of the Navigation Safety Assessment (Appendix E). The routes considered are as follows:

- Route A: Dixon Entrance to Triple Islands pilot boarding station, through Brown Passage, to Chatham Sound, Main Passage, Portland Inlet and Portland Canal
- Route B: Dixon Entrance to Caamaño Passage, through the Lax Kwaxl/Dundas and Melville Islands Conservancy to the north end of Main Passage, to Portland Inlet, and Portland Canal
- Route C: Dixon Entrance, north to between Celestial Reef and west Devil Rock, to north of McCulloch Rock, to south of east Devil Rock and north of Dundas Island, to the north end of Main Passage, to Portland Inlet and Portland Canal

The assessment relies on recent discussions with government agencies and a TERMPOL Review completed in the early 80s for the Western LNG Project proposed by Dome Petroleum Limited. Table 1.9–4 provides a summary of potential economic, environmental, cultural and social advantages/benefits and risks/costs of considered LNG and NGL shipping route options.

The assessment concludes that Route A is the preferred marine route for piloted carriers between the marine terminal and international waters as it is the safest option based on BCCP experience and the existing aids to navigation along the route. Route B is not the preferred route but is a viable alternative if required and under certain metocean conditions. Carriers should not transit Route C due to the navigation hazards. Consideration of other factors, including effects on the environment and Indigenous rights and interests are presented in Table 1.9–4; however, based on safety considerations, only Route A is presented as the preferred option.

Indigenous knowledge shared included the identification of the Lax Kwaxl/Dundas and Melville Islands Conservancy as an area of food, social and ceremonial (**FSC**) significance, and noting of increasing numbers of vessels transiting through Chatham Sound. During engagement with Indigenous Nations it was noted that the shipping route to the north of Dundas Island was more direct and avoided fishing grounds in Chatham Sound. Concerns associated with shipping routes are assessed more fulsomely in the Navigation Shipping Assessment (Appendix E). No concerns were raised during engagement with the public and other stakeholders.

Table 1.9–4 –Technical, Economic, Environmental and Social Factors for the Consideration of LNG and NGL Shipping Route Options

Factor	Route A	Route B	Route C
Description			
Description	▪ Dixon Entrance to Triple Islands pilot boarding station, through Brown Passage, to Chatham Sound, Main Passage, Portland Inlet and Portland Canal	▪ Dixon Entrance to Caamaño Passage, through the Lax Kwaxl/Dundas and Melville Islands Conservancy to the north end of Main Passage, to Portland Inlet, and Portland Canal	▪ Dixon Entrance, north to between Celestial Reef and west Devil Rock, to north of McCulloch Rock, to south of east Devil Rock and north of Dundas Island, to the north end of Main Passage, to Portland Inlet and Portland Canal
Technical and Economic Feasibility			
Use of BAT	▪ Not applicable	▪ Not applicable	▪ Not applicable.
Technical Requirements and Uncertainties	▪ BCCP have experience with the route ▪ Hazards along the route are marked with aids to navigation ▪ Vessel traffic around Triple Island pilot boarding station will need to be navigated ▪ Longest route (approximately 190 km) ▪ Based on safety considerations, only viable route	▪ Route avoids traffic near Triple Island boarding station and in Chatham Sound ▪ Route travels through Caamano Passage, which is not regularly transited by piloted vessels ▪ Caamano Passage is subject to large swells and is exposed to the weather in Dixon Entrance	▪ Pilot boarding would have to be by helicopter, which does not align with Pacific Pilotage Authority procedures ▪ Improvements to aids to navigation would be required and would likely be technically challenging ▪ Sections of the route may be within US territorial waters ▪ Route was rejected in a TERMPOL review prepared for Dome Petroleum for a proposed project at Grassy Point because it was deemed unsafe ▪ Shortest route (approximately 170 km)

Table 1.9–4 –Technical, Economic, Environmental and Social Factors for the Consideration of LNG and NGL Shipping Route Options

Factor	Route A	Route B	Route C
Capital Cost	▪ Minimal increase in fuel cost due to slightly longer route	▪ Nominal difference in fuel costs. ▪ Under inclement weather vessels may be required to use alternate route which may result in minimal increase in fuel costs.	▪ Minimal decrease in fuel cost due to slightly shorter route. ▪ Will require purchase and installation of aids to navigation.
Environmental, Social, Cultural, Health and Indigenous Interest Considerations			
Environmental Effects	▪ Route has most favourable metocean conditions for escort tugs ▪ Navigation through high traffic areas around Triple Island pilot boarding station increases the potential for an accident ▪ Between the western side of Haida Gwaii to the mouth of Portland Inlet this route is approximately 190 km. Though not different, this longer distance would result in slightly higher GHG emissions than Routes B and C.	▪ Route bisects the Lax Kwaxl/Dundas and Melville Islands Conservancy ▪ Caamano passage has some unmarked drying ledges that extend from Zayas Island and shoal rocks. This increases the risk for an accident ▪ Between the western side of Haida Gwaii to the mouth of Portland Inlet this route is approximately 175 km, making this route slightly longer than route C with slightly higher GHG emissions	▪ Route travels between many unmarked navigation hazards (West Devil Rocks, East Devil Rock, McCullock Rock and the shallows surrounding them) increasing the risk of an accident ▪ Northerly gales are experienced in the area north of Dundas Island increasing the risk of an accident ▪ Between the western side of Haida Gwaii to the mouth of Portland Inlet this route is approximately 170 km, making it the shortest route, with the lowest GHG emissions
Species at Risk (as per SARA)	▪ Potential for a vessel collision with killer whales, harbour porpoises, humpback whales, fin whales and Steller sea lions ▪ As the shortest route, expected to have the least potential for potential interactions with marine mammals and sea turtles	▪ Potential for a vessel collision with killer whales, harbour porpoises, humpback whales, fin whales and Steller sea lions	▪ Potential for a vessel collision with killer whales, harbour porpoises, humpback whales, fin whales and Steller sea lions

Table 1.9–4 –Technical, Economic, Environmental and Social Factors for the Consideration of LNG and NGL Shipping Route Options

Factor	Route A	Route B	Route C
Social, Cultural, and Health Effects	▪ Route traverses the southern and eastern sides of the Lax Kwaxl/Dundas and Melville Islands Conservancy which is a Cultural and Natural Area identified by the Lax Kw'alaams as an area of key FSC significance ▪ Travels through Chatham Sound, an area identified by Kitsumkalum as an important fishing area ▪ Travels through Chatham Sound, an area identified by Kitsumkalum as an important fishing area	▪ Route bisects the Lax Kwaxl/Dundas and Melville Islands Conservancy which is an area identified by the Lax Kw'alaams as an area of key FSC significance	▪ Route traverses the northern end of the Lax Kwaxl/Dundas and Melville Islands Conservancy which is an area identified by the Lax Kw'alaams as an area of key FSC significance
Indigenous Interests and Rights	▪ Route traverses the southern and eastern sides of the Lax Kwaxl/Dundas and Melville Islands Conservancy, an area of FSC significance to the Lax Kw'alaams	▪ Route bisects the Lax Kwaxl/ Dundas and Melville Islands Conservancy, an area of FSC significance to the Lax Kw'alaams	▪ Route traverses the northern end of the Lax Kwaxl/Dundas and Melville Islands Conservancy, an area of FSC significance to the Lax Kw'alaams
GBA Plus	▪ Equal potential for effects on Indigenous subgroup	▪ Equal potential for effects on Indigenous subgroup	▪ Feedback from Indigenous Nations is that this route has the least potential for effects
Consultation and Engagement Feedback[1]	▪ No specific comments	▪ No specific comments	▪ Kitsumkalum indicated preference for a shipping route to the north of Dundas Islands to reduce the potential for accidents in Chatham Sound

Table 1.9–4 –Technical, Economic, Environmental and Social Factors for the Consideration of LNG and NGL Shipping Route Options

Factor		Route A	Route B	Route C
Sustainability	Human-ecological systems	▪ Marine route represents increased use of marine environment	▪ Marine route through a conservancy represents increased use of sensitive marine habitat	▪ Marine route and addition of navigation aids represents increased use of marine environment
	Well-being of generations	▪ Transiting vessels through an area of FSC use to the Lax Kw'alaams has the potential to affect current and future generations	▪ Transiting vessels through the Lax Kwaxl/Dundas and Melville Islands Conservancy would have potential impacts on current and future of this area for FSC purposes	▪ No known effect on well-being of generations
	Enhance positive and reduce adverse effects	▪ Transiting vessels through an area of FSC use to the Lax Kw'alaams has the potential to result in adverse effects use of this area for FSC purposes	▪ Transiting vessels through the Lax Kwaxl/Dundas and Melville Islands Conservancy would have potential adverse impacts on current and future of this area for FSC purposes	▪ Location of this route between many unmarked navigation hazards (West Devil Rocks, East Devil Rock, McCullock Rock and the shallows surrounding them) increasing the risk of an accident ▪ Northerly gales are experienced in the area north of Dundas Island increasing the risk of an accident ▪ Diverting vessels to this less used route will increase potential adverse interactions with marine users in this area while reducing potential adverse potential interactions with marine users in Chatham Sound

Table 1.9–4 –Technical, Economic, Environmental and Social Factors for the Consideration of LNG and NGL Shipping Route Options

Factor		Route A	Route B	Route C
	Precautionary principle, uncertainty and risk	▪ There are no likely effects associated with this route option that would result in irreversible harm	▪ Some may consider transiting vessels through the Lax Kwaxl/Dundas and Melville Islands Conservancy irreversible harm	▪ Should an accident occur in this area due to the higher risk the potential impacts of that accident may result in irreversible harm

1.9.2 Site Layout

There were two areas for which alternative Site layouts were considered during early phases of the Project: (1) consideration of a floating versus a land-based LNG facility, and (2) construction of distinct or combined berths for the FLNGs and mooring and loading of the LNG carriers.

1.9.2.1 Land-based versus Floating LNG Facility

As presented in Table 1.9–5, early in Project design it was decided to proceed with a FLNG facility based on the following:

- The FLNG barge would be built at an off-Site manufacturing facility thus reducing demands on local infrastructure and services as well as labour and housing due to a shorter on-Site construction time
- More efficient FLNG construction in off-Site shipyards with established quality control procedures and construction conditions
- Reduced terrestrial footprint at the Site and associated impacts on the environment and Indigenous interests
- Reduced terrestrial facilities and impacts facilitate remediation of the Site at the end of the Project’s life
- Lower expected construction cost due to smaller construction footprint
- During decommissioning the FLNG is more easily reused or repurposed as it can be floated away for re-use at a different site or to salvage components and metal for alternate purposes

A land-based facility would require the LNG storage and liquefaction components to be built at the Site thus requiring a larger (by an order of magnitude) construction workforce. To accommodate the larger construction crew there would need to be an onshore construction camp/accommodations, larger warehouses, and increased water demands and wastewater discharge. A land-based facility would also require a larger terrestrial footprint resulting in increased impacts to vegetation, wetlands, wildlife and archaeological and cultural sites as well as increased construction costs due to the larger area requiring clearing, grubbing and stripping.

No Indigenous knowledge shared with the Proponent is relevant to the assessment of alternatives on land-based verses floating LNG facilities. During engagement with Indigenous Nations, the public and stakeholders, no concerns related to land-based verses floating LNG facilities were shared.

Table 1.9–5 provides a complete summary of economic, environmental, cultural and social considerations related to the LNG facility options. For the reasons identified here, a land-based alternative is no longer under consideration.

Table 1.9–5 –Technical, Economic, Environmental and Social Factors for the Consideration of Land-based and Floating LNG Facility Options

Factor		Land-based LNG	Floating LNG
Technical and Economic Feasibility			
Use of BAT		▪ Not applicable	▪ FLNG design currently represents focus of engineering innovation in LNG facilities
Technical Requirements and Uncertainties		▪ Site geotechnical conditions and terrain could make construction more technically challenging with higher potential construction risk.	▪ More efficient construction and design based on experienced and established quality control procedures at the manufacturing facility. ▪ Decommissioning of the FLNG is expected to be more efficient since the removal of equipment from Site will allow for salvage of the entire facility once it is floated away
Capital Cost		▪ Increased cost and construction workforce to prepare the Site and build a land-based facility. ▪ Site geotechnical conditions and terrain, combined with the remoteness of the Site, would make construction costly.	▪ Significantly smaller on-Site construction workforce because the FLNGs are built at an off-Site manufacturing facility. ▪ Lower expected construction cost.
Environmental, Social, Cultural, Health and Indigenous Interest Considerations			
Environmental Effects		▪ Larger terrestrial footprint could push the Project footprint into sensitive areas such as wetlands. ▪ Smaller marine footprint means reduced shading of fish habitat (soft sediment bottom) and loss of fish habitat from the anchor points. ▪ Increased workforce during construction would necessitate a land-based construction camp, increasing the footprint of temporary facilities, water usage, and discharges during construction. ▪ A land-based LNG facility may require a longer construction timeline and additional construction equipment, resulting in a higher construction phase release of GHGs	▪ Reduced terrestrial footprint means fewer impacts to vegetation, wildlife and freshwater fish and less remedial work during decommissioning. ▪ Larger marine footprint means increased shading of fish habitat (soft sediment bottom) and loss of soft sediment and riparian habitat at the anchor points but avoids the need for an infilled causeway as is often required on causeways connecting on-land LNG infrastructure to off-loading equipment. ▪ The integrated storage tanks in an FLNG typically require shorter cryogenic piping lines, which means a reduced potential for a spill or leak ▪ Smaller construction workforce requires less water, less marine traffic, etc. during construction phase ▪ Reduced land-based infrastructure is expected to result in lower GHG emissions due to less clearing and reduced construction power generation as well as reduced remediation requirements
Species at risk (as per SARA)		▪ A land-based LNG would result in a slightly higher, but still small, increase in terrestrial habitat loss and mortality risk for species at risk including grizzly bear, little brown myotis, western toad	▪ A floating LNG would result in a slightly higher, but still small, increase in marine habitat loss and mortality risk for species at risk including horned grebe, western grebe, red necked phalarope, marbled murrelet,
Social, Cultural and Health Effects		▪ Larger construction workforce would result in extensive impacts on infrastructure and services, labour needs and housing and potential adverse effects on community well-being	▪ Smaller construction workforce will result in reduced demands on infrastructure and services, labour, and housing as well as impacts on community well-being
Indigenous Interests and Rights		▪ Increase on-land footprint will result in a larger loss in land and resources used by the Nisga'a	▪ Smaller terrestrial footprint means fewer impacts on land and resources used by the Nisga'a
GBA Plus		▪ No known disproportionate effects on sub-populations and/or groups	▪ Reduced land based infrastructure will limit potential effects on Indigenous owned land
Consultation and Engagement		▪ None	▪ None
Sustainability	Human-ecological systems	▪ Larger on-land footprint represents an increased use of the terrestrial environment ▪ Marine infrastructure represents use of marine environment	▪ Marine infrastructure represents use of marine environment
	Well-being of generations	▪ Larger on-land footprint would result in a greater loss of terrestrial habitat available for FSC purposes	▪ Slightly larger marine footprint would result in a greater loss of marine habitat available for FSC purposes
	Enhance positive and reduce adverse effects	▪ Represents the largest terrestrial footprint, thereby increasing potential adverse effects on the terrestrial environment including wildlife and wildlife habitat (including species at risk), wetlands, and areas traditional used for FSC purposes	▪ Potential for a slightly larger marine footprint, thereby increasing adverse effects on marine habitat and marine life
	Precautionary principle, uncertainty and risk	▪ There are no likely effects associated with this option that would result in irreversible harm	▪ There are no likely effects associated with this option that would result in irreversible harm

1.9.2.2 Dedicated LNG Carrier Berths or FLNG Ship to Ship Mooring

An early marine terminal design considered the use of dedicated berths with their own marine infrastructure that would be used to moor and load LNG carriers. The FLNGs would be moored nearby at separate berths. This design would require considerable additional onshore and marine footprint resulting in the potential for greater effects on the environmental and Indigenous interests than a design where the berths are combined. The additional berths would require a larger construction workforce, potentially resulting in effects on social factors. Additionally, this option would require significant interconnecting piping and infrastructure to convey LNG (and NGLs) from the FLNGs to the LNG carrier berths, necessitating the associated spill containment systems, etc. The dedicated berth design is no longer under consideration due to its potential impacts on terrestrial footprint, marine footprint, regional social factors, and construction cost. Table 1.9–6 presents the economic, environmental, cultural and social advantages/benefits and risks/costs of these alternatives.

No Indigenous knowledge shared with the Proponent is relevant to the assessment of alternatives on LNG carrier berths. During engagement with Indigenous Nations, the public and stakeholders no concerns related to LNG carrier berths were shared.

