AS1 INTRODUCTION

Nexen Energy ULC (Nexen), for and on behalf of Aurora LNG, a joint venture between Nexen and INPEX Gas British Columbia Ltd. (Aurora LNG), is proposing to construct and operate the Aurora LNG Project (the Project), a liquefied natural gas (LNG) facility and marine terminal near Prince Rupert, British Columbia (BC). The Project will convert natural gas from northeast BC into LNG for shipment by LNG carriers to markets in Asia where it will be regasified and distributed. Together, the joint venture participants bring to the Project a unique combination of expertise, market access, well established networks with customers in key growth markets, and decades of experience in the global LNG industry.

The Project is a reviewable project under the *BC Environmental Assessment Act* (BCEAA) and a designated project under the *Canadian Environmental Assessment Act*, 2012 (CEAA 2012), and therefore requires an environmental assessment (EA) under both provincial and federal legislation. This Application has been prepared to provide sufficient information to support the provincial and federal environmental assessment decision-making processes necessary for the Project to proceed.

The following sections provide a summary of the Application.

AS2 PROPOSED PROJECT OVERVIEW

AS2.1 Proponent Description

The joint venture partners are industry leaders in BC and Asia.

- Nexen is a wholly-owned subsidiary of CNOOC Limited and is an industry leader in the development of natural gas in northeast BC.
- The CNOOC Group, of which CNOOC Limited is a subsidiary, is a diversified energy holding company with interests in upstream, midstream, and downstream businesses including CNOOC Gas & Power Ltd.
- CNOOC Gas & Power Ltd. is currently the largest importer of LNG into China with 12.3 million tonnes per annum (MTPA) of LNG import capacity, an additional 8.5 MTPA under construction, and plans to expand to 60 MTPA of LNG import capacity by 2020 to meet China's growing domestic demand.
- INPEX Gas British Columbia Ltd. (IGBC) is a BC corporation. IGBC's largest shareholder is INPEX Corporation (INPEX).
- INPEX has been supplying LNG to Japan, Korea, Taiwan, and other Asian customers since 1977 through its LNG projects, and has developed strong relationships with Japanese and other Asian utility customers who make up the majority of the global LNG demand.
- INPEX currently has working interests in seven LNG projects in the Asia-Pacific region. These include three large operator projects: Ichthys LNG in Australia, Abadi LNG in Indonesia, and Naoetsu LNG receiving terminal in Japan. INPEX has been producing natural gas in Japan for over 30 years, where it is the largest producer of natural gas and owns a gas distribution pipeline that is over 1,000 kilometres (km) long.

Nexen is coordinating the preparation of the environmental assessment certificate (EAC) application (the Application) on behalf of the joint venture partners. If approved, the Application and operational permits for the Project will be held by Nexen on behalf of the joint venture partners.

The contact information for the Proponent is:

Proponent	**Nexen Energy ULC, for and on behalf of Aurora LNG**
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Principal Contact	Darcy Janko Sr. Manager, Regulatory Affairs - Natural Gas Telephone: (403) 699-5065 Email: darcy.janko@nexencnoocltd.com
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Nexen has retained Stantec Consulting Ltd. (Stantec) to manage and prepare the Application. The contact information for Stantec is:

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AS2.2 Project Description

AS2.2.1 Regulatory (Provincial and Federal) Scope

The Project has been determined to be a reviewable project under BCEAA, and a designated project under CEAA. The Project therefore requires an EA under both provincial and federal legislation. The federal Minister of the Environment has approved substitution of the federal EA process with the provincial EA process.

The provincial and federal scope of the Project to be assessed in the EAC Application is set out by the BC Environmental Assessment Office (BC EAO) in the Section 11 Order issued on August 25, 2014 and as amended in Section 13 Orders issued on December 16, 2014 and August 30, 2016. Part B of the Section 11 Order lists the on-site and off-site components included in the scope of the Project. On-site components are:

- A natural gas receiving and LNG production facility
- Liquefied natural gas storage tanks
- A marine terminal and an LNG loading facility
- Supporting infrastructure and facilities
- Temporary infrastructure and facilities.

Activities associated with the on-site components that are within the scope of the Project are construction, operation and decommissioning.

Off-site shipping activities included in the scope of assessment are:

- Operation of LNG carriers and other supporting marine traffic along the shipping route between the marine terminal and the pilot boarding location at or near Triple Island.

The scope of the assessment does not include:

- Natural gas exploration and production activities
- Transportation of natural gas to the facility
- Activities required in order to prepare this Application.

AS2.2.2 Technical Project Scope

The Project will be developed through a phased approach, and will consist of the following key components:

- A natural gas receiving and LNG production facility ("LNG facility") that will process approximately 24 MTPA of LNG at full build out. When fully developed, the LNG facility will require approximately 104 million cubic metres per day (Mm^3/d) (3.7 billion standard cubic feet per day [Bcf/d] or 3.9 Peta Joules per day [PJ/d]) of natural gas. Of this amount, it is estimated that approximately 97 Mm^3/d (3.4 Bcf/d or 3.6 PJ/d) will be processed into LNG, and 7 Mm^3/d (0.3 Bcf/d or 0.3 PJ/d) will be required for facility operation. At full build-out there will be three LNG storage tanks at the LNG facility with a total storage capacity of up to 585,000 m^3.
- A marine terminal on Digby Island and a LNG loading facility ("marine terminal") capable of accommodating up to two LNG carriers with a capacity up to 217,000 m^3 (Q-Flex size).
- Supporting infrastructure and facilities, including a materials offloading facility (MOF), laydown area, soils storage area, air and water supply utilities, waste and wastewater management, power generation and supply, camp for operations, maintenance and turnaround personnel, access road, and haul roads.
- Temporary infrastructure and facilities during construction, including a pioneer facility, laydown area, construction camp, and construction offices.
- Operation of LNG carriers and other supporting marine vessels along the shipping route between the marine terminal on Digby Island and the pilot boarding location at or near Triple Island.

At full build out, the Project will require approximately 160 to 320 LNG carrier visits each year to transport the LNG to overseas markets.

AS2.2.3 Purpose

The purpose of the Project is to convert natural gas from the Western Canadian Sedimentary Basin of northeast BC into LNG, through a liquefaction process, for shipment by LNG carriers to markets in Asia. At full build-out, the facility will produce approximately 24 MTPA of LNG. Once delivered to markets in Asia, the LNG will be regasified and distributed, where it may reduce reliance on other non-renewable energy sources such as coal and nuclear fuels, in some markets.

According to the United States Energy Information Administration (US EIA 2016), from 2005 to 2014 global LNG trade increased by an average of 6% per year, with expansion of 3% in 2015. World LNG trade is anticipated to expand by nearly one-third from 2012 to 2020, and more than double, from about 12 trillion cubic feet (Tcf) in 2012 to 29 Tcf in 2040 (US EIA 2016). The Asia Pacific region, which accounted for 75% of global LNG trade in 2014, led the world growth in LNG demand over the past decade; however, trade is anticipated to expand as more countries transition to LNG as a flexible source of energy.

Several large-scale LNG projects will be required to meet this demand, and BC is well positioned to compete in the international LNG market. The Project will play a key role in meeting the increased demand of the Asia Pacific markets, as well as other growth markets, and is consistent with provincial policies and priorities to promote the development of the LNG industry in BC.

AS2.2.4 Location

The Project is located on Digby Island, approximately 4 km southwest of downtown Prince Rupert, BC, on BC's northwest coast. Coordinates for the LNG facility, marine terminal, and MOF are provided in Table AS2-1.

Table AS2-1 Coordinates of LNG Facility and Marine Terminal

Location	UTM[1] (Zone 9U)		WGS[2]-84	
	Easting	Northing	Latitude	Longitude
LNG Facility (centre of principal land lot)	409400	6015021	- 54.275072	- 130.391215
Marine Terminal	410874	6012074	- 54.24886	- 130.367892
MOF	410421	6015534	- 54.27987	- 130.375875

NOTES:
1 UTM = Universal Transverse Mercator coordinates
2 WGS-84 = World Geodetic System 1984 coordinates

LNG carriers will transit through Chatham Sound within designated shipping zones between Digby Island and Triple Island.

AS2.2.5 Project Components and Activities

The Project will occur in three phases: construction, operations, and decommissioning. Construction of the Project is anticipated to occur in phases; the first phase will include the construction of two liquefaction trains (10 – 12 MTPA of LNG), two LNG storage tanks, and the marine terminal. Full design build-out would include an additional two liquefaction trains and an additional LNG storage tank, for the planned ultimate design capacity of approximately 24 MTPA LNG. The key Project components are summarized in Table AS2-2. The two additional LNG trains will be constructed as required by market conditions.

Table AS2-2 Key Components of the Project

Infrastructure	Description of Infrastructure / Activity
LNG Facility	▪ Feed gas reception system ▪ Feed gas treatment system ▪ Natural gas liquefaction system ▪ Four liquefaction trains with gas turbine driven compressors, with full build-out capacity of approximately 24 MTPA ▪ Liquefaction refrigerant storage ▪ LNG storage tanks ▪ Natural gas liquids (NGL) storage tanks and infrastructure for staging and loading of NGLs ▪ Process heat system ▪ Boil-off gas recovery system ▪ Flare system ▪ Control room

Table AS2-2 Key Components of the Project

Infrastructure	Description of Infrastructure / Activity
Marine Terminal	▪ Marine jetty, with up to two LNG carrier (Q-flex) berths (at full build-out) ▪ Pipe-rack corridor between the LNG facility and marine terminal ▪ LNG loading, including a conventional trestle, loading platform, and loading and offloading arms ▪ Dredge areas around each berth to enable sufficient depth for LNG vessels
Supporting Infrastructure	▪ MOF and associated dredge pocket to enable safe access ▪ Laydown areas ▪ Soil storage area ▪ Nitrogen and compressed air equipment ▪ Water supply system, including ocean water intake, pump station, desalination plant, and supply pipelines ▪ Site stormwater management system ▪ Wastewater collection and treatment system ▪ Solid waste management system ▪ Power generation and supply ▪ Safety systems, including safety instruments, fire protection, and safety measures ▪ Administration buildings, storage facilities, and medical centre ▪ Facility and maritime security ▪ Heliport for emergency evacuation ▪ Camp for operations, maintenance, and turnaround personnel ▪ Access road ▪ Haul roads
Temporary Infrastructure and Facilities (Construction-related)	▪ Pioneer facility ▪ Laydown areas ▪ Construction camp ▪ Construction offices
Shipping	▪ Supporting marine activities during construction ▪ Shipping between the marine terminal and the pilot boarding location at Triple Island during operations, including approximately 160 to 320 LNG carrier visits each year at full build-out

The Project components are described based upon conceptual design; site layout and equipment requirements will be further refined as the Project progresses through front end engineering design (FEED) and in consideration of potential areas of environmental and archaeological concern; however, the extent of on-land development will remain within the current project development area (PDA).

AS2.3 Land and Marine Use

The Project will be located mainly on provincial Crown land within the Skeena-Queen Charlotte Regional District (SQCRD), and on one private lot owned by the Aurora LNG joint venture partners. The community of Dodge Cove is the nearest community; a small part of the PDA near Casey Cove overlaps with the periphery of the Dodge Cove Official Community Plan (OCP) planning area (13% or 49 ha of the total OCP area). The PDA does not intersect with any First Nations reserves; parks or protected areas; or forestry, guide-outfitting, oil, gas, or mineral tenures. Approximately 10% of a single trapline tenure is overlapped by the PDA.

