

WOODFIBRE LNG

PROJECT DESCRIPTION



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Appendix 1

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Acronyms and Abbreviations

Term	Description
AIR	Application Information Requirements
AOA	Archaeological Overview Assessment
asl	Above Sea Level
BC	British Columbia
BCEAA	<i>British Columbia Environmental Assessment Act</i>
BCEAO	British Columbia Environmental Assessment Office
BCOGC	British Columbia Oil and Gas Commission
°C	Degrees Centigrade
CDN	Canadian (\$)
CEAA	<i>Canadian Environmental Assessment Act 2012</i>
CO ₂	Carbon dioxide
COLREGs	International Regulations for Preventing Collisions at Sea
COSWEIC	Committee on the Status of Endangered Species in Canadian
dAIR	Draft Application Information Requirements
m ³ /day	Cubic metres per day
m ³ /sec	Cubic metres per second
DC	Direct Current
DFO	Department of Fisheries and Oceans Canada
DWT	Dead Weight Tonnes
EA	Environmental Assessment
EAC	Environmental Assessment Certificate
EMP	Environmental Management Plan
FA	<i>Fisheries Act 2012</i>
FEED	Front End Engineering Design
FLNG	Floating Liquefied Natural Gas
FOB	Free on Board
FSU	Floating Storage Unit
GSB	Geological Survey Branch
GHG	Greenhouse gas
H ₂ S	Hydrogen Sulphide
ha	Hectares
HADD	Harmful Alteration, Disruption or Destruction of Fish Habitat
HCA	<i>Heritage Conservation Act</i>
Hg	Mercury
km	Kilometres
KO	Knockout (drum)
kV	Kilovolt
LNG	Liquefied Natural Gas
LOA	Length overall

Term	Description
m	Metre(s)
m ³	Cubic metres
m ³ /day	Cubic metres per day
MARPOL	International Convention for the Prevention of Pollution from Ships
mm	Millimetres
MW	Megawatts
MARPOL	International Convention for the Prevention of Pollution From Ships
MEMPR	Ministry of Energy Mines
MMscfd	Million standard cubic feet per day
MOE	Ministry of the Environment
MPMO	Major Projects Management Office
MMPA	Million tonnes per annum (year)
NG	Natural Gas
NOW	Notice of Work
NOx	Oxides of nitrogen
NRC	Natural Resources Canada
NWPA	<i>Navigable Waters Protection Act 2012</i>
OCP	Official Community Plan
OGC	Oil and Gas Commission
PPA	Pacific Pilotage Authority
PM _{10, 2.5}	Particulate matter (in size fractions 10 and 2.5 micros)
ppm	Parts per Million
ROW	Right-of Way
RPR	Reviewable Projects Regulations
SAR	Species at Risk
SARA	<i>Species at Risk Act</i>
SIS	Safety Instrumented System
SMR	Single Mixed Refrigerant
SOx	Oxides of sulphur
TC	Transport Canada
TERMPOL	Technical Review Process of Marine Terminal Systems and Transshipment Sites
TRC	TERMPOL Review Committee
TRP	TERMPOL Review Process
UPS	Uninterruptible power supply
WFP	Western Forest Products
WHRU	Waste Heat Recovery Unit
WNGL	Woodfibre Natural Gas Limited

1 INTRODUCTION

Woodfibre Natural Gas Limited (WNGL) proposes the development and operation of a Liquefied Natural Gas (LNG) production, storage and marine carrier LNG transfer facility on the previous industrial Woodfibre Pulp and Paper Mill site (hereinafter referred to as the project site).

The project site is located approximately 7 kilometres (km) west-southwest of the urban centre of Squamish, British Columbia (BC), within the District of Squamish municipal boundaries, on the northwestern shoreline of Howe Sound (Figure 1). In addition, Britannia Beach is approximately 5.5 km southeast of the site; Darryl Bay is approximately 6.2 km to the east, while Port Mellon is approximately 22 km southwest of the site. Vancouver is approximately 50 km southeast of the project site. Various owners, including recently Western Forest Products (WFP), have operated the Woodfibre Pulp and Paper Mill site from the early 1900's until closure in 2006. The Woodfibre property and site of the proposed Woodfibre LNG project comprises operating and permitted facilities including a tertiary sewage treatment plant, existing landfills, chemical and hazardous waste storage, laydown areas, access roads with the site, and a deep sea marine vessel terminal.

The project site has the following coordinates: **49°40'00 N; 123°15'10 W** and the designated project name is **Woodfibre LNG** and is referred to in this project description as "Woodfibre LNG" or "the project". Appendix 1 of this report provides a series of historical and recent site photos.

The project property comprises 86 hectares (ha) of privately owned, previously developed industrial lands, along with existing water lots adjacent to the site. There is no road access to or from the site (Figure 1), with access via water using private passenger ferry from Squamish Government Docks (Figure 2).

The entire private property has greater than a century of existing industrial land use developed as part of the former Woodfibre Pulp and Paper Mill site operations. The lower flat portion of the property has been defined as the site for the Woodfibre LNG project and is entirely cleared of native mature forest and riparian vegetation, with a single creek (Mill Creek) dividing the eastern and western portions of the project site. No flora and fauna designated as Species at Risk (SAR) have been identified on the lower developed portion of the property and the proposed LNG facilities on land and in marine areas. The soil conditions at the site comprise man-made fill deposits placed during historical operations of the Woodfibre Mill, which overlies geologically recent alluvial sands and gravel (creek and river sediments), atop dense glacial till and bedrock.

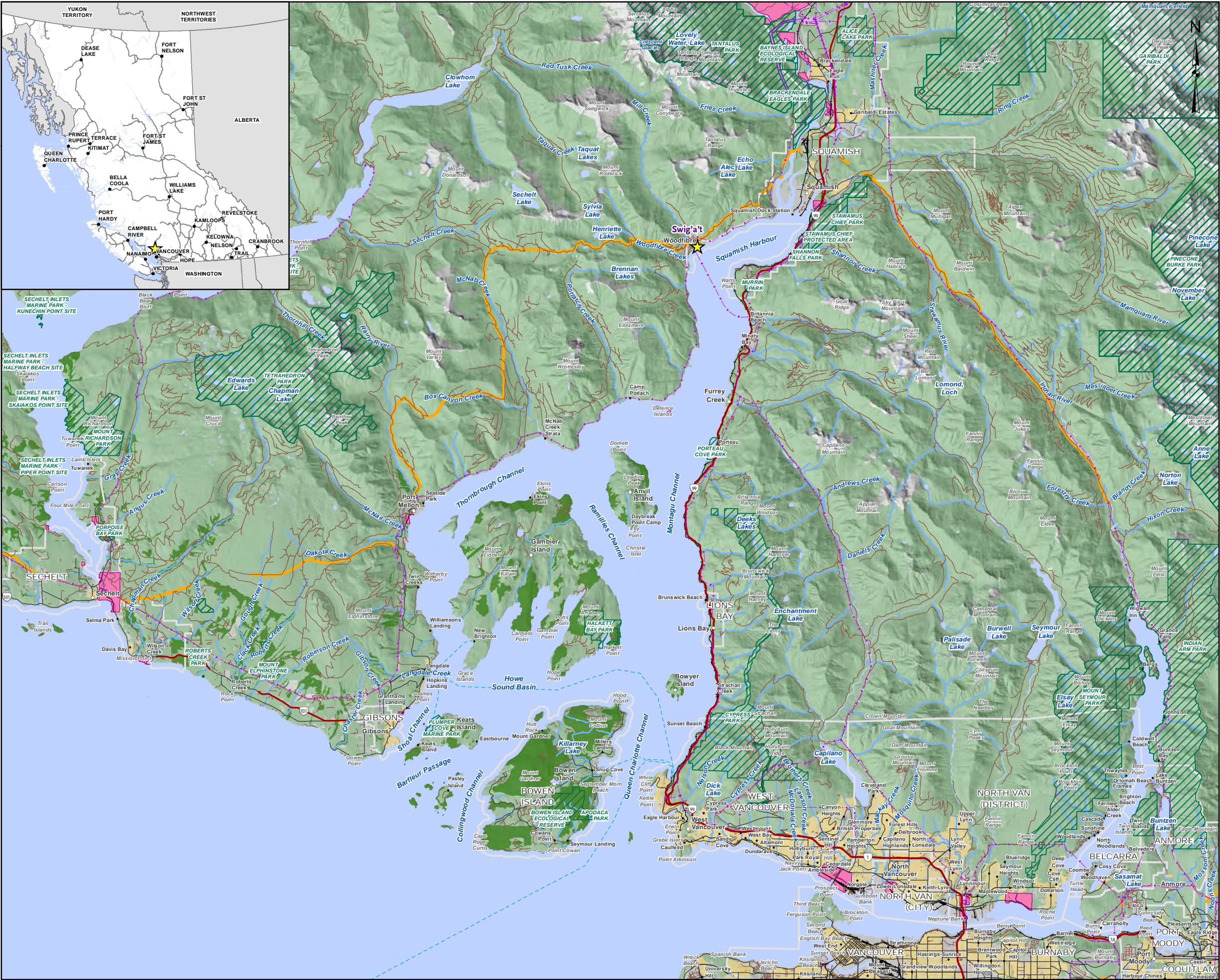
The Woodfibre LNG facility is anticipated to have a LNG production capacity of between 1.5 and 2.1 million tonnes per annum (MMTPA), depending on the quantity of gas available for liquefaction from the pipeline. LNG will be exported using a LNG carrier that will be loaded at a dedicated terminal facility.

The Woodfibre LNG project and project site have the following general characteristics, along with anticipated potential project-related environmental, social and cultural effects:

- The project site will be constructed on an existing industrial brown field site with over 100 years of industrial use;
- The project site is zoned for industrial use within the District of Squamish's Official Community Plan (Figure 3);

- The project site has existing deep-water marine terminal (Figure 4) and existing and historic deep water vessel berthing capability;
- The Woodfibre LNG project will use an existing dock for personnel access during the site preparation and construction phase of the project;
- The project site is connected to existing safe navigation shipping routes from Squamish south to the Pacific Ocean (Figure 4);
- The project site has safe and available access to an existing natural gas supply and pipeline within the existing property (Figures 1, 2 & 3);
- The project site will not construct or use a new independent power supply and will connect to existing electric transmission power grid and existing local hydroelectric generation (approximately 1.7 megawatts (MW)) (Figures 1 & 2);
- The project will use existing permitted onsite tertiary sewage wastewater treatment facilities and an existing permitted functioning landfill;
- The project will use existing stormwater and hazardous waste material storage areas and expand these facilities as needed;
- The project is not anticipated to affect existing mature forests and terrestrial habitats;
- The project is not anticipated to have potential project-related impacts on aquatic flora and fauna, migratory and resident birds, wildlife and species at risk (SAR);
- The project is not anticipated to affect sensitive ecosystems, critical marine or freshwater aquatic habitats or fish and aquatic species;
- The project is not anticipated to affect existing commercial, recreational, or ceremonial and/or subsistence fisheries;
- The LNG vessel traffic will be undertaken by third parties under contract to Woodfibre LNG, and will adhere to existing Canadian and international safety standards and practices, including use of BC Coastal pilots and assist tugs and vessels within Canadian waters for in and outbound traffic;
- The project site is 7.5 km from the closest federal lands designated as Squamish Nation reserve Stawamus No. 24 (Figure 6);
- The project will not use federal funding;
- The project is not anticipated to affect existing Aboriginal Group interests, although this will be confirmed and addressed during consultation;
- The project is not anticipated to affect existing Metis interests and is not near any existing or past Metis communities;
- The project and its activities are not anticipated to affect existing local community interests, although this will be confirmed and addressed during community consultation;
- The project will adhere to best practices and mitigation measures to avoid and limit effects to environmental and social resources;

- The project will manage and create new habitats in aquatic or terrestrial environmental habitats to offset any potential effects on these resources from the proposed Woodfibre LNG project;
- The project site will improve existing aquatic and terrestrial habitats relative to historic effects associated with previous industrial use of the site; and
- The project will undergo all permitting and statutory regulatory approvals, including an environmental and social assessment review prior to initiating construction.



LEGEND

- ★ PROJECT SITE
- URBAN AREA
- FOREST AREA
- SENSITIVE ENVIRONMENTAL AREA
- PARKS / PROTECTED AREAS (NAME)
- INDIAN RESERVE
- GAS PIPELINE RIGHT OF WAY
- MUNICIPALITY
- HIGHWAY
- ARTERIAL ROAD
- LIMITED ACCESS ROAD
- RAILWAY
- TRANSMISSION LINE (ELECTRIC)
- NAMED WATERCOURSE
- FERRY ROUTE

REFERENCE

PARKS/PROTECTED AREAS AND SENSITIVE ENVIRONMENTAL AREAS FROM GEOBC. SUBDIVISIONS BOUNDARIES (2012) FROM STATISTICS CANADA. BASE DATA FROM CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED. IMAGERY PROVIDED BY GEOBC 2009 WMS. PROJECTION: UTM ZONE 10 DATUM: NAD 83

SCALE

4,000
 0
 4,000

METRES

PROJECT

WOODFIBRE NATURAL GAS LTD.
WOODFIBRE, HOWE SOUND, B.C.

TITLE

LOCATION OF PROJECT SITE

PROJECT NO. 13-1422-0006	PHASE No. 1000
DESIGN MJ 19 Aug. 2013	SCALE 1:230,000
GIS AS 19 Aug. 2013	REV. 1
CHECK AL 19 Aug. 2013	
REVIEW MJ 30 Oct. 2013	

FIGURE 1

PATH: N:\ACAD-GIS\AVI\2013\13-1422\13-1422-0006 - Woodfibre\Mapping\MXD\General\WOODFIBRE - PROJECT_DESCRIPTION FIGURE_02a_Prefered_Configuration.mxd Date: 11/29/2013 Time: 10:33:38 AM



LEGEND
PREFERRED CONFIGURATION ELEMENTS


- EXISTING FEATURES
- NEW FEATURES
- TEMPORARY FEATURES
- SURVEY PARCELS
- WOODFIBRE PROPERTY BOUNDARY
- PROPOSED GREEN ZONE
- LIMITED ACCESS ROAD
- GAS PIPELINE
- TRANSMISSION LINE (ELECTRIC)
- WATERCOURSE
- ELEVATION CONTOUR (40M)

REFERENCE

SURVEY PARCELS, PIPELINE AND TRANSMISSION LINE FROM THE CITY OF SQUAMISH. BASE DATA FROM CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED. IMAGERY FROM MCELHANNEY (2013).
PROJECTION: UTM ZONE 10 DATUM: NAD 83

SCALE

100 0 100
METRES

PROJECT		WOODFIBRE NATURAL GAS LTD. WOODFIBRE, HOWE SOUND, B.C.				
TITLE		PREFERRED CONFIGURATION (FLOATING)				
		PROJECT NO. 13-1422-0006		PHASE No. 1000		
		DESIGN	MJ	19 Aug. 2013	SCALE	1:5,000
		GIS	AS	29 Nov. 2013		REV. 3
		CHECK	AL	29 Nov. 2013	FIGURE 2A	
		REVIEW	MJ	29 Nov. 2013		

PATH: N:\ACAD-GIS\2013\13-1422\13-1422-0006 - Woodfibre\Mapping\MXD\General\WOODFIBRE - PROJECT_DESCRIPTION.FIGURE_02b_Alternate Configuration.mxd Date: 11/29/2013 Time: 10:33:49 AM



LEGEND
ALTERNATIVE CONFIGURATION ELEMENTS

- EXISTING FEATURES
- NEW FEATURES
- TEMPORARY FEATURES
- SURVEY PARCELS
- WOODFIBRE PROPERTY BOUNDARY
- PROPOSED GREEN ZONE
- LIMITED ACCESS ROAD
- GAS PIPELINE
- TRANSMISSION LINE (ELECTRIC)
- WATERCOURSE
- ELEVATION CONTOUR (40M)

REFERENCE

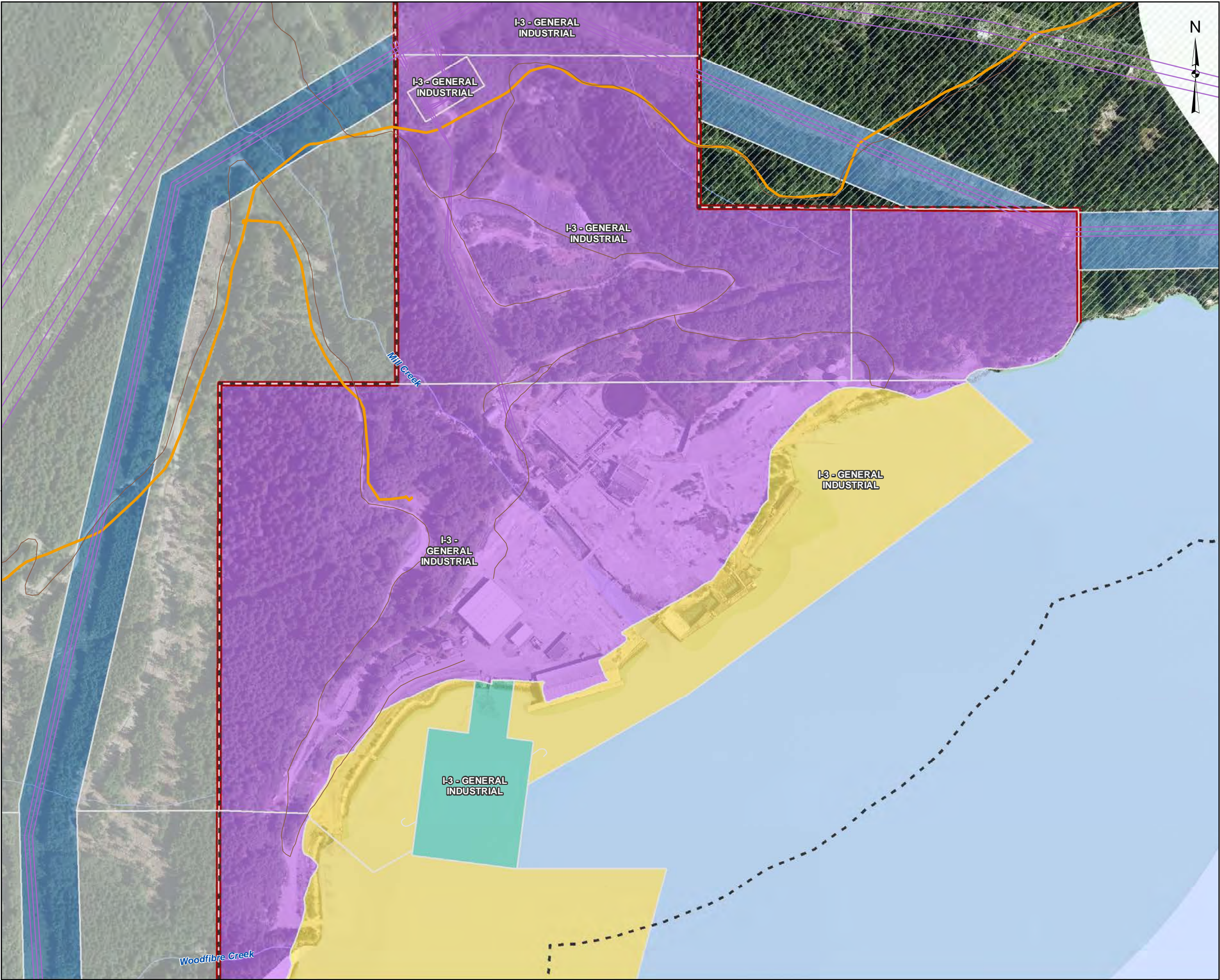
SURVEY PARCELS, PIPELINE AND TRANSMISSION LINE FROM THE CITY OF SQUAMISH. BASE DATA FROM CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED. IMAGERY FROM MCELHANNEY (2013).
PROJECTION: UTM ZONE 10 DATUM: NAD 83

SCALE

100 0 100
METRES

PROJECT		WOODFIBRE NATURAL GAS LTD. WOODFIBRE, HOWE SOUND, B.C.				
TITLE		ALTERNATE CONFIGURATION (LAND-BASED)				
		PROJECT NO. 13-1422-0006		PHASE No. 1000		
		DESIGN	MJ	19 Aug. 2013	SCALE	1:5,000
		GIS	AS	29 Nov. 2013		REV. 3
		CHECK	AL	29 Nov. 2013	FIGURE 2B	
		REVIEW	MJ	29 Nov. 2013		

PATH: N:\CAD-GIS\GIS\2013\13-1422\13-1422-0006 - WoodfibreMapping\MXD\General\WOODFIBRE_PROJECT_DESCRIPTION_FIGURE_03_Land_Ownership_and_Zoning.mxd Date: 12/5/2013 Time: 4:44:41 PM



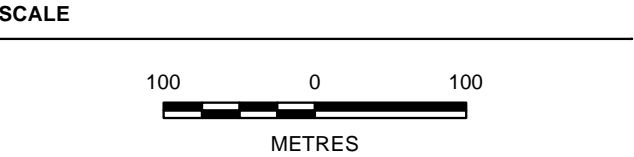
LEGEND

TENURE TYPE (ZONING)

- PRIVATE LAND
- CROWN TENURE - RESERVE/NOTATION
- CROWN TENURE - LEASE
- CROWN TENURE - RIGHT-OF-WAY
- CROWN TENURE - LICENCE
- UNSERVED CROWN LAND
- SURVEY PARCELS
- MUNICIPAL BOUNDARY
- WOODFIBRE PROPERTY BOUNDARY
- LIMITED ACCESS ROAD
- GAS PIPELINE
- TRANSMISSION LINE (ELECTRIC)
- WATERCOURSE

REFERENCE

SURVEY PARCELS, PIPELINE AND TRANSMISSION LINE FROM THE CITY OF SQUAMISH. TENURE TYPES FROM GEOBC. BASE DATA FROM CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED. IMAGERY FROM MCELHANNEY (2013). PROJECTION: UTM ZONE 10 DATUM: NAD 83



PROJECT		WOODFIBRE NATURAL GAS LTD. WOODFIBRE, HOWE SOUND, B.C.		
TITLE		LAND OWNERSHIP AND ZONING		
	PROJECT NO. 13-1422-0006		PHASE No. 1000	
	DESIGN	MJ 19 Aug. 2013	SCALE	1:5,000
	GIS	AS 19 Aug. 2013	REV.	0
	CHECK	AL 19 Aug. 2013	FIGURE 3	
REVIEW		MJ 30 Oct. 2013		

1.1 Proponent Contacts

Woodfibre Natural Gas Limited (WNGL) is a Canadian company incorporated in the Province of BC, with offices in Vancouver, BC and Calgary, Alberta (AB). The principal proponent contact persons for purposes of the project are as follows:

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Director (CEO Equivalent)**

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Woodfibre Natural Gas Limited (WNGL) website is www.woodfibrelngproject.ca

2 PROJECT INFORMATION

2.1 Project Summary

The Woodfibre LNG project is a natural gas processing, liquefaction and marine carrier LNG transfer facility located on an industrial zoned site with existing natural gas, electricity, and marine terminal facilities (Figure 2). The Woodfibre LNG project will be on private industrial lands and provincial water lots (Figure 3) situated 5.5 km from the nearest community (Figures 1, 6).

The project site is not located on or near any federal lands or reserves, will not use federal financial funding, and is not within the waters or lands administered by the Canada Port Authority.

The Woodfibre LNG project will not require access or use of lands or resources currently used for traditional purposes by Aboriginal peoples. It is anticipated that the Woodfibre LNG project will not affect any terrestrial or marine SAR under the Species at Risk Act (SARA) based on proposed project designs and implemented mitigation measures. Given the historical industrial development of this brownfield site, no SAR or migratory birds have been identified in the portion of the site that would be affected by the proposed Woodfibre LNG development. The project will transfer LNG to marine carriers operated by third party prequalified shipping companies engaged in the business of LNG transport. LNG carriers used for the Project will transit in accordance with the *Canada Shipping Act* (2001) and by-laws established by Transport Canada and the Pacific Pilotage Authority (PPA).

2.2 Project Components

Table 1 presents the major components of the Woodfibre LNG project. There are two possible configurations for the project relating to the placement of the gas pre-treatment and LNG processing modules within the Woodfibre LNG site as presented in Table 1 and Figure 2, as follows:

- The **preferred** configuration will comprise the placement of gas pre-treatment and LNG processing prefabricated modules on a permanently moored nearshore FLNG barge (Image 1); and
- The **alternative** configuration will comprise the placement of the gas pre-treatment and LNG processing prefabricated modules on land (Image 2).

Note: The **alternative** land-based configuration, when compared to the **preferred** configuration, will comprise all the same prefabricated modules, processing units, and infrastructure as defined in Table 1, except that the gas pre-treatment and LNG processing modules will be on land (Figure 2).

LNG storage will be using floating storage units (FSU) for both configurations.

Table 1: Project Component, Configurations and Project Description Section

Project Component	Section Reference	Preferred FLNG Configuration	Alternative LNG Land, Configuration
Natural gas reception system from a nearby existing Fortis BC delivery gas pipeline (land-based)	3.1.1	Yes	Yes
Gas pre-treatment modules			
FLNG barge configuration	3.1.2	Yes	N/A
Land based configuration	3.1.2	N/A	Yes
Natural gas liquefaction train modules: total capacity of between 1.5 and 2.1 MMTPA			
FLNG barge configuration	3.1.2	Yes	N/A
Land based configuration	3.1.2	N/A	Yes
LNG FSU (permanently moored) with a capacity of between 170,000 and 250,000 cubic metres (m ³)	3.1.3	Yes	Yes
Marine terminal and LNG transfer and offloading infrastructure	3.1.5	Yes	Yes
Single marine mooring facilities for one LNG off-take (export) carrier	3.1.4.1	Yes	Yes
Supporting Infrastructure			
Private passenger ferry terminal for site access	3.1.5.1	Yes	Yes
Materials Offloading Facility, land-based site for temporary construction facilities including an existing barge ramp	3.1.5.2	Yes	Yes
Electric substation and connections to nearby existing transmission line (land-based)	3.1.5.3	Yes	Yes
Site administration and safety facilities (including helipad for emergency response) (land-based)	3.1.5.4	Yes	Yes
Chemical and Fueling Storage (land-based)	3.1.5.4	Yes	Yes
Utilities infrastructure (i.e., power, drinking water, sewer and waste water) (land-based)	3.1.5.4	Yes	Yes

It is anticipated that the Woodfibre LNG project will be constructed and assembled in a single activity phase to its anticipated capacity of 2.1 MMTPA, with target construction duration of two years and operations beginning at the end of 2016. The project is predicted to operate for 25 years. Decommissioning will include removal of all floating LNG and storage project components and decommissioning and removal of all land-based infrastructure, including removal of the gas reception facilities.

2.3 Project Location and Coordinates

The project site (Figure 3) is located at the former Woodfibre Pulp and Paper Mill industrial site, at the northern tip of Howe Sound near Squamish, BC. The project site, accessible only by water, is located approximately 7 km southwest of the urban centre of Squamish, BC with the following site coordinates: **49°40'00 N; 123°15'10 W** (Figure 1).

2.3.1 Legal Description of Lands

The project site comprises freehold lands, foreshore leases and water lots as more particularly described below:

Lands

- Parcel Identifier 015-791-459; District Lot 6232; Group 1; New Westminster District;
- Parcel Identifier 015-791-611; District Lot 6237; Group 1; New Westminster District;
- Parcel Identifier 015-822-061; District Lot 5899; Group 1; New Westminster District;
- Parcel Identifier 015-895-963; District Lot 2802; Group 1; New Westminster District; and
- Parcel Identifier 015-910-717; District Lot 2351; Group 1; New Westminster District.

Foreshore Lease

- Foreshore leases granted by the Province of British Columbia dated October 4, 1986 and identified as Lease 233133, being a lease of Lots 5095 and 7286, Group 1, New Westminster District.

Water Lots

- Permit over Crown Land No. 4512 dated May 1, 1959;
- Permit over Crown Land No. 4604, dated February 1, 1960;
- Permit over Crown Land No. 4605, dated February 1, 1960;
- Permit over Crown Land No. 4606, dated February 1, 1960;
- Permit over Crown Land No. 4607, dated February 1, 1960; and
- Permit over Crown Land No. 4608, dated February 1, 1960.

2.3.2 Zoning

The project site, including the foreshore and water lots, has been designated for industrial and employment use by the District of Squamish in its official community plan (OCP). Refer to Figure 3 for the current land ownership and zoning for the project site.

2.3.3 Communities and Residences

The project site is located on the northwestern shoreline of Howe Sound within the municipal boundaries of Squamish, which is within the Squamish-Lillooet Regional District. The site is located approximately 7 km west-southwest of the urban centre of Squamish, BC (Figure 1). In addition, across Howe Sound, Britannia Beach is approximately 5.5 km southeast of the site; Darryl Bay is approximately 6.2 km to the east; Port Mellon is approximately 22 km southwest of the site (Figure 4). Vancouver is approximately 50 km southeast of the project site. Figure 4 also provides a summary for over the water distances between nearby communities and the proposed marine shipping route.

2.3.4 Aboriginal Reserves, Traditional Territories and Resources

The Woodfibre LNG project site is approximately 7.5 km from the Squamish Nation reserve located in Squamish (Stawamus Reserve No. 24). The project site is within the traditional territory of the *Skwxwú7mesh* (Squamish) Nation, referred also as “Swig’a’t” by the Squamish Nation. The project will not require access to, use, or occupation of or the exploration, development, or production of lands and resources currently used for traditional purposes by Aboriginal peoples.

The project site is approximately 50 km from the Tsleil-Waututh Nation reserve (Figure 6) located in North Vancouver (Burrard Inlet Reserve No. 3). Other Aboriginal Groups are also being considered for consultation as part of the Woodfibre LNG project as part of the FEED design phase of the project.

2.3.5 Federal Lands, Environmental Studies, Financial Support

The Woodfibre LNG project is located entirely on private lands and provincial Crown lands (water lots) and is not on or in proximity to any federal lands. The nearest federal lands, being the Stawamus Reserve No. 24, are located approximately 7.5 km from the site. The Woodfibre LNG project is not within waters or lands administered by the Canada Port Authority. The Woodfibre LNG project is located in a region that has not been the subject of federal regional environmental studies. No federal financial funding support is proposed or anticipated for the project.

2.4 Project Purpose and Rationale

The purpose of the Woodfibre LNG project is to receive, process, and liquefy natural gas, and to store and transfer LNG to marine carriers for export to offshore markets. The Woodfibre LNG project is located at an existing industrial site with a deep-water harbour, with existing connections to electric power supply and natural gas supply, and is advantageously located to ship LNG to international markets through existing marine shipping and navigation channels from Squamish through Howe Sound to the Pacific Ocean.

Pacific Rim Markets offer a new long-term opportunity to Canadian producers. Since natural gas deregulation in Canada began in 1985, Canadian producers have been able to obtain ever-improving access to North American markets. However, they have largely remained excluded from international markets.

At present, the price of natural gas in North American markets is significantly lower than the international market, suggesting that there is a surplus in supply. LNG exports offer the opportunity for Canadian producers to access international markets, potentially allowing them to obtain the higher prices for their natural gas.

WNL believes that natural gas supply from Canada is highly attractive in the Pacific Rim Markets. Canada is considered a desirable source of natural gas supply because of its political and regulatory stability. Thus, the Pacific Rim represents a substantial market opportunity for Canadian producers. As such, WNL seeks to export LNG from the Woodfibre LNG facility to wholesale importers in Pacific Rim Markets. The wholesale importers in the Pacific Rim will be responsible for obtaining all the necessary import authorizations to permit resale to local distributors and end use customers.

2.5 Natural Gas Supply

Natural gas will be distributed to the facility from Western Canadian market hubs through an expansion of the existing gas transmission system being completed by Fortis BC (Figure 1). Fortis BC's expansion project (called Eagle Mountain – Woodfibre Pipeline Expansion Project) includes the construction of a 52 km long natural gas pipeline loop of its existing facilities from the area north of the Coquitlam watershed in Metro Vancouver to the facility. The expanded system will be able to supply up to 220 million standard cubic feet per day (MMscfd) of natural gas to the facility and up to an additional 100 MMscfd on an interruptible basis. It is expected that natural gas for the facility will be procured through gas marketers.

2.6 Project Capital Costs and Employment Estimates

The operational life of the Woodfibre LNG facility is anticipated to be at least 25 years. The estimated capital cost of the project is in excess of \$1.6 billion CDN. These project costs will be refined during the Environmental Assessment (EA) and Front End Engineering Design (FEED) process. Approximately 600 person-years of direct employment generation are anticipated during the construction phase. It is expected that 2,500 person-years of employment will be created during the operational phase of the project, including many types of potential employment opportunities as outlined below:

Project Employees – The project is anticipated to employ approximately 100 fulltime equivalent (in shifts) people directly as either facility or office staff. Facility positions may include skilled technicians and operators, management and supervision, and unskilled workers. Office positions may include management, professional engineers, and office support staff.

Contracted Employment – Contractors will undertake many operational activities for the project, and may provide employment within a number of positions, including specialist LNG technologists, tug operators, local transportation services, cleaning and catering services, and safety, audit and monitoring services.

Indirect Employment – A number of supplies such as food, fuel, transportation, information technology, and office equipment will be required for the construction and operation of the project. Because of this demand, employment opportunities will be created within businesses that manufacture, process, or market these goods.

Induced Employment – Construction and operation of the project will provide an increase in employment and household income, thereby promoting extra spending in the local economy. Extra spending will in turn lead to higher employment in a range of sectors such as housing and real estate services, recreation, entertainment, and food services.

The emphasis will be placed on hiring local workforce including Squamish and the surrounding area where possible. According to a 2009 report by America's Natural Gas Alliance, for large oil & gas projects such as an LNG facility, employment multipliers are approximately 2.5, indicating that during operations an additional 3,750 person-years may be created. Similar multipliers may be applied during construction. Multipliers in this case refer to indirect and induced employment.

2.7 Spatial Scope of Assessment

Woodfibre LNG project site and study area is defined within the land based and water lots of the immediate project site (refer Section 2.3.1) (Figures 1, 2) and within the eastern area of Howe Sound from the Woodfibre LNG site in Montagu and Queen Charlotte Channels to Passage Island (Figure 4).

To help define the spatial scope of the assessment, Woodfibre LNG has undertaken a preliminary marine traffic analysis to evaluate the potential incremental changes in shipping traffic and activity from the proposed marine loading facility in Howe Sound (Montagu and Queen Charlotte Channels) through to existing marine shipping lanes in the Strait of Georgia (Figure 4). The analysis was based on the Automated Identification System (AIS), a mandatory vessel signal transmitted from all commercial vessels and relayed by satellite to receiving and archive centres.

AIS data for a one-year period (i.e., 1 September 2012 to 1 September 2013) was acquired from Industry Canada and Transport Canada for all commercial vessels within the entire Fraser River, Burrard Inlet, Howe Sound, Strait of Georgia, Strait of Juan de Fuca areas. This data was compiled to help model Woodfibre LNG's contribution to existing marine traffic over a 365 day period. Considered in the analysis were the following shipping routes (Figure 4):

1. Howe Sound, Montagu and Queen Charlotte Channels - from project site past the eastern edge of Gambier Island to the south-eastern tip of Gambier Island near Bowen Island to Queen Charlotte Channel past Passage Island; and
2. Strait of Georgia south of Howe Sound.

The AIS data is presented in Table 2 as large commercial vessel movements per day (i.e., cargo, bulk, hazardous, tug, and barge vessels). Woodfibre LNG's incremental change in cargo and tug-barge vessel movement per day has also been estimated (Table 2). Ferry, recreational vessels, passenger, pilotage, and other vessels were not included in this analysis; however, these vessels will be considered as part of the EA being prepared for the project.

Table 2: AIS Commercial Vessel Activity per Day from 1 September 2012 to 1 September 2013.

