7.4 Marine Transportation and Use

7.4.1 Introduction

Marine transportation and use is a VC because Project construction, operation, and decommissioning might conflict with existing marine uses. For example, the expansion of the terminal and the associated increase in shipping traffic could affect marine fisheries, including Aboriginal fisheries, or the ability to pursue recreational activities in the areas along the marine access route. The potential effects of the Project on marine navigation, existing shipping, and human use of the marine environment within the navigable waters along the Project's marine access route (Figure 7.4-1) are assessed.

Potential effects on fish and fish habitat and on marine mammals are assessed in Section 5.8, and potential effects on visual quality are assessed in Section 7.3. The potential for Project-related accidents to affect marine transportation and use is discussed in Section 10.

7.4.2 Scope of Assessment

7.4.2.1 Regulatory and Policy Setting

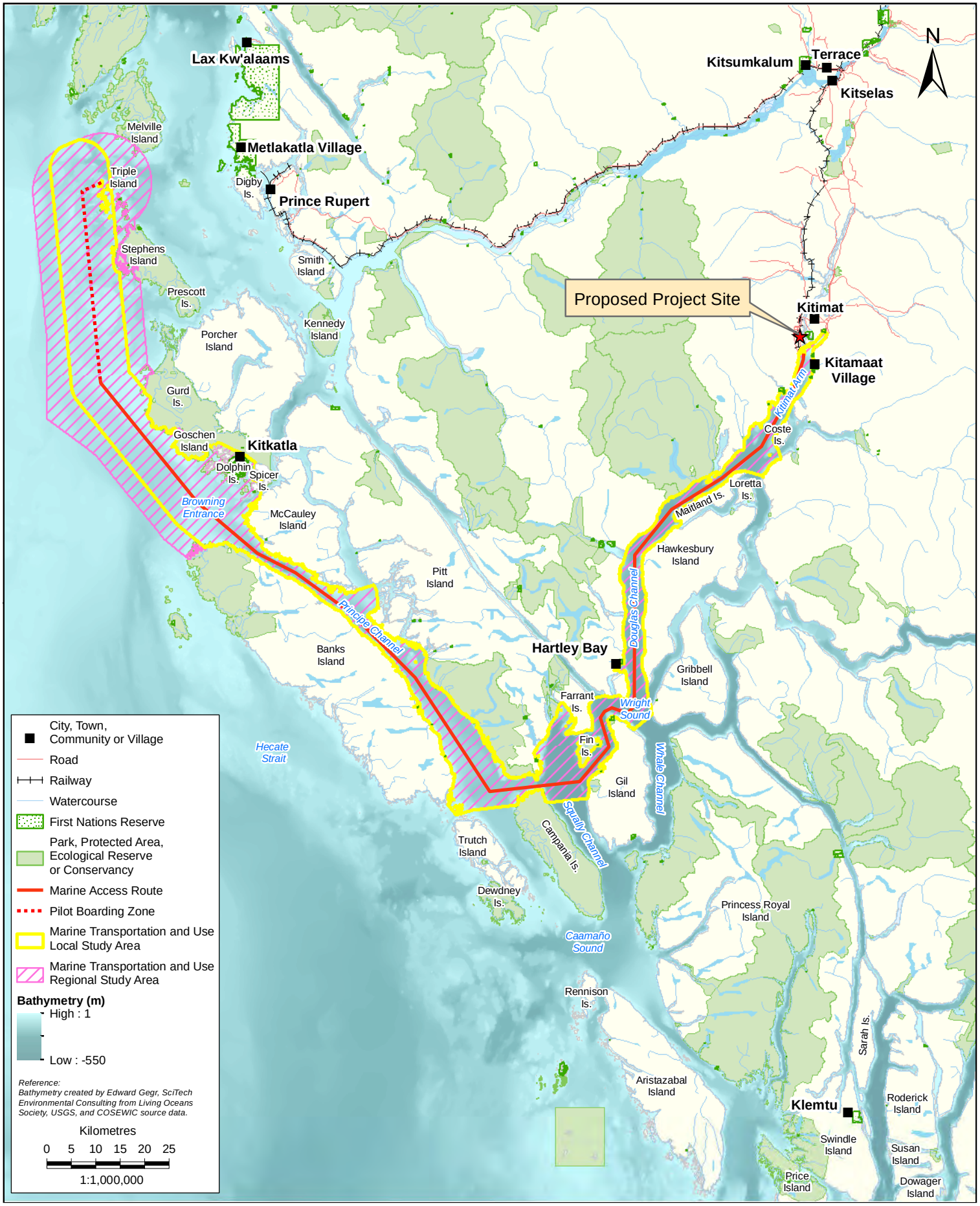
Acts and regulations concerning commercial shipping and construction activities in navigable waters include:

- *Navigation Protection Act*
- *Canada Shipping Act*, 2001
- Canadian *Ballast Water Control and Management Regulations*
- *Transportation of Dangerous Goods Act* and Regulations, and
- *Canada Marine Act*.

The *Navigation Protection Act* (NPA) protects the public's right to navigate and regulates the construction of works that might affect this right. The NPA is administered by Transport Canada and applies to scheduled waterways in Canada. Transport Canada will only authorize major works upon satisfactory review of the final design and development plan for the works.

Although the port of Kitimat is currently private and therefore does not have a federal port authority, LNG Canada and its marine contractors will be required to manage potential navigation conflicts by communicating with Marine Communication and Traffic Services (MCTS). This service provides notice to other vessels of potential issues of navigation.

While not a legal requirement, LNG Canada has requested that a Technical Review Process of Marine Terminal Systems and Transshipment Sites (TERMPOL) be done for the Project. The recommendations resulting from this process will be included, as appropriate, in the construction, operation, and decommissioning phases of the Project.



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MARINE TRANSPORTATION AND USE ENVIRONMENTAL EFFECTS ASSESSMENT

MARINE TRANSPORTATION AND USE LOCAL AND REGIONAL STUDY AREAS

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

PROJECTION	DRAWN BY
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7.4.2.2 Consultations' Influence on the Identification of Issues and the Assessment Process

LNG Canada has held information sessions, workshops, focus groups and one-on-one interviews to identify issues, characterize effects, and develop mitigation measures. Consultation with the public, Aboriginal Groups, the EAO Working Group, and other interested parties identified a number of issues of concern related to shipping and the marine terminal, including:

- interference with navigation related to the expansion of the marine terminal
- changes to marine safety
- reduced access to the marine environment (e.g., Kitimat River estuary and water front access)
- reduced access to fishing grounds
- loss or damage to fishing gear
- adverse effects of vessel wake (on fisheries, shoreline harvesting, and small craft), and
- increased competition for limited moorage space.

As a result of consultation with local residents, stakeholders, Aboriginal Groups in Kitimat, Terrace, Prince Rupert, and Aboriginal communities, LNG Canada has included the following in the Application:

- change in demand for marina and moorage facilities as a potential effect
- vessel wakes from LNG carriers and escort tugs as a potential effect mechanism
- lost fishing time as a potential mechanism of interference with marine fisheries and shoreline harvesting, and
- conduct, at a minimum, two safe-shipping workshops aimed at promoting safe navigation around shipping traffic for mariners prior to operation (Mitigation 7.4-1).

7.4.2.3 Traditional Knowledge and Traditional Use Incorporation

Traditional knowledge and use studies informed LNG Canada's understanding of Aboriginal fisheries and marine use. Studies reviewed are:

- Gitga'at List of Proposed Potential Adverse Project Effects, Rationale and Measurable Parameters (Gitga'at First Nation 2013)
- *Being Gitka'a'ata: A Baseline Report on Gitka'a'ata Way of Life, a Statement of Cultural Impacts Posed by the Northern Gateway Pipeline, and a Critique of the ENGP Assessment Regarding Cultural Impacts* (Satterfield et al. 2011)
- *Gitga'at Economic Development Strategy* (Hartley Bay Council 2011)
- *Giga'at Sustainable Tourism Strategy* (Gitga'at Nation 2003)
- *Gitxaala Nation Use Study: LNG Export Terminal Project* (Calliou Group 2014a)
- *Gitxaala Valued Components Report* (Calliou Group 2014b)

- Gitxaala Nation Socioeconomic Study: Report for the LNG Canada Project (The Firelight Group 2014)
- *The LNG Canada Proposed Terminal Site and Tanker Route within Haisla Traditional Territory: Haisla TLUS and Socio-economic Profile* (Powell 2013)
- *Report to the Kitselas First Nation Regarding Kitselas Traditional Use/Occupancy of the Coastal Territories Between the Mouths of the Kitimat and Skeena Rivers* (Smith 2008)
- *Report on the Kitselas Traditional Histories and Territories Project August 1998 to 1999* (Smith 1999)
- *Interim Letter Report for LNG Canada's Environmental Assessment Application Submission–Kitsumkalum First Nation TUS and SIA Preliminary Information* (Crossroads Cultural Resource Management 2014)
- *Interim Land and Marine Resource Plan of the Allied Tsimshian Tribes of Lax Kw'alaams* (Lax Kw'alaams First Nation 2004)
- *Interim Metlakatla Traditional Use Study* (DM Cultural Services Inc. 2014), and
- *Metlakatla Draft Marine Use Plan Executive Summary* (Metlakatla First Nation 2014).

Based on these studies and on consultation, LNG Canada includes Aboriginal information in the Application concerning:

- species harvested
- location of fishing areas
- current fishing practices and gear used, and
- marine use and planning initiatives.

7.4.2.4 Selection of Effects

The final selection of potential effects on marine transportation and use is based on the Project description of activities, government regulations, the professional judgment and experience of the assessment team, and issues identified through consultation. The four effects selected are:

- interference with marine navigation
- change in demand on marinas and moorage facilities
- interference with marine fisheries and shoreline harvesting, and
- interference with marine recreation and tourism.

7.4.2.5 Selection of Measurable Parameters

Measurable parameters (see Table 7.4-1) facilitate quantitative or qualitative measurement of each of the four potential Project effects and cumulative effects. The selection is based on government regulations, standards or guidelines, regulatory requirements, professional judgment of the assessment team, and consultation.

Table 7.4-1: Potential Project Effects on Marine Transportation and Use and Measurable Parameters

Potential Adverse Project Effects	Measurable Parameters	Notes or Rationale for Selection of the Measurable Parameter
Interference with marine navigation	▪ Proportion of the navigable channel affected by construction and operation of the marine terminal, including safety zones	▪ Construction of the marine terminal, including potential safety zones, might interfere with navigation. ▪ Approval under the NPA might be necessary for some marine infrastructure components.
Change in demand on marinas and moorage facilities	▪ Attribute data on marina and moorage facilities (i.e., moorage slips)	▪ Project might increase the demand on marinas and moorage facilities.
Interference with marine fisheries and shoreline harvesting	▪ Number and types of marine vessels as a result of the Project (LNG carriers per month) ▪ Location of fisheries along the marine access route ▪ Attribute data (i.e., characteristics of a fishery, such as type of fish caught, location of landings) on marine uses along shipping channel (i.e., fishing, aquaculture, other seafood and shoreline harvesting)	▪ An increase in vessel traffic might affect commercial, recreational, and Aboriginal fisheries.
Interference with marine recreation and tourism	▪ Recreational and tourism activities, destinations, and routes overlapping with Project infrastructure and marine access route ▪ Indicators of visitor frequency (i.e., visitor days)	▪ An increase in vessel traffic might affect existing marine use and tourism activities.

7.4.2.6 Boundaries

7.4.2.6.1 Spatial Boundaries

The boundaries of the LSA and RSA are:

- LSA includes waters surrounding the marine terminal where interference with navigation could occur, plus the confined channels along the marine access route and waters extending 6 km on both sides of the marine access route between Browning Entrance and the Triple Island Pilot Boarding Station (Figure 7.4-1).
- RSA encompasses the extent of shipping activities within the confined channels (e.g., Kitimat Arm, Douglas Channel, Principe Channel), and waters to the Pilot Boarding Station area near Triple Island in the north; and where the marine access route is not confined by geography, a buffer of approximately 10 km is used on both sides of the route (Figure 7.4-1).

In addition to the study areas, the following descriptive areas for Project activities are used:

- Marine terminal includes the area for construction of the marine terminal and waters immediately surrounding the marine terminal (Figure 7.4-2).
- Shipping corridor is 2 km wide, extending 1 km from each side of the centre line of the marine access route. In confined waters where the width of the channel is less than 2 km, the shipping corridor is taken to be the entire width of the channel.
- Safety zones are areas extending up to 300 m around each berth of the marine terminal: a 200 m ignition free radius from the loading point and 300 m to the public. These zones will be confirmed during design review (Figure 7.4-3). During transit, LNG carriers should maintain a 200 m safety zone. Further conversations with Transport Canada indicated that defined safety zones will be determined through the LNG Canada TERMPOL. Currently, there is no LNG shipping on Canada's west coast, so the TERMPOL review committee will consider all west coast LNG projects before a final decision is made.

7.4.2.6.2 Temporal Boundaries

Based on the current Project schedule, the temporal boundaries are:

- construction, Phase 1 (trains 1 and 2) to be completed approximately five to six years following issuance of permits, the subsequent phase(s) (trains 3, 4) to be determined based on market demand
- operation, minimum of 25 years after commissioning, and
- decommissioning, approximately two years at the end of the Project life.

7.4.2.6.3 Administrative and Technical Boundaries

Administrative Boundaries

The LNG facility is located on private land in the District of Kitimat. The adjacent waters come under federal government jurisdiction regulated for transportation use by Transport Canada as part of the Near Coast, Class 2 voyage area and include Fisheries and Oceans Canada (DFO) Fisheries Management Areas (FMAs) 4, 5, and 6, which comprise a subsection of a larger area commonly referred to as the Pacific North Coast Integrated Management Area (PNCIMA). LNG Canada carriers and escort tugs will use the prescribed marine access route, unless provided with alternative routing advice by BC Coast Pilots for safety reasons.

The Project is aligned with strategic planning objectives outlined in the PNCIMA Plan (2013), the Marine Planning Partnership (MaPP) (2013), and by the District of Kitimat (2008) to provide sustainable economic opportunities to communities located in the north coast region.

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MARINE TRANSPORTATION AND USE ENVIRONMENTAL EFFECTS ASSESSMENT

EXISTING MARINE TERMINAL

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

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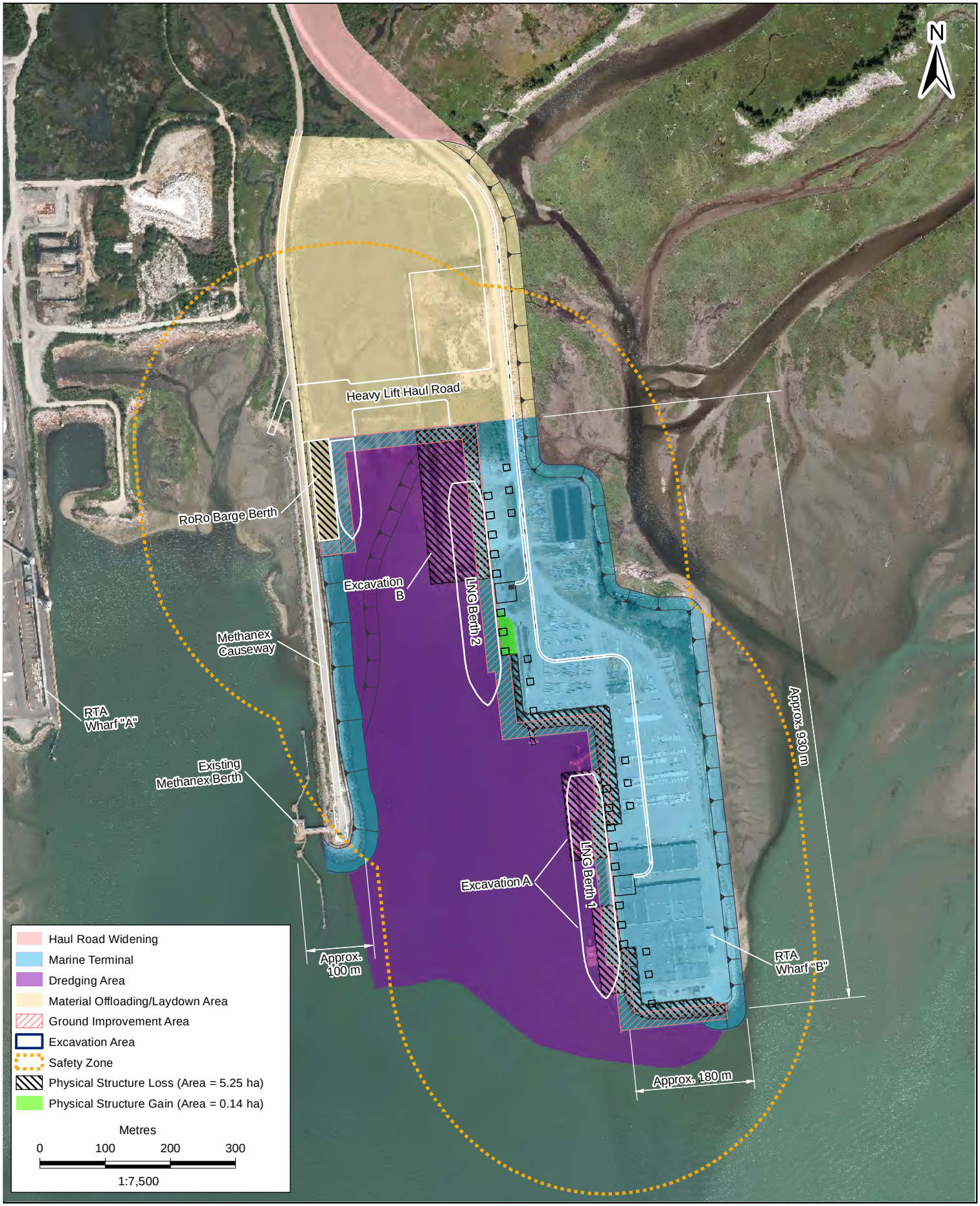

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MARINE TRANSPORTATION AND USE ENVIRONMENTAL EFFECTS ASSESSMENT

MARINE TERMINAL

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

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Technical Boundaries

Government data collection methods and privacy restrictions limit the resolution of some fisheries data. To comply with the *Privacy Act* and the *Access to Information Act*, DFO cannot release fishing statistics when there is a reasonable possibility that the information could be connected to an individual fisher. Consequently, catch landings and value data are not released for a fishery in an FMA if the fishery had fewer than three vessels. The same is true for subareas in FMAs. Therefore, the fish statistics for very small fisheries cannot be presented. For further information regarding data sources, see Stantec Consulting Ltd. (2014).

While shipping activities can be described quantitatively using the Canadian Coast Guard's (CCG's) MCTS data, the related geospatial information was not released to LNG Canada because of privacy and security reasons. Moreover, the spatial boundaries for which these data are available (i.e., the Prince Rupert traffic zone; see Stantec Consulting Ltd. 2014) are not well suited to describe shipping traffic travelling to Kitimat (see Stantec Consulting Ltd. 2014). Consequently, more spatially relevant data, such as the Pacific Pilotage Authority (PPA) and District of Kitimat data, were used.

7.4.2.7 Residual Effects Description Criteria

The criteria used to characterize residual effects on marine transportation and use are described in Table 7.4-2. Where possible, quantitative measures are used to characterize residual effects. If quantitative measures were not available or feasible, qualitative terms are identified and defined.

7.4.2.8 Significance Thresholds for Residual Effects

The significance thresholds for residual effects on marine transportation and use are:

- interference with marine navigation—a residual effect that causes substantial and persistent interference with navigation
- change in demand on marinas and moorage facilities—a residual effect that results in a substantial and persistent decrease in the level of services provided to the community
- interference with marine fisheries and shoreline harvesting—a residual effect that causes a substantial and persistent reduction in fishing or harvesting opportunities, and
- interference with recreation and tourism—a residual effect that causes a substantial and persistent decrease in recreation or tourism opportunities or quality of experience.

Table 7.4-2: Characterization of Residual Effects on Marine Transportation and Use

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Magnitude	The expected size or severity of effect. Low-magnitude effects may have negligible to little effect, while high-magnitude effects may have a substantial effect.	Negligible—no appreciable change given background conditions; character of the VC remains unchanged. Low—small change relative to background conditions; character of the VC remains largely unaltered. Moderate—moderate change relative to background conditions; character of the VC has been moderately altered. High—large change relative to background conditions; character of the VC has been substantially altered.
Geographical Extent	The spatial scale over which the residual effects of the Project are expected to occur. The geographic extent of effects can be local or regional. Local effects may have a lower effect than regional effects.	Marine terminal—effects restricted to the marine terminal and the waters immediately surrounding the facility. Shipping corridor—effects restricted to the shipping corridor. LSA—effects restricted to the LSA. RSA—effects restricted to the RSA.
Duration	The length of time the residual effect persists. The duration of an effect can be short term or longer term.	Short-term—effects are persistent no longer than the Project construction phase. Medium-term—effects are persistent for up to 10 years after construction. Long-term—effects are persistent more than 10 years after construction. Permanent—effects occur in perpetuity.
Frequency	How often the effect occurs. The frequency of an effect can be frequent or infrequent. Short-term and or infrequent effects may have a lower effect than long term and or frequent effects.	Single event—occurs once. Multiple irregular events (no set schedule)—occurs sporadically at irregular intervals throughout the construction, operation, or decommissioning phases. Multiple regular events—occurs on a regular basis and at regular intervals. Continuous—occurs continuously throughout the life of the Project.
Reversibility	Whether or not the residual effect on the VC can be reversed once the physical work or activity causing the disturbance ceases. Effects can be reversible or permanent. Reversible effects may have a lower effect than irreversible or permanent effects.	Reversible—effects can be reversed. Irreversible—effects cannot be reversed.

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Context	Refers primarily to the sensitivity and resilience of the VC. Consideration of context draws heavily on the description of existing conditions of the VC, which reflect cumulative effects of other projects and activities that have been carried out, and information about the impact of natural and human-caused trends on the condition of the VC. Project effects may have a higher effect if they occur in areas or regions that have already been adversely affected by human activities (i.e., disturbed or undisturbed or are ecologically fragile and have little resilience to imposed stresses (i.e., fragile)	Low reliance—area has low importance relative to others Medium reliance—area has medium importance relative to others High reliance—area has high importance relative to others Low resilience—refers to the inability to incur a small disturbance without adverse effects Moderate resilience—refers to the ability to incur a medium size disturbance without adverse effects High resilience—refers to the ability to incur a large disturbance without adverse effects.
Likelihood of Residual Effects		
Likelihood	Whether or not a residual effect is likely to occur.	Low—low likelihood of the residual effect occurring based on the potential Project interactions, mechanisms, and mitigation measures. Medium—a medium likelihood the residual effect occurring based on the potential Project interactions, mechanisms, and mitigation measures. High—a high likelihood the residual effect occurring based on the potential Project interactions, mechanisms, and mitigation measures.

7.4.3 Baseline Conditions

7.4.3.1 Baseline Data Sources

Baseline information was obtained from consultation with Aboriginal Groups and stakeholders, primary research, and from publicly available information, including government reports and data, environmental assessments for projects in the region, primary literature, and online sources.

7.4.3.1.1 Literature

Literature sources include DFO's Integrated Fishery Management Plans (IFMPs) and statistical reports, environmental assessments (e.g., Kitimat LNG project), and strategic marine planning resources such as the PNCIMA Plan (2013), MaPP initiative (2013), and the District of Kitimat website.

7.4.3.1.2 Shipping Data

Shipping data were collected from multiple sources, including:

- CCG's MCTS records of vessel movements in the Prince Rupert traffic zone
- PPA records of vessel movements requiring pilotage to or from the port of Kitimat
- District of Kitimat statistics for vessels arriving and departing from the port
- observation data on marine users in the RSA and LSA based on field studies conducted by Stantec Consulting Ltd.
- Cruise Lines International Association records of cruise ship movements, and
- BC Ferries schedule of crossings.

For further information on data sources, see Stantec Consulting Ltd. (2014).

7.4.3.1.3 Commercial and Recreational Fisheries Data

Marine fisheries data were collected primarily from DFO (2013a) and the British Columbia Marine Conservation Analysis (BCMCA) online database (BCMCA 2013), and were supplemented with information obtained from consultation with stakeholders and Aboriginal Groups. For example, three fisheries workshops were conducted in Kitimat (December 11) and Prince Rupert (December 12 and March 3) with commercial and recreational fishers (including guided anglers) in 2013 (Marine Community Consultation 2013a, 2013b, pers. comm.) and 2014 (Marine Community Consultation 2014, pers. comm.).

Four types of data were requested from DFO for commercial, recreational, and Aboriginal fisheries in FMAs 4 to 6 between 2000 and 2013:

- landings—weight or count of the number of organisms landed derived from logbook or at sea observer records

- value—dollar amount derived from wholesale fish slip records as reported by DFO (e.g., landed value as opposed to wholesale or retail value)
- licence—count of the number of licences issued by DFO, and
- spatial—location of the fishing grounds.

7.4.3.1.4 Aboriginal Fisheries Data

Information on Aboriginal fisheries was obtained from DFO (2013d), existing reports, and consultation. Sources of Aboriginal fishing information not already identified in Section 7.4.2.3 include:

- *Social and Economic Assessment and Analysis of First Nations Communities and Territorial Natural Resources for Integrated Marine Use Planning in the Pacific North Coast Integrated Management Area* (Ference Weicker & Company Ltd. 2009)
- fisheries workshops held with Metlakatla First Nation (March 3, 2014) and Kitselas First Nation (March 13, 2014); see Section 13.2 for a further discussion, and
- *Economic Impacts of the Enbridge Northern Gateway Project on the Gitga'at First Nation* (Gregory et al. 2011).

7.4.3.1.5 Recreation and Tourism Data

Marine-based recreation and tourism data were primarily derived from the BCMCA (2013) online database and available reports. These sources were supplemented with information from consultation with stakeholders and Aboriginal Groups. For further information regarding data sources, see Stantec Consulting Ltd (2014).

7.4.3.1.6 Marinas and Moorage Facilities Data

Information on marinas and moorage facilities was derived from the BCMCA online database (2013), websites, publicly available municipal documents, and through consultation with local business managers, stakeholders, and Aboriginal Groups. For further information regarding data sources, see Stantec Consulting Ltd (2014).

7.4.3.1.7 Primary Research

LNG Canada conducted research to collect information where publicly available data were considered incomplete. This research includes:

- fisheries workshops—in Kitimat and Prince Rupert to meet with commercial, recreational, and guided angling outfitters to identify potential Project effects and solicit ideas for mitigation
- one-on-one interviews—with Kitimat residents to discuss fisheries, recreation, guided angling, and to solicit ideas for mitigation

- vessel surveys—along the marine access route to supplement shipping data, especially with respect to recreational boating and placement of fishing gear (e.g., floats attached to trap lines), and
- phone surveys—with eco-tourism operators to determine the nature and size of the eco-tourism industry (including guided angling operators).

7.4.3.2 Baseline Overview

7.4.3.2.1 Marine Terminal

The marine terminal consists of two existing marine structures: the RTA Wharf "B" and the Methanex jetty (Figure 7.4-2). The jetty is used on average eight times per year to import methanol (Northwest Coast Energy News 2011; Stantec Consulting Ltd. 2014) and is accessed through a private road system (Invest in Northwest BC 2013a).

Wharf "B" was originally constructed with a single berth (sufficient space for one ship to dock) in 1967 to which a second berth was added in the late 1980s. Both berths are 137 m long and are spaced some distance apart from each other (i.e., Wharf "B" is longer than the two berths combined). Berth 1 has a depth of approximately 14 m, and berth 2 has a depth of approximately 10.9 m (Figure 7.4-3). At present, Wharf "B" extends approximately 1,390 m into the ocean and is approximately 210 m wide. The Methanex jetty extends approximately 1,100 m and is approximately 100 m wide. Overall, the two marine structures have a combined width of 310 m (west to east direction) (Figure 7.4-2). Given a channel width of approximately 2,800 m (Figure 7.4-2), the terminal currently occupies 11% of the navigable channel at the head of Kitimat Arm.

Haisla Nation Use of the Marine Terminal Area

The asserted traditional territory of Haisla Nation includes the head of Kitimat Arm and extends the length of Douglas Channel to Blue Jay Falls (near to the south end of Maitland Island) and is called *Q'axdlalisla*. The existing terminal is located in an area called *Yaksda*, which means "dirty water" (Powell 2013). Haisla are concerned about potential pollution (Powell 2013) and habitat loss in the estuary.

Public Use of the Marine Terminal Area

The waters near the existing marine terminal are used by some residents for crabbing; however, most avoid crabbing in this area because of perceptions of contamination from previous industry practices (Hummel and Langagger 2013, pers. comm.). DFO Bivalve shellfish biotoxin closures are in effect for all of FMAs 4 through 6, with the exception of FMA sub-areas, which are only open to geoduck and horse clams (DFO 2014a):

- 4-2, 4-4, 4-9, and
- 5-10, 5-11, 5-12, 5-13.

DFO Bivalve shellfish sanitary contamination closures are in effect for FMA sub-areas (DFO 2014a):

- 4.1 – 4.4; Humpback Bay and Hunt Inlet, Porcher Island; Prince Rupert Harbour; Metlakatla Bay and Venn Passage
- 5.1 and 5.A; Kitkatla, Dolphin Island; Grenville Channel (seasonal closure May 1 – Oct 15), and
- 6.1, 6.2, 6.3, 6.5; Kitimat Arm, Higgins Passage, Hartley Bay, Swindle Island.

Fishing for salmon and halibut occur along the east side of the channel in deeper water. Fishing from shore also occurs (Hummel and Langagger 2013, pers. comm.; Wakita 2013, pers. comm.).

7.4.3.2.2 Shipping

Navigational Aids, Communications, Coast Guard Services, and Safety

Aids to navigation include any government-approved features placed along the coast that increase marine safety. Examples include lights, buoys, fog (sound) signals, day markers, and electronic systems whether fixed on shore (including lighthouses) or afloat. The CCG publishes annual information about these aids in the Pacific Coast volume of their *List of Lights, Buoys, and Fog Signals or Radio Aids to Marine Navigation*. Some examples include fixed aids located on Triple Island and floating aids found within Hecate Strait, Principe Channel, and Douglas Channel. The CCG also tracks information related to any change concerning these aids to navigation, including those that are damaged or missing, and disseminates that information to the public via Notices to Mariners and Notices to Shipping.

Radio aids to navigation include global positioning system (GPS), differential GPS, and radar reflectors and radar beacons. Automatic Identification System (AIS) is another tool that improves navigational safety at sea. This system is required internationally by all vessels of 300 gross tonnage or more, and all passenger ships regardless of size (International Maritime Organization 2014). Domestically, the federal Navigation Safety Regulations, which came into force in 2005, require every ship, other than a fishing vessel, of 500 gross tonnage or more that is not engaged on an international voyage to be fitted with an AIS.

The CCG runs the MCTS centres, which provide marine safety and security communication services, including coordination of search and rescue resources with the Joint Rescue Coordination Centre and security information to the Marine Security Operations Centre, both located in Victoria, and manages the movement of vessel traffic. Prince Rupert MCTS is the closest centre to Kitimat. The nearest CCG station is located in Prince Rupert at the Seal Cove Seaplane Base and offers the following services to assist maritime safety:

- MCTS—provides information on marine weather conditions, first response to distress calls, and monitoring and regulation of vessel traffic movement in Canadian waters
- aids to navigation—deploys and maintains buoys and beacons
- environmental response—coordinates pollution preparedness planning, aerial surveillance, environmental education, pollution prevention, monitoring and response
- search and rescue

- supports Transport Canada's Office of Boating Safety—by promoting marine and boating safety for pleasure craft operators through the distribution of safety information and publications on their behalf, and
- waterways development—is responsible for the safety and accessibility of active fishing harbours.

Several anchorages and areas of refuge are located in the RSA that could accommodate large vessels in the event of an emergency. These locations include:

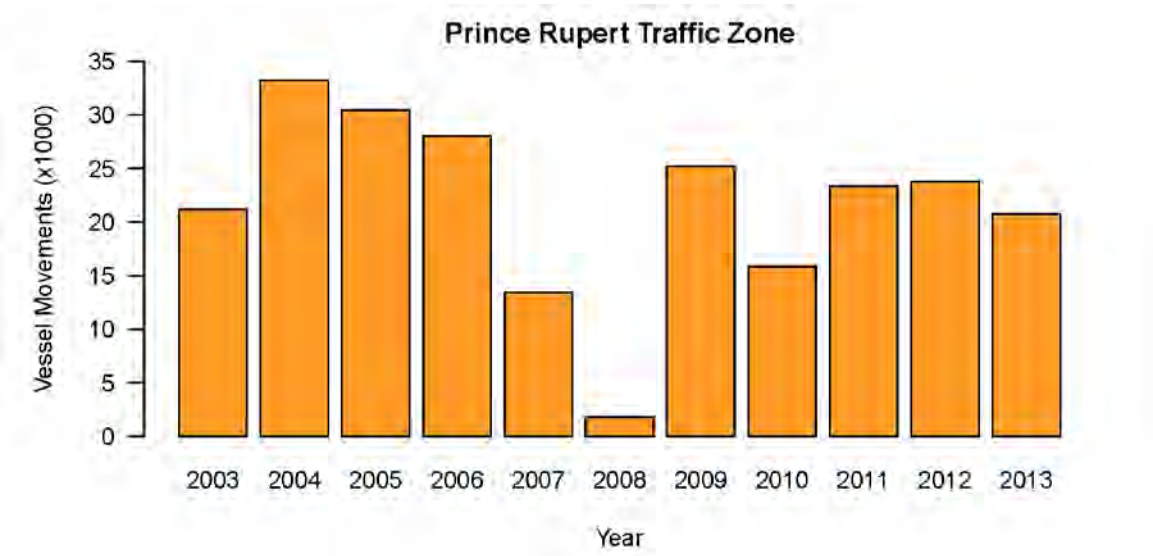
- Anger Anchorage (off Anger Island at the junction of Principe and Petrel channels)
- port of Kitimat
- Kitkiata (Douglas Channel; emergency only, with tug assist), and
- Coghlan Anchorage (near Wright Sound; emergency only, with tug assist).