Table 1.9–6 –Technical, Economic, Environmental and Social Factors for the Consideration of Dedicated LNG Carrier Berths or Ship to Ship Mooring

Factor		Dedicated LNG Carrier Berths	Ship to Ship Mooring
Technical and Economic Feasibility			
Use of BAT		▪ Not applicable	▪ Use of ship-to-ship mooring represents BAT
Technical Requirements and Uncertainties		▪ Requires a larger construction workforce. ▪ Requires more interconnecting piping and infrastructure to convey LNG (and NGLs) from the FLNGs to the LNG carrier berths, requiring associated spill containment systems.	▪ Spread mooring system for the FLNGs must account for the loads of LNG carriers moored to the FLNGs. Requires heavier / stronger mooring equipment.
Capital Cost		▪ Additional infrastructure and larger workforce will result in increased capital cost	▪ Most efficient capital cost
Environmental, Social, Cultural, Health and Indigenous Interest Considerations			
Environmental Effects		▪ Additional infrastructure on-land and in the water lot would result in a larger Project footprint increasing the potential effects to vegetation, wildlife, and freshwater fish ▪ Additional infrastructure would result in more construction equipment which would result in increased GHG emissions ▪ Dedicated LNG carrier berths would increase the number of marine piles at the Site, extending the duration of any marine noise effects	▪ Smaller onshore and marine footprint will result in fewer potential environmental effects
Species at Risk (as per SARA)		▪ Potential for loss in habitat for terrestrial and marine species at risk	▪ Smaller onshore and marine footprint will reduce potential for potential effects on species at risk
Social, Cultural and Health Effects		▪ Increased construction workforce has the potential to result in increased effects on regional infrastructure and services	▪ Smaller construction workforce requirements will result in the least potential effects on regional infrastructure and services
Indigenous Interests and Rights		▪ None	▪ None
GBA Plus		▪ No disproportionate effects on sub-populations and/or groups	▪ Reduced onshore footprint will reduce use of Indigenous owned land
Consultation and Engagement		▪ None	▪ None
Sustainability	Human-ecological systems	▪ Larger marine footprint represents increased use of marine environment	▪ Smaller marine footprint represents reduced use of marine environment
	Well-being of generations	▪ Larger marine footprint would result in a great effect on the ability of current and future generations to use area for FSC purposes	▪ Smaller marine footprint means a reduced effect on current and future generations that use the area for FSC purposes
	Enhance positive and reduce adverse effects	▪ The larger marine footprint will result in a greater potential adverse effect on the marine environment associated with direct habitat loss and increased shading ▪ Increased amount of infrastructure means more construction equipment which increases greenhouse gases and a larger construction crew which has a larger adverse effect on regional infrastructure and services	▪ Reduced marine footprint thereby reducing potential adverse effects on the marine environment ▪ Reduced requirements for infrastructure means less construction equipment and associated greenhouse gases ▪ Reduced infrastructure means a reduced workforce which will have less of an adverse effect on regional infrastructure and services
	Precautionary principle, uncertainty and risk	▪ There are no likely effects associated with this option that would result in irreversible harm	▪ There are no likely effects associated with this option that would result in irreversible harm

1.9.3 Site Energy Sources

During an earlier phase of the Project, several alternatives for electrical power supply were evaluated, as presented in Section 2.14.1.4 of the Detailed Project Description and translated here as Table 1.9–7 using the same considerations presented in this section. As the Base Case, the Project will utilize a renewable energy source connection via the BC Hydro electrical grid; however, should a connection not be available at the start of operation, temporary on-Site power generation will be required. For this temporary source of power, the Project has evaluated three alternatives that are dependent, primarily, on the system of cooling incorporated into the design of the temporary power barges.

- Alternative 1: Temporary power barges using once-through seawater cooling, which is no longer under consideration due to the potential marine impacts of the seawater temperature rise associated with such systems
- Alternative 2: Temporary power barges using evaporative cooling system, which is no longer under consideration due to the increased treated water usage (approximately 60 times the base case) required for such a system compared to the other alternatives
- Alternative 3: Temporary power barges using closed-loop onshore cooling towers, which is the preferred/only option still under consideration should an on-Site power generation source be required until the operational BC Hydro grid connection can be established

A final decision on whether temporary electric power generation is required will depend on studies to be completed by BC Hydro related to the timing of the permanent electrical power supply.

Engagement with Indigenous Nations and the public identified GHGs as a primary concern. The Proponent is focused on addressing this concern through on-going engagement with BC Hydro to facilitate timely completion of the necessary upgrades to the BC electricity grid to address Project power needs.

Table 1.9–7 –Technical, Economic, Environmental and Social Factors for the Consideration of Project Energy Source Options

Factor	Base Case	Alternative 1	Alternative 2	Alternative 3
Description				
Description	▪ Electricity provided by BC Hydro at Project start	▪ Connection to BC Hydro grid is delayed. Power generation on-Site from temporary power barges that use open loop sea water cooling	▪ Connection to BC Hydro grid is delayed. Power generation on-Site from temporary power barges that use water cooling via onshore evaporative cooling towers	▪ Connection to BC Hydro grid is delayed. Power generation on-Site from temporary power barges that use water cooling via closed loop onshore cooling towers
Source of Electricity	▪ High voltage transmission line connected to BC Hydro's grid	▪ Preliminary estimate of 1 to 5 years of temporary power barge use ▪ As soon as BC Hydro grid connection in place, temporary power barges removed	▪ Preliminary estimate of 1 to 5 years of temporary power barge use ▪ As soon as BC Hydro grid connection is in place, temporary power barges and supporting infrastructure will no longer be used	▪ Preliminary estimate of 1 to 5 years of temporary power barge use ▪ As soon as BC Hydro grid connection is in place, temporary power barges and supporting infrastructure will no longer be used
Water Source	▪ No water use associated with electrical power needs	▪ Open loop (e.g., once through) seawater cooling for temporary power barges ▪ Treated Water usage approximately twice base case to provide demineralized water for the power barge steam systems	▪ Onshore evaporative cooling for temporary power barges resulting in high volume water use (approximately 60 times the base case treated water use)	▪ Onshore closed loop cooling water system to provide requirements for temporary power barges ▪ Treated water usage approximately twice base case to provide demineralized water for the power barge steam systems
Technical and Economic Feasibility				
Use of BAT	▪ Not applicable	▪ Not applicable	▪ Not applicable	▪ Not applicable
Technical Requirements and Uncertainties	▪ Requires BC Hydro grid connection prior to start of operation	▪ Additional parasitic power requirements will result in less available power	▪ Additional parasitic power requirements will result in less available power ▪ Extensive onshore infrastructure that will be unnecessary after BC Hydro grid connection ▪ Large volume water requirements will require a substantive desalination plant as other sources will likely be unable to supply the demand necessary for evaporative cooling	▪ Largest parasitic power requirements will result in less available power ▪ Extensive onshore infrastructure that will be unnecessary after BC Hydro grid connection
Capital Cost	▪ Capital cost savings related to power barge (up to $1.5 billion CAN)	▪ Major (over $1.0 billion CAN) capital cost expenditure related to temporary power barges and expanded MOF Modest capital cost recovery following sale/redeployment of temporary power barges	▪ Major (over $1.5 billion CAN) capital cost expenditure related to temporary power barges, expanded MOF and cooling infrastructure ▪ No or limited capital cost recovery	▪ Major (over $1.5 billion CAN) capital cost expenditure related to temporary power barges, expanded MOF and cooling infrastructure ▪ No or limited capital cost recovery

Table 1.9–7 –Technical, Economic, Environmental and Social Factors for the Consideration of Project Energy Source Options

Factor		Base Case	Alternative 1	Alternative 2	Alternative 3
Environmental, Social, Cultural, Health and Indigenous Interest Considerations					
Environmental Effects		▪ Smallest marine footprint (no temporary power barges) ▪ Lowest GHG emissions ▪ Limited critical air contaminant (CAC) air emissions	▪ Potential effects to marine water quality as well as entrainment and impingement effects to plankton and small fish ▪ Large MOF ▪ Increased marine footprint from base case ▪ Additional marine infrastructure for seawater cooling ▪ Substantive (approximately 6 times) increase to Project GHG emissions during temporary power barge operation ▪ Increased CAC air emissions during temporary power barge operation	▪ Potential water source effects including water quality, fish habitat as well as entrainment and impingement effects from large volume withdrawals of sea water ▪ Large MOF ▪ Increased marine footprint from base case ▪ Additional marine infrastructure for much larger desalination unit ▪ Large onshore footprint for evaporative cooling system infrastructure only used until BC Hydro grid connection in place ▪ Substantive (approximately 6 times) increase to Project GHG emissions during temporary power barge operation ▪ Increased power and therefore increased GHG emissions to desalinate necessary water ▪ Increased CAC air emissions during temporary power barge operation	▪ Large MOF ▪ Largest terrestrial footprint due to cooling infrastructure ▪ Substantive (approximately 6 times) increase to Project GHG emissions during temporary power barge operation ▪ Increased CAC air emissions during temporary power barge operation ▪ This Alternative emits the largest quantity of GHG emissions during temporary power barge operation
Species at Risk (as per SARA)		▪ This option has the smallest terrestrial and marine footprint of all options considered which would result in the smallest potential effect on species at risk in the area	▪ The larger marine footprint relative to base case would result in a slightly higher, but still small, increase in habitat loss and mortality risk for species at risk including horned grebe, western grebe, red necked phalarope, marbled murrelet,	▪ The larger marine footprint relative to base case would result in a slightly higher, but still small, increase in habitat loss and mortality risk for species at risk including horned grebe, western grebe, red necked phalarope, marbled murrelet, ▪ A larger terrestrial footprint relative to base case would result in a slightly higher, but still small, increase in habitat loss and mortality risk for species at risk including grizzly bear, little brown myotis, western toad	▪ The larger marine footprint relative to base case would result in a slightly higher, but still small, increase in habitat loss and mortality risk for species at risk including horned grebe, western grebe, red necked phalarope, marbled murrelet, ▪ A larger terrestrial footprint relative to all other cases would result in a slightly higher, but still small, increase in habitat loss and mortality risk for species at risk including grizzly bear, little brown myotis, western toad
Social, Cultural and Health Effects		▪ While social, cultural and health effects have been identified due to the BC Hydro grid connection, these are common to all options	▪ Increased air emissions due to temporary power barge operation	▪ Increased air emissions due to temporary power barge operation	▪ Increased air emissions due to temporary power barge operation
Indigenous Interests and Rights		▪ None	▪ None	▪ None	▪ None
GBA Plus		▪ No disproportionate effects on sub-populations and/or groups	▪ No disproportionate effects on sub-populations and/or groups	▪ No disproportionate effects on sub-populations and/or groups	▪ No disproportionate effects on sub-populations and/or groups
Consultation and Engagement		▪ While concerns have been identified related due to BC Hydro grid connection, these are common to all options	▪ Increased GHG emissions ▪ Additional concern related to temporary open loop (e.g., once-through) cooling sea water use identified during engagement	▪ Increased GHG emissions ▪ Additional concern related to water usage for cooling identified during engagement	▪ Increased GHG emissions
Sustainability	Human-ecological systems	▪ Lack of need for water for cooling means no change in use of the marine environment	▪ Discharge of warm seawater into the marine environment represents an increased use of the marine environment	▪ Withdrawal of sea water for use in cooling represents an increased use of the marine environment	▪ Minimal water withdrawal represents a limited impact on the marine environment

Table 1.9–7 –Technical, Economic, Environmental and Social Factors for the Consideration of Project Energy Source Options

Factor		Base Case	Alternative 1	Alternative 2	Alternative 3
	Well-being of generations	▪ Increased access to power in the Nass Area will increase business opportunities and general well-being of communities	▪ Increased access to power in the Nass Area will increase business opportunities and general well-being of communities ▪ Discharge of warm water into the marine environment could alter the marine habitat thereby affecting the ability of current and future generations to harvest in the area	▪ Increased access to power in the Nass Area will increase business opportunities and general well-being of communities ▪ Continuous withdrawal of marine water could harm marine life through entrainment and impingement thereby altering the marine life community in ways that could affect the ability of current and future generations to harvest in the area	▪ Increased access to power in the Nass Area will increase business opportunities and general well-being of communities
	Enhance positive and reduce adverse effects	▪ Social, cultural and health benefits due to the BC Hydro grid connection	▪ Social, cultural and health benefits due to the BC Hydro grid connection ▪ Water withdrawal has the potential to result in an adverse effect on plankton and small fish due entrainment and impingement effects ▪ Discharge of warm water has the potential to result in an adverse effect to marine resources ▪ The need for power barges means an increase in the emission of GHGs relative to Base Case	▪ Social, cultural and health benefits due to the BC Hydro grid connection ▪ The large amount of water withdrawal has the potential to result in an adverse effect on plankton and small fish due entrainment and impingement effects ▪ The need for power barges means an increase in the emission of GHGs relative to Base Case	▪ Social, cultural and health benefits due to the BC Hydro grid connection ▪ Temporary barges in this alternative would result in the highest GHG emissions
	Precautionary principle, uncertainty and risk	▪ There are no likely effects associated with this option that would result in irreversible harm	▪ On-going discharge of warmed sea water to the marine environment could result in irreversible damage to marine life	▪ There are no likely effects associated with this option that would result in irreversible harm	▪ There are no likely effects associated with this option that would result in irreversible harm

1.9.4 Transmission Line

As outlined in Section 1.4.6.2, a third party will undertake the design, routing, development, construction, operation and seek regulatory approval of a 287 kilovolt transmission line that would begin at a new BC Hydro substation in the New Aiyansh area and then travel through the Nass Valley on Nisga'a Lands (as defined in the Nisga'a Treaty) ultimately terminating at the Site. This Application includes an assessment of the construction and operation of the portion of the transmission line that is not on Nisga'a Lands (i.e., between Nisga'a Lands and the Project Site on Pearse Island). The portion of the transmission line within Nisga'a Lands has been included as a foreseeable project within this Application and is therefore assessed for potential cumulative effects. In addition, the portion within Nisga'a Lands will be assessed under Chapter 10 of the Nisga'a Treaty.

There are several potential routes being considered for the portion of the line between Nisga'a Lands and the Site, which include scenarios for aerial crossings, terrestrial installation and subsea installation. Figure 1.4-1 provides potential transmission line routes that have been considered to date. The following describes the scenarios considered. Table 1.9–8 provides a summary of economic, environmental, cultural and social factors considered for the proposed transmission line scenarios. The potential health effects from exposure to the electromagnetic fields from the transmission line is an inoperable exposure pathway and therefore not considered further in this analysis (see Section 7.14 for additional information).

1.9.4.1 Terrestrial Crossings

Terrestrial crossings of various lengths would be required in all routing options. Construction and operation of terrestrial transmission lines is well understood. Construction activities include clearing and brushing for rights-of-way access; transmission tower construction, including foundations; transmission line stringing; and conductor installation. Operation activities include rights-of-way maintenance as well as tower and line inspection and maintenance. Activities associated with construction of a terrestrial transmission line have the potential to result in habitat loss due to clearing of rights-of way and sensory disturbance (Section 7.7), whereas operation may result in a change in wildlife movement or mortality risk due to the presence of the rights-of-way, and collisions with the lines. Similarly, transmission line construction and maintenance will result in vegetation clearing and the potential loss of plant species of interest; regrowth and maintenance during operation will result in change in vegetation communities. Effects on wildlife movement and mortality and effects on vegetation may also affect harvesting, hunting and trapping activities. Effects on surface water and wetlands are expected to be mitigated during final routing by the third-party developer. Given the remote location of the transmission line, social, cultural and health effects are anticipated to be limited to effects associated with the presence of the line from the perspective of aesthetics and its effects on sense of place. The presence of a transmission line on the landscape may alter the enjoyment of traditional activities such as hunting, trapping and harvesting (see the Indigenous nation Sections 11.0 through 19.0).

1.9.4.2 Aerial Crossing

Aerial crossing over a body of water is an option where the crossing distance between two points of land enables the transmission line to be sufficiently elevated during all weather conditions (e.g., high temperatures, snow, wind) to not impact marine shipping or interfere with aviation. A location where an aerial line may be appropriate is from Sgawban on Nisga'a lands, east over Observatory Inlet to Ashington Ridge (northeast of the Project Site). Construction of aerial crossings is well understood and can be a more cost effective and less environmentally impactful option than subsea cables.

An aerial crossing would require the on-land construction of transmission towers on each side of the crossing and associated limited land clearing. Potential effects associated with construction are similar to those described in Section 1.9.4.1 for terrestrial crossings. The exception is when a helicopter would be required to string the transmission line between the towers on either side of the water body. Potential effects associated with use of the helicopter include short-term sensory disturbance to wildlife as well as people that may be in the area at that time.