Shipping Route	AIS Data: Vessel Type	Proposed Woodfibre LNG Carriers	
	Commercial Vessels (Vessels Per Day)	% of Total Vessel Traffic	% Incremental Change in Project-related Vessel Traffic
Howe Sound, Montagu and Queen Charlotte Channels	1.4	6.7	0.4
Strait of Georgia South of Howe Sound (South of Passage Island)	61.5	0.16	0.001

There is anticipated to be a limited increase (i.e., 0.4%) in Woodfibre LNG's contribution to marine traffic via LNG carrier shipping along routes transiting through Howe Sound. In addition, there is anticipated to be very limited (i.e., 0.001%) increase by Woodfibre LNG's contribution to existing marine traffic as a result of the project from the point where the LNG carriers would intersect with existing shipping routes (i.e., between the southern boundary of Howe Sound to off Point Grey south of Passage Island through to the Pacific Ocean). LNG carriers from the Woodfibre LNG facility will transit in accordance with the *Canada Shipping Act* (2001) along with by-laws established by Transport Canada and the PPA. WNGL's ability to direct changes or mitigate in the highly regulated marine shipping routes from Point Grey to the open ocean is extremely limited. Regulatory authorities will dictate vessel traffic and routes.

Given this analysis and the limited incremental change in project related vessel movements, Woodfibre LNG considers that the spatial scope for the marine shipping component of the environmental assessment should be limited to transit within Howe Sound.

3 DETAILED PROJECT COMPONENTS

As described in Section 2.2, the Woodfibre LNG project comprises major components as outlined in Table 1 and detailed below in Section 3. There are two possible configurations of the major components based on either floating or land-based placement of the prefabricated gas pre-treatment and LNG processing modules within the Woodfibre LNG site, as follows:

- The **preferred** configuration will be the placement of the gas pre-treatment and LNG processing prefabricated modules on a permanently moored nearshore FLNG barge; and
- The **alternative** configuration will be the placement of the gas pre-treatment and LNG processing prefabricated modules on land.

All other major project components are similar between the **preferred** and **alternative** configurations including FLNG storage. The specific layout of equipment will be determined after completion of the FEED process.

Figure 2 illustrates the proposed **preferred** (Figure 2a, Image 1) and **alternative** (Figure 2b, Image 2) configurations based on placement of gas pre-treatment and LNG processing modules, along with common project infrastructure and components for storage, electrical substation, passenger ferry, mooring, marine terminal, and site administration on the existing developed project site. Design concepts, plans and locations for detailed siting and life cycle development of the facilities, LNG production plant, storage, and marine loading facility will be completed during the FEED design process.

No physical activities, disturbance to fish habitat, or discharges will occur in Mill Creek or Woodfibre Creek and both creeks will maintain full connectivity to Howe Sound on the project site. In addition, it is anticipated that the existing concrete-lined stream channel walls of Mill Creek will be removed, with a natural stream bank and riparian vegetation reinstated as a more natural riparian 'green zone' on each side of Mill Creek.

The general characteristics of the project components are consistent with existing LNG production facilities and include project specific gas pre-treatment and LNG production train prefabricated modules and floating LNG storage.

The following sections provide an overview of the proposed project components associated with the **preferred** and **alternative** configurations as presented in Table 1, including natural gas processing and safety systems, as follows:

- 3.1 – Power Supply;
- 3.2 - Natural Gas Reception System;
- 3.3 - Gas Pre-treatment Modules;
- 3.4 - Gas Liquefaction Train Modules
 - 3.4.1 - Process Heat System
 - 3.4.2 Process Control Systems
 - 3.4.3 Fire Protection and Safety Systems

- 3.4.4 Safety, Shutdown and Depressurization Systems
- 3.4.5 Safety Flare and Vents Systems
- 3.4.6 LNG Floating Storage Unit
- 3.4.7 Marine Terminal, LNG Transfer & Offloading Infrastructure
- 3.4.8 Marine Mooring Facilities
- 3.4.9 Supporting Infrastructure
 - 3.4.9.1 - Private Passenger Ferry Terminal
 - 3.4.9.2 - Marine LNG/Materials Offloading Facility
 - 3.4.9.3 - Site Administration, Site Infrastructure and Safety Facilities (including Chemical Storage and Handling, Fuel Storage Systems, Refrigerant Storage and Handling)
- 3.4.10 Shipping Activities (including LNG Carriers, Other Marine Vessels)
- 3.4.11 Shipping Route
- 3.4.12 Navigational Approach
- 3.4.13 Vessel Berthing
- 3.4.14 Operational Safety Zones
- 3.4.15 Refueling and Provisioning

3.1 Power Supply System

The upgraded electric substation will form the primary electric power supply point throughout the construction and operational phases of the project.

Up to 140 MW of power will be required during peak operations at the site. Electricity will not be generated onsite for the project, except as needed in emergencies and special circumstances. The former pulp mill required 90 MW of power from BC Hydro and this existing connection to the nearby transmission power grid via a BC Hydro 138 kilovolt (kV) energized power line will be used of power the project. The existing power line connects to the existing 138 kV electric substation, which will be upgraded during the site preparation phase of the project to provide additional capacity and to accommodate associated local electrical infrastructure.

The backup power system will be from the existing BC Hydro electricity grid. An emergency power supply will be provided on site by a <10 MW generator (Figure 2a, b).

Woodfibre LNG project will take electrical power from the existing BC Hydro 138 kV grid that runs adjacent to the project site. A switching station will be constructed at the Point-of-Interconnection ("PoI") for connection of power supply from the grid. A primary step-down substation with transformers, revenue meter, switchgears, protection and control equipment will be constructed onshore at the project site (Figure 2a, b). The LNG process equipment and storage facilities will take power from the onshore substation whether they are on land or installed on the FLNG unit.

Emergency diesel/gas generator(s), battery/direct current (DC) and uninterruptible power supply (UPS) system will provide emergency power supply to essential loads to ensure safe shutdown of the plant in the event of total loss of power supply from the grid.

Essential loads include the following:

- Instrumentation and control system;
- Instrument air system;
- Lube oil system;
- Critical actuators;
- Fire and gas detection;
- Telecommunication;
- Emergency shutdown systems; and
- Emergency lighting.

The FEED design phase will identify exact essential loads and the electrical scheme will be properly implemented.

3.2 Natural Gas Reception System

Natural gas will be delivered to the Woodfibre LNG project from an existing natural gas pipeline on the property. The natural gas pre-treatment process and infrastructure will be similar for both the **preferred** FLNG configuration and **alternative** land-based configuration. The only difference will be the layout of the prefabricated modules, as the space available on the FLNG barge is more constrained than the land based configuration.

The feed-gas supply pipeline will be connected to the Woodfibre LNG facility from the north via a pipeline, the approach route of which has yet to be finalized. The pipeline will enter the property boundary via a dedicated pipeline delivery station. Gas received from the pipeline will be metered at the inlet to verify inventory transfer. Custody of gas from the pipeline to the facility inlet will be transferred in this location following metering. The facility will use the existing gas pipe corridor and tie in, and will be upgraded to accommodate the required gas volumes (Figure 2a, b). The associated works for this upgrade will include:

- Access and laydown areas for all works making use of existing roadway and cleared areas;
- Trenching and removal of existing pipeline valves and appendages;
- Scrubbing and brushing as needed along the existing pipeline right of way (i.e., as part of construction equipment access); and
- Installation of new pipeline, valves and appendages.

3.3 Gas Pre-Treatment Modules

The natural gas pre-treatment process and infrastructure will be similar for both the **preferred** FLNG configuration and **alternative** land-based configuration. Prior to metering, the gas pipeline-receiving infrastructure will remove any contaminants from the gas feed that cannot be processed by the main gas-processing unit. Following debris removal and metering the gas will typically be dry and contain no free water or hydrocarbon condensate.

A compressor will be located in the inlet to the pre-treatment facilities to compress feed gas from the arrival pressure to the optimum liquefaction pressure. In addition, although mainline gas pipelines transporting dry, clean natural gas with little to no presence of natural gas liquids are pigged very infrequently, a pig receiver for the gas transmission line will be located within the property site boundary to allow for maintenance pigging operations.

The gas pre-treatment module will first remove carbon dioxide (CO₂) and any trace levels of hydrogen sulphide (H₂S), if present from the feed gas. The removal processes for CO₂ and H₂S will be confirmed during FEED. The feed gas will also undergo dehydration to remove water from the gas to prevent freezing during the cryogenic process. The dehydration process involves cooling the gas using heat exchangers, removing the resulting condensed water, and, passing the gas feed through molecular sieve beds for adsorption of the remaining water vapour.

Following dehydration, any mercury (Hg) will be removed from the gas feed. Although mercury levels should be negligible in the gas feed, removal is a precautionary procedure undertaken as a routine safeguard within the process-gas stream. The Hg removal beds will be located upstream of the liquefaction process and will allow safe, secure, and environmentally compliant removal of mercury from the pre-treatment facilities for proper disposal from the site. Any mercury removed will be stored and transported off site to an appropriate facility for effective disposal.

3.4 Gas Liquefaction Train Modules

The **preferred** configuration for the Woodfibre LNG gas pre-treatment and processing and LNG production facility will comprise a permanently moored Floating Liquefaction (FLNG) unit for receiving and processing natural gas into LNG. The FLNG unit will contain the liquefaction equipment and systems.

The **alternative** configuration for the Woodfibre LNG gas pre-treatment and processing and LNG production facility will comprise a land-based modular unit for receiving and processing natural gas into LNG. The LNG unit will contain the liquefaction equipment and systems.

Both the **preferred** and the **alternative** proposed configurations will use a Single Mixed Refrigerant (SMR) liquefaction process technology as a well-proven process available from multiple technology providers. The intent is to have two trains operating at 100% of their capacity to achieve the desired LNG production capacity of up to 2.1 MMTPA.

3.4.1 Process Heat System

The LNG facility has two major process units that require process heat including the amine reboiler and the dehydration regeneration gas heater. Both of these heat loads involve continuous operating processes that use an intermediate heating fluid in a closed loop to transfer the heat from the source to the end user. The type of drives used for the refrigerant compressors will determine which design option applies and will be used in the final process heat configuration. There are two options under consideration for process heat, these being:

- 1) If the facility incorporates **gas turbines** for the refrigerant compressor drivers, a Waste Heat Recovery Unit (WHRU) will be used. The WHRU would use a heating medium to cool the exhaust gas from the turbine prior to dispersion in the atmosphere; and
- 2) If **electric motors** are selected to drive the refrigerant compressors, there will be no process waste heat. In this case, fuel gas would be combusted in two stand-alone fired heaters (i.e., one for the amine reboiler and one for the dehydration regeneration gas heater). The fired heaters would employ state of the art burners and achieve oxides of nitrogen (NO_x) levels of less than 15 parts per million (ppm).

3.4.2 Process Control Systems

A central control room will house equipment to monitor the process and utility operations at the Woodfibre LNG facility, with environmental monitoring equipment and a full internal and external communications suite, and a telecommunications system installed to enable any emergency or unusual event control from the central facility. Local shutdown facilities associated with onsite equipment will be used to control and manage shutdown and equipment isolation near the point of failure.

3.4.3 Fire Protection and Safety Systems

Fire protection, safety measures (i.e., emergency response plan, operating procedures), and safety systems/equipment (i.e., firewater pumps, hydrants, fire extinguishers, high expansion foam systems, gas detection and cryogenic leak detection, etc.) will be used to actively protect facility personnel, construction and operations equipment, and the surrounding areas and resources. Protection and safety systems and planning will be used to avoid, limit, and mitigate any injury or damage from incidents associated with the release of LNG product or associated vapour.

3.4.4 Safety, Shutdown and Depressurization Systems

A safety-instrumented system (SIS) will operate to manage the safety, shutdown and gas depressurisation processes for the site. The SIS will include separate components for each LNG process train and the ship-loading facilities, and will include a combination of manual and automatic shutdown processes.

3.4.5 Safety Flare and Vents Systems

The **preferred** and **alternative** configurations proposed for gas processing and LNG production will include on site safety flaring or gas venting for emergency purposes only. Safety flaring or gas venting will only occur during emergency scenarios to reduce gas pressure at the Woodfibre LNG facility. Any such safety flaring would be of very short duration and is not anticipated to occur during normal operating procedures.

The dual flare system (i.e., one stack rigging, with two separate flow pipes) will comprise a warm/wet disposal flare stream containing moisture that may freeze or form hydrates at low temperature, along with a cold/dry flare for cryogenic or moisture-free stream disposal. Collection of liquids will be through flare knock out drums upstream of the flare stack for appropriate disposal, and each flare will be fitted with small, permanently lit gas fired pilot lights to ensure safe operation of the flare. All fugitive gas emissions from the plant operations will be directed to the safety flaring system. The following flare components will be installed to service the LNG facility:

- Warm flare (located in main flare riser) and knockout (KO) drum;
- Cryogenic flare (located in main flare riser) and KO drum; and
- The main flare stack.

3.4.6 LNG Floating Storage Unit

Storage of LNG will be provided within the FLNG, along with dedicated storage that may be provided on one or more permanently moored FSUs. Storage capacity between 170,000 and 250,000 m³ will be provided and determined based on the selected off-take LNG carrier size. The exact storage configuration will be determined during the FEED phase of the project.

Floating LNG storage will be common for both the **preferred** FLNG configuration and **alternative** land-based configuration. In the case of the **alternative** land based configuration, the storage will all be provided in one or more permanently moored FSUs.

3.4.7 Marine Terminal, LNG Transfer & Offloading Infrastructure

LNG will be offloaded from the LNG storage unit to LNG carriers, which will ship the LNG to overseas markets. The project will include a dedicated marine jetty specifically designed for the safe mooring the FSU and off-take transfer vessels. The exact offload configuration will be determined during the FEED phase of the project. The marine terminal facilities and infrastructure will be common for both the **preferred** and **alternative** configurations for gas processing and LNG production.

3.4.8 Marine Mooring Facilities

The Woodfibre LNG project will use the existing deep water and shoreline marine terminal characteristics of the project site and, where viable, will use existing marine infrastructure. It is anticipated that most of the existing infrastructure will need to be upgraded or replaced to address safety, regulatory compliance, and specific project requirements. The marine mooring facilities and infrastructure will be common for both the **preferred** and **alternative** configurations for gas processing and LNG production.

Permanent mooring facilities will be required for both the **preferred** configuration and the **alternative** configuration. In the **preferred** configuration, the FLNG and the FSU will be permanently moored, with ancillary equipment and connections installed to connect the natural gas supply from shore to the FLNG and to connect the LNG from the FLNG to the FSU. In the **alternative** configuration, the FSU will be permanently moored, with ancillary equipment and connections installed to connect the LNG supply from shore to the FSU.

The mooring system will be laid-out and designed with consideration of the following:

- Permanent vessel moorage for the FLNG configuration and the FSU to safely withstand and endure extreme weather and wind and marine environmental conditions;
- Water depth and adequate vessel under-keel clearance;
- Siting of the marine terminal infrastructure to avoid and limit potential impacts from berthed and transiting vessels to the Mill Creek and Woodfibre Creek river mouths; and
- Siting of the marine terminal infrastructure to ensure continuation of the current navigational passage.

LNG carriers ranging from 125,000 to 180,000 m³ in capacity will berth alongside the FSU for transfer of cargo. Fendering will be located along the FSU for berthing LNG vessels and provide a point of contact for the moored vessel. Spring line mooring points will be provided along the FSU. Mooring dolphins will provide additional connection points for berthed LNG carriers.

3.4.9 Supporting Infrastructure

Additional facilities associated with the proposed Woodfibre LNG project include all facilities permanently installed for the duration of the project life cycle to support the safe operation of the plant and terminal facilities. These facilities and infrastructure will be common for both the **preferred** FLNG and **alternative** land-based configurations for gas processing and LNG production. The following sections provide an overview of the proposed project supporting infrastructure components.

3.4.9.1 Private Passenger Ferry Terminal

Access to the site will only be via water using private passenger ferry from Squamish to the site. A permanent passenger ferry terminal and ferry berthing facility will be established at the project site for connection between the site and Squamish.

3.4.9.2 Marine LNG/Materials Offloading Facility

An existing materials offloading facility at the project site will be upgraded and additional infrastructure will be constructed during the site preparation phase of the project to form the primary access and egress point for materials. The marine offloading facility and barge ramp will be designed for use during construction and operation phases, with its exact location to be determined during FEED taking into considering the upland facilities layout both during and after construction (Figure 2a, b).

3.4.9.3 Site Administration, Site Infrastructure and Safety Facilities

Chemical Storage and Handling

Chemical storage will be provided for propane, lubricants, and other chemicals (e.g., oil drums, absorbent refrigerants, and treatment chemicals used during the LNG production process). Storage facilities will be designed to prevent spill release to the environment, as well as control heat flux resulting from ignition of flammable liquids.

Fuel Storage Systems

An existing on site above-ground fuel storage tank system will be upgraded and additional tank systems constructed to provide fuel for engine-driven equipment (e.g., fire pumps and emergency generators), along with onsite vehicles (e.g., maintenance trucks). Fuel storage will be located to the right of Mill Creek, with a capacity of 50 m³ of diesel fuel (Figure 2a, b). Refer to Section 3.4.10 for a summary of transporting of fuels via barge from Squamish terminals to the project site.

Refrigerant Storage and Handling

Refrigerant storage will be located adjacent to the LNG process facility, with a storage capacity of approximately 40,000 kilograms (kg) per year (Figure 2a, b). Fugitive emissions of refrigerants will be directed to the safety flaring system. Refer to Section 3.4.10 for a summary of refrigerant transport to the project site from Squamish terminals.

3.4.10 Shipping Activities

Shipping activities associated with the Woodfibre project include transit of LNG carriers, with up to 40 vessel calls per year or three to four calls per month for two LNG trains. Tug assist and BC Coastal pilots will be used to support inbound and outbound safe transit of LNG carriers to and from the Woodfibre LNG facility. A variety of LNG carrier sizes may be used to export LNG from the Woodfibre LNG facility. The largest vessels anticipated to use the Woodfibre LNG facility include latest standard LNG carrier designs, which are 295 m in vessel length, 47 m wide with a draught depth of 12 m. These vessels have capacity to ship up to 180,000 m³ of LNG, with a deadweight tonnage (DWT) of 85,000 tonnes.

There will not be moorages or additional anchorages within Howe Sound or near the project site. It is anticipated that established Vancouver mooring and additional anchorage sites would be used as needed and communication and scheduling will be conducted Port Metro Vancouver Authority and through coordination with the Pacific Pilotage Authority and BC Coast Pilots. All LNG carrier vessel activities

during mooring, anchoring, and transit will be conducted in accordance with the *Canada Shipping Act* (2001) and by-laws established by Transport Canada.

For the inbound vessels, LNG carriers will move through Howe Sound (Figure 4) in accordance with the *Canada Shipping Act*, 2001. Inbound LNG carriers will pick up BC Coast Pilots at appropriate pilot boarding stations (e.g., Brotchie Boarding Station off Victoria and Sands head Boarding station off Main Arm Fraser River), along with tethering of assist and escort tugs (Figure 4).

BC Coast Pilots will assist in transit of the LNG carrier to and from the project site. The LNG Vessels will likely have two BC Coastal pilots at all times. For the outbound vessels, LNG carriers will transit using two BC Coastal pilots from the project site through Howe Sound within designated shipping zones and in accordance with the *Canada Shipping Act*, 2001 and the Canadian Coastguard and BC Coast Pilots under normal operations the vessels. BC Coastal pilots will be transported to site and will board the LNG carrier for outbound transit at the Woodfibre LNG terminal. After exiting Howe Sound, LNG carriers will move through existing designated shipping lanes to the Pacific Ocean.

Vessel traffic will use Canadian federally designated shipping lanes and amount to a negligible increase in monthly shipping vessel movement relative to existing commercial shipping traffic. The project, if approved, would incrementally add approximately three to four export vessel arrivals per-month through the Port Metro Vancouver Authority harbour area. In 2011, the Port Metro Vancouver accommodated 3,024 foreign vessel arrivals^[1]. LNG vessels will transit existing shipping lanes under regulated vessel speeds using safe passage under the direction and guidance of BC Coastal pilots with the support of assist and escort tugs.

In recent years, LNG vessels have transited a portion of the proposed Woodfibre LNG shipping route, although we anticipate many of these vessels are destined for terminals in Washington State. According to The West Coast Spill Response Study (July 2013)^[2], there was limited LPG and LNG carrier activity in western Canadian waterways in 2011 - 2012. LPG and LNG carriers made up less than 1% of total vessel traffic activity. The number of transits doubled from four in 2011 to eight in 2012.

LNG will be shipped out of the project site by LNG carriers contracted by WNGL to carry cargo throughout the Woodfibre LNG facility life. Shipping of the LNG product will be conducted separately from the operations of the LNG facility and marine terminal. The party responsible for care, safety and control of the LNG product, once it leaves the Woodfibre LNG facility and marine terminal, will vary depending on the contractual arrangement between WNGL and its customers. LNG carriers not contracted by WNGL may also be used, including where LNG is purchased Free on Board (FOB) from the Woodfibre LNG facility by a third party.

WNGL does not own or operate LNG carriers; rather, WNGL will contract LNG carriers under WNGL terms and conditions, as required on a short, medium and long-term charter, to capture business opportunities and maintain a balanced shipping position. In addition, WNGL will require the contracted shipping carriers to comply with all applicable national and international shipping and safety requirements.

[1] Port Metro Vancouver Statistics Overview 2011 Report: http://www.portmetrovancouver.com/docs/default-source/about-facts-stats/PMV_2011_Stats_Overview.pdf?sfvrsn=0

[2] The West Coast Spill Response Study, Volume Two: Vessel Traffic Study, July 2013. Report prepared by Nuka Research and Planning Group.

If FOB is used, WNGL will transfer ownership of the LNG product as it leaves the Woodfibre LNG marine terminal. In this circumstance, WNGL would transfer care, safety and control to the buyer/shipper, which may or may not include the provision of LNG shipping. This would be subject to the specific terms of LNG sale and Canadian and international regulatory standards and practices for shipping.

In the circumstance that WNGL contracts through an ex-ship delivery (DES) agreement, WNGL would be responsible for transport of the LNG product and retain ownership of the LNG until transfer to its customer transfer port. In both scenarios, WNGL and the LNG product buyer/shipper, can make use of ships owned and operated by a third party contracted LNG carrier.

LNG carriers are designed with a double hull, which provides optimum protection for the integrity of the LNG product in the event of collision or grounding. Double hulls also provide separate ship ballast. Separate from the hull design, LNG ships have safety equipment to facilitate ship handling and LNG cargo system handling. The ship-handling safety features include vessel radar and positioning systems that enable the crew to monitor the ship's position, traffic, and identified hazards around the ship. A global maritime distress system automatically transmits signals if there is an onboard emergency requiring external assistance. The cargo-system safety features will include an extensive instrumentation package that safely shuts down the system if it starts to operate outside of predetermined parameters. Ships also have gas and fire detection systems and nitrogen purging. Should fire occur on a ship, two safety relief valves are designed to release the ensuing boil off to the atmosphere without over-pressurizing the tank.

LNG ships will use approach velocity meters when berthing to ensure that the prescribed impact velocity for the berth fenders are not exceeded. Automatic mooring line monitoring will provide individual line loads to help maintain the security of the mooring arrangement while alongside moorings. When connected to the onshore system, the instrument systems and the shore-ship LNG transfer system act as one system, allowing emergency shutdowns of the entire system either from the vessel, or from the shore.

Other Marine Vessels

Shipping of equipment and other materials to site will be undertaken through use of the Woodfibre LNG materials offloading facility (Figure 2a, b) in accordance with the *Canada Shipping Act* (2001) along with by-laws established by Transport Canada. Approximately one barge movement per month will transport chemicals, cement, fuel and refrigerant to the site. In addition, two ferry trips per day will occur to take site personnel and food supplies for these personnel to and from the site during construction, operation, and closure. Additional water taxis may be used each day. Personnel and supplies will be limited to barges and ferry transits to the site. It is expected that the Squamish terminal and Port Metro Vancouver will be the point of origin for the barges, tugs, and water taxis.

WNGL does not intend to own or operate barges, tugs or water taxis. WNGL intends to contract barges, tugs and water taxis under WNGL terms and conditions, as required on a short, medium, and long-term charter. In addition, WNGL will require the contracted barge, tugs, and water taxi operators to use appropriate vessels, take required precautions and safety measures, and comply with all applicable national shipping and safety requirements to ensure the security, integrity, and safe delivery of materials, supplies, and personnel to the site.

Any pre-fabricated modules associated with construction of the LNG facility will be transported from Asia for direct offload at the project site using specialised transportation vessels contracted by WNGL under WNGL terms and conditions, pursuant to which WNGL will require the contracted transportation vessels to comply with all applicable national and international shipping and safety requirements. The number of specialised vessel movements for construction will be confirmed during the FEED design phase of the project.

3.4.11 Shipping Route

The following provides a summary of the anticipated vessel activities associated with the Woodfibre LNG project:

- Regular transit of up to 40 LNG carrier visits to the Woodfibre LNG project site per year (refer to Table 2 (Section 2.7) for further information related to anticipated vessel movements);
- Tug and pilot boat operation to support safe passage, tethering support tugs, and berthing of LNG carriers from international waters in the Pacific Ocean to Howe Sound and the project site; and
- Shipping equipment and other construction materials from Squamish Terminals and Port Metro Vancouver, to the onsite materials offloading facility.

3.4.12 Navigational Approach

The LNG carriers will navigate from the Woodfibre LNG site through established navigational and channels in Howe Sound to the Pacific Ocean through designated and existing shipping lanes/navigation routes. The route is piloted and vessel transit will be undertaken in accordance with the *Canada Shipping Act* (2001) along with by-laws established by Transport Canada and the Pacific Pilotage Authority (PPA) (Figure 4). Given the preliminary marine traffic analysis presented in Section 2.7, WNGL considers that the spatial scope for the marine shipping component of the environmental assessment should be limited to transit within Howe Sound.

3.4.13 Vessel Berthing

The LNG carriers will approach the berth at the Woodfibre LNG site with the assistance of tugboats. Each vessel will turn and align with tugboat assistance in a designated turning basin located adjacent to the berth. Once aligned, the tugboats will assist the LNG carrier berthing perpendicular to the berth face on the marine jetty. After the LNG carrier has berthed, some of the tugs will hold the vessel in place, while the others assist with anchoring the mooring lines to the mooring structures.

3.4.14 Operational Safety Zones

The International Regulations for Preventing Collisions at Sea 1972 (COLREGs) apply to all vessels all navigation waters to the project site including Howe Sound. The Navigation Rules to be followed by ships and other vessels, including LNG Carriers, are intended to prevent collisions between two or more vessels.

Port safety zones are established by Transport Canada, the Pacific Pilotage Authority (PPA), and the port authority captain, based on the specific risk factors at a given terminal. There are two key purposes for safety zones for LNG ships:

1. To minimize the potential for collision while the ship is underway; and
2. At berth, to protect surrounding property and personnel from hazards that could be associated with accidents.

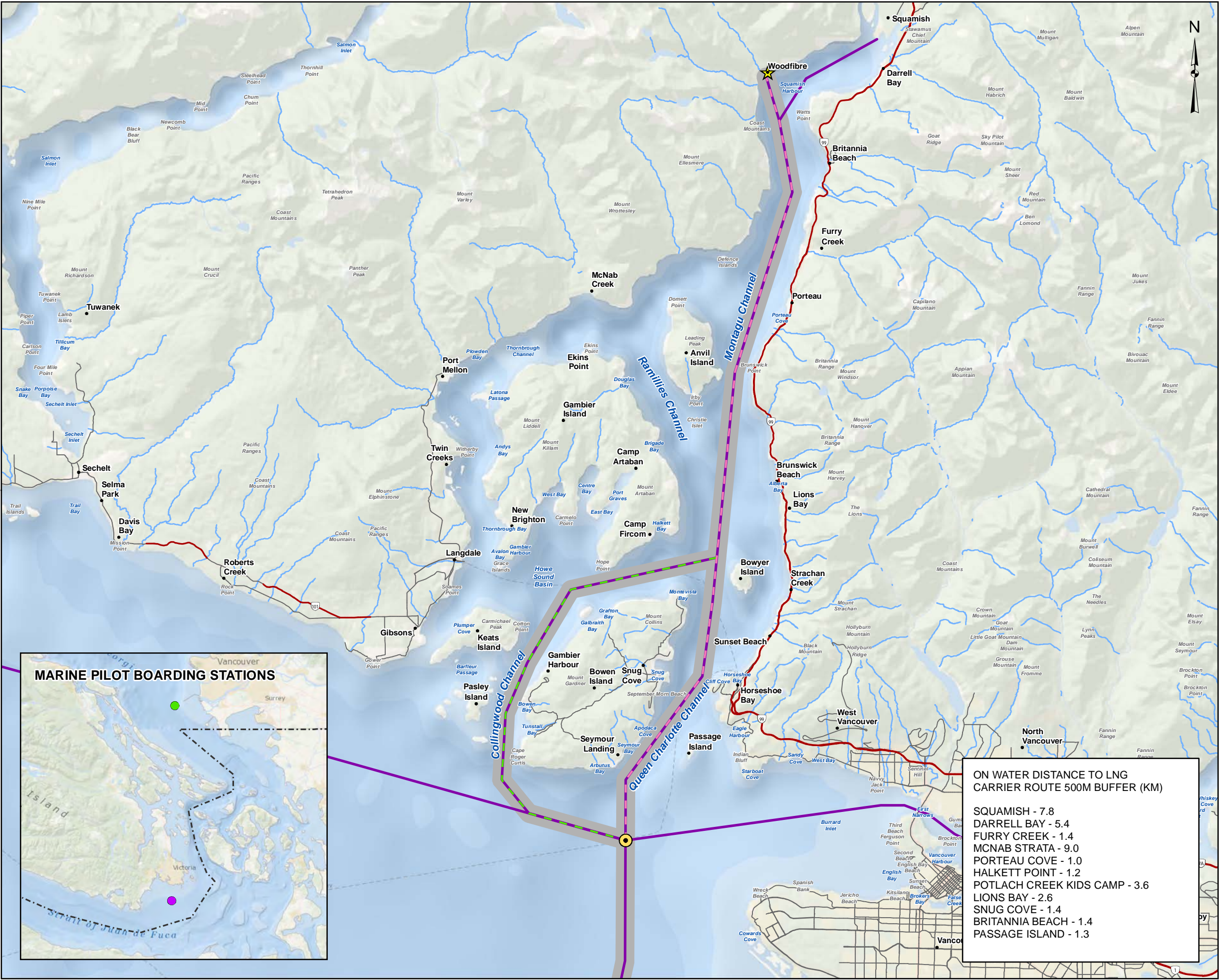
Established safety zones are based on the specific circumstances, including navigational requirements, in a specific area. In some ports, Transport Canada and the PPA may require a tug escort and specified safety zones around LNG ships when a ship is underway to the receiving terminal. Transport Canada's intention is to minimize disruption to shipping and boating traffic in the area while ensuring safe operations. Tugs will assist in the safe docking of LNG carriers.

It is anticipated that an exclusion zone will extend an approximately 250 m radius from the loading platform during loading operations, with the safety zone patrolled by the standby tug. By comparison, a 50 m safety zone will be in effect at all other times (i.e., when the jetty is unoccupied). The exclusion zones will include vapor dispersion, thermal radiation, and general safety guidelines (security). This radius is a preliminary estimate and will be verified during the FEED phase of the project, and through discussion with regulators. Woodfibre LNG will establish control over those areas included in the exclusion zones.

3.4.15 Refueling and Provisioning

Refuelling, bunkering, along with solid and liquid waste removal for the LNG carriers will occur outside Howe Sound, and will be the responsibility of the LNG carrier owners. While docked at the loading facility either before or after LNG loading operations have been undertaken, food and other provisions may be loaded onto the vessels.

PATH: N:\CAD-GIS\VAN2013\13-1422\13-1422-0006 - WoodfibreMapping\MXD\General\WOODFIBRE - PROJECT_DESCRIPTION FIGURE_04 Marine Shipping_Route.mxd Date: 12/6/2013 Time: 11:10:10 AM

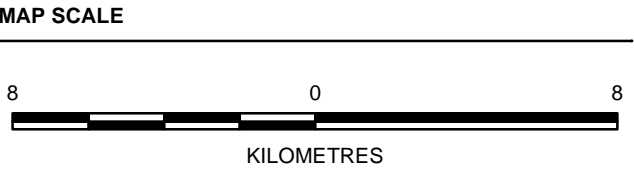


LEGEND

- ★ PROJECT SITE
- EXISTING COMMERCIAL VESSEL SHIPPING ROUTES
- PROPOSED LNG CARRIER ROUTE
- ALTERNATIVE LNG CARRIER ROUTE
- 500M BUFFER FROM LNG CARRIER ROUTES
- HIGHWAY
- ARTERIAL ROAD
- FERRY ROUTE
- WATERCOURSE
- CANADA/USA BORDER
- WOODFIBRE SHIPPING MERGE WITH EXISTING COMMERCIAL SHIPPING ROUTE
- SAND HEADS MARINE PILOT BOARDING STATION
- BROTCHIE MARINE PILOT BOARDING STATION

REFERENCE

BASE DATA FROM CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED. IMAGERY PROVIDED BY ESRI OCEAN BASEMAP. WARNING: MAP IS NOT TO BE USED FOR NAVIGATION. PROJECTION: UTM ZONE 10 DATUM: NAD 83



PROJECT

WOODFIBRE NATURAL GAS LTD.
WOODFIBRE, HOWE SOUND, B.C.

TITLE

MARINE SHIPPING ROUTE - HOWE SOUND

PROJECT NO. 13-1422-0006	PHASE No. 1000
DESIGN MJ 19 Aug. 2013	SCALE: 1:800K/200K REV. 3
GIS AS 19 Aug. 2013	
CHECK AL 04 Oct. 2013	
REVIEW MJ 30 Oct. 2013	

FIGURE 4

Golder Associates

4 PROJECT ACTIVITIES

4.1 Site Preparation

4.1.1 Site Clearance

Site works for both the **preferred** FLNG and **alternative** land-based configurations will begin with removal of the concrete hard standing, where required for future site operations. In addition, clearing any existing vegetation across the footprint of the project site and proposed facility, along with other areas where vegetation clearance is required for ancillary facilities (e.g., perimeter fencing and firebreaks) will also be undertaken. At present, the site clearing will include small areas of recent vegetation that has grown following the shutdown of the previous Woodfibre Pulp and Paper mill operations. Existing site structures and buildings will be demolished where necessary, with onsite retention of demolition rubble for use as compacted construction fill, or deposited in the existing on site permitted landfill. The cleared ground surface will be graded and leveled as needed and prepared for construction.

Laydown areas, materials storage, along with chemical, fuel storage, and handling facilities will be constructed and will be used to store construction materials and ancillary equipment during site construction.

4.1.2 Drainage System

During site preparation, a temporary drainage system, and erosion and sediment control measures will be established and implemented to collect and control stormwater flows and runoff from the site to Mill Creek and to marine water in Howe Sound for both the **preferred** and **alternative** configurations. The temporary drainage and stormwater system will include the following control measures: perimeter ditches, internal ditches, cut-off swales, and erosion and sediment control mitigation measures around the construction site. Civil work will include construction of the permanent stormwater management infrastructure, including storm sewers and drains. Erosion and sediment control structures will be installed around the perimeter of the site to control potential sediment discharge into Howe Sound and Mill Creek. No sediment pond will be required as part of site activities.

4.1.3 Sanitary Sewage System

The existing permitted project site tertiary sanitary sewage treatment plant, which previously accommodated the pulp and paper facility operations and associated town, is located adjacent to the proposed FLNG trestle, and treated water will be discharged through an existing pipe located on the western portion of the proposed site (Figure 2a, b). This existing sanitary sewage facility will be used during site preparation, construction, operational, and decommissioning/closure phases for both the **preferred** and **alternative** configurations. The sanitary sewage system will provide tertiary treatment and will be used to meet the current regulatory liquid waste discharge requirements.

The existing sewage system will provide the necessary capacity during site preparation, site construction, operations, and closure phases of the project. For the **preferred** FLNG configuration, sanitary waste from the floating facilities will be piped to the project site and to shore for processing within the existing permanent permitted tertiary sanitary sewage facility. For the **alternative** land based configuration, sanitary waste will be piped to this same facility.