Port of Kitimat

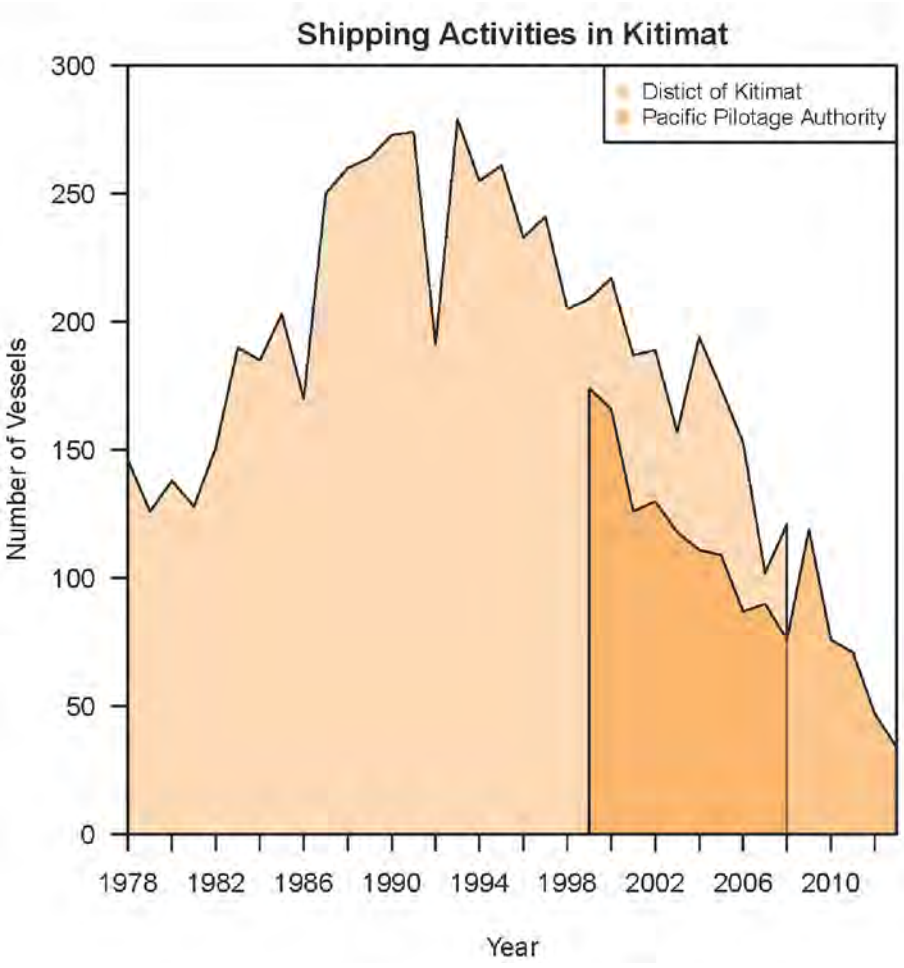
The port of Kitimat is a private, industrial port that since the 1950s has accommodated large vessel traffic (upwards of 50,000 dead weight tonnes [DWT]) bound for international markets (TERMPOL 2012; Stantec Consulting Ltd. 2014). In terms of international trade, Kitimat is the third largest port on the west coast of Canada, behind Port Metro Vancouver and the port of Prince Rupert.

On average, over 21,000 vessels per year report to the MCTS as they move throughout the Prince Rupert traffic zone, including large merchant ships, passenger vessels, LNG carriers, tankers, tugs, and barges (Figure 7.4-4). While the MCTS data provide an overview of the broader traffic patterns, trends that are more specific to the Project's marine access route can be inferred from the PPA and District of Kitimat datasets because these data only include ships travelling to and from the port of Kitimat.

Figure 7.4-5 shows the number of vessel visits per year between 1978 and 2011 that entered the port of Kitimat and provides a conservative estimate of commercial shipping traffic using the marine access route (since some vessels might have travelled from, or were headed to, a southern port and will therefore not use the entire route). On average, 203 commercial vessel visits occurred for the port each year, with up to 102 of those vessel visits piloted by the PPA. Not all vessels are required to carry BC Coast Pilots onboard. For example, domestic vessels less than 10,000 gross registered tonnes are not required to carry a BC Coast Pilot but do visit the port. When this occurs, vessels are recorded in the District of Kitimat dataset but not by the PPA (NOTE: PPA vessel movement data were converted to number of vessel visits by dividing the number of movements by two because a vessel visit will always have an inbound and outbound portion to its trip; this provides an estimate of the number of vessel visits piloted by the PPA). A review of vessel attribute data (e.g., length overall, DWT, draft, beam) from the PPA dataset show that commercial vessels travelling to Kitimat were up to 225 m long and were rated to carry over 70,000 DWT. Ship traffic generally increased from 1978 until 1993, when it peaked at 279 vessels. Peak traffic occurred between 1987 and 1995, with an average of more than 250 vessels visiting the port of Kitimat those years. Following the peak in 1993, shipping traffic declined to less than 150 vessel visits per year in 2008.



Stantec	LNG CANADA Opportunity for British Columbia. Energy for the world	*MARINE TRANSPORTATION AND USE ENVIRONMENTAL EFFECTS ASSESSMENT* **VESSEL MOVEMENTS REPORTED BY THE MCTS IN THE PRINCE RUPERT TRAFFIC ZONE** LNG CANADA EXPORT TERMINAL KITIMAT, BRITISH COLUMBIA	PROJECTION: UTM9 DATUM: NAD 83 DATE: 21-JUL-14	DRAWN BY: SHS CHECKED BY: SW FIGURE NO.: **7.4-4**



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MARINE TRANSPORTATION AND USE
ENVIRONMENTAL EFFECTS ASSESSMENT

VESSEL MOVEMENTS REPORTED BY THE DISTRICT OF KITIMAT

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

PROJECTION	DRAWN BY
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DATE	FIGURE NO.
21-JUL-14	**7.4-5**

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Cruise Ships

Cruise ships bound for Alaska commonly travel through the PNCIMA and LSA. They use the open waters of Hecate Strait or the more confined waters of the inside passage (an area that overlaps with the marine access route). However, use of the inside passage requires assistance of two BC Coast Pilots and is not preferred because of cost and longer overall travel times to reach Alaska (Spalding 2013, pers. comm.).

In 2005, more than 300 transits were made using the inside passage for travelling to Alaska (MacConnachie et al. 2007), with considerably fewer trips in 2013. The Cruise Line International Association (2013) reported 71 trips through Laredo Channel in 2013, of which 50 also went through Principe Channel. Twenty-one transits were therefore made through Grenville Channel (and were generally made by ships travelling south). Vessels travelled between 14 knots and 21 knots (Cruise Line International Association 2013). This demonstrates that large vessels 240 m to 294 m in length use sections of the marine access route and travel at speeds greater than those proposed for the Project.

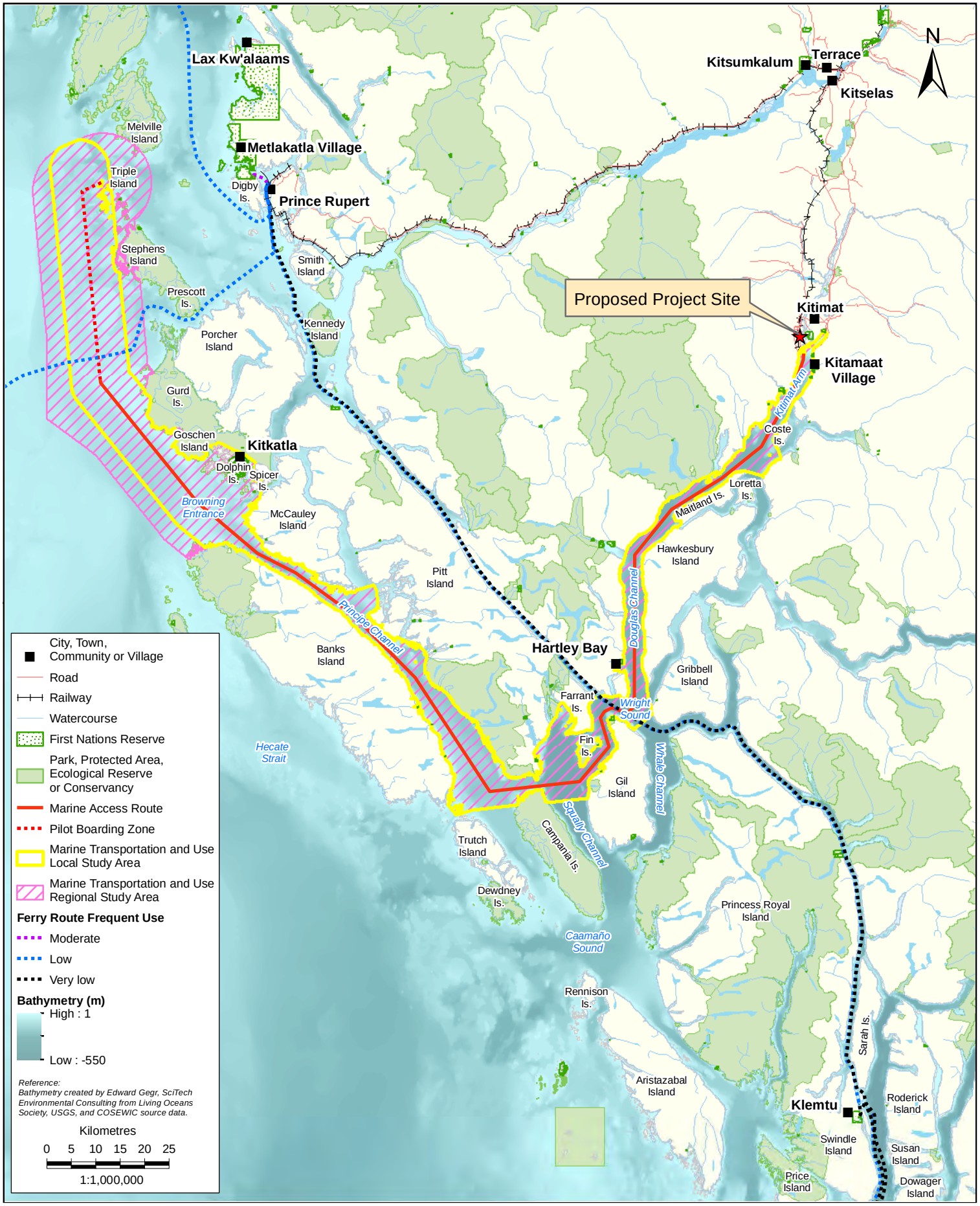
BC Ferries

Two BC ferry routes intersect the marine access route: 1) Prince Rupert to Port Hardy (and return trip); and 2) Prince Rupert to Skidegate (and return trip) (Figure 7.4-6). Given the current schedule, they will cross the marine access route approximately 450 times per year (BC Ferries 2013; Stantec Consulting Ltd. 2014).

LNG Canada Vessel Surveys

Surveys were conducted to characterize the use of the marine access route. The goal was to estimate the density of vessels along different sections of the route and to predict how often different types of vessels might interact with LNG carriers. All craft observed during surveys were recorded (including fishing, CCG, and military vessels, aircraft and helicopters, and small sail and power boats). These data were analyzed to determine the density of different groups of vessel types along the marine access route (e.g., commercial, recreational, and Aboriginal fishing vessels or gear). These data filled an important information gap because smaller vessels (i.e., less than 30 m) are not reliably captured in the other datasets.

Vessel surveys were conducted during specific marine mammal surveys along the entire marine access route (see Section 5.8). Five two-week surveys were conducted from June through August 2013. Because the waterways are busiest during this time of year (Stantec Consulting Ltd. 2014), the information gathered is considered to represent the highest estimated traffic for the area.



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BC FERRY ROUTE

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

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18-JUN-14	**7.4-6**

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Vessel density (observations/hectare/day) was calculated for five different traffic zones by dividing the number of observations by the associated area and search time. Calculations are made for two different subsets of the data (see Stantec Consulting Ltd. [2014] for further details) (Table 7.4-3):

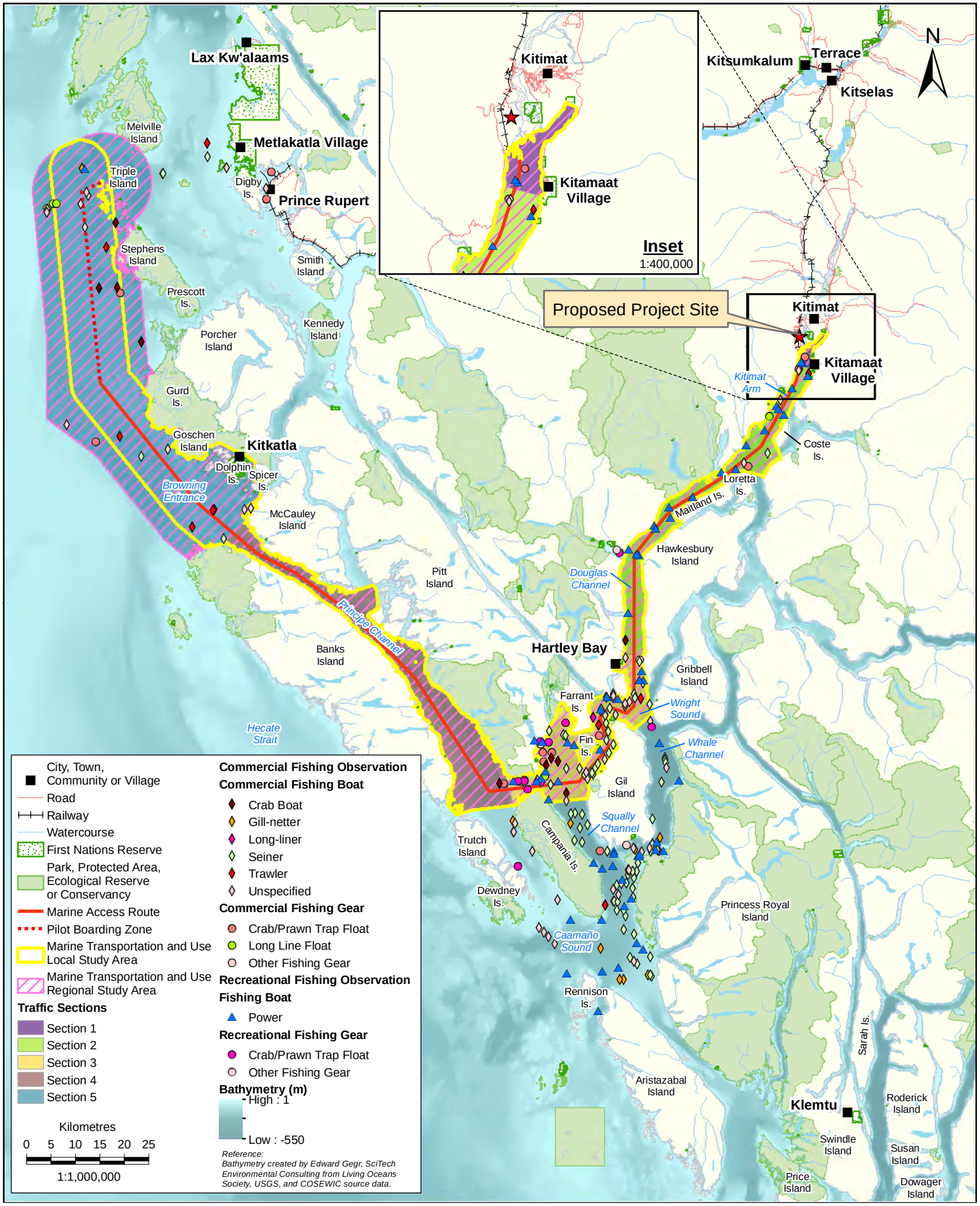
- fishing related data—includes all observed commercial and recreational fishing vessels and floating fishing gear
- recreational and tourism related data—includes all non-fishing recreational power and sail vessels (military and coast guard vessels, and aircraft are not included)

Using the data presented in Table 7.4-3, the number of interactions is estimated between Project LNG carriers and other commercial and recreational vessels (Sections 7.4.6.2 and 7.4.6.3).

Table 7.4-3: Commercial, Recreational, and Aboriginal Fishing Vessels or Gear Observed

Traffic Section	Number of Observations	Density (Obs./ha/day)
Commercial and Recreational Fishing Vessels or Gear Observed		
1: Head of Kitimat Arm	3	0.026585
2: Douglas Channel	28	0.000514
3: Wright Sound	84	0.000702
4: Principe Channel	2	0.000011
5: Browning Entrance to Triple Island	28	0.000041
Recreational Vessels (Non-fishing Power and Sail) Observed		
1: Head of Kitimat Arm	2	0.017723
2: Douglas Channel	57	0.001047
3: Wright Sound	101	0.000844
4: Principe Channel	17	0.0000927
5: Browning Entrance to Triple Island	27	0.0000398

NOTES:
Fishing gear (e.g., long lines or prawn and crab traps) is counted individually.
Data collected during five vessels surveys during June through August 2013.
Traffic sections are shown on Figure 7.4-7 and Figure 7.4-8.
SOURCE: see Stantec Consulting Ltd. (2014) vessel survey data for further details.



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MARINE TRANSPORTATION AND USE ENVIRONMENTAL EFFECTS ASSESSMENT

VESSEL SURVEY RESULTS: COMMERCIAL AND RECREATIONAL FISHING VESSEL OR GEAR

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

PROJECTION: UTM9	DRAWN BY: SS
DATUM: NAD 83	CHECKED BY: SW
DATE: 18-JUN-14	FIGURE NO.: **7.4-7**

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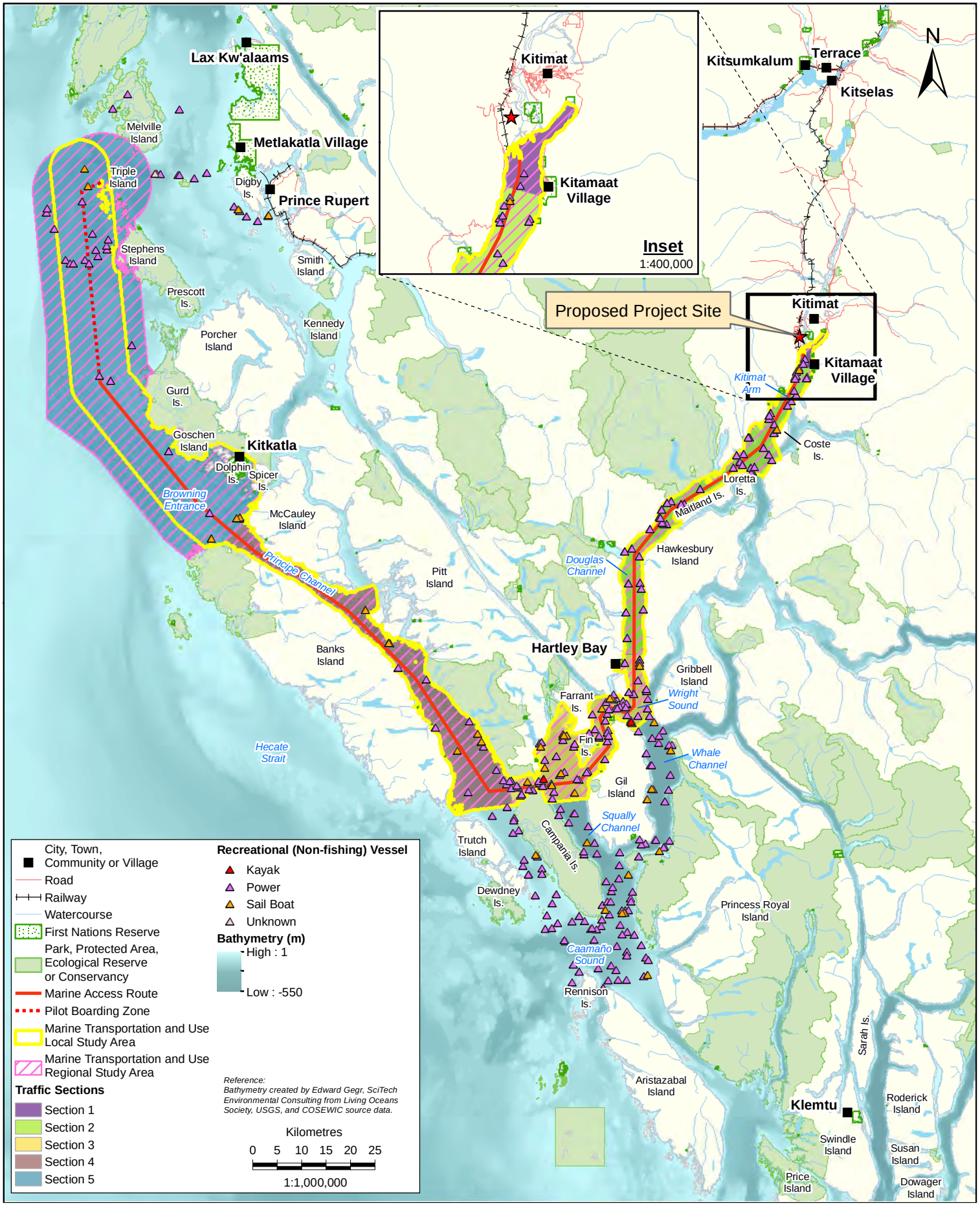

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MARINE TRANSPORTATION AND USE ENVIRONMENTAL EFFECTS ASSESSMENT

VESSEL SURVEY RESULTS: RECREATIONAL VESSELS (NON-FISHING)

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

PROJECTION	DRAWN BY
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Vessel Wake

Aboriginal Groups and various stakeholders expressed concern about vessel wake along the marine access route. Concerns included effects on:

- shoreline harvesting
- small craft safety, and
- shoreline erosion processes.

The size of wake waves depends on a range of factors, including water depth (middle of channel and approaching shore), channel width, vessel design (hull form), vessel size (length and draft), vessel speed, and distance between the source vessel and the wave (Jonason 1993; Sorensen 1997; Ellis et al. 2005; Pullar and Single 2009). In addition to these factors, the degree to which vessel wake waves will be differentiable from wind waves will depend on background sea conditions. For example, in highly sheltered waters, vessel wake waves might be the main source of wave energy. In contrast, in the open ocean, vessel wake waves might be a negligible source of wave energy.

In south Hecate Strait and in Douglas Channel wave height is recorded by two DFO-operated weather buoys. Data indicate that wave height has reached up to approximately 13.7 m in Hecate Strait but on average is only 1.8 m. In Douglas Channel, wave height has reached up to approximately 3.4 m but on average is 0.14 m (Table 7.4-4; DFO 2014a). In addition to large natural wind generated waves, wake waves from cruise ships (vessels up to 294 m long) and other large craft (up to 225 m long) occur in the region and along portions of the marine access route (Section 7.4.3.3; Stantec Consulting Ltd. 2014). The exact size of wakes generated by these vessels has not been empirically documented; however, based on previous wake studies conducted in the region, the height of wake waves reaching shoreline habitats is within the range of natural wave conditions.

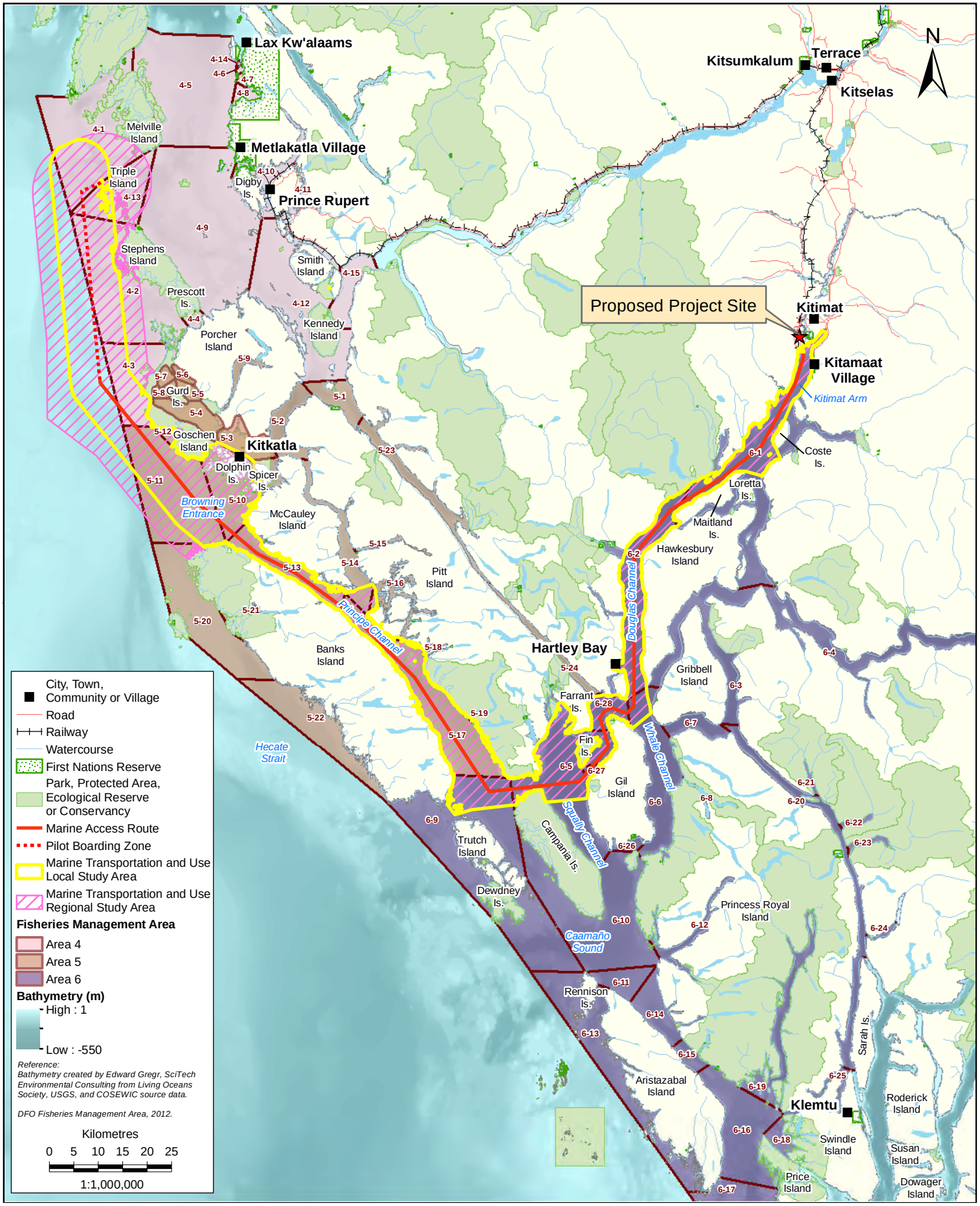
7.4.3.2.3 Marine Fisheries

DFO manages all marine fisheries. The RSA for marine transportation and use overlaps with FMAs 4, 5, and 6 (Figure 7.4-9). FMA 4 extends north to the BC-Alaska border and south to Porcher Island. FMA 5 continues south from FMA 4 and includes the Inside Passage (down to Wright Sound), Principe Channel (down to Otter Channel), and the near shore areas off Banks Island (down to the southern edge of Banks Island). FMA 6 encompasses all of Douglas, Devastation, Whale, and Squally channels, and Wright and Caamaño sounds. Descriptions of the commercial, recreational, and Aboriginal fisheries in these FMAs follow.

Table 7.4-4: Wave Height at Weather Buoy Stations Along the Marine Access Route

Buoy Station / No.	Water Depth (m)	Latitude / Longitude	Wave Height (m)													
			Mean / Max.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Nanakwa Shoal (46181)	22	53° 50.0' N 128° 49.9' W	Mean	0.24	0.18	0.15	0.09	0.10	0.11	0.11	0.09	0.09	0.11	0.16	0.22	0.14
			Max.	2.02	2.33	2.27	3.36	3.04	2.05	0.75	0.78	0.71	0.85	1.23	1.79	3.36
South Hecate Strait (46185)	228	52° 24.4' N 129° 47.0' W	Mean	2.53	2.24	2.16	1.74	1.36	1.13	0.97	1.03	1.33	1.91	2.43	2.65	1.80
			Max.	12.80	12.00	10.20	7.96	7.87	5.84	6.89	7.09	8.20	11.00	12.50	13.70	13.70

SOURCE: DFO (2014a)



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FISHERIES MANAGEMENT AREA

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

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Commercial Fisheries

Ten major commercial fisheries occur in FMAs 4 to 6 (Table 7.4-5). The landings, catch value, and licences issued for the FMA with the highest yearly average are listed in Table 7.4-5. For example, the highest mean annual landings of salmon was reported in FMA 6, while the highest mean annual average value of fish sold was in FMA 4. For the Pacific herring and groundfish fisheries, the number of boat days and sets was reported. A boat day is a measure of effort, with one unit representing one boat fishing for one day. A "set" is one complete cycle of deploying and retrieving fishing gear. For groundfish, long-line gear is usually retrieved and re-set once per day (e.g., one set per day). The term "set" can be applied to other types of gear, including halibut long line, prawn and crab traps, and salmon seine and gill nets. For more information, see Stantec Consulting Ltd. (2014).

Table 7.4-5: Highest Mean Annual Landings, Value, and Licences for Commercial Fisheries in FMAs 4 to 6 (2000 to 2012)

Fishery	Landings	FMA with Highest Landings	Value (dollars)	FMA with Highest Value	Licences	FMA with Most Licences
Salmon [a]	1,816,747 fish	6	6,448,918	4	353	6
Pacific herring [b]	1,763 kg	4	3,904,578	4	204 (boat days not licences)	4
Geoduck clams [c]	313,523 kg	5	3,612,010	5	22	5
Red sea urchins	1,076,418 kg	6	1,817,254	6	71	6
Pacific halibut [d]	73,116 kg	6	722,387	5	286	6
Dungeness crab	97,880 kg	4	559,670	4	13	4
Sea cucumbers [e]	126,676 kg	6	499266	6	27	6
Prawns and shrimps [f]	27,034 kg	4	402,765	4	57	4
Groundfish [g]	94,686 kg	6	NA	NA	210 (sets not licences)[h]	6
Octopus	NA	NA	NA	NA	1	4 and 5

NOTES:

[a] All spp. and gear types.

[b] All gear types and products.

[c] Value based on 2002 data only.

[d] Longline gear only. Value based on 2000 data only.

[e] Split weight, not whole.

[f] All spp. and gear types. Value derived from trawl gear only.

[g] All spp. and gear types. A set is one complete cycle of deploying and retrieving fishing gear.

[h] A "set" is one complete cycle of deploying and retrieving fishing gear. For groundfish, long-line gear is usually retrieved and re-set once per day (e.g., one set per day). The term "set" can be applied to other types of gear, including halibut long line, prawn and crab traps, and salmon seine and gill nets

NA = Not available

Value = landed value

SOURCE: DFO (2013a); see Stantec Consulting Ltd. (2014) for further details.

Salmon

Salmon fishing using gill nets, purse seines, and troll gear occurs throughout the RSA (BCMCA 2013; Figure 7.4-10). Commercial fishing can occur between May and October, but will vary according to the time of local runs, distribution, and health of salmon stocks. The length of time the salmon seine or gill net fisheries are open can vary from several weeks to several days. In FMAs 4 to 6, salmon fishing usually begins in early June and starts to slow by September (DFO 2013b; Stantec Consulting Ltd. 2014). Gill nets must be actively fished and cannot legally be left unattended (Marine Community Consultation 2014, pers. comm.).

Pacific Herring

The herring fishery yields multiple products (e.g., spawn on kelp, roe, food, and bait). These are harvested using different gear types (e.g., seine, drift nets, and hand rigs). Fishing locations exist around Browning Entrance and to the west of Goshen Island (BCMCA 2013; Figure 7.4-11). Since 2008, the herring fishery has been closed in FMA 6 to protect stocks, with limited catches taken in FMA 4 and FMA 5 (DFO 2013c; Stantec Consulting Ltd. 2014).