During operation, the transmission line would need to be sufficiently elevated above the ocean surface to not interfere with marine shipping and would require appropriate markings to prevent interactions with aircraft. Potential effects to wildlife include change of movement and risk of mortality to birds and bats using the airspace (Section 7.7). Given the remote location of the transmission line, social, cultural and health effects are anticipated to be limited to effects associated with the presence of the transmission line from the perspective of aesthetics and its effects on sense of place. The presence of a transmission line on the landscape may alter the enjoyment of traditional activities such as hunting, trapping and harvesting (see the Indigenous nation Sections 12.0 through 19.0).

1.9.4.3 Subsea Crossing

It is anticipated that a subsea crossing of some length would be required for any of the potential transmission line options. Within intertidal and shallow subtidal habitats, subsea cables are typically installed to approximately 1 m depth using a water jet and/or excavator. In subtidal habitats cables are typically laid out on the seabed using a specialized marine vessel, no active trenching or burial will occur. The cables are expected to settle into marine sediments over time.

Installation of a subsea transmission line has the potential to result in sensory disturbance to marine fish, including invertebrates, and may result in the alteration, disturbance or destruction of fish habitat (Section 7.9). Terrestrial disturbance would be limited to the intertidal zone and shoreline riparian habitat where the cable is laid. Alteration of this area is most likely to affect animals that use intertidal habitat (e.g., marine birds, grizzly bears) and shoreline habitat (e.g., savannah sparrow) (see Section 7.7). In addition, tidal wetlands may be affected; however, final routing is expected to limit and/or eliminate this potential effect. Once installed, the cable will remain buried and there is limited potential for interaction between marine users, including fishers, and the subsea transmission line (see Section 7.11). Social, cultural and health impacts may include a change in composition of diet and nutrition due to changes in access to country foods (see the Indigenous nation Sections 11.0 through 19.0).

1.9.4.4 Summary of Transmission Line Construction Options

Table 1.9–8 outlines the factors that are considered to identify transmission line scenarios for the Project. All three scenarios are technically and economically feasible and none result in irreversible potential effects. The route ultimately selected by the third-party provider will be a combination of one or more of these scenarios. As a result, to avoid duplication, Table 1.9–8 presents factors for each scenario (i.e., aerial, terrestrial and subsea) as opposed to each option.

Based on terrain and Site location it is expected that the route selected by the third-party provider will require all or a portion of the line to be subsea. As such, alternate options likely include, but are not necessarily limited to:

- Subsea, terrestrial, and aerial
- Subsea and terrestrial
- Subsea

The primary concern identified during engagement with Indigenous Nations was in relation to a subsea transmission line potentially interacting with fishing practices and potential cumulative effects of a subsea transmission line, a subsea pipeline and shipping activity. Proposed mitigation measures are expected and include clearly identifying the location of the transmission line and/or pipeline on nautical maps and through signage on the shoreline (i.e., where the potential lines enter/exit the intertidal). No feedback from the public was received by the Proponents in relation to the transmission line or subsea pipeline.

Table 1.9–8 – Technical, Economic, Environmental and Social Factors for the Consideration of Transmission Line Construction Options

Factor	Aerial	Terrestrial	Subsea
Technical and Economic Feasibility			
Use of BAT	▪ Proven technology currently in use in BC	▪ Proven technology currently in use in BC	▪ Proven technology currently in use in BC
Technical Requirements and Uncertainties	▪ Tension in line will need to withstand a range of weather conditions including ice and wind ▪ Tower heights, line tension and local tide variations will have to be considered to provide for minimum safe clearance for local shipping	▪ Routing will need to consider terrain and inclement weather including high winds and steep terrain ▪ Routing will need to consider future maintenance requirements	▪ Near shore installation will need to consider potential for scour and erosion potential
Capital Cost	▪ Conductor material costs less than subsea cable ▪ Towers on each side of the aerial crossing may cost more to install than those at crossings designated for subsea cables	▪ Conductor material costs less than subsea cable ▪ Final routing will need to consider installation costs related to terrain ▪ Installation costs can vary quite widely depending on the terrain	▪ Conductor material costs more than terrestrial or aerial conductor materials; however, towers are not required ▪ Final routing will need to consider costs related to bathymetry
Environmental, Social, Cultural, Health and Indigenous Interest Considerations			
Environmental Effects	▪ Potential wildlife habitat and vegetation alteration as a result of clearing tower footprint ▪ Potential mortality risk for birds and bats ▪ No conservation lands impacted	▪ Potential wildlife habitat and vegetation alteration as a result of rights-of-way clearing ▪ Potential mortality risk for birds and bats ▪ No conservation lands impacted	▪ Temporary intertidal impacts ▪ Potential alteration, disturbance or destruction of fish habitat ▪ Potential for a vessel-marine mammal collision during construction
Species at risk (as per SARA)	▪ Aerial species at risk, such as western screech-owl, northern goshawk, olive-sided flycatcher, the little brown myotis and northern myotis may collide with the transmission line which could result in mortality or harm	▪ Aerial species at risk, such as western screech-owl, northern goshawk, olive-sided flycatcher, the little brown myotis and northern myotis may collide with the transmission line which could result in mortality or harm ▪ The right of way cleared for the transmission line may be used by grizzly bears as a travel corridor	▪ There is a small potential that construction activities could result in a collision or sensory disturbance, with species at risk including killer whales, harbour porpoises, humpback whales, fin whales and Steller sea lions
Social, Cultural and Health Effects	▪ Temporary impacts to marine vessel passage during installation ▪ Potential risk to aircraft ▪ Change in aesthetics	▪ Change in aesthetics	▪ Temporary impacts to marine vessel passage during installation ▪ Potential for perceived impacts to ground fishing
Indigenous Interests and Rights	▪ Change in vegetation and wildlife habitat may result in changes to hunting, trapping and/or harvesting potential ▪ Change in aesthetics that may affect sense of place ▪ Excepting tower footprint, limited potential for archaeological effects	▪ Change in vegetation and wildlife habitat may result in changes to hunting, trapping and/or harvesting potential ▪ Change in aesthetics that may affect sense of place ▪ Potential for routing within areas having moderate or high archaeological potential	▪ Potential for perceived impacts to ground fishing ▪ Temporary disruption in access for marine users during construction ▪ Excepting intertidal areas, limited potential for archaeological effects
GBA Plus	▪ Potential for alteration to sense of place for Indigenous nations of marine and terrestrial areas in proximity of the aerial transmission line	▪ Depending on final route, options may result in terrestrial crossing of Indigenous territory	▪ Potential for restrictions to use of marine area by Indigenous users in proximity to subsea transmission line
Consultation and Engagement	▪ Engagement with the Nisga'a Nation and Indigenous Nations on potential route options and effects	▪ Engagement with the Nisga'a Nation and Indigenous Nations on potential route options and effects	▪ Engagement with the Nisga'a Nation and Indigenous Nations on potential route options and effects

Table 1.9–8 – Technical, Economic, Environmental and Social Factors for the Consideration of Transmission Line Construction Options

Factor		Aerial	Terrestrial	Subsea
Sustainability	Human-ecological systems	▪ No known interdependence of human-ecological systems	▪ No known interdependence of human-ecological systems	▪ No known interdependence of human-ecological systems
	Well-being of generations	▪ Increased access to power in the Nass Area will increase business opportunities and general well-being of communities	▪ Increased access to power in the Nass Area will increase business opportunities and general well-being of communities	▪ Increased access to power in the Nass Area will increase business opportunities and general well-being of communities
	Enhance positive and reduce adverse effects	▪ Aerial transmission lines have the potential to adversely affect aerial species including birds and bats ▪ Aerial transmission lines would not result in an adverse effect on marine use	▪ Terrestrial transmission line require the clearing of a right ow way which can adversely affect wetland and vegetation as well as wildlife mortality risk and behaviour	▪ Subsea cables have the potential to affect marine use due to the actual and perceived risk of the transmission line interacting with fishing gear
	Precautionary principle, uncertainty and risk	▪ There are no likely effects associated with this option that would result in irreversible harm	▪ There are no likely effects associated with this option that would result in irreversible harm	▪ There are no likely effects associated with this option that would result in irreversible harm

1.9.5 Water Supply

The Project is currently considering water supply options for domestic and process water. Water supply options considered are:

- Local surface water
- Groundwater (well)
- Rainwater
- Desalination of seawater

Volume requirements will be refined during FEED and will be a key consideration in the final selection of the water source. To support early efforts to understand water supply options initial water needs during operation have been estimated as 14-25 m^3/hr. The following describes the water supply options being considered given estimated water need. Table 1.9–9 provides a summary of economic, environmental, cultural and social factors considered for the proposed water sources.

1.9.5.1 Local surface water

Three watercourses have been identified near the Project as potential water sources; two are located in DL 5431 (WC-02 and WC-04), and one in DL 7235 (WC-09) (see Sections 7.04 [Surface Water] and 7.08 [Freshwater Fish and Fish Habitat] for details and figures on watercourses). To understand the potential for these watercourses to act as a water source for the Project a desktop-based assessment of mean water volumes and water flows was completed using modelled flow data from Northwest BC Water Tool (FLNRORD 2022). Results of the assessment indicated that the WC-09 has sufficient flow to be viable throughout the year as a water source whereas WC-02 and WC-04 are viable except during July and August.

Any watercourse selected for use by the Project will require an access road, power, piping, etc. WC-02 and WC-04 are both located within or near the Project footprint and therefore construction of these additional component would have little additional impact on the environment. WC-09 is located more than 1 km (straight line distance) from the rest of the onshore Project infrastructure. Construction of infrastructure to access and operate this Site (including a road, power supply, piping and prepared footprint) would result in new environmental impacts and would add capital and operating costs to the Project. For these reasons, WC-09 is no longer under consideration.

WC-02 and WC-04 have the potential to supply water for the Project but exhibit significant seasonal variations in quantity and availability of water. These two water courses are being further evaluated as part of the FEED phase of the Project, but proposed usage will likely be limited to the construction phase.

In conclusion, given the increased costs and environmental effects associated with pumping water from WC-09, the Project is not carrying this option forward for use during operation. Due to the seasonal variability in availability of surface water from the other viable water courses, the Project is currently limiting proposed use of surface water to the construction phase and will supplement water needed during construction by delivering water to Site by barge.

1.9.5.2 Groundwater

To understand the potential for groundwater in the vicinity of the Site, a review was conducted of the Site's surficial and bedrock geology aquifer potential. The surficial geology is characterized as consisting of unconsolidated sediment deposits including glaciomarine sediments, colluvium, till and organics (McCuaig 2003). Deposit landforms are generally veneers. These types of deposits are characterized as having high enough fractions of clay and silt, which are characteristically low permeability (Freeze and Cherry 1979) such that the permeability of these sediments can be inferred to be low to the extent that they likely reduce hydraulic connection between overlying surface water features and underlying groundwater. The conclusion was that the deposits were of insufficient thickness or permeability to warrant further investigation for groundwater resource potential.

The bedrock underlying the north half of Pearse Island has been mapped as early Tertiary granodiorite (McIntyre et al. 1994). Fresh, competent granodiorite typically has a low primary porosity and any potential for a groundwater resource is dependent on the characteristics of secondary fracturing and jointing to store and transmit groundwater. Therefore, it has been inferred that the groundwater resource potential of the granodiorite is poor, based on an assumed low primary permeability and considerable uncertainty as to the characteristics of secondary fracturing.

The granodiorite bedrock is not limited by thickness like the overlying unconsolidated deposits. It is possible that the required potable water supply could be achieved via groundwater wells drilled and installed in the bedrock given sufficient water-bearing fractures are encountered and that there is a sufficient degree of interconnectedness between the fractures over a large enough area.

Given the low probability of groundwater being present at this Site and the extensive drilling program that would be required to confirm groundwater is a viable source, groundwater is no longer a water supply source being considered by the Project.

1.9.5.3 Desalination of Seawater

If seawater is sourced as a water supply option, it would be sourced locally and treated on-Site through reverse osmosis technology with concentrated brine solutions (concentrated salts) discharged to the marine environment. Two key concerns with desalination plants are effects associated with the discharge of brine and the death of fish through impingement and entrainment.

Brine from desalination plants contains elevated salinity and the residues of pre-treatment and cleaning chemicals. The desalination process will result in a brine concentrate typically two to three times the concentration of ambient seawater. When discharging the brine, it will be required to meet BC water quality guidelines and Canadian Council of Ministers of the Environment (**CCME**) water quality guidelines at the edge of the initial dilution zone. To meet these guidelines, the outfall will be located in a well flushed, tidally influenced and dynamic environment with a diffuser to disperse effluent upwards to reduce the potential for the brine to sink to the seabed and affect benthic communities. Concerns with impingement and entrainment will be addressed through the design of a sea water intake system consistent with DFO guidance.

With the identification of a suitable water intake/outfall location and characterization of the effluent discharge to the local environment, desalination is considered a viable option as a water source for the Project.

In conclusion, seawater would provide an unlimited water source to the Site. Desalination plants are a well-established technology, making their proposed use at the Site both technologically and economically feasible. Potential environmental effects can be addressed through meeting BC and federal water quality guideline at the edge of the initial dilution zone, designing the seawater intake structure based on DFO guidance, and locating the outfall in a well flushed, tidally influenced and dynamic environment with diffuser(s) to disperse effluent upwards to reduce effects on benthic habitats. As such, desalination of seawater is being considered the primary source of water for use during operation.

1.9.5.4 Rainwater/Precipitation

Rainwater (and other forms of precipitation in or after it becomes liquid) can be collected from the roofs of Project buildings and stored in a cistern (or cisterns) for Project use. To obtain a rough estimate of the amount of rainwater that may be available, the average monthly rainfall estimated for the Site was multiplied by the area (m^2) of Project buildings (Accommodation, Administration and Maintenance/Warehouse). Calculations suggest that the Site could collect an average of approximately 51 m^3/day or an annual average of approximately 18,700 m^3. This is insufficient to support Project water needs and cannot be considered a reliable source.

However, collection of rainwater from the Project footprint is anticipated to have limited to no environmental, social, economic, cultural impacts or impact on Indigenous interests and is therefore considered a viable option as a water source, which would be used to supplement supply from another primary source.

1.9.5.5 Summary of Project Water Supply Options

Table 1.9–9 outlines the factors that are considered to identify water source options for the Project. Groundwater has been eliminated as a viable water supply option based on the need to conduct extensive exploration to determine availability and the predicted low potential for locating a sufficient supply of water. Based on the seasonal variability and potential restrictions related to ensuring instream flow requirements, surface water will be carried forward for consideration as a water source during construction.

Preferred supply options for water during operation has been identified as rainwater/precipitation based on the minimal capital cost investment and limited/no environmental, social, cultural and health effects. However, based on the seasonal variation and the estimated available volume of rainwater/precipitation, desalination has also been identified as a preferred water supply option. While desalination has the highest (expected) capital cost as well as potential environmental effects related to seawater withdrawal and brine disposal, it represents the only reliable water supply option.

Indigenous engagement identified concerns with carrying forward too many water supply options into the effects assessment as well as potential effects on the local aquatic environment as a result of withdrawing water from the local watershed and the discharge of wastewater following the desalination process to the marine environment. These concerns are largely addressed by relying on rainwater and desalination and dropping groundwater as a potential water source. The Project intends to limit the use of surface water to construction and the discharge of wastewater will be completed in compliance with water quality guidelines. No feedback was shared by the public on water supply options.