4.1.4 Waste Material Landfill

The existing permitted onsite landfill will be used to dispose of waste materials during site preparation and construction (Figure 2a, b). Demolition and construction site waste is acceptable under the existing permit conditions for deposition in the existing Woodfibre landfill. The existing permitted landfill has sufficient capacity to handle all expected materials. In the event that materials from site clearing, construction, and operations that are not acceptable for deposition within the existing permitted landfill, these solid waste will be transported offsite by barge for disposal to an appropriate designated disposal facility.

Runoff from the existing landfill will continue to be collected and treated based on conditions required and set forth for the previous property owner, within the existing onsite landfill water treatment facility located immediately downslope of the existing landfill.

Seismic upgrades to the existing permitted landfill will be undertaken to meet regulatory seismic requirements for an LNG processing facility. Seismic upgrades will use clean onsite demolition rubble and concrete materials to support engineer design standards for the landfill and its seismic stability.

4.1.5 Site Access and Materials Storage

The project site is only accessible by water. The existing personnel access dock will be renovated to allow movement of personnel to the site during site preparation and construction. A site security fence will be erected around the perimeter of the site, where applicable, to limit safe entry to the site. Onsite access roads and a haul road will be upgraded and constructed, where needed, between laydown, construction, and storage areas.

The laydown and storage areas will be appropriately banded (delimited and controlled) to mitigate for accidental spills and discharges, and runoff to limit and avoid impacts to aquatic environments in accordance with applicable regulatory requirements (Figure 2a, b). Raw materials will be stored in batches and appropriately banded in designated areas to avoid and limit emissions. In addition, any cement storage will be enclosed within a dry building that is located within the laydown and storage area.

The new materials barge ramp will be used for site access of construction materials, construction equipment, machinery fuel and workers during the construction period, and will be maintained for use during operation of the Woodfibre facility (Figure 2a, b). Refer to Section 3.4.10 for a summary of the marine vessel transport associated with construction.

4.1.6 Civil Works and Foundations

The site is an existing brownfield industrial site comprising concrete hard standing, buildings, structures, related infrastructure, and small areas of vegetation. Civil works, foundations, and structures associated with the onsite LNG and ancillary facilities for both the **preferred** FLNG configuration and **alternative** land-based configurations will be completed throughout the site as required. A concrete batching plant will be commissioned and located in the bunded laydown area for use during civil works. Blasting is not anticipated for civil works associated with onshore facilities.

Civil works for the marine facilities for both the **preferred** FLNG and **alternative** configurations will be undertaken concurrently with the onshore civil works program. Marine facilities will include the LNG jetty and trestle. Construction of the jetty will involve drilling or driving piles for foundations. The trestle will extend from the shoreline across a pile-supported deck connecting to the jetty head. Blasting and dredging works are not anticipated for civil works associated with marine facilities.

4.2 Project Construction

Project construction will involve activities at the project site and in shipyards and other facilities at other locations. Woodfibre LNG will purchase prefabricated modules for gas pre-treatment, LNG production, and the FSU. These construction activities will take place in shipyards and or conversion yards qualified to undertake this type of work, most likely in Asia. For the **preferred** configuration, individual modules will be assembled on the hull and the FLNG will be transported to site. The **alternative** land-based configuration will also include construction of individual modules in conversion yards in Asia. The individual gas pre-treatment and liquefaction train modules will be transported to site, before connection and assembly to the land-based infrastructure in accordance with the FEED specific layout.

Construction activities undertaken at the project site for the **preferred** configuration will involve civil, electrical, and mechanical work to enable the FLNG and FSU units to be permanently moored at the site and to receive the gas and utilities required for their operation.

Construction activities undertaken at the project site for the **alternative** land based configuration will involve civil, electrical, and mechanical work to enable the land-based LNG modules to be placed on the site and the FSU units to be permanently moored to receive the gas and utilities required for their operation.

Construction of the major off-site and onsite project components will occur concurrently for both the **preferred** and **alternative** options. Once complete the LNG and FSU modular components for **preferred** or **alternative** unit configurations will be transported to the site, where they will be connected for commissioning activities prior to operation of the facility. The construction phase for both **preferred** and **alternative** options is expected to commence in 2014, with estimated completion at the end of 2016 and the overall construction period lasting 24 months.

4.2.1 Construction Activities and Sequencing

Construction activities will commence once the FEED engineering work is complete and all permitting requirements have been met. To ensure an efficient project schedule, the major project components will be purchased and constructed in parallel at different construction sites. The **preferred** and **alternative** gas pre-treatment and natural gas liquefaction module construction options will be sequenced in a similar manner (see Table 3).

4.2.1.1 Preferred LNG Configuration

The **preferred** configuration for the FLNG and the FSU will be constructed as individual units as part of the selected shipyard/conversion yard production schedule, as per the sequence and schedule provided in Table 3. Once the mechanical and electrical installation of the LNG modules onto the hull is complete at the shipyard, the FLNG and FSU units will be towed, by qualified contracted shipping operators, to the project site for final hook up and commissioning work.

The local site activities will be undertaken to meet the schedule of FLNG and the FSU unit arrivals at the site. The major onsite construction activities will include the construction and installation of a new jetty, mooring facilities for the FLNG and FSU units, gas piping tie-ins and electrical power supply tie-ins.

4.2.1.2 Alternative LNG Configuration

The **alternative** configuration for the LNG and the FSU will be constructed as part of the selected shipyard/conversion yard production schedule, as per the schedule provided in Table 3. The **alternative** configuration will involve additional onsite construction sequencing to assemble the modular units into the appropriate natural gas processing and LNG production layouts. The timing of these activities will follow a timeframe consistent for assembly on a floating unit or on land.

The prefabricated LNG modules and FSU units will be towed, by qualified contracted shipping operators, to the project site for final mechanical and electrical installation, hook up and commissioning work.

The local site construction activities will be undertaken to meet the schedule of LNG module and the FSU unit transportation and shipping arrival to the site. The major onsite construction activities for the **alternative** LNG configuration will include mechanical and electrical installation and tie-ins, gas piping and tie-ins for the prefabricated gas pre-treatment and liquefaction modules, along with installation of a new jetty and mooring facilities for the FSU.

4.2.1.3 Common Site Construction Activities

Onsite construction activities will be scheduled to ensure efficient installation of the LNG and FSU once these units arrive to the project site, which may involve work being undertaken at night and during the weekends depending on the overall construction schedule. Mitigation measures implemented to control potential effects on wildlife and marine mammals during the construction phase are summarised in Section 8.0 (Table 7) of this Project Description. Tree clearance (limited to safety exclusion zones on existing cleared site), or habitat-altering activities will be limited to time periods outside the breeding season for birds or amphibians (i.e., critical life stage) where possible.

Other common site preparation activities undertaken include the construction of administration offices and other facilities and utilities required to support the operation. These activities will be further detailed during the FEED design phase of the project.

Blasting activities are not anticipated as part of construction activities for the project. In addition, dredging activities are not anticipated as part of the project.

Hook-up of the FLNG unit for the **preferred** configuration will be made at the marine terminal in accordance with the final mooring configuration design. Connection of the mooring wires and utilities will be undertaken at site. This will involve the connection of power lines to the FLNG barge and the FSU. Interconnecting piping will also be connected which includes the connection of the inlet gas line to the FLNG barge. Other communication and control connections will be installed and commissioned at the facility.

For the **alternative** configuration there will only be hook-up activities associated with the FSU unit and this will involve providing LNG connections from the land based liquefaction modules. In addition, other utilities such as power, communication and control systems will be connected to the FSU unit prior to commissioning activities taking place.

Table 3: Anticipated Woodfibre LNG Project Construction Sequencing

	2015				2016		
	Q1	Q2	Q3	Q4	Q1	Q2	Q3
Offsite Construction (in Asia)							
• Preferred Configuration - FLNG and Hull Construction							
• Alternative Configuration - LNG Processing Modules Construction							
• Preferred Configuration - Prefabricated gas pre-treatment and processing module installation on FLNG							
• Alternative Configuration - Prefabricated gas pre-treatment and processing modules installation on site (land)							
• LNG Floating Storage Unit (FSU)							
Onsite Preparation and Construction							
• Facilities site preparation, draining and laydown area							
• Prefabricated gas pre-treatment and processing module site preparation and foundations							
• Jetty and mooring systems							
• Utility connections							
• Electrical tie in							
• Gas tie in							
Transportation of Materials to Site							
• Preferred Configuration - FLNG transported to site							
• Alternative Configuration - Prefabricated gas pre-treatment and processing modules for land configuration transported to site							
• FSU transported to site							

Table 3: Anticipated Woodfibre LNG Project Construction Sequencing

	2015				2016		
	Q1	Q2	Q3	Q4	Q1	Q2	Q3
Hook-up of Modules Onsite							
• <i>Preferred Configuration – FLNG and FSU mooring and utility connections completed</i>							
• <i>Alternative Configuration – FSU mooring and utility connections</i>							
Commissioning of Onsite Facilities							
Final Onsite Facility Completion							

4.2.2 FLNG and FSU Construction Activities

4.2.2.1 LNG Unit and Processing Modules

The **preferred** configuration for the FLNG unit will be constructed in a shipyard or conversion yard that will be selected for the project based on the capacity and capability to undertake the work scope. Initially the hull of the vessel will be constructed as a platform for the LNG processing equipment. The hull will be fabricated using steel and be built into blocks onshore. The hull blocks will then be assembled in a dry dock and welded together to complete the barge. The barge will also be equipped with any required storage in the hull as well as other structures and tanks as required to support the operation of the facility.

Both the **preferred** and **alternative** LNG processing modules will be prefabricated as individual units and then assembled either on the FLNG hull (**preferred** configuration), or on land (**alternative** configuration). The modules will be fully equipped with mechanical and electrical work completed prior to installation. The number and type of modules will be confirmed during the FEED phase of the project to contain all the equipment required to process the natural gas into LNG as well as all the supporting utilities required.

It is expected that the modules will be prefabricated then assembled at the shipyard/conversion yard on the FLNG unit (**preferred** configuration), or assembled on land at the project site (**alternative** configuration). The maximum module size will depend on the facilities available at the contracted shipyard and conversion yard. This approach provides efficient construction of the LNG processing and production unit with a substantial portion of the work being complete prior to arriving at the site for installation and commissioning. The modular approach also enables work to be undertaken in parallel, thereby reducing the overall construction time for the project. An image of a typical FLNG unit with LNG processing modules for the **preferred** configuration is provided in Image 1. The **alternative** configuration LNG unit on land, with LNG processing modules is provided in Image 2.

The work scope associated with refurbishing the FSU will be undertaken at prequalified conversion yards. The unit will require refurbishment of the hull structure and existing marine systems to allow for a permanently moored FSU, as well as providing new systems, which will enable the FSU to integrate with the LNG unit (either **preferred** or **alternative** LNG configurations). This work will be undertaken in parallel with the construction of the LNG modules.



Image 1: Typical FLNG unit with LNG processing modules



Image 2: Land-Based LNG Processing Modules

4.2.2.2 LNG Floating Storage Unit

LNG storage will require the use of one or more FSU's. It is anticipated that this storage will be provided using refurbished LNG tankers to construct a permanently moored FSU unit. The major construction activities associated with refurbishing the FSU will be undertaken at prequalified ship conversion yards. The unit will require refurbishing of the hull structure, which will involve steel and coating work to provide the necessary design life (greater than 30 years) for the FSU to remain moored at the facility.

Existing marine and cargo systems will need to be upgraded or in some cases replaced to provide the necessary design life for the unit. The scope of work will be determined once a vessel is identified and selected as the proposed FSU. Based on the vessels existing specifications, the modifications to convert the carrier to an FSU will be determined, designed and constructed. Additional equipment will also be constructed onto the FSU to include the LNG transfer equipment to the offloading LNG carrier. Finally, upgrade and integration of the control systems with the LNG plant will also be required. Image 3 provides an example of a FSU. The FSU will be permanently moored in the marine terminal of the facility.

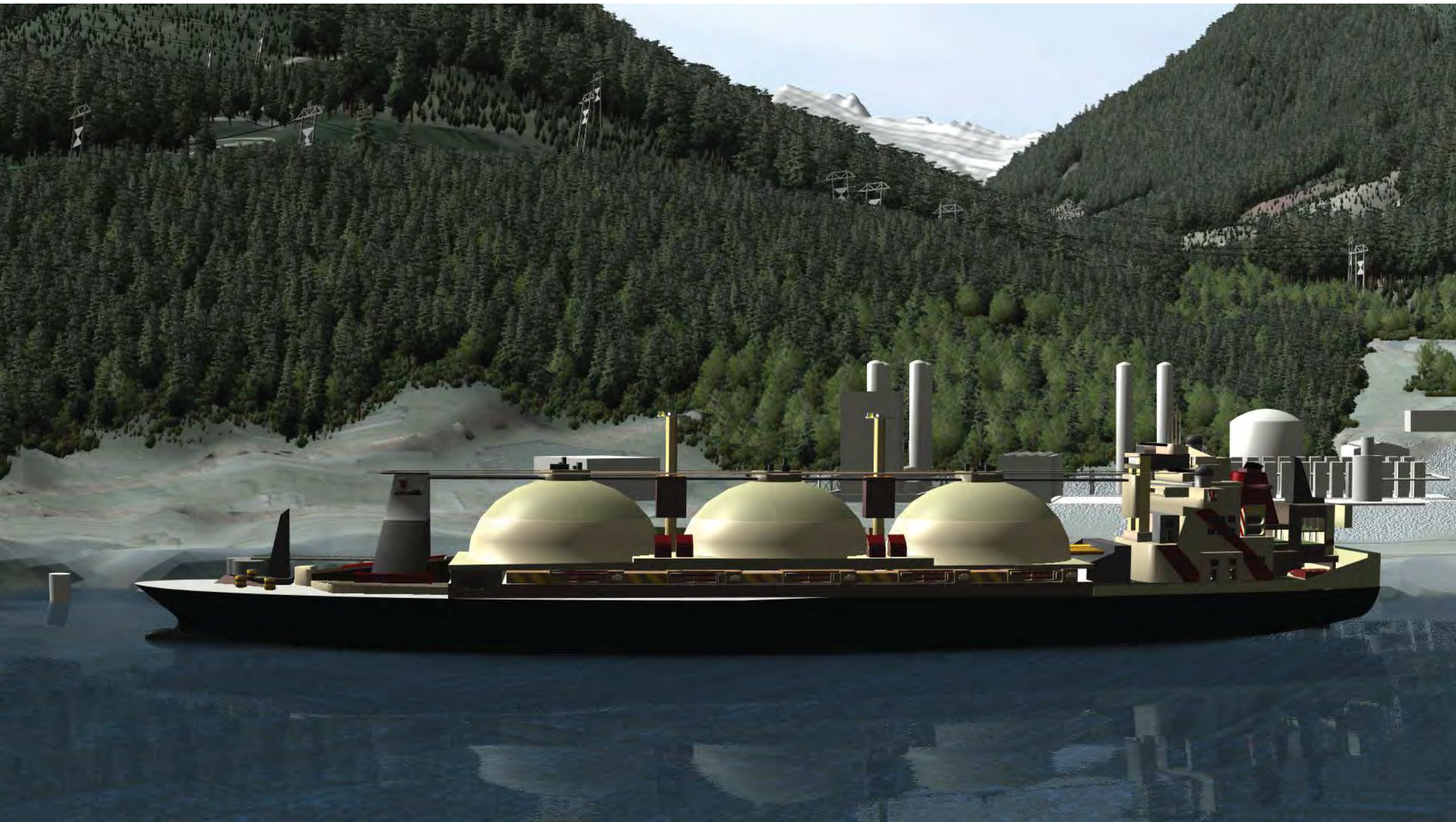


Image 3: Example of a Floating Storage Unit

4.2.3 Site Construction Activities

Prior to commencing site clearance activities for either the **preferred** or **alternative** configuration, a temporary drainage system will be established to collect and control storm water flows across the site throughout the construction period. Temporary drainage systems will be installed as required and may include perimeter ditches, internal ditches, and cut-off swales. Site preparation will begin with clearing vegetation across the project footprint as required. This will include the exclusion zones, perimeter fencing, drainage and preparation for foundations for equipment.

Major equipment requiring foundations will comprise the mooring and jetty system for the FLNG and FSU units for the **preferred** configuration and additional LNG processing module foundations on land for the **alternative** configuration, as required. Other site preparation activities will include preparing the site for foundations for other equipment and facilities such as office facilities, workshops and other storage and laydown areas as required.

4.2.3.1 Construction of Mooring Facility

The mooring facility for the **preferred** or **alternative** configurations will be designed and engineered to account for site-specific conditions (e.g., wind environment, marine sea conditions, bathymetry, and foreshore geology). The vessels will be moored at the facility and will be maintained in position during all weather and sea conditions that will be experienced at site. Construction of the mooring system will be undertaken at the project site and will involve the construction of new securing foundations, mechanical connections, or wire connections between the vessels. The details of the mooring system will be developed during the FEED phase of the project and will be designed for the specific facility design.

Construction activities may include piling and the excavation and placement of reinforced concrete bases at the connection points. During construction, barges and lifting equipment will be required on site to enable the construction and installation of this facility.

4.2.4 Maintenance of FLNG and FSU and Site Facilities

The FLNG and FSU are permanently moored structures and will not be subject to periodic drydocking for maintenance. Prior to delivery of the FLNG and FSU facilities to the site, the FLNG unit and FSU hulls will be painted with anti-corrosive painting systems to ensure hull integrity for project operations to projected decommission beyond approximately 30 years of operational life (the LNG facility's proposed operational life cycle is 25 years). In addition, a single application of anti-fouling paint will be applied to the FSU and FLNG hull to ensure clean hulls for transport to the site. The anti-corrosive and anti-fouling painting systems will fully comply with international marine standards. The FLNG and FSU hulls will be maintained to exceed the operational life of the facility.

The hulls of these vessels will be designed to remain in place without major maintenance for the life of the project. Once permanently moored at the site, the hulls will not be cleared of marine growth except in localised areas of the hull as required by The Classification Society (i.e., a non-governmental organization that establishes and maintains technical standards for the construction and operation of ships and offshore structures) for inspection purposes.

In lieu of drydocking, The Classification Society accepts in-water visual survey of the submerged hulls. It is anticipated that the FLNG and FSU hulls will be extensive aquatic habitats the life span of the project.

The FLNG, FSU and site facilities are designed for periodic total shutdown to perform required maintenance for certain components such as gas turbine drives. Maintenance for associated components in the process and in systems such as the flares will be accomplished while the process facilities are under shutdown. The maintenance function will be responsible for:

- Ensuring the safety systems will protect the staff, environment and the facility;
- Monitoring and maintain the facility integrity to prevent uncontrolled releases of fluids or energy; and
- Ensuring the facility is reliable and available to meet production targets.

The FLNG, FSU and site facilities will be designed, operated, and maintained as such to comply with all environmental and safety standards and regulations. Closed and open drainage systems will be used for collection and treatment of all hydrocarbons and oily water to avoid and limit discharge as per regulatory environmental requirements. Accidental LNG spill during maintenance or operations will be collected in appropriately bunded areas.

All equipment internals will be inspected, cleaned, and replaced as part of a defined maintenance schedule. Any waste liquids or solids left behind will be collected and sent offsite for treatment and disposal in accordance with appropriate regulations. For instance, the mercury guard bed internal will be removed by vendor specialist through a closed container and return back to the vendor shop according to agreed maintenance contract.

4.2.5 Transportation of FLNG, LNG Modules and FSU to the Woodfibre Site

Once the scope of work is complete at the shipyard, the FLNG (**preferred** configuration), or LNG module (**alternative** configuration) and FSU will be towed to the site for hook up and commissioning. Towing tugs and escort tugs and vessels will be used to move and transport LNG modules (either FLNG or LNG modules) and FSU. By this point, the site will have been prepared to accept the vessels, and the mooring system will be complete to accept the vessels.

The tow to the site will only be undertaken within predefined weather windows to ensure the vessels can be safely towed and moored at the facility. Other equipment required at the site (e.g., site vehicles, construction equipment) will be transported by barge and offloaded to lay down areas defined for the project.

4.2.6 Commissioning

Once all the utility connections including gas connection are been completed, commissioning activities will commence at the facility. Commissioning will include the start-up and testing of all systems prior to operation and will be undertaken to determine the functionality of safety systems and shutdown systems, along with operational control parameters. This will be consistent for both the **preferred** or **alternative** configuration.

Integration testing between the LNG processing and production modules and the FSU will be undertaken to ensure that the electrical connections and control system and safety systems operate as designed. All commissioning activities will take place against a pre-approved commissioning plan.

Upon completion, the commissioning activities will verify that facilities can begin production and storage, while operating within the appropriate design specifications. Start-up and commissioning will involve introducing process fluids and hydrocarbons into the production facility to produce LNG. Upon completion of commissioning, with appropriate inspection, witness, and approval by the applicable regulators, the facility will be start operations.

4.2.6.1 Construction Facilities

Facilities required to support the construction phase of the project effort are summarised in the following sections. These facilities and infrastructure will be common for both the **preferred** FLNG and **alternative** land-based configurations for gas processing and LNG production.

Accommodation for Construction Personnel

Construction workers will be transported to site daily via a marine ferry from Squamish. Accommodation of construction workers will be facilitated through existing communities around Squamish and greater Vancouver. It is not anticipated that a project specific construction camp will be required. A parking lot will be confirmed for construction worker vehicles at the marine ferry terminal in Squamish.

Transportation Infrastructure

Transportation infrastructure needed to support movement of equipment and people to and from the site will include onsite marine ferry dock, access and haul roads, along with an area to park, store and maintain construction vehicles. Onsite access will be provided by marine ferry from Squamish. A heavy haul road will allow transport of construction materials within the site from the existing Woodfibre dock facilities to the laydown areas. There will be no road access to or from the project site.

Warehouses, Laydown Areas and Construction Offices

Construction support facilities will include warehouses, laydown areas, construction offices, fuel storage, fabrication workshops, and paint shop. A small warehouse will be located onsite for storing materials and equipment that require storage away from the elements. The site currently contains a number of buildings that may be upgraded or replaced for use as storage facilities during construction. Additional operational warehousing and maintenance facilities may be located offsite in Squamish on a temporary basis. Laydown areas will be provided for the following construction elements:

- Civil engineering material and preparation areas;
- Structural steel material and fabrication equipment;
- Concrete plant;
- Electrical and onsite instrument cables; and
- Pre-constructed modules.

The construction office area will include:

- Offices for WNGL and construction contractor(s);
- A facility to administer first aid, ambulance services, and safety training;
- A canteen and mess hall for site personnel;
- Ablution facilities for site workers; and
- A utility area, water storage, and gasoline station to supply construction equipment.

Where possible, onsite clean demolition foundation and concrete materials will be crushed and re-used as aggregate material during the construction phase of the project. In addition, aggregates and rock materials may be sourced on the site and from aggregate suppliers, depending on available supply. Cement product will be stored in sealed silos and used within a temporary concrete batch plant, while aggregates and sands will be stored in open stockpiles.

Utilities

Power during construction will be supplied from the existing BC Hydro grid with connection to existing transmission lines at the site, with arrangements made to power all static construction equipment. Liquid fuels will only be used within mobile equipment, emergency back-up generators and vehicles. It is anticipated that approximately 5 Megawatts (MW) will be required for construction activities and is based on the operation of electrical construction equipment.

Water for the site will be sourced from existing water licence extraction permits for Woodfibre Creek. Untreated water will be used for general construction processes (e.g., compacting soil, dust control). Water will also be treated for human consumption and for hydro-testing and civil works (e.g., mixing concrete). Total peak untreated and potable water consumption at the site during construction activities is estimated to be 50 and 20 cubic metres per day (m^3/day), respectively.

Sewage will be treated through the existing tertiary sewage treatment plant for wastes from the ablation block and canteen within the office building, and from other temporary construction facilities prior to discharge. Outlet discharge pipes exist from the treatment plant into Howe Sound. Sanitary sewage treatment will meet all applicable regulatory requirements. Where needed, portable toilets will be used for construction staff. A licensed contractor will maintain the portable toilets, with effluent transported offsite for disposal within an appropriately licensed facility.

4.3 Project Operations

4.3.1 Natural Gas Pre-treatment and Liquefaction Operations

Following supply of the receiving feed gas, the production process for Woodfibre LNG includes gas pre-treatment, liquefaction, and storage. The following sections summarize the pre-treatment, liquefaction, and storage processes for both the **preferred** and **alternative** configurations.

4.3.1.1 Gas Pre-Treatment Operations

The natural gas pre-treatment process and infrastructure will be similar for both the **preferred** FLNG configuration and **alternative** land-based configuration. Prior to metering, the gas pipeline-receiving infrastructure will remove any contaminants from the gas feed that cannot be processed by the main gas processing unit. Following debris removal and metering the gas will typically be dry and contain no free water or hydrocarbon condensate.

A compressor will be located in the inlet to the pre-treatment facilities to compress feed gas from the arrival pressure to the optimum liquefaction pressure. In addition, although mainline gas pipelines transporting dry, clean natural gas with little to no presence of natural gas liquids are pigged very infrequently, a pig receiver for the gas transmission line will be located within the property site boundary to allow for maintenance pigging operations.

The gas pre-treatment module will first remove carbon dioxide (CO₂) and any trace levels of hydrogen sulphide (H₂S), if present from the feed gas. The removal processes for CO₂ and H₂S will be confirmed during FEED. The feed gas will also undergo dehydration to remove water from the gas to prevent freezing during the cryogenic process. The dehydration process involves cooling the gas using heat exchangers, removing the resulting condensed water, and, passing the gas feed through molecular sieve beds for adsorption of the remaining water vapour.

Following dehydration, any mercury (Hg) will be removed from the gas feed. Although mercury levels should be negligible in the gas feed, removal is a precautionary procedure undertaken as a routine safeguard within the process-gas stream. The Hg removal beds will be located upstream of the liquefaction process and will allow safe, secure, and environmentally compliant removal of mercury from the pre-treatment facilities for proper disposal from the site. Any mercury removed will be stored and transported off site to an appropriate facility for effective disposal.

4.3.1.2 Natural Gas Liquefaction Operations

The LNG production facility will be comprised of either a **preferred** floating or **alternative** land-based configuration. The LNG unit will contain systems for receiving the pre-treated natural gas and liquefying it. During the liquefaction process, the treated gas will be cooled to approximately -162 degrees centigrade (°C) through a cryogenic process undertaken in parallel processing units (i.e., called 'trains') to form a liquid.

The liquefaction process combines integrated refrigeration circuits to cool, liquefy and then sub-cool the gas into LNG. The refrigerant circuits use hydrocarbons (e.g., methane, ethane, ethylene, propane), and

to provide the refrigeration requirements for the process. Multi-stage compressors are used to supply isopentane refrigerants at different pressure levels to ensure efficient cooling and liquefaction.

4.3.2 LNG Floating Storage Unit Operations

The final onsite storage capacity and layout/arrangement will be completed during the FEED phase of the project. The storage capacity will be optimised based on the LNG carrier size intended to transport the LNG to overseas markets, as well as to provide buffer storage for the transportation interruptions and delays to avoid interrupting the production of LNG at the facility. The total LNG storage at the facility will be between 170,000 - 250,000 m³. Storage will be integrated in the FLNG unit (**preferred** configuration) provided by one or more dedicated FSUs, or a combination of both for the **preferred** and **alternative** LNG processing and production configurations. The FSU will be a converted LNG carrier and will be specifically designed and refurbished for LNG storage. Off-taker LNG carriers will load LNG directly from the FSU.

4.3.3 LNG Transfer Offloading Operations to Carrier

Approximately 40 LNG carriers will be loaded per year for either the **preferred** or **alternative** LNG processing configurations based on the planned 2.1 MMTPA LNG production rate. There may be some variation to the number of vessels loaded each month due to available carriers and vessel capacity. LNG will be pumped from the FSU through a cryogenic pipeline to the loading platform at the dedicated jetty head. The nature of the cargo arms, loading systems, and vapour recovery systems will be determined during the FEED phase of the project. It is anticipated that the LNG carriers would be loaded within 14 to 29 hours and any vapour generated as part of loading activities will be collected and returned to the facility through a separate pipeline.

It is anticipated for LNG carriers to arrive at the loading jetty with a small volume of LNG within the vessel (i.e., so the storage containers are already cooled to the appropriate storage temperature). A period of cool-down will be expected before recently arrived carriers can be loaded with Woodfibre LNG-produced LNG. Although there will be no flaring of released vapour or venting during normal operation, it will occur if either the LNG carriers arrive directly from dry dock, or if the vapour recovery systems are offline due to maintenance, or system upset inhibits the return of vapour to the LNG tank.

4.4 Woodfibre LNG Project Decommissioning and Reclamation

The Woodfibre LNG site is zoned for industrial use; therefore, at the end of the project's operational life span the facility and marine terminal will be decommissioned in accordance with regulations applicable at that time including BC Oil and Gas Commission permitting requirements. The LNG facility's proposed operational life cycle is 25 years and that decommissioning will occur at the end of the LNG project life.

On completion of the project for both configurations the FLNG and/or the FSU vessels will be removed from the site and either redeployed or recycled at a qualified and certified vessel recycling facility. During the design and approval process, the Classification Society will provide a notation to demonstrate that the new building vessels have been built with decommissioning considered in the initial design. This will include lists of equipment and materials, which will be provided to the recycling facility to support the full safe and efficient recycling of the vessel in accordance with industry best practice.

Decommissioning activities will include dismantling onsite equipment and buildings, selling reusable equipment and materials, recycling scrap equipment and materials, and demolishing and disposal of the concrete structures. The vessels will be removed from the site. The site would then be generally prepared for its next use. Prior to decommissioning, a review will identify if the subsequent industrial activity could re-use any of the LNG equipment, buildings and structures. The schedule of decommissioning activities will be identified during the FEED design phase of the project.

5 ANTICIPATED EMISSIONS, DISCHARGES & WASTE

5.1 General

The facilities and infrastructure for both the **preferred** FLNG and **alternative** land-based configurations for gas processing and LNG production will have common specifications for all prefabricated equipment and modules. It is anticipated that both the **preferred** FLNG and **alternative** land-based configurations will also have common emissions, discharges, and wastes. The following sections provide an overview of the anticipated project-related emissions, discharges, and wastes.

LNG production facilities can potentially produce a variety of emissions, discharges, and wastes, the location of such will be identified during the FEED design phase of the project. Nonetheless, examples of potential discharges to air, land, or water include:

- Emissions of atmospheric contaminants such as refrigerants, NO_x, sulphur dioxide (SO_x), carbon monoxide (CO), CO₂, benzene, H₂S, unburned hydrocarbons, volatile organic compounds (VOC), and particulate matter (PM);
- Emissions from small volumes of refrigerants via the pilot light as part of the emergency flare facility;
- Ancillary equipment can also generate minor emissions during emergency operations (emergency generator, firewater pumps, etc.). These equipment items are only used as a secondary back-up during facility down time (emergency situations);
- Liquid discharges (e.g., process water and sewage), which will be controlled and collected; and
- Solid wastes, such as household and industrial wastes (e.g., lubricant containers, worn-out equipment parts) associated with the LNG facility operation.

The Woodfibre LNG facility will be constructed, operated and decommissioned to avoid, limit, and mitigate emissions, discharges, and wastes as follows:

- If gas turbines are used as the refrigerant compressor drivers, the selected turbines will be state of the art in terms of combustion technology and will limit the exhaust gas and potential harmful or GHG constituents;
- If electric motors are used, the fired heaters will limit the NO_x and CO exhaust gas;
- CO₂ and sulfur species from the overhead of the amine regeneration column and heavy hydrocarbons (including benzene, toluene, ethylbenzene, and xylenes (BTEX) and C6+ (hydrocarbons characterized as being hexane or higher molecular weight components)) will be sent to a thermal oxidizer for complete oxidation and exhausting to atmosphere;
- The flare will be used only during emergencies for short duration. These emissions will be determined during the FEED phase of the project;
- Ancillary equipment and their emissions will be determined during the FEED phase of the project; however, it will comprise low emission engine configurations or equivalent; and

- All process drains will go to collection drums and transported off-site for disposal. Oily water will be collected at oil source locations (e.g., pumps, etc) and transported off-site for disposal. All storm water will be collected without treatment since adequate containment for spills will be provided. The existing on-site sewage treatment plant will treat sanitary waste prior to discharge to Howe Sound. Sanitary sewage treatment will meet all applicable regulatory requirements.

In addition, the Woodfibre LNG facility will be designed to avoid, where practical emissions and waste discharges to the environment, and where they cannot be eliminated, will be limited in accordance with the best practical design and appropriate mitigation measures. The following environmental considerations will be taken into account within the design, construction, operation, and decommissioning of the Woodfibre LNG project:

- General clearing, site reclamation and existing facility decommissioning and abandonment, where necessary;
- Risk management of any remaining remediated wastes and contaminated components from previous industrial facility (pulp mill), which may contaminate sediments and be distributed in the foreshore region;
- Implementation of a Hazardous Waste Management Plan to mitigate for releases to the environment (refer to Section 5.1.1.6 for further details);
- Protection of terrestrial riparian zones, freshwater fisheries resources, foreshore and marine habitat, fisheries resources, and aquatic species;
- Effective engagement with regional fishing industry and marine habitat stakeholders, including First Nations;
- Aquatic, coastal, estuarine and terrestrial assessments to understand design considerations;
- Addressing re-suspension of sediment from LNG vessel and tug prop wash in terminal area;
- Protection of resources with historical, heritage or cultural significance;
- Effective waste management;
- Controlling the release of various plant discharges during construction and operation;
- Providing local air quality and noise monitoring associated with construction, operation and decommissioning activities, which will be detailed within air quality and noise management plans;
- Minimizing emission of greenhouse gases, most notably CO₂ associated with fuel combustion; and
- Cryogenic spill management and control philosophy.

Air emission permits applications will be based upon minimising greenhouse gas (GHG) emissions from the LNG facility, which will include (as appropriate):

- Selection of equipment with maximum efficiencies and lowest GHG contribution;
- Use of treated gas (e.g., boil off gas (BOG) as the primary source of fuel for the facility);
- Component selection which minimizes fugitive emissions to the environment;
- Avoiding and limiting waste gas streams to vent or flare;

- Design that allows for isolation of equipment for inspection and repair;
- Control philosophies that minimize the amount of flared and vented gases; and
- Selection of chemicals that minimize contribution to global warming.

Chemical selection for the facility will not use those with an Ozone Depletion Potential (ODP), while systems such as refrigeration, fire suppression (enclosed spaces), and air conditioning that use ODP substances (e.g., Halons, Chlorofluorocarbons (CFC's) and Hydrochlorofluorocarbons (HCFC's)) will use chemicals with zero ODP.

Operational practices that reflect BC Oil and Gas Commission (BC OGC) regulations will be implemented, including reporting of volumes of flared and vented gases from the facility, based on approved procedure and reporting of normal and accidental releases. To ensure this information can be provided to the BC OGC, flare and vent stream metering should be incorporated into the design as appropriate, and calculation routines developed. Other air quality monitoring i.e. online/real-time public accessibility may require to be installed according to social license and regulation.

Equipment selection, engineering design, and control philosophies will support (as a minimum) the maximum discharge quality constraint. Machinery areas, oil/chemical storage areas, and processing areas will be required to provide segregation between clean 'storm water' and contaminated 'drainage water'. Effluent from processing facilities, machinery, chemical, and work spaces (including wash-water) will be directed to a central collection and treatment system. Therefore, concentrations will be maintained as low as reasonably practicable to ensure maximum allowable is not exceeded at any circumstances.

During the FEED design phase the Woodfibre LNG facility will evaluate the proposed facilities and marine vessel traffic for the potential for unanticipated released to the environment and identify hardware, and practices to prevent or limit the risk associated with spills from fuel, chemical, and product transfer include:

- Breakaway self-sealing couplings to be fitted on the hoses (i.e., LNG loading arms); and
- Tandem mooring hawser fitted with quick release hook and load monitoring cell.

The following section provides a breakdown by activity of the types and sources of potential emissions, while Table 7 also presents plans to manage such emissions.