The PDA partly overlaps with the following:

- Map Reserve #204652, which has designated Crown land within the reserve for industrial use
- Order-in-Council Reserve # 63109, established by the BC Ministry of Forest, Lands and Natural Resource Operations (BC MFLNRO) to designate the area for potential roadway use.
- Notation of Interest #84564, corresponding to the protected watershed zone described in the Dodge Cove OCP.

Non-tenured use of Crown land in the PDA includes recreation, hunting, fishing, and vegetation and marine plant harvesting. There are no sites identified by Recreations Sites and Trails BC within the PDA; however, there are four recreational features within the PDA that are listed on the Recreational Features Inventory.

Active container and bulk terminals are operated under the Prince Rupert Port Authority (PRPA) on Kaien Island and Ridley Island located across the channel to the east of Digby Island. Other proposed projects in the vicinity of Prince Rupert and Port Edward include expansion of the Fairview Container terminal; several LNG facilities and associated gas transmission lines, at various stages of permitting; and a clean energy generation project. There are no other proposed projects on Digby Island.

The shipping route to Digby Island via Brown Passage and into Chatham Sound transits through the traditional territories of several coastal Aboriginal Groups and the jurisdictional area of the PRPA. The shipping route is used by Aboriginal Groups for traditional harvesting and for a variety of marine-based activities that may be affected by the Project. Commercial and recreational fishing is managed by Fisheries and Oceans Canada (DFO).

Marine use of Chatham Sound includes traffic of commercial and recreational fishing vessels, commercial charter vessels, pleasure craft, cargo vessels, ferries, cruise ships, tug and tow vessels, and eco-tourism vessels. The PRPA has five terminals in operation and manages multiple anchorages. Traffic has been managed by the Harbour Master since 1997, in coordination with other agencies (e.g., the Pacific Pilotage Authority).

AS2.4 Benefits of Project

The Project will provide natural gas production from the Western Canadian Sedimentary Basin to growing global markets for LNG, and offers an opportunity for increased economic growth locally in Prince Rupert and surrounding area, as well as throughout the province and country. The Project will benefit both BC and Canada through economic development and diversification, job creation, and increased government revenue. It will also support the provincial government's current strategic interests in developing an LNG industry.

Aurora LNG estimates spending approximately $28 billion on construction and $4.5 billion per year during 25 years of operations (inclusive of LNG facility operation and gas costs), with decommissioning expected to cost approximately $1.4 billion (figures in nominal 2016 Canadian dollars [$]). The Project will directly and indirectly create approximately 670,000 person-years (PYs) of employment in Canada during construction, 25 years of operation, and decommissioning. It will generate approximately $11 billion in tax revenues for the Government of Canada, during construction and operations, exclusive of corporate income taxes paid during the operations phase.

About 15% of total construction costs, 96% of annual operating costs (assuming all natural gas used in LNG production will be obtained from BC sources) and 82% of decommissioning costs will be spent in BC. This will create an estimated 431,000 PYs of employment in BC during construction, operation and decommissioning. Revenue for the provincial government associated with the Project over the construction and operations phases is estimated at approximately $25 billion.

AS2.4.1 Project Costs

Construction will draw labour, equipment, and materials sourced from within Canada and internationally. Preliminary estimates indicate that approximately 12% of construction expenditures, including labour, equipment, and materials, will be procured from BC, 18% from elsewhere in Canada, and 70% internationally. Expenditures within BC during construction are estimated to be $2.7 billion, exclusive of labour, of which an estimated $1.0 billion will be spent in northwest BC.

Annual operating costs are estimated to be approximately $4.5 billion, of which approximately 89% ($4.1 billion) will be for natural gas, and the balance for operating expenditures needed to run the LNG facility ($220 million for goods and services and $85 million for labour). Approximately 64% of labour ($54 million) of labour and 44% ($66 million) of purchased goods and services will occur in BC. Based on Project design all natural gas expenditures ($4.1 billion) will occur in BC. Over 25 years of operations, total operating costs, excluding natural gas, will be approximately $12 billion, of which an estimated $8 billion in spending will occur in BC (estimates are provided in nominal dollars (2016)).

AS2.4.2 Employment

Total labour requirements for constructing the Project to full build-out is estimated at 21,500 PYs. Of this, an estimated 14,200 PYs will be required to construct and commission Phase 1 (trains 1 and 2) and 7,300 PYs to construct and commission Phase 2 (trains 3 and 4). During Phase 1 the workforce is predicted to peak at 5,000 workers with an average labour force over the 5-year construction and commissioning period being 2,650. During Phase 2 the peak workforce is estimated at 4,250 workers with an average labour force over the 3-year construction and commissioning period being 3,000 workers.

It is estimated that Project construction will directly provide 17,200 PYs of employment for Canadian workers, 6,600 PYs for BC residents of which an estimated 1,100 PYs will occur in northwest BC. Indirect employment created through Project expenditures on goods and services is estimated at 45,300 PYs of which 13,900 PYs are anticipated to occur within BC. Induced employment created through worker (direct and direct) spending on goods and services is estimated at 21,300 PYs of which 6,500 PYs are anticipated to occur within BC. Direct, indirect, and induced labour income during construction is estimated to be $5.7 billion, of which $1.7 billion will occur in BC.

Over its 25-year operating life, the Project will create an estimated 572,000 PYs of employment, or 22,900 PYs annually (67% for residents of BC). Approximately 80% of labour will be associated with natural gas exploration, production, and transportation in Canada (18,600 PYs) and 20% will be associated with facility operation (4,300 PYs). Labour income for the Canadian component is estimated at $1.6 billion (68% for residents of BC), similarly split with 80% associated with natural gas exploration, production, and transportation in Canada and 20% with facility operations.

Employment requirements during decommissioning are conceptual, and based on the estimated expenditures that will occur during this phase. Total employment during decommissioning is estimated to be approximately 14,300 PYs (an estimated 73 for residents of BC), with 78% attributed to Project expenditures (direct and indirect), and 22% attributed to induced employment.

AS2.4.3 Government Revenue

Over the construction period, the Government of Canada will receive an estimated $969 million, of which 64% will be personal income taxes, 16% will be corporate income taxes, 12% will be sales tax, and 7% will be from other taxes and levies. Customs duties on some imported components will add to this total.

Government of BC revenue over the construction period is estimated at $290 million, with 25% from personal income taxes, 27% from sales taxes, 12% from corporate income taxes, and 37% from other taxes and levies. Municipal government revenue to be paid by the Proponent over the construction period is estimated at $50 million.

Over the operations period, the Government of Canada will receive approximately $401 million annually, plus any corporate income taxes payable by the Proponent. Of the $401 million, approximately 41% will be from corporate income taxes associated with Project expenditures, 41% will be from personal income taxes, and 18% will be from GST and other federal taxes. Of the total $401 million, 12% will be attributed to facility operations and 88% from gas supply.

Annual revenues for the Government of BC during operations are estimated at $982 million, plus taxes on corporate profits generated directly by the Proponent. Of the $982 million, 10% will come from corporate income taxes associated with expenditures, 16% from sales taxes, 4% from personal incomes taxes, 36% from carbon taxes, and 33% from other tax sources. Annual property tax paid by the Proponent is estimated at $15 million per year.

The Project will also pay BC's LNG tax, which will be calculated based on a two-tiered system, in which the tier 1 tax will be based on net proceeds (revenues less expenses), and the tier 2 tax will be based on net proceeds less capital investment account. The amount of LNG taxes payable each year – if any - depend on Project revenue which, in turn, depends on the price received for the LNG shipped to market. Because it is not possible to predict what LNG prices will be at the time the Project becomes operational, LNG taxes have not been estimated.

AS2.4.4 Contribution to BC Economy

Over the Project life, the Project will contribute an estimated nearly $88 billion to the BC gross domestic product (GDP). The GDP contributions during each project phase are estimated as follows (using 2016 nominal dollars):

- Almost $2.6 billion over the construction period for Project-related purchases of labour, goods, and services (24% of the Project's contribution to provincial GDP)
- An estimated $3.4 billion per year during operations, most of which will be an indirect Project effect associated with natural gas production ($3.2 billion annually, or 94%). This is a very conservative estimate, because corporate income taxes and LNG taxes are not included in the calculations
- Approximately $875 million during decommissioning.

AS2.4.5 Contribution to the Canadian Economy

Over the Project life, the Project will contribute an estimated $119 billion to Canada's GDP. The GDP contributions during each project phase are estimated as follows (using 2016 nominal dollars):

- Almost $8.5 billion over the construction period for purchase of labour, goods and services (22% of the Project's contribution to national GDP), as direct Project effects
- An estimated $4.3 billion per year during operations, most of which will be an indirect Project effect associated with natural gas production ($3.9 billion annually, or 91%). This is a very conservative estimate because corporate income taxes and LNG taxes are not included in the calculations
- Approximately $1.4 billion during decommissioning.

AS2.5 Applicable Permits and Authorizations

Aurora LNG is not requesting concurrent permitting under BCEAA pursuant to the Concurrent Approval Regulation (BC Reg. 371/2002).

Applicable federal and provincial permits, authorizations and/or approvals anticipated to be required for construction and operation of the Project, including shipping activities, and the associated responsible regulatory body are:

- Authorization under Section 35(2)(b) of the *Fisheries Act* to carry out work, undertaking, or activity causing serious harm to fish habitat.
- Approval under section 5(1) of the *Navigation Protection Act* for works in and about navigable water
- Certificate of Compliance under the *Marine Transportation Security Act* (section 4(1)) for operation of the LNG facility, marine terminal, and carrier
- Permit under the Canadian Aviation Regulation of the *Aeronautics Act* for the flare
- Disposal at Sea Permit under section 125(1)(b) of the *Canadian Environmental Protection Act* Disposal at Sea Regulations
- Explosives Permit / Licence in accordance with section 7(1) of the *Explosives Act*, Explosives Regulations

- LNG Export Licence under section 117 of the *National Energy Board Act*; required for the export of LNG outside of Canada to international markets (Aurora Liquefied Natural Gas Ltd. (sole purpose corporation held by the Aurora LNG joint venture participants) received approval from the NEB for a LNG export license to the NEB on May 2, 2014)
- PRPA lease under the *Canada Marine Act* Port Authority Operations Regulations, to occupy and use PRPA-administered federal land
- Approval under section 11 of the *Water Sustainability Act* for changes in and about a stream
- Waste Discharge Permit(s) under the *Environmental Management Act* for on-land dredged sediment disposal, wastewater discharge, hydrostatic test water discharge, Project air emissions, and waste discharges
- LNG Facility Permit under the *Oil and Gas Activities Act*, section 21, Pipeline and Liquefied Natural Gas Facility Regulation
- Licence to cut timber in accordance with section 47 of the *Forest Act*
- Provincial Crown Land Tenure under sections 39 and 40 of the *Lands Act* or the *Ministry of Lands, Parks and Housing Act*
- Authorization for Sewage Facilities under the *Environmental Management Act*, Municipal Wastewater Regulation and *Public Health Act,* Sewerage System Regulation
- Fuel Storage Registration under the Petroleum Storage and Distribution Facilities Storm Water Regulation under the *Environmental Management Act*
- Camp Permit under the *Public Health Act*, Industrial Camp Regulations
- Heritage Inspection Permits and Heritage Investigation Permits under the *Heritage Conservation Act*, section 14
- Site Alteration Permit under the *Heritage Conservation Act*, section 12.