Table 1.9–9 – Technical, Economic, Environmental and Social Factors for the Consideration of Water Source Options

Factor		Surface Water	Groundwater Well	Desalination Plant	Rainwater
Technical and Economic Feasibility					
Use of BAT		▪ Not applicable	▪ Not applicable	▪ Not applicable	▪ Not applicable
Technical Requirements and Uncertainties		▪ Would require installation of additional infrastructure (pumps, piping, roads, power) ▪ Periods where water would not be available due to insufficient flow	▪ Site geology suggests medium to low potential for groundwater ▪ Confirmation of groundwater availability would require installation of an exploration well or wells over an extended period of time	▪ Proven technology for water extraction ▪ Seawater source is reliable even in droughts	▪ Proven technology for water collection ▪ Not a consistent water source during periods of low rainfall
Capital Costs		▪ Capital cost associated with required pump and piping installation and including potential access roads for system maintenance	▪ Capital costs associated with drilling wells and installation of pump and pipes	▪ Highest capital cost; requires capital investment for the desalination plant and larger water pumps	▪ Expected minimal capital cost associated with building design including collection, storage and pumps
Environmental, Cultural, Social and Indigenous Interest Considerations					
Environmental Effects)		▪ Would require extraction from fish bearing water courses. Project will be required to meet environmental flow needs for biology requirements to reduce potential to harm fish	▪ Potential that groundwater withdrawal could affect surface water quantity and in turn affect fish and fish habitat	▪ Water intake could result in the impingement or entrainment of fish ▪ Brine discharge could settle on the ocean floor and impact benthic organisms	▪ None
Species at risk (as per SARA)		▪ No freshwater species at risk are present at the Site	▪ No anticipated effect on species at risk	▪ Water intake could result in the impingement or entrainment of species at risk including quillback rockfish, rougheye rockfish and yelloweye rockfish	▪ No anticipated effects on species at risk
Social, Cultural and Health Effects		▪ None	▪ None	▪ None	▪ None
Indigenous Interests and Rights		▪ Potential concern with impacts to anadromous fish that use these watercourses	▪ Potential concern with impacts to anadromous fish if groundwater extraction affects surface water	▪ Concerns with potential effects on fish health and fish mortality due to intake and discharge	▪ None
GBA Plus		▪ Potential for use of surface water located on Indigenous owned land	▪ No disproportionate effects on sub-populations and/or groups	▪ No disproportionate effects on sub-populations and/or groups	▪ No disproportionate effects on sub-populations and/or groups
Consultation and Engagement		▪ Concerns about impacts to the aquatic environment due to removal of water from the local watershed	▪ Concerns about impacts to the aquatic environment due to removal of water from the local watershed	▪ Concerns related to the release of wastewater into the marine environment	▪ None
Sustainability	Human-ecological systems	▪ The withdrawal of surface water for Project use may result in a reduction in water available for fish and wildlife	▪ If the withdrawal of groundwater for Project use interacts it may result in a reduction in water available for fish and wildlife	▪ The withdrawal of sea water may result in the impingement or entrainment of fish	▪ No known interdependence of human-ecological systems
	Well-being of generations	▪ No anticipated effect on the well-being of generations	▪ No anticipated effect on the well-being of generations	▪ No anticipated effect on the well-being of generations	▪ No effect on the well-being of generations
	Enhance positive and reduce adverse effects	▪ Extraction of freshwater from a fish bearing watercourse has the potential to harm fish.	▪ If extraction of groundwater interacts with the quality or quantity of a watercourse there is the potential to adversely affect fish	▪ Extraction of seawater from the marine environment could result in the impingement or entrainment of marine life	▪ None
	Precautionary principle, uncertainty and risk	▪ There are no likely effects associated with this option that would result in irreversible harm	▪ There are no likely effects associated with this option that would result in irreversible harm	▪ There are no likely effects associated with this option that would result in irreversible harm	▪ There are no likely effects associated with this option that would result in irreversible harm

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1.9.6 Waste and Wastewater Management

1.9.6.1 Waste Management

Management of solid and hazardous wastes during the construction and operation phases of the Project is described in Sections 1.5.2.1.6 and 1.5.3.1, respectively. Where possible, non-hazardous wastes will be recycled or reused. Where reuse is not possible, waste will be stored at the Site and then shipped for disposal at a local landfill, other approved waste disposal facility, or a recycling facility in compliance with applicable legal requirements. No other means for waste management have been considered for the Project.

1.9.6.2 Wastewater Management

Management of wastewater during the construction and operation phases of the Project is described in Sections 1.5.2.1.6 and 1.5.3.1, respectively.

Options for management of non-process sanitary wastewater include gravity sewers, force mains and septic tanks. Gravity sewers rely on pipes buried a minimum of 1 m below the surface and on sufficient decline (approximately 1 m depth/100 m distance, depending on pipe size) to move wastewater from its source to a termination (e.g., treatment plant). This system is problematic at the Project Site because the substrate below the organic layer quickly becomes rock. Trenching rock to get the initial 1 m depth and to maintain the necessary continued decline is costly, particularly given the larger diameter pipe required for a gravity sewer, and excavated rock would have to be dispositioned.

A force main system relies on pressurized piping to move the wastewater from its source(s) to its destination. Force mains are installed at lifting stations outfitted with pumps to push the wastewater to a treating unit. Construction of a force main system may be less expensive than a gravity sewer system at this Site due to the smaller pipe diameter and reduced trench depth; however, operation of a force main system requires the construction and operation of one or more lift stations.

A third alternative is a septic tank system. In this system the wastewater flows to an underground holding tank that contains biological agents that breakdown the waste. Water from the tank then flows through pipes to a leach field where it permeates the soil. This alternative is not appropriate for personnel populations that will be present at the Site and would likely not be feasible in rocky environments like that at the Site.

Given limitations of the Site, the Project is currently proposing use of a force main system consisting of small lift stations at each main building (or a common lift station if buildings are close together) with sewage grinder pumps that use smaller diameter piping to convey the wastewater to the treatment unit.

Table 1.9–10 provides a summary of the economic, environmental, cultural and social factors considered for the proposed sanitary wastewater management options.

Once sanitary waste reaches the on-Site treatment unit, it will be treated to meet applicable provincial and federal regulations and then discharged, under permit, into the marine environment of Portland Canal. The proposed location for discharge is between the personnel dock and the MOF and adjacent to the currently planned location of the wastewater treatment plant. This area is characterized by deep waters and strong currents that will facilitate rapid mixing of the treated water into the marine environment.

No Indigenous knowledge shared with the Proponent is relevant to the assessment of alternatives on sanitary wastewater management. During engagement with Indigenous Nations concerns associated with the discharge of wastewater to the marine environment were raised. The Proponents confirmed that discharge of effluent to the marine environment would be done under permit and would meet water quality guidelines. Engagement with the public and stakeholders did not identify concerns related to sanitary wastewater management.

Table 1.9–10 – Technical, Economic, Environmental and Social for the Consideration of Non-Process Sanitary Wastewater Management Options

Factor	Gravity Sewer System	Force Main System	Septic Tank
Description			
Description	▪ Relies on gravity acting on the pipes buried a minimum of 1 m below the surface with a minimum decline of approximately 1 m depth/100 m distance to move wastewater from its source to a treatment plant	▪ Relies on pressurized piping to move the wastewater from its source to a treatment plant	▪ Wastewater flows to an underground holding tank that contains biological agents that breakdown the waste that then flows through pipes to a leach field where it permeates the soil
Technical and Economic Feasibility			
Use of BAT	▪ Not applicable	▪ Not applicable	▪ Not applicable
Technical Requirements and Uncertainties	▪ Due to the rocky terrain at Site the cost of completing the trenching that would be required for this system would make this option costly ▪ Terrain slope following Site clearing may not have sufficient grade for gravity sewers to be feasible	▪ Technically better suited due to the Site terrain and geology, but more costly to operate due to the pumps and lift stations	▪ Septic tank systems require leach fields which are not available in sufficient area given the rocky terrain at the Site. ▪ Septic tanks are also not designed for the size of workforce that will be required during operation
Capital Costs	▪ Lower equipment and operating costs but higher installation costs associated with rock blasting and trenching	▪ Higher equipment and operating costs associated with pumps and pressurized piping systems, but lower Site preparation, rock blasting and trenching costs	▪ Not applicable – This option is not technically feasible
Environmental, Cultural, Social and Indigenous Interest Considerations			
Environmental Effects	▪ Blasting and drilling into the bedrock to construct trenches of sufficient depth has the potential to affect groundwater and surface water ▪ Excavated rock must be dispositioned (either crushed or discarded) ▪ Gravity sewers have the potential to contaminate surface water if leaks develop and are not contained	▪ Force main systems have the potential to contaminate surface water if leaks develop and are not contained	▪ Leach fields have the potential to contaminate groundwater and surface water
Species at risk (as per SARA)	▪ There is a small chance that terrestrial species at risk including grizzly bears and western toads could experience harm or mortality from the exposure to contaminated water ▪ Some habitat loss as a result of blasting and drilling to construct trenches may affect species at risk including grizzly bears and western toads as well as some avian species	▪ Terrestrial species at risk including grizzly bears and western toads could experience harm or mortality from the exposure to contaminated water ▪ There are no known freshwater fish species at risk at the Site	▪ Terrestrial species at risk including grizzly bears and western toads could experience harm or mortality from the exposure to contaminated water ▪ There are no known fish species at risk at the Site
Social, Cultural and Health Effects	▪ None	▪ None	▪ Unlikely to be an acceptable option given potential long-term viability and contamination concerns
Indigenous Interests and Rights	▪ None currently identified	▪ None currently identified	▪ None currently identified
GBA Plus	▪ No disproportionate effects on sub-populations and/or groups	▪ No disproportionate effects on sub-populations and/or groups	▪ No disproportionate effects on sub-populations and/or groups
Consultation and Engagement	▪ None currently identified	▪ None currently identified	▪ None currently identified

Table 1.9–10 – Technical, Economic, Environmental and Social for the Consideration of Non-Process Sanitary Wastewater Management Options

Factor		Gravity Sewer System	Force Main System	Septic Tank
Sustainability	Human-ecological systems	▪ No known interdependence of human-ecological systems	▪ No known interdependence of human-ecological systems	▪ No known interdependence of human-ecological systems
	Well-being of generations	▪ Contamination of soil could affect current and future use of the area for FSC purposes	▪ Contamination of soil could affect current and future use of the area for FSC purposes	▪ Contamination of soil could affect current and future use of the area for FSC purposes
	Enhance positive and reduce adverse effects	▪ Blasting and drilling into the bedrock to construct trenches of sufficient depth has the potential to affect groundwater and surface water ▪ Gravity sewers have the potential to contaminate surface water if leaks develop and are not contained	▪ The potential to contaminate surface water if leaks develop and are not contained	▪ Leach fields have the potential to contaminate groundwater and surface water
	Precautionary principle, uncertainty and risk	▪ There are no likely effects associated with this option that would result in irreversible harm	▪ There are no likely effects associated with this option that would result in irreversible harm	▪ There are no likely effects associated with this option that would result in irreversible harm

1.9.6.3 Stormwater Management

Stormwater management is an important consideration to mitigate potential effects related to flooding, erosion and sedimentation control as well as potential contamination due to uncontrolled release of contaminated runoff water. The FLNG is designed to manage stormwater using an oily water drain system that collects rainwater, wash water, firewater, and other fluids from skids and equipment with potential for (lube) oil, grease, or similar contaminated spills. Collected water that meets water quality guidelines will be discharged directly to Portland Canal. Water that does not meet water quality guidelines will be gravity drained to a common oily water tank for treatment in an oily water separation package. Treated water will be discharged to Portland Canal once in compliance with regulatory requirements. There are no realistic alternatives to the FLNG stormwater management described here and therefore none have been considered.

On-land components of the Project will also have a stormwater management system that includes oil water separators and only discharges stormwater when it is in compliance with regulatory requirements. The Proponents are committed to developing and implementing Site-specific stormwater management measures during FEED. Currently, design has not identified options for evaluation since basic stormwater management design is based on industry standard (e.g., the use of drainage channels) and considerations will be based primarily on the final grading design and plan. No Indigenous knowledge shared with the Proponent is relevant to the assessment of alternatives on stormwater management. During engagement with Indigenous Nations, the public and stakeholders no concerns related to stormwater management were shared.

1.9.7 Construction Alternatives

1.9.7.1 Construction Crew Accommodations

Utilization of a construction camp is a commonly used execution approach whereby temporary accommodations, along with required utilities, are constructed early during the construction phase. Having crew accommodation in a construction camp at Site will avoid the introduction of a large temporary construction workforce in nearby communities that are relatively small and therefore avoid the potential social impacts resulting from an influx of temporary residents. Crew accommodations at Site could be via an onshore construction camp or on floating vessels. Table 1.9–11 presents a summary of the economic, environmental, cultural and social factors that were considered to evaluate the potential use of onshore versus floating on-Site crew accommodation.

Onshore construction camps require a prepared terrestrial footprint that will be occupied for the duration of the construction phase. Such camps are expensive to construct and operate at remote sites, and while some portions of the construction camp can be removed and reused on another project, the impacted terrestrial footprint requires remediation and restoration. Early during Project development, the option for the construction crew accommodation to be located on the mainland was deemed infeasible due to logistical, economic and safety reasons.

In contrast, floating accommodations, a floatel, could be transported to Site with relative ease, avoiding logistical constraints and resulting in minimal disturbance to the environment relative to the terrestrial footprint of a land-based camp. Furthermore, use of a floating accommodation execution approach would enable the Project to phase in varying versions of the floatel to accommodate workforce peaks and ebbs. Finally, the floatel can be towed from the Site and is fully reusable for other (unrelated) construction projects.

For these reasons described above, no further consideration is being made for an onshore construction camp.

No Indigenous knowledge shared with the Proponent is relevant to the assessment of alternatives on crew accommodation. During engagement with Indigenous Nations, the public and stakeholders no concerns related to crew accommodation were shared.

Table 1.9–11 – Technical, Economic, Environmental and Social for the Consideration of Onshore and Floating On-Site Crew Accommodation Options

Factor		Onshore Crew Camp	Floating Crew Camp
Technical and Economic Feasibility			
Use of BAT		▪ Small, modular camps could be used to limit potential effects	▪ Size of floatel may be changed during construction to accommodate changing construction crew size
Technical Requirements and Uncertainties		▪ Need for self-contained units will be required	▪ Need for self-contained unit will be required
Capital Costs		▪ Higher Site preparation costs due to additional terrestrial acreage required for the camp, the temporary water and wastewater systems, temporary power generation / distribution, fuel storage and telecommunications equipment. Rock blasting and terracing of additional land would be required. Installation of additional roads in the camp and additional fencing for the larger footprint. Higher costs at the end of the construction phase to decommission and remove the camp and restore the land to existing conditions	▪ High operating costs for the floatel but lower capital cost impacts to the terrestrial footprint. Substantially lower costs at the end of the construction phase, as the floatel will be transported away from the Site for use on other projects and no costs associated with land restoration
Environmental, Cultural, Social and Indigenous Interest Considerations			
Environmental Effects		▪ Potential need for additional Project footprint to accommodate the facility would result in additional terrestrial effects	▪ Potential for marine effects related to the temporary mooring and/or potential need for piles
Species at risk (as per SARA)		▪ A land-based crew camp would result in a slightly higher, but still small, increase in habitat loss and mortality risk for species at risk including grizzly bear, little brown myotis, and western toads	▪ A floating crew camp would result in a slightly higher, but still small, increase in habitat loss and mortality risk for species at risk including horned grebe, western grebe, red necked phalarope, marbled murrelet, harbour porpoises and Stellar sea lions
Social, Cultural and Health Effects		▪ Anticipated effects are the same between the two options	▪ Anticipated effects are the same between the two options
Indigenous Interests and Rights		▪ Barging components of the camp to Site may result in temporary interference with fishing or recreational activities	▪ While floating to Site there is the potential for temporary interference with fishing or recreational activities
GBA Plus		▪ Since the camp would be located within the proposed footprint, disproportionate effects would be limited to if additional Indigenous owned land is required	▪ No disproportionate effects on sub-populations and/or groups
Consultation and Engagement		▪ None currently identified	▪ None currently identified
Sustainability	Human-ecological systems	▪ Larger on-land footprint represents an increased use of the terrestrial environment	▪ Marine infrastructure represents use of marine environment
	Well-being of generations	▪ Larger on-land footprint would result in a greater loss of terrestrial habitat available for FSC purposes	▪ Marine footprint would result in a greater loss of marine habitat available for FSC purposes
	Enhance positive and reduce adverse effects	▪ Represents the largest terrestrial footprint, thereby increasing potential adverse effects on the terrestrial environment including wildlife and wildlife habitat (including species at risk), wetlands, and areas traditional used for FSC purposes	▪ Potential for a slightly larger marine footprint, thereby increasing adverse effects on marine habitat and marine life
	Precautionary principle, uncertainty and risk	▪ There are no likely effects associated with this option that would result in irreversible harm	▪ There are no likely effects associated with this option that would result in irreversible harm

1

1.9.7.2 Water Crossing Methods

The Project layout has been configured to limit potential impacts on sensitive habitat including wetlands and watercourses. There are no rivers at the Site; however, eighteen streams, or water courses, have been identified on DL 5431 and DL 7235. The Project was designed to avoid the need to redirect streams to accommodate Project infrastructure; however, crossings will be required over some of the streams to enable construction of roads around the Site. It is anticipated that there will be approximately eleven watercourse crossings that will impact five streams and associated tributaries and three non-classified drainages. All watercourse crossings will be free span bridges or culverts (including open bottom pipe arch culverts) that will be installed in accordance with the guidance provided in Fish-stream Crossing Guidebook (September 2012) published by the Ministry of Forests, Lands and Natural Resource Operations, the Ministry of Environment, and Fisheries and Oceans Canada. Where bridges are used for road crossings over fish bearing watercourses, no works are anticipated to take place below the high-water mark. As such, impacts on fish and fish habitat would be negligible. There would, however, be potential effects on wildlife including sensory disturbance to wildlife during construction, and disturbance to or loss of wildlife habitat during construction and operations. Potential effects on habitat would be long-term due to the bridge footprint but limited in scale given the small size of the disturbance. Sensory disturbance would be limited to a few weeks during bridge construction after which it would cease. Sensory disturbance during operations from vehicles crossing the bridge is expected to be nominal given the roads will only be used during maintenance. Where open bottom pipe arch culverts or over-sized and counter-sunk culverts are used for road crossings, approximately 20 m of streambed may be temporarily disturbed. This temporary disturbance has the potential to result in such short-term potential effects as an alteration in fish and amphibian (e.g., western toad) habitat, disturbance to wildlife and wildlife habitat, and increased sedimentation. These effects would be largely limited to the construction phase and would be managed by completing construction works in isolation of water flow and restoration of channel substrates and the banks of the watercourses to as near as possible to pre-construction conditions. Potential effects to wildlife habitat would be long-term but limited in scale given the small footprint of the culvert. Sensory disturbance would be limited to a few weeks during culvert installation after which it would cease. Sensory disturbance during operations from vehicles crossing the culvert is expected to be nominal given the roads will only be used during maintenance. The decision to use a free span bridge or culvert will be dependent on the size of the stream.