The construction, operation and decommissioning activities will be guided by site and activity specific plans to manage emissions and discharges, while avoiding and limiting effects on environmental resources. The general environmental management program for the project will include development of specific management plans including, but not limited to the following specific plans:

- Sediment, Erosion and Drainage Control;
- Water Management;
- Soil Management;
- Spill Prevention and Emergency Response Procedures (all aspects of construction and operations);
- Material Storage, Handling, and Hazardous Waste Management (including lists of all substances and control practices);

- Tree and Vegetation Clearing;
- Pile Construction Management;
- Solid Waste Management;
- Fish, Vegetation, Wildlife Protection;
- Invasive Species Management;
- Air Quality and Dust Control;
- Noise and Light Management;
- Access and Recreational Use Management; and
- Site Restoration Management.

5.1.1 Anticipated Construction Emissions

The following provides an overview of the anticipated construction emissions that are consistent for both the **preferred** FLNG and **alternative** land-based configurations, while Table 7 of this Project Description presents a summary of anticipated mitigation measures. There will be slight increases in emissions during construction activities at the site if the **alternative** LNG processing configuration is adopted. This is due to additional mechanical and installation work require to locate the modules in the require position as well as providing the necessary foundations and assembly work.

Thereafter, it is anticipated that construction emissions will comprise combustion engine exhaust based on the construction equipment and the general waste expected as part of construction activities. A summary of the types of potential construction emissions includes the following:

- Construction equipment emissions, including stored fuels, oils and grease VOCs, as well as exhaust;
- Construction waste including worker trash, rubbish, food trash, and waste;
- Shipping waste and trash associated with materials and equipment, and salvage;
- Sanitary waste and construction water such as hydro-test water discharges, equipment and facilities wash down water, along with dust suppression water runoff;
- Firewater runoff on the site during the construction period should an emergency occur;
- Stormwater runoff on the site during the construction period following rainfall events;
- Silt and soil control (i.e., roads, access ways, aggregate storage yards, and storm water drainage facilities, general dust control, and soil storage areas);
- Hazardous waste such as unserviceable batteries, used motor and hydraulic oils, contaminated filters, medical waste, used chemical cleaning fluids, paints, and other waste items considered as hazardous by jurisdictional authorities;
- Marine transport discharges (lightering); and
- Light, noise, and vibration emissions.

As the project's basic engineering package is defined in more detail and the estimates and program schedules are quantified and finalized (i.e., particularly with regard to the various execution strategies for the project), the order of magnitude for each aforementioned construction waste and emission can be forecast, so that solutions can be identified to minimize such emissions. In addition, a number of mitigation measures will be considered as summarised in Table 7 of this Project Description.

The following provides an overview of the anticipated construction emissions for both the **preferred** FLNG and **alternative** land-based configurations.

5.1.1.1 Air Emissions

Air emissions will be generated from construction activities and the operation of construction equipment. Dust or particulate matter (PM) will be the primary air emissions from construction activities, especially during site preparation and construction activities (e.g., such as clearing, grading and compaction of the project site, and during construction of buildings and other structures). Given that the nearest residential settlement to the site is approximately 5.5 km away at Britannia Beach, and that dispersion of dust is likely to be less than 1 km, adverse effects on air quality during construction are considered to be local and intermittent.

Combustion of diesel and gasoline fuels from construction equipment will also release atmospheric emissions such as NO_x, hydrocarbons, CO, PM, and SO₂. However, these emissions are expected to be temporary and intermittent during the construction phase of the project, thereby producing low-level and localised reductions in air quality. In addition, GHGs may be released because of construction activities, site clearing and preparation, and operation of construction equipment.

An air quality monitoring plan will be produced during the FEED phase of the project design to ensure appropriate monitoring of air emissions during the periods of greatest activity. In addition, the FEED design will integrate low emissions equipment and design to minimise emissions to air.

5.1.1.2 Noise Emissions

Construction noise will be generated through construction activities such as site clearing, grading and compaction of the project site, jetty pile-driving, construction of buildings and other structures, along with facility assembly, general equipment movement, bolt tightening, pneumatic testing, line cleaning and pressure testing of pipework and pressure vessels onsite. Given that the nearest residential settlement to the site is approximately 5.5 km away at Britannia Beach, adverse noise effects during construction are considered to be local and intermittent.

A noise monitoring plan will be produced during the FEED phase of the project design to ensure appropriate monitoring of noise emissions during the periods of greatest noise emissions activity.

5.1.1.3 Light Emissions

Construction activities will be predominantly undertaken during daylight hours. Light emissions during night-time construction activities will be based on mobile and fixed onsite lighting established for health and safety purposes. Light emissions will be mitigated through directional lighting both site placement, height of lighting, low lumen fixtures and directional focus for illumination.

The nearest residents are located approximately 5.5 km from the site at Britannia Beach. Given the distance to residents and the purposed lighting mitigation measures, the light emissions during construction are at this time considered local and intermittent. A construction lighting strategy will be developed as a component of the FEED phase of the project design and used to avoid and limit light emissions and potential effects on environmental and social resources.

5.1.1.4 Stormwater and Accidental Discharges

During construction, stormwater and accidental discharges will be directed to a site temporary stormwater drainage system established during site preparation. To control adverse effects of erosion and sedimentation on surface waters, construction activities will be conducted in accordance with a Sediment Erosion Control Plan and Stormwater Management Plan. Precautions will be taken during construction to avoid hydrocarbon spills, both onshore and in near shore areas. However, given that small hydrocarbons (fuel, grease and oils) or other substance releases from construction equipment are possible, the potential for such spills to enter Mill Creek, Woodfibre Creek or Howe Sound will be controlled through the following:

- Trained fuel-handling personnel;
- Establishing a Spill Prevention Plan and spill prevention procedures;
- Installing spill containment and clean-up equipment on barges and ferries; and
- Maintaining spill cleanup equipment in accordance with contingency plans.

5.1.1.5 Process Water and Sanitary Sewage Discharges

Process water will be used where possible to minimise extraction of water from Woodfibre Creek for construction activities (e.g., dewatering, spent hydrotest water, water from maintenance shops, equipment wash water). Once the process water is no longer re-usable it will be treated onsite in the existing tertiary treatment system, and monitored to ensure compliance with applicable permit requirements prior to being released to the environment.

The existing tertiary treatment plant will be used to treat sanitary waste from the ablution block and canteen within the office building, and to treat sewage from other temporary construction facilities prior to discharge. Sanitary sewage treatment will meet all applicable regulatory requirements. In addition, portable toilets may be used onsite. The collection and disposal of the waste from portable toilets will be managed by a licensed contractor, with offsite disposal to an appropriately licensed facility.

5.1.1.6 Liquid and Solid Waste Discharges

Solid and liquid wastes may be generated from site preparation and construction of the facility. A Construction Waste Management Plan will be developed for the project that presents procedures to minimize, segregate, safely store, and dispose of all wastes. A waste reduction program will also be implemented to reduce the volume of wastes generated during construction by systematically assessing opportunities for reduction at source, reuse, recycling, and recovery of materials, or converting waste into useable materials. Solid waste, including construction site domestic waste will be disposed of within the

onsite landfill or barged offsite to another suitable facility. A Hazardous Waste Management Plan will be developed in consultation with the appropriate authority(s) and include the following:

- Legislation and Approval Regime (i.e., standards are guidelines required for the site);
- Safeguards and Contingency Plans (i.e., to outline how risks to environment, animals, plants, public and public property can be mitigated);
- Classification of Hazardous Substances and dangerous goods that will be stored/used on the site (i.e., including approach for appropriate labeling and signage);
- Chemical and Waste Management Procedures (i.e., requirements for transport, handling, management, storage, disposal, auditing, approaches to avoid chemical and waste production, recycle/reuse, or how/where wastes will be treated);
- Personnel Qualifications and Training Requirements for handling of waste materials;
- Accidental Discharge or Spill Response Procedures (i.e., response protocols and responsibilities in the event of a spill on or off-site);
- Hazardous Substances, Dangerous Goods, Fuel and Oil Register (i.e., to include approach to maintenance of the register; medical/environmental safety information; quantities and storage locations; safety and hazard management procedures; contingency, cleanup and disposal procedures; auditing and review procedures);
- Stakeholder Consultation Plan (i.e., approach to maintaining and informing appropriate regulators and the public); and
- Reporting Protocols (i.e., outline of annual environmental management reporting, incident reporting and compliance reporting).

In the event that materials not permitted for deposition within the existing permitted onsite landfill are identified during site clearance and construction, these will be transported offsite by barge for disposal to a designated facility. Any materials not permitted for deposition in the landfill during site operations will be transported offsite by barge for disposal to a designated facility.

Solid non-hazardous waste will be collected in a contained area onsite. Non-hazardous waste that cannot be recycled or reused will be disposed of within the existing onsite permitted landfill.

Solid and liquid hazardous waste (e.g., unserviceable batteries, used motor and hydraulic oils, contaminated filters, used chemical cleaning fluids, paints and other waste items considered as hazardous by jurisdictional authorities) will be collected in an onsite segregated, secured, and contained area. For example, although Hg levels should be negligible in the gas feed, removal will be undertaken as a precautionary procedure using Hg removal beds located upstream of the liquefaction process. The Hg will be collected in the onsite segregated, secured, and contained area.

All hazardous waste, including such materials as Hg, unserviceable batteries, used motor and hydraulic oils, contaminated filters, lubricants, used chemical cleaning fluids, paints, and other waste items considered as hazardous by jurisdictional authorities, will be shipped offsite by a licensed waste hauler to an existing licensed hazardous waste management facility. Established onsite bioremediation areas for hydrocarbon contaminated soils will be used where required.

5.1.2 Anticipated Operational Emissions

The facilities and infrastructure for both the **preferred** FLNG and **alternative** land-based configurations for gas processing and LNG production will have common specifications for all prefabricated equipment and modules. It is anticipated that both the **preferred** FLNG and **alternative** land-based configurations will also have common emissions, discharges, and wastes.

Thereafter, it is anticipated that operational emissions will comprise combustion engine exhaust and the general waste expected as part of operational activities. A summary of the types of potential operational emissions includes the following:

- Operational equipment emissions, including stored fuels, oils and grease VOCs, as well as exhaust;
- Operational waste including worker trash, rubbish, food trash, and waste;
- Shipping waste and trash associated with materials and equipment, and salvage;
- Sanitary waste, equipment and facilities wash down water, and dust suppression water runoff;
- Firewater runoff on the site during the operational period should an emergency occur;
- Stormwater runoff on the site during the operational period following rainfall events;
- Silt and soil control (i.e., roads, access ways, aggregate storage yards and storm water drainage facilities, general dust control and soil storage areas);
- Hazardous waste such as unserviceable batteries, used motor and hydraulic oils, contaminated filters, medical waste, used chemical cleaning fluids, paints, and other waste items considered as hazardous by jurisdictional authorities;
- Marine transport discharges (lightering); and
- Light, noise and vibration emissions.

5.1.2.1 Air Emissions

Air Emissions will be generated primarily from the thermal oxidisers and fired heaters (and gas turbines if selected over motors for refrigeration) and comprise mainly atmospheric emissions such as NO_x, hydrocarbons, CO, PM and SO₂. Operational equipment will produce atmospheric emissions from combustion of fuels, such as diesel and natural gas. Sources of GHGs may include road traffic, site maintenance and cleaning, and mechanical equipment operations. An air quality monitoring plan will be produced during the FEED phase of the project design to ensure appropriate monitoring of air emissions during the periods of greatest activity. In addition, the FEED design will integrate low emissions equipment and design to minimise emissions to air.

5.1.2.2 Noise Emissions

During the operational phase, potential noise sources include:

- Refrigerant compressors and BOG compressors;

- Daily operation of the facility (e.g., air coolers, cooling towers, gas turbines, compressors, pumps);
- Vehicle traffic;
- Marine vessel operation; and
- Loading of LNG carriers.

Acoustical enclosures, blankets, and other measures will be employed to ensure these are within acceptable limits. A noise monitoring plan will be produced during the FEED phase of the project design to ensure appropriate monitoring of noise emissions during the periods of greatest operational noise emissions activity.

5.1.2.3 Light Emissions

Operational light emissions during night-time activities will be based on mobile and fixed onsite lighting established for health and safety purposes. Light emissions will be mitigated through directional lighting both site placement, height of lighting, low lumen fixtures and directional focus for illumination.

The nearest residents are located approximately 5.5 km from the site at Britannia Beach. Given the distance to residents and the purposed lighting mitigation measures, the light emissions during operation are at this time is expected to be local. A construction lighting strategy will be developed as part of the FEED phase of the project design and used to avoid, and limit light emissions and potential effects on environmental and social resource values.

5.1.2.4 Stormwater and Accidental Discharges

During operation of the facility, stormwater and accidental discharges will be directed to a drainage system established during site preparation. To control adverse effects of erosion and sedimentation on surface waters, operational activities will be conducted in accordance with a Sediment Control Plan and Stormwater Management Plan. Precautions will be taken during operations to avoid hydrocarbon spills, both onshore and in near shore areas. However, given that small hydrocarbons (fuel, grease, and oils) or other substances releases from onsite equipment are possible, the potential for such spills to enter Mill Creek, Woodfibre Creek or Howe Sound will be controlled through the following:

- Trained fuel-handling personnel;
- Establishing a Spill Prevention Plan and spill prevention procedures;
- Installing spill containment and clean-up equipment on barges and ferries; and
- Maintaining spill cleanup equipment in accordance with contingency plans.

5.1.2.5 Process Water and Sanitary Sewage Discharges

All process discharges during operation will be directed to collection drums and transported off-site for disposal. The potential for spills to enter marine waters or freshwater ponds and streams will be controlled through operating procedures and an emergency response plan developed in future phases of the project. Process discharges from the LNG production facility are expected to be minimal and may include the processed water from the oily water open drain system.

The existing tertiary sanitary sewage system and a liquid and solid waste treatment and disposal system will be used and design details will be specified during FEED. Oily water will be collected at oil source locations (e.g., pumps, etc) and transported off-site for disposal. Stormwater will be collected and treated prior to discharge. Mitigation measures will be used to avoid and limit solid and liquid waste discharge and effects. These mitigation measures are summarised in Table 7 of this project description.

5.1.2.6 Liquid and Solid Waste Discharges

Solid and liquid wastes may be generated from operation of the facility. A Construction Waste Management Plan will be developed for the project that presents procedures to avoid, limit, segregate, safely store, and dispose of all wastes. A waste reduction program will be implemented to reduce the volume of wastes generated during construction by systematically assessing opportunities for reduction at source, reuse, recycling, and recovery of materials, or converting waste into useable materials. Solid waste, including construction site domestic waste will be disposed of within the onsite landfill or barged offsite to another suitable facility.

The Woodfibre LNG facility may also require back-up storage of liquefaction refrigerants onsite to make up for operational losses of refrigerants during the liquefaction process. The volume of back-up refrigerant required for this site will be identified during the FEED phase of the project; however, the volume of such refrigerant will be minimized wherever possible. Refrigerants will be transported to the project site by marine barge. In addition, although the storage technology will be confirmed during the FEED phase of the project, it is anticipated to comprise a pressurized storage approach.

5.1.2.7 LNG Carrier Emissions

Canada is a signatory to the International Convention for the Prevention of Pollution from Ships (MARPOL). Therefore, emissions from the LNG carriers will comply with the regulations on emissions of SO_x and NO_x in MARPOL Annex VI and applicable Canadian regulations. In addition, ship lighting will be used as part of navigational safety requirements in accordance with requirements set out in The International Regulations for Preventing Collisions at Sea 1972 (COLREGs).

The exact configuration of the Woodfibre LNG facility and the systems used to load the LNG carriers will be determined during the FEED phase of the project. Nonetheless, it is expected that cryogenic spill containment systems may be required to prevent cryogenic temperature LNG from harming personnel or damaging equipment. Further to this, vapour release will also be managed through vapour collection and/or containment, following by the return of any releases through a vapour recovery system.

Qualified experienced third party LNG shippers will be engaged to transport the LNG. WNGL will require the LNG carrier companies to comply with all applicable national and international shipping requirements.

5.1.3 Anticipated Site Decommissioning/Closure Emissions

The facilities and infrastructure for both the **preferred** FLNG and **alternative** land-based configurations for gas processing and LNG production will have common specifications for all prefabricated equipment and modules. It is anticipated that both the **preferred alternative** configurations will also have common

emissions, discharges and wastes. The operational life of the Woodfibre LNG facility is anticipated to be at least 25 years.

It is anticipated that emissions associated with site decommissioning/closure will comprise combustion engine exhaust and the general waste expected as part of closure activities. A summary of the types of potential closure emissions includes the following:

- Operational equipment emissions, including stored fuels, oils and grease VOCs, as well as exhaust;
- Waste associated with site closure including worker trash, rubbish, food trash, and waste;
- Shipping waste and trash associated with materials and equipment, and salvage;
- Sanitary waste, equipment and facilities wash down water, and dust suppression water runoff;
- Firewater runoff on the site during the decommissioning/closure period should an emergency occur;
- Stormwater runoff on the site during the decommissioning/closure period following rainfall events;
- Silt and soil control (i.e., roads, access ways, aggregate storage yards and storm water drainage facilities, general dust control, and soil storage areas);
- Hazardous waste such as unserviceable batteries, used motor and hydraulic oils, contaminated filters, medical waste, used chemical cleaning fluids, paints and other waste items considered as hazardous by jurisdictional authorities;
- Marine transport discharges (lightering); and
- Light, noise and vibration emissions.

5.1.3.1 Air Emissions

Air Emissions during site closure will be generated primarily from combustion of fuels, such as diesel and natural gas. Sources of GHGs may include road traffic, site maintenance and cleaning, and mechanical equipment operations. Given that the nearest residential settlement to the site is approximately 5.5 km away at Britannia Beach, and that dispersion of dust is likely to be less than 1 km, adverse effects on air quality during decommissioning are considered to be local and intermittent.

Combustion of diesel and gasoline fuels from onsite equipment will also release atmospheric emissions such as NO_x, hydrocarbons, CO, PM, and SO₂. However, these emissions are expected to be temporary and intermittent during the decommissioning phase of the project, thereby producing low-level and localised reductions in air quality. In addition, greenhouse gases may be released because of decommissioning activities such as demolition, and operation of equipment.

An air quality monitoring plan will be produced during the FEED phase of the project design to ensure appropriate monitoring of air emissions during the periods of greatest activity. In addition, the FEED design will integrate low emissions equipment and design to minimise emissions to air.

5.1.3.2 Noise Emissions

Noise sources during closure will be generated primarily from combustion of fuels, such as diesel and natural gas. Given that the nearest residential settlement to the site is approximately 5.5 km away at Britannia Beach, adverse effects on noise during site closure are considered to be local and intermittent. A noise monitoring plan will be produced during the FEED phase of the project design to ensure appropriate monitoring of noise emissions during the periods of greatest decommissioning noise emissions activity.

5.1.3.3 Light Emissions

Decommissioning activities will be predominantly undertaken during daylight hours. Light emissions during night-time decommissioning activities will be based on mobile and fixed onsite lighting established for health and safety purposes. Light emissions will be mitigated through directional lighting both site placement, height of lighting, low lumen fixtures, and directional focus for illumination.

The nearest residents are located approximately 5.5 km from the site at Britannia Beach. Given the distance to residents and the purposed lighting mitigation measures, the light emissions during decommissioning are at this time is considered local and intermittent. A construction lighting strategy will be developed as a component of the FEED phase of the project design and used to avoid and limit light emissions.

5.1.3.4 Stormwater and Accidental Discharges

During site closure, stormwater and any accidental discharges will be directed to a pre-established drainage system. To control adverse effects of erosion and sedimentation on surface waters, decommissioning activities will be conducted in accordance with a Sediment Control Plan and Stormwater Management Plan. Precautions will be taken during operations to avoid hydrocarbon spills, both onshore and in near shore areas. However, given that small hydrocarbons (fuel, grease, and oils) or other substances releases from onsite equipment are possible, the potential for such spills to enter Mill Creek, Woodfibre Creek or Howe Sound will be controlled through the following:

- Trained fuel-handling personnel;
- Establishing a Spill Prevention Plan and spill prevention procedures;
- Installing spill containment and clean-up equipment on barges and ferries; and
- Maintaining spill cleanup equipment in accordance with contingency plans.

5.1.3.5 Sanitary Sewage Discharges

Use of the existing tertiary sanitary sewage system and a liquid and solid waste treatment and disposal system will be specified during the FEED phase of the project. Oily water will be collected at oil source locations (e.g., pumps, etc.) and transported off-site for disposal. All stormwater will be collected and treated.

Prior to decommissioning of onsite sewage treatment facilities, portable toilets will be installed for use, with the waste from these managed by a licensed contractor, with offsite disposal to an appropriately licensed facility.

5.1.3.6 Liquid and Solid Waste Discharges

Solid and liquid wastes may be generated from closure of the facility. A Waste Management Plan will be developed for the project that presents procedures to minimize, segregate, safely store, and dispose of all wastes. A waste reduction program will also be implemented to reduce the volume of wastes generated during construction by systematically assessing opportunities for reduction at source, reuse, recycling, and recovery of materials, or converting waste into useable materials. Solid waste, including domestic waste will be disposed of within an onsite landfill or barged offsite to another suitable facility. In addition, a Hazardous Waste Management Plan will be produced for the decommissioning phase of the project.

6 REGULATORY CONTEXT

6.1 Environmental Assessment

The facilities and infrastructure for both the **preferred** FLNG and **alternative** land-based configurations for gas processing and LNG production will have common specifications for all prefabricated equipment and modules. It is anticipated that both the **preferred** FLNG and **alternative** land-based configurations have consistent project regulatory review triggers for CEAA and BCEAA.

6.1.1 Environmental Assessment Act (BCEAA)

The Woodfibre LNG project will trigger a provincial environmental assessment pursuant to the British Columbia *Environmental Assessment Act* (BCEAA) because it exceeds the trigger for assessment as follows:

“A new energy storage facility with the capability to store an energy resource in a quantity that can yield by combustion >3 PJ of energy” (Reviewable Projects Regulation, Part 4, Table 8).

This 3 PJ threshold is equivalent to approximately 118,000 m³ of liquid natural gas. The Woodfibre LNG project is expected to have an energy storage capacity of between 4.26 and 6.27 PJ (170,000 – 250,000 m³).

Another potentially applicable trigger for a BC environmental assessment is for marine port facilities, as set out in Part 8 (Table 14) of the *Reviewable Projects Regulation*:

“1) A new marine port facility, other than a ferry terminal, if construction of the facility entails dredging, filling or other direct physical disturbance of:

(a) >1,000 m of linear shoreline, or

(b) >2 ha of foreshore or submerged land, or a combination of foreshore and submerged land, below the natural boundary of a marine coastline or marine estuary”.

However, as the site comprises an existing marine port facility, the Woodfibre LNG project does not exceed the above marine port facility thresholds, and therefore does not trigger a provincial EA on this basis.

WNGL has met with the BCEAO to provide an overview of the Woodfibre LNG project and initiate discussion and consultation on the Woodfibre LNG project, its layout and approach intending to avoid and limit potential impacts.

6.1.2 Canadian Environmental Assessment Act (CEAA)

It is also anticipated that the Woodfibre LNG project will be subject to the federal environmental assessment process under the *Canadian Environmental Assessment Act, 2012* (CEAA 2012) because the project includes the construction of:

“14(d) facility for the liquefaction, storage or regasification of liquefied natural gas, with a liquefied natural gas processing capacity of 3 000 t/day or more or a liquefied natural gas storage capacity of 55 000 t or more”.

The Woodfibre LNG project is expected to have a liquefied natural gas process capacity of 1.5 to 2.1 MTPA (4,110 – 5,753 t/d), and a storage capacity of 170,000 – 250,000 m³ (78,200 – 115,000 t) which exceeds the thresholds set out in the regulation above. Therefore, the project would be considered a physical activity pursuant to the *Regulations Designating Physical Activities*, and thereby reviewable under the *Canadian Environmental Assessment Act, 2012*.

The Woodfibre LNG project is not located on or near any federal lands or reserves, will not require federal financial support, and is not within the waters or lands administered by the Canada Port Authority. The project is located in a region that has not been the subject of federal regional environmental studies. The project will not require access or use of lands or resources currently used for traditional purposes by Aboriginal peoples and it is anticipated that the Woodfibre LNG project will not impact any SAR under SARA or migratory bird under the *Migratory Bird Convention Act*.

The Woodfibre LNG project will use a marine terminal on lands that are routinely and have been historically used as a marine terminal; accordingly, s.27 of the Schedule to the Regulations Designating Physical Activities does not apply.

WNGL has met with CEAA to provide an overview of the Woodfibre LNG project and initiate discussion and consultation on the Woodfibre LNG project, its layout and approach intending to avoid and limit potential project-related impacts.

Given that both the federal and provincial EA processes are triggered, WNGL will ask that the province request the federal Minister of Environment to approve the substitution of the BC EA process for the CEAA 2012 process. A Memorandum of Understanding between the CEA Agency and BCEAO on the Substitution of Environmental Assessment (2013) addresses the conduct of substituted environmental assessments in BC. If substitution is approved for the Woodfibre LNG project, it is expected that the BCEAO will conduct the EA in accordance with the conditions set out in the Substitution Decision, and at the end of the assessment process the BCEAO will provide its report to both the provincial and federal Ministers for their consideration.

6.2 Other Permits and Approvals

In addition to the provincial and federal environmental assessment approvals, the project will require additional permits, licences, and authorizations. The permits, licences and authorizations required may be dependent on the configuration of the project, and in particular the configuration of land-based versus floating facilities. The permits, licences and authorizations potentially required for the project are set out in Table 4 at the end of this section.

WNLGL anticipates applying for concurrent permitting, under BC's *Concurrent Approval Regulation*, for the following provincial permits and licences:

- LNG Facility Permit (BC *Oil and Gas Activities Act*);
- Water Licence (BC *Water Act*); and
- Waste Discharge Permits (BC *Environmental Management Act*).ⁱ

The following sections address the key federal permits, licences and authorizations that will likely be required for the Woodfibre LNG project.

6.2.1 Navigable Waters Protection Act (NWP)

The Woodfibre LNG project will result in the construction of new or the rebuilding of existing structures in navigable freshwater habitats so would need approval under the NWP. As well, the marine carrier loading facility will be constructed in the marine environment in existing foreshore lease areas. The loading structure is expected to extend approximately 50 m from the shoreline into deeper water into Howe Sound. It is expected that construction of the facility will involve pile driving and will not involve dredging or disposal at sea. WNLGL has met with Transport Canada (TC) to provide a high level description of the Woodfibre LNG project. To date, TC has not identified any significant impacts on navigation associated with the project.

6.2.2 Fisheries Act 2012

Fish and fish habitat are potentially present in Mill Creek, and marine waters of Howe Sound, adjacent to and within the proposed project site and area. The proposed project is not expected to prevent fish passage, result in fish mortality, or result in the deposition of deleterious substances into fish-frequented waters.

The LNG production and storage facility will be designed to avoid and limit project-related impacts to the flow regime or discharges to freshwater environments of Mill Creek and Woodfibre Creek. Freshwater baseline studies are underway. Similarly, because the project will not involve directed extraction of water from the creeks, it is not expected to affect the flow downstream of the project site.

Intertidal and sub-tidal marine fish habitat is present in the area where the marine carrier loading facility will be constructed using piles and surface foundations. It is expected that project review application will be submitted to DFO to provide a letter of advice or authorization under the Fisheries Act 2012 for the construction and operation of the loading facility. The marine loading structure will be partially self-compensating because it is not expected to cause shading of intertidal habitat, but will create hard, vertical structures through piles which can be colonized by sessile marine organisms, and provide cover for fish. WNLGL has had preliminary discussions with DFO to provide a high level description of the project.

6.2.3 National Energy Board Act

The project will require an Export Licence, issued by the National Energy Board (NEB). An application for the Export Licence was submitted to the NEB on July 23, 2013.

6.2.4 Canada Shipping Act

If the LNG processing facilities are situated on a FLNG, they may fall within federal jurisdiction and the *Canada Shipping Act*. WNGL has had high level discussions with Transport Canada to discuss the applicable regulations and international standards that may apply.

Table 4: Potential Permits and Approvals Required for the project

Potential Approvals	Regulatory Agency	Applicable Legislation/Regulation	Regulatory Approach and Potential Issues
BC Environmental Assessment Certificate Require a review under BCEAA if it meets one or more of the following: <ul style="list-style-type: none"> Natural gas processing facility >5.634 million m³/day or <5.634 million m³/day and will result in sulphur emissions >2 tonnes/day. Port Facility with physical disturbance of >1.0 km of linear shoreline or >2.0 hectares of foreshore or submerged lands. 	Environmental Assessment Office (BCEAO)	BC <i>Environmental Assessment Act</i> (2002) BC Reviewable Project Regulation Prescribed Time Limits Regulations	EAC approval required at Gate 3 for project endorsement. Concurrent Permitting would allow provincial permits to be issued 60 days after the EAC is issued.
Environmental Impact Statement (EIS) Require a review under CEAA 2012 if it meets one or more of the following: <ul style="list-style-type: none"> Processing capacity of over 3000 t/d or as an LNG storage capacity of more than 50,000 t. Expanded New Marine terminal designed to handle vessels larger than 25,000 Dead Weight Tonnage (DWT). 	Canadian Environmental Assessment Agency	Canadian <i>Environmental Assessment Act</i> 2012 (CEAA 2012) Regulations Designating Physical Activities	EIS approval required at Gate 3 for project endorsement. Concurrent permitting regulations not in place for federal permits
New Permit Holder Application Form	BC Oil and Gas Commission (BC OGC) ¹	<i>Oil and Gas Activities Act</i> (OGAA)	The OGC will not accept any additional permit applications until registered with the Corporate Land Management Unit.
Oil and Gas Facility Permit Application	BC Oil and Gas Commission (OGC)	<i>Oil and Gas Activities Act</i> Facilities Application and Operations Manual (May 2013)	Required prior to any construction activities. Permit application must include detailed construction plans and First Nations packages. Permitting fees - Currently under review for revision Fall 2013 (related to filing Project Description)

¹.Approval review timelines initially defined through discussion with OGC.

Table 4: Potential Permits and Approvals Required for the project

Potential Approvals	Regulatory Agency	Applicable Legislation/Regulation	Regulatory Approach and Potential Issues
Heritage Inspection Permit	Archaeology Branch, BC MFLNRO (on public and private lands in BC)	<i>BC Heritage Conservation Act</i> (1996) (Section 14) <i>Environmental Assessment Act</i>	<p>Must be submitted to the Archaeology Branch prior to submitting the Archaeological Information Assessment Form (AAIF) to BC OGC and is required to undertake an AIA.</p> <p>An AIA is undertaken in response to development proposals that could disturb or alter the landscape and, as a result, disturb or alter archaeological sites protected by the <i>Heritage Conservation Act</i>. An AIA may be preceded by a non-permitted Archaeological Overview Assessment (AOA), which is intended to identify archaeological resource potential within a proposed study area. An AOA may include a preliminary field reconnaissance, which will inform the AIA, should one be deemed necessary. The AIA is intended to provide an adequate inventory of archaeological resources that could be affected by a project, to evaluate project impacts, and to provide management recommendations for avoidance or mitigation of project effects on archaeological resources.</p> <p>It is expected that an AIA will be required for development proposals on federal lands; however, a Heritage Inspection Permit will only be required for AIAs on provincial and private lands in BC.</p>
Archaeological Information Assessment Form (AAIF)	BC Oil and Gas Commission (OGC) (on public and private lands in BC)		<p>All oil and gas developments proposed in BC require an Archaeological Information Assessment Form (AAIF) to be submitted with the application package to BC OGC. The AAIF indicates whether the proposed development will require further archaeological studies, such as an archaeological impact assessment (AIA).</p> <p>The form cannot be completed until an application for a Heritage Inspection Permit under Section 14 of the <i>Heritage Conservation Act</i> has been submitted to the Archaeology Branch, MFLNRO.</p>
Heritage Investigation Permit	Archaeology Branch, BC MFLNRO (on public and private lands in BC)	<i>Heritage Conservation Act</i> (Section 14)	A Heritage Investigation Permit may be required to authorize systematic study and data recovery from an archaeological site that cannot be avoided during development activities. A Heritage Investigation Permit is typically used during mitigation of significant archaeological sites.

Table 4: Potential Permits and Approvals Required for the project

Potential Approvals		Regulatory Agency	Applicable Legislation/Regulation	Regulatory Approach and Potential Issues
Heritage Site Alteration Permit		BC Oil and Gas Commission (OGC) (on public and private lands in BC)	<i>Heritage Conservation Act</i> (Section 12)	A Heritage Site Alteration Permit will be required to alter (meaning to change in any manner) an archaeological site. Typically follows a Heritage Inspection Permit and/or Heritage Investigation Permit.
Wildlife Act Permit		Ministry of Environment, Environmental Stewardship Division	<i>Wildlife Act</i>	Required for wildlife salvages and potentially surveys. Bird nest removal or relocation.
Export License		National Energy Board (NEB)	<i>National Energy Board Act</i>	Export License required prior to Gate 3 (major approval). Can be applied for prior to the approval of the EA. Export licenses typically approved for 25 year terms.
Species at Risk Act (SARA) Permit		Environment Canada (EC), Fisheries and Oceans Canada (DFO), and Parks Canada	<i>Species at Risk Act</i> (SARA)	The competent minister may issue a SARA permit authorizing activities that will affect a listed wildlife species, any part of its critical habitat or the residences of its individuals. As effects on SAR species are not anticipated by the project, a SARA permit is not considered required.
Fisheries Act 2012 Authorization	Section 35 Harmful Alteration, or Disruption or Destruction (HADD) Authorization	Fisheries and Oceans Canada (DFO)	<i>Fisheries Act</i> Notification	<p>If the project can be considered low risk and avoid harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery and comply with the <i>Fisheries Act</i> by planning using DFOs Operational Statements it does not require a review or authorization.</p> <p>DFO has developed a series of 17 Operational Statements to streamline the undertaking of low risk activities.</p> <p>Notifications may be required for the proposed Project due to the intake structure, marine and freshwater riparian clearing, road crossing of fish bearing streams, barge-based facility and marine terminal associated with Project infrastructure.</p>

Table 4: Potential Permits and Approvals Required for the project

Potential Approvals		Regulatory Agency	Applicable Legislation/Regulation	Regulatory Approach and Potential Issues
			<i>Fisheries Act</i> Request for Review	If the project is not able to follow the planning Operation Statements or the statements are not applicable to the project, then a request for review will need to be submitted to DFO for review and assessment. Request for review may be required for the proposed Project due to the intake structure, marine and freshwater riparian clearing, road crossing of fish bearing streams, barge-based facility and marine terminal associated with Project infrastructure.
			<i>Fisheries Act</i> Authorization	Required prior Gate 3 (major approval) and construction. Required if the work, undertaking or activity will likely results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery. A Section 35 <i>Fisheries Act</i> Authorizations may be required for the proposed Project due to the intake structure, marine and freshwater riparian clearing, road crossing of fish bearing streams, barge-based facility and marine terminal associated with Project infrastructure. Implications due to potential changes to the <i>Fisheries Act</i> will require discussion with DFO.
Navigable Waters Approval		Transportation Canada (TC)	<i>Navigable Water Protection Act</i> 2009, Section 5	An approval is required for any construction in navigable waters that is considered to substantially interfere with navigation (e.g. the terminal, water intake station, pipeline crossings and barge-based facilities).
Waste Discharge Permit(s)	Permits for Introduction of Waste	BC Oil and Gas Commission (OGC)	Oil and Gas Waste Regulation under the EMA – Section 14	Required prior to operations. Permits required for all air emissions, solid wastes and waste water discharges. This would include discharges from water intake/outfall structure.
	Approval for Introduction of Waste		Oil and Gas Waste Regulation under the EMA – Section 15.	May approve the introduction of waste into the environment for a period of up to 15 months without issuing a Section 14 permit.
Water System Construction Permit		BC Ministry of Health	<i>Drinking Water Protection Act</i>	Required prior to construction of system.
Drinking Water System Operations Permit		BC Ministry of Health	<i>Drinking Water Protection Act</i>	Required prior to operation of system.
Construction Permit for a Potable Water Well (if applicable)		BC Ministry of Health	<i>Drinking Water Protection Act</i>	Prior to drilling well. For camp and/ or plant, domestic use.