AS3 ENVIRONMENTAL ASSESSMENT PROCESS

The Project has been determined to be a reviewable project under BCEAA, and as a designated project under CEAA 2012. The Project therefore requires an EA under both provincial and federal legislation, and is undergoing a substituted process. This Application has been developed pursuant to the approved Application Information Requirements (AIR) and complies with relevant instructions provided in the Section 11 and Section 13 Orders.

AS3.1 Provincial Environmental Assessment Process

The BC EAO issued a Section 10(1)(c) Order to Aurora LNG on June 23, 2014 confirming that the Project is a reviewable project, based on the provincial thresholds listed in the Reviewable Projects Regulation pursuant to the BCEAA. The provincial thresholds and Project rationale are listed in (Table AS3-1):

Table AS3-1 Provincial Thresholds for the Aurora LNG Project

Reviewable Projects Regulation Section	Applicable Category/ Criterion	Rationale
Part 4 (Energy Projects), Table 7 (Electricity Projects)	Project Category 1 (Power Plants) ▪ A new facility with a rated nameplate capacity of ≥ 50 megawatts (MW) of electricity that is (b) a thermal electric power plant	The Project may generate ≥ 50 MW of electrical power (currently estimated at 250 MW)
Part 4 (Energy Projects), Table 8 (Petroleum and Natural Gas Projects)	Project Category 1 (Energy Storage Facilities) ▪ A new energy storage facility with the capability to store an energy resource in a quantity that can yield by combustion >3 petajoules (PJ) of energy.	The Project will have the capability to store an energy resource, other than electricity, in a quantity that can yield by combustion ≥ 3 PJ of energy
	Project Category 3 (Natural Gas Processing Plant) ▪ A new natural gas processing plant facility that has the design capacity to process natural gas at a rate of >5.634 Mm^3/day.	The Project's natural gas processing plant facility has a design capacity to process natural gas at a rate of >5.634 Mm^3/day
Part 8 (Transportation Projects), Table 14 (Transportation Projects)	Project Category 4 (Marine Port Facilities) ▪ Modification of an existing facility, other than a ferry terminal, if the modification results in dredging, filling, or other direct physical disturbance of ◦ > 1,000 metres of linear shoreline, or ◦ > 2 hectares (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.	The Project consists of a new marine port facility the construction of which may entail dredging, filling, or other direct physical disturbance of ≥ 2 ha of foreshore or submerged land, below the natural boundary of a marine coastline or marine estuary

On August 25, 2014, during the pre-Application stage, the BC EAO issued a Section 11 Order requiring the environmental assessment of the Project be conducted in accordance with Schedules A, B, C, and D of the Order, including the scope, procedures and methods for the environmental assessment of the Project, and the Aboriginal Groups included in the assessment. A Section 13 Order amending the Section 11 Order was issued by the BC EAO on December 16, 2014. The amendment moved Gitxaala Nation, Kitselas First Nation, and Kitsumkalum First Nation from Schedule C to Schedule B Aboriginal Groups, since the Section 11 Order contained no procedural distinction between Schedule B and C with respect to consultation. A second Section 13 Order was issued by the BC EAO on August 30, 2016. The amendment moved Gitga'at Nation to Schedule B Aboriginal Groups, and added Lax Kw'alaams Band and Metlakatla First Nation to Schedule C.

Following issuance of the Section 11 Order, Aurora LNG prepared a draft AIR document. The public had the opportunity to review and comment on the draft AIR during a public consultation period and a BC EAO-led open house. Aurora LNG responded to all comments from the public and Working Group, and the BC EAO issued the AIR for the Project on November 23, 2015.

The Application, prepared in accordance with the requirements of the AIR, identifies and assesses the potential adverse environmental, economic, social, heritage, and health effects that may result from the Project, and identifies mitigation measures to avoid, reduce or manage those adverse effects. At the end of the pre-Application stage, the Application is submitted to the BC EAO; the BC EAO screens the Application for completeness.

When the Application is deemed complete, the Project enters the Application Review stage where the BC EAO has 180 days to review the content of the Application. The Working Group and public will be provided opportunity to review and comment on the Application. Aurora LNG is required to respond to all Working Group and public comments on the Application to the satisfaction of the BC EAO.

Following its review, the BC EAO prepares an Assessment Report to summarize the findings of the Application, the extent to which potential adverse effects have been mitigated, and any outstanding concerns or potential adverse effects. The Assessment Report and related materials are submitted to the two provincial ministers for a decision – the Minister of the Environment and another minister responsible for that category of reviewable project – in this case, the Minister of Energy and Mines (and Responsible for Core Review). The Assessment Report is also submitted to the federal Minister of the Environment and Climate Change for a decision on the Project in accordance with CEAA (see Section 2.2).

AS3.2 Federal Environmental Assessment Process

The Project is a designated project pursuant to the Regulations Designating Physical Activities (SOR/2012-147) under CEAA 2012. Federal thresholds and Project rationale are listed in Table AS3-2.

Table AS3-2 Federal Thresholds for the Aurora LNG Project

Applicable Regulation Section	Applicable Criteria	Rationale
Section 2(a)	The construction and operation, decommissioning and abandonment of a new fossil fuel-fired electrical generating facility with a production capacity of 200 MW or more.	The Project may construct and operate a fossil fuel-fired electricity generating station with a production capacity of between 200 MW and 550 MW (currently estimated at 250 MW).
Section 14(d)	The construction, operation, decommissioning and abandonment of a new facility for the liquefaction, storage or regasification of liquefied natural gas, with a liquefied natural gas processing capacity of 3,000 tonnes per day (t/day) or more or a liquefied natural gas storage capacity of 55,000 t or more.	The Project will have an LNG processing capacity of more than 3,000 t/day or an LNG gas storage capacity of more than 55,000 t (currently estimated at 585,000 m^3).
Section 24(c)	The construction, decommissioning and abandonment of a marine terminal designed to handle vessels larger than 25,000 dead weight tonnage (DWT) unless the terminal is located on lands that are routinely and have been historically used as a marine terminal or that are designated for such use in a land-use plan that has been the subject of public consultation.	The Project's marine terminal is designed to handle vessels larger than 25,000 DWT (currently estimated at 109,500 DWT)

The federal Minister of the Environment and Climate Change granted substitution of this assessment to the BC EAO subject to the following conditions:

- The designated project to be assessed is the construction, operation and decommissioning of a natural gas liquefaction facility, marine terminal and any incidental physical activities, including marine shipping activities.
- The substituted process will include a consideration of the factors set out in subsection 19(1) of CEAA 2012 and the BC EAO will ensure that any orders under sections 11, 13 and 14 or 15 of BCEAA require subsection 19(1) factors.
- The public will be given an opportunity to participate in the EA and will have access to records in relation to the EA to enable their meaningful participation.
- At the end of the EA, in the decision stage of the assessment process, the BC EAO will submit a report to the Canadian Environmental Assessment Agency (CEA Agency) and the report will be made available to the public.
- Expert federal authorities will be involved in the BCEAA assessment process.
- The BC EAO will provide the environmental assessment report to the Agency within a time frame that will enable the Minister to make decisions under subsection 52(1) of CEAA 2012 within the time limits set out in CEAA.
- The BC EAO will conduct procedural aspects of Aboriginal consultation in accordance with the process set out in the memorandum of understanding.
- The BC EAO will make available to Aboriginal Groups funding provided by the Agency to support Aboriginal consultation during the substituted EA.

AS3.3 Key Information and Concerns

During the pre-application stage, the BC EAO held a number of consultation meetings with the Working Group where members had the opportunity to review and comment on the Project and the assessment process. In particular, the Working Group had the opportunity to provide comment during two rounds of review of the draft AIR and Valued Component (VC) Selection Document (January to February 2015, and September to October 2015).

The public participated in the environmental assessment during the draft AIR and VC Selection Document public comment period (September to October 2015), and the BC EAO's open house on September 23, 2015.

A summary of the key information and concerns raised by the Working Group (government agencies and Aboriginal Groups) and the public during the pre-application stage and how these concerns are addressed by Aurora LNG in the Application are included in Table AS3-3 and Table AS3-4, respectively.

A description of the concerns raised by Aboriginal Groups specifically related to traditional knowledge (TK) and traditional use (TU) can be found in Table 12.4-1 in Section 12.0 of the Application, which includes references to the specific VC sections in Part B where the issues have been addressed.

Table AS3-3 Summary of Key Concerns Raised by the Working Group during the Pre-Application Stage