Given the Project does not result in the need to cross any major waterways, that the crossings that are required will be relatively minor, the only options considered are free span bridges and open bottom culverts, and that all crossings will be installed in accordance with guidance documents, a more detailed alternatives analysis was not deemed necessary. Final design will be completed during FEED.

1.9.7.3 Preliminary Cut, Fill and Overburden Planning

Site preparation will include tree clearing, grubbing, and grading which will include some blasting. All merchantable timber would be the property of the NLG and would be stamped, scaled and barged off the Island for sale. Non-merchantable logs, stumps and slash would be piled up and burned or transported to the overburden storage area where it could be used to create habitat for birds and small mammals.

Blasting will be required in select areas of the Project footprint. The locations and sizes of charges to be used will be calculated during detailed engineering. A rock crusher (or crushers) will be established on the footprint to disposition the blasted rock. Where possible crushed rock will be used as riprap, aggregate for road construction, or backfill.

Prior to re-using rock at the Site, it will be tested for acid generating or leaching potential. Existing knowledge of the Site suggests that the underlying bedrock is granodiorite with layers of clay, silt and cobbles on top. Granodiorite is considered an intermediate, and not an acid rock as such the potentially for acid generating and leaching rock at the Site is considered low. If acid rock is identified at the Site an acid rock management plan will be developed.

Overburden that has been cleared from the footprint and found to be unusable as backfill will be transported and placed in a prepared overburden storage area, where it will be stored for the life of the facility. The only reasonable alternative to storing cut, fill and overburden at the overburden storage area is barging to an organics land fill site on the mainland; however, this alternative is less than optimal from environmental and economic aspects because it would require organics to be imported back to the Site during decommissioning in order to complete Site remediation.

Given the remote location of the Project, and it being on fee simple land with a low likelihood of acid generating or leaching rock options for reuse, alternatives to storage and disposal of overburden are limited and therefore a more detailed analysis of options is not deemed necessary.

1.9.7.4 Schedule Options

The Project schedule, as outlined in Section 1.1, indicates that construction will begin in Q2 2025 following completion of detailed engineering and receipt of environmental approvals. Construction is estimated to take three to four years with commissioning of the first FLNG and onshore facility between Q4 2027 and Q1 2028. Construction of the Project follows a linear schedule. One FLNG will complete commissioning prior to the second but it is not considered a phased project where there are alternatives associated with timing of different project components. The Project is expected to be operational in 2028.

Various timing considerations will impact the Project schedule, particularly construction, including:

- Regulatory: construction activities will not begin before all required regulatory permits, authorizations, licenses and approvals have been received. Section 2 outlines the regulatory requirements that have been identified for the Project including estimated submission timing.
- Environmental constraints: timing restrictions have been identified related to:
  - Migratory birds – clearing should be avoided during the primary nesting period for the Site (April 11 through August 8) as well as year-round considerations related to removal of nests of bird species listed on Schedule 1 of the Migratory Birds Regulation 2022
  - Bald eagle nests – high disturbance activities will be avoided within 300 m of an active bald eagle nest during the breeding period (February 5 through August 31)
  - Amphibians – considerations for amphibian breeding and dispersal approximately mid-April to late-September
  - Marine resources – least risk windows will be developed in consultation with DFO and NLG
- Commercial: the Proponents are currently in commercial negotiation for various Project components; however, there are many more commercial arrangements that will be required including for materials, personnel and contractors. It is not anticipated that any one commercial arrangement will drive the schedule; however, it may influence the schedule in both planned and unplanned ways.
- Financial: advancement of the Project requires securing funding and a positive FID.

All of these considerations will influence the schedule; currently, except those identified above, schedule options that require consideration of economic, environmental, cultural and social considerations and decision have not been identified.

1.9.8 Summary

Alternative means of carrying out the Project were considered based on input from the assessment of effects completed for this Application, preliminary (i.e., pre-FEED) design, FEED design (where available), relevant legislation and design requirements as well as Project engagement and consultation. Alternative means were considered for Site access and transportation to Site (Section 1.9.1), Site layout (Section 1.9.2), potential Site energy sources (Section 1.9.3), water supply options (Section 1.9.4), water and wastewater management (Section 1.9.5) and construction alternatives (Section 1.9.6). For each of these options, consideration of factors related to technical and economic feasibility as well as environmental, social, cultural, health and Indigenous considerations (including feedback received during consultation and engagement) were considered.

Table 1.9–12 provides an overview summary of the preferred options for each of the evaluated alternative means. The potential advantages/benefits as well as risks/costs are also presented.

Table 1.9–12 – Overview of Alternative Mean Currently Selected for the Project, Including Potential Advantages/Benefits and Risks/Costs

Project Component		Alternative Means Currently Selected and Rationale	Advantages/Benefits of Selected Alternative Mean	Risks/Costs of Selected Alternative Mean
Site Access and Transportation to Site	Transport of personnel and goods to Site	From Terrace, the primary transport route is anticipated to be via Highway 113/Nisga'a Highway to Gingolx, then via marine vessel to Site. This is considered the safest and most economical due to the shorter and more protected marine transport route, which is particularly advantageous during inclement weather. Nevertheless, the transport option selected will depend on the origin and number of personnel, origin and nature of goods, frequency of travel and weather conditions.	▪ Traffic counts are low and have been decreasing, suggesting there should be some capacity for additional traffic ▪ The shorter total distance (188 km) of this route will result in lower GHG emissions than the alternate route (262 km)	▪ Enhanced cell coverage likely required ▪ Some additional infrastructure improvements may be required in Gingolx ▪ The portion of Highway 113/Nisga'a Highway from New Aiyansh to Gingolx parallels the Nass River, an important salmon and eulachon river
	Shipping routes for LNG and NGL	Route A (Dixon Entrance to Triple Islands pilot boarding station, through Brown Passage, to Chatham Sound, Main Passage, Portland Inlet and Portland Canal) is considered the safest shipping route option.	▪ BCCP have experience with the route ▪ Hazards along the route are marked with aids to navigation ▪ Route has more favourable metocean conditions for escort tugs than Routes B and C	▪ Navigation through high traffic areas around Triple Island pilot boarding station increases the potential for an accident ▪ Route traverses the southern and eastern sides of the Lax Kwaxl/Dundas and Melville Islands Conservancy which is an area of key FSC significance ▪ Travels through Chatham Sound, an important fishing area
Site Layout	Floating versus a land-based LNG facility	A floating LNG facility design was selected due to overall reduced potential environmental effects related to a smaller terrestrial footprint, and lower costs of construction due to ability to build the facility off-Site.	▪ Lower expected construction cost and more efficient construction and design based on experienced and established quality control procedures at the off-Site manufacturing facility ▪ Smaller construction workforce will require less water and marine traffic, and will place less demand on infrastructure and services, labour, and housing as well as impacts on community well-being ▪ Reduced terrestrial footprint means fewer impacts to vegetation, wildlife and freshwater fish, and fewer impacts on land and resources used by the Nisga'a	▪ None identified compared to land-based LNG facility
	Construction of dedicated LNG carrier berths or use of ship-to-ship Mooring	A ship-to-ship mooring design was chosen due to overall reduced potential environmental effects related to a smaller onshore and marine footprint, smaller construction workforce requirements and lower cost of construction.	▪ Smaller onshore and marine footprint will result in the least environmental effects ▪ Most efficient capital cost	▪ None identified compared to dedicated berth LNG facility layout
Site Energy Sources	If required, temporary energy source	While the base case (i.e., no temporary on-Site energy source) is the most economically and technically feasible option, Alternative 3 (temporary power barge with closed-loop onshore cooling towers) is the only option still under consideration should on-Site power generation be required. A final decision on whether temporary electric power generation is required will depend on the availability and timing of the permanent electrical power supply from BC Hydro.	▪ Least water requirements ▪ Least marine environmental effects	▪ Largest parasitic power requirements results in highest generation requirement ▪ Largest terrestrial footprint due to cooling infrastructure ▪ Largest quantity of GHG emissions during temporary power barge operation due to parasitic loads

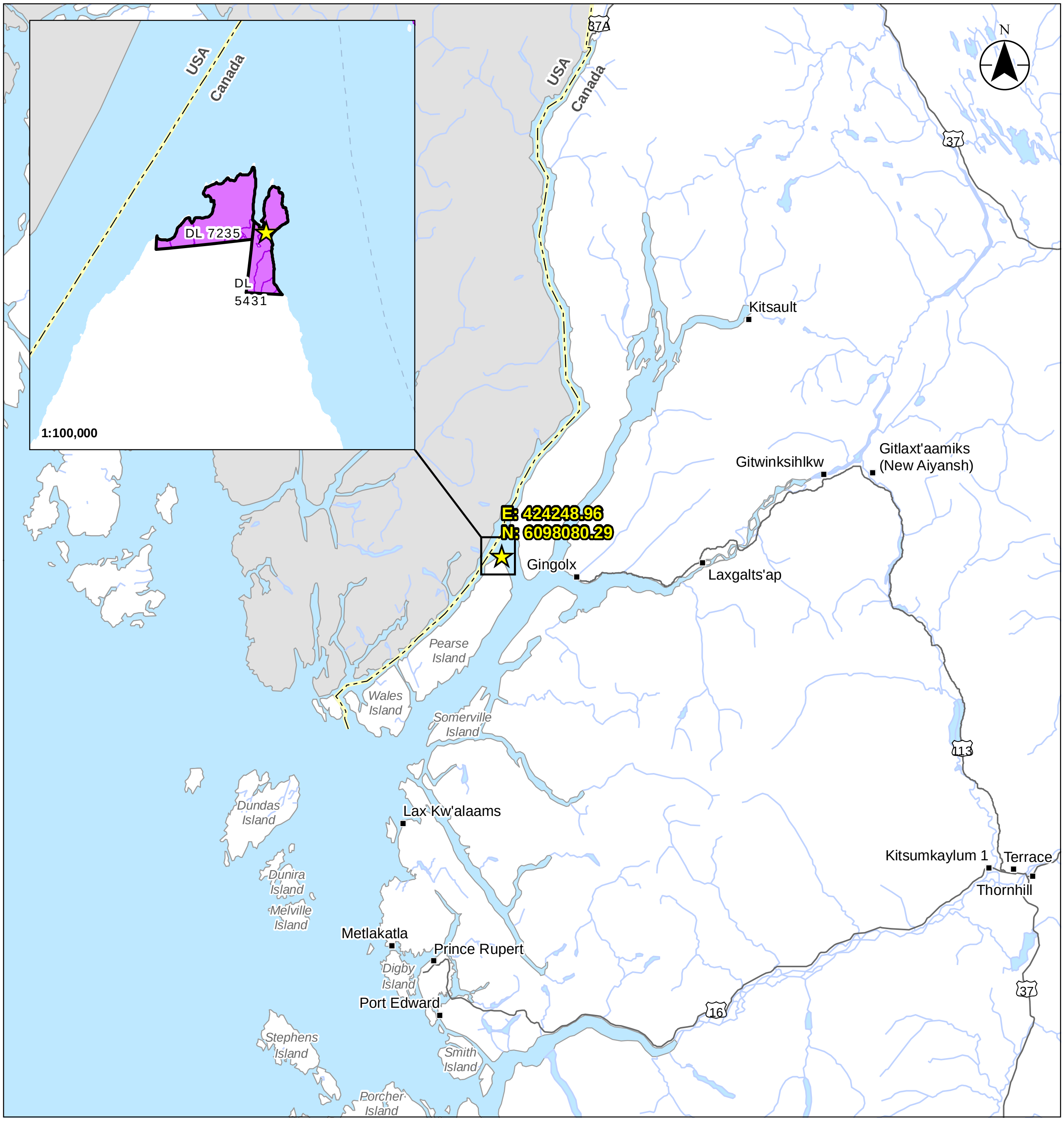
Table 1.9–12 – Overview of Alternative Mean Currently Selected for the Project, Including Potential Advantages/Benefits and Risks/Costs

Project Component		Alternative Means Currently Selected and Rationale	Advantages/Benefits of Selected Alternative Mean	Risks/Costs of Selected Alternative Mean
Transmission Line	Aerial and/or terrestrial and/or subsea transmission line scenario	Final scenario selection for the routing will be completed by the third-party developer. It is expected that some portion of the final route will be subsea; alternate options likely include, but are not necessarily limited to: ▪ Subsea, terrestrial, and aerial ▪ Subsea and terrestrial ▪ Subsea	▪ Each scenario offers advantages and benefits: • Aerial scenario offers lower capital cost versus subsea for ocean crossing • Terrestrial scenario offers lower capital cost versus subsea for ocean crossing • Subsea scenario offers least aesthetic effects	▪ Each scenario offers risks and costs: • Aerial scenario has potential for biophysical effects related to wildlife habitat and vegetation change • Terrestrial scenario has potential for biophysical effects related to wildlife habitat and vegetation change • Subsea scenario will have temporary effects during construction for marine users
Water Supply	Water source - construction	During construction, water will be sourced from local surface water and supplemented with water delivered to Site by barge.	▪ Least infrastructure requirements for early water supply	▪ Would require installation of additional infrastructure (pumps, piping, roads, power) ▪ Periods where water may not be available due to insufficient flow ▪ Would require extraction from fish bearing water courses. Project will be required to meet environmental flow needs for biology requirements to reduce potential to harm fish, including anadromous fish that use the watercourses
	Water source - operation	During operation, desalinated sea water will be the primary source of water, which will be supplemented by collected rainwater. Desalination plants are a well-established technology, making their proposed use at the Site both technologically and economically feasible. Potential environmental effects can be addressed through meeting BC and federal water quality guideline at the edge of the initial dilution zone, designing the seawater intake structure based on DFO guidance, and locating the outfall in a well flushed, tidally influenced and dynamic environment with diffuser(s) to disperse effluent upwards to reduce effects on benthic habitats. Rainwater will be captured and used to supplement (and reduce the load on) the desalination plant.	Desalination ▪ Proven technology for water extraction ▪ Water source is reliable even in droughts Rainwater ▪ Low capital cost for a collection and storage system ▪ Proven technology for water collection ▪ No identified environmental, social, economic, cultural impacts or impact on Indigenous interests	Desalination ▪ Requires capital investment for the desalination plant ▪ Water intake could result in the impingement or entrainment of fish ▪ Brine discharge could settle on the ocean floor and impact benthic organisms Rainwater ▪ Not a consistent water source during periods of low precipitation
Waste and Wastewater Management	Management of solid and hazardous wastes during construction and operation	Management of solid and hazardous wastes during the construction and operation is described in Sections 1.5.2.1.6 and 1.5.3.1, respectively. No other means for waste management have been considered for the Project.	N/A	N/A
	Management of non-process sanitary wastewater	Given limitations of the Site, the Project is currently proposing use of a force main system consisting of small lift stations with sewage grinder pumps to convey wastewater to the on-Site treatment unit. Once sanitary waste reaches the treatment unit, it will be treated to meet applicable provincial and federal regulations and then discharged, under permit, into the marine environment of Portland Canal.	▪ Technically better suited due to the Site terrain and geology, but more costly to operate due to the pumps and lift stations	▪ Force main systems have the potential to contaminate surface water if leaks develop and are not contained

Table 1.9–12 – Overview of Alternative Mean Currently Selected for the Project, Including Potential Advantages/Benefits and Risks/Costs