Table 4: Potential Permits and Approvals Required for the project

Potential Approvals	Regulatory Agency	Applicable Legislation/Regulation	Regulatory Approach and Potential Issues
Short Term Use of Water	BC Oil and Gas Commission (OGC)	BC <i>Water Act</i> – Section 8	Short-term use of water approval (less than 12 months) for activities such as hydrostatic testing and tank flushing.
Changes in and About a Stream	BC Oil and Gas Commission (OGC)	BC <i>Water Act</i> – Section 9 Notification	Notifications are typically used for works that do not involve any diversion of water, may be completed within a short period and will have minimal impact on the environment or third parties.
		BC <i>Water Act</i> – Section 9 Approval	Changes in and about a stream or other identified water bodies. Examples are stream crossings for activities such as road or pipeline construction (culverts and bridges).
Water License	BC Oil and Gas Commission (OGC)	BC <i>Water Act</i> – Section 1	Water License is necessary if a project will cause diversion of surface waters.
Pollutant Discharge Reporting Regulations	Transport Canada (TC)	<i>Canada Shipping Act</i> 2001	The Act concerns marine navigation, marine search and rescue, pleasure craft safety, marine ship-source pollution prevention and response, as well as support to other federal departments and agencies. The federal Minister of Transport has authority under the Act, along with limited responsibility by the Minister of DFO for navigation services and oil spill response (ships or facilities near the ocean).
Small Vessel Regulations			
Ballast Water Control and Management Regulations			
Regulations for the Prevention of Pollution from Ships and for Dangerous Chemicals			
Vessel Clearance Regulations			
Vessel Operation Restriction Regulations			
Technical Review Process of Marine Terminal Systems and Transshipment Sites (TERMPOL)		Unknown – Procedures developed through the TERMPOL Review Committee at Transport Canada	TERMPOL is a voluntary process, but in some instances through the EA process it has been made mandatory by way of a requirement stipulated by a Responsible Authority (RA) during their review and approval process. At present, TC is re-evaluating the necessity and function of the TERMPOL process.
Flammable Liquids Bulk Storage Regulations		<i>Canada Transportation Act</i> 2011	Regulations respecting the design, location, construction, operation and maintenance of stationary bulk storage facilities for flammable liquids.
Transportation of Dangerous Goods Regulations		<i>Transportation of Dangerous Goods Act</i> 2009	This Act addresses the classification, documentation, marking, means of containment, required training, emergency response, accidental release, protective measures and permits required for the transportation of dangerous goods by road, rail, marine, or air.
<i>Marine Liability Act</i>		<i>Marine Liability Act</i> 2010	Makes owner and/or operators of vessels liable for the vessel and consequences of its operation.

Table 4: Potential Permits and Approvals Required for the project

Potential Approvals	Regulatory Agency	Applicable Legislation/Regulation	Regulatory Approach and Potential Issues
<i>Marine Transportation Act</i>		<i>Marine Transportation Security Act 2010</i>	Applies to Canadian ships outside Canadian water and all ships and marine facilities in Canadian water.
International Convention for the Control and Management of Ships' Ballast Water and Sediments (IMO 2004, 2004 edition)	International Maritime Organization (IMO)	Conventions	Require all ships to implement a Ballast Sediments Management Plan, carry a Ballast Water Record book and carry out ballast management procedures.
International Convention on the Control of Harmful Anti-Fouling Systems on Ships (IMO 2001, 2005 edition)			The convention prohibits the use of harmful substances in anti-fouling paints used on ships and establishes a mechanism to prevent the potential future use of other harmful substances in anti-fouling systems.
Guidelines on Implementation of Effluent Standards and Performance Tests for Sewage Treatment Plants (IMO, MARPOL Annex IV Sewage, 2006)			Prevents pollution created by sewage.
International Convention for the Prevention of Pollution from Ships (MARPOL) (IMO 1973, 2011 edition)			Focused on the preventing the pollution of marine environments by operational or accidental causes from ships.

7 BIOPHYSICAL AND SOCIAL PROJECT SETTING

7.1 Geology

The Woodfibre LNG project site is located within the Coast Mountains adjoining Howe Sound and geologically within the 'Coast Plutonic Complex', which is generally characterized as granitic plutonic bedrock. Within the site, metasedimentary rock (e.g., phyllite, slate) crops out locally on the east and west side of the project site, although granodiorite bedrock dominates the area. In addition, some possible volcanic units are reported within the valley. The surrounding mountain peaks are dominantly formed of granodiorite plutonic rock.

Unconsolidated glaciofluvial and glacial sediments dominate the surficial geology of the lower project site, although post glacial fluvial deposits occur in the valley. The sand-and-gravel fan-delta extends from the valley within the cleared project site into Howe Sound, with a steep drop-off located a distance of a few hundred metres offshore. It is likely that the valley glacial fan was created as glacial ice receded and decayed some ten thousand years ago, well after the present Howe Sound fjord was formed. Glacial decay would have produced significant sediment deposition due to higher water volumes.

The bedrock surface on which the fan has accumulated is likely to be undulating and irregular, with the deposit thickness ranging between 25 to 50 m (approximately). The stratigraphy of the lower project site is variable, with textural and compositional range consistent with the variable prevailing sedimentological and hydraulic conditions at the time and locale of deposition. In addition, sediment provenance reflects local bedrock geology and is dominated by granitic rock, with some volcanic and metamorphic components.

7.2 Climate and Physiography

The setting of the property is on an 86 ha area of land near sea level (5 to 50 m above sea level (ASL)) at the mouth of a glaciated coastal mountain valley (Figure 1), on the shore of the Howe Sound fjord. The mountain peaks that surround the valley reach a height of more than 1,500 m ASL, although the topography of the property is relatively flat.

The property and marine carrier route are located in the Coastal Western Hemlock very wet maritime biogeoclimatic zone, submontane (CWHvm1) variant. The CWHvm1 has a wet climate, with cool summers and mild winters with relatively little snow (Pojar and Meidinger 1991) and a prolonged moderate temperature growing period.

The summer climate on the property and marine carrier route is typically warm and dry; from June until late September the average temperature is from 20 - 28 degrees centigrade (°C). Winters between November and February are typically mild and wet, with average temperature range between 0 – 10 °C. Although snowfall occurs occasionally, most of the precipitation is in the form of rain.

7.3 Air Quality, Greenhouse Gases & Climate Change

There is a long history of air quality and meteorological data collection in and around Howe Sound and Squamish, driven largely by the development in the area. The available long-term monitoring data from existing sources, coupled with additional data in support of recent assessments for nearby proposed projects, provide a thorough record of baseline air quality for common constituents, and meteorology in local project site and Howe Sound area.

Investigations are currently underway to provide baseline information relating to air quality, greenhouse gases (GHG) and climate change. These baselines will be used to examine the potential effects of the construction, operational and closure phases from the project and will be presented further during the AIR/EIS Guidelines.

7.4 Noise

Noise monitoring is sensitive to atmospheric and weather conditions and a consistent period weather will be established prior to baseline monitoring to limit periods of precipitation, extreme cold, high winds, and/or humidity. Investigations are currently underway to provide baseline information relating to noise as it relates to sensitive receptors (e.g., residential dwellings, cabins, cottages, schools, etc.). These baselines will be used to examine the potential effects of the construction, operational and closure phases from the project and will be presented further during the AIR/EIS Guidelines.

7.5 Ambient Light

Ambient light (light trespass, sky glow) will be evaluated as a component discipline in the proposed project's effects assessment. Existing information will be reviewed to describe the existing light environment to establish baseline conditions for light and identify gaps for which data will be required.

Investigations are currently underway to provide information relating existing baseline light levels. Light measurements will be collected at sensitive receptors (e.g., residential dwellings, cabins, cottages, schools, shipping areas, etc.) in proximity to the project site. This information will be used to determine potential project-related effects experienced by those living in proximity to the project site, shipping lanes, and potential effects of the construction, operational and closure phases from the project during the FEED design phase of the project and will be presented further during the AIR/EIS Guidelines.

7.6 Hydrogeology

Existing data from groundwater characterization indicates that the groundwater contours slope down the Mill Creek valley. Due to the coarse sediment texture, the sands and gravels of the valley fill are typically

highly permeable. The presence of the groundwater channel appears to depress the groundwater surface within approximately 150 m of the channel. Groundwater maintains a positive pressure across the site flowing into the ocean during all levels of tide.

7.7 Hydrology

The project site comprises Mill Creek and Woodfibre Creek watersheds. Mill Creek (BC Watershed Code 900-100100) flows south-southwest for approximately 10.5 km from its headwaters on Mount Sedgwick to its mouth on the western shore of Howe Sound. The watershed has a surface area of 4,083 ha and, with the exception of the Woodfibre property, is entirely within Crown land. Where it flows across or adjacent to the property, Mill creek comprises high gradient channel with bedrock and boulder substrate. The watershed is considered steep, with elevations up to 2,040 m. Approximately 34% of the watershed area is comprised of slopes greater than 35%. Less than 1% of the watershed is comprised of channel gradients less than 16%.

Woodfibre Creek (BC Watershed Code 900-100300) flows in a south-west direction for approximately 6.8 km from its headwaters. The watershed has a surface area of 2,186 ha and, with the exception of the Woodfibre property, is entirely situated within Crown land. The watershed is considered steep, with elevations up to 1,600 m. Typical of coastal watersheds the highest stream flow in Mill and Woodfibre Creeks occur during the autumn/winter months (October through March) with total rainfall over 2,800 millimetres (mm), with maximum daily precipitation over 120 mm.

A small hydroelectric plant using a Pelton wheel of approximately 1.5 MW capacity and a mill process water system is currently operating on Woodfibre Creek. The hydroelectric plant is supplied from an old intake at approximately 370 m elevation and the process water is supplied from an intake located at approximately 237 m elevation on Mill Creek. Mill Creek has observed instantaneous discharge ranging from lows of 0.5 cubic metres per second (m^3/sec) in August to 26 m^3/sec in October – November of each year. Woodfibre Creek has observed instantaneous flows lows of 0.1 to 12 m^3/sec .

7.8 Aquatic Resources

7.8.1 Marine Environment

The shoreline and coast adjacent to site area has steep slope with boulder seafloor substrate neashore and softer fine substrate further from shore at greater depths. The project site foreshore has been augmented over time and now comprises rip-rap that extends an average of 5 m outward horizontally and 10 m vertically from the high tide line (Figure 4). Seaward of the low water level (approximately 3 m from the high tide line), the sea floor drops off steeply reaching depths greater than 200 m. The seafloor bed immediately offshore of the Woodfibre site is comprised of soft fine substrate covered with sparse wood debris and boulders. Bacterial mats of decomposing debris have been observed in patches throughout the nearshore Woodfibre site. The north end of the site has observed areas of wood and log debris and industrial waste debris including metal cables, blocks and cement pieces. The shoreline at the south end

of the site is a natural bedrock outcrop wall with a steep sloping sandy/silt bottom with some wood debris and boulders.

The intertidal flora and fauna on the site comprises primarily rockweed (*Fucus* spp) and barnacles (*Balanus* sp) respectively. Sub-tidal flora comprised primarily brown algae, such as rockweed (in the upper levels) and *Laminaria* sp sparsely distributed throughout the project area. No observations of eelgrass have been noted in the Woodfibre area.

Benthic invertebrates in the sub-tidal zone along the site comprise limited observations of Dungeness crab (*Cancer magister*), Tanner crab (*Chionoecetes bairdi*) and on existing subtidal vegetation kelp crab (*Pugettia* spp). At other locations in Howe Sound (CORI and AMR 2001), squat lobster (*Munida quadraspina*), and shrimp (*Pandalus* sp) are known to occur at greater depths. In areas of Howe Sound, assemblages of green urchins (*Strongylocentrotus droebachiensis*) and anemones (*Metridium* sp and *Urticina* sp) are known to occur at 10 to 20 m depths on muddy and sandy substrates. The subtidal benthic macroinvertebrate fauna may also include polychaete worms, snails and bivalves, crustaceans, phoronid worms and nemertean worms. Porifera, Cnidaria, Sipuncula, Entoprocta, Bryozoa and Echinodermata are also known to occur in area of Howe Sound. Underwater video surveys of the marine environment at the Woodfibre site will be used to examine the presence and habitat use of various marine species. Based on review of known marine fish species and habitats use in Howe Sound, no fish have been noted using habitats at the Woodfibre site.

Pacific white-sided dolphin (*Lagenorhynchus obliquidens*) have been observed in Howe Sound during winter and spring seasons potentially associated with the distribution and spawning of Pacific herring (*Clupea pallasii*) in the sound. There are occasional observations of harbour porpoise (*Phocoena phocoena*) in the sound and single annual observations of grey whales (*Eschrichtius robustus*). Southern resident killer whales (*Orcinus orca*) have not been noted in the upper areas of Howe Sound.

7.8.2 Freshwater Environment

The Woodfibre site comprises two freshwater watercourses including Mill and Woodfibre Creeks.

Mill Creek flows through the centre of the Woodfibre property and bisects the proposed lower site. The lower 230 m of the Mill Creek channel comprises cobble and boulder riffle-glide habitat, with no riparian vegetation. The channel is constrained by built concrete retaining walls throughout the lower portion of the Woodfibre site. This channel morphology changes to a cascade habitat upstream of the Woodfibre site and comprised coniferous riparian forest on steep banks and bedrock cliffs. Where it flows on the Woodfibre site, Mill Creek has known observations of anadromous Coho salmon (*Oncorhynchus kisutch*), Chum salmon (*O. keta*), Pink salmon (*O. gorbuscha*) and Steelhead (*O. mykiss*), and Dolly Varden (*Salvelinus malma*). Mill Creek has a small aggregated area of marine estuary.

The sections of Mill Creek upstream of the Woodfibre property appear to comprise cascade features with increasing gradients and steep banks with a coniferous forest riparian vegetation. A number of cascades and fish passage barriers exist after 300 m from the mouth, and a full fish passage barrier was noted in the information review at approximately 2.1 km upstream. Upper areas of Mill Creek may potentially support populations of Dolly Varden and resident Rainbow Trout (*O. mykiss*).

Woodfibre Creek flows along the western edge of the Woodfibre property predominantly through crown lands. The lower 75 m of the Woodfibre Creek channel and small marine estuary is comprised of riffle-cascade features with boulders and deciduous and coniferous trees and shrub understory riparian vegetation. Upstream a large channel width pool is maintained by steep sloping bedrock banks. Within the low gradient reach within the Woodfibre property, the creek supports Coastal Cutthroat Trout (*O. clarki clarki*) and resident Rainbow Trout. The channel sections of Woodfibre Creek upstream of the project site comprise a series of cascade-step habitats and at 150 m a bedrock fall barrier (10 m in height) for anadromous fish passage. Upstream of the barrier, Woodfibre Creek supports resident Rainbow Trout including Henriette Lake.

A number of unnamed watercourse were observed within the project site. Each was identified as a surface water feature with no fish present.

Birds were observed in both Mill and Woodfibre Creek including American Dippers (*Cinclus mexicanus*). Please refer to Section 7.9.2 of this Project Description for the amphibians present within the freshwater habitats of the project site.

7.9 Terrestrial Resources

7.9.1 Ecological Setting

The remaining mature forest on the property is located above the proposed Woodfibre project site. The mature forest is comprised of Western Redcedar (*Thuja plicata*) and Western hemlock (*Tsuga heterophylla*) and shrub understorey including vine maple (*Acer circinatum*), sword fern (*Polystichum munitum*) and salal (*Gaultheria shallon*). The lower portion of the property proposed as the project site comprises hard concrete surfaces with occasional ephemeral, often non native vegetation. Currently no active logging is occurring within the project site; however, active logging is underway immediately to the southwest of the Woodfibre site within Crown Lands.

The lower industrial site is comprised of non-native invasive plant species. Infestations of Japanese knotweed (*Fallopia japonica*) are present on the property, particularly around the perimeter of the industrial site, and along the roads. Himalayan blackberry (*Rubus armeniacus*) and Scotch broom (*Cytisus scoparius*) are also present along the roadsides, while holly (*Ilex aquifolium*) is present throughout the any forested areas including pole sapling and mature forests on the upper portions of the property. Greater mullein (*Verbascum thapsus*) and field bindweed (*Convolvulus arvensis*) are in isolated patches on the industrial site.

7.9.2 Wildlife Mammals

Observations of mammals on the lower project site include: black bear (*Ursus americanus*), black-tailed deer (*Odocoileus hemionus columbianus*), bobcat (*Lynx rufus*), cougar (*Puma concolor*) and various

small mammal species including shrews, rodents, and mustellids. Bats have not been observed or recorded on the site during 2013 surveys.

Birds

A variety of bird species have been observed on the lower site and within or adjacent to the Woodfibre property (Table 5). These observations include many resident and marine migratory bird species common to the westcoast of British Columbia and Howe Sound region.

Table 5: Resident and Migratory Bird Species Observed On or Adjacent to Woodfibre Property and Proposed Project Site

Common Name	Scientific Name
Resident	
American dipper	<i>Cinclus mexicanus</i>
American robin	<i>Turdus migratorius</i>
Bald eagle	<i>Haliaeetus leucocephalus</i>
Black-capped chickadee	<i>Poecile atricapillus</i>
Canada goose	<i>Branta canadensis</i>
Chestnut-backed chickadee	<i>Poecile rufescens</i>
Common merganser	<i>Mergus merganser</i>
Dark-eyed junco	<i>Junco hyemalis</i>
Grouse species	<i>Dendragapus</i> sp.
Killdeer	<i>Charadrius vociferous</i>
Mallard	<i>Anas platyrhynchos</i>
Northern flicker	<i>Colaptes auratus</i>
Pacific wren	<i>Troglodytes pacificus</i>
Pileated woodpecker	<i>Dryocopus pileatus</i>
Ruby-crowned kinglet	<i>Regulus calendula</i>
Spotted towhee	<i>Pipilo maculatus</i>
Townsend's warbler	<i>Dendroica townsendi</i>
Varied thrush	<i>Ixoreus naevius</i>
Gull species*	Laridae sp.
Migratory Birds	
Band-tailed pigeon	<i>Patagioenas fasciata</i>
Barn swallow	<i>Hirundo rustica</i>

Table 5: Resident and Migratory Bird Species Observed On or Adjacent to Woodfibre Property and Proposed Project Site

Common Name	Scientific Name
Chipping sparrow	<i>Spizella passerine</i>
Goldeneye species	<i>Bucephala</i> sp.
Olive-sided flycatcher	<i>Contopus cooperi</i>
Red-breasted sapsucker	<i>Sphyrapicus ruber</i>
Red-tailed hawk	<i>Buteo jamaicensis</i>
Rufous hummingbird	<i>Selasphorus rufus</i>
Spotted sandpiper	<i>Actitis macularius</i>
Swainson's thrush	<i>Catharus ustulatus</i>
Tree swallow	<i>Tachycineta bicolor</i>
Turkey vulture	<i>Cathartes aura</i>
Violet-green swallow	<i>Tachycineta thalassina</i>
Warbling vireo	<i>Vireo gilvus</i>
Western tanager	<i>Piranga ludoviciana</i>
Wilson's warbler	<i>Wilsonia pusilla</i>
Yellow warbler	<i>Dendroica petechial</i>

Note: * - Resident and Migrant to the site. Reference: Birds of North America Online (<http://bna.birds.cornell.edu/bna>).

Reptiles and Amphibians

Coastal tailed frog (*Ascaphus truei*) tadpoles were observed within the lower Woodfibre site in a constructed channel. Coastal tailed frogs have also been recorded in Woodfibre Creek (FSCI Biological Consultants 2010).

Garter snakes (*Thamnophis* sp.) have also been observed in portions of the lower Woodfibre site. was observed basking on the pavement in front of the main office on the property during a site visit in July 2013. In addition, a juvenile garter snake was observed during a subsequent visit to the property in July 2013, on the road up to the Fortis gas pipeline crossing.

7.9.3 Potential Impacts to Species at Risk, Migratory Birds, Fish and Aquatic Species

The proposed Woodfibre LNG project is not anticipated to have material project-related impacts on fish, aquatic, migratory and resident bird, wildlife and species at risk (SAR). Table 6 outlines the potential occurrence and negligible project-related impacts on fish, aquatic, mammal, bird species and SAR. Table 4 in Section 8 provides a summary of negligible project-related impacts and proposed mitigation measures to avoid and limit impacts to fish, aquatic, terrestrial, mammal, bird species and SAR.

Specific to the Woodfibre project and as per section 17 of the Prescribed Information for the Description of a Designated Project regulation under CEAA 2012, the federal requirement requires a description of potential impacts to aquatic flora and fauna, and migratory birds.

Migratory birds are defined in section 2(1) of the *Migratory Birds Convention Act* as a migratory bird referred to in the Convention, and includes the sperm, eggs, embryos, tissue cultures and parts of the bird.

Fish are defined as in section 2(1) of the *Fisheries Act* as fish including parts of fish, shellfish, crustaceans, marine animals and any parts of shellfish, crustaceans or marine animals, and the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans and marine animals.

Aquatic species are defined means a wildlife species that is a fish, as defined in section 2 of the *Fisheries Act*, or a marine plant, as defined in section 47 of that Act. Section 47 of the *Fisheries Act* defines marine plants as all benthic and detached algae, marine flowering plants, brown algae, red algae, green algae and phytoplankton.

Species at Risk (SAR) is a specific term applied to flora and fauna, terrestrial and aquatic species that are included in the BC Ministry of Environment's (MOE's) Conservation Data Centre's "red or blue lists"², or considered "Endangered", "Threatened", or "Special Concern" by the federal government's Committee on the Status of Endangered Species in Canada (COSEWIC) and are listed as such in Schedule 1 of federal *Species at Risk Act*.

² The MOE's Conservation Data Centre's (CDC's) "blue list" includes ecological communities, and indigenous species and subspecies (*i.e.*, "elements") that are considered to be of "special concern" in BC. Elements are considered to be of special concern if their characteristics make them particularly sensitive to human activities or natural events. Blue-listed elements are considered to be "at risk", but are not "extirpated", "endangered" or "threatened".

The CDC's "red list" includes any element that is extirpated, endangered, or threatened in British Columbia. Extirpated elements no longer exist in the wild in British Columbia, but occur elsewhere. Endangered elements are facing imminent extirpation or extinction throughout their entire geographic range. Threatened elements are likely to become endangered if limiting factors are not addressed.

Under the federal *Species at Risk Act* (SARA), the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) also has the responsibility to evaluate the status of wildlife in Canada, and to assign species to one of following categories: "special concern", "threatened", "endangered", "extirpated", or "extinct". "Special concern" species are those that may become "threatened" or "endangered" because of a combination of biological characteristics and identified threats if no action is taken to prevent this. "Threatened" species are those likely to become "endangered" if nothing is done to reverse the factors leading to their extirpation or extinction. "Endangered" species face imminent extirpation or extinction. The federal government formally recognizes the status of COSEWIC-recommended species under SARA by placing these species on one of Schedules 1 through 3 of SARA.

A wide varied of aquatic species, fish and migratory birds as well as other marine, freshwater and terrestrial wildlife potentially occur around the proposed site (refer to Table 6).

There are minimal numbers of aquatic plants or fish species that occur on or adjacent to the industrial portion of the property and the proposed LNG project site, or in adjacent marine areas according to the Conservation Data Centre (CDC) BC Species and Ecosystems Explorer (Table 6). In addition, this project is not expected to materially affect these aquatic species and aquatic wildlife (i.e., flora or fauna), nor result in direct interaction with such species along the shipping route in Howe Sound based on proposed project designs and mitigation and safety measures (Table 7).

Additional studies are being and will be carried out to further examine the occurrence and habitat use of aquatic species, fish and migratory birds as well as any aquatic and terrestrial flora and fauna within the lower industrial Woodfibre project site.

These study results will be used to assess the potential overlap and project-related effects during construction, operational and closure phases. Based on 2013 field studies, and review of the proposed constructed and operational project components and activities, WNGL does not anticipate direct interaction with limited impacts on and to existing fish, aquatic habitat, aquatic flora, resident or migratory bird species and SAR (Table 6). The proposed Woodfibre LNG project is being proposed within existing industrial lands and marine foreshore areas. Limited habitat use and occurrence have been observed for aquatic, fish, bird and mammal species and SAR on the proposed project site. It is anticipated that the project will have limited impacts on aquatic flora and fauna, bird and mammal species.

The proposed project site is greater than 7 km away from the existing Squamish River estuary where fish, aquatic habitat, aquatic flora, resident or migratory birds, and/or SAR are known to occur. The project and its activities will be limited to the proposed marine and terrestrial site. Full environmental management regimes will be implemented on the land-based site to salvage and remove any incidental occurrences of aquatic flora and fauna, bird, mammal and SAR found on the existing industrial site.

The project will not be implemented or disturb existing aquatic habitats in Mill or Woodfibre Creeks. The marine foreshore and marine subtidals areas proposed for project marine terminals, have undergone recent activity by Western Forest Products to remediate any potential site issues associated with closure of the Woodfibre Pulp and Paper Mill site (independent of the proposed LNG project at the site). Proposed LNG Carriers will transit at distances greater than 1 km from the existing bird sanctuary at Pam Rocks in Howe Sound.

Table 6: Fish, Aquatic Species and Migratory Birds Known to Occur Near or Adjacent to the Project Site and Summary of Potential Effects

Common Name		Scientific Name	Species at Risk	Occurrence on Woodfibre Property	Potential Habitat-Use On Woodfibre Property	Potential Woodfibre site, Project-related Interaction			
						Habitat Loss	Habitat Fragmentation	Barriers To Movement	Sensory Disturbance
	Amphibians								
Coastal tailed frog		<i>Ascaphus truei</i>	●	●	●		●	●	●
Northern red-legged frog		<i>Rana aurora</i>	●		●		●	●	●
Western toad		<i>Anaxyrus boreas</i>	●		●		●	●	●
	Resident and Migratory Birds								
Great blue heron		<i>Ardea herodias fannini</i>	●		●		●	●	●
Band-tailed pigeon		<i>Patagioenas fasciata</i>	●	●	●		●	●	●
Olive-sided flycatcher		<i>Contopus cooperi</i>	●	●	●		●	●	●
Barn swallow		<i>Hirundo rustica</i>	●	●	●	●	●	●	●
Sooty grouse		<i>Dendragapus fuliginosus</i>	●		●		●	●	●
Coastal western screech-owl		<i>Megascops kennicottii kennicottii</i>	●		●		●	●	●
Common nighthawk		<i>Chordeiles minor</i>	●		●		●	●	●
Surf scoter		<i>Melanitta perspicillata</i>	●		●		●	●	●
Double-crested cormorant		<i>Phalacrocorax auritus</i>	●		●		●	●	●
American dipper		<i>Cinclus mexicanus</i>		●	●				●
American robin		<i>Turdus migratorius</i>		●	●		●		●
Bald eagle		<i>Haliaeetus leucocephalus</i>		●	●				●
Black-capped chickadee		<i>Poecile atricapillus</i>		●	●		●		●
Canada goose		<i>Branta canadensis</i>		●	●		●	●	●
Chestnut-backed chickadee		<i>Poecile rufescens</i>		●	●		●		●
Common merganser		<i>Mergus merganser</i>		●	●		●	●	●
Dark-eyed junco		<i>Junco hyemalis</i>		●	●		●		●
Grouse species		<i>Dendragapus</i> sp.		●	●				●
Killdeer		<i>Charadrius vociferous</i>		●	●				●
Mallard Duck		<i>Anas platyrhynchos</i>		●	●		●	●	●
Northern flicker		<i>Colaptes auratus</i>		●	●				●

Table 6: Fish, Aquatic Species and Migratory Birds Known to Occur Near or Adjacent to the Project Site and Summary of Potential Effects

Common Name	Scientific Name	Species at Risk	Occurrence on Woodfibre Property	Potential Habitat-Use On Woodfibre Property	Potential Woodfibre site, Project-related Interaction			
					Habitat Loss	Habitat Fragmentation	Barriers To Movement	Sensory Disturbance
Pacific wren	<i>Troglodytes pacificus</i>		●	●		●		●
Pileated woodpecker	<i>Dryocopus pileatus</i>		●					●
Ruby-crowned kinglet	<i>Regulus calendula</i>		●	●		●		●
Spotted towhee	<i>Pipilo maculatus</i>		●	●		●		●
Townsend's warbler	<i>Dendroica townsendi</i>		●	●		●		●
Varied thrush	<i>Ixoreus naevius</i>		●	●		●		●
Gull species*	Laridae sp.		●	●		●		●
Chipping sparrow	<i>Spizella passerine</i>		●	●		●		●
Goldeneye species	Bucephala sp.			●		●	●	●
Red-breasted sapsucker	<i>Sphyrapicus ruber</i>			●				●
Red-tailed hawk	<i>Buteo jamaicensis</i>			●				●
Rufous hummingbird	<i>Selasphorus rufus</i>		●	●				●
Spotted sandpiper	<i>Actitis macularius</i>			●				●
Swainson's thrush	<i>Catharus ustulatus</i>		●	●		●		●
Tree swallow	<i>Tachycineta bicolor</i>		●	●		●		●
Turkey vulture	<i>Cathartes aura</i>		●	●				●
Violet-green swallow	<i>Tachycineta thalassina</i>			●		●		●
Warbling vireo	<i>Vireo gilvus</i>		●	●		●		●
Western tanager	<i>Piranga ludoviciana</i>		●	●		●		●
Wilson's warbler	<i>Wilsonia pusilla</i>		●	●		●		●
Yellow warbler	<i>Dendroica petechial</i>		●	●		●		●
Fish								
Coastal Cutthroat trout	<i>Oncorhynchus clarkii clarkii</i>	●	●	●				●
Coho salmon	<i>O. kisutch</i>		●	●				●
Chum salmon	<i>O. keta</i>		●	●				●
Steelhead salmon	<i>O. mykiss</i>		●	●				●
Dolly Varden	<i>Salvelinus malma</i>			●				●
Pink salmon	<i>O. gorbuscha</i>		●	●				●

Table 6: Fish, Aquatic Species and Migratory Birds Known to Occur Near or Adjacent to the Project Site and Summary of Potential Effects

Common Name	Scientific Name	Species at Risk	Occurrence on Woodfibre Property	Potential Habitat-Use On Woodfibre Property	Potential Woodfibre site, Project-related Interaction			
					Habitat Loss	Habitat Fragmentation	Barriers To Movement	Sensory Disturbance
Resident Rainbow Trout	<i>O. mykiss</i>		●	●				●
Pacific Herring	<i>Clupea pallasii</i>		●	●				●
Aquatic Species								
Dungeness crab	<i>Cancer magister</i>			●	●			
Tanner crab	<i>Chionoecetes bairdi</i>			●	●			
Kelp crab	<i>Pugettia spp</i>			●	●			
Squat lobster	<i>Munida quadraspina</i>				●			
Shrimp	<i>Pandalus sp</i>			●	●			
Green urchins	<i>Stronglyocentrotus droebachiensis</i>			●		●	●	●
Rockweed	<i>Fucus spp</i>		●	●		●	●	●
Anemones	<i>Metridium sp and Urticina sp</i>		●	●		●	●	●
Pacific white-sided dolphin	<i>Lagenorhynchus obliquidens</i>			●				●
Grey whale	<i>Eschrichtius robustus</i>			●				●
Harbour porpoise	<i>Phocoena phocoena</i>			●				●
Killer whales	<i>Orcinus orca</i>	●						●
Other Common Marine Benthic invertebrates: (Polychaete, nemertean and phoronid worms, snails, bivalves, Porifera, Cnidaria, Sipuncula, Entoprocta, Bryozoa, Echinodermata)			●	●		●		●

Minimal aquatic species (rockweed, anemones and other common marine benthic invertebrates) and no migratory birds have been identified on the lower industrial portion of the property and in the proposed LNG project site on land and in marine areas. In addition, the project is not anticipated to affect existing mature forests, terrestrial habitats, sensitive ecosystems or critical marine or freshwater aquatic habitats, along with implementation of the above example potential mitigation measures. Given this, the project is not anticipated to affect aquatic species (i.e., flora or fauna) or migratory birds. Nonetheless, examples of

potential mitigation measures can be implemented to avoid, limit, or mitigate for effects on aquatic species or migratory bird species known on or in proximity to the Woodfibre LNG project site as follows:

- Minimize the facility and laydown area footprint and interaction of site equipment and marine vessels with aquatic, fish, migratory birds, and SARs species their habitat during site preparation and construction;
- Minimize the footprint of the operational facility and ancillary structures, along with interaction of equipment and marine vessels with aquatic flora and fauna, resident or migratory birds, SAR and their habitat during operation;
- Avoid fish and aquatic species habitat disturbance within Mill Creek or Woodfibre Creek during site preparation, construction, operation or closure phases of the project. Maintain connectivity of Mill Creek and Woodfibre Creek to Howe Sound;
- Implement Best Management Practices to avoid or limit impacts on fish, aquatic species and migratory birds; and
- Implement parameters such as directional lighting and noise reduction mechanisms on machinery on the Woodfibre LNG site and shipping vessels to minimise potential effects on fish, aquatic, terrestrial, marine mammal, resident and migratory bird species and SAR.

7.10 Socio-community

7.10.1 First Nation Setting

The project site is within the traditional territories of the Squamish Nation, as per information received from the Squamish Nation, the Statement of Intent maps publicly available through the BC Treaty Commission, and information derived from the public version of the Consultative Areas Database. However, there are no current aboriginal settlements on or near the property.

According to the Squamish Nation website “The total area of Squamish Nation Traditional Territory is 6,732 km² (673,200 ha). The Nation consists of 23 villages encompassing 28.28 km² (2,828 ha). These parcels of land are scattered from Vancouver to Gibson’s Landing to the area north of Howe Sound. The project site was originally known as *Swig’a’t* (pronounced SWAY OTT) by the peoples of the *Skwxwú7mesh* or Squamish Nation, who have lived in the region since before glaciation. Squamish Nation Chiefs have informed us that a settlement existed on the site. In addition, the area was likely used as a site from which to hunt, fish, and gather foodstuffs as part of the Squamish people’s traditional diet.

According to a traditional Squamish Nation story, a hunter, while camping in a cave above *Swig’a’t*, encountered and killed a *Smaylilh* (wild person or Sasquatch). The closest Indian Reserves to the property are under the administration of the Squamish Nation and include the following:

- Kaikalahun Indian Reserve No.25, on west shore of Howe Sound south of Port Mellon, 11.5 ha;
- Defence Island Indian Reserve No.28, in Howe Sound, northeast from Anvil Island (Hat Island, the easterly of two islands called Defence Islands, 1.7 ha; and
- Kwum Kwum Indian Reserve, the westerly of the two Defence Islands northeast of Anvil Island, 6.2 ha.

As well, the proposed vessel route passes through the Squamish Nation Marine Management Area boundary.

WNGL has concurrently distributed the draft Project Description to the Squamish Nation and has had preliminary discussions on four occasions with the individual Squamish Chiefs and Squamish Nation councillors and staff regarding the project, Squamish interest and participation, and stewardship of fisheries and wildlife resources. The Proponent also filed, in June 2013, a formal application for consideration, with the Squamish Nation and is anticipating that full Squamish Nation Council will consider the application in the very near future. WNGL hopes the consultation with the Squamish Nation will assist in identifying whether and to what extent their aboriginal interests may be affected by the project, as well as, where necessary, measures to avoid, minimize, or otherwise accommodate any adverse effects to those interests.

WNGL has expressed to the Squamish Nation leadership its desire to be respectful and progressive throughout the process. Specifics on how that may be achieved have been presented to Squamish Nation staff and it is hoped the June application will be considered shortly.

7.11 Regional and Local Community

The project site is located in the municipality of the District of Squamish, which in turn is located with the Squamish and Lillooet Regional District, within Howe Sound. The District of Squamish presently has the site zoned as industrial land use and defines the sites purpose as for industry and employment within the OCP. While the site is located with the city limits of the District of Squamish, the nearest economic and commercial communities to the project site are Britannia Beach 5.5 km to the southeast, Darrell Bay approximately 6.2 km to the east, the urban centre of Squamish approximately 7 km to the northeast and Furry Creek approximately 9 km to the south.

The site is zoned “GENERAL INDUSTRIAL (I-3)”. The intent of this zone is to provide land that requires large lot sizes at a location near to waterfront, rail, or other major transportation routes; the uses intended are primarily oriented to intensive manufacturing, transportation, and shipment of manufactured, bulk goods, or materials. District of Squamish Zoning Bylaw, No. 2200, 2011 as updated September 2013.