Geoduck Clams

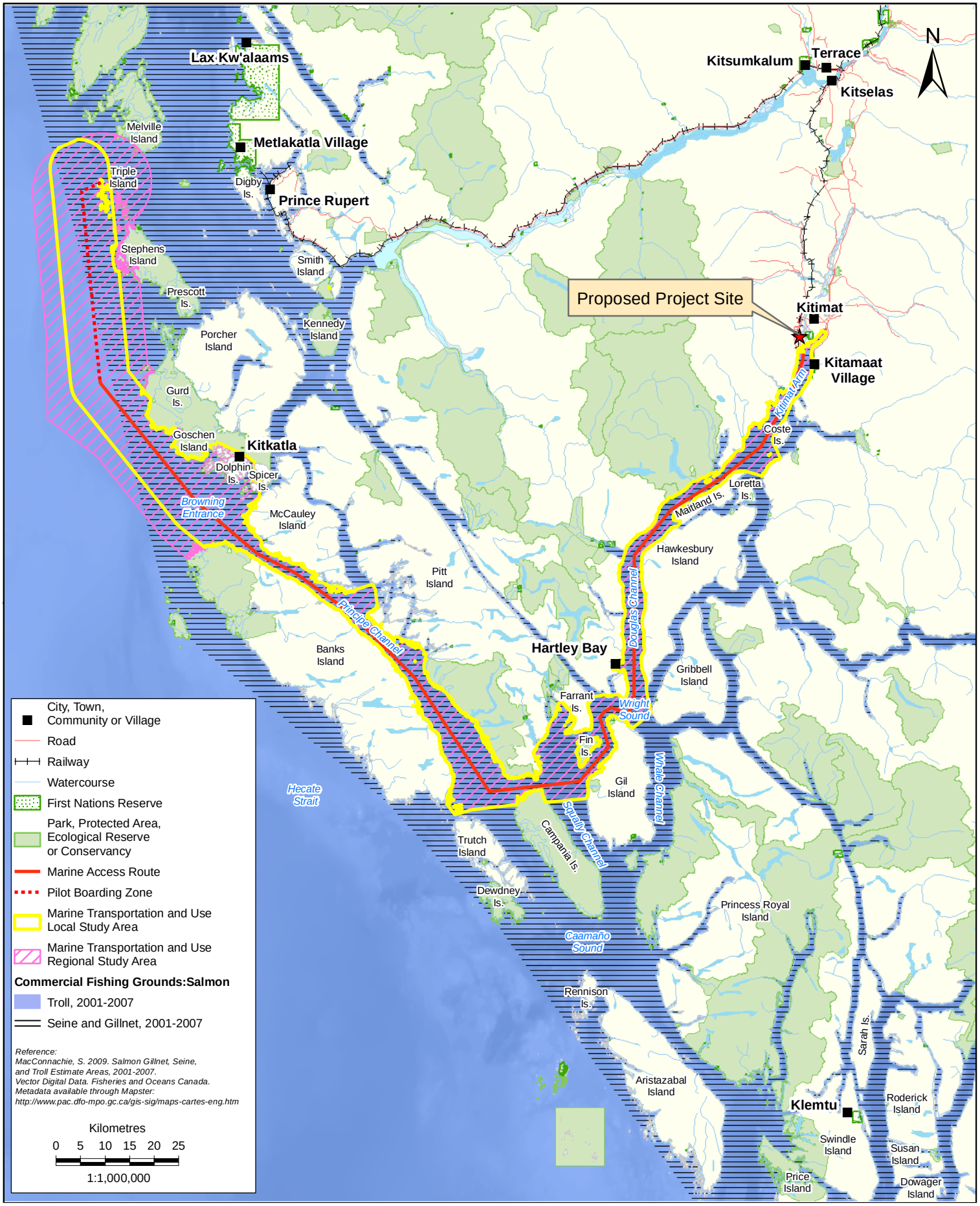
Geoducks are collected by divers using high-pressure water jets for removing them from soft substrates (DFO 2013d). Geoduck harvesting areas occur in Estevan Sound, Principe Channel, and along the west side of the islands north of Browning Entrance (BCMCA 2013; Figure 7.4-12). The dive fishery makes use of packer boats that collect, process, freeze, and land the catch from multiple fishing vessels. A packer might service 10 to 20 fishing boats and provides efficiencies to the entire dive fleet (Marine Community Consultation 2014, pers. comm.).

Red Sea Urchins

Red sea urchins are collected from the seafloor by scuba divers. Urchin diving is most concentrated in Principe Channel (BCMCA 2013; Figure 7.4-13) but occurs close to shore as divers are limited to shallow depths (DFO 2013e). Packer boats are used (see geoduck clams above; Marine Community Consultation 2014, pers. comm.).

Pacific Halibut

Pacific halibut are caught using hook and line and long-line gear (DFO 2013f) generally outside the RSA in deeper waters (BCMCA 2013; Figure 7.4-14). A single unit of long-line gear, called a “skate” is typically 400 m in length. Multiple skates can be connected and fished together as a single long line set (Marine Community Consultation 2014, pers. comm.).



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MARINE TRANSPORTATION AND USE ENVIRONMENTAL EFFECTS ASSESSMENT

COMMERCIAL FISHING GROUNDS: SALMON

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

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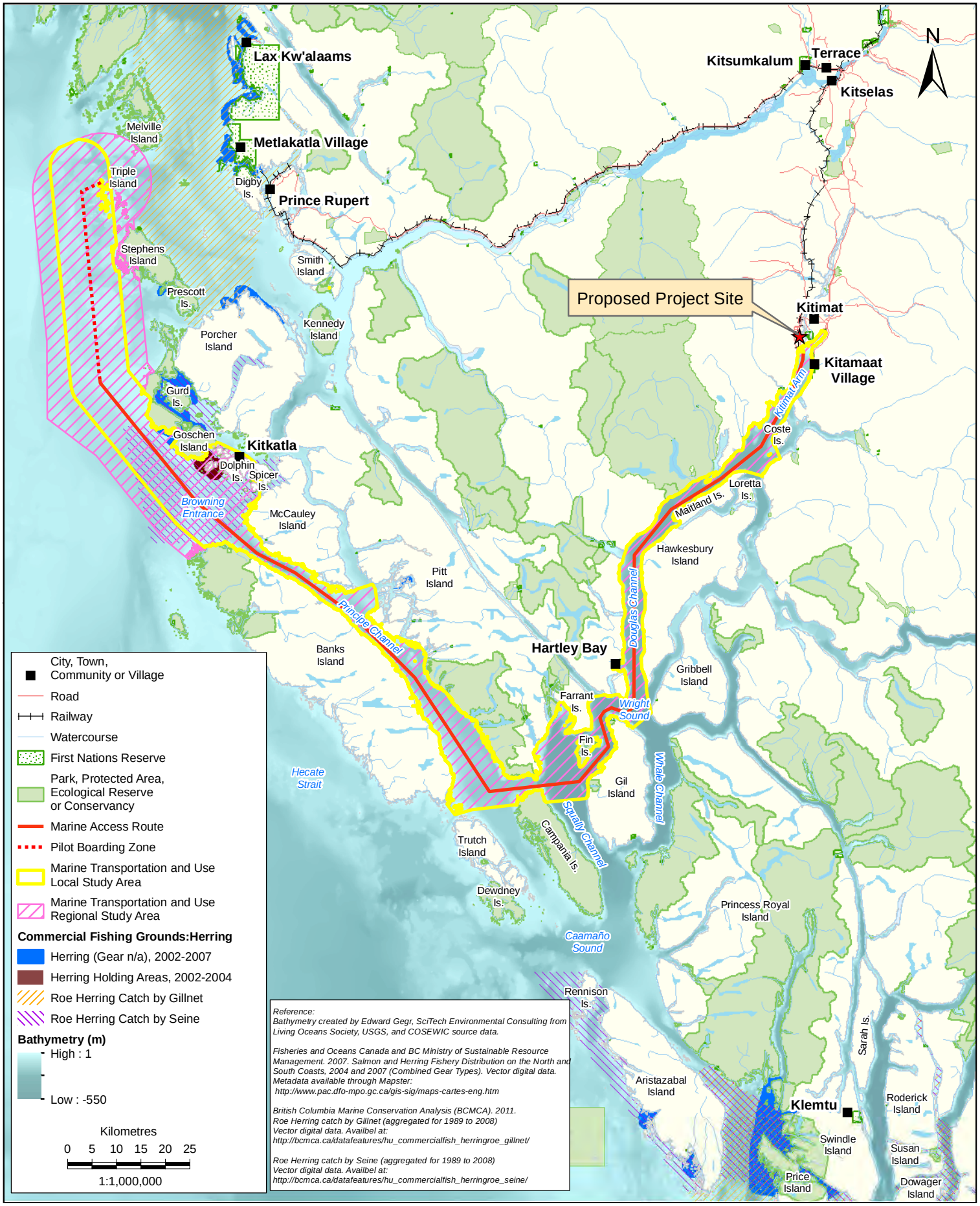

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MARINE TRANSPORTATION AND USE ENVIRONMENTAL EFFECTS ASSESSMENT

COMMERCIAL FISHING GROUNDS: HERRING

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

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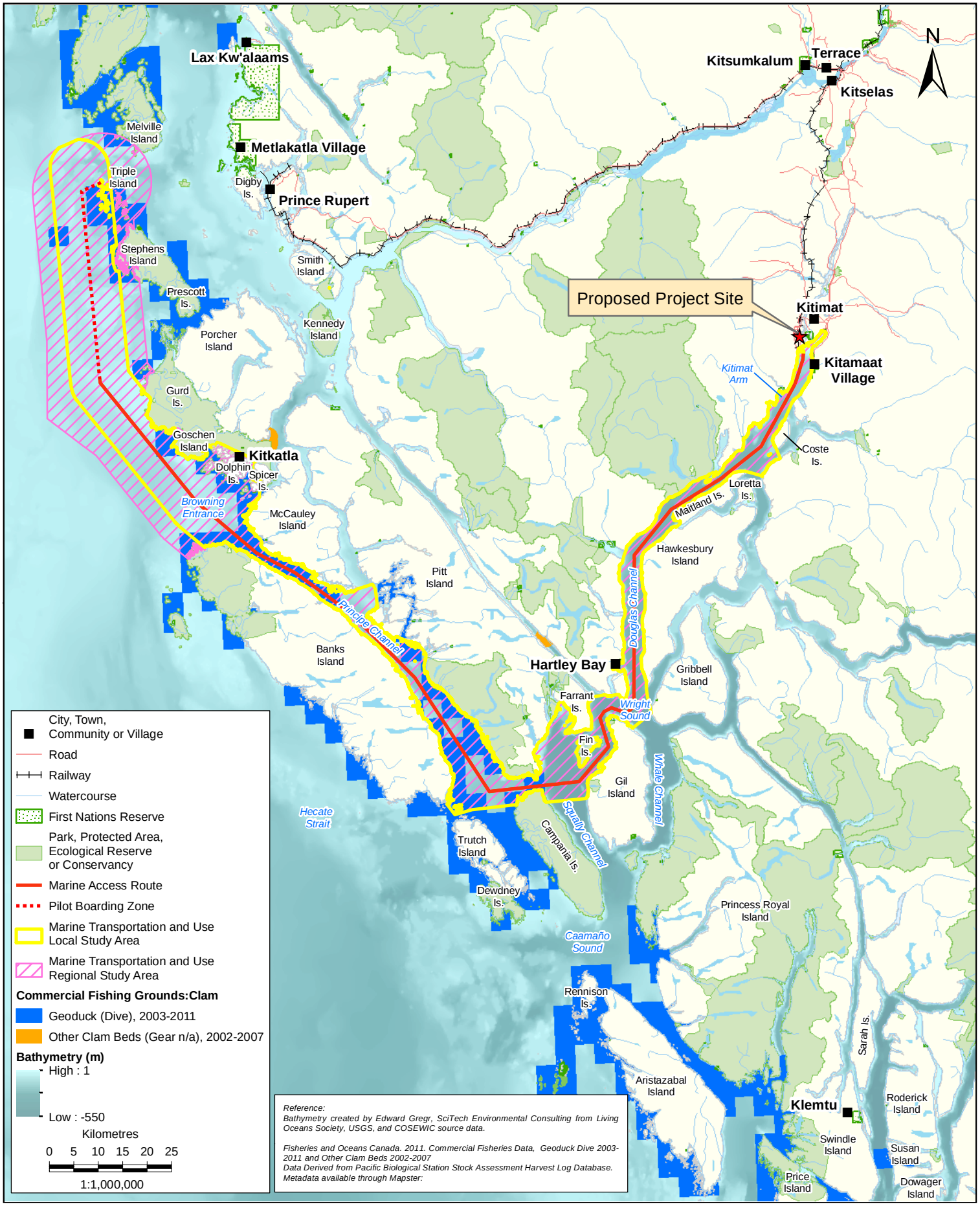

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MARINE TRANSPORTATION AND USE ENVIRONMENTAL EFFECTS ASSESSMENT

COMMERCIAL FISHING GROUNDS: GEODUCK CLAM

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

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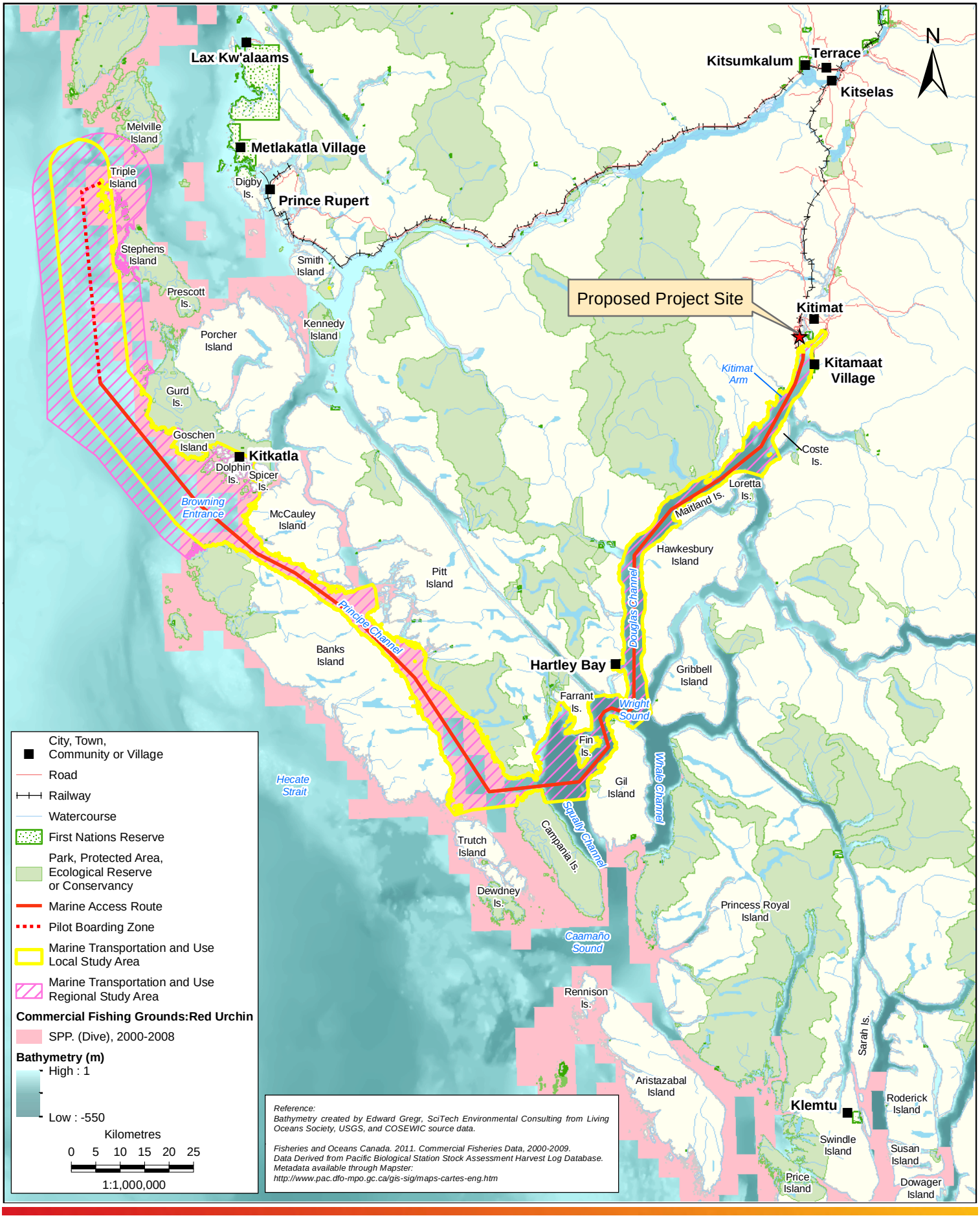

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MARINE TRANSPORTATION AND USE ENVIRONMENTAL EFFECTS ASSESSMENT

COMMERCIAL FISHING GROUNDS: RED URCHIN

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

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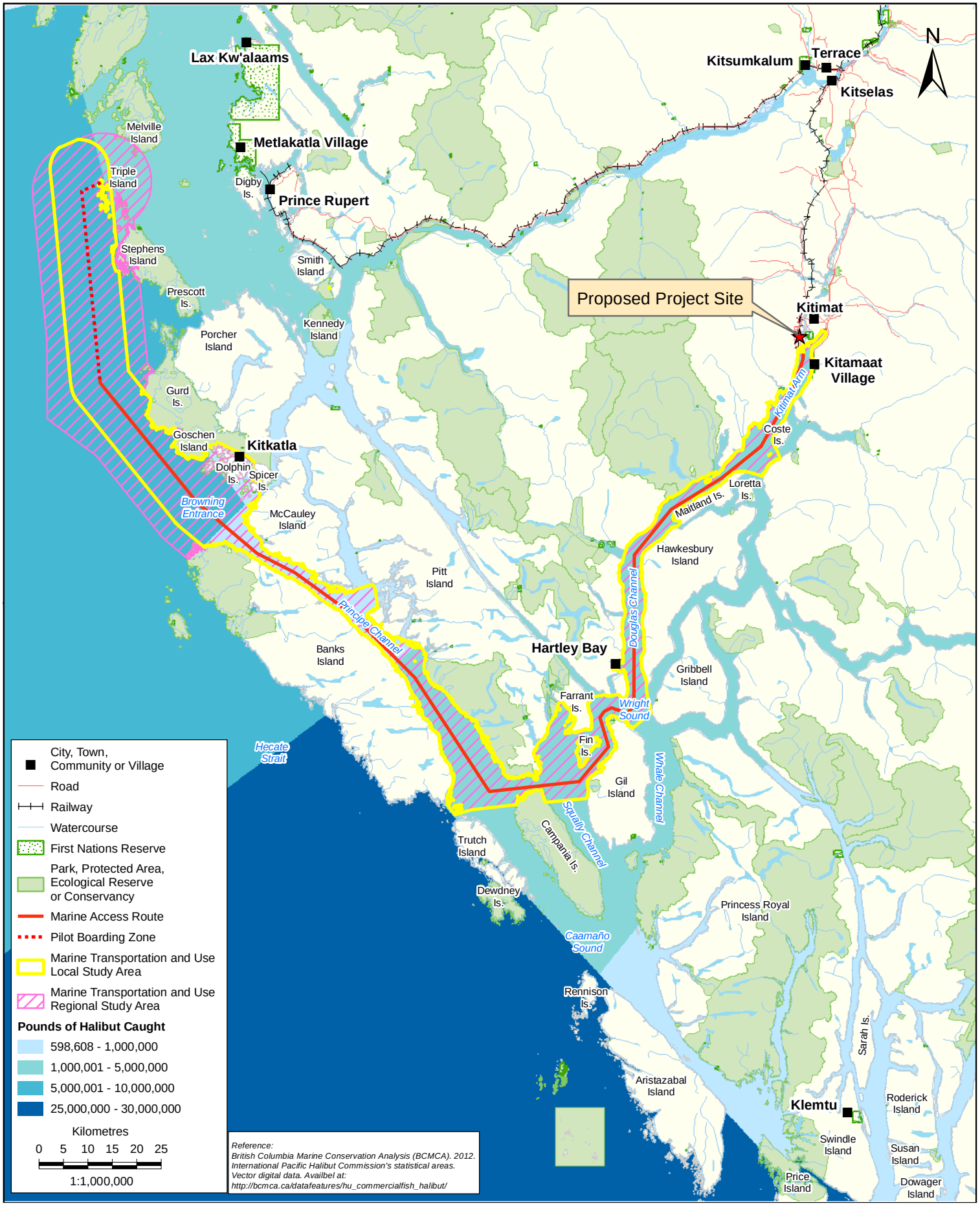

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MARINE TRANSPORTATION AND USE ENVIRONMENTAL EFFECTS ASSESSMENT

COMMERCIAL FISHING GROUNDS: PACIFIC HALIBUT

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

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Dungeness Crab

Crabs are harvested using traps that cannot be retrieved more than once per day (DFO 2013g). Commercial traps are generally fished over soft bottoms in depths between 5 m and 100 m. Identified crab fishing grounds have little overlap with the marine access route and are concentrated northwest of the Banks Island and west of Porcher Island (BCMCA 2013; Figure 7.4-15).

Sea Cucumbers

Sea cucumbers are collected by scuba divers in water generally shallower than 20 m (the safe technical limit for this means of harvesting; DFO 2012b). Sea cucumber diving occurs throughout Principe and Douglas Channels, but occurs close to shore (BCMCA 2013; Figure 7.4-16). Packer boats are used similar to the harvesting of geoduck clams (Marine Community Consultation 2014, pers. comm.).

Prawns and Shrimps

Prawns and shrimps are harvested using traps and trawl gear (DFO 2013h, 2013i). The use of traps occurs along most of the marine access route south of Browning Entrance, whereas shrimp trawls are concentrated in areas east of Triple Island (BCMCA 2013; Figure 7.4-17). Prawn-trap gear is generally placed close to shore and away from the shipping corridor (Marine Community Consultation 2013a, 2013b, 2014, pers. comm.).

Groundfish

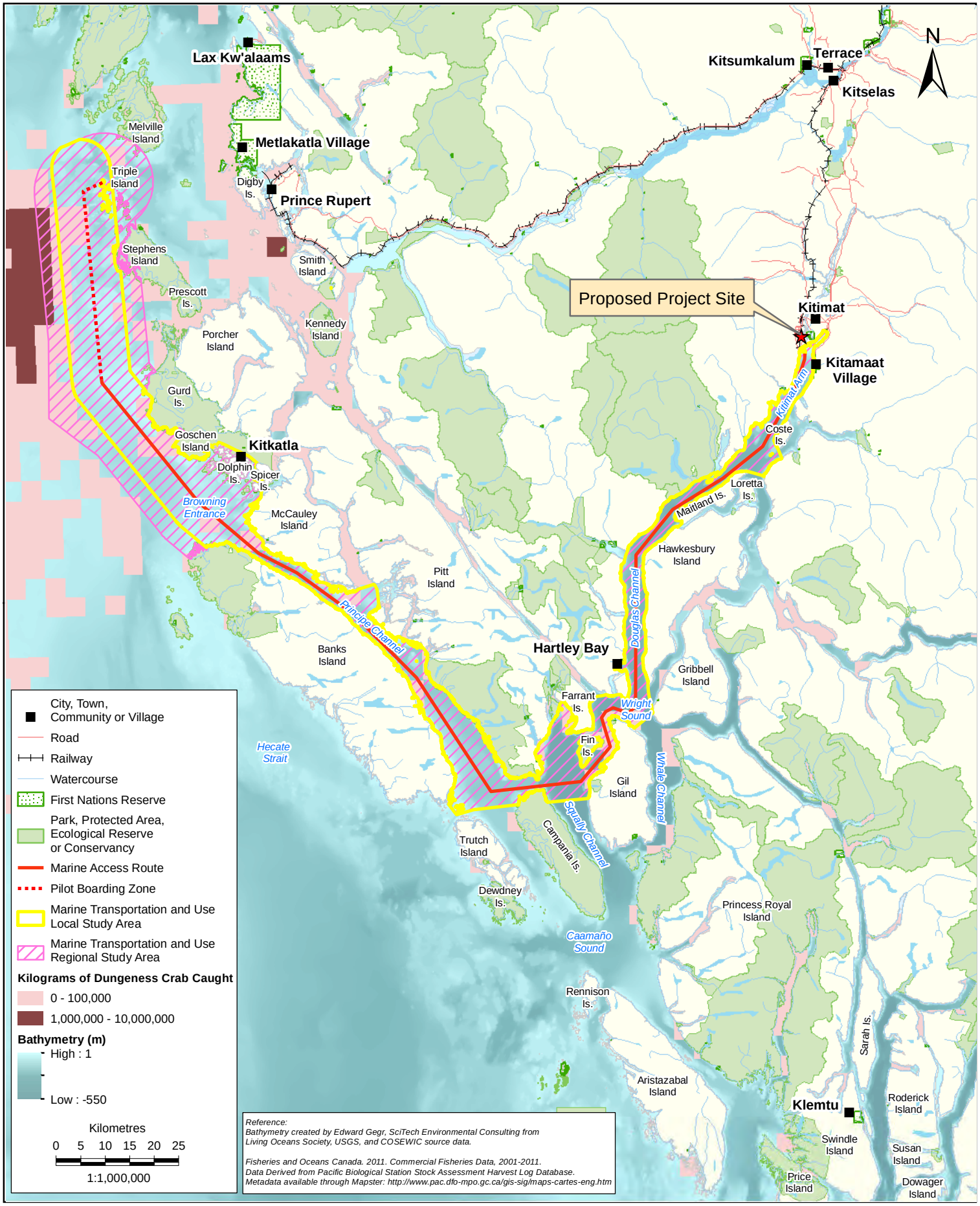
The commercial groundfish fishery is comprised of seven different fishing sectors (e.g., trawl, halibut, sablefish, inside rockfish, outside rockfish, lingcod, and dogfish) that use trawl and non-trawl gear types. Groundfish trawling is prohibited along most of the marine access route (DFO 2013f), but some trawl and long lining occurs north of Browning Entrance and around Triple Island (BCMCA 2013; Figure 7.4-18).

Octopus

Divers collect giant Pacific octopus by hand with the aid of liquid irritants to drive them from their dens. No tools other than a collection bag are permitted (DFO 2011). Octopus harvesting areas have limited overlap with the marine access route (BCMCA 2013; Figure 7.4-19). In Douglas Channel, FMA subarea 6-2 is closed from commercial octopus harvesting and is reserved for Aboriginal fishing practices (Stantec Consulting Ltd. 2014).

Recreational Fishing

Recreational fishing refers to non-commercial fishing and includes sport fishing and fish caught by private recreationalists and by a commercial recreation venture. Recreational fishing licences are issued by DFO and are required before harvesting any marine species. In the tidal and non-tidal waters of BC, salmonids are the most sought after species (DFO 2012a). Recreational fishing areas along the marine access route are concentrated in Kitimat Arm, around Hartley Bay, and north of Porcher Island (BCMCA 2013; Figure 7.4-20).



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MARINE TRANSPORTATION AND USE ENVIRONMENTAL EFFECTS ASSESSMENT

COMMERCIAL FISHING GROUNDS: DUNGENESS CRAB

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

PROJECTION	DRAWN BY
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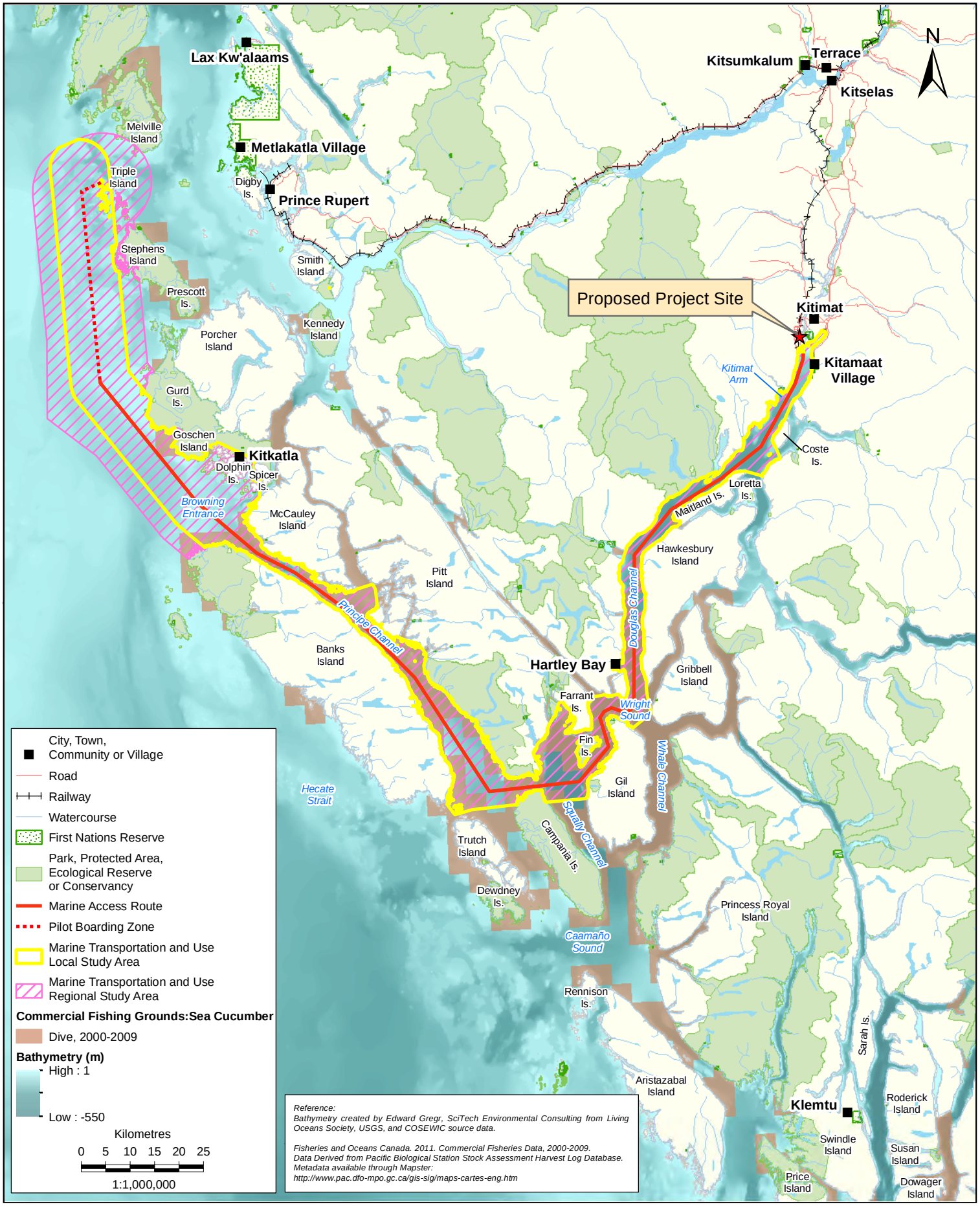

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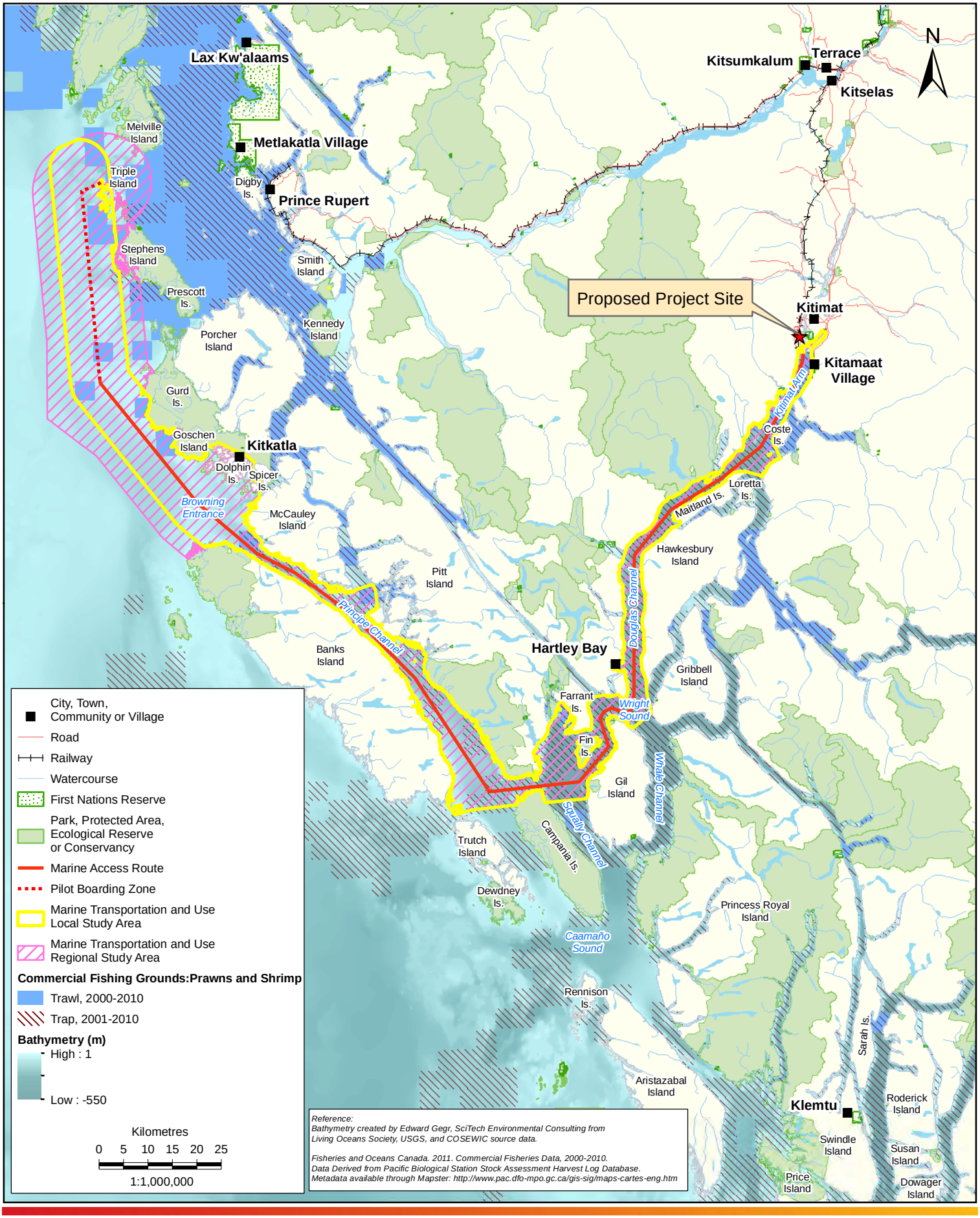