Project Component		Alternative Means Currently Selected and Rationale	Advantages/Benefits of Selected Alternative Mean	Risks/Costs of Selected Alternative Mean
	Stormwater	The Proponents are committed to developing and implementing Site-specific stormwater management measures during FEED.	▪ Design is industry standard	▪ Requires additional information related to final grading design and plan
Construction Alternatives	Crew accommodations at Site	On-Site crews will be accommodated in a floating crew camp ('floatel'). A floatel can be easily floated to Site, would result in limited terrestrial footprint and disturbance, it can be modified in size to accommodate workforce peaks and ebbs, and can be removed from Site to be reused on other projects.	▪ Lowest capital costs since floating camps are towed in, self-contained and towed away	▪ Potential for marine effects related to the temporary mooring and/or potential need for piles ▪ While floating to Site there is the potential for temporary interference with fishing or recreational activities
	Watercourse crossing methods for watercourses and drainages within the Site	Crossings that are required will be short and will be installed in accordance with guidance documents. Final design will be completed during FEED.	▪ All watercourse crossings will be free span bridges or culverts (including open bottom pipe arch culvers) that will be installed in accordance with the guidance provided by BC agencies and DFO	▪ None currently identified
	Preliminary options for cut, fill and overburden planning	Overburden that has been cleared from the footprint and found to be unusable as backfill will be transported and placed in a prepared overburden storage area, where it will be stored for the life of the facility.	▪ None currently identified	▪ The only reasonable alternative to storing cut, fill and overburden at the overburden storage area is barging to an organics land fill site on the mainland but this does not make sense economically or environmentally
	Schedule options	Various timing considerations will impact the schedule including regulatory, environmental constraints, commercial and financial.	▪ None currently identified	▪ None currently identified

1.10 Figures



KSI LISIMS LNG

Site

Boundaries of District Lots 7235 and 5431

Nisga'a Nation Category A Land

International Boundary

Provincial Boundary

Highway

Road

Local Street

Resource Road

Watercourse

Waterbody

0 10 20 30 40 km

1:1,150,000 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 BC Environment Albers
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada

Stantec

Project Location:
Pearse Island, BC

Project Number: 123221820
Prepared by TQUILICHINI on 20221109
Requested by EWATERFIELD on 20221108

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Section 1.0

Figure No.
1.1-1

Title
Project Location

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Project Mapped Stream
Boundaries of District Lots 7235 and 5431
Proposed Water Lot
International Boundary
Waterbody

0 0.2 0.4 0.6 0.8 1 km
1:30,000 (at original document size of 8.5x11)

KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Stantec

Project Location:
Pearse Island, BC

Project Number: 123221820
Prepared by TQUILICHINI on 20221115
Requested by EWATERFIELD on 20221115

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Section 1.0

Figure No.
1.1-2

Title
Ksi Lisims LNG Site

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Site
Triple Island Pilot Station
Marine Shipping Route
Open Water Marine Shipping Route
Materials and Supply Shipping Route
International Boundary

0 20 40 60 km

1:1,400,000 (at original document size of 8.5x11)

KSI LISIMS LNG

Stantec

Notes
1. Coordinate System: NAD 1983 BC Environment Albers
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada, Maxar, Rockies LNG
3. NTS Sheets: 103I, 103J, 103O, 103P

Project Location:
Pearse Island, BC

Project Number: 123221820
Prepared by TQUILICHINI on 20220729
Requested by CLION on 20220720
Checked by SMOSS on 20220730

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Section 1.0

Figure No.
1.1-3

Title
Potential Marine Transit Routes

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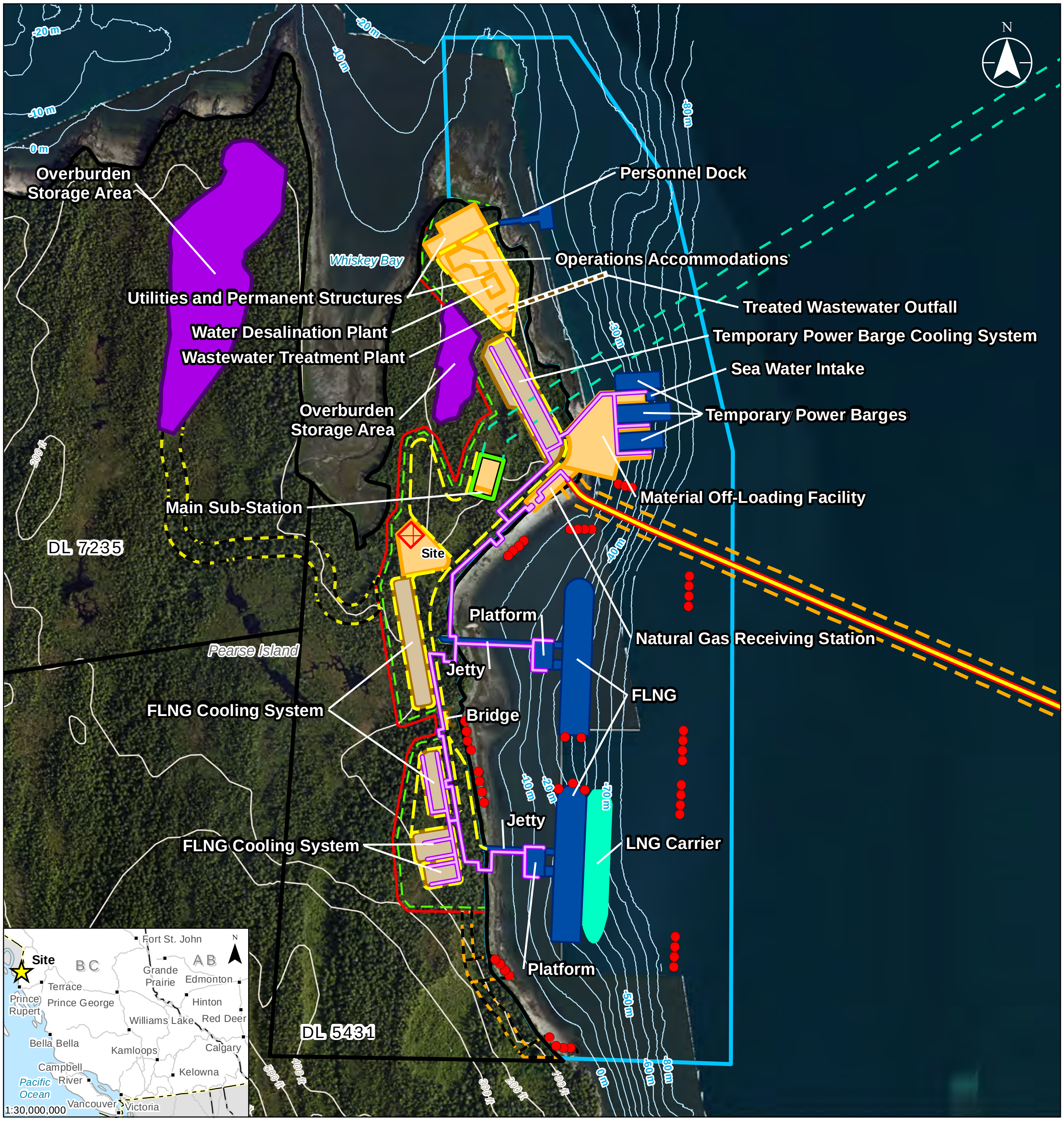

KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

- Mooring Anchor
- Site
- Proposed Access Road
- Feed Gas Pipeline
- Feed Gas Pipeline Right-of-Way
- Powerline Right-of-Way from Mainland
- Utility Line
- Wastewater Treated Effluent Pipeline
- Boundaries of District Lots 7235 and 5431
- Anchor Access Corridor
- Overburden Area Access Corridor

- Site Fenceline
- Terrestrial Footprint

Footprint Component
- Bridge
- Buildings and Utilities
- Cooling Structures
- Helicopter Pad
- Marine Component (Fixed)
- Marine Component (Not Fixed)
- Marine Footprint
- Overburden Storage Area
- Switchyard
- Bathymetric Contour

0 75 150 225 300 375 m
1:12,500 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC	Project Number: 123221820 Prepared by TQUILICHINI on 20220729 Requested by CLION on 20220720 Checked by SMOSS on 20220729

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Section 1.0

Figure No.
1.3-1

Title
Conceptual Project Layout

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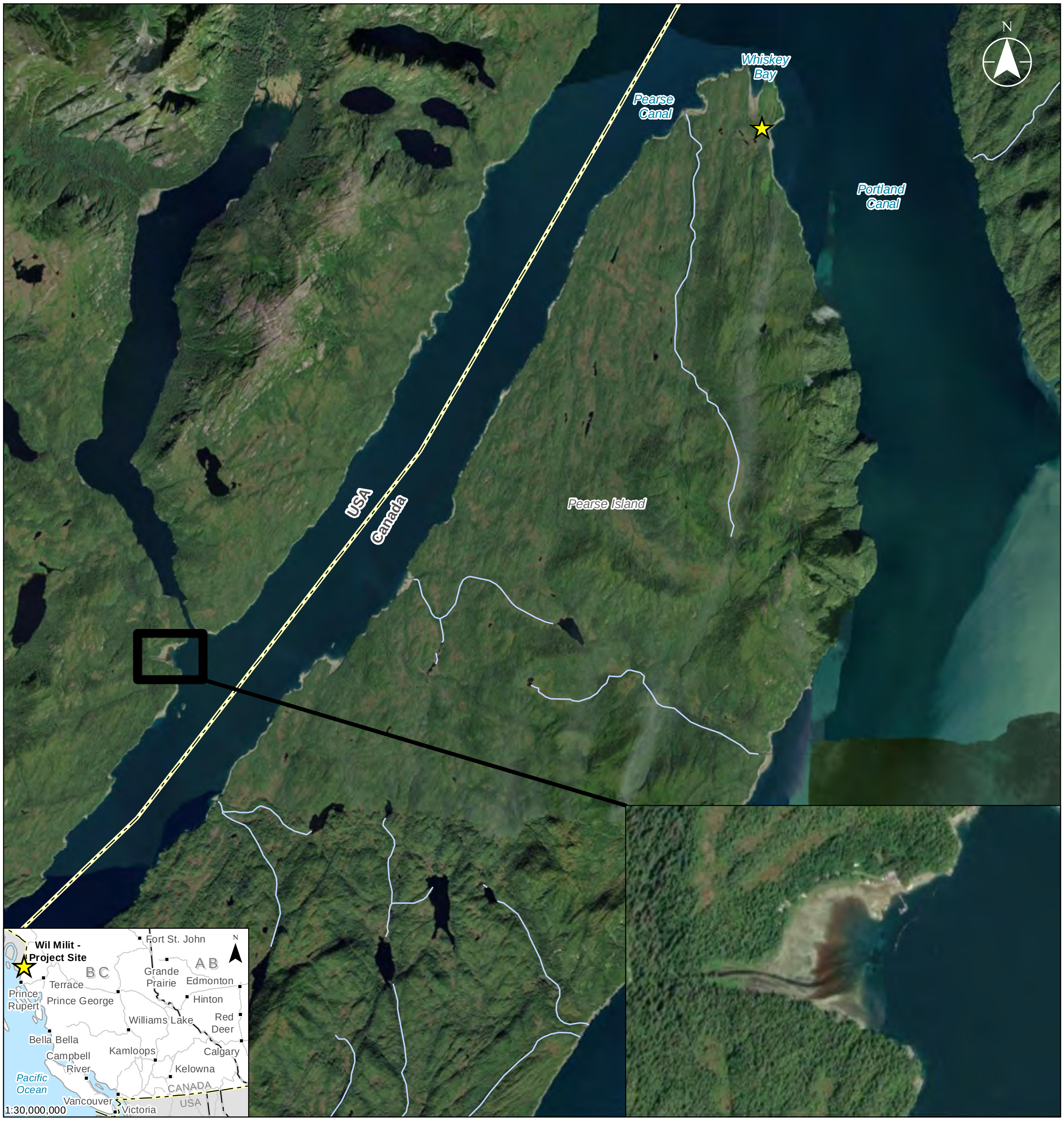

KSI LISIMS LNG

Site

International Boundary

Watercourse

0 1 2 3 4 km

1:100,000 (at original document size of 8.5x11)

Stantec

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada, Stantec, Rockies LNG, Maxar

Project Location:
Pearse Island, BC

Project Number: 123221820
Prepared by TQUILICHINI on 20220729
Requested by CLION on 20220720
Checked by SMOSS on 20220730

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Section 1.0

Figure No.
1.3-2

Title
Hidden Inlet Fishing Lodge on Pearse Canal, Alaska

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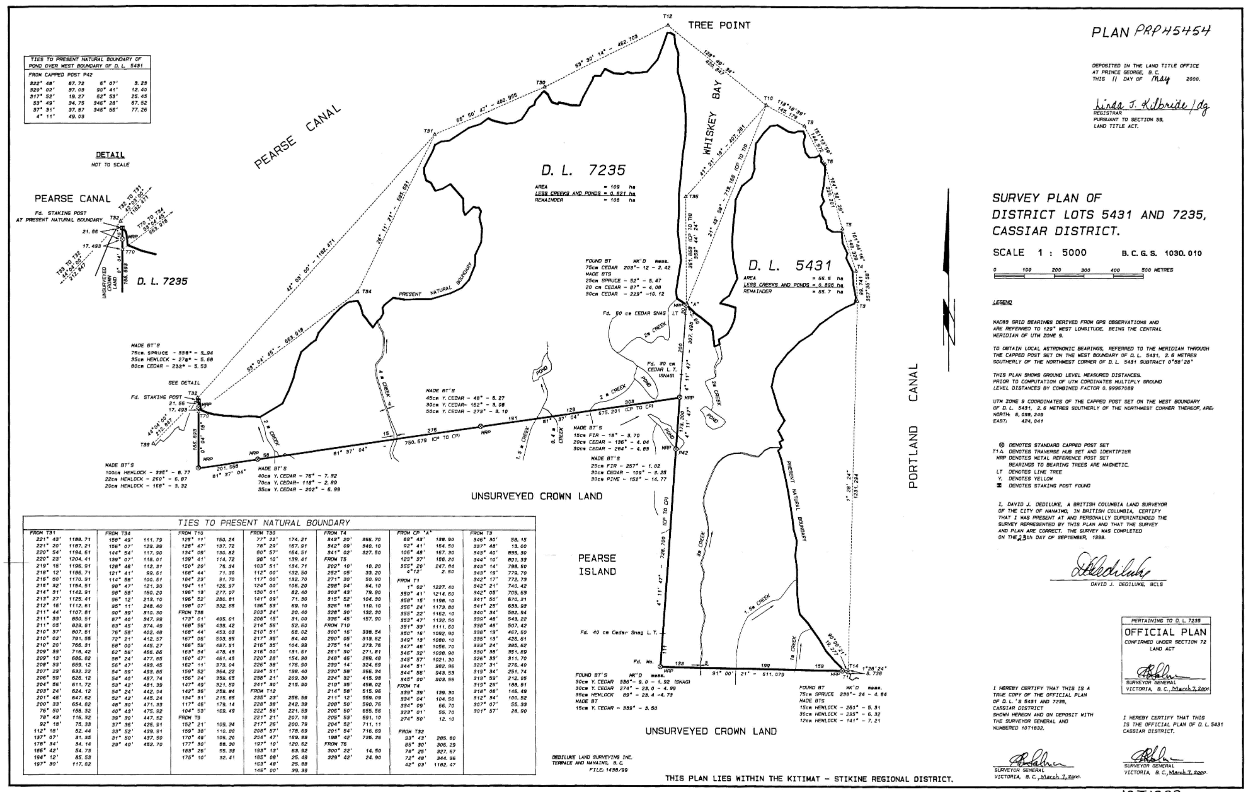
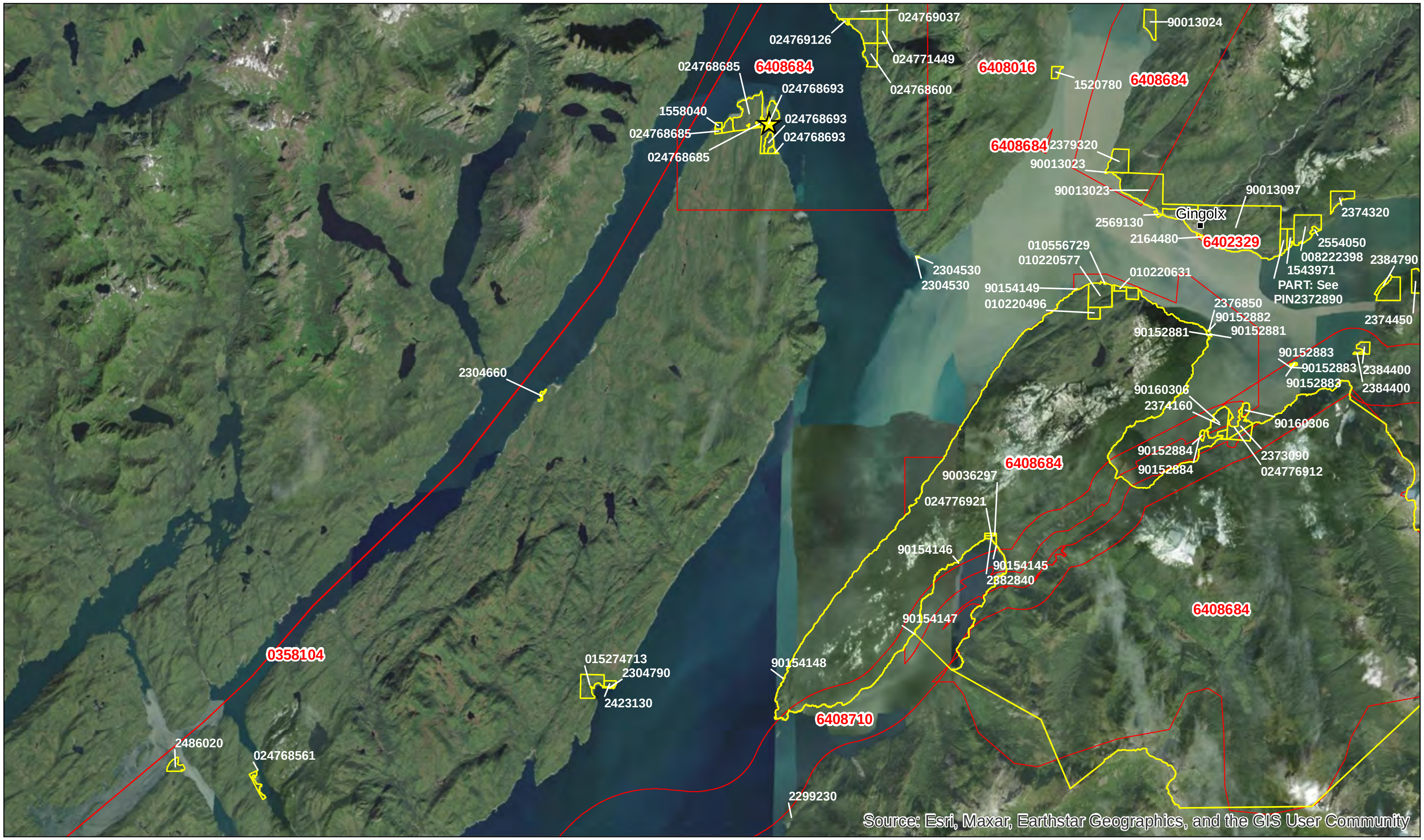