7.12 Industrial Setting

The property has been the site of a pulp mill since 1912 when the British Columbia Sulphite Fibre Company established a facility. Woodfibre Pulp and Paper Mill was one of the oldest pulp mills in British Columbia and operated for 94 years by a number of companies. Woodfibre Pulp and Paper Mill was named by Sir George Bury, the president of the Whalen Pulp and Paper Company in 1920, after it took ownership of the facility from the British Columbia Sulphite Fibre Company in 1917. Thereafter in 1925, the Whalen Pulp & Paper Company went into receivership with the assets acquired by the then formed B.C. Pulp & Paper Company Ltd. in 1925.

BC Pulp & Paper Company Ltd. operated the mill from 1925 to 1950. Thereafter through various partnerships involving Alaska Pine & Cellulose and later Rayonier Inc., Woodfibre Pulp and Paper Mill operated as a kraft mill until 1980. Then it changed hands from Rayonier and became known as the Squamish Mill. It was next acquired in 1983 by Western Pulp Ltd., who would operate the facility until its final closure in 2006.

Since 2006 Western Forest Products has maintained the site and has dismantled a significant portion of the pulp mill. A number of larger buildings and marine related structures remain. Western Forest Products is presently engaged in care and maintenance, and preliminary site remediation. Refer to Appendix 1 of this Project Description for historical and recent site photos.

Bulk vessel and barge traffic are common throughout Howe Sound and use existing shipping routes and navigation channels. Annual ship traffic in Howe Sound involves approximately 70 commercial vessel movements annually to Squamish ports and an additional 50 vessels to Port Mellon, with greater than 15,000 throughout the lower Strait of Georgia. BC Ferries also operate in the Metro Vancouver area on regular schedules and routes to ports on Bowen Island, Vancouver Island, the Sunshine Coast and Powell River, North and Central Coast, and Southern Gulf Islands.

7.13 Land, Water and Resource Use

The Woodfibre LNG project will be located on 86 ha of private land and foreshore tenure owned and permitted by WNGL (Figure 2a, b). The project site is only accessible by water and has an established ferry route from Squamish to the site. The project site has existing electric and gas supplies and water licences (Mill Creek and Woodfibre Creek) originally used by the Woodfibre Pulp and Paper Mill. Various logging roads extend from the site, but are not connected to Squamish or Port Mellon.

The Woodfibre property is presently zoned as *Industrial Land use* by the District of Squamish, comprise three existing water leases and will not require rezoning for the proposed project (Figure 3). No commercial or aboriginal fisheries are known to occur on or adjacent to the project site, in the area of foreshore lease and DFOs Fisheries Management Area 28 adjacent to the project site, or Area 28-2 along the proposed carrier shipping route within Howe Sound. Recreational fisheries for marine species including salmon, rockfish, crab, and prawns may occur in marine areas adjacent to the property (Figure 5d).

Specific resource management areas are found within the larger Management Area 28 (28-A) under specific harvest and management regulations for salmon, shrimp, intertidal clams, crabs, euphausiids, groundfish and smelt. Freshwater fishing has not been observed in Mill Creek or Woodfibre Creek in areas adjacent to the property. Hunting has been not permitted on the private lands. Access to the site is restricted and controlled by existing access and security. Recreational hunting, fishing and hiking have not been observed on the private lands or in Crown land areas immediately above the project site due to access restrictions.

8 ANTICIPATED PROJECT-RELATED ENVIRONMENTAL AND SOCIAL EFFECTS

8.1.1 Local and Regional Effects

The preliminary list of potential receptors of the environmental and social project-related effects of the proposed Woodfibre LNG Production and storage facility includes:

- Physical Resources:
 - Air Quality;
 - GHG & Climate Change;
 - Noise;
 - Ambient Light;
 - Remediation and Groundwater; and
 - Marine Geohazard Risk.
- Aquatic Resources:
 - Marine Flora & Fauna
 - Migratory Birds;
 - SAR;
 - Freshwater Flora & Fauna; and
 - Surface Water and Hydrology.
- Social & Cultural Resources:
 - Socio-Economics;
 - First Nations Consultation/Aboriginal Interests;
 - Heritage Resources;
 - Visual Aesthetics;
 - Land and Resource Use; and
 - Human Health Risk Assessment.
- Navigation and Safety:
 - Navigable Waters (as it pertains to environmental risks associated with spills or collisions with marine mammals. Carrier safety, shipping, carrier movement considerations will be addressed under a separate TERMPOL study and potential review assessment.)
- Terrestrial Resources:
 - Flora and fauna.

A summary of potential effects associated with the anticipated project-related environmental and social effects are provided in Table 7, and are presented for both the **preferred** FLNG and **alternative** land-based configurations.

A summary of potential mitigation measures associated with the anticipated project-related environmental and social effects are provided in Table 7, and are presented for both the **preferred** FLNG and **alternative** land-based configurations.

8.1.2 Effects Outside of Canada

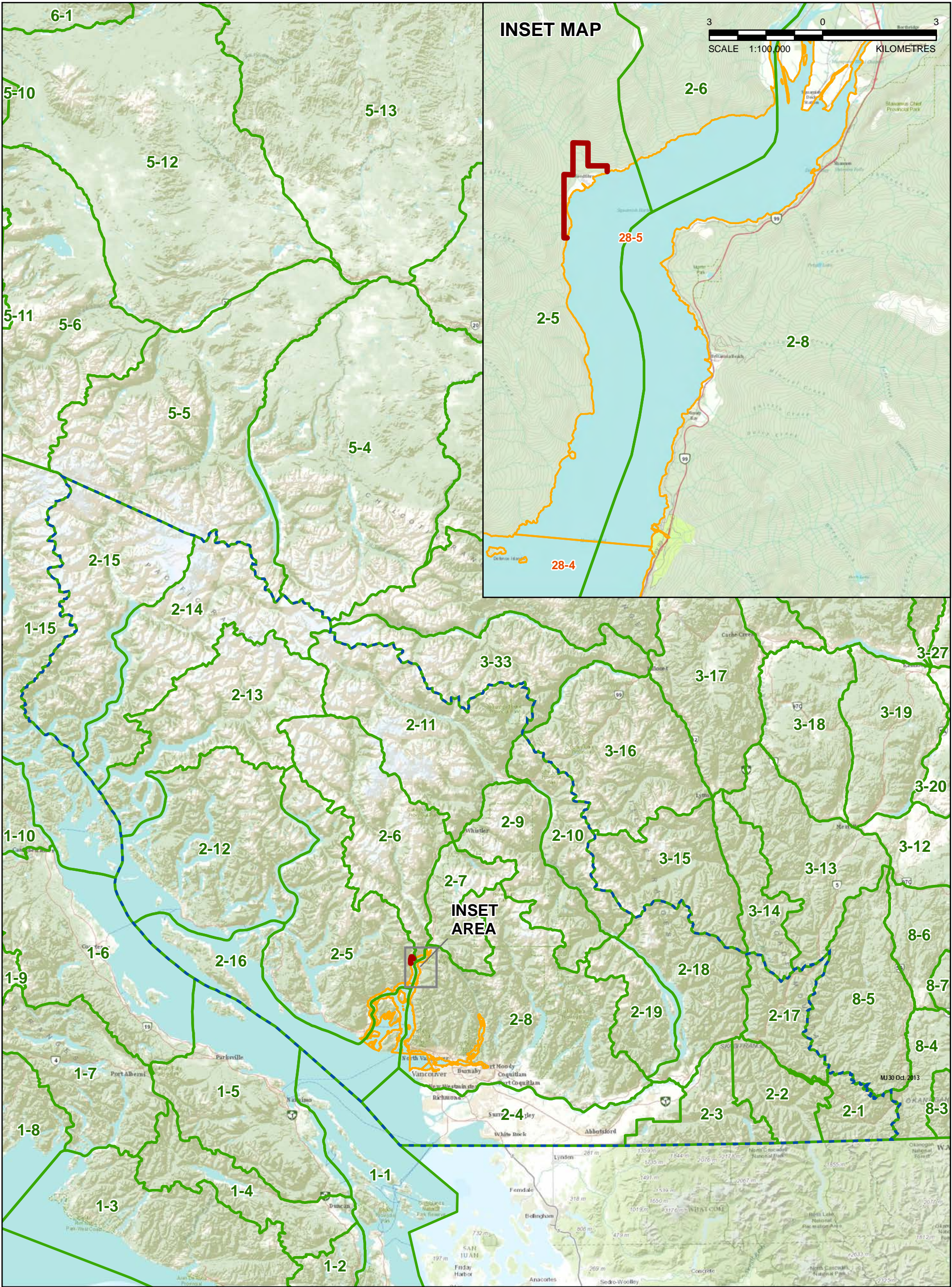
More than 135,000 LNG carrier voyages have taken place across the globe since 1959 without major accidents or safety or security problems, either in port or at sea (The International Group of Liquefied Natural Gas Importers (GIIGNL) – 2011). LNG vessels visiting the project site will be powered by LNG within 200 nautical miles of Canadian coastlines and would not be consuming other fuels while within Canadian territorial waters. Based on fuel requirements for the largest modern 173,400 m³ LNG tanker (i.e., considered a worst-case scenario in terms of vessel size visiting the project site), such vessels may carry up to 400 m³ of marine diesel, up to 150 m³ of low sulphur gas oil and up to 140 m³ of marine gas oil while in transit within Canadian territorial waters.

This is the same vessel size class as approximate 3,300 container vessels and tankers that currently transit from Ogden Point pilotage (Neah Bay) near Victoria to Vancouver Harbour. Therefore, the estimated annual 40 vessel visits associated with the project site would represent a <2% increase in comparably sized vessel traffic. In addition, the LNG carriers visiting the Woodfibre LNG facility will transit in accordance with the *Canada Shipping Act* (2001) along with by-laws established by Transport Canada and the Pacific Pilotage Authority (PPA).

In accordance with the Canadian Coastguard and BC Coast Pilots under normal operations, the vessels will transit into and out of US waters from Victoria Pilot station to the project site, which will occur in the Haro Strait and Boundary Pass for the inbound routing. LNG carriers will move through from the Pacific Ocean, through the Strait of Juan de Fuca, Haro Strait, Strait of Georgia into Howe Sound within designated shipping zones and be conducted in accordance with the *Canada Shipping Act*, 2001. LNG vessels from the project site will be operated by contracted vessel operators (see Section 3.4.10). These ships will be piloted by two onboard Canadian Pilots and escorted by tethered tugs (i.e., LNG carriers will pick up BC Coast Pilots and assist tugs (tethered) outside Victoria upon entry into the Strait of Juan de Fuca. In addition, in the event of propulsion loss during transit, adequate propulsion redundancy would be provided by the tethered escorting tugs.

Given the above, the risk of environmental impact outside of Canada is not considered significant for either the **preferred** FLNG or **alternative** land-based configurations.

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- LEGEND**
- WOODFIBRE PROPERTY BOUNDARY
 - BC FISHERIES REGION 2 - LOWER MAINLAND
 - BC FISHERIES SUB-REGIONS (ID)
 - COMMERCIAL FISHERIES MANAGEMENT AREA 28 - PACIFIC REGION SUB-AREAS (ID)

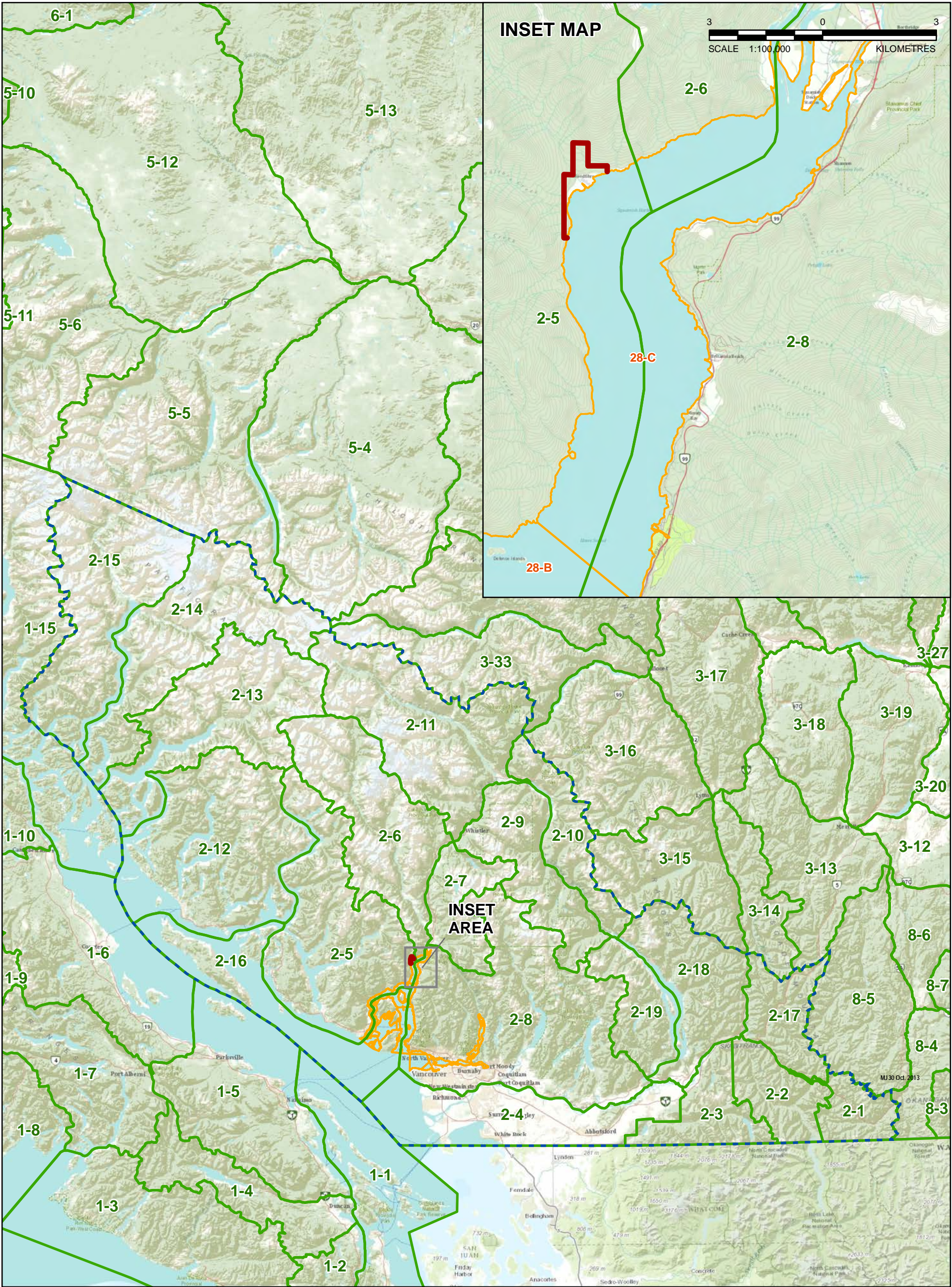
REFERENCE

FISHERIES MANAGEMENT DATA DIGITIZED BASED ON MAPS PROVIDED BY THE FEDERAL DFO. BC FISHERIES DATA BASED ON WILDLIFE MANAGEMENT UNITS FROM GEOBC, ELEVATION DATA FROM GEOBASE, BASE MAP FROM ESRI. PROJECTION: UTM ZONE 10 DATUM: NAD 83

40 0 40
SCALE 1:1,500,000 KILOMETRES

PROJECT		WOODFIBRE NATURAL GAS LTD. WOODFIBRE, HOWE SOUND, B.C.			
TITLE		COMMERICAL FISHING MANAGEMENT AREAS			
	PROJECT NO. 13-1422-0006		PHASE No.		
	DESIGN	SR	15 Aug. 2013	SCALE AS SHOWN	REV. 0
	GIS	KLN	11 Oct. 2013	FIGURE 5A	
	CHECK	AL	11 Oct. 2013		
REVIEW		MJ	30 Oct. 2013		

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- LEGEND**
- WOODFIBRE PROPERTY BOUNDARY
 - BC FISHERIES REGION 2 - LOWER MAINLAND
 - BC FISHERIES SUB-REGIONS (ID)
 - RECREATIONAL FISHERIES MANAGEMENT AREA 28 - PACIFIC REGION SUB-AREAS (ID)

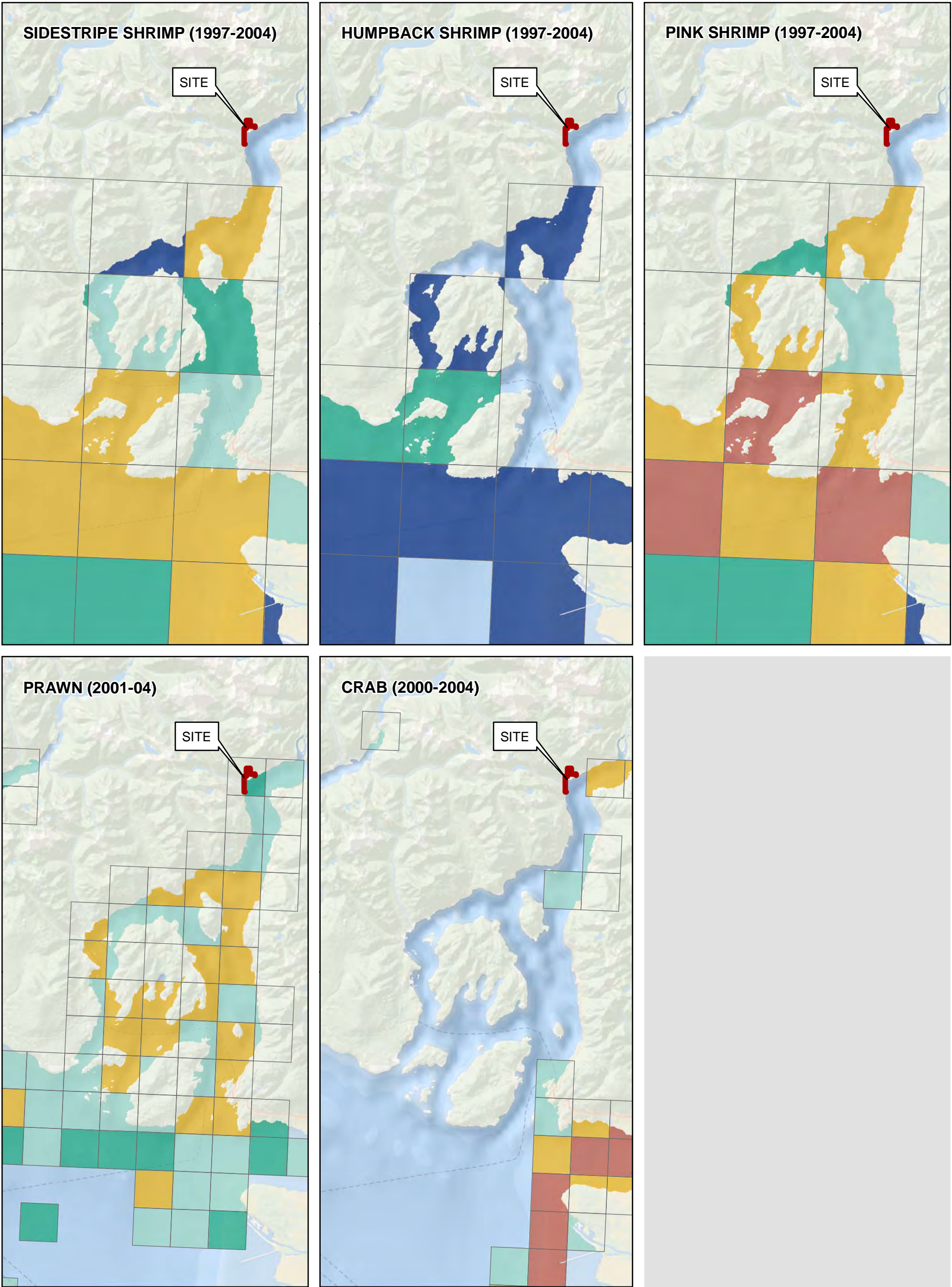
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FISHERIES MANAGEMENT DATA DIGITIZED BASED ON MAPS PROVIDED BY THE FEDERAL DFO. BC FISHERIES DATA BASED ON WILDLIFE MANAGEMENT UNITS FROM GEOBC, ELEVATION DATA FROM GEOBASE, BASE MAP FROM ESRI. PROJECTION: UTM ZONE 10 DATUM: NAD 83



PROJECT		WOODFIBRE NATURAL GAS LTD. WOODFIBRE, HOWE SOUND, B.C.			
TITLE		RECREATIONAL FISHING MANAGEMENT AREAS			
	PROJECT NO. 13-1422-0006		PHASE No.		
	DESIGN	SR	15 Aug. 2013	SCALE AS SHOWN	REV. 0
	GIS	KLN	11 Oct. 2013	FIGURE 5B	
	CHECK	AL	11 Oct. 2013		
	REVIEW	MJ	30 Oct. 2013		

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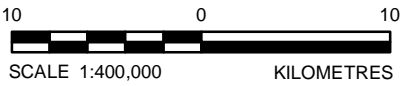


LEGEND

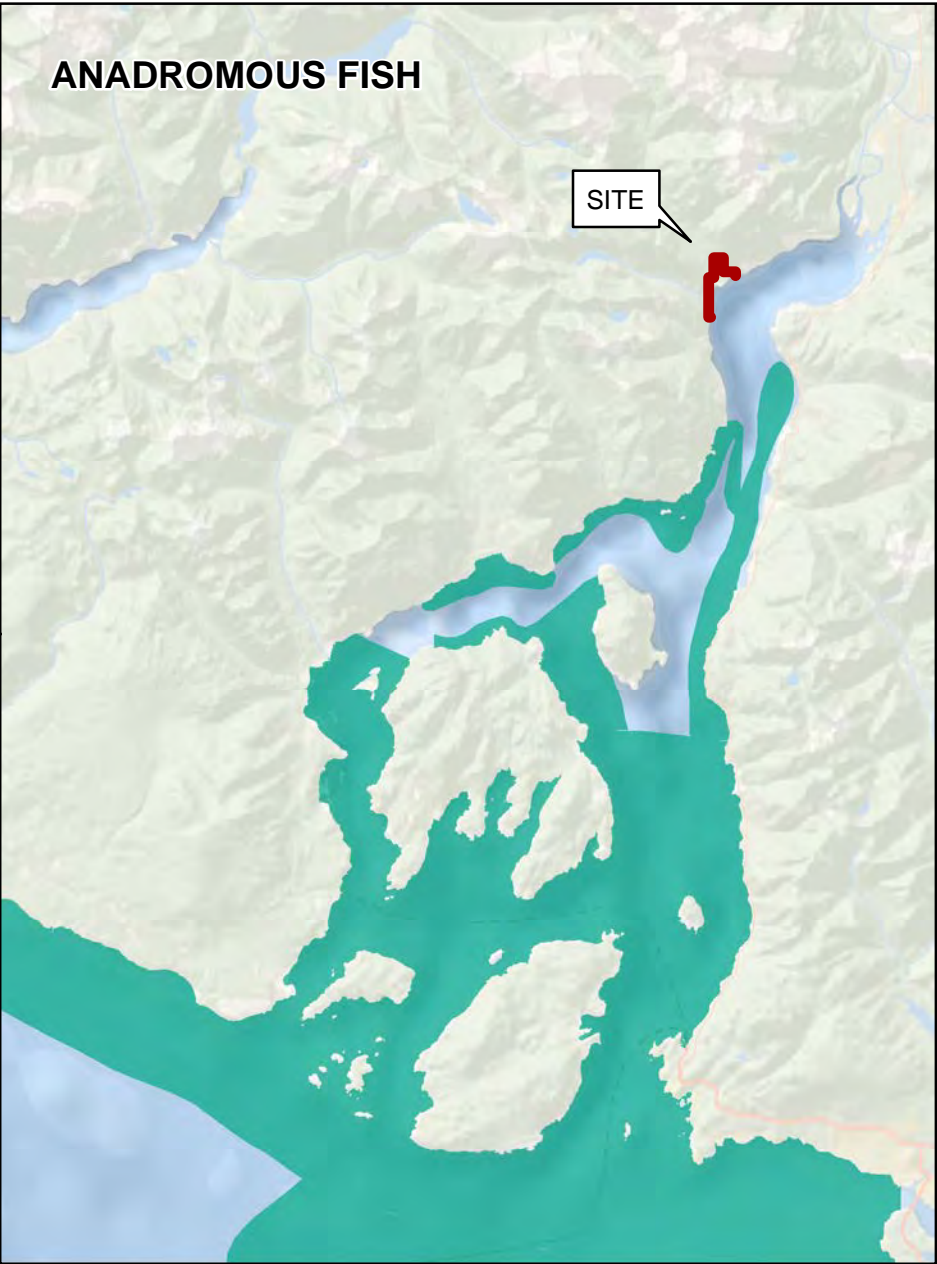
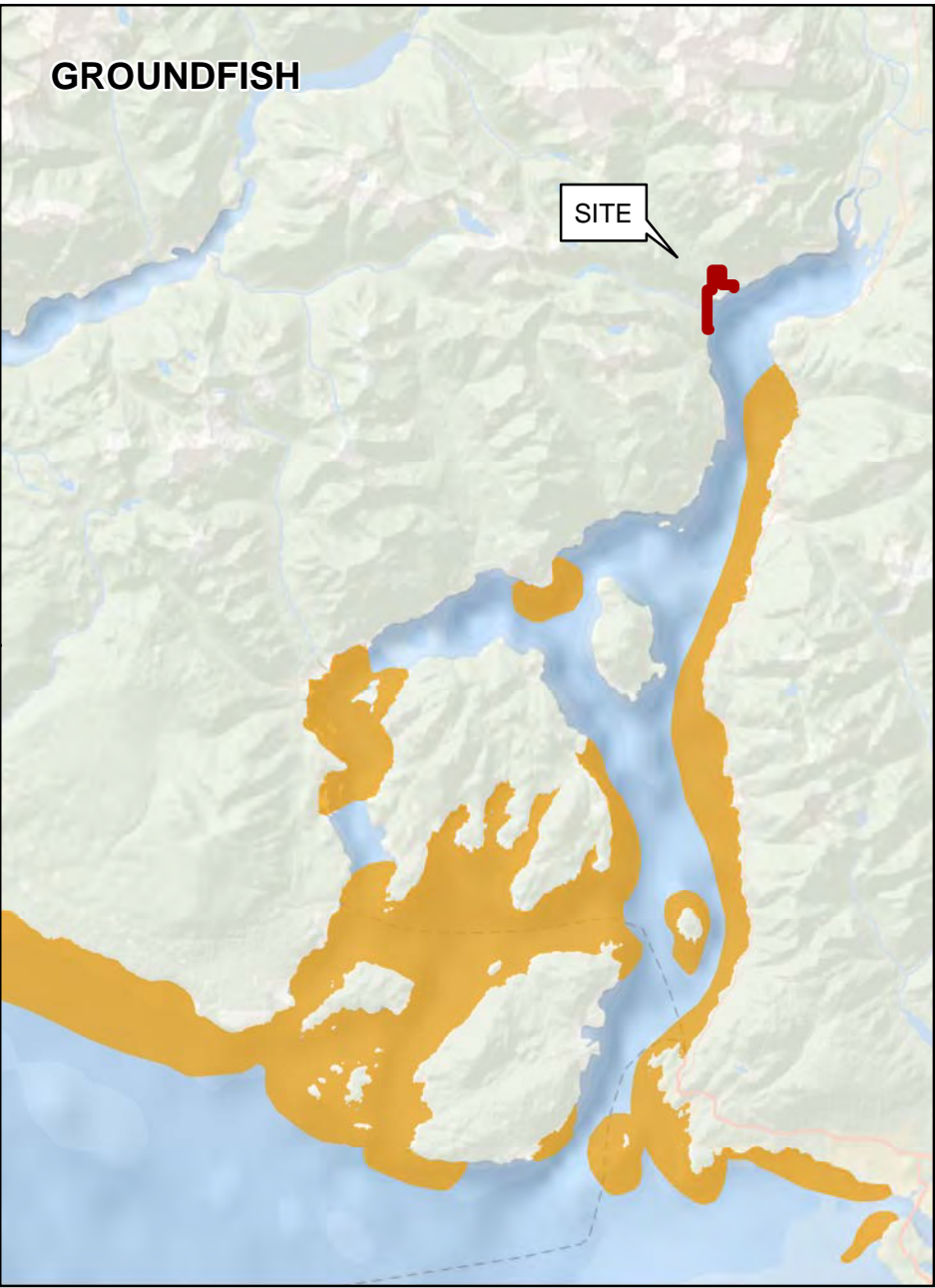
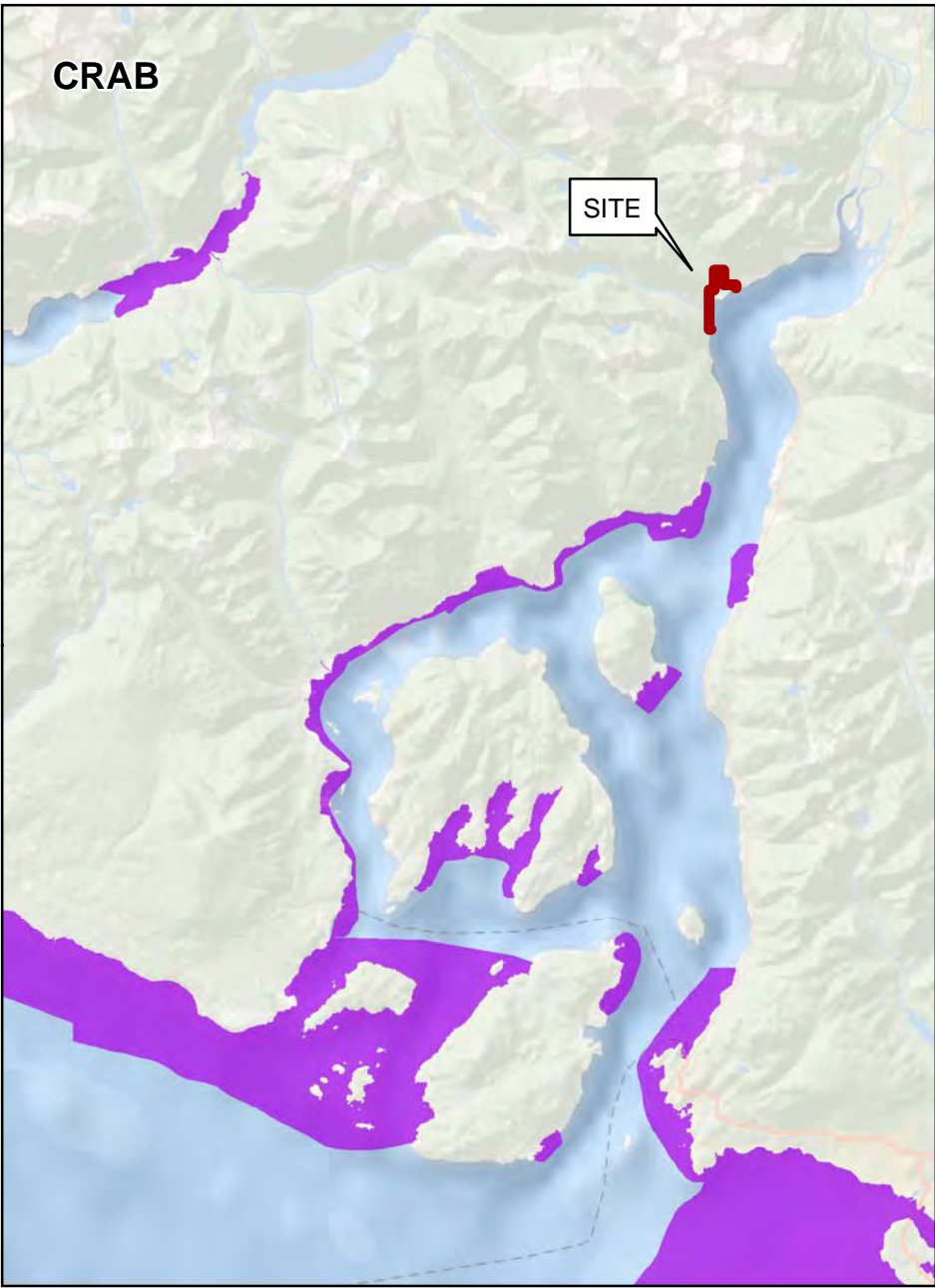
- Total Catch (lbs)**
- Under 100
 - 101 - 1,000
 - 1001 - 10,000
 - 10,001 - 100,000
 - Over 100,000
 - Data Summary Area

REFERENCE

Fishing data from BCMCA feature layers, catch data based on DFO data for all years indicated. For more information visit [HTTP://BCMCA.CA/MAPSDTA/ANALYSIS/](http://bcmca.ca/mapsdta/analysis/) Base map from ESRI. Projection: UTM Zone 10 Datum: NAD 83



PROJECT		WOODFIBRE NATURAL GAS LTD. WOODFIBRE, HOWE SOUND, B.C.			
TITLE		COMMERCIAL FISHING			
		PROJECT NO. 13-1422-0006		PHASE No.	
		DESIGN	SR	15 Aug. 2013	SCALE AS SHOWN
		GIS	KLN	11 OCT. 2013	REV. 0
		CHECK	AL	11 Oct. 2013	
		REVIEW	MJ	30 Oct. 2013	
		FIGURE 5C			



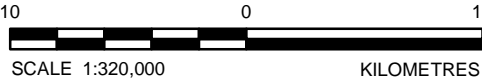
LEGEND

RECREATIONAL FISHING AREAS

- CRAB
- GROUNDFISH
- PRAWN AND SHRIMP
- ANADROMOUS

REFERENCE

FISHING DATA FROM BCMCA FEATURE LAYERS. FOR MORE INFORMATION VISIT
[HTTP://BCMCA.CA/MAPSDATA/ANALYSIS/](http://bcmca.ca/mapsdata/analysis/) BASE MAP FROM ESRI.
PROJECTION: UTM ZONE 10 DATUM: NAD 83



PROJECT		WOODFIBRE NATURAL GAS LTD. WOODFIBRE, HOWE SOUND, B.C.			
TITLE		RECREATIONAL FISHING AREAS			
		PROJECT NO. 13-1422-0006		PHASE No.	
		DESIGN	SR	15 Aug. 2013	SCALE AS SHOWN
		GIS	KLN	11 OCT. 2013	REV. 0
		CHECK	AL	11 Oct. 2013	
		REVIEW	MJ	30 Oct. 2013	
					FIGURE 5D

Table 7: Anticipated Woodfibre Project-related Effects and Potential Mitigation Measures

Environmental Component	Issue/Potential Effect	Potential Mitigation Measures
Physical Resources		
Air Quality, GHG & Climate Change	<p>Construction</p> <ul style="list-style-type: none"> Equipment exhaust emissions via gasoline or diesel combustion; Stored fuels, oils and grease and volatile organic compounds emissions. <p>Operation</p> <ul style="list-style-type: none"> Emissions from LNG carriers; Emissions of vapour during LNG production and storage; Emission of vapour during LNG carrier loading; Emissions of thermal oxidizers and heaters; Emission of water vapour from cooling systems; Exhaust emissions via gasoline or diesel combustion from site activities; Release of stored fuels, oils and grease and volatile organic compounds emissions; Emergency flaring emissions. <p>Decommissioning/Closure</p> <ul style="list-style-type: none"> Exhaust emissions via gasoline or diesel combustion from closure activities; Release of stored fuels, oils and grease and volatile organic compounds emissions; Emissions of vapour during process shutdown. 	<p>Construction</p> <ul style="list-style-type: none"> Watering or use of surfactants to reduce dust; Use electrical equipment; Limit use of fuel-burning vehicles; Use low-sulphur fuels; Idle time restrictions. <p>Operation</p> <ul style="list-style-type: none"> Watering or use of surfactants to reduce dust; Enclose operations to avoid and limit dust; Use electrical equipment; Limit use of fuel-burning vehicles; Use low-sulphur fuels; Idle time restrictions. <p>Decommissioning/Closure</p> <ul style="list-style-type: none"> Watering or use of surfactants to reduce dust; Use electrical equipment; Limit use of fuel-burning vehicles; Use low-sulphur fuels; Idle time restrictions.
Noise	<p>Construction</p> <ul style="list-style-type: none"> Equipment noise emissions during construction activities; Materials noise missions during construction activities. <p>Operation</p> <ul style="list-style-type: none"> Noise emissions from LNG carriers; Noise emissions from LNG production and storage facilities; Noise emissions from vehicle activities. <p>Decommissioning/Closure</p> <ul style="list-style-type: none"> Noise emissions from LNG shutdown activities; Noise emissions from vehicle activities during decommissioning or site cleanup. 	<p>Construction</p> <ul style="list-style-type: none"> Use source noise minimization equipment; Strobe lights rather than backup alarms on vehicles. <p>Operation</p> <ul style="list-style-type: none"> Use source noise minimization equipment; Strobe lights rather than backup alarms on vehicles. <p>Decommissioning/Closure</p> <ul style="list-style-type: none"> Use source noise minimization equipment.