Topic	Concern (Working Group Member)	Aurora LNG Response and Status
Air Quality	▪ Air quality should be assessed for all phases and components of the Project. (HC, MOE) ▪ Assessment should be based on applicable objectives (e.g., the Interim Ambient Air Quality Objectives for SO_2 and NO_2 and the BC Air Quality Objectives for other substances). (MOE, EC)	Air emissions for the construction, operations, routine flaring and decommissioning have been assessed in the Air Quality VC (see Section 4.2). Emergency operations, including upset flaring, are addressed in the Accidents and Malfunctions section (see Section 11.0) of the Application. Both the Air Quality and the Human Health VC (see Section 8.0) assessments refer to the upset flaring results, where appropriate. Applicable ambient air quality objectives have been defined and utilized within the assessment, including the Interim Ambient Air Quality Objectives for SO_2 and NO_2. **Addressed in the Application**
Greenhouse Gases (GHG)	▪ Emissions for the construction and operations phases for both the facility and shipping must be calculated. (CAS, EC) ▪ Ensure that the CEAA guidance document *Incorporating Climate Change Considerations in Environmental Assessments* (2003) is followed and the Application address how the operation of the Project would contribute to GHG emissions, and how those contributions compare with sector, provincial and federal targets and norms. (CAS)	As part of the Greenhouse Gases VC (see Section 4.3), the GHG emissions for all stages of the Project, including construction, operation and decommissioning, for both the LNG facility and shipping were quantified. Summarized emissions were included in the GHG assessment and quantification methods, assumptions and emission factors were discussed in the separate GHG TDR (see Appendix B). The GHG assessment identifies mitigations and monitoring activities proposed for the Project and a separate GHG management plan and outlines specifics about how the mitigations and monitoring activities will be prepared and implemented when finalized Project design details are available. As part of the assessment in Section 4.3, the quantified GHG emission totals were compared to provincial and national inventory total. The quantified GHG emission intensity of the Project was also calculated and compared to a sector profile, as well as the intensity threshold included in relevant legislation. **Addressed in the Application**
Acoustic Environment	▪ Assessment of acoustic environment and the associated subcomponents of noise levels, low-frequency noise and vibrations (HC) ▪ Noise impacts associated with the Project, including the road access. (SQCRD) ▪ Vessel noises and the noise from increased flights into Prince Rupert Airport for the Project should be considered as part of the assessment. (TC)	Following the receipt of the concerns, the AIR was revised to include Acoustic Environment as a VC (See section 4.4) and change in overall noise levels, low-frequency noise levels and change in vibration levels were added as potential Project effects to be assessed as part of the VC. The result of the Acoustic Environment assessment, include the assessments of change in overall noise levels, low-frequency noise levels and change in vibration levels as potential Project effects are found in Section 4.4. As part of the Acoustic Environment VC (see Section 4.4), noise effects from the operation of the road, as well as LNG carriers and tug boats were considered. Potential increases in noise levels due to a change in air traffic were also addressed. Short-term noise events were addressed qualitatively. **Addressed in the Application**
Water Quality	▪ Water quality should be a VC. (Kitselas, MOE) ▪ The watershed is within the dispersal cloud of the Project. (SQCRD) ▪ Operational discharge/ bilge and ballast water should be included. (Gitxaala) ▪ Consideration of water quality at disposal at sea sites. (CEAA)	Following the receipt of concerns, Water Quality was incorporated as a VC (see Section 4.5). This VC is assessed in comparison to BC water quality guidelines and integrated with the results from the Freshwater Fish and Fish Habitat (see Section 4.8), Marine Fish and Fish Habitat (see Section 4.9), Wildlife Resource (Terrestrial) (see Section 4.7), and Human Health (Section 8.0) VCs. Potential effects of the Project on air and water quality are assessed in the Air Quality (see Section 4.2) and Water Quality VCs (see Section 4.5) respectively. The air quality assessment includes air dispersion modeling within the LAA and RAA inclusive of any watersheds within those areas. Aurora LNG will require that Project-related LNG carriers and escort tugs comply with all relevant national and international shipping requirements regarding disposal of waste, bilge water discharge and ballast water discharge. The Marine Fish and Fish Habitat VC (see Section 4.9) considered potential effects of disposal at sea including effects of elevated TSS. **Addressed in the Application**
Vegetation and Wetland Resources	▪ The Federal Policy on Wetland Conservation may apply to the Project. Wetlands designated as ecologically or socio-economically important to BC should be identified. (ECCC) ▪ Information on effects to wetlands and mitigation measures should be included. (ECCC) ▪ A draft Wetland Compensation Plan should be provided as part of the Application. (ECCC)	The Project does not overlay any geographic areas where continuing loss or degradation of wetlands has reached critical levels. Wetlands designated as ecologically or socio-economically important to BC are included in the assessment of change in abundance or condition of ecological communities of interest and change in wetland function, in the Vegetation and Wetland Resources VC (see Section 4.6). A description of wetlands extent surveys and wetland function assessments is included in the Vegetation and Wetland Resources VC (see Section 4.6). Mitigation measures are included under the assessment of change in abundance or condition of ecological communities of interest and assessment of change in wetland function. A draft Wetland Compensation Plan is included as part of the Vegetation and Wetland Resources VC (see Section 4.6). **Addressed in the Application**
Wildlife Resources	▪ Impacts to SARA-listed bat species should be considered, and mitigation plans for each species should be provided. (Gitga'at, ECCC, FLNRO-SR) ▪ Impacts from flaring should be considered and an Avian Management and Monitoring Plan should be developed. (Lax Kw'alaams, ECCC)	Aurora LNG recognizes the recent change to the conservation status of Little Brown Myotis and acknowledges that it and Keen's Myotis may occur in the LAA. The Wildlife Resources (Terrestrial) VC (see Section 4.7) assesses potential effects on bat habitat, including hibernacula features, using appropriate survey methods. Mitigation measures are also identified in the Wildlife Resources VC (see Section 4.7) to reduce the potential impacts of planned flaring events on migratory birds. Such measures may include a plan for managing and monitoring the effects of flaring events on migratory birds. **Addressed in the Application**
Freshwater Fish and Fish Habitat	▪ Conceptual offsetting plans should be included in the Application (Kitselas, Kitsumkalum)	Conceptual Freshwater and Marine Fish and Fish Habitat Offsetting Plans are included in the Application (see Sections 4.8 and 4.9). **Addressed in the Application**

Table AS3-3 Summary of Key Concerns Raised by the Working Group during the Pre-Application Stage

Topic	Concern (Working Group Member)	Aurora LNG Response and Status
Marine Fish and Fish Habitat	▪ Non-fish species such as mussels, clams, oysters and eelgrass habitat should be included. (Lax Kw'alaams) ▪ Bladed kelp and seaweed should be addressed. (Metlakatla, Gitxaala) ▪ Marine fish must include invertebrates. (arthropods/mollusks) (Gitxaala) ▪ Conceptual offsetting plans should be included in the Application. (Kitselas, Kitsumkalum) ▪ Include impacts to marine fish and fish habitat at potential disposal sites. (CEAA)	The Marine Fish and Fish Habitat VC (see Section 4.0), utilizes a definition of marine fish that is taken from the *Fisheries Act*, which defines fish as: 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. Potential Project effects on eelgrass are assessed as part of the 'Change in Habitat' effect under the Marine Fish and Fish Habitat VC (Section 4.9). Conceptual Freshwater and Marine Fish and Fish Habitat Offsetting Plans are included in the Application (see Sections 4.8 and 4.9). The Marine Fish and Fish Habitat VC (see Section 4.9) assessment of potential effects, includes an assessment of the effects associated with the Project and dredging activities including changes in marine fish health (associated with elevated levels of total suspended solids (TSS)), changes in fish mortality risk (associated with the crushing or burial) and changes in habitat. Effects to harvested species, including marine fish and intertidal species, are also included in the Summary of Statutory Requirements under CEAA 2012 (see Section 11.0) **Addressed in the Application**
Marine Mammals	▪ Presentation of data related to important habitat for marine wildlife, as well as data related to the abundance and availability of those habitats within the Project development area (PDA), Local assessment area (LAA) and Regional assessment area (RAA). (Kitselas) ▪ The Application should identify peak seasonal timing and abundance of marine mammals in the LAA and RAA. (DFO) ▪ "Potential for injury/mortality" must be added as a potential effect to marine mammals. (Lax Kw'alaams, Metlakatla, Gitxaala) ▪ Completion of underwater noise modelling work prior to the submission of the Application. (Kitsumkalum, Gitxaala, DFO)	The assessment for the Marine Mammals VC is conducted in Section 4.10. Change in Mortality Risk was added as a Potential Adverse Project Effect for the marine mammals following the receipt of concerns. In the description of existing conditions, a summary of the seasonal distribution and abundance of marine mammals, as well as any known habitats of importance (e.g., haul out sites) has been presented. More detailed information is presented in the Marine Mammals TDR (see Appendix N). The Marine Mammals TDR presents the results of the vessel-based marine mammal surveys that were completed between July 2014 and June 2015. The TDR also includes information on marine mammals, including distribution and seasonal timing in the marine mammal LAA and RAA from field studies. Marine mammal abundance estimates within the RAA are also provided for species with sufficient sightings. Project specific underwater noise modelling was completed prior to submission of the Application and the results were used to support the assessment of potential changes to marine mammal and marine fish behaviour. Mitigation measures including, the potential implementation of Marine mammal exclusion zones for in-water construction activities, were considered and proposed. **Addressed in the Application**
Marine Birds	▪ Given the importance of the Lucy Islands group for marine birds it should be included within the RAA. (Metlakatla, Gitxaala Kitselas, Kitsumkalum) ▪ Presentation of data related to important habitat for marine wildlife, as well as data related to the abundance and availability of those habitats within the PDA, LAA and RAA. (Kitselas)	Following the receipt of the concerns from Aboriginal Groups, the RAA for marine birds was revised to incorporate Lucy Islands. The assessment for the Marine Birds VC is conducted in Section 4.11. In the description of existing conditions, a summary of the seasonal distribution and abundance of marine birds, as well as any known habitats of importance (e.g., haul out sites) is presented. More detailed information is presented in the Marine Birds TDR (see Appendix Q). The assessment of the Marine Birds VC incorporates seasonal data on abundance and distribution of marine birds collected as part of field studies conducted between July 2014 and June 2015. The methods are more completely described within the TDR. The assessment of change in behaviour for marine mammals and marine birds considers changes in localized movement patterns or access to preferred habitats, and is informed by potential changes in the distribution or availability of prey resources as a result of Project-related activities (as identified in the Marine Fish and Fish Habitat VC). **Addressed in the Application**
Economic Conditions	▪ Terrace should be included in the RAA (Kitselas, Kitsumkalum, NH) and Kitimat in the RAA. (NH) ▪ Hartley Bay and the Gitga'at membership and community should be included in the LAA. (Gitga'at)	The LAA and RAA for the assessment of Project effects on economic conditions (Section 5.0) include Terrace and adjacent communities, and Highway 16 from Terrace to Prince Rupert. Since Project residual effects are not anticipated to interact with similar effects from other projects and activities in the RAA, Kitimat was not included in the spatial boundary of the AIR. The LAA for economic conditions encompasses the communities most likely to be called upon to provide labour, goods and services for the proposed Project. As a result, the LAA includes the mainland portion of the Skeena-Queen Charlotte Regional District, as well as Highway 16 up to and including the Northwest Regional Airport Terrace Kitimat and Mills Memorial Hospital. Hartley Bay (Gitga'at First Nation) is included in the LAA for change in resource-based primary industries and subsistence economies and is also included in the RAA. **Addressed in the Application**
Visual Quality	▪ Visual quality should be a VC. (Lax Kw'alaams) ▪ For visual quality, the visual condition of both the facility and moving vessels should be assessed. (Gitga'at)	Visual Quality was included as a VC (see Section 6.2) following the receipt of concerns. The Visual Quality VC considers the potential for the LNG facility with carriers docked to potentially result in changes to visibility, existing visual conditions and changes to nighttime lighting conditions adjacent to the LNG facility. Visual quality of the shipping lane is not assessed; however, a discussion of visual quality along the shipping route, based on previous studies conducted in the area, is provided as outlined in the AIR. **Addressed in the Application**

Table AS3-3 Summary of Key Concerns Raised by the Working Group during the Pre-Application Stage