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COMMERCIAL FISHING GROUNDS: PRAWNS AND SHRIMP

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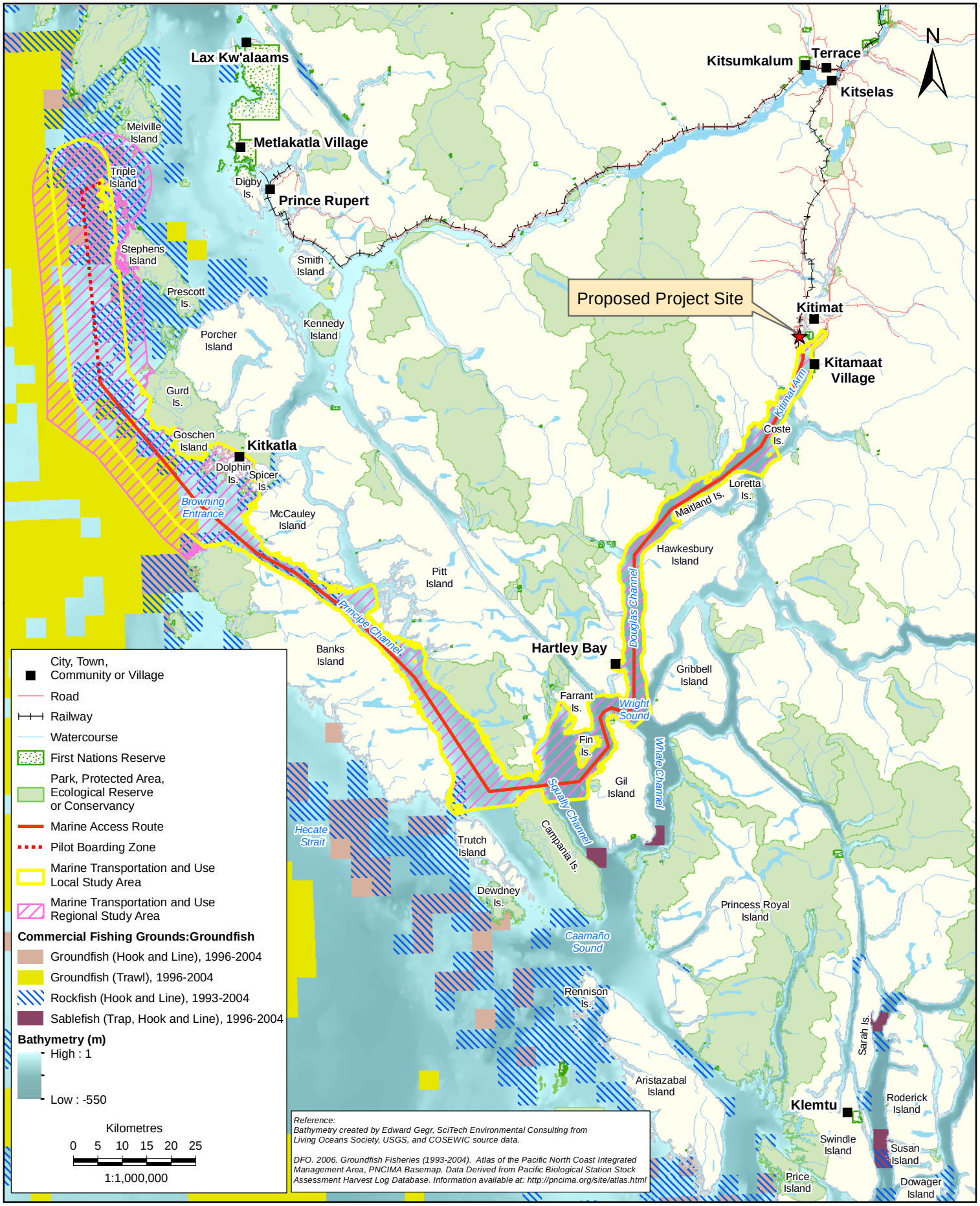

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COMMERCIAL FISHING GROUNDS: GROUNDFISH

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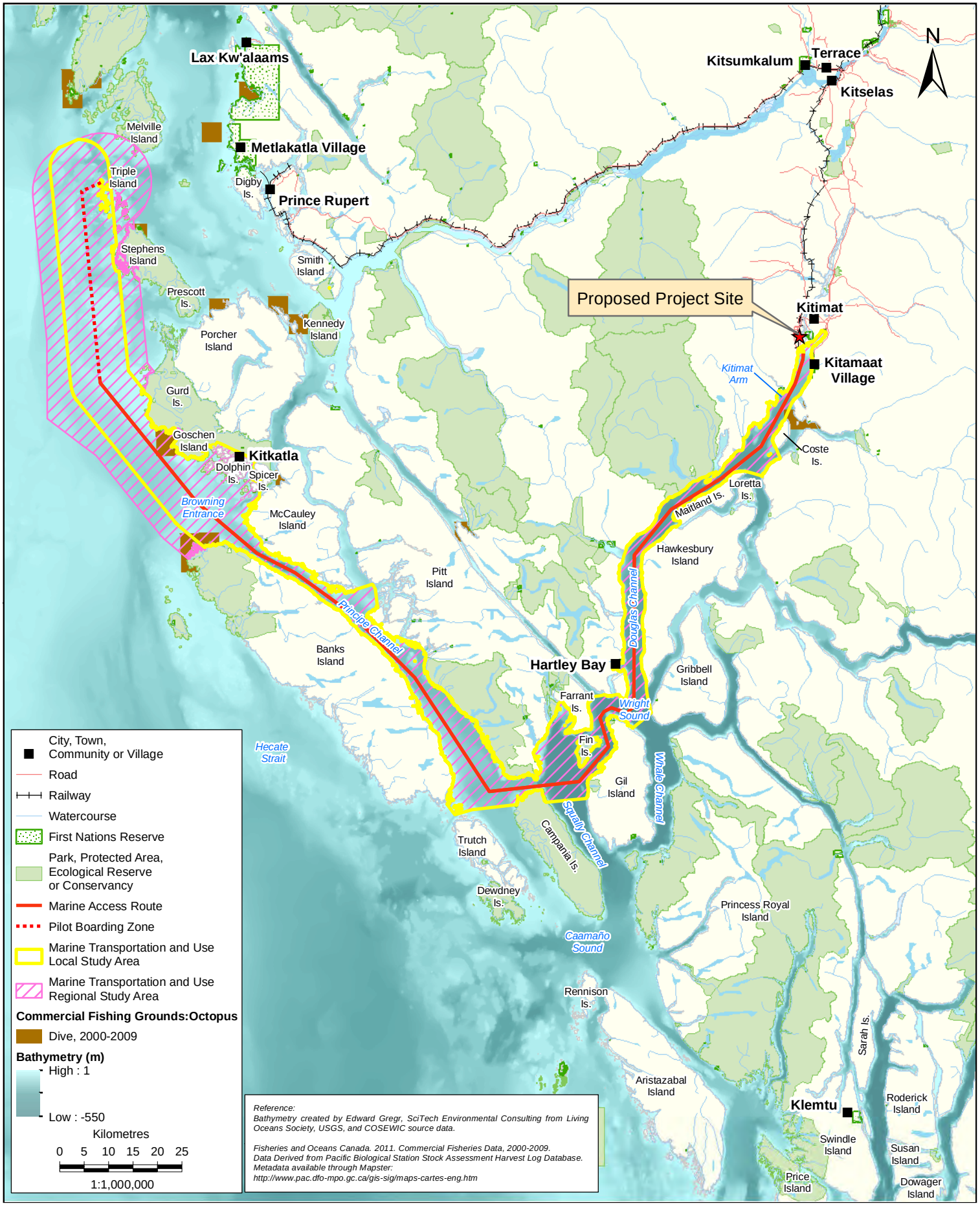

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COMMERCIAL FISHING GROUNDS: OCTOPUS

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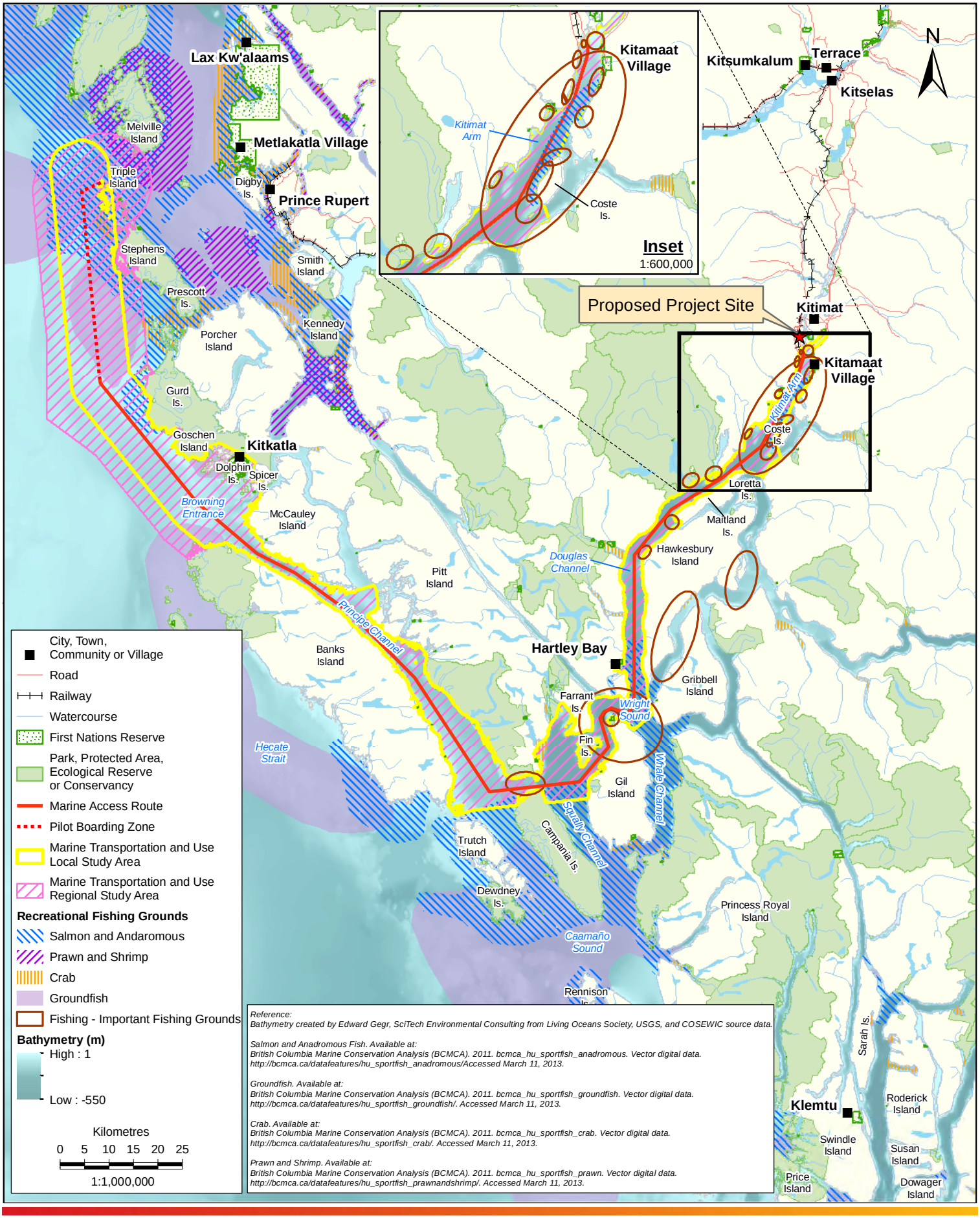

Reference:
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MARINE TRANSPORTATION AND USE
ENVIRONMENTAL EFFECTS ASSESSMENT

RECREATIONAL FISHING GROUNDS

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Aboriginal Fishing

There are seven Aboriginal Groups located in the marine transportation and use LSA: Gitga'at First Nation, Gitxaala Nation, Haisla Nation, Kitselas First Nation, Kitsumkalum First Nation, Lax Kw'alaams First Nation, and Metlakatla First Nation. Harvesting marine resources is an important part of traditional life for most coastal Aboriginal Groups, with over 40% of meals being traditionally sourced from the sea for some Nations. Marine resources are also heavily relied on to sustain Aboriginal economies (Gregory et al. 2011). Key species harvested are listed in Table 7.4-6.

Table 7.4-6: Species Harvested by Aboriginal Groups

Fish	Invertebrates	Marine Plants
Sable fish	Abalone	Sea grass
Lingcod	Chitons (various spp.)	Seaweed
Kelp greenling	Clams	Kelp (spp.)
Cod (red, black, grey)	Cockles	
Flounder	Crab	
Hake	Mussels	
Halibut	Octopus	
Herring (and eggs)	Prawns/Shrimps	
Needle fish	Scallops	
Eulachon	Sea cucumber	
Rockfishes (including red snapper)	Barnacle	
Salmon (all species)	Sea urchin	
Steelhead	Sea anemone	
Bullhead	Sea prune	
Turbot	Sea slipper	
Skate		
Pilchard or smelt		
Pollock		
Dogfish		

SOURCE: Smith (1999, 2008); Lax Kw'alaams First Nation (2004); Gregory et al. (2011); Robinson (2012); Metlakatla Fisheries 2013; Powell (2013); Calliou Group (2014a); Crossroads Cultural Resource Management (2014); DM Cultural Services 2014; Metlakatla First Nation 2014;The Firelight Group (2014)

Some of the most desired seafood items include eulachon, salmon, herring eggs, crab, seaweed, abalone, mussels, black cod, shrimp, prawns, halibut, clams, and cockles (Gregory et al. 2011; Kitselas Community Engagement 2014, pers. comm.; Metlakatla Community Engagement 2014, pers. comm.). Cockles and seaweed are generally not available from the market and must be sourced locally.

Sockeye salmon are the primary salmon species targeted by Aboriginal Groups, with this species making up to 98% of their annual catch (DFO 2013a, DFO 2013b). Catch data also indicate that groundfish such as halibut, lingcod, and rockfish are caught (DFO 2013a).

Fishing techniques used to harvest marine species for food, social, and ceremonial purposes are wide ranging but generally rely on modern techniques, including specialized boats and gear. Namely, commercial grade seine nets are used for salmon, long lines for groundfish, and traps for prawns and crabs. Other harvesting techniques include hand picking for seaweed and clams, and use of kelp and tree boughs for harvesting herring eggs (Kitselas Community Engagement 2014, pers. comm., Metlakatla Community Engagement 2014, pers. comm.).

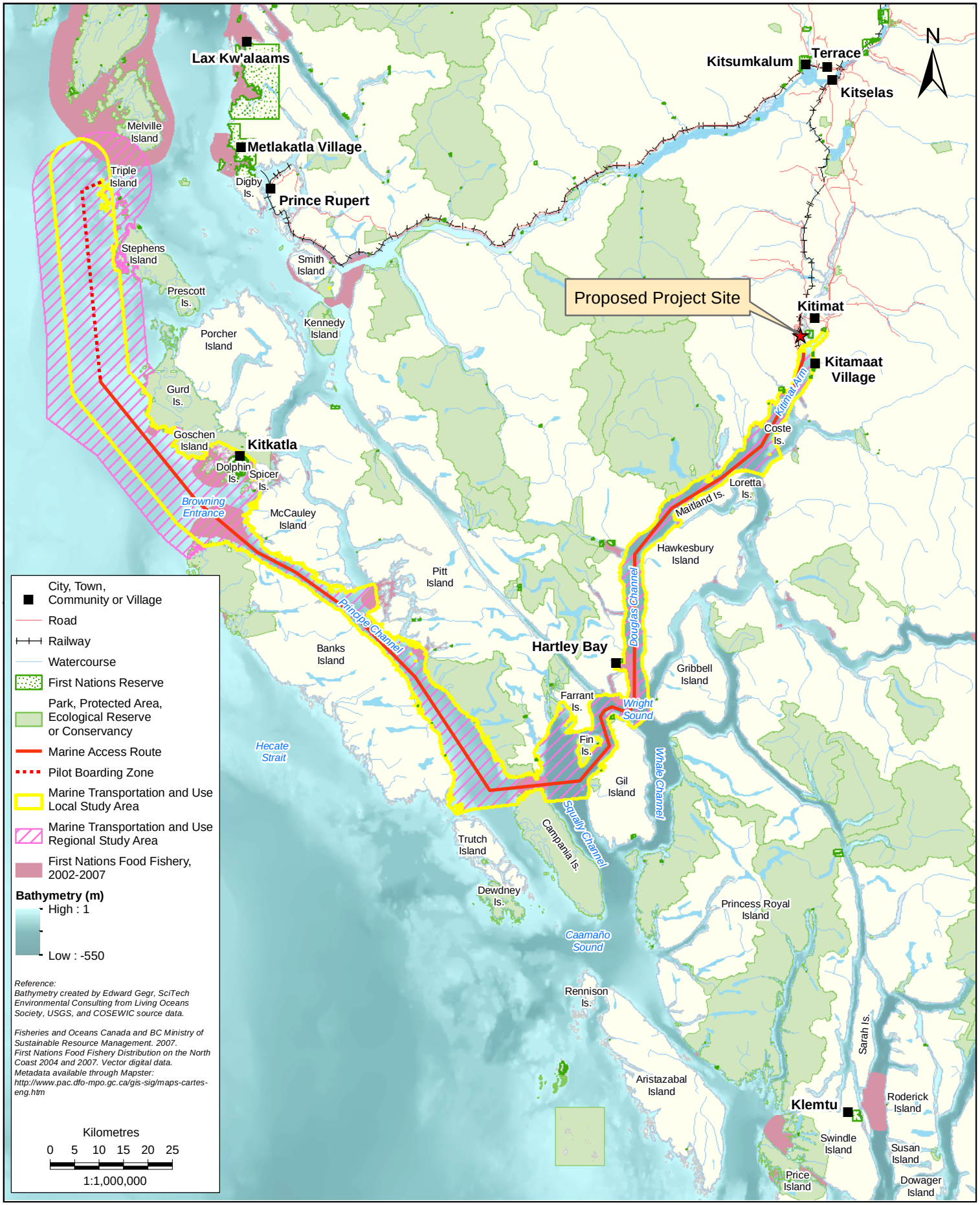
DFO spatial data on Aboriginal fishing locations were supplemented with information obtained during meetings with Aboriginal Groups (e.g., community engagements). Overlap of DFO-identified Aboriginal fishing grounds and the marine access route occurs at Hartley Bay, Otter Channel, and Browning Entrance (BCMCA 2013; Figure 7.4-21). Additional, smaller fishing areas are scattered throughout the LSA, with specific locations identified by individual Aboriginal Groups as described below. Other potential issues identified by Aboriginal Groups not covered here can be found in other sections of the Application (e.g., Section 5.6, Wildlife Resources; Section 5.8, Marine Resources; and Section 10, Accidents or Malfunctions; and sections in Part C).

Gitga'at First Nation

The marine environment provides a way of life for Gitga'at First Nation, providing traditional foods, market-based income, employment, and more (Gill and Ritchie 2011; Gregory et al. 2011). Gitga'at First Nation expressed concerns about potential wake effects, access to fishing grounds, and pollution (Gill and Ritchie 2011; Gregory et al. 2011; Sea Science Inc. 2011). Their concerns are directly tied to the importance they place on a pristine environment and their responsibility to care for it (Gregory et al. 2011).

Marine species, especially fish and shellfish, are extremely important, not just for subsistence but also for cultural and spiritual reasons. Herring, eulachon, salmon, snapper, cod, trout, halibut, flounder, and a variety of different rockfish are important fish species. Abalone, clams, cockles, octopus, prawns, scallops, shrimps, chitons, and sea urchins are important resources, many of which are collected from the intertidal zone (Satterfield et al 2011). Many Gitga'at people consume traditional foods, with up to 40% of meals being traditionally sourced (Gregory et al. 2011).

Some of the most valuable fisheries include pink, chum, coho, and sockeye salmon; geoduck; and red urchin. For the Gitga'at people, these fisheries usually comprise 99% of the total wholesale value of all their fisheries combined (for the years 1996 to 2007; Gregory et al. 2011). Gitga'at First Nation might develop a micro seafood processing facility in Hartley Bay and is participating in a larger initiative to develop a scallop farm on Fin Island. It is hoped that these initiatives will improve employment and income for the community (Hartley Bay Council 2011).



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ABORIGINAL FISHING GROUNDS

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Gitxaala Nation

Gitxaala Nation's cultural identity is tightly linked to its ability to access its territory and harvest marine resources (Calliou Group 2014a). Gitxaala Nation expressed concerns of reduced access to its territory, including fishing grounds and other important places; disruption or displacement of marine species; potential effects from wake waves (e.g., shoreline harvesting and erosion processes); pollution; and cumulative effects (Calliou Group 2014a, 2014b; The Firelight Group 2014). Other concerns include the physical presence of shipping traffic, which might act as obstacles along the marine access route, and perceived effects surrounding encounters with LNG carriers, which might lead to decreased connection with the territory (i.e., avoidance of certain areas with greater shipping traffic; Calliou Group 2014b).

Gitxaala Nation has a predominantly marine-based economy and harvest many species listed in Table 7.4-6, but it has a special reliance on halibut and abalone for trading and consumption during feasting. Feasting is a very important activity that relies heavily on the availability of traditional foods (The Firelight Group 2014). Other species used for trade include dried seaweed and shellfish, which are often traded in return for eulachon grease, because euchalon is not currently fished in Gitxaala Nation territory. Gitxaala Nation also harvests salmon, cockles, clams, seals, and herring roe-on-kelp (The Firelight Group 2014).

Fishing locations were identified by Gitxaala Nation (Calliou Group 2014a), but traditional and commercial harvesting locations were not distinguished. Salmon are fished along the entire marine access route except for the section around Otter Channel, north of Hartley Bay to the southern end of Maitland Island, and at the very head of Kitimat Arm north of Clio Bay. Some fishing locations, such as those where seine nets are used, are passed down from generation to generation and "belong to," and are used by one person only. Fishing locations for halibut and sablefish overlap with the marine access route in Principe Channel. Many other groundfish fishing sites do not. Clams and cockles harvesting sites potentially exposed to the marine access route include those on the west sides of Gurd, Goschen, Dolphin, and Spicer Islands north of Principe Channel, areas in Principe Channel, Otter Channel, and at the junction of Grenville Channel at Wright Sound.

Gitxaala Nation harvest seaweed, clams, cockles, abalone, octopus, and kelp species by hand along the shoreline. Harvesting times are limited by season and tide height. As a result, Gitxaala Nation estimates that they have 31 days per year to harvest seaweed, but it cannot be harvested at night or in the rain according to cultural harvesting protocols. Fifty-seven days are suitable to collect clams and cockles, with some members collecting at higher tides but with reduced efficiency (Calliou Group 2014b).

Haisla Nation

Haisla Nation appears to use all *wa'wais* (traditional territories) to gather traditional foods during different times of year. Preference is to fish close to Kitamaat Village using small skiffs because of high fuel prices. However, decreasing seafood availability has forced members of Haisla Nation to travel greater distances to harvest marine resources. As example, pollution from the Eurocan pulp and paper mill caused Haisla Nation to stop harvesting butter clams and cockles at the head of the inlet, forcing them to travel as far as Clio Bay to harvest these species. Shoreline harvesting of clams and cockles occurs primarily during nighttime tides. Eulachon fishing has not occurred in Haisla Nation territory for the past three years

because of low eulachon returns. Some stocks, however, do appear to be rebuilding, and there is presently a fishery on Kemano River with the possibility of another opening on Kitimat River if recovery continues (Powell 2013). Traditional Haisla Nation harvesting areas identified in Powell (2013) are listed in Table 7.4-7, indicating in which wa'wais mussels, cockles, or clams are harvested in.

Haisla Nation is concerned about shipping noise, vessel collisions with whales and other marine mammals, effects on marine birds, and possible spills (Powell 2013).

Table 7.4-7: Location of Haisla Nation Shoreline Harvesting Activities

Wa'wais (Traditional Harvesting Area)	Shoreline Harvesting Activities			
	Mussels	Cockles	Clams	Sheltered From Vessel Wake
Kitamaat Village Area	✓			N/A
Clio Bay and Mud Bay				Yes
Coste Island	✓	✓		Partially
Eagle Bay	✓	✓	✓	Yes
West side of Maitland Island				N/A
Sue Channel, East Maitland, North Hawkesbury, and Loretta Islands	✓	✓	✓	Partially
Bish Creek or Bees		✓		Partially
Elmsley Cove south to Jesse Falls	✓	✓		Partially
Jesse Lake and Upper Jesse Creek				Yes
Echo Bay	✓			Partially
Miskatla Inlet	✓	✓	✓	Yes
East side of Giltoyees Inlet	✓	✓	✓	Yes
West side of Giltoyees Inlet	✓	✓	✓	Yes
Foch Lagoon and, River and Lake	✓	✓	✓	Yes
Upper Foch Creek	✓	✓	✓	Yes
Drumlummon Bay	✓	✓	✓	Partially
Blue Jay Falls to Drumlummon Bay[a]	✓	✓	✓	N/A
Gander Island				Partially
Percentage of Wa'wais used or sheltered	83	67	50	83

NOTES:

[a] Ownership of this wa'wais is contested between Haisla Nation and Gitga'at First Nation.

Harvesting for listed species occurs year round.

N/A = Not applicable

SOURCE: Powell (2013)

Kitselas First Nation

Kitselas First Nation relies on marine and freshwater resources, including clams, seaweed, and herring (Smith 1999 and 2008), among others in Table 7.4-6. The locations of marine resource gathering areas

were identified during a fisheries workshop in Terrace (Kitselas Community Engagement 2014, pers. comm.). Most fishing locations do not overlap with the shipping corridor. As example, clam and seaweed harvesting sites exist around Dolphin and North Porcher islands, and in Kitkiata Inlet. Other important fishing areas exist on the northwest side of Fin Island (used to catch sable fish using long lines), "mink trap"—the area between Anger and Pitt Islands (used to catch salmon by gill nets), the southeast side of McCauley Island, and the southwest side of Pitt Island (used to catch prawns and crabs by traps). Fishing for salmon using gill nets in Principe Channel has reportedly been prohibited since the 1980s. Halibut long lines are fished by setting gear parallel to shore, following the contours of the bottom. Long-line gear is not fished in the centre of the channel (Kitselas Community Engagement 2014, pers. comm.).

Kitsumkalum First Nation

Kitsumkalum First Nation expressed concerns related to cumulative effects on fishing. Mechanisms identified include vessel wake, "no-go" zones, underwater noise, and the loss of habitat (Crossroads Cultural Resource Management 2014).

Kitsumkalum First Nation harvests many marine species in its traditional territory, using over 80 identified areas for traditional harvesting (a description of these locations was not available at the time of Application submission). Harvested species include many of those listed in Table 7.4-6, in particular, salmon, cod, halibut, and dogfish. Contemporary fishing methods are now primarily used by Kitsumkalum First Nation fishers. However, there is a desire to re-establish the use of traditional methods. Kitsumkalum First Nation has participated in the eulachon fishery on the Skeena and Nass rivers, and would like to see the stock restored so that sustainable fishing may continue (Crossroads Cultural Resource Management 2014).

Lax Kw'alaams First Nation

Lax Kw'alaams First Nation uses its traditional territory for fishing and eco-tourism. Important fish habitats identified by Lax Kw'alaams First Nation include kelp beds, estuaries, tidal flats, and rocky reefs. Important areas identified include Big Bay, the Khutzeymateen, Lucy Island, west of Digby Island, and Stephens Island (Lax Kw'alaams First Nation 2004). The places most heavily used to harvest include Dundas Island (boat harbour) and Stephens Island. Other locations used by Lax Kw'alaams First Nation are Zayas Island (for spring salmon), Porcher Island (for roe-on-kelp), north arm to Grenville Channel and Kinkolith (for cockles), Red Bluff on the Nass (for eulachon), Canoe Pass (for groundfish), Bernie Island, Finlayson, Melville Island, Work Channel, and Steamboat Pass. The Skeena River is also used to harvest eulachon, salmon, and halibut. Commercial fisheries with little to no involvement by Lax Kw'alaams First Nation include groundfish (e.g., halibut, lingcod, sablefish), geoduck, sea urchin, crab, and shrimp (Lax Kw'alaams First Nation 2004).

Lax Kw'alaams First Nation is concerned that over-harvesting and marine habitat degradation (e.g., pollution) might affect its ability to harvest marine resources, which is especially important to supplement the winter food supply and for a healthy diet. Species that should be protected or restored include abalone, herring, seaweed, clams and cockles, crabs, shrimp, rockfish, and halibut, with special attention given to salmon enhancement initiatives such as hatcheries (Lax Kw'alaams First Nation 2004). Lax Kw'alaams First Nation would like to be involved in fishery management decisions, restoration, and monitoring initiatives. Access to training might enhance members' eligibility for these positions and would likely be welcomed. Fishing lodges and charters are one aspect of the tourism industry that Lax Kw'alaams First Nation would like to become more involved in, especially given that many charters occur in their traditional territory but do not employ Lax Kw'alaams members (Lax Kw'alaams First Nation 2004).

Metlakatla First Nation

Metlakatla First Nation expressed concerns about increased vessel traffic around Triple Island and through Venn Channel. In particular, members of Metlakatla First Nation are concerned that additional BC Coast pilot boats and recreational and fishing charter vessels using Venn Channel might interfere with fishing practices or damage their marine infrastructure from wake waves (Metlakatla Community Engagement 2014, pers. comm.). The use of anchorages around Lucy Island by other vessels is also a concern for Metlakatla First Nation because it might disrupt access to fishing grounds. LNG Canada does not expect to use this anchorage site under normal circumstances.

Metlakatla First Nation harvests a variety of marine resources in its traditional territory for food, social, and ceremonial purposes (Metlakatla First Nation 2014). Members of the community are also active participants in commercial fisheries (Metlakatla First Nation 2014). Aboriginal fishing occurs primarily away from the marine access route in the Tree Nob Group, around Melville and Lucy Islands, North of Stephens Island, and along the inner coast in areas such as Duncan Bay, Tugwell and Kinahan islands, and around Flora Banks (Metlakatla Community Engagement 2014, pers. comm.). The Tree Nob group is used to harvest clams, cockles, abalone, lingcod, and rockfish. Lucy Island is a preferred area to fish for halibut and collect shellfish, and Duncan Bay is used to harvest herring roe on kelp. Salmon fishing occurs along the inner coastline as the fish travel to their spawning grounds. Modern gill nets that are approximately 400 m long are used. Metlakatla First Nation conducts annual community fishing operations whereby five fishers will harvest seafood for the community (Metlakatla Community Engagement 2014, pers. comm.).

Metlakatla First Nation relies heavily on the productive marine resources in its traditional territory. Given the importance of maintaining healthy stocks for future generations, Metlakatla First Nation plans to strengthen its role in marine resource management, including stock assessment, habitat restoration, monitoring, and enforcement (Metlakatla First Nation 2014).

7.4.3.2.4 Recreation and Tourism

Tourism

Marine eco-tourism is an important industry for BC and along the coast. Fifty marine recreation and eco-tourism businesses were identified and selected for interviews based on their operations or headquarters being in the LSA. Twenty (40%) responded. Key results from this study follow; for further information, see Stantec Consulting Ltd. (2014).

Of respondents, close to half (42%) operate in Kitimat and close to one-quarter (21%) operate in Prince Rupert. The remaining 37% are located in other geographic areas such as Victoria and the lower mainland of Vancouver. Multiple businesses have partnerships with and employ Aboriginal people, including Bluewater Adventures, Maple Leafs Adventures, Mothership Adventures, Ocean Adventures, and Ocean Light 2 Adventures (Gregory et al. 2011). Most businesses (65%) have been in operation for 15 years or more.

The study also indicated substantial variability in the areas of the ocean and marine access route in which the businesses operate. For example, many of the tourism operations in the Kitimat and Prince Rupert area also use the areas in Haida Gwaii, Bella Bella, and other parts of the northwest coast of BC. Businesses located on Vancouver Island and the lower mainland access water routes from Campbell River to Prince Rupert, and up to the Great Bear Rainforest.

Most (75%) of the businesses operate seasonally, but they tend to have few full-time staff. Aboriginal staff members are employed at approximately half (55%) of all businesses. These results are consistent with findings from Ference Weicker and Company (2009). Gitga'at First Nation and Metlakatla First Nation have the largest proportion of their labour force employed in the tourism industry.

Business owners reported that the main reason customers use their services (60%, the number of reasons given = 71) are for saltwater fishing, wildlife tours, and experiencing the outdoors in a rainforest or pristine setting. These findings are consistent with recent reports (Ference Weicker & Company 2009; Gregory et al. 2011), which indicate that saltwater fishing, wildlife tours, and experiencing the outdoors are the main reasons tourists visit the region.

Approximately 72% of respondents said that they believed that shipping would negatively affect their business, and 27% thought it would have a neutral or positive effect. The most common reason given for an adverse effect was that shipping traffic would alter the aesthetic quality of the area to tourists (Stantec Consulting Ltd. 2014). In contrast, Powell (2013) did not report any concerns regarding the Project affecting commercial tourism prospects for Haisla Nation.

No business reported boat rentals as one of their services. This result suggests that there are very few operators who rent boats for self-guided marine excursions in the region.

The average cost per visitor per day was approximately $750 (using a weighted average based on information obtained during interviews) and was lower than what was reported by Gregory et al. (2011) (e.g., $915 per day). In 2002, the eco-tourism industry was estimated at 18,000 user days and valued at over $16 million for the coastal area near Prince Rupert (Gregory et al. 2011). The estimates derived using the information obtained during interviews suggests that this industry has expanded since 2002 and is now estimated to be worth approximately $30 million per year (Table 7.4-8). The extrapolated values were based on 51 businesses potentially operating in the north coast region. This estimate is conservative because it is calculated using all businesses known to operate in area and is not restricted to those areas that overlapped with the marine access route. For example, many of the services offered by these businesses do not occur along the marine access route; therefore, the estimated value of the industry and what could be affected by the Project is overstated.

Table 7.4-8: Statistics for North Coast Marine Eco-tourism Operators

Tourism Statistics	Approximate Value
Weighted average cost per visitor day (n = 12)	$750
Total visitor days reported (n = 15)	16,000
Average visitor days per business per year (n = 15)	1,100
Value of responding tourism industry (n = 15)	$12,000,000
Extrapolated user days of entire tourism industry (n = 51)	38,500
Extrapolated value of entire tourism industry (n = 51)	$30,000,000

SOURCE: see Stantec Consulting Ltd. (2014) eco-tourism survey for full details.