Table 7: Anticipated Woodfibre Project-related Effects and Potential Mitigation Measures

Environmental Component	Issue/Potential Effect	Potential Mitigation Measures
Ambient Light	Construction <ul style="list-style-type: none"> Light trespass and sky glow at receptors from project during construction. Operation <ul style="list-style-type: none"> Light trespass and sky glow at receptors from project during operation; Light trespass and sky glow from LNG Carriers. Decommissioning/Closure <ul style="list-style-type: none"> Light trespass & sky glow at receptors from project as part of closure activities. 	Construction <ul style="list-style-type: none"> Review design of construction site lighting to minimize sky glow; Orientation and shading of lighting on structures to minimize light view from Howe Sound. Operation <ul style="list-style-type: none"> Review design of operational site lighting to minimize sky glow; Review of LNG carrier lighting to minimize light glow; Orientation and shading of lighting on structures to minimize light glow to Howe Sound. Decommissioning/Closure <ul style="list-style-type: none"> Removal of site lighting to minimize sky glow.
Contamination/Groundwater	Construction <ul style="list-style-type: none"> Mobilization and generation of new contamination during site clearance and construction activities; Release of stored fuels, oils and grease and volatile organic compounds. Operation <ul style="list-style-type: none"> Mobilization and generation of new contamination during operational activities; Release of stored fuels, oils and grease and volatile organic compounds. Decommissioning/Closure <ul style="list-style-type: none"> Release of stored fuels, oils and grease and volatile organic compounds. 	Construction <ul style="list-style-type: none"> Recycle and reuse construction washwater; Minimize impact to potentially contaminated sites based on certificate of compliance as appropriate. Operation <ul style="list-style-type: none"> Recycle and reuse operational water where possible; Appropriately bund hazardous material for storage or waste. Decommissioning/Closure <ul style="list-style-type: none"> Recycle closure washwater; Minimize impact to potentially contaminated sites based on certificate of compliance as appropriate.
Marine Geohazard Risk	Construction <ul style="list-style-type: none"> Landslide/debris slide (Tsunami); Sea Level Rise and storm surge; Shoreline erosion and sedimentation. Operation <ul style="list-style-type: none"> Landslide/debris slide (Tsunami); Sea Level Rise and storm surge; Shoreline erosion and sedimentation; and Effects of commercial carrier traffic on slope stability & shoreline. 	Construction <ul style="list-style-type: none"> Appropriate design of structures to meet seismic requirements; Production and implementation of emergency management planning for construction personnel. Operation <ul style="list-style-type: none"> Appropriate design of structures to meet seismic requirements; Implementation of emergency management planning for operational personnel.

Table 7: Anticipated Woodfibre Project-related Effects and Potential Mitigation Measures

Environmental Component	Issue/Potential Effect	Potential Mitigation Measures
	Decommissioning/Closure <ul style="list-style-type: none"> Landslide/debris slide (Tsunami); Sea Level Rise & storm surge; Shoreline erosion and sedimentation. 	Decommissioning/Closure <ul style="list-style-type: none"> Implementation of emergency management planning for closure personnel.
Aquatic Resources		
Marine Flora & Fauna	Construction <ul style="list-style-type: none"> Loss, alteration or isolation of marine habitat; Effects on marine environment from surface and ground water discharges causing avoidance and changed behaviour from flora and fauna including fish, aquatic species, migratory birds and SAR.; Introduction of invasive species on FLNG and FSU hulls; and Increased levels of underwater sound on marine receptors causing avoidance and changed behaviour from flora and fauna including fish, aquatic species, migratory birds and SAR.; Increased levels of underwater lighting at night on marine receptors causing avoidance and changed behaviour from flora and fauna including fish, aquatic species, migratory birds and SAR. Operation <ul style="list-style-type: none"> Loss, alteration or isolation of marine habitat; Effects on marine environment from surface and ground water discharges; Permanently moored FLNG and FSU hull surface areas for growth of marine flora and fauna; Effects of introducing exotic species on marine environment; and Increased levels of underwater sound on marine receptors causing avoidance and changed behaviour from flora and fauna including fish, aquatic species, migratory birds and SAR; and Increased levels of underwater lighting at night on marine receptors causing avoidance and changed behaviour from flora and fauna including fish, aquatic species, migratory birds and SAR. Decommissioning/Closure <ul style="list-style-type: none"> Potential effects on marine environment from surface and ground water discharges. 	Construction <ul style="list-style-type: none"> Minimize the materials offloading facility footprint and interaction of equipment, vessel traffic with marine mammals and aquatic resources; Loading facility pile driving mitigation practices in marine area; Single application of anti-fouling paint to FLNG and FSU prior to transportation to the site, along with final inspection once onsite; Implementation of Best Management Practices and development of Environmental Management Plans; Vessel traffic and noise management plans; Implementation of parameters such as directional lighting, vessel speeds and transit times and vessel routing to minimise underwater sound and potential collision effects; and Implementation of parameters such as directional lighting, vessel speeds and transit times and vessel routing to minimise underwater light effects. Operation <ul style="list-style-type: none"> Minimize the FLNG and FSU facility footprint and interaction of equipment, vessel traffic with marine mammals and aquatic resources; Allow marine flora and fauna on FLNG or FSU hulls to establish (hulls will be regularly inspected to maintain hull integrity); Habitat compensation for unavoidable loss of aquatic marine habitats; Loading facility pile driving mitigation practices in marine area; Implementation of Best Management Practices and

Table 7: Anticipated Woodfibre Project-related Effects and Potential Mitigation Measures

Environmental Component	Issue/Potential Effect	Potential Mitigation Measures
		<p>development of Environmental Management Plans;</p> <ul style="list-style-type: none"> • Vessel traffic and noise management plans; • Implementation of parameters such as directional lighting, vessel speeds and transit times and vessel routing to minimise underwater sound and potential collision effects; and • Implementation of parameters such as directional lighting, vessel speeds and transit times and vessel routing to minimise underwater light effects. <p>Decommissioning/Closure</p> <ul style="list-style-type: none"> • Removal of FLNG and FSU upon closure; • Implementation of Best Management Practices and development of Environmental Management Plans; • Vessel traffic and noise management plans during closure; • Implementation of parameters such as directional lighting, vessel speeds and transit times and vessel routing to minimise underwater sound and potential collision effects; and • Implementation of parameters such as directional lighting, vessel speeds and transit times and vessel routing to minimise underwater light effects.
Freshwater Flora & Fauna	<p>Construction</p> <ul style="list-style-type: none"> • Changes in site drainage characteristics; • Change in Mill Creek &/or Woodfibre Creek flow regime and habitats causing avoidance and changed behaviour and habitat loss for flora and fauna including fish, aquatic species, migratory birds and SAR; • Potential increase in land erosion and sediment input; • Withdrawal of freshwater for construction activities; and • Discharge of process water with chemical constituents. <p>Operation</p> <ul style="list-style-type: none"> • Changes in site drainage characteristics; • Change in Mill Creek and/or Woodfibre Creek flow regime and habitats causing avoidance and changed behaviour and habitat 	<p>Construction</p> <ul style="list-style-type: none"> • Design to avoid overlap and will not affect fish habitat or fish passage in Mill Creek or Woodfibre Creek; • Re-establish riparian margins of creeks where appropriate; • Implement Best Management Practices (e.g., sedimentation and erosion control plan) and develop of Environmental Management Plans; • Recycle process water to the extent practical; • Construct site facilities, roadways and laydown areas to reduce risk of stormwater inflows into the aquatic environment; • Maintain all effluent consistent with the appropriate guidelines;

Table 7: Anticipated Woodfibre Project-related Effects and Potential Mitigation Measures

Environmental Component	Issue/Potential Effect	Potential Mitigation Measures
	<p>loss for flora and fauna including fish, aquatic species, migratory birds and SAR;</p> <ul style="list-style-type: none"> • Potential increase in land erosion & sediment input; • Withdrawal of freshwater for plant processes; and • Discharge of process water with chemical constituents. <p>Decommissioning/Closure</p> <ul style="list-style-type: none"> • Changes in site drainage characteristics; and • Potential increase in land erosion and sediment input. 	<ul style="list-style-type: none"> • Institute construction practices to limit the generation of nitrogen and phosphorus; recycle process water where possible. <p>Operation</p> <ul style="list-style-type: none"> • Design to avoid overlap and will not affect fish habitat or fish passage in Mill Creek or Woodfibre Creek; • Implement Best Management Practices (e.g., sedimentation and erosion control plan) and develop of Environmental Management Plans; • Recycle process water to the extent practical; • Maintain all effluent consistent with the appropriate guidelines; • Institute operational practices to limit the generation of nitrogen and phosphorus; recycle process water where possible. <p>Decommissioning/Closure</p> <ul style="list-style-type: none"> • Re-establish riparian margins of creeks where appropriate; • Implement Best Management Practices (e.g., sedimentation and erosion control plan) and develop of Environmental Management Plans; • Recycle process water to the extent practical; • Maintain all effluent consistent with the appropriate guidelines; • Institute construction practices to limit the generation of nitrogen and phosphorus; recycle process water where possible.
Surface Water & Hydrology	<p>Construction</p> <ul style="list-style-type: none"> • Changes in site drainage characteristics; • Change in Mill Creek and/or Woodfibre Creek flow regime and habitats causing avoidance and changed behaviour and habitat loss for flora and fauna including fish, aquatic species, migratory birds and SAR; • Potential increase in land erosion and sediment input; • Withdrawal of freshwater for construction activities; and • Discharge of process water with chemical constituents. 	<p>Construction</p> <ul style="list-style-type: none"> • Implement Best Management Practices (e.g., sedimentation and erosion control plan) and develop of Environmental Management Plans; • Recycle process water to the extent practical; • Construct site facilities, roadways and laydown areas to reduce risk of stormwater inflows into the aquatic environment; • Maintain all effluent consistent with the appropriate guidelines;

Table 7: Anticipated Woodfibre Project-related Effects and Potential Mitigation Measures

Environmental Component	Issue/Potential Effect	Potential Mitigation Measures
	<p>Operation</p> <ul style="list-style-type: none"> • Changes in site drainage characteristics; • Change in Mill Creek and/or Woodfibre Creek flow regime and habitats causing avoidance and changed behaviour and habitat loss for flora and fauna including fish, aquatic species, migratory birds and SAR; • Potential increase in land erosion & sediment input; • Withdrawal of freshwater for operational processes; and • Discharge of process water with chemical constituents. <p>Decommissioning/Closure</p> <ul style="list-style-type: none"> • Changes in site drainage characteristics; and • Potential increase in land erosion and sediment input. 	<ul style="list-style-type: none"> • Institute construction practices to limit the generation of nitrogen and phosphorus; recycle process water where possible. <p>Operation</p> <ul style="list-style-type: none"> • Implement Best Management Practices (e.g., sedimentation and erosion control plan) and develop of Environmental Management Plans; • Recycle process water to the extent practical; • Maintain all effluent consistent with the appropriate guidelines; • Institute operational practices to limit the generation of nitrogen and phosphorus; recycle process water where possible. <p>Decommissioning/Closure</p> <ul style="list-style-type: none"> • Re-establish riparian margins of creeks where appropriate; • Implement Best Management Practices (e.g., sedimentation and erosion control plan) and develop of Environmental Management Plans; • Maintain all effluent consistent with the appropriate guidelines.
Social and Cultural Resources		
Socio-Economics	<p>Construction</p> <ul style="list-style-type: none"> • Potential project effects during construction on environmental conditions supporting recreational and tourism, and those affecting sectoral economic activity; • Potential effects on local housing market from construction worker demand; and • Potential effects on local employment and goods/services supply driven by project demand for workers. <p>Operation</p> <ul style="list-style-type: none"> • Potential project effects during operation on environmental conditions supporting recreational and tourism and those affecting sectoral economic activity; • Potential effects on local housing market from operational worker demand; and • Potential effects on local employment and goods/services supply 	<p>Construction</p> <ul style="list-style-type: none"> • Modifications to project design; • Community management planning with local communities, First Nations, and stakeholders to address population effects, availability and access to local housing, provision of services and infrastructure, and potential impacts to community well-being as appropriate; • Training and skill development strategies and support; • Public consultation; • Project construction managed integrally with local and regional economic priorities and activities; • Public and First Nations consultation findings as they pertain to economic issues will be reviewed and considered in the economic effects assessment

Table 7: Anticipated Woodfibre Project-related Effects and Potential Mitigation Measures

Environmental Component	Issue/Potential Effect	Potential Mitigation Measures
	<p>driven by project demand for workers.</p> <p>Decommissioning/Closure</p> <ul style="list-style-type: none"> Potential project effects during decommissioning/closure on environmental conditions supporting recreational and tourism, and those affecting sectoral economic activity. 	<p>results;</p> <ul style="list-style-type: none"> Local hiring and procurement policies; Sustainable employment and procurement strategies. <p>Operation</p> <ul style="list-style-type: none"> Operation of appropriate project design; Community management planning with local communities, First Nations and stakeholders to address population effects, availability and access to local housing, provision of services and infrastructure, and potential impacts to community well-being as appropriate; Training and skill development strategies and support; Traffic and navigation; Public consultation; Model indirect and induced employment, income, revenue generation and GDP effects, as a basis for understanding mechanisms to maximize employment and income benefits; Project construction managed integrally with local and regional economic priorities and activities; Public and First Nations consultation findings as they pertain to economic issues will be reviewed and considered in the economic effects assessment results; Local hiring and procurement policies; Sustainable employment and procurement strategies. <p>Decommissioning/Closure</p> <ul style="list-style-type: none"> Traffic and navigation; Public consultation; Local hiring and procurement policies; Sustainable employment and procurement strategies.
First Nations Consultation/Aboriginal Interests	<p>Construction</p> <ul style="list-style-type: none"> Potential effect on Squamish Nation traditional interests on the project site; Potential effect on Squamish Nation traditional interests as a result of marine shipping of construction materials to the site; and 	<p>Construction</p> <ul style="list-style-type: none"> Modifications to project design; Community management planning with local communities, First Nations and stakeholders to address population effects, availability and access to

Table 7: Anticipated Woodfibre Project-related Effects and Potential Mitigation Measures

Environmental Component	Issue/Potential Effect	Potential Mitigation Measures
	<ul style="list-style-type: none"> Potential effect on other Aboriginal Groups' traditional interests because of shipping of LNG from the site and shipping construction materials to the site. <p>Operation</p> <ul style="list-style-type: none"> Potential effect on Squamish Nation traditional interests; Potential effect on Squamish Nation traditional interests as a result of shipping of LNG from the site and shipping operational materials to the site; and Potential effect on other Aboriginal Groups' traditional interests because of shipping of LNG from the site and shipping operational materials to the site. <p>Decommissioning/Closure</p> <ul style="list-style-type: none"> Potential effect on Squamish Nation traditional interests on the project site; Potential effect on Squamish Nation traditional interests as a result of shipping of materials off the site as part of closure activities; and Potential effect on other Aboriginal Groups' traditional interests because of shipping of LNG from the site and shipping decommissioning/closure materials to the site. 	<p>local housing, provision of services and infrastructure, and potential impacts to community well-being as appropriate;</p> <ul style="list-style-type: none"> Training and skill development strategies and support; Traffic and navigation; First Nations consultation and engagement; Potential for Memoranda of Understanding (MOUs), Participation Agreements with First Nations. <p>Operation</p> <ul style="list-style-type: none"> Modifications to project design; Community management planning with local communities, First Nations and stakeholders to address population effects, availability and access to local housing, provision of services and infrastructure, and potential impacts to community well-being as appropriate; Training and skill development strategies and support; Traffic and navigation; First Nations consultation and engagement; Potential for Memoranda of Understanding (MOUs), Participation Agreements with First Nations. <p>Decommissioning/Closure</p> <ul style="list-style-type: none"> Modifications to project design; Community management planning with local communities, First Nations and stakeholders to address population effects, availability and access to local housing, provision of services and infrastructure, and potential impacts to community well-being as appropriate; Training and skill development strategies and support; Traffic and navigation; First Nations consultation and engagement; Potential for Memoranda of Understanding (MOUs), Participation Agreements with First Nations.
Heritage Resources	<p>Construction</p> <ul style="list-style-type: none"> Potential effect on Squamish Nation heritage resources. 	<p>Construction</p> <ul style="list-style-type: none"> Traditional knowledge and traditional use studies as

Table 7: Anticipated Woodfibre Project-related Effects and Potential Mitigation Measures

Environmental Component	Issue/Potential Effect	Potential Mitigation Measures
	Operation <ul style="list-style-type: none"> None anticipated. Decommissioning/Closure <ul style="list-style-type: none"> None anticipated. 	appropriate; <ul style="list-style-type: none"> First Nations consultation and engagement; MOUs, Participation Agreements with First Nations; Archaeological and heritage assessments and management plans. Operation <ul style="list-style-type: none"> First Nations consultation and engagement. Decommissioning/Closure <ul style="list-style-type: none"> First Nations consultation and engagement..
Visual Aesthetics	Construction <ul style="list-style-type: none"> Potential for increased levels of anthropogenic disturbance from construction activities. Operation <ul style="list-style-type: none"> Potential for increased levels of anthropogenic disturbance from operation of the facilities; LNG Carrier movement through Howe Sound. Decommissioning/Closure <ul style="list-style-type: none"> Potential for change in viewscape following closure of production facilities. 	Construction <ul style="list-style-type: none"> Orientation of stockpiles (construction material, stored topsoil etc) to minimize visual impact. Operation <ul style="list-style-type: none"> Minimising the height of the FLNG facilities; Orientation of machinery and structures to minimize visual impact. Decommissioning/Closure <ul style="list-style-type: none"> Removal of machinery and structures to minimize visual impact; Re-vegetation of the water frontage.
Land & Resource Use	Construction <ul style="list-style-type: none"> Resource use and access; and Access to lands and resources outside private lands. Operation <ul style="list-style-type: none"> Resource use and access; and Access to lands and resources outside private lands. Decommissioning/Closure <ul style="list-style-type: none"> Resource use and access; and Access to lands and resources outside private lands. 	Construction <ul style="list-style-type: none"> Implement appropriate project design based on designated site land use. Operation <ul style="list-style-type: none"> Sustainable economic development planning; Seek input on recreational access and other land use objectives. Decommissioning/Closure <ul style="list-style-type: none"> Seek input on recreational access and other end land use objectives; Implement reclamation and closure plans consistent with land use objectives.
Human Health Risk Assessment	Construction <ul style="list-style-type: none"> Emissions to air, land, and water during construction; Soil quality effects from aerial deposition by site facilities; and 	Construction <ul style="list-style-type: none"> Traffic and navigation safety planning; Minimize construction related emissions to air, land

Table 7: Anticipated Woodfibre Project-related Effects and Potential Mitigation Measures

Environmental Component	Issue/Potential Effect	Potential Mitigation Measures
	<ul style="list-style-type: none"> Sediment & water quality effects on humans to effluent quality releases to waters during construction activities. Operation <ul style="list-style-type: none"> Emissions to air, land, and water during operation; Soil quality effects from aerial deposition by site facilities and LNG Carrier emissions; and Sediment and water quality effects on humans to effluent quality releases to waters from proposed facility and LNG Carriers. Decommissioning/Closure <ul style="list-style-type: none"> Soil quality effects following aerial deposition by site facilities and carriers; and Sediment and water quality effects on humans to effluent quality releases to waters following closure of the facility. 	<p>and water;</p> <ul style="list-style-type: none"> Employee health, safety plans. Operation <ul style="list-style-type: none"> Traffic and navigation safety planning; Minimize operational related emissions to air, land and water; Employee health, safety plans. Decommissioning/Closure <ul style="list-style-type: none"> Traffic and navigation safety planning; Minimize closure related emissions to air, land and water; Employee health, safety plans.
Navigation Considerations		
Navigable Waters	Construction <ul style="list-style-type: none"> Perceived interference to navigational channels; and Safety concerns from recreational boaters. Operation <ul style="list-style-type: none"> Perceived interference to navigational channels; and Safety concerns from recreational boaters Decommissioning/Closure <ul style="list-style-type: none"> To be determined. 	Construction <ul style="list-style-type: none"> Operate construction barge transit in accordance with the Canada Shipping Act (2001) along with by-laws established by Transport Canada, and the Pacific Pilotage Authority (PPA). Operation <ul style="list-style-type: none"> Operate LNG carrier transit in accordance with the Canada Shipping Act (2001) along with by-laws established by Transport Canada and the Pacific Pilotage Authority (PPA). Decommissioning/Closure <ul style="list-style-type: none"> Operate closure barge transit in accordance with the Canada Shipping Act (2001) along with by-laws established by Transport Canada and the Pacific Pilotage Authority (PPA).
Terrestrial Resources		
Terrestrial Flora & Fauna	Construction <ul style="list-style-type: none"> Potential interaction with sensitive ecosystems, wildlife species at-risk or wildlife of ecological, cultural, scientific, and economic value; Potential effects on terrestrial flora, fauna, migratory birds and SAR from light emissions during construction; 	Construction <ul style="list-style-type: none"> Minimize the facility and laydown area footprint and interaction of equipment with wildlife; Appropriately site facility and laydown areas away from sensitive habitat; Best Management Practices to avoid or limit impacts

Table 7: Anticipated Woodfibre Project-related Effects and Potential Mitigation Measures

Environmental Component	Issue/Potential Effect	Potential Mitigation Measures
	<ul style="list-style-type: none"> Potential effects on terrestrial flora, fauna, migratory birds and SAR from noise emissions during construction; Reduction in wildlife populations of value; and Potential for spills/release of deleterious substances affecting sensitive ecosystems, valued wildlife habitats, or SAR. <p>Operation</p> <ul style="list-style-type: none"> Potential interaction with sensitive ecosystems, wildlife species at-risk or wildlife of ecological, cultural, scientific, and economic value; Potential effects on terrestrial flora, fauna, migratory birds and SAR from light emissions during operation; Potential effects on terrestrial flora, fauna, migratory birds and SAR from noise emissions during operation; Reduction in wildlife populations of value; and Potential for spills/release of deleterious substances affecting sensitive ecosystems, valued wildlife habitats, or SAR. <p>Decommissioning/Closure</p> <ul style="list-style-type: none"> To be confirmed following confirmation of closure approach. 	<p>on SAR and migratory birds;</p> <ul style="list-style-type: none"> Implementation of parameters such as directional lighting to minimise potential effects on terrestrial wildlife and migratory birds; and Implementation of parameters such as noise reduction mechanisms to minimise potential effects on terrestrial wildlife and migratory birds. <p>•</p> <p>Operation</p> <ul style="list-style-type: none"> Minimize the facility footprint and interaction of equipment with wildlife; Appropriately site facility and laydown areas away from sensitive habitat; Best Management Practices to avoid or limit impacts on SAR and migratory birds; Implementation of parameters such as directional lighting to minimise potential effects on terrestrial wildlife and migratory birds; and Implementation of parameters such as noise reduction mechanisms to minimise potential effects on terrestrial wildlife and migratory birds. <p>Decommissioning/Closure</p> <ul style="list-style-type: none"> Reclaim and restore site on closure.

9 ENGAGEMENT AND CONSULTATION

9.1 First Nations Consultation and Engagement

WGNL acknowledges the Section 35 and treaty rights of Aboriginal Groups in Canada and will seek to ensure effective relationship building and engagement throughout the project lifecycle. A particular emphasis will be placed on development of a multifaceted relationship with *Skwxwú7mesh* (Squamish Nation) leadership and members, in whose territory the project site is located. Squamish Nation has concluded, *Xay Temíxw* (Sacred Land) Land Use Plan³, which sets forth a vision for the many locations throughout their territory. The Squamish Nation has advised that the site, known as *Swig'a't* to the Squamish peoples, was a former village site and once served as an access point for hunting and gathering (Figure 6).

Based on the BC Public Consultative Area Database (CAD), the site itself is solely within the traditional territory of the Squamish Nation. The nearby waters between the site and the north end of Anvil Island (i.e., approximately 13 km south of the Woodfibre LNG site) are considered traditional territory of the Squamish Nation and the *mí ce:p kʷətxʷiləm* (Tseil-Waututh Nation).

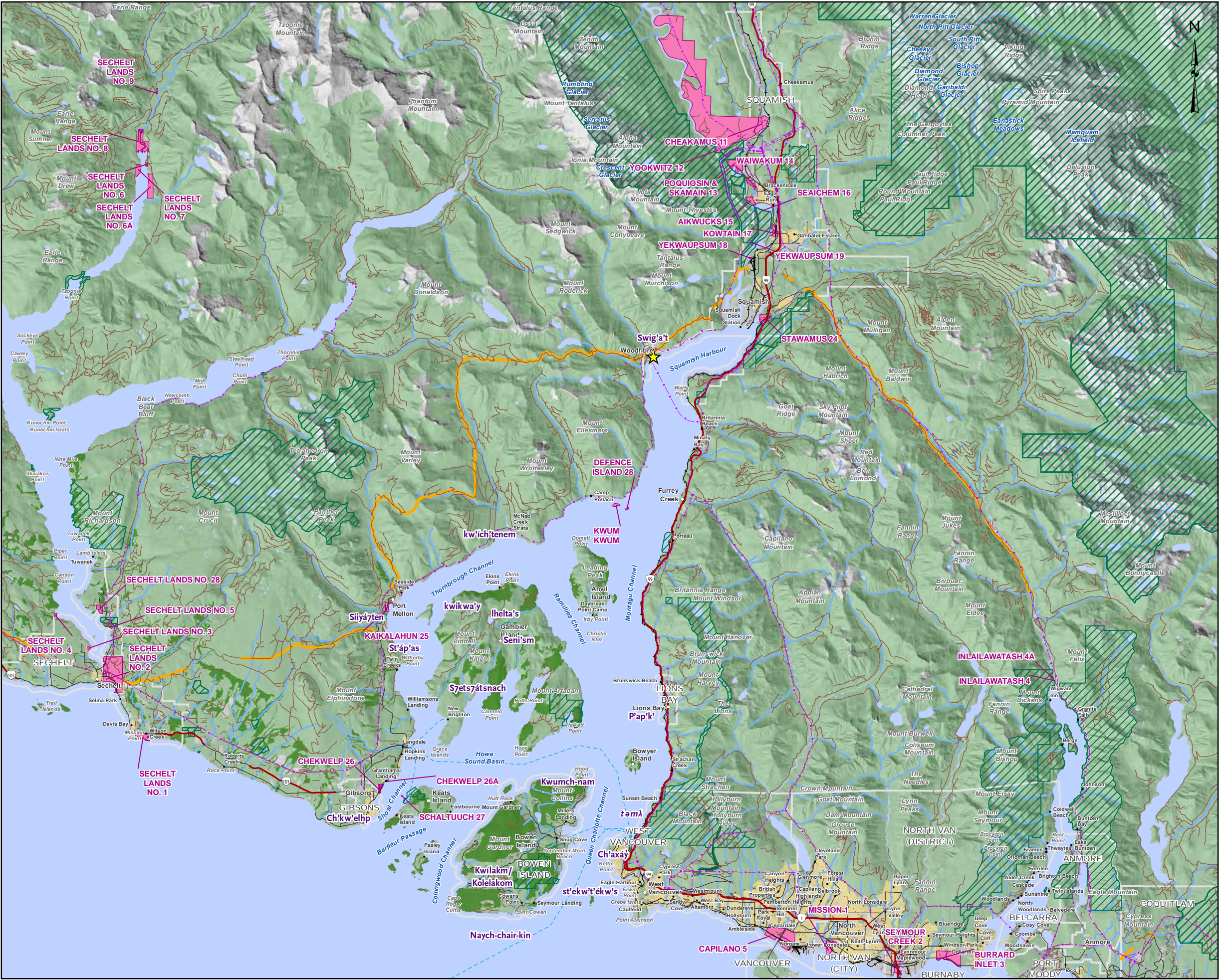
WGNL also acknowledges the aboriginal interests in marine resources by other First Nations whose traditional territories include southern Howe Sound (i.e., north end of Anvil Island to the mouth of Howe Sound). Accordingly, WGNL will approach engagement in recognition of the differing project interests unique to the project activities on the project site (i.e., land based interests) and those common to shipping activities (i.e., marine interests in Howe Sound), and overlay these with traditional territories identified by the Crown.

Some of our proposed approach includes the following activities:

- Build a continuous relationship between our company and the Squamish Nation;
- Communicate and work with Squamish Nation with the intent of seeking their support for the project;
- Ensure that reasonable capacity support & resources are available to the Squamish Nation;
- Involve the Squamish Nation in studies & data collection;
- Incorporate Squamish Nation traditional knowledge into the project;
- Develop methods/protocols of open communication with Squamish Nation;
- Seek Squamish Nation assistance in ensuring the project is developed in an environmental, social, cultural, and economic manner that is sustainable and viable for the benefit of future generations;
- Develop a human resource, employment, and education strategy to ensure Squamish Nation member involvement in the project;
- Develop, if there is interest, possible business arrangements;
- Develop possible legacy projects; and
- Support training initiatives.

³ Squamish Nation Website: <http://www.squamish.net/about-us/our-land/xay-temixw-sacred-land-land-use-plan/>

PATH: N:\CAD-GIS\VAN\2013\13-1422\13-1422-0006 - WoodfibreMapping\MXD\General\WOODFIBRE - PROJECT_DESCRIPTION FIGURE_06_Traditional_Lands.mxd Date: 11/1/2013 Time: 10:55:32 AM



LEGEND

URBAN AREA

FOREST AREA

SENSITIVE ENVIRONMENTAL AREA

PARKS / PROTECTED AREAS (NAME)

INDIAN RESERVE (NAME)

GAS PIPELINE RIGHT OF WAY

MUNICIPALITY

HIGHWAY

ARTERIAL ROAD

LIMITED ACCESS ROAD

RAILWAY

TRANSMISSION LINE (ELECTRIC)

NAMED WATERCOURSE

FERRY ROUTE

REFERENCE

PARKS/PROTECTED AREAS AND SENSITIVE ENVIRONMENTAL AREAS FROM GEOBC. BASE DATA FROM CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED. IMAGERY PROVIDED BY GEOBC 2009 WMS. PROJECTION: UTM ZONE 10 DATUM: NAD 83

SCALE

8,00008,000

METRES

PROJECT

WOODFIBRE NATURAL GAS LTD.
WOODFIBRE, HOWE SOUND, B.C.

TITLE

ABORIGINAL/TRADITIONAL LANDS

PROJECT NO. 13-1422-0006
DESIGN MJ 19 Aug. 2013
GIS AS 19 Aug. 2013
CHECK AL 19 Aug. 2013
REVIEW MJ 30 Oct. 2013

PHASE No. 1000
SCALE 1:250,000
REV. 0
FIGURE 6

9.1.1 Current Use of Lands and Resources for Traditional Purpose by Aboriginal Peoples

While use of the site by First Nations, in particular the Squamish Nation, did occur in the past, since approximately 1911 the site had been one of industrial activity. The succession of forestry and pulp and paper operations on site has prevented traditional aboriginal use, both on land and on the foreshore, for decades.

As indicated elsewhere in this document, the site is currently freehold property within the municipality of the District of Squamish. The site is zoned industrial and considered as such within the Official Community Plan. From 1911 to present the project site had been continuously used for industrial, high impact activity.

Moreover, the site falls within the 2008 Sea to Sky Land and Resource Management Plan (LRMP). A review of that plan (footnote required), which we understand included consultation with First Nations by the provincial government, did not designate any significant First Nation current social, economic, or cultural uses on the site or in its immediate vicinity.

As such, WNGL does not require access, use or occupation of, or the exploration, development, and production of lands currently used for traditional purposes by the Squamish Nation or any other aboriginal peoples. We acknowledge there may have been considerable use prior to 1911.

Traditional use by the Squamish Nation, prior to the establishment of the original saw mill, would have included settlement, temporary settlement, a base for hunting at higher elevations northwest of the site, and for fishing and the gathering of marine foodstuffs adjacent to the project site. None of these activities has occurred, to our knowledge, in the past decades due to the industrial nature of the site, pollution levels from past activities, and lack of access. The traditional use of the project site will be evaluated with First Nation input. As such and at this time, it is not expected that the proposed project will have an adverse effect on aboriginal peoples use of higher elevations northwest of the site, or for fishing and the gathering of marine foodstuffs adjacent to the project site.

Nonetheless, going forward WNGL is committed to working with the Squamish Nation to address this historic matter providing capacity support to the Squamish Nation to examine traditional and current aboriginal uses in the surrounding area. Table 8 provides a summary of the primary interaction to date.

Table 8: Primary Interaction with Aboriginal Groups to Date

Date	Activity
March 4, 2013	Initial meeting with Squamish Nation leaders.
April 24, 2013	Preliminary presentation of Woodfibre LNG project to Squamish Nation Natural Resource Working Group – Chris Lewis, Councillor; Aaron Bruce, Legal Counsel and member; Lisa Wilcox, Intergovernmental Relations.
April 30, 2013	Thank you and follow up note to Chris Lewis, Aaron Bruce and Lisa Wilcox from Byng Giraud.
May 28, 2013	Submission of Application Review letter by WNGL.
May 30, 2013	Acknowledgement of receipt of Application Review by Chief Bill Williams.
June 14, 2013	Submission of Application Review fee by WNGL.
June 27, 2013	Informal dinner with Chief Gibby Jacob, Chief Bill William and Lisa Wilcox.

Table 8: Primary Interaction with Aboriginal Groups to Date

Date	Activity
July 5, 2013	Letter to Chief Jacob from Byng Giraud offering to meet further and extending an invitation to visit operations in the far east.
July 27, 2013	Email to Lisa Wilcox informing of upcoming NEB application and offering to provide application to Squamish Nation.
August 9, 2013	Update email to Chief Jacob requesting further meetings.
September 6, 2013	Update email to Chief Jacob, Chief Williams and Lisa Wilcox informing that project description was nearing completion of internal review.
September 9, 2013	Informational and educational tour of Squamish Nation lands with Chief Ian Campbell, Chief Bill Williams and Lisa Wilcox.
September 30, 2013	Meeting to discuss project description and revision of submission documents to be taken to Squamish Council. Meeting with Chief Williams and Lisa Wilcox. Documents to be revised and printed for Squamish Councillors for potential upcoming council meeting.
October 10, 2013	Couriered 20 copies of project description summary, list of baselines studies and proposal to Squamish Nation Council.

WNGL acknowledges its relationship with the Squamish Nation and other aboriginal peoples in the area are in the early stages. Much more consultation and discussion is expected to take place. At this point, WNGL have only received preliminary comments and concerns. As our relationship becomes more formalised it is expected that further comments will be provided. Table 9 provides a summary of the preliminary comments and concerns to date from Aboriginal Groups.

Table 9: Summary of Preliminary Comments and Concerns from Aboriginal Groups to Date.

Issue	Discussion regarding possible response and actions
General concern about broad commitment to environmental values in Howe Sound	Howe Sound has had considerable industrial activity since contact, which has resulted in significant historical environmental impact. Recent efforts to remediate and improve Howe Sound have resulted in an improvement of the marine environment and the return of some species. First Nations are concerned that new industrial entrants are committed to minimizing impact to the environment in the area. WNGL's corporate philosophy is based on a triple bottom-line approach, respect for First Nations and commitment to environmental leadership. WNGL will work with First Nations to ensure this approach is applied consistently throughout the project.
Past restrictions on access to site	Although a traditional settlement, First Nations have not had access to the site in sometime. WGNL will work with First Nations to provide access where possible in the context of required safety and security arrangements required of an LNG facility.
Past restrictions on access to backcountry behind site – access	First Nations have traditionally hunted in the backcountry beyond the site and access to that backcountry was historically through the site. Nearby shorelines are quite steep and inaccessible. WNGL will work with First Nations to restore access for traditional uses beyond our site, while ensuring adherence to safety and security requirements.