Topic	Concern (Working Group Member)	Aurora LNG Response and Status
Infrastructure and Services	▪ Terrace should be included in the RAA (Kitselas, Kitsumkalum, NH) and Kitimat in the RAA. (NH) ▪ Hartley Bay and the Gitga'at membership and community should be included in the LAA. (Gitga'at) ▪ The scope and measurable parameters, particularly inclusion of traffic assessments and access information. (MOTI) ▪ Provision of a plan for worker and equipment transportation. (MOTI)	The LAA and RAA for the assessment of Project effects on infrastructure and services (Section 6.3) include Terrace and adjacent communities, and Highway 16 from Terrace to Prince Rupert. Since Project residual effects are not anticipated to interact with similar effects from other projects and activities in the RAA, Kitimat was not included in the spatial boundary of the AIR. The LAAs for the assessment of potential Project effects on infrastructure and services and community health encompasses communities where Project-related change in population and employment and income could attribute to direct, predictable and measureable adverse change in community infrastructure and services or community health. As a result, the LAA for the Project includes communities within the mainland portion of the Skeena-Queen Charlotte Regional District, as well as Highway 16 up to and including Mills Memorial Hospital (Terrace) and Northwest Regional Airport (Terrace/Kitimat). Hartley Bay is included in the RAA. Measurable parameters for Section 6.3 were updated to include vehicle collisions (collisions/year) and access information, such as ferry volume (trips/day; passengers/day). Information on the transportation of workers and equipment is included in the Infrastructure and Services VC (Section 6.3), as well as the Marine Use and Navigable Waters VC (see Section 6.5). **Addressed in the Application**
Land and Resource Use	▪ Information on land and resource use should also be provided for First Nations reserve and traditional use areas. (HC) ▪ First Nation land and resource use should be analyzed separately from recreational users as well as non-indigenous business users. (Lax Kw'alaams, Kitsumkalum)	The Land and Resource Use VC (see Section 6.4) includes an analysis of Project-related changes in non-tenured land use (including changes in the intensity of use and changes in area currently available for recreational use). As described in Section 6.4.2, traditional knowledge and use related information provided by Aboriginal Groups was reviewed and, where appropriate, integrated into the assessment of potential effects. Existing conditions for the Land and Resource Use was characterized using available information on land and resource use within the LAA and RAA (including information on traditional land and resource use by Aboriginal people both inside and outside First Nations reserves). Section 6.4 primarily addresses non-traditional land and resource use, which includes recreational use and commercial trapping. Aboriginal land and resource use is primarily addressed separately in Section 11.3 and Part C of the Application. In Section 11.3, an assessment of the potential effects on Aboriginal health and the current use of lands and resources for traditional purposes by Aboriginal people is completed to meet the requirements of CEAA 2012 section 5(1)(c). **Addressed in the Application**
Community Health	▪ Terrace should be included in the RAA (Kitselas, Kitsumkalum, NH) and Kitimat in the RAA. (NH) ▪ Hartley Bay and the Gitga'at membership and community should be included in the LAA. (Gitga'at)	The LAA and RAA for the assessment of Project effects on community health include Terrace and adjacent communities, and Highway 16 from Terrace to Prince Rupert (Section 6.6). Since Project residual effects are not anticipated to interact with similar effects from other projects and activities in the RAA, Kitimat was not included in the spatial boundary of the AIR. The LAAs for the assessment of potential Project effects on infrastructure and services and community health encompasses communities where Project-related change in population and employment and income could attribute to direct, predictable and measureable adverse change in community infrastructure and services or community health. As a result, the LAA for the Project includes communities within the mainland portion of the Skeena-Queen Charlotte Regional District, as well as Highway 16 up to and including Mills Memorial Hospital (Terrace) and Northwest Regional airport (Terrace/Kitimat). Gitga'at First Nation has been added to the LAA and RAA for change in harvested foods. **Addressed in the Application**
Marine Use and Navigable Waters	▪ The LAA should be larger. (TC) ▪ Include barge traffic related to dredging and disposal at sea. (CEAA) ▪ Dredging and disposal at sea should be considered in the environmental assessment. (CEAA)	LAAs for the Part B VCs were chosen to encompass the area in which both (a) Project-related effects can be predicted or measured with a level of confidence that allows for assessment and (b) there is a reasonable expectation that those potential effects are of concern. The 1 km buffer along the shipping route was chosen as the Marine Use and Navigable Waters VC (Section 6.5) LAA because potential effects of concern would be concentrated in this area. The RAA extends beyond this 1 km buffer to include the entire Pacific Fishery Management Area 04 plus a 16 km extension westward of Triple Island, providing context for the assessment of potential Project effects. The Marine Use and Navigable Waters VC (see Section 6.5) includes an assessment of effects from all Project-related marine traffic. Marine construction activities, including marine transport, are considered for interaction with the VC. The assessment of marine fish and fish habitat was expanded to include the potential effects of dredging and disposal at sea (see Section 4.9). **Addressed in the Application**

Table AS3-3 Summary of Key Concerns Raised by the Working Group during the Pre-Application Stage

Topic	Concern (Working Group Member)	Aurora LNG Response and Status
Archaeological and Heritage Resources	▪ Impacts on historic places registered and designated under the Local Government Act should be considered, and communities should be consulted. (FLNRO-HB) ▪ Submerged sites should be included. (Metlakatla)	The Provincial Heritage Register includes the BC Register of Historic Places as a subset of records, and was reviewed to assess existing conditions within the Archaeological and Heritage Resources VC (see Section 7.0) LAA and RAA. This included the identification of known archaeological sites, registered historic places and some non-registered historic places. Heritage information held by local governments, archives, museums and historical societies was also solicited and reviewed, where available, to identify historic places valued by a given community that have not yet been formally recognized or protected. Heritage values held by Aboriginal Groups not necessarily protected under the *Heritage Conservation Act* is included, where available, in Section 11.3 and Part C. Archaeological and heritage sites refer to anything that may have heritage value to stakeholders. This includes any archaeological site type and subtype as described in Appendix A of the British Columbia Archaeological Site Inventory Form Guide (Province of British Columbia 2010:27-34) including submerged sites. **Addressed in the Application**
Human Health	▪ Human Health Risk Assessment should be added to the assessment. (HC) ▪ Air quality and the change in human health should be assessed under the Human Health VC. (Gitga'at) ▪ Concerns regarding marine fish/biota (marine country foods) on human health. (MOE) ▪ Potential effects that acidification and eutrophication could have on drinking water with respect to human health should be included. (MOH) ▪ The assessment area for human health will be different for other pathways. (MOH) ▪ Requested more details on the health assessments related to air quality, water quality, sediment quality, and marine country foods. (MOH)	As part of the Human Health VC (see Section 8.0), potential chemical-related human health effects are evaluated using a human health risk assessment framework, consistent with Health Canada guidance. Further details on the human health risk assessment are included in the Human Health TDR (see Appendix R). Potential effects of changes in air quality on human health were also assessed in Section 8.0. Tissue samples from marine harvested foods (crabs, clams) and country foods have been analyzed for a suite of chemicals of potential concern and the results included in as baseline data in Section 8.0. In addition, The Human Health VC assesses potential effects to human health, and includes discussion on water quality (Section 8.0). Potential effects of the Project on water quality, including acidification and eutrophication, are assessed in the Water Quality VC. The Human Health VC RAA coincides with the Air Quality VC RAA (a 50 km by 50 km area centered on the Project) and includes the individual RAAs for all topics within the Human Health VC (i.e., marine harvested foods quality, drinking water quality (freshwater)). Aurora LNG provided details on the assessment methods that are used in the Application and Human Health baseline data related to air quality, water quality and marine country foods (see Section 8.0). The Marine Sediment TDR (see Appendix F) provides details on the sediment quality. **Addressed in the Application**
Accidents and Malfunctions	▪ Significance of effects from accidents and malfunctions on VCs must be included. (Gitxaala)	A significance determination for accidents and malfunctions is included in the Accidents and Malfunctions Section, as per requirements in section 19(1)(a) and (b) of CEAA 2012. **Addressed in the Application**
Aboriginal Interests	▪ Aboriginal Interests must include an analysis of the impact of the Project on Aboriginal Title. (Metlakatla) ▪ Lax Kw'alaams claim to Aboriginal title should be included and dealt with through targeted consultation. (Lax Kw'alaams) ▪ Cultural considerations are missing from the VCs. (Gitxaala) ▪ More than a description of information and concerns raised by Kitsumkalum First Nation should be included in the assessment. (Kitsumkalum) ▪ The Section 13 Order should be discussed. (Kitselas, Kitsumkalum)	Part C of the Application includes an assessment of potential adverse effects of the Project on Aboriginal Interests (including Aboriginal Title). Aurora LNG has made reasonable efforts to gather sufficient background information on physical and cultural heritage required to complete its assessment. In its Application, Aurora LNG summarized relevant existing conditions regarding physical and cultural heritage, including any available information on cultural and traditional practices that may interact with the Project. A brief summary of data sources (both past sources and data collected for the proposed Project) is provided and any important data gaps identified. Assessments in Potential Heritage Effects (see Section 7.0) and Part C (see Section 12.0) describe how information obtained through consultation with Aboriginal Groups was taken into account and integrated. The Aboriginal Consultation Reports, required as per the Section 11 Order (as amended): ▪ Summarize the efforts undertaken by Aurora LNG to consult with Aboriginal Groups in accordance with any relevant provisions in the Aboriginal Consultation Plan, ▪ Use tracking tables to record feedback received during consultation, ▪ Identify the potential adverse impacts of the Project on Aboriginal Interests, ▪ Identify how the potential adverse impacts of the Project on Aboriginal Interests will be avoided, mitigated, addressed or otherwise managed, and ▪ Outline next steps of future consultation activities, other than those outlined in the approved Aboriginal Consultation Plan. An explanation noting that the Order under section 13 amends the section 11 Order is included in the Application (see Section 2). **Addressed in the Application**

Table AS3-3 Summary of Key Concerns Raised by the Working Group during the Pre-Application Stage

Topic	Concern (Working Group Member)	Aurora LNG Response and Status
Other Issues / Concerns	▪ WCC LNG, Grassy Point LNG and other Prince Rupert area LNG proposals and the pipeline for the Project should be included. (Lax Kw'alaams, Metlakatla, Gitxaala) ▪ Metlakatla Development Corp Shellfish Aquaculture and Smith Island Quarry should be included in the project inclusion list. (TC)	The Project and Physical Activities Inclusion List (see Section 3.0) includes WCC LNG, Prince Rupert LNG, Grassy Point LNG and Pacific NorthWest LNG. The Project and Physical Activities Inclusion List was also updated to include the Metlakatla Development Corp Shellfish Aquaculture and Smith Island Quarry. **Addressed in the Application**
	▪ Disposal at sea should be added to the list of construction activities (Gitxaala)	Dredging and disposal at sea are included on the list of construction activities (Table 3-6). **Addressed in the Application**
	• Recycling and solid waste management are important to the regional district	Section 1.0 of the Application describes Project waste management activities. Waste and landfill capacity are discussed in the Infrastructure and Services VC (see Section 6.3). **Addressed in the Application**

PROVINCIAL AGENCIES
BC MOE: BC Ministry of Environment
BC MFLNRO-HB: BC Ministry of Forests, Lands and Natural Resource Operations (Heritage Branch)
BC MOH: BC Ministry of Health
BC MOTI: BC Ministry of Transportation and Infrastructure

FEDERAL AGENCIES
CEAA: Canadian Environmental Assessment Agency
ECCC: Environment and Climate Change Canada
HC: Health Canada
TC: Transport Canada

REGIONAL & LOCAL AGENCIES
NH: Northern Health
BC MFLNRO-SR: Ministry of Forests, Lands and Natural Resource Operations – Skeena Region
SQCRD: Skeena-Queen Charlotte Regional District

ABORIGINAL GROUPS
Lax Kw'alaams: Lax Kw'alaams Band
Metlakatla: Metlakatla First Nation
Gitxaala: Gitxaala Nation
Kitselas: Kitselas First Nation
Kitsumkalum: Kitsumkalum First Nation
Gitga'at: Gitga'at First Nation

Table AS3-4 Summary of Key Concerns Raised by the Public during the Pre-Application Stage