It is also understood that in addition to commercial eco-tourism marine traffic, local boaters will be using the waterways. An estimate of the number of recreational power and sail vessels that will interact with Project shipping is presented in Section 7.4.6.2.

Meetings with Metlakatla First Nation and Kitselas First Nation confirm their interests in continuing to develop commercial eco-tourism operations in their territories (Kitselas Community Engagement 2014, pers. comm.; Metlakatla Community Engagement 2014, pers. comm.). Gitga'at First Nation also identified this sector as an area of potential growth and has worked to develop this sector for over 10 years (Gitga'at Nation 2003; Hartley Bay Council 2011). Lax Kw'alaams First Nation is also interested in becoming more involved in the tourism industry, particularly fishing lodges and charter operations (Lax Kw'alaams First Nation 2004).

Recreation

Marine-Accessible Parks

Several parks overlap with the LSA (Figure 7.4-22). Most parks are accessible by boat only, and many offer sheltered bays for anchoring or going ashore; however, there are no docks, and visitors must access the sites using the beach. Some sites offer camping and have nearby streams with suitable drinking water, but these generally do not offer any amenities such as electricity, showers, or shelter. Several parks have individual management plans that focus on maintaining flora and fauna, protecting plant communities and species at risk, protecting special features in both the terrestrial and marine environment, and protecting Aboriginal values, including harvesting and hunting areas, access, and culturally important areas. Finally, management plans focus on enhancing important recreational opportunities for boating, kayaking, saltwater angling, camping, picnicking, and day hiking (BC Parks 2011).

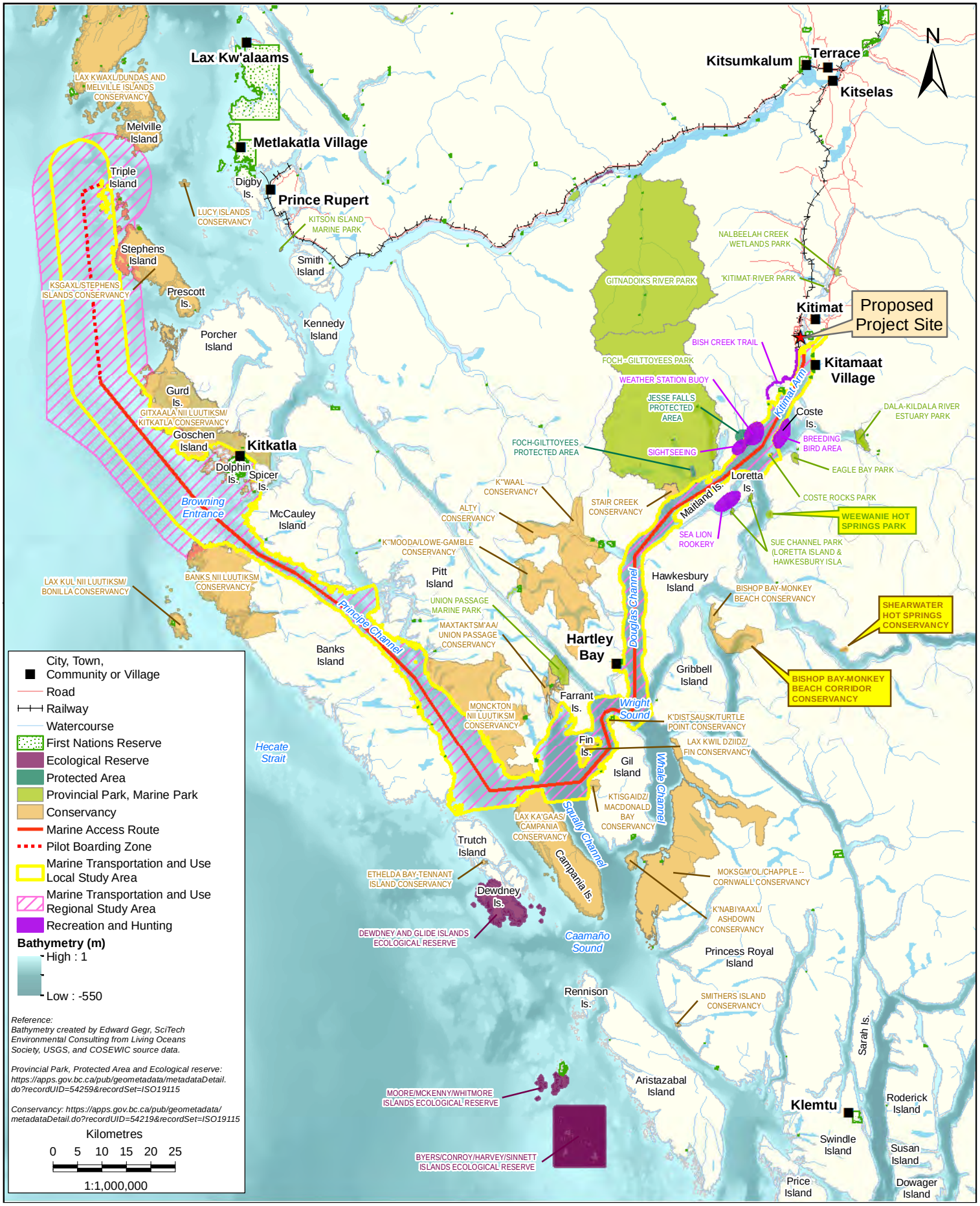
Three natural hot springs (Weewanie, Shearwater, and Bishop Bay) are very popular recreational, tourist, and boat anchorage areas (Hummel and Langagger 2013, pers. comm.; Parsons 2013, pers. comm.; Wakita 2013, pers. comm.; Walker and Peacock 2013, pers. comm.). These hot springs are not located on the marine access route and exist outside the RSA. Unfortunately, no data were available to estimate the frequency of use for any marine-accessible parks.

Recreational Boating Routes

Project shipping traffic and recreational vessels have the most potential for interaction in Wright Sound where one recreational boating route intersects the marine access route and where another parallels the marine access route for approximately 85 km in Douglas Channel between Kitimat and Wright Sound (Figure 7.4-23). Interviews with residents revealed that most mariners use Devastation Channel (up to 90%; Parsons 2013, pers. comm.) because of its sheltered nature (Hittel 2013, pers. comm.; Wakita 2013, pers. comm.; Walker and Peacock 2013, pers. comm.).

Anchorages and Scuba Dive Sites

In the Kitimat area, 329 anchorages and safe boat havens have been identified, and approximately 37 dive sites also exist in the area (Figure 7.4-24). Several of the known anchorage areas and dive sites were confirmed during consultation. For example, Coste Island is used by the Kitimat SCUBA Dive Club (Wakita 2013, pers. comm.). Overall, sites appear scattered throughout the RSA and show no pattern or clustering along the marine access route.



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MARINE TRANSPORTATION AND USE ENVIRONMENTAL EFFECTS ASSESSMENT

MARINE ACCESSIBLE PARKS AND IMPORTANT AREAS

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

PROJECTION	DRAWN BY
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DATE	FIGURE NO.
18-JUN-14	**7.4-22**

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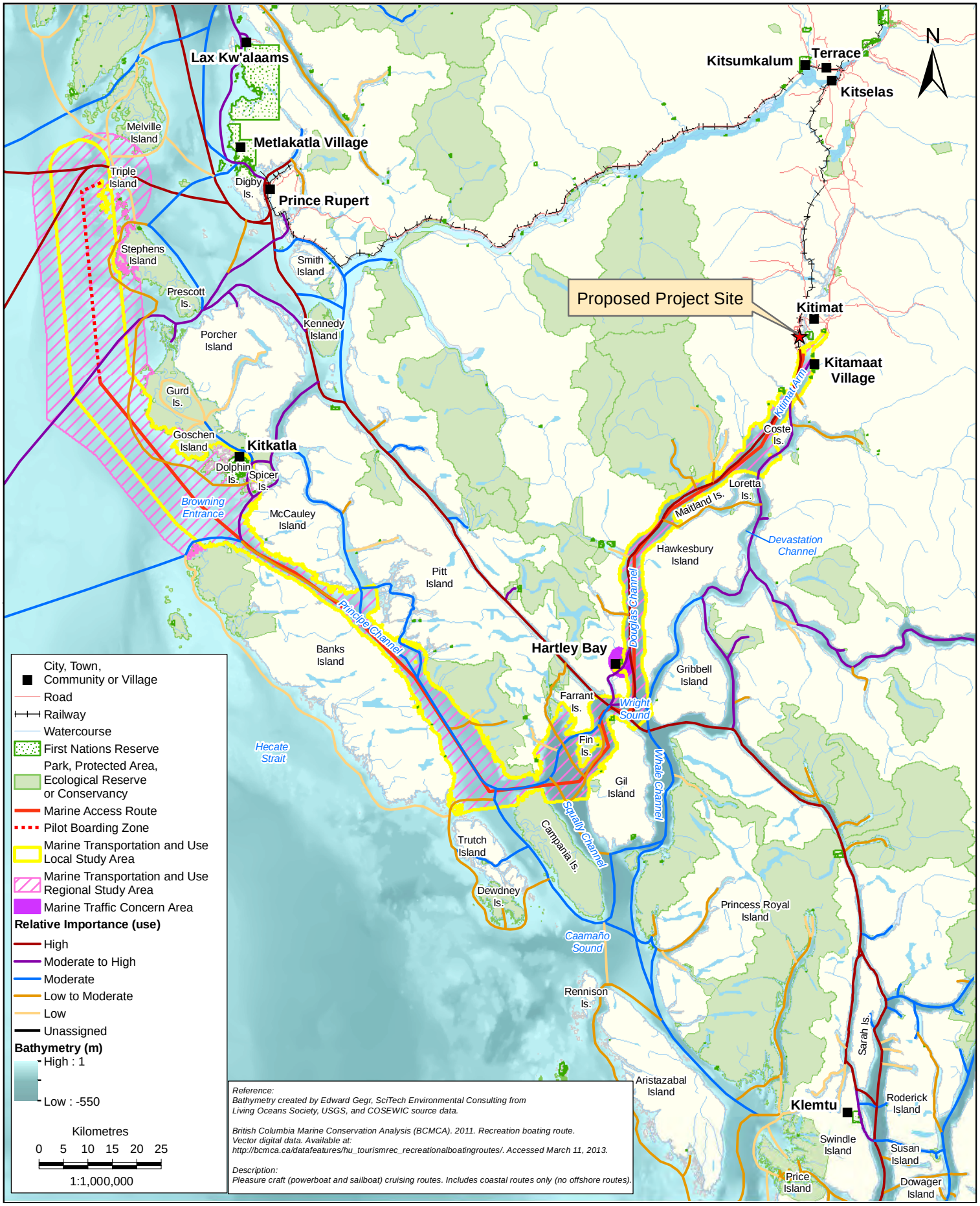

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MARINE TRANSPORTATION AND USE ENVIRONMENTAL EFFECTS ASSESSMENT

RECREATIONAL BOATING ROUTES

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

PROJECTION	DRAWN BY
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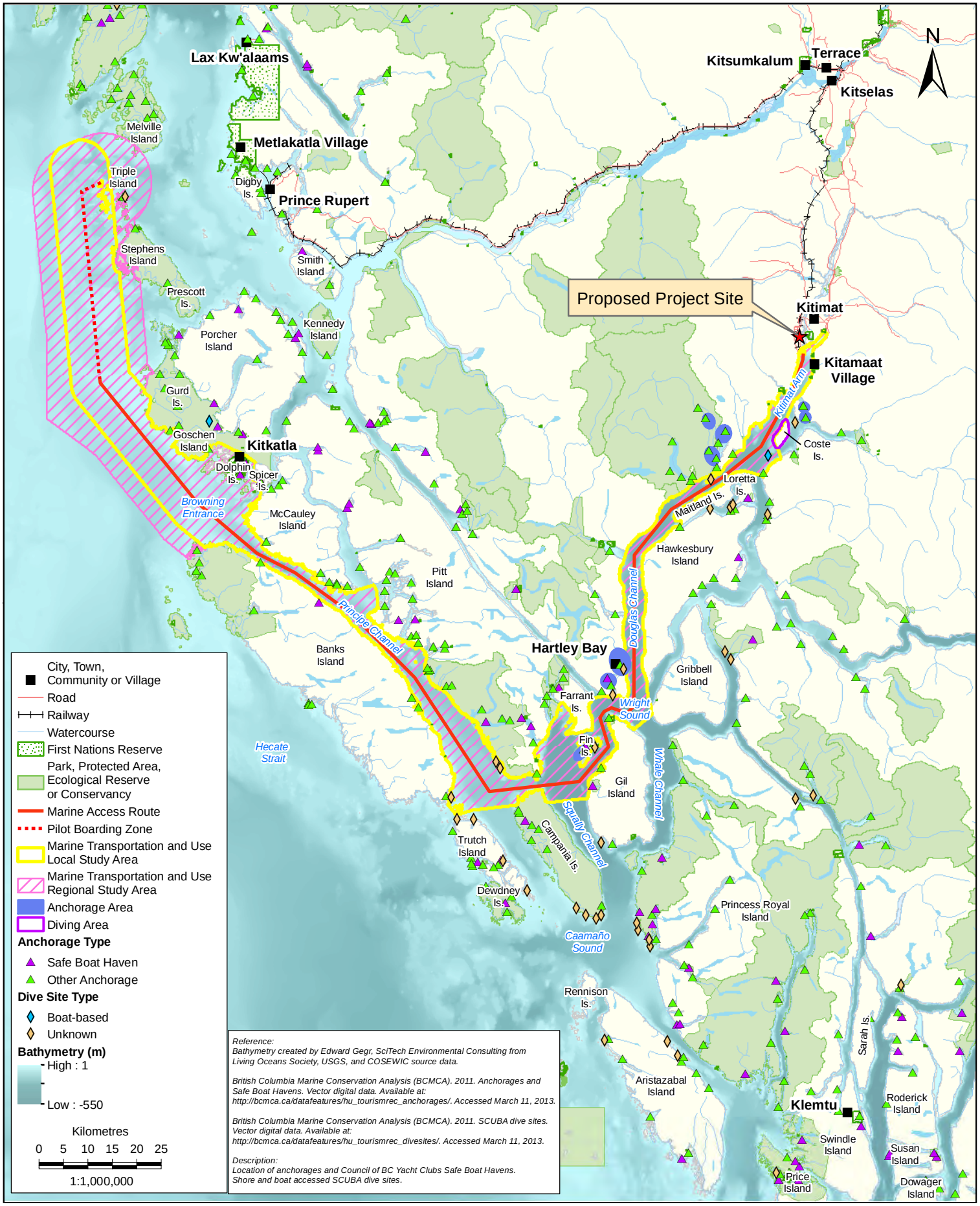

Reference:
Bathymetry created by Edward Gegr, SciTech Environmental Consulting from Living Oceans Society, USGS, and COSEWIC source data.

British Columbia Marine Conservation Analysis (BCMCA). 2011. Anchorages and Safe Boat Havens. Vector digital data. Available at: http://bcmca.ca/datafeatures/hu_tourismrec_anchorages/. Accessed March 11, 2013.

British Columbia Marine Conservation Analysis (BCMCA). 2011. SCUBA dive sites. Vector digital data. Available at: http://bcmca.ca/datafeatures/hu_tourismrec_divesites/. Accessed March 11, 2013.

Description:
Location of anchorages and Council of BC Yacht Clubs Safe Boat Havens. Shore and boat accessed SCUBA dive sites.

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MARINE TRANSPORTATION AND USE ENVIRONMENTAL EFFECTS ASSESSMENT

ANCHORAGES AND SCUBA DIVE SITES IN AND NEAR THE LSA AND RSA

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

PROJECTION	DRAWN BY
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Sea Kayaking

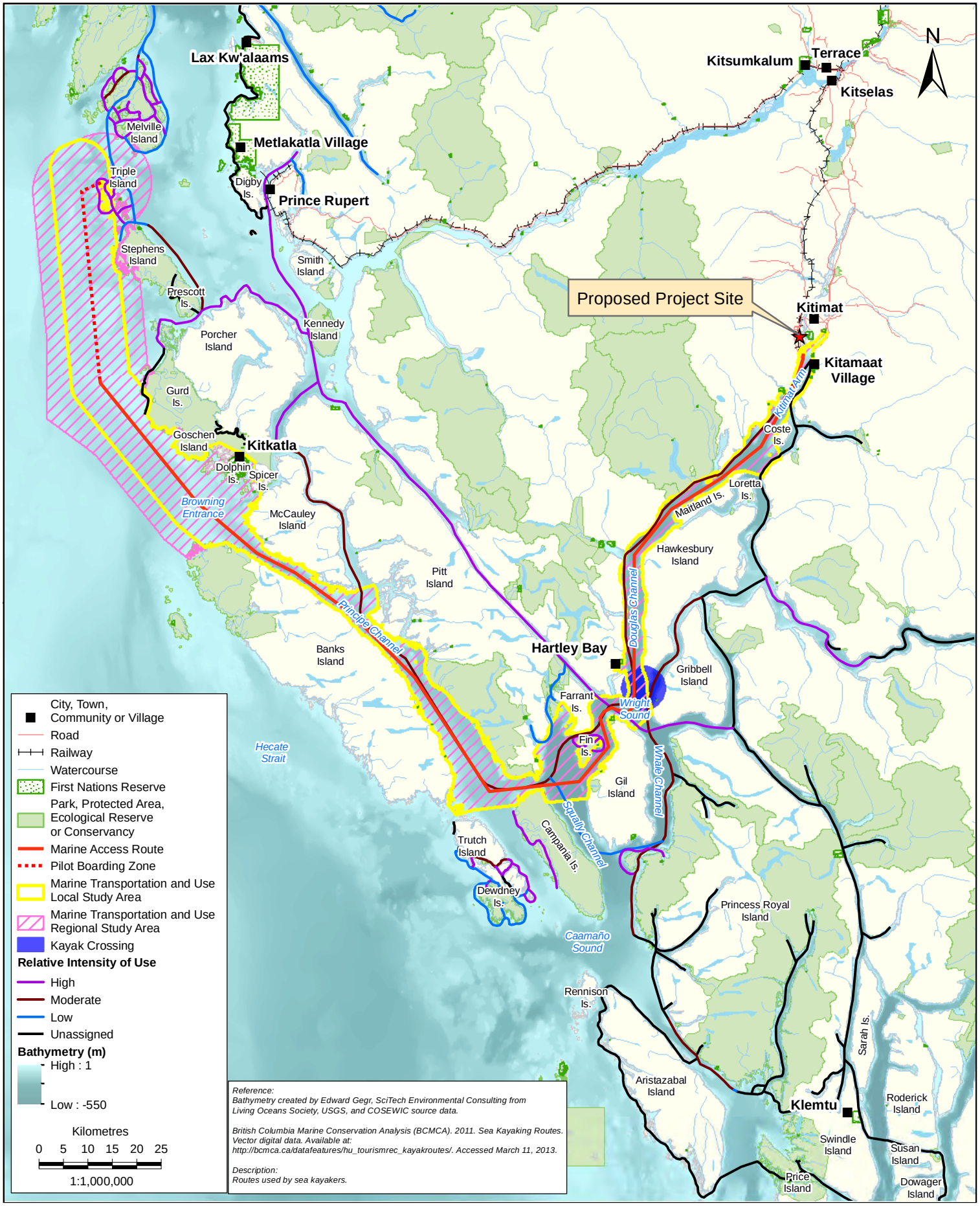
Sea kayaking routes were compiled by the BCMCA and assigned to categories of relative importance, with one additional kayak crossing area identified during consultation (Figure 7.4-25) (Hickman 2013, pers. comm.). Sea kayakers are most likely to interact with commercial shipping traffic in Wright Sound and around Triple Island.

Marinas and Moorage Facilities

Five operating marinas and moorage facilities (i.e., small craft harbours [SCH]) were identified in the LSA (Figure 7.4-26):

- MK Bay Marina
- Minette Bay Marina
- Kitamaat Village SCH
- Hartley Bay SCH, and
- Kitkatla Bay SCH.

Moon Bay Marina has been decommissioned and is no longer operational. Table 7.4-9 summarizes facility information. Small craft harbours have a federal mandate to provide a safe network of harbours in support of economically prosperous fisheries. Local harbour authorities are contractually responsible for the daily operations of their respective harbours through a lease agreement with DFO. Because of this mandate, the local harbour authority may give priority moorage to fishers, but the harbour authority will generally make every effort to accommodate all vessels. Although the moorage facilities are built by the federal government, the collection of revenue to cover operational expenses, such as utilities and minor maintenance, is fulfilled by the harbour authority. As an independent not-for-profit business, the harbour authority is also responsible for setting the rates for berthage and any additional services (Richardson 2014). Before decommissioning of Moon Bay marina, a small boat launch was accessible at that location.



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MARINE TRANSPORTATION AND USE ENVIRONMENTAL EFFECTS ASSESSMENT

SEA KAYAKING ROUTES IN AND NEAR THE LSA AND RSA

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

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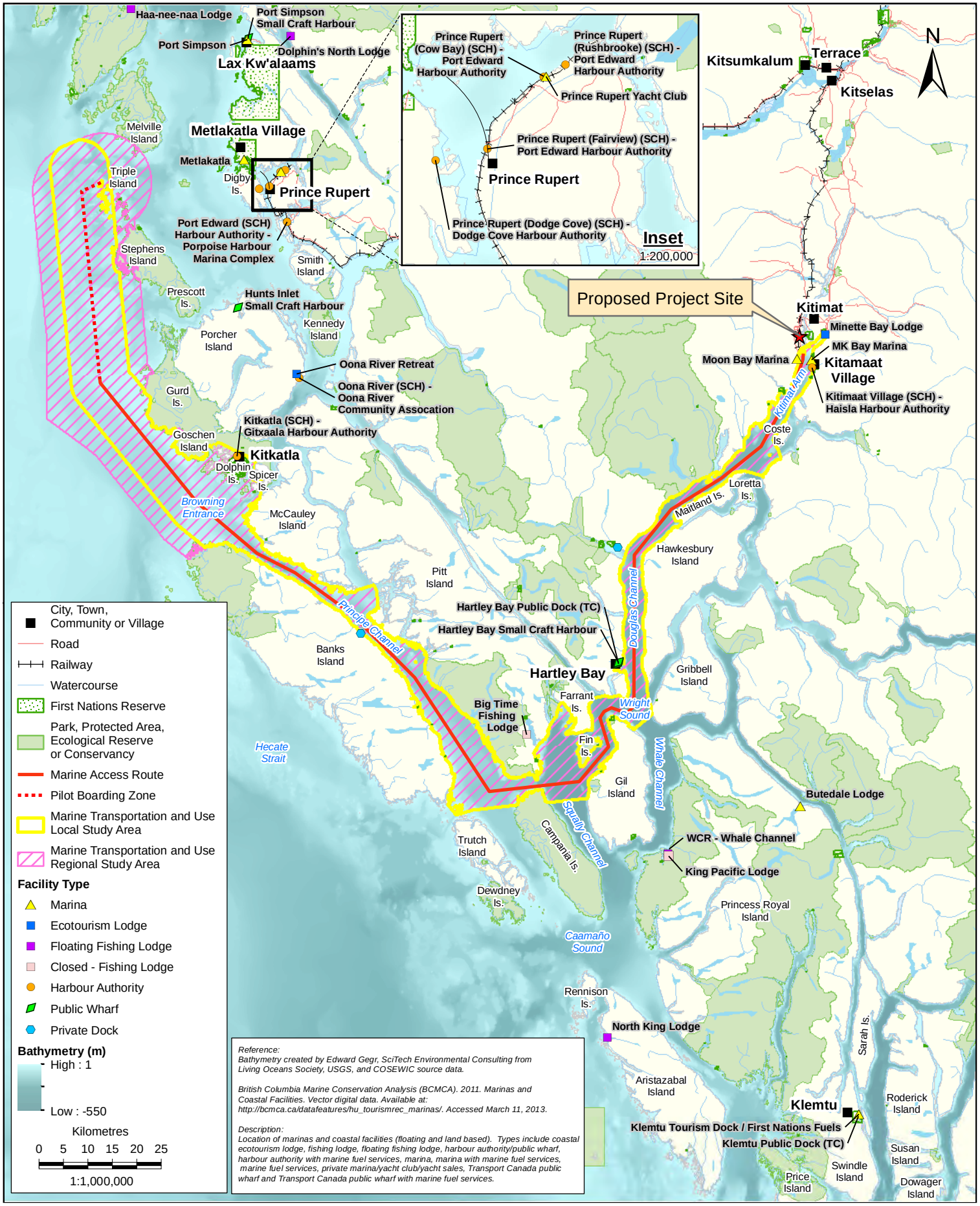

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MARINE TRANSPORTATION AND USE ENVIRONMENTAL EFFECTS ASSESSMENT

MARINAS AND COASTAL FACILITIES IN AND NEAR THE LSA AND RSA

LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

PROJECTION	DRAWN BY
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Table 7.4-9: Identified Marinas and Moorage Facilities in the LSA

Facility	Managed By	Location	Services Offered	Use by Recreational Boats (BCMCA)	Approximate Distance from Terminal (km)
MK Bay Marina	Regional District of Kitimat-Stikine	Head of Kitimat Arm	Moorage (147 boats), gas, boat launch, dry dock storage, and accommodation	Moderate–high	2.1
Minette Bay Marina	Private business	Head of Kitimat Arm	Moorage (40 boats) and accommodation	Moderate–high	6
Kitamaat Village SCH	Haisla Port Authority	Head of Kitimat Arm	Moorage (40 boats)	Moderate–high	3.5
Hartley Bay SCH	Gitga'at Port Authority	Hartley Bay	Moorage (40 boats), gas, accommodation, and recreation facilities	Moderate–high	80
Kitkatla Bay SCH	Gitxaala Port Authority	Dolphin Island	Moorage (25 boats)	Moderate	220

NOTE:
SCH – small craft harbour
SOURCE: BCMCA (2013); see Stantec Consulting Ltd. (2014) for further details.

MK Bay Marina

MK Bay Marina is located on the east side of the Douglas Channel and is approximately 2 km southeast from the Project terminal. It is run by the Regional District of Kitimat-Stikine and supports much of the boating activity in the area. It offers a refueling station and general supplies. It has capacity for approximately 147 vessels and is fully booked year round. There is currently a greater than 90-person waitlist for permanent moorage space and the “first in line” has been waiting 2 to 3 years (Hickman 2013, pers. comm.). MK Bay Marina staff make considerable effort to maintain availability for transient vessels that visit for several days. Many community members are frustrated by the long waits and high fees to use MK Bay’s boat launch (costs include launch and parking fees) (Hummel and Langagger 2013, pers. comm.; Kitimat Daily Online 2011). Regional District of Kitimat-Stikine is currently developing plans to expand services and update infrastructure, including new concrete breakwaters (the existing breakwater is made of rafted logs), floating lodges, concrete fuel dock, and additional marina floats (Regional District of Kitimat-Stikine 2014).

Minette Bay Marina

Minette Bay Marina is located in the Kitimat River estuary approximately 6 km east of the marine terminal. It is a private business with capacity for approximately 40 boats. However, only 10 to12 boats are currently using the marina, and it is not operating at capacity, most likely because access to this marina is restricted during low tide (Hickman 2013, pers. comm.; Hittel 2013, pers. comm.; Hummel and Langagger 2013, pers. comm.; Wakita 2013, pers. comm.). The breakwater is made of rafted logs and an active log sort exists next to the marina.

Kitamaat Village SCH

Kitamaat Village SCH is approximately 3.5 km southeast of the marine terminal. It is managed by the Haisla Harbour Authority. It has three 30 m long floats (fingers) extending off a 50 m main float and can accommodate approximately 40 boats. It is currently operating at full capacity, and expansion of the facility (e.g., larger platform and breakwater, and the creation of a boat launch) would be welcomed (Amos 2014, pers. comm.).

Hartley Bay SCH

Hartley Bay SCH is located approximately 80 km south from the marine terminal in the Gitga'at community (180 full time residents) and is managed by the Gitga'at Harbour Authority. The marina offers refueling services, indoor and outdoor recreation facilities, and internet, and is reportedly operating at full capacity (40 boats) (Gitga'at 2014). Twelve Gitga'at-operated fishing vessels, including salmon gillnetters, seiners, boats with halibut gear, and one with crab gear, were moored in Hartley Bay in recent years (Gregory et al. 2011).

Kitkatla SCH

Kitkatla SCH is located approximately 220 km from the marine terminal in the Gitxaala Nation community on Dolphin Island. It is managed by the Gitxaala Harbour Authority. The marina has a single float approximately 140 m long with estimated capacity for 40 boats. The dock is sheltered by a small island nearby.

7.4.4 Project Interactions

Table 4.4-1 (Section 4) identifies potential interactions of concern between Project activities and each of the selected VCs that are carried forward in the assessment. The potential effects identified in Section 7.4.2.4 that might result in an adverse effect as a result of interactions with Project activities are assessed. The extent to which the interactions will be considered is ranked in Table 7.4-10. The ranking categories (i.e., 0, 1, or 2) are defined in a footnote to the table.

A conservative approach is taken in assigning a Rank of 1, whereby interactions with a meaningful degree of uncertainty are assigned Rank 2 so that a detailed effects assessment is conducted.

Table 7.4-10: Potential Project Effects on Marine Transportation and Use

Project Activities and Physical Works	Potential Effects			
	Interference with Marine Navigation	Interference with Marine Fisheries and Shoreline Harvesting	Interference with Marine Recreation and Tourism	Effects on Marinas and Moorage Facilities
Facility Activities and Works				
Construction				
Site preparation (clearing, grubbing, grading, levelling, and set-up of temporary facilities)	0	0	0	2
Onshore construction (installation of LNG facility, utilities, ancillary support facilities, access roads, and includes hydrotesting)	0	0	0	2
Dredging (includes disposal)	2	1	1	2
Marine terminal construction (modifications to existing wharf, installation of sheet piling, material offloading and laydown areas, transfer piping and electrical installations)	2	1	1	2
Waste management (waste collection and treatment)	0	0	0	2
Vehicle and rail traffic (haul road upgrades, road use, vehicle traffic)	0	0	0	2
Commissioning and start-up	0	0	0	2
Operation				
LNG production (including natural gas treatment, condensate extraction, storage, and transfer), storage and loading	0	0	0	1
Waste management (solid and liquid waste collection and disposal, wastewater effluent collection and treatment, site stormwater management)	0	0	0	1
Vehicle and rail traffic (haul road upgrades, road use, vehicle traffic)	0	0	0	1
Decommissioning				
Dismantling of land-based and marine infrastructure	1	1	1	1
Remediation and reclamation of the site	0	0	0	1
Waste management	0	0	0	1
Post-closure monitoring and follow-up	0	0	0	1
Shipping Activities				
Construction				
Shipping equipment and materials	1	2	2	0
Operation				
LNG shipping	1	2	2	0
Decommissioning				
Shipping equipment and materials	0	2	2	0

KEY:

0. No interaction.
1. Potential adverse effect requiring mitigation, but further consideration determines that any residual adverse effects will be eliminated or reduced to negligible levels by existing codified practices, proven effective mitigation measures, or BMPs.
2. Interaction may occur and the resulting effect may exceed acceptable levels without implementation of Project-specific mitigation. Further assessment is warranted.

NOTE: Only activities with an interaction of 1 or 2 for at least one effect are shown.

7.4.4.1 Justification of Interaction Rankings

Interactions ranked as 0 mean that no interaction is expected. For example, site preparation will not affect marine navigation or fisheries. Consequently, interactions Ranked 0 warrant no further explanation. Interactions ranked as 1 are discussed below; while these interactions are not considered in the Project effects assessment (Section 7.4.5 and 7.4.6), they are considered in the cumulative effects assessment as part of the potential Project contribution to cumulative effects. Interactions ranked as 2 are discussed in Section 7.4.5 and Section 7.4.6.

7.4.4.1.1 Facility Activities and Works

Marine Navigation: Facility Operation and Decommissioning Ranked as 1

The marine terminal berths will be designed to accommodate the loading of LNG carriers with the capacity to load up to 265,000 m^3 of LNG (e.g., up to the largest currently available LNG carriers). The marine terminal design will include the necessary measures to promote LNG carrier safety during operation. Only those LNG carriers that have undergone a terminal compatibility review and approval process before arriving in the area will be permitted at the marine terminal. All regulatory requirements and operational safety policies and procedures relevant to the berthing and securing of commercial ships will meet international industry standards. In addition to these protocols, Transport Canada approved safety zones will extend from each berth to reduce the potential for incidents between LNG carriers and other vessels, especially during berthing, loading, and unberthing (Figure 7.4-3 and Section 7.4.3.2). Vessels that enter this area will be immediately advised to leave the zone for their own safety and the safety of the operation and, if necessary, they will be escorted to a distance outside the safety zone by a harbour vessel. While safety zones are not explicitly covered under the NPA, they are included in the assessment because they have the potential to interfere with navigation. However, because the safety zones are relatively small and located between the jetty and the wharf (an area that is avoided by the vast majority of non-commercial ships [Hummel and Langagger 2013]), they will not impede marine navigation. During decommissioning, marine structures will be dismantled according to Transport Canada permit conditions (e.g., NPA permit) so that none will interfere with navigation afterwards. Procedures for decommissioning will be similar to those approved for construction but specific for the removal of the structures.

Consequently, with the mitigation and adherence to the regulations, there will be no residual effects on marine navigation during the operation and decommissioning phases of the Project.

Marine Fisheries and Shoreline Harvesting: All Facility Activities and Works Ranked as 1

Several activities and works have the potential to affect fisheries and harvesting near the marine terminal (see Table 7.4-10). Collectively, these undertakings span all phases of the Project and include dredging, marine terminal construction, LNG loading, and dismantling of infrastructure. Effects from dredge disposal are discussed in more detail in Section 5.8 (Marine Resources). These activities have all been ranked as 1 because, while fishers might be displaced, the affected area is small, occurs in a pre-existing industrial port, and is not heavily relied upon by fishers. The details are outlined below.