Table 9: Summary of Preliminary Comments and Concerns from Aboriginal Groups to Date.

Issue	Discussion regarding possible response and actions
Possible impacts on re-emerging Elk herds in backcountry NW of site	The Squamish Nation has played a key role in the reestablishment of elk herds in the region. While baseline work on the site does not indicated use by Elk, proximity is an issue that will be examined. WNGL will work with First Nations to measure or monitor any potential impact and, where necessary, work together on any mitigation methods.
Concern over possible discharges into the marine environment	The historic pollution of the Howe Sound has made First Nations and others sensitive to any impacts on the marine environment. WNGL is already committed to technologies that will not discharge into the marine environment and is committed to avoiding or minimizing any need to discharge. WNGL will work with First Nations on technology selection to meet this objective.
Effects on herring/herring eggs	The return of herring has been a real and a symbolic indicator of the recovery of the Howe Sound. Work in the area by First Nations and volunteer groups have assisted in the recovery of this key species. WNGL's activity on site and in the foreshore will be undertaken with a consideration of the herring. Discharges to the marine environment will be avoided where possible. Remediation of past impacts and creation of new habitat will be considered in consultation with First Nations.
Effects on re-emerging Howe Sound fisheries	The return of the herring has resulted in an improvement of the populations of commercial fisheries in the region. A small commercial fishery was undertaken in 2013. WNGL will work with First Nations to minimize or avoid impacts on the marine environment. WNGL will take input from First Nations as to how the project may support protection and improvement of habitat.
Effects on re-emerging marine mammals	Of local significance, particularly to First Nations, is the return of marine mammals (dolphins, whales) to the Howe Sound. While related to the herring and fisheries issue, WNGL will work with First Nations to minimize or avoid
Number and size of vessels	First Nations have asked about the number and size of vessels in the Howe Sound. WNGL expects the number of vessels to be approximately 40 per year. WNGL will work with First Nations on matters related to timing of vessels, possible exclusion zones and any impacts on marine life. WNGL will work with First Nations to establish baselines and monitoring standards to ensure minimal impact on traditional and current use in the Howe Sound.
Opportunities for jobs and contracting (social, economic impacts)	First Nations are interested in ensuring that job and contracting opportunities benefit local aboriginal peoples. There is concern that historically major projects in the region have not included aboriginals. WNGL is committed to working with designated First Nation representatives to access necessary training opportunities and to provide opportunities for First Nation contractors to participate in construction and operations. Training and job creation will require integration with the provincial government. Contracting opportunities, once identified more fully, will be presented to designated First Nations companies and/or agencies.
Long term legacy or project for First Nations (social and cultural impacts)	First Nations in the Howe Sound region are redressing legacy impacts through significant social and cultural activities and opportunities (Squamish-Lil'Wat Cultural Centre, cultural sites on Sea to Sky Highway). This cultural assertion is important to First Nations. WNGL will work with First Nations to ensure that social and cultural matters are included in the project and as possible legacy opportunities that showcase First Nations culture or assist in the promotion and retention of cultural values within the community.

Table 9: Summary of Preliminary Comments and Concerns from Aboriginal Groups to Date.

Issue	Discussion regarding possible response and actions
Opportunities to remediate or improve Mill Creek given past impacts by pulp & paper operations	Past impacts on Mill Creek have resulted in a less than ideal habitat, although the water body still provides salmon habitat up to the fish barrier. Currently the creek has concrete sides and walls with no nearby vegetation. WNGL will work with First Nations to remediate and restore the water body where possible.
Importance of site remediation and clean-up of site given past pollution	First Nations are aware of the historic legacy of industrial activity on and near the site, whether landfills, contaminated soils etc. First Nations have expressed their desire that the site continues to be improved and remediated. WNGL is committed to providing a site is considerably cleaner than past usages. WNGL will work with First Nations in reviewing and planning any future site cleanup and improvement following possession of the site.

9.1.2 Prediction of Potential Effects on Aboriginal Groups

Project Site and Nearby Howe Sound

Given the historical use of the brownfield industrial site, the proposed Woodfibre LNG facility is not anticipated to effect traditional rights of the Squamish Nation. Examples of likely historic effects associated with the former pulp and paper operations include loss of:

- Access and use of a traditional village site (*Swig'a't*);
- Access to traditional foodstuffs that may have been collected on the site including plants, land animals, near shore marine animals, freshwater fish in nearby creeks and salmon in Howe Sound;
- Traditional site and loss of access through the site to hunting or gathering areas beyond;
- Culture associated with the changing of a traditional place names (e.g., *Swig'a't* to Woodfibre); and
- Possible archaeological sites due to physical occupation of the site by almost 100 years of major industrial activity, along with the construction, operation and closure of a non-aboriginal historical town-site.

The site has over 100 years of industrial use and was the site of a significant non-aboriginal community for this period of operation; therefore, effects to Aboriginal land-based activities from expected changes in land use at the site are not anticipated.

Possible changes to the environment that may have an affect the traditional activities of the Squamish Nation people include changes to the terrestrial and marine environment and associated resources. Construction of necessary works could alter any nearby marine habitat not previously impacted by the past pulp mill and sawmill operations. Nearby vegetation may be impacted by site activities. This could in turn, affect any mammals, birds, or fish traditionally or currently used for food. Noise and light from the site could have impacts on nearby animal populations, which in turn, could have an impact on Aboriginal Groups' right to hunt or fish. Light and sound from the site, while a historic disturbance and impact, may also impact the cultural uses of nearby sites by Aboriginal Groups.

Project Site to North Anvil Island

The transit by and arrival of approximately 40 LNG vessels per year and associated support vessel marine traffic may have an effect on traditional fishing activities in the nearby Howe Sound area for both the Squamish and Tsleil-Waututh Nations. Other traditional activities may also be affected including cultural activities associated with the marine area (e.g., canoe journeys).

Other First Nations

South of Anvil Island to the mouth of Howe Sound is currently considered traditional territory by Squamish Nation, Tsleil-Waututh Nation and up to an additional eight Aboriginal Groups as follows:

- Musqueam Indian Band;
- Hul'quimi'num Treaty Group (i.e., Stz'uminus Nation, Cowichan Tribes, Halalt First Nation, Lake Cowichan First Nations, Lyackson First Nation and Penelakut Tribe); and
- Métis Nation British Columbia.

These shared or overlapping territories begin approximately 13 km south of the project site. The project's LNG vessels will pass through these waters. As indicated in Section 9.1, WNGL acknowledges the various Aboriginal Group's' interests in this portion of Howe Sound. While LNG vessels constitute a small portion of marine traffic in the area (refer Section 2.7), the LNG vessels nonetheless may have potential effects on these Aboriginal Groups and their people. More specifically possible impacts on these First Nations include:

- Impacting any traditional marine harvesting such as fishing (commercial or cultural);
- Vessel emissions may impact traditional hunting, trapping and gathering grounds in the Howe Sound area;
- Vessel emissions may have potential human health risks from consumption of traditional foods (plant and/or animal); and
- Vessel traffic may cause wakes, noise or visual impacts that may affect cultural activities or the use of the cultural sites.

Through the environmental assessment process, WNGL will assess any changes to the marine environment and marine resources in Howe Sound, and assist in the development of measures to reduce or remove any potential effects on Aboriginal Groups.

9.1.3 Land Location of the Woodfibre Site

The project is located within the traditional territory of the Squamish Nation (Figure 6). We understand the federal obligations with regard to consultation with the Metis of BC. At this point, we have not identified any Metis representatives or communities in the immediate vicinity. WNGL will adapt these plans should additional Aboriginal Groups be identified during this process.

WNGL seeks to develop a respectful, long-term and mutually beneficial relationship with Squamish Nation over the course of the project and will be seeking Squamish Nation direction as to how to proceed.

9.1.4 Marine Region – North Howe Sound⁴

WGNL has identified the following Aboriginal Groups, whose territories do not include the project site, but who may have aboriginal interests related to the greater airshed and marine areas near the proposed facility in Howe Sound:

- Tsleil-Waututh First Nation.

WGNL will share project fact sheets and communicate where requested with the leadership and community members of these First Nations. WGNL will work with Fortis and BC Hydro to identify opportunities where their project engagement may be enhanced by sharing information related to the end use of the gas and electricity.

Carriers calling on the project site facility will follow federally designated shipping lanes to their destination in Howe Sound. First Nations with an aboriginal interest in the marine environment of southern Howe Sound (at a point near Anvil Island, approximately 13.5 km away) have been identified as:

- Squamish Nation; and
- Tsleil-Waututh Nation.

WGNL will provide an initial project information letter and fact sheet to each First Nation, indicating the project on a map and outlining its scope. The notification letter will offer a meeting with a project site staff should further information be sought. Engagement efforts will be coordinated with Fortis and where necessary or relevant, BC Hydro to enable a cohesive picture of the project for any community meetings requested.

Tsleil-Waututh Nation
3075 Takaya Drive North Vancouver, BC V7H 3A8
P: 604-929-3454
F: 604-929-4714

General Inquiries:
info@twnation.ca

Squamish Nation
Intergovernmental Relations Squamish Nation
415 West Esplanade
North Vancouver, BC V7M 1A6
P: 604 998-0285

9.2 Project Footprint (WGNL)

WGNL acknowledges that the project is in the asserted traditional territory of the Squamish Nation and has initiated communication with the Nation (Figure 6). Future consultation with the Squamish Nation will attempt to identify whether and to what extent the Squamish Nation's aboriginal interests may be affected by the Woodfibre LNG project footprint. WGNL will also identify, where necessary, measures to avoid, limit, mitigate or otherwise accommodate any adverse project related effects to those interests.

⁴ BC Ministry of Forests, Lands and Resource Operations, First Nation Consultation Areas Database

As indicated elsewhere, the site is currently designated freehold property, zoned industrial within the boundaries of the municipality of the District of Squamish. It is designated for industry and employment within the OCP.

WNGL will consult with the Squamish Nation and its leadership to ensure the Nation and its membership are engaged through regular meetings and other forms of communication. WNGL provided initial project overviews in meeting with representatives of the Squamish Nation in February, April and June of 2013. A draft copy of the project Description has been provided to the Squamish Nation. Project baseline workplans and other materials will be provided to the Squamish Nation as they become available. At this point the Squamish Nation has yet to identify their lead persons for future communication, but current contacts for the Woodfibre LNG project include:

- Chief Gibby Jacob;
- Chief Bill Williams;
- Chief Ian Campbell; and
- Lisa Wilcox (Senior Executive Assistant, Referrals and Consultation).

9.3 Public, Stakeholder and Agency Consultation

9.3.1 Public Engagement Plan

WNGL is committed to engaging with community and regional stakeholders before, during and after the EA process. Developing a long-term relationship with District of Squamish and engaging in work to demonstrate a commitment to the community and the Howe Sound area are key objectives. The project envisions being an effective economic driver and a catalyst for continued environmental enhancements the region. The Proponent is responsible for the safe design, construction and operation of an LNG facility on a terrestrial and marine environment.

Two marine components are envisioned as follows:

- a) Project facility; and
- b) Vessel traffic.

Comprehensive community consultation approach that allows for consultation based on the level of potential effect and interest will be used. The objectives of the Public Engagement Plan will include:

- Identification of potentially affected stakeholders;
- Development of appropriate and timely project communication materials;
- Providing effective means of sharing information and collecting project input regarding interests and considerations from a broad range of stakeholders. Effort will also be made to reach audiences and individuals who might not normally engage in consultation (e.g., online surveys, active project website, open houses and information sessions, local office); and
- Collecting, evaluating and responding to project input in a transparent and timely manner.

9.3.2 Consultation to Date

Immediate consultation audiences include the jurisdictions and direct environmental and economic influences of the project include Public, Stakeholder and Agency (Table 10), along with BC and federal government consultation to date (Table 11).

Table 10: Public, Stakeholder and Agency Consultation to Date

Stakeholder	Consultation initiated	Notes
District of Squamish (DoS) (municipality) Mayor and Council	Yes	WNGL has met with the Mayor on four occasions in 2013 and has spoken informally to City Council once.
District of Squamish, Development Services & Public Works	Yes	DoS Development Services & Public works will be responsible for any local permits or related matters as the site is within municipal boundaries. WNGL has met with the manager on one occasion and provided a tour of staff to the site.
District of Squamish, Business and Community Services	Yes	DoS Business and Community Services is responsible for economic development with the municipality. WNGL has met with representatives on more than six occasions including providing a tour to site for some staff.
Squamish Lillooet Regional District	No	-
Squamish Lillooet Regional District – Area A director Maurice Freitag	Yes	Two informal conversations have occurred with the Area director.
Squamish Historical Society	Yes	WNGL has met with the Society on a number of occasions in order to preserve historic information and archive material from the project site and former community.
Squamish Chamber of Commerce	Yes	WNGL met with the Squamish Chamber of Commerce in April 2013 and has since acquired membership with the Chamber.
Squamish Terminals	Yes	Met in April 2013. Provide with site tour.
Quest University	No	-
Capilano University-Squamish	No	-
Squamish Off Road Cycling Club	No	-
Squamish Streamkeepers	Yes	Informal meetings with various members. Intending more formal presentation before end of 2013.
Squamish Estuary Management Committee	No	-
Squamish Yacht Club	No	-
Downtown Squamish Business Improvement Association	No	-
Squamish Oceanfront Development Corporation	Yes	Met in July 2013.
Sea to Sky Squamish Gondola	Yes	Met in April 2013.
Local Residents	Yes*	Various residents have been met on informal basis. WNGL has conducted one public opinion poll and two focus groups to gauge local interest in the project.
Local Business Leaders	Yes*	Various business leaders in the community have been met on an informal basis.
Gurudwara Baba Nanak Sahib Sikh Temple Squamish	Yes	Dinner with Makhana Sanghera, President of the Temple, September 2013.
Squamish service clubs	No	List of clubs being assembled for presentations in 2013/2014
Squamish sporting organizations	No	List of clubs being assembled. Some informal contacts made to date.

Table 10: Public, Stakeholder and Agency Consultation to Date

Stakeholder	Consultation initiated	Notes
BC Chamber of Commerce	Yes	Met in June 2013, now members.
BC Business Council	Yes	Met in June 2013, now members.
Vancouver Board of Trade	Yes	Met in July 2013, now members.
Port Metro Vancouver	Yes	Met with Peter Xotta, Vice President, Planning and Operations, June 2013 to discuss marine safety issues, possible collaboration.
Fortis BC	Yes	Ongoing meeting since 2012.
BC Hydro	Yes	Ongoing meetings throughout 2013.
Britannia Mining Museum	No	-

Table 11: BC and Federal Government Consultation to Date

Date	Event	Description
2012		
August 8, 2012	B.Hansen, BC Ministry of Energy & Mines	Introduction to B.Hansen of WNGL, and set up meeting for August 14 for R.Bedi and L Ng.
August 10, 2012	K.Spence, BC OGC	Introduce WNGL to BC OGC.
August 15, 2012	K.Spence (Many OGC Staff and EAO Staff)	Introductions: understand the structure of the OGC, processes in place to review project applications for LNG facilities, the breadth of permitting and timing for reviews.
August 15, 2012	B.Hansen, I.Piccinino, BC MEM	Introduce WNGL as an interested party seeking to develop a project in BC.
August 15, 2012	P.Wieringa, S.Bonnyman, BC MEM	Introduce WNGL to Electricity ADM and key policy staff (P.Wieringa A/ADM and S.Bonnyman).
August 17, 2012	B.Hansen, BC MEM	Provided a thank you for the meeting on August 15, reaffirmed FID was mid-December 2012, and there is a desire to initiate negotiations with BC Government in October.
August 23, 2012	W.Bell, BC Hydro	Introduce WNGL to BC Hydro and set up a time for a briefing.
August 29, 2012	B.Hansen, BC MEM	Email to set up a meeting with MEM and Chairman Oct 22-25, and seek a call in early Sept to plan.
August 30, 2012	E.Chan, BC OGC	Understand engineering planning related to FLNG considerations.
August 31, 2012	K.Spence, BC OGC	Email to set up a preliminary meeting to discuss engineering, land/marine and legal considerations as part of the early pre-application process. This is important to WNGL to assist in evaluating the land purchase options.
September 4, 2012	W.Bell, BC Hydro (BCH)	Understand role of BC Hydro and electricity pricing, use of gas generation on BCHs existing system.
September 7, 2012	B.Hansen, BC MEM	WNGL forwards draft letter introducing the proponent and requesting meeting between Chairman and Premier.
September 11, 2012	K.Spence, R. Slocomb BC OGC	Facility regulations discussion.
September 17, 2012	A.Riddell, R.Shaw, BC EAO	Met with Rachel Shaw and Archie Riddell, LNG project team leads to discuss early pre-Application process.
November 19, 2012	B.Hansen, BC MEM	Industrial electricity policy for new clients.
November 21, 2012	B.Hansen, BC MEM	EF and BH discussed next steps toward initiating the Non-Disclosure Agreement and Confidentiality Agreement.
November 23, 2012	B. Tyzuk, BC Attorney General's office	Email and voicemail requesting initiation of sharing of NDA and Communications protocol.

Table 11: BC and Federal Government Consultation to Date

Date	Event	Description
November 26, 2013	B.Hansen, BC MEM	Agenda sharing/Edits for Dec third meeting.
December 10, 2012	K.Spence, BC OGC	Request for list of guidelines and other international standards that were to be referenced in design work.
2013		
January 21, 2013	W.Bell, S. Morii, R.Soulsby, BC Hydro	Formal notice to BC Hydro that WNGL seeks to initiate the preliminary discussions.
January 21, 2013	S.Morii, W.Bell, BC Hydro	Transmission of documents and project technical data to initiate review.
January 23, 2013	W.Bell, BC Hydro	Email exchange regarding completion of preliminary study.
February 7, 2013	D. Riddell, BC EAO	Meeting set-up.
March 3, 2013	B.Hansen, BC MEM	Email exchange with B.Hansen regarding draft Press Release on the project.
March 5, 2013	B.Hansen, BC MEM	Exchanges regarding media coverage.
March 27, 2012	B.Hansen, BC MEM	Convey proposed topics for 12 June 2013 meeting with LNG working group.
April 30, 2013	Doug Little, BC Hydro	General update.
May 24, 2013	Transport Canada	Initial discussions regarding shipping and TERMPOL process.
May 28, 2013	Renny Talbot, Paula Doucette, Fisheries and Oceans Canada (Major Projects), John Mackie, Bob Gowe, Transport Canada (Navigable Waters Protection)	Initial project discussions regarding <i>Fisheries Act</i> , <i>Navigable Waters Protection Act</i> issues and permitting
June 6, 2013	Colin Metcalfe, Federal Ministers Regional Office, Office of Minister James Moore	Introduction of project.
June 12, 2013	Brian Hansen, ADM, BC Ministry of Natural Gas Development & staff	Project update.
June 12, 2013	Brian Hansen, ADM, BC Ministry of Natural Gas Development & consultants	Financial matters related to LNG in BC.
June 12, 2013	Brian Hansen, ADM, BC Ministry of Natural Gas Development and BC Hydro	Energy issues.
June 12, 2013	K.Spence, BC OGC	Confirm meeting with James O'Hanley at BC OGC on June 13.
June 12, 2013	B. Hansen, A. Powell, D. Eakins, P. Flanagan, K. Mahoney, B. Giraud, W. Bell, R. Soulsby	Introductions, update on company, LNG Task Force, Industrial land use planning, regulatory working group etc.
June 13, 2013	K.Spence	Emails between K. Spence and E. Frisch clarifying that R. Slocomb is the engineering lead and E. Chan no longer works on LNG.
June 13, 2013	R. Slocomb	Email exchange between E. Frisch and R. Slocomb. EF asked if BC OGC has someone specializing in FLNG.
June 13, 2013	Trish Baclean of BC Environmental Assessment Office and staff, Giovanni Puggioni, BC Ministry of Aboriginal Relations and Reconciliation, Karen Spence, BC Oil & Gas Commission	Roundtable on BC EA processes and permitting processes.
June 13, 2013	Karen Spence, BC Oil & Gas Commission	Discussion of BC OGC permitting and regulatory roles.

Table 11: BC and Federal Government Consultation to Date

Date	Event	Description
June 17, 2013	R. Slocomb, BC OGC	Invitation to LNG Proponents to introduce OGCs LNG Regulatory development initiative.
June 18, 2013	R. Slocomb, BC OGC	Emails to determine next round of engagement on LNG Facility regulation.
June 19, 2013	Bob Gowe, Transport Canada & staff	TERMPOL and TERMPOL Review Process (TFP)
June 20, 2013	Jordan Sturdy, MLA, West Vancouver-Sea to Sky	Introduction to project.
June 21, 2013	Peter Xotta, Port Metro Vancouver	Introduction to project, discussion of regional safety initiatives.
July 3, 2013	Minister Teresa Wat, BC Minister of International Trade and staff	Informal conversation at social event. Intro to project and determination to meet further.
July 12, 2013	Minister Teresa Wat, BC Minister of International Trade	Introduction of project and background on company.
July 24, 2013	Bob Gowe, Transport Canada, Brian Young, Pacific Pilotage Authority & staff – TERMPOL Review Committee (TRC) Meeting	TERMPOL, TRP vessel safety issues, consultation issues, TERMPOL studies.
July 25, 2013	Vivian Au, CEAA	Introductions, brief discussion of project, overview of CEAA approach.
July 25, 2013	Warren Bell, Sue Foster, Sachie Mori, BC Hydro	Project updates, electricity options, permitting and aboriginal consultation.
August 8, 2013	Conference call with Transport Canada	Updates on deliverables from previous meeting.
August 20, 2013	BC EAO joint workshop with Fortis BC led by Josh Handysides and Kenneth Howes, BC EAO	Project updates from WNGL and Fortis, discussion of potential EAO issues, coordination.
August 27, 2013	BC Hydro, Dorie Huey, Warren Bell	Updates.
September 6, 2013	Conference call with Brian Hansen, Ministry of Natural Gas Development	Pre-discussion of upcoming meeting with Minister.
September 10, 2013	Meeting with Hon. Rich Coleman, BC Minister of Natural Gas Development	Project update.
September 11, 2013	BC Hydro with Doug Little, Cam Matheson & staff	Range of issues related to electricity options, regulatory processes, engineering needs.
September 19, 2013	Minister Teresa Wat, Shannon Baskerville, Deputy Minister, Ramona Soares, ADM and staff	Trade issues and mission.
September 30, 2013	Meeting with Kenneth Howes, BC EAO	To review project description.
October 1, 2013	BC Government, Paul Kan, International Investment, Henry Han, Director, Greater China, Greg Eidsness, Manager, China, Edwina Ramirez, Senior Manager, Indian and Southeast Asia, Leslie Wada, Director, Developed Markets, International Investment	Trade issues, trade mission.
October 3, 2013	BC Ministry of Environment and Climate Change Secretariat staff	Workshop on GHG management for LNG sector.
October 4, 2013	Conference call with BC OGC	Discussion of classification of vessels.

Table 11: BC and Federal Government Consultation to Date

Date	Event	Description
October 10, 2013	Meeting with CEAA Staff	Discussion and feedback following submission of draft Project Description.
October 10, 2013	BC Ministry of Environment staff	Workshop on air emissions and airshed issues for LNG sector.

The summary of consultation with public, stakeholder, agency and government provided in Table 10 and Table 11 is not exhaustive and, given the proximity of the project to major population centres, additional potential stakeholder groups could be identified throughout the consultation process.

9.3.3 Summary of Findings from Stakeholder Communications

WNGL has carried out a number of smaller meetings and has conducted public opinion research in the area including polling and focus group research. Below is a summary of the findings. WNGL is crafting materials and information in order to respond to the issues being raised.

Table 12: Summary of Preliminary Comments and Concerns from Stakeholders to Date

Issue	Discussion
Issues regarding possible spills, environmental impacts and safety measures	<p>What kind of natural gas accidents happen?</p> <p>What is the impact of a spill or leak?</p> <p>What are the earthquake plans for Squamish? Who has strategies?</p> <p>Who measures the increases in any and all forms of pollution?</p> <p>Can it be assured environmentally safe?</p> <p>Will a natural gas rupture be hazardous to air, birds, water, fish?</p> <p>What kinds of natural gas accidents have happened elsewhere, and what has been the long-term impact?</p>
General understanding of the project	<p>How is the gas acquired? Where does it come from?</p> <p>What is the life of the project?</p> <p>What facilities currently exist at the project site?</p> <p>What other uses could the site be put towards?</p> <p>Who pays for the initial cleanup?</p> <p>Where does Fortis' Gas line run?</p> <p>How would they get their employees over? Ferry or bridge?</p>
Concerns surrounding the approval processes	<p>What are the environmental regulations that apply to pipelines and tanker traffic?</p> <p>Will there be advanced info sessions?</p> <p>What is the time frame?</p> <p>What is the consultation process?</p> <p>Where can we go for accurate information?</p>
Jobs and benefits to community	<p>How can local youth be trained so they can compete for jobs?</p> <p>Will local first nations be included in training?</p> <p>Are there career jobs at the site? or is it automated</p> <p>Will the jobs be local?</p> <p>Besides jobs, what other benefits would come to the community like infrastructure, Community Centre?</p> <p>Are general taxes expected to be reduced?</p> <p>What guarantees are there that this potential tax boost would ever be realized by homeowners?</p> <p>What percentage of the money made from the project stays in Squamish?</p>

Further potential consultation audiences including incorporated and unincorporated communities and residences, located across Howe Sound and within 20 km of Woodfibre and along the Sea to Sky Corridor:

- Britannia Beach (5.5 km);
- Darrell Bay (6.2 km);
- Porteau Cove (12 km);
- Gambier Island/Ekins Point (20 km);
- Islands Trust;
- Recreational, wildlife and business interests within 20 km of Woodfibre; and
- Other commercial marine operations with an interest based on shared use of Howe Sound include:
 - Port of Squamish;
 - Howe Sound Pulp and Paper; and
 - BC Ferry Corporation.

Other incorporated and unincorporated communities and organizations with an interest in the broader Howe Sound region or an active interest in the linear components of the project led by Fortis BC and BC Hydro include:

- Village of Lions Bay (22.88 km);
- Village of Gibsons (36.8 km);
- Sunshine Coast Regional District;
- Resort Municipality of Whistler (56 km); and
- Pemberton (81 km).

Table 13 provides a summary of the anticipated approach to consultation with the respective public, stakeholder and agency consultation.

Table 13: Anticipated Consultation Approach

Region	Proposed Approach
High Interest	<ul style="list-style-type: none"> • Direct meetings; • Invitation to Open Houses in Community; • Project Information Updates; • Website; • Quantitative and qualitative public opinion research; • Door to door; • Advertising; • Meeting with individual stakeholder groups; • Fact sheets; and • Opening of a dialogue/exhibit centre.
Moderate Interest	<ul style="list-style-type: none"> • Notification and invitation to meet; • Attend Project Partner Open Houses; • Invitation to Open Houses hosted by project partners; • Website; and

Table 13: Anticipated Consultation Approach

Region	Proposed Approach
	<ul style="list-style-type: none"> Quantitative and qualitative public opinion research.
Low interest or interest related to associated projects	<ul style="list-style-type: none"> Notification with Information Fact Sheet; Invitation to Project Partner Open Houses; and Website.

9.4 Consultation Planning and Activities

First Nations and Public Consultation plans will be carried out before, during and after the EA. WNGL will continue to meet with public, stakeholder, industry, First Nations, and agencies to support ongoing consultation for the project. A range of consultation activities (Table 11) is planned in late 2013 and continuing into 2014 as part of the draft Application Information Requirement (dAIR) review and as part of the ongoing environmental and social assessment review. The consultation programs are designed with the intent of meeting all Environmental Assessment Certificate (EAC) consultation requirements. Further, WNGL intends to engage communities at key project milestones in the project design to gather and consider input regarding topics of interest to communities, such as community benefits, traffic management (if necessary) and other mitigation plans.

The objective of the consultation programs will be for First Nations, regulatory agencies, key stakeholders, and members of the public to have an opportunity to provide input to project design, issue identification, baseline characterization programs, and review of key EAC documents, including dAIR, the EAC Application and Environmental Management Plans (EMPs). WNGL and project staff have met informally with Squamish Nation council and staff, District of Squamish representatives, provincial and federal agency staff and a range of local stakeholders businesses on a number of occasions during the initial stages of project planning. These discussions and meetings are being tracked through a specific log.

9.5 Long-term Property and Resource Stewardship

WNGL will manage and provide long-term stewardship for forest, fisheries, wildlife, and water resources on the private property. WNGL has met with the Squamish Nation and will continue discussions related to local fisheries and wildlife resource enhancement and access management.

10 SUSTAINABILITY CONSIDERATIONS

The CEEA defines sustainable development as “*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*”. This definition is adapted from the World Commission on Environment and Development (UN 1987). Project-related environmental, social, economic, and cultural sustainability issues will be identified by considering aspects linked to the project site infrastructure, layout, planning, design and production schedule. WNGL will support sustainability by designing, constructing and operating the Woodfibre LNG project by incorporating practices including information presented in the following sections.

10.1 Environmental Sustainability

- A reduced environmental footprint through use of floating LNG production and storage facilities;
- Collecting, treating, and recycling process of the water before discharge into the receiving environment;
- Management of lands not involved in the project activities as private forest lands; and
- Management and long-term stewardship for forest, fisheries, wildlife, and water resources on the property.

10.2 Economic Sustainability

- Maximizing employment and business opportunities, and associated income benefits to local communities through hiring of appropriately skilled personnel;
- Adding economic diversity to the local and regional economy and increase government revenues (i.e., taxes and fees), especially when the LNG facility is in full operation to supply LNG to the Asian markets and the potential to supply LNG for local shipping; and
- Ongoing employment opportunities with local residents and First Nations by providing opportunities to upgrade skills, working with other regional employers to find replacement jobs and identifying new opportunities for economic development.

10.3 Social Sustainability

- Supporting individual capacity and skill development (including transferable skills) through training, potentially prioritized for local residents and First Nations;
- Supporting local business capacity such that their skill base is strengthened and can be applied elsewhere in the economy (i.e., supporting longer term economic diversification and stability);

- Supporting First Nations' sustainable development goals through consultation processes; and
- Working with communities on legacy projects to support and sustain the social fabric of the community in areas of sport, arts and culture.

10.4 Cultural Sustainability

- Preserving cultural heritage and any structure or site that is of archaeological significance;
- Maintenance of access to traditional territories and accommodation of traditional culture and customs in the project area;
- Opportunities to enhance or highlight First Nations cultural significance in the region; and
- Working with Squamish historical organizations to properly catalogue and celebrate the history and significance of the project site and the community that once existed there.

11 PROJECT SCHEDULE

The key permitting milestones throughout the development, operation and closure phases of the project are summarized in Table 14. The key milestones throughout the construction phase of the project are summarized in Table 3 and schedules for construction, operations, and decommissioning are summarized in Section 4.

Table 14: Anticipated Project Schedule

Task	Start Date	Completion Date
Baseline Data Collection		
Air Quality, Climate & GHG	November 2013	March 2014
Noise	November 2013	March 2014
Ambient Light	November 2013	March 2014
Contamination/Groundwater	November 2013	March 2014
Marine Slope Risk	November 2013	March 2014
Marine Flora and Fauna	June 2013	April 2014
Freshwater Flora and Fauna	June 2013	December 2013
Socio-economics	November 2013	April 2014
Heritage	November 2013	April 2014
Visual Aesthetics	August 2013	February 2014
Land and Resource Use	November 2013	March 2014
Human Health Assessment	November 2013	March 2014
Navigable Waters	November 2013	March 2014
Terrestrial Flora and Fauna	June 2013	December 2013
Consultation		
First Nations	June 2013	Ongoing TBC
Public and Stakeholder	TBC	TBC
Application Information Requirements (AIR)		
<i>Draft AIR production (dAIR)</i>		
dAIR Document Production	November 2013	April 2014
dAIR Working Group/Aboriginal Groups/Public Comment and Response	January 2014	March 2014
Tacking Comments/Response/Working Group Meetings	February 2014	April 2014
<i>Final AIR Production</i>		

Table 14: Anticipated Project Schedule

Task	Start Date	Completion Date
AIR Production and Review	January 2014	June 2014
Projected Submission of AIR to BCEAO	July 2014	
EAC Application		
Application production for Submission to BCEAO	March 2014	November 2014
Application Reviewed for Completeness	December 2014	January 2015
Application Review (and Public Comment)	January 2015	May 2015
Application Report (BCEAO)	June 2015	July 2015
Project Decision by Ministers	July 2015	August 2015
Concurrent Permitting		
Navigable Waters Protection Act	TBC	TBC
BC Oil and Gas Activities Act	TBC	TBC
BC Water Act	TBC	TBC
BC Environmental Management Act	TBC	TBC
Canadian Environmental Protection Act	TBC	TBC
Fisheries Act	TBC	TBC
National Energy Board Act	TBC	TBC

Note: TBC – to be confirmed following consultation with regulators.

12 REFERENCES

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APPENDIX 1

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Figure 1: Woodfibre – Unknown Date



Figure 2: Original Site Photo from 1912



Figure 3: Original Site Photo from 1912



Figure 4: Woodfibre in 1960



Figure 5: Woodfibre – Unknown Date



Figure 6: Woodfibre in 1987

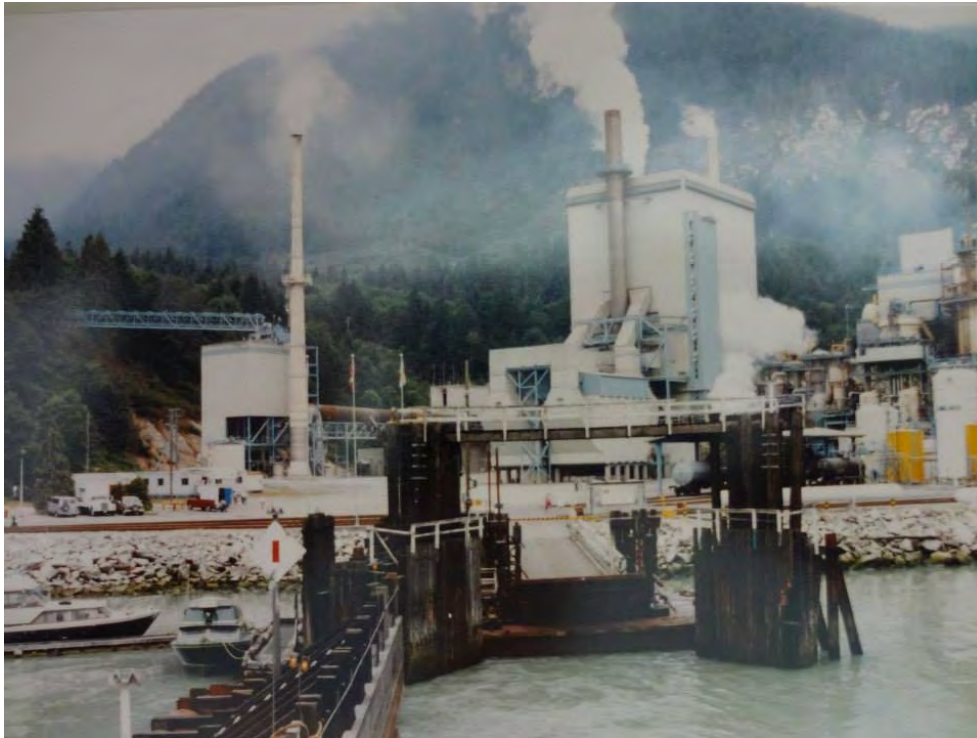


Figure 7: Woodfibre in 1987



Figure 8: Woodfibre in 1987



Figure 9: Woodfibre in 1987



Figure 10: Woodfibre – Unknown Date



Figure 11: Woodfibre in 2013



Figure 12: Woodfibre in 2013



Figure 13: Woodfibre in 2013