Topic	Key Concern	Aurora LNG Response and Status
Air Quality	▪ Potential impact of emissions from facility construction and operation, and how they may affect residents on Digby Island ▪ Clarity regarding the types and quantities of emissions	Air emissions for the construction, operations and decommissioning have been assessed in the Air Quality VC (see Section 4.2). The air quality assessment focuses on emissions of CACs, namely NO2, CO, PM10, PM 2.5, SO2, H2S, and total VOCs, emitted by the construction, operation and decommissioning of the LNG facility, including all vessels at berth for loading. Potential effects of changes in air quality on human health were assessed in Section 8.0. **Addressed in the Application**
Greenhouse Gases (GHG)	▪ The amount of GHG emissions released from construction and operation of the LNG facility ▪ Confirmation of which regulatory body will manage and monitor GHG emissions	As part of the Greenhouse Gases VC (see Section 4.3), the GHG emissions for all stages of the Project for both the LNG facility and shipping were quantified. The GHG assessment identifies mitigations and monitoring activities proposed for the Project and a separate GHG management plan and outlines specifics about how the mitigations and monitoring activities will be prepared and implemented when finalized Project design details are available. The Application also outlines the provincial and federal regulatory regime related to GHG management and monitoring. As part of the assessment in Section 4.3, the quantified GHG emission totals were compared to provincial and national inventory total. The quantified GHG emission intensity of the Project was also calculated and compared to a sector profile, as well as the intensity threshold included in relevant legislation. **Addressed in the Application**
Acoustic Environment	▪ Noise impacts from construction, including traffic, facility operations and shipping ▪ Impact of increased helicopter and airport traffic on noise levels	Following the receipt of the concerns, the AIR was revised to include Acoustic Environment as a VC (see Section 4.4) and change in overall noise levels, low-frequency noise levels and change in vibration levels were added as potential project effects to be assessed as part of the VC. The result of the Acoustic Environment assessment, include the assessments of change in overall noise levels, low-frequency noise levels and change in vibration levels, as potential project effects are found in Section 4.4. As part of the Acoustic Environment VC (see Section 4.4), noise effects from the operation of the road, as well as LNG carriers and tug boats were considered. Potential increases in noise levels due to a change in air traffic were also addressed. Short-term noise events were addressed qualitatively. **Addressed in the Application**
Water Quality	▪ Impacts to fresh water quality, including impacts to the watershed, small waterbodies and acidification ▪ Impacts to drinking water obtained from surface collection ▪ Impacts to marine water quality from waste disposal and ballast water discharge	Following the receipt of concerns, Water Quality was incorporated as a VC (see Section 4.5). This VC is assessed in comparison to BC water quality guidelines and integrated with the results from the Freshwater Fish and Fish Habitat (Section 4.8), Marine Fish and Fish Habitat (see Section 4.9), Wildlife Resource (Terrestrial) (Section 4.7), and Human Health (Section 8.0) VCs. Potential effects of the Project on air and water quality are assessed in the Air Quality (see Section 4.2) and Water Quality VCs (Section 4.5), respectively. The air quality assessment includes air dispersion modeling within the LAA and RAA inclusive of any watersheds within those areas. The Human Health VC (see Section 8.0) addresses the potential for changes to human health from changes in surface water quality. Project activities are not expected to have direct effects to surface water quality in a manner that would affect human health. There will be no discharges to the freshwater aquatic environment on Digby Island that could affect drinking water. Refer to Section 8.0 for additional detail. Aurora LNG will require that Project-related LNG carriers and escort tugs comply with all relevant national and international shipping requirements regarding disposal of waste, bilge water discharge and ballast water discharge. **Addressed in the Application**
Vegetation and Wetland Resources	▪ Impact to rare plants and ecosystems on Digby Island	The Vegetation and Wetland Resources VC considers red- and blue-listed ecological communities, as well as vascular and nonvascular plants that are red- and blue-listed, SARA-listed and those listed by the Committee on the Status of Endangered Wildlife in Canada (see Section 4.6). **Addressed in the Application**
Wildlife Resources	▪ Potential impacts to wildlife and wildlife habitat, including species at risk, such as marbled murrelet and great blue heron ▪ Impacts of the flare stacks to local or migrating wildlife	The Application evaluates potential effects to wildlife resources, including murrelets and herons, in the Wildlife Resources (Terrestrial) VC (Section 4.7) and Marine Birds VC (see Section 4.11). Mitigation measures are also proposed to reduce the potential impacts of planned flaring events on migratory birds. **Addressed in the Application**
Fish and Fish Habitat	▪ Impacts to fish and fish habitat, including spawning grounds for local fish species ▪ Impact of shoreline disturbances to fish and fish habitat ▪ Loss of eel grass in the vicinity of Digby Island	The Freshwater Fish and Fish Habitat VC (see Section 4.8) assesses the following potential Project effects: change in fish habitat, change in fish mortality or health, and change in fish abundance or relative abundance. The Marine Fish and Fish Habitat VC (see Section 4.9) assesses the following potential Project effects: changes in habitat, behaviour, mortality risk and health. The assessment of change in habitat includes the total area (square metres [m^2]) of marine fish habitat permanently altered or destroyed, which includes intertidal habitat. Potential Project effects on eelgrass are assessed as part of the 'Change in Habitat' effect under the Marine Fish and Fish Habitat VC (see Section 4.9). Conceptual Freshwater and Marine Fish and Fish Habitat Offsetting Plans are included in the Application (see Sections 4.8 and 4.9). **Addressed in the Application**

Table AS3-4 Summary of Key Concerns Raised by the Public during the Pre-Application Stage

Topic	Key Concern	Aurora LNG Response and Status
Economic Conditions	▪ Impacts on local business ▪ Contracting and employment opportunities	The Economic Conditions VC (see Section 5.2) assesses the following potential Project effects: change in labour supply and demand, change in activities for commercial businesses affected by Project spending, and change in resource-based primary industries and subsistence economies. Mitigation measures are also proposed to avoid or reduce potential adverse effects. The Application also describes the economic benefits of the proposed Project in Section 1.3. **Addressed in the Application**
Visual Quality	▪ Degraded visual quality (from highly-valued land and marine sites around the project site). ▪ Potential visual effects (light pollution) due to construction and operations.	The Application evaluates the predicted change in landscape character experienced from important viewpoints near the LNG facility in the Visual Quality VC (see Section 6.2). Mount Comblain was added as a viewpoint as a result of feedback received from the Dodge Cove community. The Visual Quality VC also considers changes to nighttime lighting conditions adjacent to the LNG facility. **Addressed in the Application**
Infrastructure and Services	▪ Impacts due to increased strain on services such as hospitals, RCMP, social services and emergency response ▪ Impact of construction camps on local services and proximity of workers to the community.	The Infrastructure and Services VC (see Section 6.3) addresses the potential change in community, transportation and health care infrastructure and services that could result from the in-migration of temporary and/or permanent populations and Project activities. The Application includes mitigation measures proposed to manage potential demands on infrastructure and services as a result of the Project. In addition, the Application describes camp policies intended to avoid or reduce demand on community infrastructure and services. **Addressed in the Application**
Land and Resource Use	▪ Impacts to land used for recreational purposes and for food harvesting, hunting, and firewood collection ▪ Impacts to visitors and annual seasonal events	The Land and Resource Use VC (see Section 6.4) includes an analysis of Project-related changes in non-tenured land use, including changes in the intensity of use (e.g., visitor trips/year) and changes in area currently available for recreational use. The Application includes mitigation measures proposed to avoid or reduce potential effects on non-tenured land uses. **Addressed in the Application**
Community Health	▪ Protection of community health, safety and mental wellness	As a result of concerns, the Community Health VC was added to the Application. This VC addresses the potential change in community health and wellness resulting from the Project and includes measurable parameters related to health status and select social determinants of health. The Application includes mitigation measures proposed to avoid or reduce potential adverse effects and enhance beneficial effects on community health and wellness. **Addressed in the Application**
Marine Use and Navigable Waters	▪ Impact of increased harbour traffic and access to docks and marine recreational activity ▪ Location of LNG berths and associated impacts to marine traffic routes	The Marine Use and Navigable Waters VC (see Section 6.5) includes an assessment of potential effects on marine navigation and marine fisheries and other uses from construction of marine infrastructure and Project-related marine traffic. The Application includes mitigation measures proposed to avoid or reduce potential effects on marine use and navigation. The Project will adhere to all applicable regulations and operating guidelines to ensure the safe operation and navigation of shipping vessels. Aurora LNG also intends to participate in the voluntary Transport Canada TERMPOL process, which is intended to provide a technical review of marine terminal system and transshipment sites. **Addressed in the Application**
Archaeological and Heritage Resources	▪ Impacts to coastal heritage landmarks	The Application provides information on the archaeological and heritage background of the proposed Project site and includes an assessment of the loss of information about or alteration to site contents or context as a result of the proposed Project in Section 7.0. **Addressed in the Application**
Human Health	▪ Impacts to air quality and water quality on human health	Potential effects of changes in air quality on human health were assessed in Section 8.0. In addition, the Human Health VC includes discussion on water quality (see Section 8.0). Project activities are not expected to have direct effects to surface water quality in a manner that would affect human health. There will be no discharges to the freshwater aquatic environment on Digby Island that could affect drinking water. Refer to Section 8.0 for additional detail. Potential effects of the Project on water quality were assessed in the Water Quality VC (see Section 4.5). **Addressed in the Application**
Accidents and Malfunctions	▪ Public safety in the event of an incident at the LNG facility, and safeguards in place for docking, fuelling and departure of LNG tankers	Section 9 of the Application assesses the potential adverse environmental, social, economic, heritage or human health effects that may result from potential accidents or malfunctions related to the proposed Project. Several types of accidents or malfunctions have been considered. For these potential events, the Application will describe the event, methods for assessing the potential risk, an assessment of the likelihood and probability of the event occurring, mitigation measures to reduce the likelihood of occurrence, assessment of potential effects and/or consequences, and emergency response measures to mitigate the effects and/or consequences, amongst others. Aurora LNG has made safety a priority and takes the safety of its employees, contractors and the public extremely seriously. Aurora LNG also intends to participate in the voluntary Transport Canada Technical Review Process of Marine Terminal Systems and Transshipment Sites process, which will include a comprehensive risk assessment to ensure safety of vessel transits from the terminal to open ocean, the development of recommendations to improve safety and minimize risk and the development of detailed safety procedures and emergency response plans. **Addressed in the Application**

Table AS3-4 Summary of Key Concerns Raised by the Public during the Pre-Application Stage

Topic	Key Concern	Aurora LNG Response and Status
Other Issues / Concerns	▪ Proximity of the Project ▪ Site layout and location, including the flare stack and MOF ▪ Consideration of SIGTTO and Sandia report	Site selection criteria and feedback from the public that resulted in changes to Project design are outlined in Section 1.2 of the Application. Alternative designs for the Project that have and continue to be considered are discussed in Section 1.7 of the Application. With respect to the application of guidance from the Society of International Gas Tanker and Terminal Operators (SIGTTO) and the Sandia report, Aurora LNG notes that it has and will continue to consider guidance from SIGTTO, including the Site Selection and Design Guidelines for LNG Ports and Jetties (SIGTTO 2000), and the Sandia Report entitled Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water (Sandia 2004) as part of facility design, construction and operations. Aurora LNG refers to its technical assessment of the contents and applicability of these documents as provided in the Public Comment Tracking Table (posted 2015/11/23). For the reasons cited in this analysis, Aurora LNG is of the view that, while not currently legally enforced, its current facility component siting is consistent with the recommendations provided by SIGTTO and in the Sandia Report. Aurora LNG will continue to consult with local residents as Project design progresses. **Addressed in the Application**

AS4 ASSESSMENT METHODS

AS4.1 Scoping and Selection of Valued Components

As specified in the AIR, the Application focuses on aspects of the natural and human environment that could be adversely affected by the Project and that have environmental, economic, social, heritage, health, or other importance to government, stakeholders, the public, and Aboriginal Groups. The identified VCs for the Project, potential effects on these VCs, and standard measurable parameters used to assess the extent of effects are presented in Table AS4-1.