Primary research revealed that Dungeness crabs are targeted by recreational fishers in the shallow areas between the Methanex jetty and the RTA Wharf "B" (Wakita 2013, pers. comm.). It is only recreational fishing that occurs at this location; no commercial or Aboriginal fishing occurs.

Haisla Nation does not collect shellfish or crab near the existing terminal because of real or perceived chemical contamination in the estuary (Powell 2013), and most other local residents avoid fishing near the existing terminal because of the same concerns (Hummel and Langagger 2013, pers. comm.). Clam harvesting is closed at the head of the channel because of biotoxin and sanitary closures (DFO 2014b), and will not be affected by facility activities and works. Finally, crab fishing at this site has only recently been possible because of decreased shipping activities and is not expected to be heavily relied upon by fishers. Indeed, the area has been used for shipping since the 1950s (Stantec Consulting Ltd. 2014). Consequently, because of the small area involved and the low reliance by fishers on the area, potential effects from the marine terminal on fisheries and shoreline harvesting will be negligible and no further assessment is warranted, except in the cumulative assessment for the Project contribution.

Recreation and Tourism: All Facility Activities and Works Ranked as 1

The Project has the potential to affect water-based recreation and tourism activities occurring next to the marine terminal (see Section 7.4.3.2). However, limited activity occurs in this area. Those activities that do occur (i.e., hunting and wildlife viewing) are land-based but use the marine environment or private roads to gain access to the estuary (Hummel and Langagger 2013, pers. comm.; MacCleod 2013, pers. comm.; Wakita 2013, pers. comm.). The Project is not expected to affect access to the estuary beyond a negligible level because the estuary, to the east of the Project, will continue to be accessible from the marine environment beyond the 300 m safety zones around each berth and the LNG loading line corridor. The safety zones are not expected to change the types or quality of recreational opportunities available. Land-based access is also not expected to be affected because the terminal will remain on private land zoned for industry (see Section 7.2). By contrast, workers engaged in facility activities might increase business revenues for eco-tourism operators, especially during slower winter months (see eco-tourism survey results in Stantec Consulting Ltd. 2014). Consequently, no substantial effects on recreation and tourism are expected and no further assessment is warranted for facility activities and works, except in the cumulative assessment for the Project contribution.

Marinas and Moorage Facilities: Decommissioning Ranked as 1

The Project is expected to have an operational life of at least 25 years. Over the operational life of the Project, marina operators will have adequate time to adjust the supply of marinas and moorage facilities to the changing demands caused by decommissioning of the facility. As a result, effects are anticipated to be negligible, and no further assessment on marine services and infrastructure during decommissioning is warranted, except in the cumulative assessment for the Project contribution.

7.4.4.1.2 Shipping Activities

Marine Navigation: Construction and Operation Ranked as 1

LNG Canada has considered various options for the disposal of dredged marine sediments, including deep or shallow water disposal at sea (see Section 2.3.4). Under section 22 of the *Navigation Protection Act* the deposition of sinkable materials is prohibited in navigable waters of less than 36 m depth. Should LNG Canada select disposal at sea additional assessment will be undertaken as part of a disposal at sea application to assess potential effects on navigation.

The normal operation of LNG carriers will not result in an obstruction to navigation, as defined under the *Navigation Protection Act*. As well Project-related shipping will comply with all maritime regulations, including the *Canada Shipping Act, 2001,* and International Regulations for Preventing Collisions at Sea, 1972 with Canadian Modifications, and the International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978, and therefore assessment of the effects of LNG carrier operations on marine navigation is not required.

7.4.5 Assessment of Residual Effects from the LNG Facility

The two potential effects of the LNG Facility to be assessed are interference with marine navigation and effects (i.e., change in demand) on marinas and moorage facilities.

7.4.5.1 Analytical Methods

7.4.5.1.1 Analytical Assessment Techniques

Potential interference with marine navigation is assessed by comparing the proportion of the navigable channel occupied by the marine terminal before and after the construction of Project infrastructure. The assessment also considers safety zones.

Potential effects on marinas and moorage facilities are assessed by estimating the increase in the use of, and the capacity for these facilities to cope with the additional demand potentially imposed by Project workers. Use is defined as the number of user days and is calculated using the proportion and frequency of the Project workforce that are estimated to access marinas and moorage facilities.

7.4.5.1.2 Assumptions and the Conservative Approach

The calculation of the proportion of the navigable waters affected by the marine terminal, before and after the modifications, is done as conservatively as possible. For example, the existing terminal structures are understated where uncertainty existed, and those dimensions are compared to the largest possible footprint of the marine terminal. As a result, the size of the marine terminal is overstated rather than potentially underestimated in the assessment. Further, safety zones are included in the assessment when only permanent structures are required to be assessed under the NPA.

Limited information on the tendencies of mobile workers, the proportion who use marinas and moorage facilities, and the available capacity of existing marinas and moorage facilities will affect the precision of the estimated potential Project effects. To compensate for prediction error, the assessment uses the following conservative assumptions to overstate potential effects:

- The analysis uses a population increase of approximately 6,200 (during the construction phase), inclusive of in-migrating and transient populations (see Section 7.2 for further details).
- A figure of 4.4%, the larger value of two identified during primary research, is used to estimate the proportion of mobile workers that might use marinas and moorage facilities.
- When the number of available berths at a marina or moorage facility is not available, capacity is estimated assuming a single vessel per berth (i.e., vessels do not tie up to each other or "raft up") and an overall length of 8 m, even though "rafting up" is common practice in small craft harbours and 8 m likely overestimates the median size fishing vessel.

7.4.5.2 Assessment of Potential Interference with Marine Navigation

7.4.5.2.1 Description of Project Effect Mechanisms for Interference with Marine Navigation

Changes to the existing terminal will occur during the construction phase of the Project and will include the removal and modification of some features, dredging, and the reinforcement of existing support structures, which could interfere with marine navigation as a result of safety zones around work areas.

7.4.5.2.2 Mitigation for Interference with Marine Navigation (Facility)

The following mitigation measures will address potential effects of Project construction and operation on marine navigation:

- Project-related marine traffic including LNG carriers will use the Coast Guard Marine Communication and Traffic System (MCTS) to provide notice of planned arrival time at Triple Island, and encourage Aboriginal Groups and stakeholders to use the system to plan their routing and scheduling (Mitigation 7.3-3).
- Regular communication on Project activities will occur with marine users, including recreationalists, commercial tourism operators, CRA fishers, Transport Canada, DFO, and relevant stakeholders (Mitigation 6.2-7).
- Use of safety zones which specify "no go" areas around the marine terminal for the safety of public marine traffic, during construction and operation (Mitigation 7.4-2).
- Support federal government in installation of any navigational aids determined to be necessary for safety on the new marine terminal where required (Mitigation 7.4-3).
- Provide notification and information to the Canadian Hydrographic Service to accurately include the appropriate marine terminal information and berth locations on future navigational charts (Mitigation 7.4-4).

These measures will inform the public of the timing of construction activities, maintain a safety perimeter around the marine terminal, and will clearly mark the new terminal. These measures are based on government requirements, BMPs, and past experience. These measures should become effective immediately upon implementation. Moreover, construction activities will comply with all Transport Canada approval conditions that might accompany the NPA permit.

7.4.5.2.3 Characterization of Interference with Marine Navigation

As a result of the modifications for the existing terminal, the physical structures will become narrower and the harbour area deeper. The existing terminal occupies an area of 31 ha. The jetty and wharf have a combined width of 310 m. The marine terminal will be smaller, occupying an estimated 26 ha, and will have a width of 280 m (a reduction in area of approximately 5 ha and width of 30 m). The proportion of the navigable channel (i.e., the width of the channel) affected by the terminal will be reduced by 1%. In regards to channel navigability, these changes are positive but negligible.

To enhance marine safety, safety zones will be implemented around each of the LNG carrier berths during all phases of the Project. While safety zones are not explicitly covered under the NPA, they are included in the assessment because they have potential to interfere with navigation. However, because they are relatively small and almost entirely located between the jetty and the wharf (a small section extends east of the marine terminal) and are areas largely avoided by non-commercial ships (Hummel and Langagger 2013, pers. comm.; Figure 7.4-3), they are not expected to impede marine navigation. Moreover, the interface between the marine safety zone and land will be entirely within LNG Canada property (or industrial land) and would therefore not be legally accessible to the public.

As a result of the small scope of the existing terminal modifications and with the implementation of mitigation measures, potential residual effects on marine navigation will be eliminated or reduced to negligible levels. Mitigation measures associated with lighting, navigational aids, and signage will clearly mark the marine terminal so that it is visible to mariners at all times.

Summary

Overall, the Project will improve navigational safety near the marine terminal because the marine terminal will be smaller than the existing terminal, the harbour area will be deeper, and safety zones will be enforced. Positive residual effects will have a low magnitude, be restricted to the head of Kitimat Arm, and will occur in an area previously used for industrial shipping since the 1950s. Consequently, there is a low likelihood that adverse residual effects will occur.

7.4.5.2.4 Determination of Significance for Interference with Marine Navigation

The Project will not cause substantial and persistent interference to marine navigation. The berths are already in use, and the modifications will continue to allow vessels to travel in and around Douglas Channel. Safety around the marine terminal will be refined through the implementation of small but effective safety zones. Therefore, Project residual effects related to interference with marine navigation are assessed as not significant.

7.4.5.3 Assessment of Effects on Marinas and Moorage Facilities

7.4.5.3.1 Project Effects Mechanisms for Effects on Marinas and Moorage Facilities

The Project could increase demand on marinas and moorage facilities if workers begin using them when they have time off. For example, the number of vessels or boaters requesting services such as moorage, fuel, or boat launch might surpass the available capacity of the existing facilities and reduce the overall level of service provided to the community.

7.4.5.3.2 Mitigation for Effects on Marinas and Moorage Facilities

Mitigation measures intended to reduce potential Project effects and improve the level of marine services provided to the community will include the following:

- Provide input, with other industry and the municipal government, into the creation of a waterfront access space (that may include a public boat launch) for the community (Mitigation 7.4-5).

7.4.5.3.3 Characterization of Effects on Marinas and Moorage Facilities

The degree to which the Project might cause adverse effects on marinas and moorage facilities will depend on several factors, including the:

- size of the workforce accommodation centre(s) and the proportion of workers that choose to go boating
- capacity of existing facilities to accommodate increased use
- number of boats available for hire or that are brought into the community (e.g., strictly rental boats or worker-owned boats, not charters)
- work rotation schedule (e.g., structure of time off), and
- accessibility of marine facilities (e.g., distance from Kitimat).

Of these factors, the one that is most strongly limiting the potential for the Project to have adverse effects is the lack of rental boats available for hire in Kitimat and the region in general. None of the 20 eco-tourism or fishing charter business interviewed offer boats for hire (Section 7.4.3.2). In addition, none of the 50 marine-related businesses located in the region appear to offer those services (Stantec Consulting Ltd. 2014). Instead, guided tours are the main services sold by marinas, fishing charters, and other eco-tourism operators. Therefore, regardless of the size of the workforce accommodation centre(s) or details surrounding the work rotation schedule (e.g., structure of worker time off), it is estimated that very few workers will be able to access any of the five marinas and moorage facilities in the LSA using rented boats. Further, Project workers are not expected to bring their own boats as a result of either the remoteness of the Project site, or not owning a boat or not owning a boat suitable for the west coast. If rental boats do become available in the future, most would not be authorized for overnight use (Sewell's Marina 2014, pers. comm.), and would therefore not take up limited moorage space in Kitimat or other nearby locations. Rather, the boats would be taken out during the day and returned to the rental company at the end of the day, not moored overnight. Moreover, because most day-use rental boats are small

(e.g., 5 to 6 m long equipped with 60 hp to 115 hp engines), they are not suitable for long distance trips and are generally not permitted to travel more than 40 km to 50 km from the rental location (Sewell's Marina 2014, pers. comm.). Consequently, if similar rules were imposed by newly established rental companies in Kitimat, Project workers would not be expected to travel to Hartley Bay or Kitkatla because they are more than 50 km from Kitimat (Section 7.4.3.2). However, if they were able to travel to Hartley Bay, for example, visitors would likely contribute positively to the Gitga'at Tourism Strategy, as developed in 2003, which outlines services offered specifically for travellers, including gas, moorage, and accommodations (Gitga'at Nation 2003).

A more realistic scenario is one where Project workers might hire a guide for a day trip. These operators would already be using the existing marinas and moorage facilities such that additional day trips will not overburden marinas in the area. Rather, greater use by Project workers might generate positive economic benefits for multiple businesses, including tackle shops and outdoor supply stores. While the lack of boats available for hire is expected to strongly reduce the potential for the Project to cause adverse effects on marinas and moorage facility, the assessment predicts the number of annual and daily users (user days) potentially generated by the Project in a hypothetical scenario.

Estimate of Annual User Days

A report on mobile workers in the Wood Buffalo region of Alberta found that 20% of oil-field workers participated in backcountry activities. Of those who did, 22% went fishing (Nichols Applied Management 2007). Therefore, the conditional probability that a mobile worker will go fishing is 4.4%. This value is similar to the BC average. The Survey of Recreational Fishing in Canada conducted by DFO (2012) found that 3.7% of BC residents participated in saltwater fishing activities in 2010. The more conservative estimate of 4.4% is used in this analysis. The report on mobile workers done by Nichols Applied Management (2007) also determined the frequency distribution of different "activity levels" (i.e., they assigned workers that did participate in backcountry activities to different categories based on the number of times per year they participated).

Using this information and assuming that Project workers in Kitimat will behave similarly to Alberta workers and that all workers who go fishing will use marinas and moorage facilities, it is estimated that with an average maximum workforce accommodation centre size of 5,600 (e.g., during construction in 2018; see Section 7.2), the use of marinas and moorage facilities could increase by up to approximately 1,855 user days per year (Table 7.4-11). This analysis considers both direct and indirect population increases as a result of Project activities (see Section 7.2 for further details).

Table 7.4-11: Maximum Estimated Demand on Marinas and Moorage Facilities

Activity Level	Percent of Workers Participating in Back Country Activities (%)	Activity Level Multiplier	Individuals	User Days
None	80	0	4,960	0
Once	6	1	372	74
2 to 5 times	7	5	434	432
5 to 10 times	2	10	124	246
More than 10 times	5	15	310	924
Total number of user days				1,855

NOTE:
Maximum potential demand is based on an average workforce accommodation centre size of approximately 5,600 during construction in 2018.

SOURCE: Activity level and percent of mobile workers in each category is based on Nichols Applied Management (2007).

Minette Bay Marina, one of three marinas at the head of Kitimat Arm, has available moorage space. The others do not. Minette Bay Marina has an estimated capacity for approximately 40 boats and is currently only used by 10 to 12 boats (see Section 7.4.3.2; Stantec Consulting Ltd. 2014). Subsequently, there should be room for an additional 28 boats, or the equivalent of 10,220 user days of annual moorage space. Therefore, Minette Bay Marina could accommodate the hypothetical maximum demand from the Project five times over (however, access to this marina is restricted during low tides). Moreover, there are plans to expand MK Bay Marina in the next several years. These plans include the addition of new concrete breakwaters, floating lodges, a concrete fuel dock, and additional marina floats (e.g., moorage space) (Regional District of Kitimat-Stikine 2014). Not only is the potential demand for moorage space from the Project estimated to be well below what is currently available in the community, competition for moorage, even with the presence of the Project, might be reduced compared to current levels as a result of the mitigation measures and proposed expansion of MK Bay Marina (Section 7.4.3.2).

Estimate of Daily Users

On a shorter time scale, because workers might have 0.5 to 1 day off during their work rotation, the second part of the analysis focuses on estimating the average number of users for a single day and how this might affect marinas and moorage facilities. The hypothetical worst-case scenario is based on a work schedule that allows up to 300 workers a day off together. Although the exact nature of the work schedule has not been determined, the use of a schedule will constrain the maximum potential daily demand on facilities. To estimate the potential daily demand, the annual number of user days (1,855) is randomly redistributed according to a normal distribution. A random normal distribution is chosen because literature and primary research indicate that the tourism industry in Kitimat has a single peak and that it occurs during the summer.

The pattern of seasonality is ubiquitous in the tourism industry, with different sectors commonly having single or bi-modal distributions (Lee et al. 2008). The marine eco-tourism sector in Kitimat has a distribution with a single peak as a result of natural and social factors acting synergistically. For example,

the timing of salmon spawning, warmer climate, and calmer seas promote tourism during the summer months in Kitimat. Social conditions, such as the end of the school year and willingness to take holidays in the summer, also contribute to increased recreational and tourism activities (Lee et al. 2008). This notion was validated by interviews conducted with eco-tourism businesses operating in the RSA (Stantec Consulting Ltd. 2014). Surveys confirmed that Kitimat does indeed have a single peak in eco-tourism that occurs during the summer (Stantec Consulting Ltd. 2014). Redistributing the annual number of user days is therefore the best done using a normal distribution with appropriate mean and standard deviation.

The total number of annual user days was redistributed according to a normal distribution with a mean of 13 and standard deviation of 8 to estimate the average number of daily users. The input parameters for this exercise are determined as follows. The mean is derived by multiplying 300, the average number of workers that might simultaneously have a day off together by 4.4%—the proportion that are estimated to go fishing (Nichols Applied Management 2007). The magnitude of the standard deviation is chosen such that it corresponds to a coefficient of variation (standard deviation divided by the mean) of approximately 60%. Sixty percent is used in the analysis because it is a conservative estimate of the variation in the tourism industry (Daniel and Rodrigues 2010). Using this method, the average number of users for a single day ranges from 5 to 21 (i.e., 13 plus or minus 8).

Therefore, it is a possibility that on any given day during the construction phase of the Project, 5 to 21 people might use one of the three marinas and moorage facilities or that each facility might receive one additional request for service fuel per hour (based on an eight-hour day). It is estimated that the existing marinas and moorage facilities will be able to accommodate this level of additional potential demand stemming from the Project.

Summary

Project residual effects on marinas and moorage facilities will be strongly restricted as a result of no businesses currently offering rental boats for hire. Instead, Project workers are more likely to participate in guided tours, which will increase revenue generated for multiple businesses. Daily use of marinas and moorage facilities will be low in magnitude and restricted to the head of Kitimat Arm. Use by Project workers might occur as multiple irregular events during the life of the Project but will be concentrated during the construction phase. With the implementation of mitigation measures, residual effects will be eliminated or reduced to negligible levels. For example, providing input towards the creation of a water front access space that might include a boat launch is intended to improve new marine services that become available to the community. Moreover, Minette Bay Marina has sufficient capacity to accommodate the maximum estimated Project demand five times over. Moreover, it is anticipated that the existing facilities will be able to accommodate one additional visitor per hour. Consequently, there is a low likelihood of adverse effects on marinas and moorage facilities.

7.4.5.3.4 Determination of Significance for Effects on Marinas and Moorage Facilities

Project residual effects on marinas and moorage facilities will not result in a persistent decrease in the level of services provided to the community. Residual effects on marinas and moorage facilities will be low in magnitude, restricted to the head of Kitimat Arm, and occur as multiple irregular events in an area

with moderate resilience. Residual effects will be reversible at the end of the Project lifecycle. Overall, mitigation measures will reduce competition for moorage in Kitimat by managing demand and increasing supply. As a result, the Project's effect on marinas and moorage facilities is assessed as not significant.

7.4.5.4 Summary

The LNG facility will have neutral to positive effects on marine navigation at the head of Kitimat Arm. Overall, the marine terminal will be smaller than the existing terminal resulting in less of the navigable channel being occupied. Minimum safety zones from each berth will promote safety but will not interfere with navigation. Consequently, there is a low likelihood that adverse residual effects will develop; therefore, they are assessed as not significant.

Demand on marinas and moorage facilities might increase by a maximum of 1,855 annual user days, with an average of 13 daily users during the construction phase. Use by Project workers might occur as multiple irregular events during the life of the Project, but will be concentrated during the construction phase because that phase will have the largest workforce. Minette Bay Marina has sufficient capacity to accommodate the Project demand five times over (not including the proposed expansion of MK Bay Marina). The mitigation measures, including providing input towards the creation of a new marine access space, will help to eliminate or reduce potential adverse effects to negligible levels. Consequently, potential Project residual effects on marinas and moorage facilities are assessed as not significant.

7.4.6 Assessment of Residual Effects from Shipping

7.4.6.1 Analytical Methods

7.4.6.1.1 Analytical Assessment Techniques

Potential effects on marine fisheries and shoreline harvesting are assessed by evaluating the potential for Project shipping traffic or their wakes to either interfere with access to fishing or harvesting grounds, or to damage fishing gear. The assessment begins with determining where two conditions are met: fishing grounds overlap with the shipping corridor and the local fishing practices—the gear or techniques used. It is these areas of overlap that could be disrupted by shipping traffic. For example, in some circumstances the fishing grounds may appear to overlap with the shipping corridor (e.g., the fisheries for sea cucumbers, urchins, and geoducks), but because the fishery uses divers to collect the catch and because diving occurs close to shore in relatively shallow waters well away from the marine access route, shipping traffic will not interfere with several fisheries. Similarly, a fishery might implement practices, such as setting gear in certain habitat types that do not exist along the marine access route, which precludes interactions with shipping traffic. For fisheries where an interaction is possible, a further assessment of potential effects is provided.

Potential effects on marine recreation and tourism are assessed by evaluating the potential for shipping traffic to interfere with access to known sites or to change the quality of the recreation and tourism experience (a discussion of wake waves is included). Potential effects of shipping traffic on visual quality are assessed in Section 7.3.

7.4.6.1.2 Assumptions and the Conservative Approach

Limited information on the location of commercial, recreational, and Aboriginal fisheries; the practices of fishers; and the adaptability of the marine community to shipping will affect the precision of predicted Project effects. To compensate for potential prediction error, the assessment uses the following conservative assumptions to overstate potential Project effects:

- 350 LNG carriers; the high end estimate that 170 to 350 LNG carriers will visit the marine terminal per year.
- Commercial and Aboriginal salmon fishing occurs throughout FMAs 4 to 6, even though fishing is actually localized.
- Every low tide cycle is suitable for shoreline harvesting, even though most harvesting requires 0 m to 1 m low tides, which do not occur every day. Further, suitable harvesting times are plus or minus one hour from low tide, and likely overestimates the actual frequency and quantity of time gathering might be affected.

Shipping traffic during construction and operation are estimated to be similar, with approximately one vessel per day visiting the marine terminal. Module carriers (approximately 173 m long), break bulk carriers (approximately 194 m long), and tugs with tows (tugs will be approximately 25 m long) will be used during construction, with tugs making up approximately 80% of this traffic. Tugs are common around the port of Kitimat, and local mariners will be accustomed to their presence. Vessels might spend one to seven days working around the marine terminal before leaving. All relevant shipping mitigation measures (Section 7.4.6.2) will apply during all phases of the Project. Consequently, the assessment focuses on the operational shipping traffic because it includes a greater number of larger and less common vessel types (e.g., LNG carriers and escort tugs) and therefore has the greatest potential of all Project phases to result in adverse effects. The assessment of wake waves focuses on LNG carriers and their escort tugs.

7.4.6.2 Assessment of Potential Interference with Marine Fisheries and Shoreline Harvesting

The estimated percent increase in shipping traffic attributable to the Project during its operation phase is 172% based on the most relevant shipping data (see Section 7.4.3.2). The result of this estimated increase in shipping traffic attributable to the Project is that up to four fishing vessels might interact with Project-related shipping traffic per day (see Section 7.4.3.3 and Table 7.4-12).

These predictions are conservative because the data were collected during the busiest months of the year when the greatest number of commercial, recreational, and Aboriginal fishers are active. They also do not consider that many recreational fishers fish close to shore (while trolling for salmon, jigging for groundfish, or deploying crab traps) or in Devastation Channel (Figure 7.4-20) (Hittel 2013, pers. comm.; Hummel and Langagger 2013, pers. comm.); that is, most recreational fishers are not expected to interact with shipping traffic on a daily basis.

Table 7.4-12: Estimated Interactions with Commercial and Recreational Fishing Vessels or Gear

Traffic Section	Estimated Interactions per LNG Carrier Transit
1: Head of Kitimat Arm	0.16
2: Douglas Channel	1.24
3: Wright Sound	0.78
4: Principe Channel	0.03
5: Browning Entrance to Triple Island	0.14
Estimated interactions per transit	2.35

NOTE:
Data for all fishing vessels or gear is included.
Traffic sections are shown on Figure 7.4-7 and Figure 7.4-8.
SOURCE: see Stantec Consulting Ltd. (2014) vessel survey data for further details.

7.4.6.2.1 Description of Project Effect Mechanisms for Interference with Marine Fisheries and Shoreline Harvesting

Interference with marine fisheries and shoreline harvesting could occur either through direct LNG carrier interference with fishing vessels or their gear or through wake waves generated by LNG carriers and their escort tugs. These mechanisms are discussed below.

Displacement of Fishing Vessels Attributable to Shipping Traffic

Shipping traffic might physically displace fishing vessels engaged in fishing activities along the marine access route. This could result in lost fishing time if the gear has to be pulled in and reset. Alternatively, shipping traffic might prohibit fishers from setting gear in places that were previously accessible.

Displacement of Fishing Vessels and Shoreline Harvester Attributable to Wake Waves

Wake waves generated by LNG carriers and escort tugs might displace fishing vessels if the waves are sufficiently large to cause fishers to stop fishing. A real or perceived threat of danger is most likely to exist when fishing vessels are near to LNG carriers because wake waves are largest closest to their source. Therefore, the likelihood of adverse effects will decrease with increasing distance from LNG carriers and escort tugs. The potential for adverse wake effects is examined in light of historical records of sea conditions in Douglas Channel and Hecate Strait and information from other wake wave studies.

Displacement of shoreline harvesters could occur through the same mechanism and rationale. However, waves reaching the shore are estimated to be much smaller than those encountered by fishing vessels because the shoreline will be farther away from the wave source.

Damage to Gear from Physical Interactions with Shipping Traffic

Fishing gear could become entangled in the propeller of an LNG carrier or escort tug. Entanglement is most likely to occur with long lines and traps because they are passively fished (i.e., they are deployed and left unattended), can be hard to see, and may drift from their original locations.

Fishing gear that is actively fished, such as gill nets, purse seines, troll, and jigs, are less likely to be damaged because they can be retrieved by fishers as shipping traffic approaches.

Damage to Gear from Vessel Wake Waves

Damage to fishing gear from wake waves is assessed using historical records of sea conditions in Douglas Channel and Hecate Strait and information from other wake wave studies.

7.4.6.2.2 Mitigation for Interference with Marine Fisheries and Shoreline Harvesting (Shipping)

The following are mitigation measures to address potential effects of Project shipping traffic on marine fisheries and shoreline harvesting:

- Regular communication on Project activities will occur with marine users, including recreationalists, commercial tourism operators, CRA fishers, Transport Canada, DFO, and relevant stakeholders (Mitigation 6.2-7).
- Conduct, at a minimum, two safe-shipping workshops aimed at promoting safe navigation around shipping traffic for mariners prior to operation (Mitigation 7.4-1).
- Use escorts tugs between Triple Island and Kitimat during all LNG carrier transits (Mitigation 7.4-6).
- Project-related marine traffic including LNG carriers will use the Coast Guard Marine Communication and Traffic System (MCTS) to provide notice of planned arrival time at Triple Island, and encourage Aboriginal Groups and stakeholders to use the system to plan their routing and scheduling (Mitigation 7.3-3).
- LNG carriers will travel at speeds up to 14 knots. Speeds will vary depending on navigational safety, weather conditions, location, and marine mammal presence, and will be determined based on the judgment of the ship's master who receives advice from the BC Coast Pilots on board. Subject to navigational safety needs, in areas of high whale density between the northern end of Campania Island and the southern end of Hawkesbury Island, LNG carriers will travel at speeds of 8 or 10 knots from July through October (recognizing predicted periods of high use by marine mammals) (Mitigation 5.8-12).
- Strict adherence to the prescribed route and passing restrictions so that LNG Canada carriers may only pass other large commercial vessels in straight sections of the route (Mitigation 7.4-7).

- No planned anchoring for the LNG carriers along the marine access route (unless directed to do so by BC Coast Pilots due to weather or other unplanned conditions); LNG carriers will only be permitted to enter the marine access route if a berth at the terminal will be available (Mitigation 7.3-4).
- LNG carriers will maintain safe operating distances from other marine craft (Mitigation 7.4-8).
- LNG carrier's passage route to avoid interference with fishers, where possible, with safety being primary concern (Mitigation 7.4.-9).
- Develop and implement a Marine Activities Plan (MAP) in accordance with applicable federal and provincial legislation and regulations. The MAP will include measures to address potential effects from dredge activities, pile installation (including marine mammal exclusion zone, soft start procedures and consideration of sound dampening technologies) and shipping (Mitigation 5.8-2).

In addition to these mitigation measures, Project-related shipping will comply with all maritime regulations, including the *Canada Shipping Act, 2001,* and International Regulations for Preventing Collisions at Sea, 1972 with Canadian Modifications, and the International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978. These regulations prescribe protocols to limit the potential for loss of life at sea and to prevent pollution from entering the oceans. LNG Canada is also participating in the TERMPOL process. The recommendations resulting from this process will inform, as appropriate, the construction, operation, and decommissioning phases of the Project and will help to further reduce the potential for adverse effects on the marine transportation and use. However, because the LNG Canada TERMPOL report was not complete at the time of Application submission, it is not possible to identify its recommendations.

Two BC Coast Pilots will accompany all LNG carriers when travelling between Triple Island and the port of Kitimat, greatly enhancing the expertise and local knowledge on watch during all transits. The enhanced bridge will therefore consist of the LNG carrier captain, two BC Coast Pilots, office of the watch, and a dedicated crew member acting as lookout. Further, LNG Canada will offer two safe-shipping workshops that will help clarify expectations regarding safe navigation procedures around the marine terminal and near LNG carriers along the marine access route. During these workshops, the advantages of using AIS will be highlighted to the fishing and small vessel operators. Collectively, these measures will reduce residual effects during all phases of the Project to manageable levels by implementing the safest possible shipping practices and promoting effective communication between fishers, LNG carrier operators, LNG Canada, and other relevant parties (for further information on the safety record and history of LNG shipping around the world, see Section 10).

LNG carrier traffic will be constrained to the shipping corridor during normal operation. Therefore, LNG carrier traffic will only interact with mariners who are fishing within the marine access route. LNG carriers destined for or departing the marine terminal will travel at reduced speeds along the marine access route, up to a maximum of 14 knots, and will plan to pass other large commercial vessels only in wider areas of the route (thereby allowing large vessels to remain close to their routing in narrow and confined areas and reduce the risk of collision or grounding). LNG carriers can adjust their transit voyage to avoid bad

weather conditions in the LSA by adjusting their speed and therefore greatly reducing any need to anchor. This will also improve navigational safety during transits to Kitimat. LNG carriers and the escort tugs will be fitted with the AIS that can transmit information such as the ship's real time position, speed, direction of travel, name, cargo type, and number of persons on board. This information will be available to other vessels with an AIS receiver. Moreover, all sailings will be communicated to the MCTS, who may relay shipping information to other mariners via "Notice to Shipping" or "Notice to Mariner" when appropriate.

The marine community will have access to detailed Project transit route information that will help reduce potential conflict by improving fisher awareness and confirming the timing and whereabouts of Project LNG carriers and tug traffic. Any vessel with a marine VHF radio will be able to contact the MCTS and receive up to date information regarding LNG carriers and escort tugs in the area. Safety will also be improved by the presence of two BC Coast Pilots onboard, who will provide local knowledge of the waterways, in addition to an escort tug that will provide immediate assistance to the LNG carrier in the event of an emergency. Up to four tugs will be available for berthing the LNG carrier at the marine terminal.

Finally, a particularly important mitigation measure will be regular communication with commercial, Aboriginal and recreational fishers (including guided anglers), DFO, Transport Canada, and other relevant parties to discuss fisheries related concerns. The goal will be create a forum to discuss and find solutions to fisheries-related issues. Collectively, these mitigation measures will promote safe, efficient, and profitable fishing while developing a safe, reliable, and efficient shipping industry in Kitimat.

7.4.6.2.3 Characterization of Interference with Marine Fisheries and Shoreline Harvesting

Displacement of Fishing Vessels Attributable to Shipping Traffic

Fishing activities that do not overlap with the marine access route (or have extremely small areas of overlap) will not be adversely affected by Project shipping traffic. For commercial fisheries, this includes Dungeness crab trap, shrimp trawl, and groundfish trawl fisheries (Figure 7.4-15, Figure 7.4-17, and Figure 7.4-18). For recreational and guided angling, this includes crabbing and prawning sites (Figure 7.4-20). Table 7.4-13 summarizes commercial, recreational, and Aboriginal fisheries that might interact with the Project based on overlap of fishing grounds with the shipping corridor and the fishing practices used.

For some other fisheries, the gear or practices used preclude interference from LNG carrier. For example, those fisheries that use scuba divers to collect the catch, which by necessity operate in shallow water, will not interact with shipping traffic, which will necessarily operate in parts of the channel that are deep and unused by divers. As a result, commercial, recreational, and Aboriginal fisheries for geoduck clams, red sea urchin, sea cucumbers, and octopus will not be affected by Project shipping. It is also unlikely that recreational fishing for crabs will be affected because they are not fished along the shipping corridor (i.e., crabs traps are usually deployed near shore in shallow water; Marine Community Consultation 2013a, 2013b, 2014, pers. comm.), which is inaccessible by an LNG carrier because of its draft restriction.