Figure 1.3–3 – Site Lot Plan



KSI LISIMS LNG

Site

Land Parcel

Crown Land Reserves and Notation

N

0 2,500 5,000 metres

(At original document size of 8.5x11)
1:200,000

Project Location
Pearse Island
British Columbia

Prepared by TQUILICHINI on 20220729
Requested by CLION on 20220720
Checked by SMOSS on 20220729

123221820

Client/Project
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Section 1.0

Figure No.
1.3-4

Title
Land Titles in the Vicinity of the Site

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada, Rockies LNG, Canadian Hydrographic Service

Stantec

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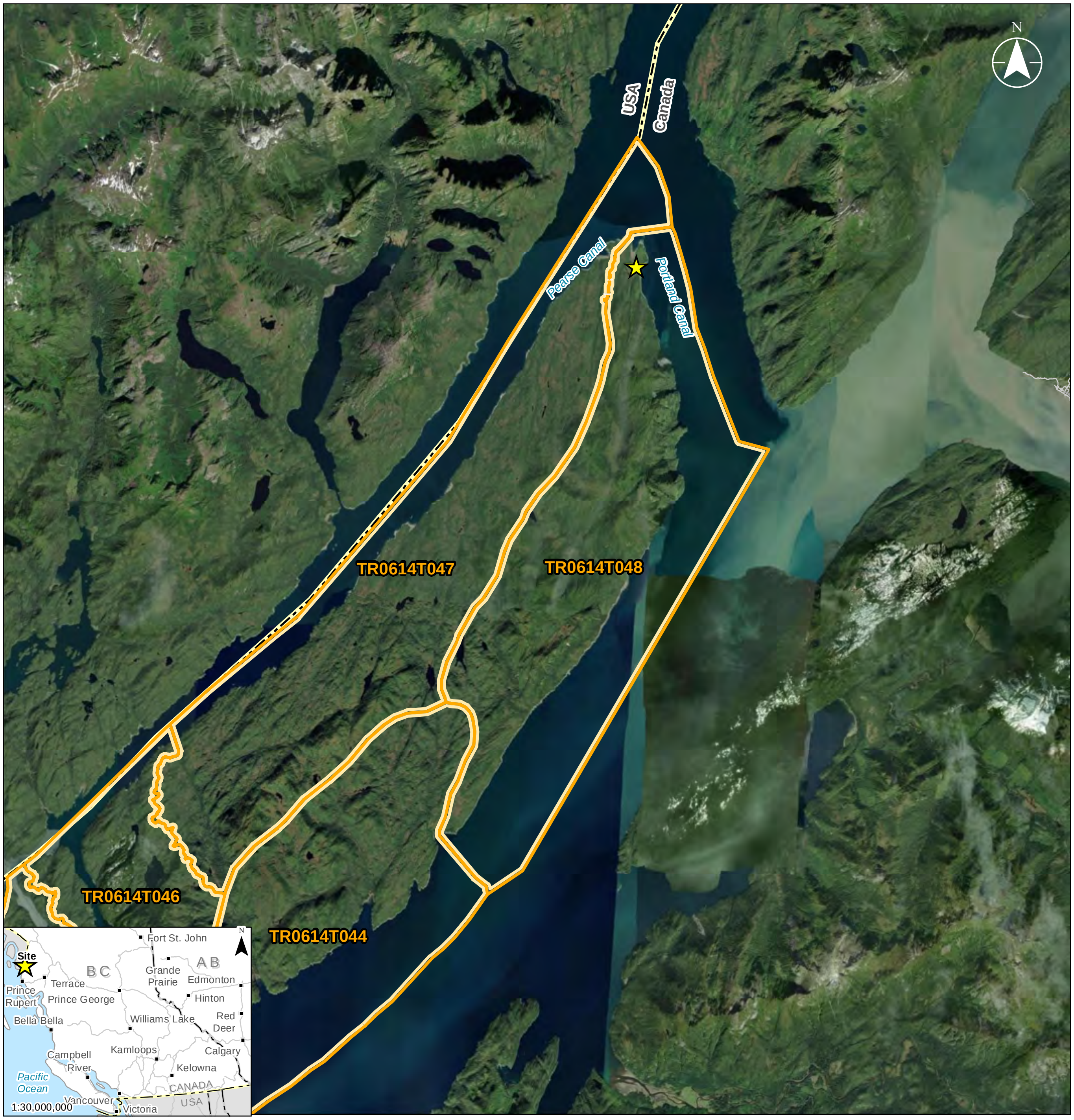

KSI LISIMS LNG

★ Site
Trapline Boundary
International Boundary

0 2 4 6 8 km
1:200,000 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 BC Environment Albers
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada, Stantec, Rockies LNG, Maxar

Stantec

Project Location:
Pearse Island, BC

Project Number: 123221820
Prepared by TQUILICHINI on 20220729
Requested by CLION on 20220720
Checked by SMOSS on 20220730

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Section 1.0

Figure No.
1.3-5

Title
Traplines Intersecting with the Project Site

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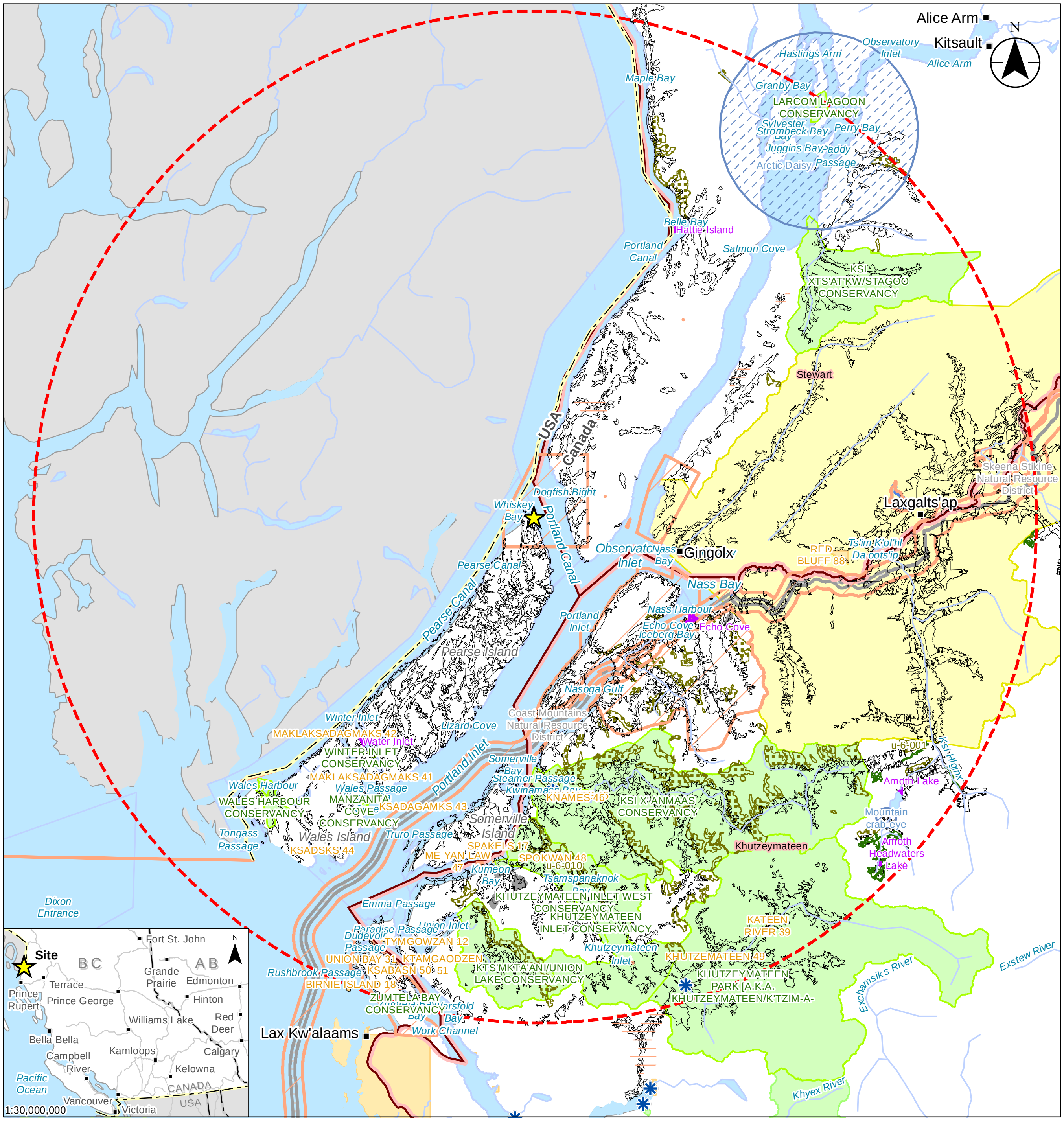

★ Site
Estuary (Pacific Estuary Conservation Program, 2019)
Merged Footprint 50km Buffer (including temporary disturbance)
Blue Listed Occurence (BCList)
Community Watershed, Axe
Critical Habitat for federally-listed species at risk (terrestrial), Marbled Murrelet
Crown Tenure
Waterbody
Grizzly Bear Population Unit
Harvesting Authority
Old Growth Management Area (OGMA) Legal
Provincial Park, Ecological Reserve, Protected Area or Conservancy Area
Reserve Land
Treaty Lands, Nisga'a
Ungulate Winter Range (UWR)
Wildlife Habitat Area (WHA), Marbled Murrelet
Nisga'a Category B Lands
International Border
Watercourse
Waterbody

0 5 10 15 20 25 km
1:600,000 (at original document size of 8.5x11)

KSI LISIMS LNG™

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada

Stantec

Project Location:
Pearse Island, BC

Project Number: 123221820
Prepared by DROBERTSON on 20220920
Requested by CLION on 20220920
Checked by SMOSS on 20220920

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Section 1.0

Figure No.
1.3-6

Title
Key Environmental Features Near the Project Area

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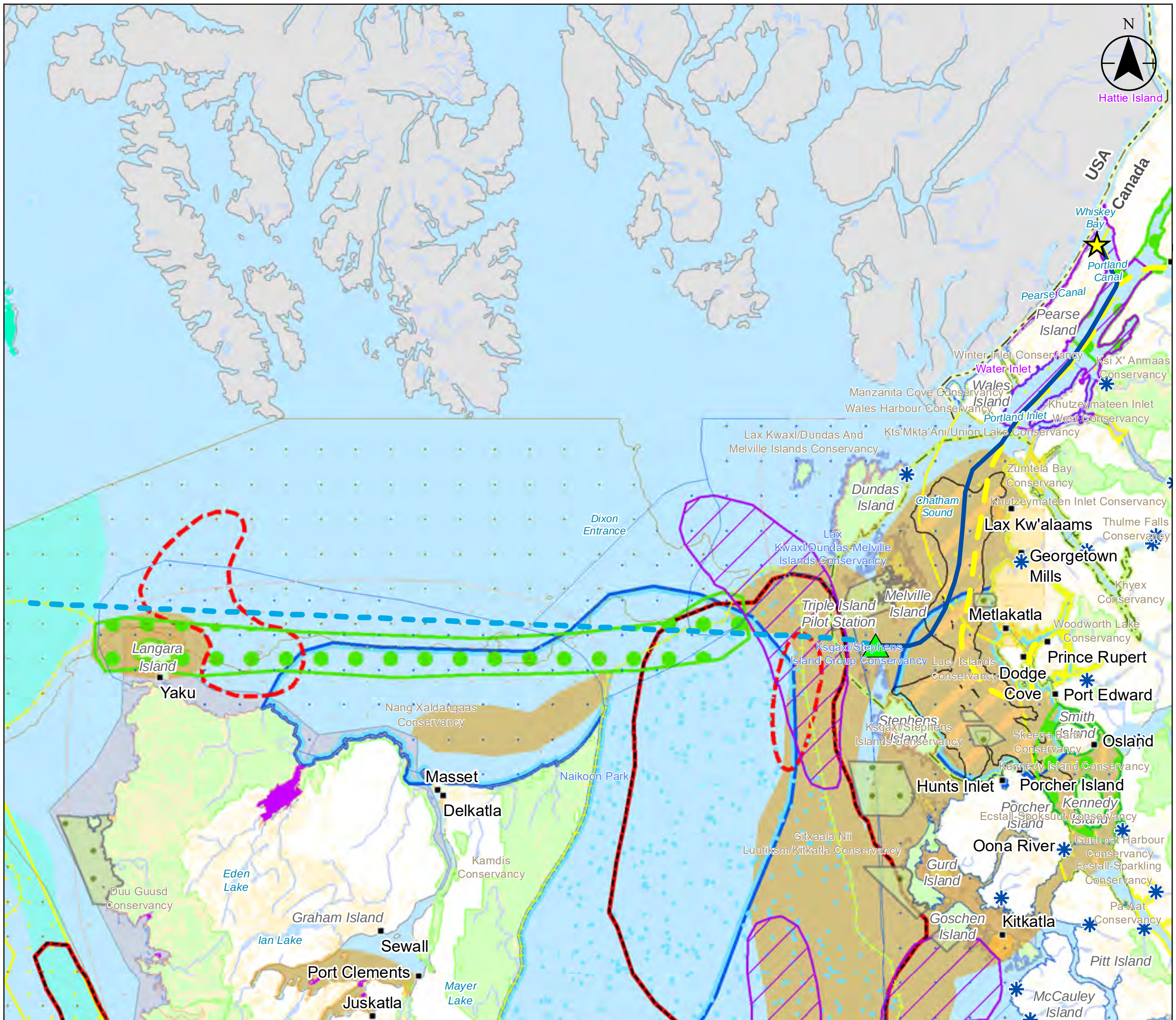

- Herring Spawning Area
- DFO Important Area for Pollock
- DFO Important Area for Eulachon
- DFO Important Area for Sole
- DFO Important Area for Shrimp
- DFO Important Area for Sablefish
- DFO Important Area for Pacific Cod
- DFO Important Area for Coral Sponge
- DFO Important Area for Tanner Crab and Mottled Sculpin
- DFO Important Area for Green Sea Urchin
- DFO Important Area for Rockfish
- DFO Important Area for Dungeness Crab
- DFO Important Area for Herring
- DFO Important Area for Humpback Whale
- DFO Important Area for Fin Whale
- DFO Important Area for Northern Resident Killer Whale

KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada

- Site
- Triple Island Pilot Station
- Marine Shipping Route
- Open Water Marine Shipping Route
- Materials and Supply Shipping Route
- Estuary

(Pacific Estuary Conservation Program, 2019)

- Marine Protected Area
- Rockfish Conservation Area
- International Border
- Watercourse
- Geographic Location Polygon (Environment Canada 2014) †

† Geographic location polygons within which critical habitat may be found, ECCC 2014.