Table AS4-1 Potential Effects and Measurable Parameters

Valued Component	Potential Project Effects	Measurable Parameters
Environment Pillar		
Air Quality	Change in ambient CAC concentrations	Increase in magnitude and spatial extent of ground-level concentrations (in µg/m^3) of CACs (SO_2, NO_2, CO, PM_{10} and $PM_{2.5}$) when compared with baseline.
Greenhouse Gases	Emission of GHGs	Release rates of GHGs (CO_2, CH_4, N_2O, reported as CO_2e)
Acoustic Environment	Change in noise level	Overall equivalent continuous A-weighted (dBA) daytime and nighttime sound level (L_d and L_n) Linear (dB) daytime and nighttime sound level (L_d and L_n) [1] A-weighted (dBA) daytime and nighttime equivalent sound level (L_{dn}) Percent highly annoyed (%HA) The difference between A-weighted and C-weighted (dBA and dBC) daytime sound level (L_d) [1] The difference between A-weighted and C-weighted (dBA and dBC) nighttime sound level (L_n) [1]
	Change in vibration level	Ground vibration (mm/s) Air overpressure (dBL)
Water Quality	Change in chemical and physical composition of surface water (freshwater)	Water chemistry (standard water quality parameters, including but not limited to: anions, base cations, dissolved organic carbon (DOC), pH, alkalinity, total suspended solids (TSS), temperature, dissolved oxygen (DO) Acid neutralizing capacity (ANC) to measure the buffering capacity of the water (to predict acidification) Nutrient concentrations (nutrient-nitrogen, phosphorous) associated with algal growth and blooms (eutrophication)
	Change in physical or chemical composition of marine waters	Water properties (physical and chemical): TSS, turbidity, metals, salinity, DO, temperature, pH Sediment properties (physical and chemical): particle size, total organic carbon, organic contaminants (e.g., polycyclic aromatic hydrocarbons [PAH], polychlorinated biphenyls [PCB], dioxins, and furans) and metals

Table AS4-1 Potential Effects and Measurable Parameters

Valued Component	Potential Project Effects	Measurable Parameters
Vegetation and Wetland Resources	Change in abundance of plant species of interest	Abundance (count or occurrence) of: ▪ Federally or provincially listed plant species ▪ Traditional use plant species ▪ Invasive plant species
	Change in abundance or condition of ecological communities of interest	Areal extent (hectares [ha]) of: ▪ Ecological communities at risk ▪ Old-growth forest ▪ Ecological communities identified as sensitive to: ▪ High atmospheric concentrations of NO_2 or SO_2, or ▪ Soil acidification, or ▪ Soil eutrophication from air emissions sources
	Change in wetland functions	Areal extent (ha) of wetland ecosystems (by class) Characteristics of wetland function (hydrological, biogeochemical and habitat functions)
Wildlife Resources (Terrestrial)	Change in habitat	Change in areal extent of habitat (ha); including zones of influence which accounts for species-specific sensory disturbance effects (e.g., noise) and reduction of habitat quality and quantity
	Change in mortality risk	Qualitative estimate of change in wildlife mortality risk due to Project activities: ▪ Interactions with vehicles and equipment ▪ Interactions with Project activities and infrastructure, including effects from light, and removal of nuisance animals
	Change in movement	Qualitative discussion of effects of Project on movement (e.g., newly created openings, sensory disturbance)
Freshwater Fish and Fish Habitat	Change in fish habitat	Total area of freshwater fish habitat permanently altered or destroyed (m^2)
	Change in fish mortality or health	Risk of fish mortalities (all life stages) due to extent, duration, or timing of instream work; or modification of flows
	Change in fish abundance or relative abundance	Fish population abundance or relative abundance (fish/m^2 of instream habitat or catch per unit effort)

Table AS4-1 Potential Effects and Measurable Parameters

Valued Component	Potential Project Effects	Measurable Parameters
Marine Fish and Fish Habitat	Change in habitat	Total area (m^2) of marine fish habitat permanently altered or destroyed Permanent alteration or destruction of habitat used for spawning, rearing, feeding or migration
	Change in behaviour	Timing, duration (hr), intensity (dB), frequency (Hz), and extent (m^2) of underwater noise, relative to published studies of marine fish responses to underwater noise The timing, duration and over-water extent (m^2) of changes in light conditions (over-water structures shading and artificial lighting), relative to published studies of marine fish responses to changes in light conditions
	Change in mortality risk	Total area (m^2) of marine fish habitat within which fish could be crushed or buried Timing, duration (hr), intensity (dB) and extent (m^2) of underwater noise, relative to interim criterion for fish injury A qualitative estimate of the likelihood of a change in mortality risk for marine fish due to entrainment or impingement associated with the seawater intake pipe
	Change in health	Levels (mg/L), spatial extent (m^2), timing and duration of TSS above published thresholds for marine fish
Marine Mammals	Change in health	Timing, duration (hr), intensity (dB) and extent (km) of underwater noise, relative to published and/or industry standards for the onset of auditory injury (i.e., permanent threshold shifts) to marine mammals from underwater noise
	Change in behaviour	Timing, duration (hr), intensity (dB) and extent (km) of underwater noise, relative to published and/or industry standard thresholds for marine mammal behavioural responses to underwater noise
	Change in mortality risk	Estimated change in qualitative likelihood (qualitative) of mortality or injury to marine mammals resulting from Project-related increases in marine traffic (i.e., increased potential for vessel strike)
Marine Birds	Change in habitat	Change in areal extent of marine bird habitat (m^2) in the marine environment
	Change in mortality risk	Change in marine bird mortality risk from vessel-based lighting, the LNG facility, and the marine terminal
	Change in behaviour	Change in localized movement patterns or use of movement corridors from Project infrastructure or activities.

Table AS4-1 Potential Effects and Measurable Parameters

Valued Component	Potential Project Effects	Measurable Parameters
Economic Pillar		
Economic Conditions	Change in labour supply and demand	Qualified labour supply (persons), employment rate, participation rate, non-basic/basic ratio, wage levels, labour income
	Change in activities for commercial businesses affected by Project spending	Value of local and regional spending ($) and related employment
	Change in resource-based primary industries and subsistence economies	Change in resource quality and quantity, change in access to resources, market value of affected resources
Social Pillar		
Visual Quality	Change in visual quality (LNG facility with carriers docked)	Visibility, existing visual condition (EVC)
Infrastructure and Services	Change in community infrastructure and services	Number of workers and their dependents for each phase Demand and supply of community infrastructure and services (e.g., education and municipal services) Parameters based on infrastructure and services affected (e.g., police officers/1,000 population, police caseload, rated capacity/peak demand) Local government expenditures
	Change in accommodations	Availability of accommodations (vacancy rates, inventory levels) Shelter-to-income ratio Cost of accommodation ($) Measures of core housing needs (e.g., adequacy, affordability, and suitability)
	Change in transportation infrastructure and services	Road volume (vehicles/day) Air traffic volumes (aircraft movements, passenger volume) Vehicle collisions (collisions/year) Aeronautical clearance metrics (e.g., vertical and horizontal clearance from the flare stack to the airport landing path in metres)
	Change in health care infrastructure and services	Demand and supply of health care infrastructure and services

Table AS4-1 Potential Effects and Measurable Parameters

Valued Component	Potential Project Effects	Measurable Parameters
Land and Resource Use	Change in tenured land use and private property	Area (ha) of tenured land-use overlapped by the proposed Project Attribute data on overlapping land uses
	Change in non-tenured land-use	Areas (ha) of current recreational use (e.g., hunting, hiking, and skiing that would be restricted) Access to land use areas Intensity of use of area (e.g., visitor trips/year)
Marine Use and Navigable Waters	Change in marine navigation	Extent (width in metres and area in m^2) of the navigable channel affected by Project infrastructure. Shipping traffic in Prince Rupert harbour (ships per year)
	Change in marine fisheries and other uses	Shipping traffic (ships per year) Fisheries area affected (e.g., fishing area that is overlapped by the shipping route) Attribute data on fisheries (e.g., target species, fishing gear types, harvest volume, frequency, access) Attribute data on other uses (e.g., recreational boating routes, marine park locations, visitor frequency, and access)
Community Health	Change in community health and wellness	Occurrence rates for medical and mental health incidents Qualitative assessment of the following social determinants of health: income and social status, social support networks, social environments, personal health practices and coping skills
	Change in harvested foods	Qualitative assessment of: ▪ Volume of foods harvested ▪ Harvested foods consumption
Heritage Pillar		
Archaeological and Heritage Resources	Loss of information about or alteration to site contents or context	Number, area, density, uniqueness and value of CMT sites/individual CMTs altered or removed through logging or vegetation clearing Number, volume, density and value of other heritage resources, archaeological sites and historic places being altered or removed

Table AS4-1 Potential Effects and Measurable Parameters

Valued Component	Potential Project Effects	Measurable Parameters
Health Pillar		
Human Health	Changes to human health from changes in air quality	Concentration ratio (CR) for health risks from exposure to non-carcinogenic chemicals.
	Changes to human health from changes in surface water quality	Hazard quotient (HQ) for health risks from exposure to non-carcinogenic chemicals.
	Changes to human health from changes in harvested food quality	Hazard quotient (HQ) for health risks from exposure to non-carcinogenic chemicals. ILCR for cancer risk from exposure to carcinogenic chemicals

NOTE:

[1] Measurable parameter for low frequency noise effect

AS4.2 Assessment Boundaries

The spatial assessment areas boundaries for each VC are specified in the AIR and are selected principally with consideration of the geographic extent of measurable potential environmental, economic, social, heritage and health effects of the Project and with consideration to comments received from members of the Working Group.

The PDA is the boundary that encompasses the terrestrial and marine areas that will be developed to accommodate the LNG facility and the marine terminal. The total terrestrial area of the Project is approximately 773 ha; the total marine area is 13 ha.

The LAA for each VC encompasses the area (a) in which Project-related effects can be predicted or measured with a level of confidence that allows for assessment; (b) where there is a reasonable expectation that those potential effects will be of concern; and/or (c) that has been independently established by regulators in the AIR. The LAA for each VC is described in the relevant VC sections.

The RAA is defined for each VC, and is the area that establishes the context for the determination of significance of Project-specific effects. It is also the area within which potential cumulative effects—the residual effects from the Project in combination with those of past, present and reasonably foreseeable projects—are assessed.

The LAA and RAA for each VC are described in the relevant VC sections. As part of the Application development process, some of the VC spatial boundaries were adjusted from those described in the AIR. These adjustments were made based on sampling or modelling results, as per the process outlined in the AIR; the rationale for these changes is provided in the relevant VC sections.