Table 7.4-13: Summary of Assessment on Potential Displacement of Fisheries

Fishery	Fishing Grounds Overlap with Shipping Corridor	Fishing Gear or Practices Enable Interaction	Interaction Possible
Commercial and Aboriginal			
Salmon	Yes	Yes	Yes
Pacific herring	Yes	No	No
Geoduck clams	Yes	No	No
Red sea urchins	Yes	No	No
Pacific halibut	Yes	Yes	Yes
Dungeness crab	No	Yes	No
Sea cucumbers	Yes	No	No
Prawns and shrimps	Yes	No	No
Groundfish	Yes	Yes	Yes
Octopus	Yes	No	No
Recreational and Guided Angling			
Salmon	Yes	Yes	Yes
Crab	No	No	No
Prawns and shrimps	No	No	No
Groundfish	Yes	Yes	Yes

Some fisheries will not interact with shipping traffic as a result of specific practices or techniques that preclude interactions. For example, the commercial and Aboriginal Pacific herring roe and spawn-on-kelp fisheries target herring that aggregate in shallow bays and inlets as they prepare to spawn and consequently do not fish along the shipping corridor (DFO 2013c; Marine Community Consultation 2014, pers. comm.; Metlakatla Community Engagement 2014, pers. comm.). Therefore, no interaction will occur with these fisheries. There are two remaining herring fisheries: bait and special use. However, in FMAs 4 to 6, these fisheries are very small or are prohibited such that only minimal interactions, if any, are expected. The mitigation measures will further reduce residual effects.

Local prawn fishing practices reduce the potential for displacement by shipping traffic because gear is generally placed at the interface of steep fjord walls and the seafloor (Marine Community Consultation 2013a, 2013b, 2014, pers. comm.). These areas are typically found close to shore and are not located along the shipping corridor. Hence, commercial, recreational, and Aboriginal prawn fishing (using traps) will not interact with shipping traffic.

The remaining fisheries where an interaction might occur include halibut, other groundfish, and salmon.

Halibut and Other Groundfish

Commercial and Aboriginal fisheries for halibut and other groundfish make use of long-line gear. The gear consists of a main line with two floats, two anchors, and several hundred baited hooks attached. When deployed, the gear makes the shape of a “U” as a result of the floats marking the two ends at the surface

and the anchors separating the bottom line with hooks attached. The hooks are baited and left submerged for several hours at a time. One unit of this gear is called a "skate," with floats separated by approximately 400 m. In most cases, halibut fishers avoid the shipping corridor and are not expected to interact regularly with shipping traffic (Marine Community Consultation 2013b, 2014, pers. comm.). Because long-line gear is completely submerged (except for the two lines extending to the surface), simple precautions will enable fishing anywhere along the marine access route. For example, gear can be deployed and retrieved when the area is clear of traffic and will not become entangled so long as the surface floats are not placed directly in the shipping corridor. This can be achieved by deploying multiple connected skates of gear such that shipping traffic can pass between the floats. This scenario would also apply to commercial crab and prawn gear, which make use of similar setups (but use traps rather than hooks).

A large portion of the recreational groundfish fishing locations exist outside the shipping corridor (Figure 7.4-20). However, some overlap occurs, but temporary disturbances will only affect fishers that are fishing directly in the shipping corridor. Recreational anglers generally target groundfish by jigging with heavy-duty rods and reels. Displacement would occur for 15 minutes or less as the LNG carrier passes. In the interim, anglers will be able to move out of the way and continue fishing at a nearby site, with the option of returning to their original site after the LNG carrier passes.

Salmon

The extent of the commercial, recreational, and Aboriginal salmon fisheries is difficult to quantify and is therefore assumed to occur throughout the entire extent of FMAs 4 to 6. Commercial and Aboriginal fisheries are assessed together because they use similar gear types and practices (Metlakatla Community Engagement 2014, pers. comm.). Salmon fishing vessels might be forced to stop fishing and retrieve their gear as result of LNG-related shipping traffic. Consequently, fishing time might be reduced. For example, a seine vessel or gill netter might lose 30 minutes of fishing time if resetting of gear is required. A worst-case and unrealistic scenario would have a fishing vessel losing one hour each day (as a result of two LNG transits). Calculations using DFO catch statistics reveal that potential average annual losses for commercial or Aboriginal fisheries will be low magnitude and are will not affect the viability of salmon fishing operations. However, it is far more likely that salmon fishers will not have to stop fishing with the implementation of the mitigation measures and that no fishing time or revenue will be forfeit. Specifically, the Mitigation 7.3-3 (or the use of the free ShipFinder smartphone application) will allow fishers to plan their fishing activities and anticipate the arrival of oncoming traffic such that lost time can be limited or eliminated.

Recreational Salmon Fishing

Although primary research revealed that most recreational salmon fishing locations do not overlap with the marine access route (Marine Community Consultation 2013a, 2013b, 2014, pers. comm.; Figure 7.4-20) because fishing boundaries are fluid, potential issues are briefly discussed. Recreational salmon fishers usually troll, fishing close to shore. This is a technique whereby lures are dragged from the boat as it moves ahead at a slow speed. Consequently, displacement by shipping traffic is not likely because

fishers can easily continue fishing while moving onto and off of the shipping corridor as LNG carriers pass by. Consequently, implementation of mitigation measures and minor adjustments by recreational salmon fishers can easily eliminate or reduce to negligible levels potential effects.

Displacement of Fishing Vessels Attributable to Wake Waves

LNG carrier or escort tug wake waves would only be expected to displace fishing vessels if the height of the waves generated are substantially larger than what is normally experienced with weather waves along the marine access route because most vessels are not operating at or near to their operational limits (i.e., in sea conditions that could compromise the vessel's ability to navigate safely).

While there is currently a lack of empirical evidence that can be used to estimate the wake wave heights from LNG carriers and escort tugs, numerous studies provide evidence that wake waves will not be substantially larger than what is normally experienced with weather waves along the marine access route.

Fisheries and Oceans Canada operate two weather buoys. One is stationed in Douglas Channel at Nanakwa Shoal, and a second is stationed in south Hecate Strait. The average natural wave height in Douglas Channel and in Hecate Strait is 0.14 m and 1.8 m, respectively. The maximum wave heights for any given month are also determined and are between 0.71 m to 3.36 m in Douglas Channel and 5.84 m to 13.70 m in Hecate Strait, with rougher seas generally occurring during the winter (see Section 7.4.3.3).Therefore, during the "calmest" months, wave heights are estimated to reach 0.71 m in Douglas Channel.

Pullar and Single (2009) analyzed the wake wave heights of commercial shipping traffic travelling in the Lower Otago Harbour in New Zealand using photographic records. The largest single wake wave observed was approximately 0.35 m in height and was observed from a container ship (with capacity for 4,100 containers) travelling at approximately 9.6 knots. The vessel was 268 m long and had a draft of 11.3 m and a cargo rating of 53,452 DWT (Pullar and Single 2009). A second study made observations of fast ferries travelling between Estonia and Finland and recorded a maximum wake wave height of 0.98 m from a ferry travelling at approximately 28 knots. The ferry was approximately 177 long, 28 m wide, and had a reported draft of 7 m (Kurennoy et al. 2009). From these observations it is assumed that the wake waves generated by LNG carriers and escort tugs will be between 0.35 m to 0.98 m in height. But, because LNG carriers will travel much slower compared to the fast ferries (e.g., at speeds between 9 knots to 14 knots) and will have a different hull design, their wake waves will likely be closer to 0.35 m in height (Jonason 1993; Sorensen 1997; Ellis et al. 2005; Pullar and Single 2009).

Moreover, the average width and depth of the channel along the marine access route are greater than those in the Lower Otago Harbour; therefore, the wake wave heights recorded by Pullar and Single (2009) are expected to be conservative (e.g., on the larger side). In other words, the same vessel travelling along the marine access route to Kitimat is estimated to generate a smaller wake than in Otago Harbour as a result of the channel being much deeper and wider (Jonason 1993; Sorensen 1997; Ellis et al. 2005; Pullar and Single 2009). In addition to smaller waves being generated, a larger channel will allow vessels to pass each other at a greater distance resulting in smaller wake waves being experienced by each vessel (because of the dissipation of wave energy as the wave travels away from the source

(Jonason 1993; Sorensen 1997; Ellis et al. 2005; Pullar and Single 2009). Wake waves will continue to decrease in size until they reach the shoreline.

The smallest maximum naturally occurring wave height recorded by the weather buoy in Douglas Channel was 0.71 m and is approximately twice as large as the estimated wake waves from LNG carriers and escort tugs. However, the size of wind waves observed most months (9 out of 12) are an order of magnitude larger (e.g., 1.0 m high or greater; see Section 7.4.3.3). Consequently, shipping traffic will not generate waves that are substantially larger than what occurs naturally along the marine access route.

Given the background sea conditions and the presence of commercial shipping traffic in the region for over 50 years, mariners will be accustomed to dealing with vessel wake similar to that which will be generated by LNG carriers. For example, other large craft, such as ore carriers, bulk carriers, ferries, and cruise ships use the area (MCTS 2014; Stantec Consulting Ltd. 2014). Therefore, the wake waves created by Project shipping will not pose a safety risk to typical commercial, recreational, Aboriginal, or charter fishing vessels operating in the area and will, therefore, not disrupt access to fishing locations. Regardless, LNG Canada is undertaking an additional wake wave study to inform possible mitigation measures, but the results of this study were not available at the time of Application submission.

Displacement of Shoreline Harvesters Attributable to Wake Waves

Only clam and seaweed harvesting locations that are exposed to the marine access route (i.e., that are not sheltered from wake waves by islands) will potentially be affected by shipping traffic wake waves. With respect to Haisla Nation, approximately 83% of the wa'wais used for harvesting clams, cockles, or mussels are partially or completely sheltered from wake waves and are therefore not expected to be affected beyond negligible levels by wake waves. Similarly, many of the harvesting sites identified by Metlakatla First Nation and Kitselas First Nation during community engagements and from DFO datasets are sheltered from wake waves (Section 7.4.3.2.3). Consequently, relatively few sites (17% of the sites used by Haisla Nation as reported in Powell [2013]) are expected to be affected by the Project as a result of being at least partially sheltered (Section 7.4.3.2.3).

Further, potential interference with shoreline harvesters would only occur during a portion of a transit because it must coincide with the timing of one of the two daily low-tide cycles and the presence of a harvester. Low tides suitable for harvesting are conservatively assumed to be plus or minus one hour from any low-tide time and, therefore, occur less than 20% in each 24-hour period. This means that 80% of the time, shipping traffic cannot interact with shoreline harvesters. For the times where it does, wake waves generated by Project LNG carriers are estimated to be approximately half the size of the smallest maximum monthly wave height (e.g., 0.71 m) and will be, therefore, well within the range of naturally generated wind waves. The size of waves experienced by shoreline harvesters will be even smaller because wave energy (and height) will decrease as the wave travels to shore. Consequently, shoreline harvesters are expected to be accustomed to dealing with waves of this size and shipping traffic will not cause a substantial disturbance. Finally, many of the mitigation measures, including communication with the MCTS and potential release of "Notices to Shipping" by the Coast Guard and the fact that ships will travel at reduced speeds, will reduce to negligible levels potential residual effects on shoreline harvesters.

Damage to Gear from Physical Interactions with Shipping Traffic

Damage to fishing gear could occur if traps, long line, and seine or gill nets are set directly in, or drift into, the shipping corridor and are not retrieved before an LNG carrier transits the area. However, for most fisheries, entanglement is not likely to occur because the fishing grounds do not overlap with the shipping corridor, the type of gear used precludes interactions, or the fisheries are conducted in ways that strongly reduce the potential for entanglement (see Table 7.4-13). Fisheries and gear types that might reasonably become entangled are discussed. These include prawn trap, groundfish long line, and salmon fishing gear.

Long line and prawn gear is not generally used along the shipping corridor (Marine Community Consultation 2013a, 2013b, 2014, pers. comm.; Figure 7.4-13). Only in rare circumstances might lines drift into the shipping corridor and potentially be damaged. In these instances, LNG Canada will work with the affected fisher(s) as a mediator between the vessel owner and affected fisher to find an appropriate solution. This applies to commercial, recreational, and Aboriginal fishers alike.

Gill nets and purse seines are the predominant gear types used by commercial and Aboriginal fishers to catch salmon in FMAs 4 to 6. Recreational fishers generally troll for salmon. Purse seines and gill nets are both actively fished, but gill nets must remain in the water, floating at the surface for several hours before being retrieved. Consequently, it is unlikely that purse seines could accidently become entangled with shipping traffic because seine fishers will be onsite and capable of retrieving their nets if required. Alternatively, LNG carriers might be able to maneuver around active seine fishers in some instances. Gill nets are also actively fished, and it is a legal requirement for fishers to remain near their nets (Marine Community Consultation 2014, pers. comm.); therefore, they can be retrieved if necessary. As a result, damage to purse seines and gill nets from entanglement with Project LNG carriers is not expected. However, in the unlikely event that an incident does occur, LNG Canada will mediate between the LNG carrier operator and the affected fisher(s) to determine an appropriate resolution. This applies to commercial and Aboriginal fishers.

Because recreational salmon fishers usually troll and will therefore be moving ahead at a slow speed, damage to gear is extremely unlikely because fishers can easily move off the shipping corridor before traffic gets too close. Consequently, entanglement with troll gear is not expected.

Finally, all fishers will be able to request a shipping update from the MCTS using a VHF radio. Moreover, other vessels using AIS or the free ShipFinder smartphone application will have access to detailed shipping information. Avoiding adverse interactions will rely on communication so that all mariners are aware of the activities occurring along the marine access route, including providing LNG Canada with important fishing updates. LNG Canada is confident that the mitigation measures will be effective at eliminating or reducing the occurrence of damaged fishing gear to negligible levels.

Damage to Gear From Vessel Wake Waves

Damage to fishing gear from wake waves is not expected. Wake waves from Project LNG carriers are estimated to be relatively small compared to the range of naturally occurring waves in the region.

Summary

During operation at full build-out, the Project will result on average in two LNG carrier and escort tug transits per day (one inbound and one outbound). Although shipping traffic along the marine access route might increase by approximately 172%, transits will be relatively brief, will be restricted to the LSA, and will occur on a regular schedule; effects will be reversible upon decommissioning of the Project. LNG carriers will travel using a well-established route that has moderate resilience to increased shipping activities and that is not heavily fished. With implementation of mitigation measures, there is low likelihood that Project shipping will restrict access to fishing grounds, damage fishing gear, or affect shoreline harvesters. Regular communication between LNG Canada and commercial and recreational fishers (including guided anglers), DFO, Transport Canada, and other relevant parties will help to identify emerging issues that were not anticipated at the onset of the Project.

7.4.6.2.4 Determination of Significance for Interference with Marine Fisheries and Shoreline Harvesting

The Project will not result in a substantial and persistent decrease in fishing opportunities. Many fisheries will not interact with shipping traffic because of either the fishing grounds not being located in the shipping corridor or the use of fishing gear or practices that preclude interactions. With implementation of mitigation measures, potential interference with fishing operations will be avoided or reduced to negligible levels. Therefore, Project residual effects related to fisheries and shoreline harvesting are assessed as not significant.

7.4.6.3 Assessment of Potential Interference with Marine Recreation and Tourism

7.4.6.3.1 Project Effects Mechanisms for Interference with Marine Recreation and Tourism

The presence of LNG carriers and supporting vessels or their wakes could affect recreation and tourism by interfering with access to sites or changing the quality of, or the experience, at a site. Potential effects of shipping on visual quality, which might also change the quality of the recreational or tourist experience, are discussed in Section 7.3.

Access to sites by recreational and eco-tourism vessels might be decreased as a result of shipping traffic momentarily physically blocking the way, or if wake waves generated by the passing LNG carriers and escort tugs are perceived as a safety hazard to the recreational or tourist activity.

The quality of a recreation or tourist experience might be degraded by shipping traffic if its presence were not expected by visitors or indirectly affected other expectations for the area. For example, increased shipping traffic in an area that previously had less traffic could change the setting and potentially the experience. Shipping traffic could have indirect adverse effects if the success of wildlife viewing or fishing is reduced; these are common activities for the region.

7.4.6.3.2 Mitigation for Interference with Marine Recreation and Tourism

The following mitigation measures will reduce the potential for adverse effects on marine recreation and tourism activities:

- Conduct, at a minimum, two safe-shipping workshops aimed at promoting safe navigation around shipping traffic for mariners prior to operation (Mitigation 7.4-1).
- Provide input, with other industry and the municipal government, into the creation of a waterfront access space (that may include a public boat launch) for the community (Mitigation 7.4-5).
- Regular communication on Project activities will occur with marine users, including recreationalists, commercial tourism operators, CRA fishers, Transport Canada, DFO, and relevant stakeholders (Mitigation 6.2-7).

Implementation of the recommendations resulting from the LNG Canada TERMPOL report (not yet completed) will also reduce the potential for adverse effects. Collectively, these mitigation measures will promote safe, sustainable, and enjoyable recreation, eco-tourism, and guided angling operations.

7.4.6.3.3 Characterization of Interference with Marine Recreation and Tourism

Physical Displacement Attributable to Shipping Traffic

Most sites used by eco-tourism and guided angling outfitters occur close to shore or in bays or inlets (i.e., not mid-channel), and do not overlap with the shipping corridor (Figure 7.4-20 and Figure 7.4-22). These areas will not be directly affected by Project shipping. Moreover, interviews with business operators in the LSA indicate that they use a broad area and are not necessarily dependent on a single site. The LSA represents just a small part of a wide regional area used by marine tourism and recreation operators, with many of these areas not located directly along the shipping corridor.

Recreation and tourism sites most often referred to during consultation were three natural hot springs (Weewanie, Shearwater, and Bishop Bay/Monkey Beach Conservancy) (Hummel and Langagger 2013, pers. comm.; Parsons 2013, pers. comm.; Wakita 2013, pers. comm.; Walker and Peacock 2013, pers. comm.). These sites occur outside the LSA and will not be affected by Project activities. Most recreational dive sites and anchorages also occur outside the LSA and will not be affected by Project-related shipping. Devastation Channel is an important boat route used by up to 90% of local traffic (Parsons 2013, pers. comm.) because of its sheltered nature (Hittel 2013, pers. comm.; Walker and Peacock 2013, pers. comm.). It is outside the LSA and will not be affected by Project shipping. However, some kayaking and recreational boating routes intersect the marine access route. For example, a high use sea kayaking route intersects the marine access route in Wright Sound. However, this area is a known traffic node (Enbridge Northern Gateway Project 2010b), and kayakers are expected to be familiar with shipping traffic and the proper procedures for navigation and maneuvering around large vessels. The shipping traffic industry is also fully aware of the need to exercise caution at this junction.

For other sites that do exist along the marine access route, interference will be minimal. Recreational and charter vessels pursuing fishing, sightseeing, or wildlife viewing might be temporarily delayed while an

LNG carrier and escort tug pass by, with relatively short delays if a vessel had to wait for an LNG carrier to pass by before proceeding. However, the boats used for eco-tourism or guided angling will generally have sufficient horsepower to pass across the path of an LNG carrier quickly and safely and would not be delayed. Moreover, most mariners will be accustomed to dealing with shipping traffic (Hittel 2013, pers. comm.; Marine Community Consultation 2013b, 2014, pers. comm.) because industrial shipping has occurred since the 1950s (Enbridge Northern Gateway Project 2010b). Two additional transits per day along the marine access route will not create a large disturbance, given the historical context of the route.

Interactions between LNG carriers and other marine traffic will occur infrequently. Primary research conducted by LNG Canada in the LSA indicates that up to four recreational vessels will be encountered per LNG transit, with most vessels being encountered near Douglas Channel and Wright Sound. Estimated encounter rates for other sections of the route are very low (Table 7.4-14) (see Section 7.4.6.2 for details on the methods). Moreover, these data were collected during the high-season (summer) and therefore provide conservative predictions. LNG Canada is confident that the mitigation measures will reduce residual effects on recreation and tourism to negligible levels.

Table 7.4-14: Estimated Interactions with Recreational Vessels

Traffic Section	Estimated Interactions per LNG Carrier Transit
1: Head of Kitimat Arm	0.11
2: Douglas Channel	2.5
3: Wright Sound	0.94
4: Principe Channel	0.26
5: Browning Entrance to Triple Island	0.13
Estimated Interactions per Transit	3.94

NOTE:
Non-fishing recreational power and sail vessel data were used.
Traffic sections are shown on Figure 7.4-7 and Figure 7.4-8.
SOURCE: see Stantec Consulting Ltd. (2014) vessel survey data for further details.

Displacement by Wake Waves

Given that the wake waves generated by LNG carriers and their escort tugs (travelling at up to 14 knots) are estimated to be well within the range of naturally generated wind waves in the region, vessels used for recreation and tourism are expected to be able to safely operate in seas of this size (see Section 7.4.6.2).

Change in the Quality of the Experience

Businesses report that the primary reason people visit the region is to go saltwater fishing. Because data indicates that shipping traffic (and the associated underwater noise) does not cause substantial changes to fish or fish habitat (see Section 5.8), neither the availability of fish nor the number of tourists travelling to Kitimat to fish are expected to change as a result of the Project.

The second reported reason that people visit the region is for a wilderness experience. Business operators are concerned that increased commercial marine traffic might affect tourist perceptions of the area leading to fewer people travelling to the region to participate in eco-tourism activities. However, most businesses have been operating alongside fluctuating levels of commercial shipping traffic for the past 40 years, when the eco-tourism industry started 10 years after the port of Kitimat was established. This indicates compatibility between the two industries owing to the large wilderness areas outside but near the marine access route, and that clients expect some level of shipping traffic, including tugs, cruise ships, and barges, which have been travelling along the marine access route since the 1950s. Two additional LNG carrier transits per day travelling along the marine access route are not expected to change the quality of the recreational or tourist experience. The number of visitors travelling to the region to purse eco-tourism activities is therefore not expected to change because of changes in shipping traffic.

Finally, the extent of the potential disturbance will be restricted to the established marine access route, with LNG carriers and escort tugs only visible from any location for small periods of time. Where ships remain in the line of sight, they will become hard to distinguish from the background at a distance of approximately 8 km, or after approximately 18 to 25 minutes of travel time, depending on the speed of the LNG carrier (10 knots to 14 knots). For further details regarding visual disturbance and perceptions related to shipping, see Section 7.3.

LNG Canada is confident that the mitigation measures will reduce residual effects on recreation and tourism to negligible levels.

Summary

Project residual effects from shipping on recreation and tourism will be low magnitude. Effects will occur multiple times, twice per day during the operation phase, and on set schedules along a corridor used for shipping since the 1950s. Potential residual effects will last for a medium duration in an area that has moderate resilience to increased shipping traffic and of low reliance for recreationalists and the eco-tourism industry. Mitigation measures such as the safe-shipping workshops, among others, will be important for clarifying expectations regarding navigation around the marine terminal and near LNG carriers. Collectively, these mitigation measures will eliminate or reduce potential effects on recreation and tourism to negligible levels.

7.4.6.3.4 Determination of Significance for Interference with Marine Recreation and Tourism

The Project will not result in a substantial and persistent decrease in recreation or tourism opportunities or quality of experience. In addition, the Project will not reduce access to important sites or routes (e.g., kayaking and boating routes, anchorages, scuba dive and fishing sites), nor change the quality of experience available to residents and tourists alike. The port of Kitimat has existed since the 1950s, and most visitors have been exposed to fluctuating levels of shipping traffic. Most recreation and tourism sites exist outside the LSA and will not be affected by Project activities. The quality of experiences and perceptions of the area are not expected to change with two additional LNG carrier transits along the access route per day. Consequently, Project residual effects related to recreation and tourism are assessed as not significant.

7.4.6.4 Summary

Shipping activities will have minimal effects on marine fisheries and shoreline harvesting. Overall, while Project shipping activities are estimated to increase traffic by two transits per day, because most fishing grounds do not overlap with the shipping corridor or fishers use gear that precludes interference (e.g., where scuba divers are used), the likelihood of adverse effects is low. Therefore, increases in shipping traffic will not adversely affect marine fisheries or shoreline harvesting.

Marine recreation and eco-tourism businesses in Kitimat have always operated alongside fluctuating levels of commercial shipping traffic along the marine access route. The persistence of the industry suggests that clients are accustomed to passing ships and accept the presence of industry and associated shipping traffic. Moreover, most areas used for recreational activities or by tour operators are not located on the marine access route and will not be affected by the Project. Finally, implementation of the mitigation measures will effectively reduce residual effects to acceptable levels.

7.4.7 Summary of Project Residual Effects

Overall, the marine terminal will be smaller than the existing terminal, with portions of the surrounding water becoming deeper. These changes will have a neutral to positive effect on marine navigation around the terminal area. During construction of the Project, annual demand on marinas and moorage facilities might increase by up to 1,855 user days. However, given the limited number of boats available for hire, use of a work schedule, distances to some of the marinas, and the other mitigation measures in Section 7.4.5.3 (including providing input towards the creation of a marine access space complete with boat launch), Project residual effects on marinas and moorage facilities are assessed as not significant (Table 7.4-15).

While Project shipping activities are estimated to increase annual marine traffic by an average of two transits per day, most fisheries do not overlap with the marine access route or the gear or practices used preclude interactions with shipping traffic. Mitigation measures are designed so that boat-based fishing and shoreline harvesting opportunities are not compromised. Eco-tourism businesses have always operated alongside fluctuating levels of commercial shipping traffic, indicating that clients are accepting of passing ships. Moreover, many areas used for recreational activities and by tour operators are not located on the marine access route and will not be affected by the Project. Overall, implementation of the mitigation strategies will reduce residual effects to negligible levels. Therefore, all residual effects are assessed as not significant (Table 7.4-15).

Table 7.4-15: Residual Effects: Marine Transportation and Use

Project Phase	Mitigation Measures	Residual Effects Rating Criteria						Likelihood of Residual Effects	Significance	Prediction Confidence	Follow-up and Monitoring
		Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Context				
Facility Works and Activities											
Interference with marine navigation: Construction of the marine terminal, including safety zones, may interfere with navigation											
Construction	Mitigation 6.2-7 Mitigation 7.3-3 Mitigation 7.4-2 Mitigation 7.4-3 Mitigation 7.4-4	L	T	MT	C	R	L/H	L	N	M	None
Operation		NA	NA	NA	NA	NA	NA	NA	NA	NA	
Decommissioning		L	T	MT	C	R	L/H	L	N	M	
Residual effects for all phases		L	T	MT	C	R	L/H	L	N	M	
Effects on marinas and moorage facilities: Project may create increased demand on marinas and moorage facilities											
Construction	Mitigation 7.4-5	L	LSA	MT	MI	R	H/M	L	N	M	None
Operation		L	LSA	MT	MI	R	M/M	L	N	M	
Decommissioning		N	LSA	MT	MI	R	L/H	L	N	M	
Residual effects for all phases		L	LSA	MT	MI	R	M/M	M	N	M	

Project Phase	Mitigation Measures	Residual Effects Rating Criteria						Likelihood of Residual Effects	Significance	Prediction Confidence	Follow-up and Monitoring
		Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Context				
Shipping Activities											
Interference with Marine Fisheries and Shoreline Harvesting: Increased vessel traffic may affect commercial, recreational, and Aboriginal fisheries											
Construction	Mitigation 5.8-2 Mitigation 5.8-12 Mitigation 6.2-7 Mitigation 7.3-3 Mitigation 7.3-4 Mitigation 7.4-1 Mitigation 7.4-2 Mitigation 7.4-3 Mitigation 7.4-4 Mitigation 7.4-7 Mitigation 7.4-8 Mitigation 7.4-9	L	LSA	MT	MI	R	M/M	L	N	M	None
Operation		L	LSA	MT	MR	R	M/M	M	N	M	
Decommissioning		L	LSA	MT	MI	R	M/M	L	N	M	
Residual effects for all phases		L	LSA	MT	MR	R	M/M	L	N	M	
Interference with recreation and tourism: Increased shipping traffic might affect existing marine recreation and tourism activities											
Construction	Mitigation 6.2-7 Mitigation 7.4-1 Mitigation 7.4-5	L	LSA	MT	MI	R	M/M	L	N	M	None
Operation		L	LSA	MT	MR	R	M/M	M	N	M	
Decommissioning		L	LSA	MT	MI	R	M/M	L	N	M	
Residual effects for all phases		L	LSA	MT	MR	R	M/M	L	N	M	

KEY

MAGNITUDE:

N = Negligible—no appreciable change given background conditions; character of the VC remains unchanged

L = Low—small change relative to background conditions; character of the VC remains largely unaltered

M = Moderate—moderate change relative to background conditions; character of the VC has been moderately altered

H = High—large change relative to background conditions; character of the VC has been substantially altered

GEOGRAPHIC EXTENT:

T = Marine terminal—effects restricted to the marine terminal and the waters immediately surrounding the facility

LSA—effects restricted to the LSA

RSA—effects restricted to the RSA

DURATION:

ST = Short-term—effects are persistent no longer than the Project construction phase

MT = Medium-term—effects are persistent for up to 10 years after construction

LT = Long-term—effects are persistent more than 10 years after construction

P = Permanent—effects occur in perpetuity

FREQUENCY:

S = Single event—occurs once

MI = Multiple irregular events (no set schedule)—occurs sporadically at irregular intervals throughout the construction, operation, or decommissioning phases

MR = Multiple regular events—occurs on a regular basis and at regular intervals

C = Continuous—occurs continuously throughout the life of the Project

REVERSIBILITY:

R = Reversible—effects can be reversed

I = Irreversible—effects cannot be reversed

SIGNIFICANCE:

S = Significant

N = Not Significant

CONTEXT:

L = Low reliance—area has low importance relative to others

M = Medium reliance—area has medium importance relative to others

H = High reliance—area has high importance relative to others

L = Low resilience—refers to the inability to incur a small disturbance without adverse effects

M = Moderate resilience—refers to the ability to incur a medium size disturbance without adverse effects

H = High resilience—refers to the ability to incur a large disturbance without adverse effects

PREDICTION CONFIDENCE:

Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation, and assumptions made.

L = Low level of confidence

M = Moderate level of confidence

H = High level of confidence

LIKELIHOOD OF RESIDUAL EFFECTS OCCURRING:

Based on professional judgment

L = Low probability of occurrence—low likelihood of the residual effect occurring based on the potential Project interactions, mechanisms, and mitigation measures

M = Medium probability of occurrence—a medium likelihood the residual effect occurring based on the potential Project interactions, mechanisms, and mitigation measures

H = High probability of occurrence—a high likelihood the residual effect occurring based on the potential Project interactions, mechanisms, and mitigation measures

NA = Not Applicable

7.4.8 Assessment of Cumulative Effects

Cumulative effects are considered for each Project residual effect. Three stages are involved: (1) establishing context by providing an overview of the cumulative effects of other projects and activities on the marine transportation and use; (2) determining the potential for Project residual effects to interact with the effects of other projects and activities; and if the Project does interact cumulatively with other actions, (3) if the Project does interact cumulatively with other projects and activities, assessing the significance of the resulting overall cumulative effect, and characterizing the Project's contribution to the change in cumulative effects. All potential effects (even those scored as Rank 1) are considered in the assessment of cumulative effects.

7.4.8.1 Stage 1, Cumulative Effects context

Past, present, and future project activities within the marine transportation and use RSA include developments of shoreline infrastructure and associated shipping activities. These activities have the potential to result in cumulative effects on marine use and transportation. Table 7.4-16 summarizes past, present, and reasonably foreseeable projects and activities, and shipping traffic at the port of Kitimat. Additional information on the historical context and current conditions at the port of Kitimat, and along the marine access route are provided in Section 7.2.3.