- Marine Park, Ecological Reserve, Protected Area or Conservancy Area
- Waterbody

0 10 20 30 40 50 km

1:1,300,000 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC

Project Number: 123221820
Prepared by DROBERTSON on 20221007
Requested by EWATERFIELD on 20221007
Checked by TQUILICHINI on 20221007

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Section 1.0

Figure No.
1.3-7

Title
Key Environmental Features Near the Marine Shipping Route

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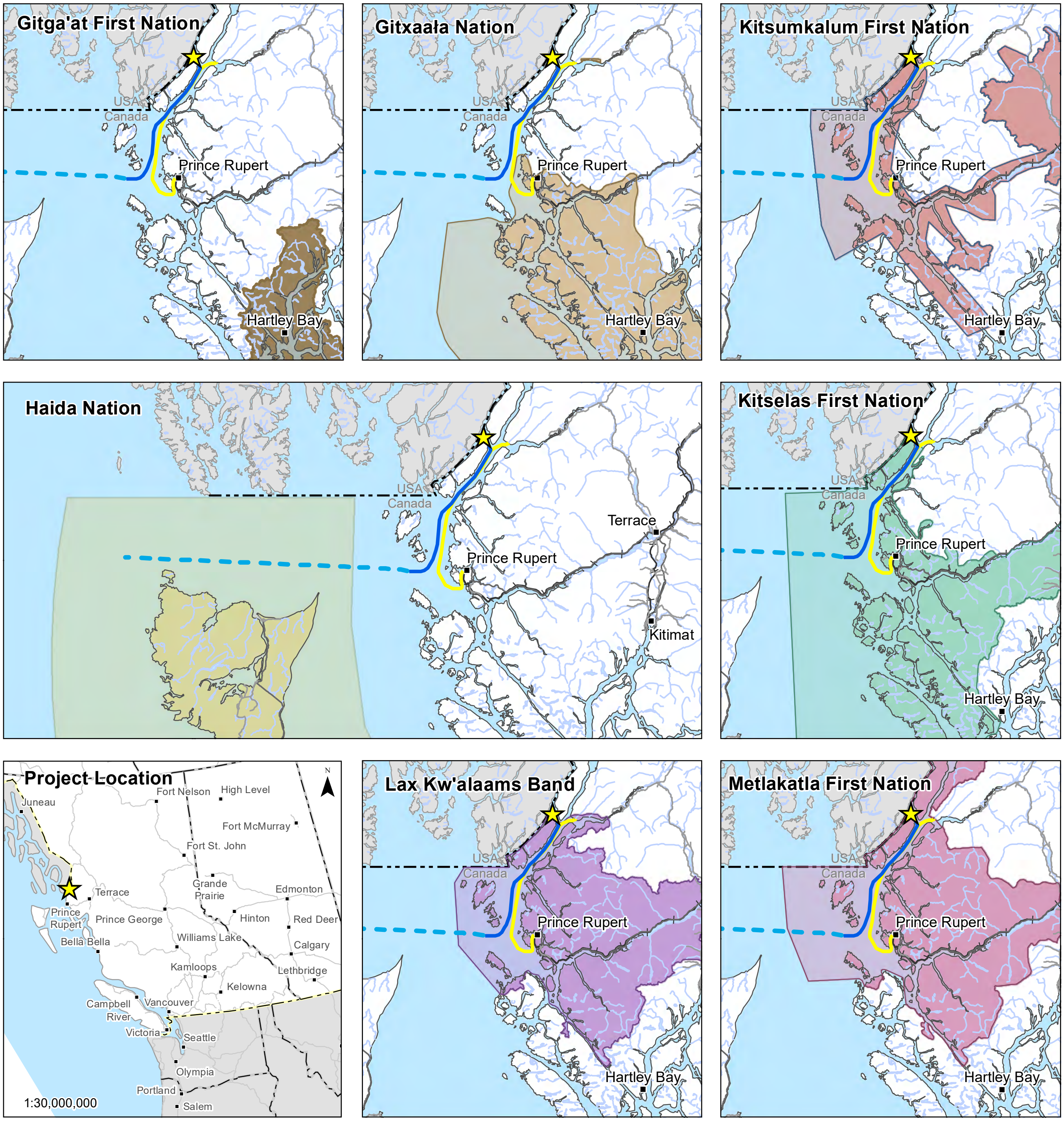

KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada

Site
Marine Shipping Route
Open Water Marine Shipping Route
Materials and Supply Shipping Route

Indigenous Nation

Gitga'at Nation Combined Harvesting Area and Territory
Gitxaała Nation Territory
Haida Nation Territory
Kitselas First Nation Combined Harvest Area and Territory
Kitsumkalum Band Council Territory
Lax Kw'alaams Band Territory
Metlakatla Band Council Territory

International Boundary
Highway
Road
Railway
Watercourse
Waterbody

0 20 40 60 80 km

1:3,850,000 (at original document size of 11x17)

N

Stantec

Project Location
Pearse Island
British Columbia

Project Number 123221820
Prepared by TQUILICHINI on 20220729
Requested by CLION on 20220720
Checked by SMOSS on 20220730

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Section 1.0

Figure No.
1.3-8

Title
Indigenous Territories in Northwest British Columbia

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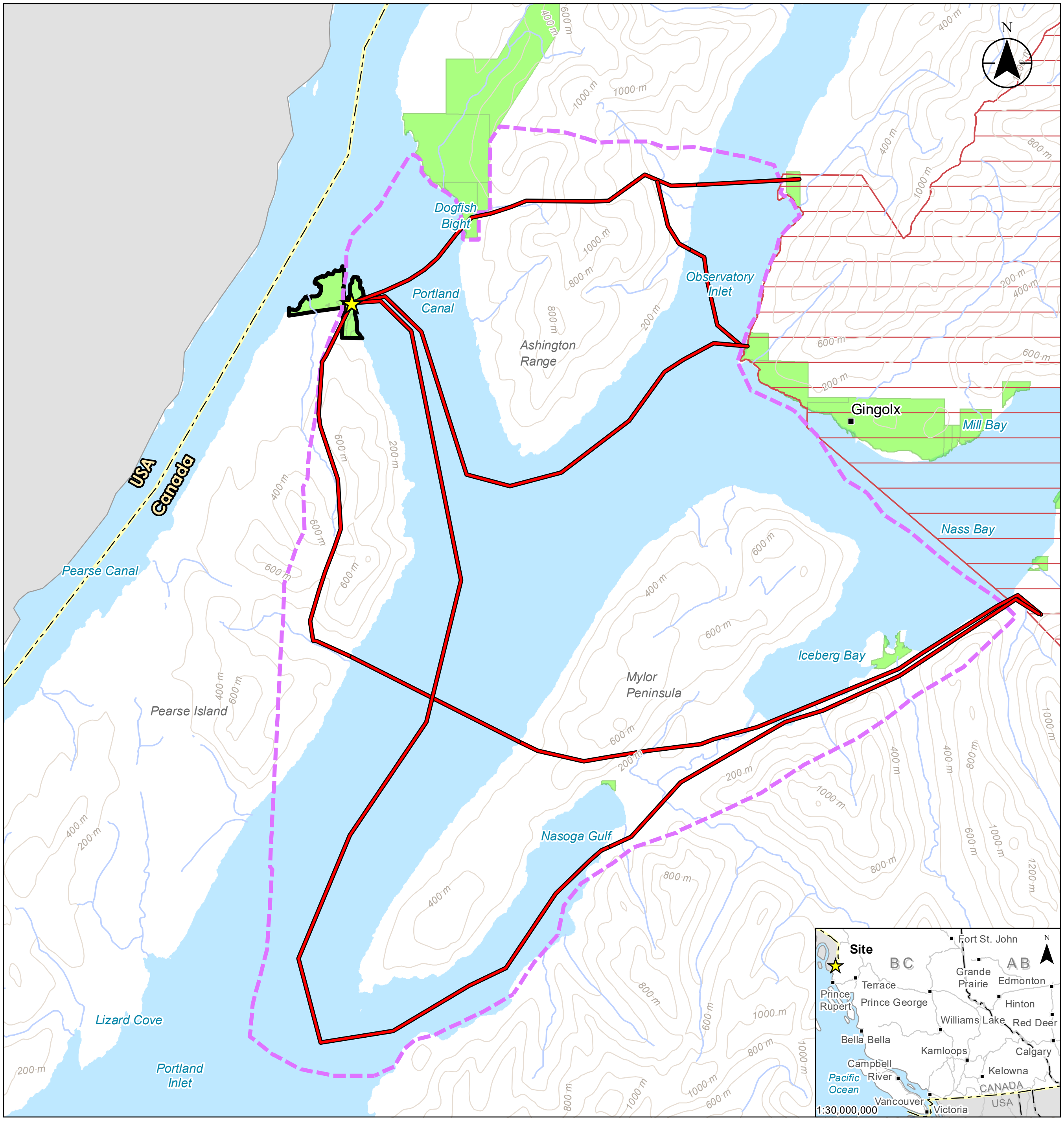

KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada

- Site
- Potential Transmission Line
- Boundaries of District Lots 7235 and 5431
- Nisga'a Lands
- Nisga'a Nation Category A/B Land
- Transmission Line Assessment Area
- International Boundary
- Topographic Contour
- Watercourse

0 1 2 3 4 5 6 km
1:175,000 (at original document size of 8.5x11)

Stantec

Project Location:
Pearse Island, BC

Project Number: 123221820
Prepared by TQ on 20230803
Requested by EF on 20230802
Checked by SM on 20230803

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Section 1.0

Figure No.
1.4-1

Title
Potential Transmission Line Options Between Nisg̲a'a Lands and the Project Site

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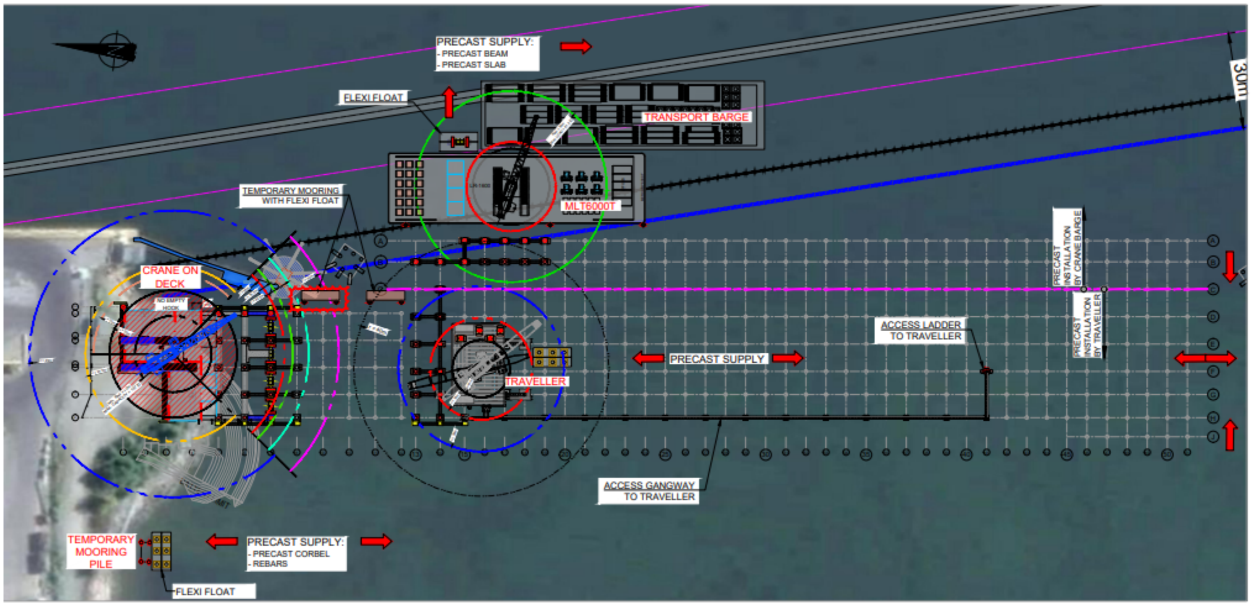

Figure 1.5–1 – Typical Trestle Pile Installation Using a Traveller

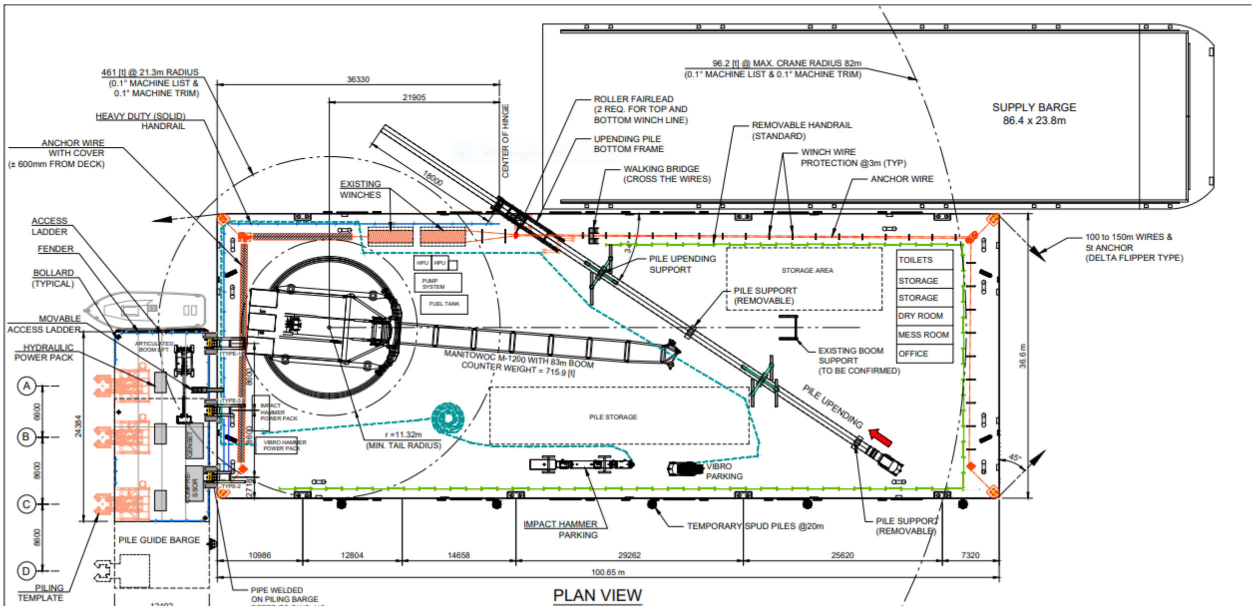

Figure 1.5–2 – Typical Piling Installation Using Marine Barge(s)

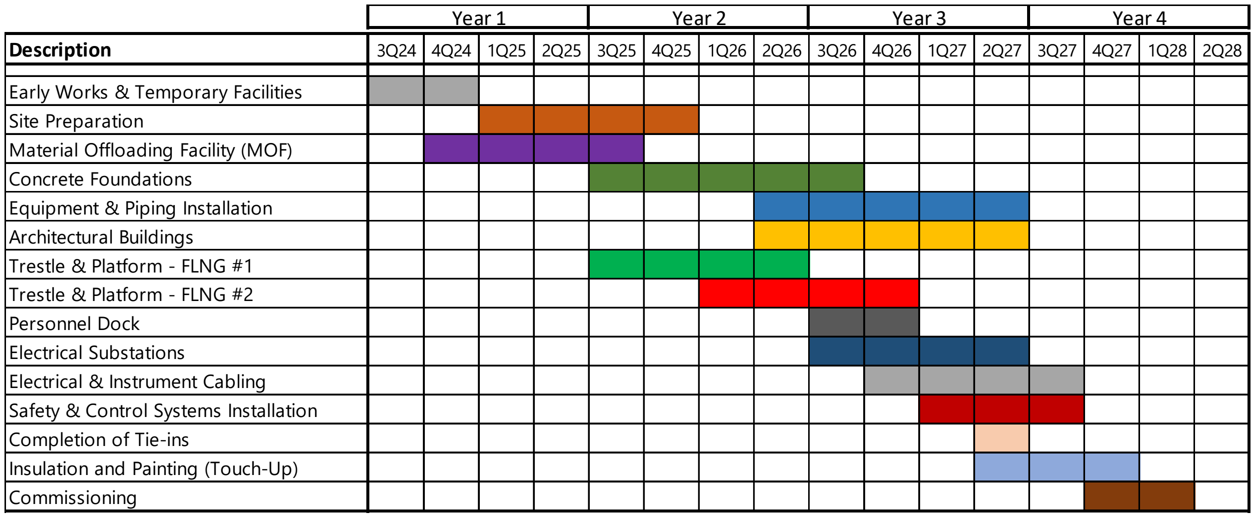

Figure 1.5–3 – Level 1 Construction Schedule