Table 7.4-16: Summary of Past, Present, and Reasonably Foreseeable Projects

Project	Location	Project Type	Status	Estimated Maximum Number of Vessels per Year	Maximum Annual Export Capacity
Kitimat Area Project/Facility					
Coastal GasLink Pipeline Project [a]	Dawson Creek to Kitimat	Natural Gas Pipeline	Proposed	N/A	N/A
Douglas Channel LNG Terminal (also known as BC LNG) [bc]	Moon Bay (near Kitimat)	LNG Plant and Terminal	Proposed	12	900,000 tonnes
Enbridge Northern Gateway Project [bd]	Edmonton to Kitimat	Oil Pipeline	Proposed	250	191.6 million barrels of oil
Former Methanex/Cenovus Terminal [ef]	NA	NA	Ongoing	8*	NA
Former Moon Bay Marina (footprint only) [f]	NA	NA	Closed	N/A	
Kitimat Clean Oil Refinery and Pipeline [bf]	Kitimat (25 km north)	Oil Refinery and Pipeline	Proposed	N/A	N/A
Kitimat LNG Terminal Project [g]	Kitimat (18 km south)	LNG Plant and Terminal	Proposed	90	10 million tonnes
MK Bay Marina [f]	Head of Kitimat Arm	Private Marina	Ongoing	N/A	N/A
Pacific Northern Gas Pipeline (includes proposed looping) [h]	Summit Lake to Kitimat	Natural Gas Pipeline	Proposed	N/A	N/A

Project	Location	Project Type	Status	Estimated Maximum Number of Vessels per Year	Maximum Annual Export Capacity
Pacific Trail Pipelines Project [i]	Summit Lake to Kitimat	Natural Gas Pipeline	Proposed	N/A	N/A
Rio Tinto Alcan Facility and Kitimat Modernization Project [j]	Kitimat	Aluminum Facility	Ongoing	80*	420,000
RTA Terminal A Extension [aa]	Kitimat	Export Terminal	Proposed	0**	N/A
Prince Rupert Areas Project/Facility					
BG Group – Prince Rupert LNG Project [l]	Ridley Island	LNG Plant and Terminal	Proposed	284	21 million tonnes
Canpotex – Potash Export Terminal [m]	Ridley Island	Potash Terminal	Proposed	150	11.5 million tonnes
Maher Terminals – Fairview Terminal Phase 2 Expansion Project [n]	Prince Rupert	Container Terminal	Ongoing	728	2 million twenty foot equivalents containers
Pinnacle Renewable Resources – Pellet Export Terminal [o]	Prince Rupert	Pellet Export Terminal	Ongoing	25	NA
Prince Rupert Grain Terminal [p]	Prince Rupert	Grain Terminal	Completed	96	7 million tonnes
Prince Rupert Port Authority – Ridley Island Road, Rail Utility Corridor [q]	Prince Rupert	Container Terminal	Ongoing	N/A	N/A
Progress Energy – Pacific Northwest LNG Project [r]	Lelu Island (south of Prince Rupert)	LNG Plant and Terminal	Proposed	350	19.2 million tonnes
Ridley Terminal Inc.[p]	Ridley Island	Coal Terminal	Ongoing	176	24 million tonnes
Spectra Energy – Natural Gas Pipeline [s]	Northeast BC – Prince Rupert	Natural Gas Pipeline	Proposed	N/A	N/A
TransCanada Corporation – Prince Rupert Gas Transmission Project [t]	Hudson Hope – Prince Rupert	Natural Gas Pipeline	Proposed	N/A	N/A
Watco – Watson Island Re-Development [u]	Watco Island	Industrial Port	Proposed	NA	2.5 million tonnes of total product
Terrace Area Project/Facility					
Galore Creek Copper-Gold-Silver Project [c]	Wrangell, Alaska (transported through Stewart, BC)	Mine	On Hold	N/A	N/A
KSM (Kerr-Sulphurets-Mitchell) Project [c]	Steward (65 km north)	Mine	Proposed	N/A	N/A
Brucejack Gold Mine Project [v]	Steward (65 km north)	Mine	Proposed	N/A	N/A
Kitsault Mine Project [w]	Prince Rupert (145 km northeast)	Mine	Proposed	N/A	N/A
Altagas Hydro Projects (Forest Kerr, McLymont Creek, Volcano Creek) [x]	Northeastern BC	Hydroelectric Projects	Proposed /Ongoing	N/A	N/A

Project	Location	Project Type	Status	Estimated Maximum Number of Vessels per Year	Maximum Annual Export Capacity
Kinskuch Hydro Project [c]	Connects along Highway 37	Transmission Line	Proposed	N/A	N/A
Northwest Transmission Line[y]	Skeena Substation (near Terrace) to Bob Quinn Lake	Transmission Line	Ongoing	N/A	N/A
Activity					
BC Ferries [f]	NA	NA	Ongoing	225	N/A
Cruise Ships [z]	NA	NA	Ongoing	35	N/A
Forestry Activities	NA	NA	NA	NA	NA
Fisheries and Aquaculture [f]	NA	NA	Ongoing	NA	NA

NOTE:
The estimated maximum number of vessels per year is the number of vessels that will be transporting the Project's product. NA = not available. N/A = not applicable.
*All of these vessels are captured in the baseline and are not counted towards cumulative effects (see Stantec Consulting Ltd. 2014 for further details).

** No net increase in shipping traffic is expected from the extension of Terminal "A" (RTA 2014b)

SOURCE: [a]Coastal Gaslink (2012); [b] Province of BC (2013); [c] Douglas Channel LNG Project (2014); [d] Enbridge Northern Gateway Pipeline (2010a,d); [e] Kitimat Chamber of Commerce (2013); [f] Stantec Consulting Ltd. (2014); [g] BCEAO (2006) [h] BCEAO (2013b); [i] BCEAO (2008);[j] RTA (2014a); [k] Arthon Industries Ltd (2014); [l] AECOM (2013); [m] Stantec (2011); [n] BC EAO (2012); [o] Golder Associate (2012); [p] Prince Rupert Port Authority (2014); [q] Invest in Northwest BC (2014); [r] Stantec Consulting Ltd. (2013); [s] BCEAO (2013c); [t] BCEAO (2013d); [u] Watson Island Development Corporation (2012); [v] Rescan Environmental Services Ltd. (2013); [w] Amec (2012); [x] Altagas (2013); [y] Invest in Northwest BC (2013b); [z] Cruise Line International Association (2013); [aa] RTA(2014b)

7.4.8.1.1 Context for Potential Interference with Marine Navigation

The existing RTA facility is the only other structure at the head of Kitimat Arm that might affect marine navigation. In June 2014, RTA filed a project description with the EAO for its proposed Terminal A Extension project. That proposed project will consist of an extension of the Terminal A wharf, located on the west side of Kitimat harbour, and the replacement of the barge ramp and tug dock. The proposed terminal Extension will be 55 m wide by 230 m long and will be accessed by a 30 m wide by 105 m long trestle (RTA 2014b). The barge ramp will include an 8 m wide access trestle, and the tug dock will be on a floating pontoon. Project infrastructure will occupy 1.85 ha while an additional 10.95 ha of dredging will be required (RTA 2014b).

If built, the Terminal A Extension project will reduce the area of navigable waters within Kitimat Harbour by approximately 1.85 ha. Because the terminal extension and barge and tug berth will extend into the harbour, other marine operators will need to divert around this infrastructure if transiting along shoreline at the head of Kitimat Arm. Navigation would also be restricted during the construction of project infrastructure and dredging.

Considering its relatively small footprint, the terminal extension will occur in an area currently used for industrial shipping (by RTA) and marine transportation will not block or substantially impede other marine users in the area, that project will have low interference with marine transportation.

7.4.8.1.2 Context for Potential Interference with Marinas and Moorage Facilities

Projects approved but not yet constructed in the region will increase the population size during their construction and operation. As a result, they might contribute to cumulative effects on marinas and moorage facilities if project workers use the facilities. Potential cumulative effects are, therefore, strongly linked to the overall population size of the region (e.g., in Kitimat, Terrace, and Prince Rupert). A population projection, if all projects are built, is provided in Section 7.2.

In the marine transportation and use LSA, there are five marinas or moorage facilities, with several additional ones located outside the RSA near to Prince Rupert (Figure 7.4-26). The facilities near Prince Rupert and outside the LSA are expected to accommodate (and benefit from) additional use by workers based in Prince Rupert. Other facilities that are in the LSA are likely too far from Prince Rupert (the closest, Kitkatla, is more than 50 km away) to be used regularly by these project workers (Section 7.4.5.3). Consequently, projects in Prince Rupert are not likely to contribute to increased demand on any of the marinas and moorage facilities in the LSA. Therefore, population predictions for projects proposed for Douglas Channel are used as the basis for assessing cumulative effects on marinas and moorage facilities.

If these projects are built, the population increase might be as large as approximately 9,000 people. For further details regarding the assumptions of the population model, refer to Section 7.2. By applying the same rationale and conservative assumptions used in the assessment of marinas and moorage facilities in Section 7.4.5.3, demand might increase by a maximum of 2,700 user days per year in the Kitimat area.

There are three marinas and moorage facilities that are reasonably accessible to projects proposed for the Douglas Channel: Minette Bay Marina, MK Bay Marinas, and Kitamaat Village SCH. At present, Minette Bay Marina has over 10,000 user days of available moorage capacity, with upgrades proposed for MK Bay Marina that are expected to provide additional marine services in addition to what is already available (see Section 7.4.5.3).

7.4.8.1.3 Context for Potential Interference with Fisheries, Shoreline Harvesting, and Recreation and Tourism

Not all proposed projects (on the inclusion list) that have a shipping component are expected to contribute to cumulative effects along the marine access route. Mainly, vessels travelling to Prince Rupert will only intersect the marine access route and will not travel along its length (Figure 7.4-1). These vessels are not expected to contribute to cumulative effects. If all of the projects proposed for Prince Rupert are approved (Table 7.4-16), traffic might increase by approximately 1,800 roundtrip vessel movements annually (or roughly 3,600 one-way vessel movements; MCTS 2013). The MCTS (2013) recorded approximately 6,000 vessel movements in and out of the port of Prince Rupert in 2012 (movements were counted for the three call-in points used by vessels entering and leaving the port). Consequently, vessel traffic might

increase by approximately 60%. Vessels travelling to the port of Kitimat and included in the assessment of cumulative effects are:

- RTA facility and Kitimat Modernization Project
- RTA Terminal Expansion Project
- Kitimat LNG Terminal Project
- Douglas Channel LNG Terminal Project (also known as BC LNG)
- Enbridge Northern Gateway Project
- former Methanex/Cenovus Terminal, and
- cruise ship traffic using Principe Channel.

If all proposed projects for Douglas Channel are approved, excluding the LNG Canada Export Terminal, up to 387 additional vessel visits per year are estimated for the marine access route between Triple Island and the port of Kitimat. Consequently, without the Project, vessel traffic might increase almost threefold (590 vessel visits) when compared to the entire Kitimat time series data. However, when compared to the period of highest shipping traffic from 1987 to 1995, vessel traffic might only increase by 2.5 times. Shipping traffic travelling to Kitimat peaked in 1993 with almost 300 vessel visits in a single year (see Section 7.4.3).

Douglas Channel LNG shipping was estimated by multiplying its annual export capacity with the ratio of LNG Canada's export capacity to its shipping volume (i.e., 26 mtpa requires approximately 350 LNG carrier loadings per year, depending on the ship sizes available). All other values are taken from sources identified in Table 7.4-16.

The threshold for significant adverse effects on marine transportation and use attributable to shipping traffic is much higher than the traffic estimated if all projects are approved (i.e., 590 vessel visits per year). This determination is based on the fact that other west coast BC ports have much higher traffic levels and must also operate in confined channels shared with other boat traffic and that their surrounding areas still support viable commercial, recreational, and Aboriginal fisheries, and providing safe marine recreation and eco-tourism opportunities. For example, an average of 2,979 vessels visited Port Metro Vancouver each year during the period of 2010 to 2013 (Port Metro Vancouver 2012). Data from the MCTS confirms a high level of traffic at Port Metro Vancouver, consisting of over 50,000 vessel movements in 2013 (a vessel might make several movements in a port before leaving; therefore movements recorded by the MCTS cannot be accurately converted into number of ships but can still provide a relative indication of traffic patterns). Moreover, marine fisheries, recreation, and tourism occur near the port of Victoria, which recorded nearly 115,000 movements during the same year (MCTS 2013).

The Prince Rupert traffic zone encompasses both the ports of Kitimat and Prince Rupert, and records an average of 21,000 vessel movements per year (MCTS 2013; Stantec Consulting Ltd. 2014). If all the proposed projects near Kitimat are approved, excluding the LNG Canada Export Terminal Project, and the number of vessel movements using the marine access route between Triple Island and the port of Kitimat increases to 590 vessel movements per year (see Section 7.4.3), the number of annual vessel

movements will still be far lower than what Port Metro Vancouver experiences. These numbers indicated that traffic destined for Kitimat and along the marine access route, when all the proposed terminals are fully operational, is small by comparison. Moreover, the vessels in Vancouver operate in a region expected to have far greater unpiloted and non-reporting marine traffic, further suggesting that the threshold for significant adverse effects on marine transportation and use from shipping could be much higher than what could occur as a result of approval of all projects proposed for Kitimat and Prince Rupert.

7.4.8.1.4 Context Summary

Cumulative effects on marine transportation and use from other past, present, and reasonably foreseeable projects are low.

7.4.8.2 Stage 2, Determination of Potential Cumulative Interactions

Table 7.4-17 indicates for each potential effect whether and with which other activities or projects there is potential for the Project to contribute to cumulative effects on marine transportation and use.

Table 7.4-17: Potential for the Project Contributing to Cumulative Effects on Marine Transportation and Use

Other Projects and Activities with Potential for Cumulative Effects	Potential Cumulative Effects			
	Interference with Marine Navigation	Interference with Marine Fisheries and Shoreline Harvesting	Interference with Marine Recreation and Tourism	Change in Demand on Marina and Moorage Facilities
Kitimat Area Project/Facility				
Douglas Channel LNG Terminal (also known as BC LNG)		✓	✓	✓
Enbridge Northern Gateway Project		✓	✓	✓
Former Eurocan Pulp and Paper Co. site	✓			
Former Methanex/Cenovus Terminal	✓	✓	✓	✓
Kitimat LNG Terminal Project		✓	✓	✓
MK Bay Marina		✓	✓	✓
Rio Tinto Alcan Facility and Modernization Project	✓	✓	✓	✓
Rio Tinto Alcan Terminal A Extension	✓			✓
Activities				
BC Ferries		✓	✓	
Cruise Ships		✓	✓	
Forestry Activities		✓	✓	
Fisheries and Aquaculture		✓		

NOTES:

✓ = those 'other projects and activities' whose effects have potential to interact cumulatively with the Project's residual effects.

* These projects will be included in the cumulative assessment of social and economic VCs only.

Projects for which check marks are absent indicate that they are not expected to interact cumulatively with Project activities. As example, by nature, pipeline projects will not have a shipping component and will therefore not affect marine fisheries, recreation, or tourism. It is also expected that because pipeline construction workers will be moving as construction progresses, they will not place persistent demand on marinas or moorage facilities. As a result, pipeline projects will not interact cumulatively with the marine transportation and use. However, the marine terminal counterparts to the pipeline projects are included in the cumulative effects assessment as a result of their associated contribution to shipping traffic or potential effects on marine navigation.

7.4.8.2.1 Facility Activities and Works

Cumulative effects on marine navigation are possible if modifications to the existing terminal interact with effects on navigation resulting from adjacent existing and proposed structures (e.g., the existing RTA Wharf "A" and the proposed extension of this wharf).

Cumulative effects on marinas and moorage facilities are possible because Project activities overlap with the timing of other projects and share common interaction mechanisms (i.e., are based on population size and the proportion that pursue marine activities). Consequently, the Project might act cumulatively with other projects to increase demand on marinas and moorage facilities. However, potential effects will be restricted to marinas and moorage facilities in Kitimat because it is unlikely that workers will use facilities in Prince Rupert.

7.4.8.2.2 Shipping

Cumulative effects on marine fisheries and shoreline harvesting, and recreation and tourism are possible because Project shipping activities will occur along the same marine access route at the same time as other projects. However, potential effects from the Project will only interact in a substantial way with projects that are proposed for Kitimat Arm because vessels travelling to Prince Rupert will not use the same route. Instead, they will only cross it.

7.4.8.3 Stage 3, Determining Significance of Cumulative Effects

Marine Navigation

Cumulative effects on navigation will be low because the RTA Terminal A Extension project will occupy only a small area within Kitimat Arm and will not block or substantively impede other marine users in Kitimat Arm. Marine safety in Kitimat Harbour will be improved through the implementation of safety zones around the terminal (see Section 7.4.5.2). Moreover, because marine construction is subject to government review under the NPA (2014), with strict government regulations in place, approved works will not result in cumulative effects of concern (BCEAO 2013). Consequently, cumulative effects on marine navigation are assessed as not significant.

Marinas and Moorage Facilities

The Project construction phase might increase demand on marinas and moorage facilities by up to 1,855 user days per year (see Section 7.4.5.3). This demand will combine with that from other projects (approximately 2,700) for a total potential increase of 4,555 annual user days. Kitimat has capacity to accommodate approximately 10,000 annual user days of moorage space immediately. This moorage space is available at Minette Bay Marina, with additional space and services (e.g., fuel, camping, electricity, water) likely becoming available in the near future from the expansion of MK Bay Marina (see Section 7.4.5.3). LNG Canada will participate, along with other industry and municipal government in discussions about the creation of new water access that might include a new boat launch. This mitigation measure is intended to improve new marine services that become available to the community.

Therefore, cumulative effects from all past, present, and reasonably foreseeable projects, including the Project, will not cause a substantial and persistent decrease in the level of services provided to the community. Consequently, cumulative effects on marinas and moorage facilities are assessed as not significant, with the Project's contribution to these effects being restricted to the head of Kitimat Arm, occurring as multiple irregular events and having a negligible magnitude.

Marine Fisheries and Shoreline Harvesting

The Project could increase shipping traffic travelling to Kitimat by up to 350 LNG carrier visits per year (by a fleet of approximately 34 LNG carriers, depending upon the size available), or approximately two transits per day. This traffic will add to existing and reasonably foreseeable traffic travelling to Kitimat, which is estimated at 590 vessel visits, for a total of 940 vessel visits per year. The marine access route can safely accommodate this level of traffic because other west coast ports operate safely with similar constraints (e.g., narrow channels and presence of other recreational boats) and with commercial shipping traffic approximately three times greater than in Kitimat (Section 7.4.3.2). Commercial, recreational, and Aboriginal fishers that fish in the Kitimat region already have experience operating in areas frequented by large vessels and may be accustomed to their presence (Section 7.4.3). With implementation of the mitigation measures, LNG Canada is confident that any Project residual effects will be eliminated or reduced to negligible levels. For example, LNG carriers will travel at reduced speeds along an already established shipping route and advance notice of all shipping activities will be available to fishers via the MCTS and vice versa so that each party can plan accordingly to avoid or limit potential interference. Shipping will be conducted in the safest manner possible and according to all relevant regulations. Finally, regular communication between LNG Canada and commercial and recreational fishers (including guided anglers), DFO, Transport Canada, and other relevant parties will help to identify emerging issues that were not anticipated at the onset of the Project.

Overall, cumulative effects from all past, present, and reasonably foreseeable projects will not cause a substantial and persistent decrease in fishing opportunities. Consequently, cumulative effects on marine fisheries and shoreline harvesting are assessed as not significant. The Project's contribution will consist of two brief, scheduled transits per day along a route that has moderate resilience to increased traffic.

Marine Recreation and Tourism

Similar to fishers and shoreline harvesters, marine recreationalists and eco-tourism operators have experience navigating, sightseeing, and generally operating in areas frequented by large vessels, such that they may be accustomed to their presence. With implementation of the mitigation measures (Section 7.4.6.3), LNG Canada is confident that any Project residual effects will be eliminated or reduced to negligible levels. For example, the MCTS will be made aware of all LNG sailings so that the CCG can have discretion to release a "Notice to Shipping" or "Notice to Mariners". Contacting the MCTS will allow other users to obtain advance notice of all shipping activities so that they may plan accordingly and avoid potential interference (e.g., physical presence or potential visual disturbance). LNG carriers will travel at reduced speeds in confined waters to limit the potential effect of wake waves on access. Further, LNG Canada will offer two safe-shipping workshops before commencing the operation phase to provide guidance on safe navigation practices around the marine terminal and near LNG carriers. LNG Canada will also provide input, with others, towards the creation of a marine access space and boat launch, which is expected to benefit recreationalists and tourists alike.

Recreation and tourism in Kitimat has occurred alongside fluctuating levels of industrial shipping traffic since the 1950s. The persistence of the tourism industry suggests that operators and clients accept the presence of some industry. However, many areas used for recreational activities and by tour operators are not located on the marine access route and will not be affected by the Project. Most people do not only rely on sites located along the access route and will therefore be able to choose where the go. Tour operators might plan their trips to avoid seeing LNG carriers by planning a course away from the marine access route or timing their trip according to LNG carrier transits. This information can be obtained from the MCTS 24 hours in advance of LNG carriers arriving at Triple Island.

Overall, cumulative effects from all past, present, and reasonably foreseeable projects will not cause a substantial and persistent decrease in recreation or tourism opportunities or quality of the experience. Consequently, cumulative effects, including the Project's contribution to cumulative effects, on marine recreation and tourism are assessed as not significant. The Project's contribution will consist of two brief, scheduled transits per day along a route that has moderate resilience to increased traffic.

7.4.8.4 Summary of Cumulative Effects

At full build-out, the Project could increase shipping traffic by up to approximately 350 LNG carrier visits per year along the marine access route from Triple Island to the port of Kitimat. If this Project and all reasonably foreseeable projects are approved, approximately 940 vessel visits per year are estimated to use the marine access route. LNG Canada could therefore contribute up to approximately one third to the overall estimated marine traffic levels.

Despite a large relative increase in shipping traffic compared with current levels, cumulative effects on marine transportation and use are assessed as not significant. The increased level of shipping is not expected to result in a substantial and persistent decreased in fishing and shoreline harvesting activities due to limited spatial overlap and limited interactions between large vessel shipping and fishing/harvesting activities (see Section 7.4.6.2.3 and Section 7.4.6.2.4). As well, the cumulative change

in shipping is not anticipated to result in a substantial and persistent decrease in recreation or tourism activities, or quality of experience.

As discussed in Section 7.4.8.2 other west coast BC ports currently accommodate over three times the volume of shipping estimated in the cumulative effects case for the Project, yet support viable fisheries, and recreation and tourism opportunities in their surrounding waters. This also supports the conclusion that the volume of large vessel shipping in the cumulative effects case is below the threshold for when significant adverse effects can occur.

The Project's contribution to cumulative effects on marine transportation and use will be eliminated or reduced to negligible levels through the implementation of the mitigation measures. These measures will promote the sustainability of marine transportation and use and reduce potential effects on navigation, fisheries, recreation, and tourism. LNG Canada will communicate regularly with commercial and recreational fishers (including guided anglers), DFO, Transport Canada, and other relevant parties to discuss fisheries related concerns. Collectively, these measures, among others, will help protect the sustainability of marine transportation and use. In summary, all cumulative effects on marine transportation and use are assessed as not significant. Table 7.4-18 summarizes the cumulative effects on marine transportation and use.

Table 7.4-18: Summary of Cumulative Effects on Marine Transportation and Use

Effect	Other Projects, Activities and Actions	Cumulative Effects Characterization					
		Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Context
Cumulative Effects on Marine Navigation							
Cumulative effect with the Project and other projects, activities and actions ▪ Current and foreseeable project works will result in adverse cumulative effects on marine navigation, but which will be not significant.	▪ Rio Tinto Alcan Facility and Modernization Project ▪ RTA Terminal A Extension	L	LSA	LT	C	R	H/M
Contribution from the Project to the overall cumulative effect ▪ Project works will result in a decrease in in-water infrastructure, leading to a net increase in the navigable channel		L	LSA	LT	C	R	H/M
Cumulative Effects on Marinas and Moorage Facilities							
Cumulative effect with the Project and other projects, activities and actions ▪ A potential increase in annual user days of 4,776 is within the available capacity of marinas and moorage facilities at Kitimat.	▪ Coastal GasLink Pipeline Project ▪ Douglas Channel LNG Terminal (also known as BC LNG) ▪ Enbridge Northern Gateway Project ▪ Former Methanex/Cenovus Terminal ▪ Kitimat Clean Oil Refinery and Pipeline ▪ Kitimat LNG Terminal Project ▪ MK Bay Marina ▪ Pacific Northern Gas Pipeline (includes proposed looping) ▪ Pacific Trail Pipelines Project ▪ Rio Tinto Alcan Facility and Modernization Project ▪ Rio Tinto Alcan Terminal A Extension	M	LSA	MT	MI	R	M/M
Contribution from the Project to the overall cumulative effect ▪ The contribution to cumulative effects from the additional demand associated with the Project will be not significant for marinas and moorage facilities.		M	LSA	MT	MI	R	M/M

Effect	Other Projects, Activities and Actions	Cumulative Effects Characterization					
		Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Context
Cumulative effects on Marine Fisheries and Shoreline Harvesting							
Cumulative effect with the Project and other projects, activities and actions ▪ Increase in shipping volume to 940 vessels per year is not expected to result in a substantial and persistent decrease in fishing or shoreline harvesting activities.	▪ Rio Tinto Alcan Facility and Modernization Project ▪ Kitimat LNG Terminal Project ▪ Douglas Channel LNG Terminal Project (also known as BC LNG) ▪ Enbridge Northern Gateway Project ▪ Former Methanex/Cenovus Terminal, and ▪ Cruise ship traffic using Principe Channel	M	RSA	LT	MR	R	M/M
Contribution from the Project to the cumulative effect ▪ The Project will account for 37% of cumulative shipping traffic to Kitimat Harbour. This is not expected to result in a substantial and persistent decrease in fishing or shoreline harvesting activities.		M	LSA	LT	MR	R	M/M
Cumulative Effects on Marine Recreation and Tourism							
Cumulative effects with the Project and other projects, activities and actions ▪ Increase in shipping volume to 940 vessels per year is not expected to result in a substantial and persistent decrease tourism and recreational opportunities	▪ Rio Tinto Alcan Facility and Modernization Project ▪ Kitimat LNG Terminal Project ▪ Douglas Channel LNG Terminal Project (also known as BC LNG) ▪ Enbridge Northern Gateway Project ▪ Former Methanex/Cenovus Terminal, and ▪ Cruise ship traffic using Principe Channel	L	RSA	LT	MR	R	M/M
Contribution from the Project to the cumulative effects ▪ The Project will account for 37% of cumulative shipping volume to Kitimat Harbour. This is not expected to result in a substantial and persistent decrease tourism and recreational opportunities.		L	LSA	LT	MR	R	M/M

KEY

MAGNITUDE:

N = Negligible—no appreciable change given background conditions; character of the VC remains unchanged

L = Low—small change relative to background conditions; character of the VC remains largely unaltered

M = Moderate—moderate change relative to background conditions; character of the VC has been moderately altered

H = High—large change relative to background conditions; character of the VC has been substantially altered

GEOGRAPHIC EXTENT:

T = Marine terminal—effects restricted to the marine terminal and the waters immediately surrounding the facility

LSA—effects restricted to the LSA

RSA—effects restricted to the RSA

DURATION:

ST = Short-term—effects are persistent no longer than the Project construction phase

MT = Medium-term—effects are persistent for up to 10 years after construction

LT = Long-term—effects are persistent more than 10 years after construction

P = Permanent—effects occur in perpetuity

FREQUENCY:

S = Single event—occurs once

MI = Multiple irregular events (no set schedule)—occurs sporadically at irregular intervals throughout the construction, operation, or decommissioning phases

MR = Multiple regular events—occurs on a regular basis and at regular intervals

C = Continuous—occurs continuously throughout the life of the Project

REVERSIBILITY:

R = Reversible—effects can be reversed

I = Irreversible—effects cannot be reversed

SIGNIFICANCE:

S = Significant

N = Not Significant

CONTEXT:

L = Low reliance—area has low importance relative to others

M = Medium reliance—area has medium importance relative to others

H = High reliance—area has high importance relative to others

L = Low resilience—refers to the inability to incur a small disturbance without adverse effects

M = Moderate resilience—refers to the ability to incur a medium size disturbance without adverse effects

H = High resilience—refers to the ability to incur a large disturbance without adverse effects

PREDICTION CONFIDENCE:

Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation, and assumptions made.

L = Low level of confidence

M = Moderate level of confidence

H = High level of confidence

LIKELIHOOD OF RESIDUAL EFFECTS OCCURRING:

Based on professional judgment

L = Low probability of occurrence—low likelihood of the residual effect occurring based on the potential Project interactions, mechanisms, and mitigation measures

M = Medium probability of occurrence—a medium likelihood the residual effect occurring based on the potential Project interactions, mechanisms, and mitigation measures

H = High probability of occurrence—a high likelihood the residual effect occurring based on the potential Project interactions, mechanisms, and mitigation measures

NA = Not Applicable

7.4.9 Prediction Confidence and Risk

The confidence of the predictions made in this assessment are a function of the quality and quantity of baseline data, level of understanding of the effect mechanisms and assumptions made (i.e., some effects are assessed qualitatively), and the effectiveness of the mitigation measures.

One uncertainty associated with the assessment includes limitations in the ability to estimate Project demand on marinas and moorage facilities. Although the size of the worker accommodation centre(s) and number of workers that might simultaneously have a day off can be estimated, predicting the number that will actually use the local marinas and moorage facilities, and the ability of these facilities to cope with the increase in demand, is highly speculative.

With respect to the analysis of potential effects on marine fisheries and shoreline harvesting, the lack of detailed spatial data limited the resolution of the assessment, especially for recreational and Aboriginal fisheries, which are not as well described as other commercial fisheries. Despite making substantial effort to understand marine fisheries (see Section 7.4.3.2), some degree of uncertainty in the assessment of fisheries exists and will always exist until better spatial and long-term datasets become available.

In addition, the effectiveness of some of the mitigation measures is uncertain. For example, it is unclear what fraction of fishers and other stakeholders will participate and with what frequency LNG Canada will be engaged. The intention is to build relationships to generate meaningful discussion and resolution of emerging fisheries-related issues. It is also unclear as to whether or not fishers will contact the MCTS to determine the whereabouts of LNG carriers to assist with minimizing potential interference with fishing activities. Other examples include the safe shipping workshops, which have the goal of providing navigational guidance to recreational boaters and eco-tourism operators travelling around the marine terminal and near LNG carriers. It is not possible at this stage to know to what degree the information presented at these workshops will benefit participants, despite the workshops being specially tailored to address potential Project-related issues and concerns.

To address these uncertainties and increase the overall prediction confidence, the assessment takes a conservative approach that errs on the side of overstating potential effects. Similarly, mitigation measures will be more than adequate for reducing potential effects to acceptable levels.

Overall, as a result of the quality and quantity of available information on marine navigation, marinas, moorage facilities, shipping traffic, fisheries, recreation and tourism, and the understanding of the effect mechanisms and effectiveness of mitigation measures, there is a moderate level of confidence in the assessment of Project residual and cumulative effects.

7.4.10 Follow-up Program and Compliance Monitoring

No follow-up or compliance monitoring programs are proposed for marine transportation and use.

7.4.11 Summary of Mitigation Measures

Marine Navigation

LNG Canada commits to the following mitigation measures related to marine navigation:

- Project-related marine traffic including LNG carriers will use the Coast Guard Marine Communication and Traffic System (MCTS) to provide notice of planned arrival time at Triple Island, and encourage Aboriginal Groups and stakeholders to use the system to plan their routing and scheduling (Mitigation 7.3-3).
- Regular communication on Project activities will occur with marine users, including recreationalists, commercial tourism operators, CRA fishers, Transport Canada, DFO, and relevant stakeholders (Mitigation 6.2-7).
- Use of safety zones which specify “no go” areas around the marine terminal for the safety of public marine traffic, during construction and operation (Mitigation 7.4-2).
- Support federal government in installation of any navigational aids determined to be necessary for safety on the new marine terminal where required (Mitigation 7.4-3).
- Provide notification and information to the Canadian Hydrographic Service to accurately include the appropriate marine terminal information and berth locations on future navigational charts (Mitigation 7.4-4).

Marinas and Moorage Facilities

LNG Canada commits to the following mitigation measures intended to improve the level of marine services provided to the community:

- Provide input, with other industry and the municipal government, into the creation of a waterfront access space (that may include a public boat launch) for the community (Mitigation 7.4-5).

Marine Fisheries and Shoreline Harvesting

LNG Canada commits to the following mitigation measures related to marine fisheries and shoreline harvesting:

- Regular communication on Project activities will occur with marine users, including recreationalists, commercial tourism operators, CRA fishers, Transport Canada, DFO, and relevant stakeholders (Mitigation 6.2-7).
- Conduct, at a minimum, two safe-shipping workshops aimed at promoting safe navigation around shipping traffic for mariners prior to operation (Mitigation 7.4-1).
- Use escorts tugs between Triple Island and Kitimat during all LNG carrier transits (Mitigation 7.4-6).

- Project-related marine traffic including LNG carriers will use the Coast Guard Marine Communication and Traffic System (MCTS) to provide notice of planned arrival time at Triple Island, and encourage Aboriginal Groups and stakeholders to use the system to plan their routing and scheduling (Mitigation 7.3-3).
- LNG carriers will travel at speeds up to 14 knots. Speeds will vary depending on navigational safety, weather conditions, location, and marine mammal presence, and will be determined based on the judgment of the ship's master who receives advice from the BC Coast Pilots on board. Subject to navigational safety needs, in areas of high whale density between the northern end of Campania Island and the southern end of Hawkesbury Island, LNG carriers will travel at speeds of 8 or 10 knots from July through October (recognizing predicted periods of high use by marine mammals) (Mitigation 5.8-12).
- Strict adherence to the prescribed route and passing restrictions so that LNG Canada carriers may only pass other large commercial vessels in straight sections of the route (Mitigation 7.4-7).
- No planned anchoring for the LNG carriers along the marine access route (unless directed to do so by BC Coast Pilots due to weather or other unplanned conditions); LNG carriers will only be permitted to enter the marine access route if a berth at the terminal will be available (Mitigation 7.3-4).
- LNG carriers will maintain safe operating distances from other marine craft (Mitigation 7.4-8).
- LNG carrier's passage route to avoid interference with fishers, where possible, with safety being primary concern (Mitigation 7.4.-9).
- Develop and implement a Marine Activities Plan (MAP) in accordance with applicable federal and provincial legislation and regulations. The MAP will include measures to address potential effects from dredge activities, pile installation (including marine mammal exclusion zone, soft start procedures and consideration of sound dampening technologies) and shipping (Mitigation 5.8-2).

Marine Recreation and Tourism

LNG Canada commits to the following mitigation measures that will reduce the potential for adverse effects on marine recreation and tourism:

- Conduct, at a minimum, two safe-shipping workshops aimed at promoting safe navigation around shipping traffic for mariners prior to operation (Mitigation 7.4-1).
- Provide input, with other industry and the municipal government, into the creation of a waterfront access space (that may include a public boat launch) for the community (Mitigation 7.4-5).
- Regular communication on Project activities will occur with marine users, including recreationalists, commercial tourism operators, CRA fishers, Transport Canada, DFO, and relevant stakeholders (Mitigation 6.2-7).

7.4.12 Conclusion

With the implementation of mitigation measures, residual effects will be eliminated or reduced to negligible levels. Characterization of residual effects used the most conservative assumptions so as to overstate potential Project residual effects. This approach improves the level of confidence in the assessment's conclusions. The quality and quantity of data and understanding of the effects mechanisms and effectiveness of the mitigation measures allows an assessment with a moderate degree of confidence. Residual effects are assessed as not significant. Cumulative effects are assessed as not significant.