Any relevant temporal, administrative, and technical boundaries are also identified and discussed in the VC sections.

AS4.3 Existing Conditions

Existing conditions are described for each VC in its applicable section in sufficient detail to allow potential interactions to be identified, understood, and assessed, and compared to estimated changes. The existing conditions focus on the information required to adequately address the measurable parameters defined for each VC.

AS4.4 Project Interactions

The potential Project interactions with each VC are identified and assessed in the VC sections consistent with those identified in the AIR. Justification is provided for non-interactions, including any input received from BC EAO, the Working Group, government agencies, Aboriginal Groups and the public.

AS4.5 Assessment of Project Residual Effects

Potential Project effects are assessed for each VC following a standard approach consistent with BC EAO guidance (EAO 2013):

- A description of the analytical techniques applied in the assessment of potential effects is provided for each VC, including a discussion of conservative assumptions made
- Mechanisms by which Project activities and actions could result in environmental, economic, social, heritage, or health effects are described for each VC. Where applicable, the Project effects mechanisms are described for each phase (i.e., construction, operations and decommissioning)
- Mitigation measures that reduce or eliminate potential adverse effects are identified
- Residual effects are characterized using the following criteria:
  - Magnitude
  - Geographical extent
  - Frequency
  - Duration
  - Reversibility
  - Context.
- Threshold criteria for each potential effect, beyond which a residual effect would be assessed as significant, are identified
- Likelihood of a residual adverse effect occurring and the rationale for this determination is discussed
- Project residual effects for each selected VC are characterized.

AS4.6 Assessment of Cumulative Effects

Each VC section includes an assessment of potential cumulative effects that could occur when residual effects resulting from the Project interact with similar effects of past, present, and reasonably foreseeable future projects and activities.

The assessment of cumulative effects is initiated only when two conditions are met:

- The Project is assessed as having residual environmental effects on the VC
- The residual effects could act cumulatively with residual effects of other past, present, or reasonably foreseeable future physical activities.

If either condition is not met, the cumulative effects assessment for that particular effect is not carried forward because the Project would not interact cumulatively with other projects or activities.

The RAA boundaries for each VC are used to assess the potential for cumulative effects.

AS4.7 Determination of Significance

The significance of each Project-specific residual effect is determined using the significance thresholds defined during the assessment of residual effects. This same threshold is used to determine the significance of residual cumulative effects. The Project's contribution to residual cumulative effects is also described (i.e., how much of the total residual cumulative effects can be attributed to the Project). Prediction confidence in the conclusions about Project-specific and cumulative effects is described for each VC.

AS5 ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS

AS5.1 Environmental Background

Section 4.1 of the Application summarizes the existing biophysical environment for the Project area (PDA and surrounding areas), to provide a general understanding of current conditions in the Project area.

AS5.2 Air Quality

Air Quality was selected as a VC because of its intrinsic importance to the health and well-being of people, wildlife, vegetation, and other biota. The atmosphere is an important pathway for transport of contaminants to the human, freshwater, and terrestrial environments, and has been identified as a concern to Aurora LNG, regulators, Aboriginal Groups, stakeholders, and the public. Other VCs that are supported by components of this assessment are Water Quality, Vegetation and Wetland Resources, and Human Health.

Conclusions of this assessment are based on dispersion modelling completed in a manner consistent with the Guidelines for Air Dispersion Modelling in British Columbia (the Guidelines). The effect of the Project on air quality is determined in part by comparing predicted concentrations to applicable objectives. Applicable objectives for CACs include the British Columbia Ambient Air Quality Objectives (AAQO), the National Ambient Air Quality Objectives, and the Canadian Council of Ministers of the Environment's (CCME) Canadian Ambient Air Quality Standard. The potential effect addressed in the air quality assessment is the increase of CAC concentrations due to Project air emissions.

The LAA for Air Quality is a 30 km by 30 km square centered on the PDA, and was selected as the study area where Project effects are expected to be greatest. The RAA is a 50 km by 50 km square area centered on the PDA. The RAA provides the required spatial coverage and includes sources that may have overlapping effects with the Project effects.

Ambient air quality measurements indicate that CAC concentrations are low and that the existing air quality in the RAA is good overall. Existing air quality conditions are influenced by existing marine-based regional sources (i.e., vessel movement and anchorage in Prince Rupert Harbour) and some nearby industrial facilities.

Construction activities that could change air quality are the use of heavy equipment and vehicles during site clearing and grading, construction and upgrading of existing access roads; mobilization of materials to Digby Island; Project commissioning; start-up; marine-based transport; dredging; and installation of the marine terminal. The emission rates from these activities during the construction phase are small relative to the operations phase.

Operation activities that could change air quality are the operation of the LNG facility, LNG production, and LNG shipping (LNG carrier and tugboat traffic). During decommissioning, dismantling of land-based and marine infrastructure and site remediation/reclamation will produce CAC emissions. However, these emissions are expected to be much less than during construction or operations.

The assessment of changes in CAC concentrations focuses on the operations phase only. Emissions during construction will be less than during operations; therefore, the assessment assumes that if ambient CAC concentrations during operations are less than the applicable objectives, they will also be less than the applicable objectives during the construction and decommissioning phases.

The estimated total annual Project-alone case air emissions (long-term, based on the 98th percentile of daily 1-hour maxima, averaged over one year) are as follows:

- Sulphur oxides = 713 tonnes per year (t/y)
- Nitrous oxides ($NO_{x)}$) = 4,941 t/y
- Carbon monoxide (CO) = 5,420 t/y
- Respirable particulate matter (<2.5 µm in aerodynamic diameter; PM_{10}) = 19.2 t/y
- Inhalable particulate matter (<10 µm in aerodynamic diameter; $PM_{2.5}$) = 18.4 t/y.

All predicted CAC concentrations are less than the applicable objectives. Maximum predicted ground-level CAC concentrations are located either at the Project PDA or within the immediate vicinity of the Project on Digby Island, and decrease within increasing distance from the source.

Outside of industry-standard mitigation measures, specific Project design mitigation measures include:

- Optimizing timber salvage
- Minimizing open burning of accumulated waste materials from the construction camp
- Developing and implementing an Air Quality Management Plan
- Adopting best commercially available equipment to maximum practical extent (e.g., continuous NOx emissions associated with the gas turbine exhaust will be managed by adopting the BC Best Achievable Technology Policy into the Project engineering design)
- During normal operating conditions, operating combustion sources at optimal efficiency settings to reduce fuel consumption
- Recovering boil-off gas during storage and loading processes, and re-injecting the recovered gas into the fuel / feed gas system.

An environmental effect will be considered significant if ambient concentrations are greater than the relevant applicable objectives (i.e., are high in magnitude) and are of concern relative to the geographical extent of predicted exceedances, their frequency of occurrence and the presence of potentially susceptible receptors (e.g., human, wildlife, vegetation, soils, or water bodies) that uptake ambient air.

Predicted CAC concentrations associated with the Project-alone case were less than the applicable objectives. With proposed mitigation measures, potential adverse residual effects will be moderate in magnitude, local in extent, and continuous over the life of the Project. Once Project operations ceases, adverse effects will be reversible. With adherence to applicable legislation and regulations, and implementation of Project-specific mitigation measures, residual Project effects on change in ambient CAC concentrations are predicted to be not significant.

Cumulative residual effects on air quality were quantified within the RAA. For locations in close proximity to the Project (e.g., residential locations in Dodge Cove or Prince Rupert), the Project contribution to changes in ambient CAC concentrations is greater than at locations in Port Edward or Metlakatla village.

Predicted concentrations were generally less than the applicable objectives. Predicted exceedances were infrequent and were partly attributed to existing regional or future regional project contributions.

With proposed mitigation measures, potential cumulative residual effects will be low to moderate in magnitude, local in extent, and continuous over the life of the Project. Once Project operations cease, adverse effects will be reversible. With the implementation of Project-specific mitigation measures, and the mitigation measures of other projects within the RAA, the residual cumulative effects on change in CAC concentrations are predicted to be not significant.

AS5.3 Greenhouse Gases

Greenhouse Gases (GHGs) was selected as a VC because GHGs will be released into the atmosphere during construction, operation, and decommissioning of the Project, and has been identified as being of concern to Aurora LNG, regulators, stakeholders, Aboriginal Groups and the public. A GHG can be any atmospheric gas that absorbs and re-emits infrared radiation, thereby acting as a thermal blanket for the planet and warming the lower levels of the atmosphere. GHG emissions are a global issue with environmental and political importance. Current provincial and federal legislation mandates the reporting of annual GHG emissions from industrial facilities and compliance with a regulated emission intensity threshold applicable to LNG facilities.

The potential effect addressed in the GHG assessment is the emission of GHGs. No spatial or regional spatial boundaries (e.g., LAA or RAA) are used in the assessment of GHGs as the environmental effect associated with GHG emissions is a global phenomenon. The assessment considers the release of GHGs associated with the LNG facility's construction, operations, and decommissioning phases and associated with shipping activities. Provincial and federal policy and legislation for GHG emissions do not provide a quantitative significance threshold; therefore, the GHG assessment uses CEA Agency guidance, professional judgment (i.e., interpretation of the precedent set by the BC EAO on similar projects), and an industry profile to arrive at a significance determination. The most recent federal (National Inventory Report (NIR)) estimate for total GHG emissions in Canada, completed for 2014, is 732 million tonnes (Mt) of carbon dioxide equivalent (CO_2e) for that year, with 62.9 Mt of CO_2e attributed to BC.

The primary source of GHG emissions during construction will be activities associated with land clearing and biomass decay, and the operation of vehicles, vessels, and heavy equipment used to build the facilities. The primary source of GHG emissions during operations will be combustion sources, such as gas turbine-driven compressors and incinerators, along with emissions from LNG carriers and tug boats. In the decommissioning phase, GHG emissions from the dismantling of LNG facility is expected to result in lower GHG emissions than during the construction phase; the potential effect associated with decommissioning is assessed qualitatively.

A GHG Management Plan will be prepared to identify the requirements of relevant GHG reporting legislations and will contain requirements for continuous assessment of monitoring and management. Current provincial and federal legislation mandates the reporting of annual GHG emissions from industrial facilities as well as compliance with a regulated emission intensity benchmark applicable to LNG facilities (ECCC 2015, Government of BC 2016a, and Government of BC 2016b). Additionally, Aurora LNG will be required to pay the BC carbon tax on the combusted fuel amounts.

In addition to industry-standard mitigation measures, specific Project design mitigation measures include the following:

- Using buses, where feasible, at the facility and construction camp to reduce traffic emissions
- Optimizing timber salvage
- Minimize open burning of accumulated waste materials from the construction camp
- Using efficient gas turbine technology to drive the refrigeration compressors in the liquefaction process
- Recovering boil-off gas during storage and loading processes, and re-injecting the recovered gas into the fuel / feed system.

The Project, under full build-out scenario, which includes four trains, will release approximately 925,970 tonnes of CO_2e into the atmosphere over the entire construction period. Approximately 46% of the Project's GHG emissions are from land clearing activities, 48% are from site preparation (fleet emissions) and on-shore construction, and 1% and 5% are from marine construction and vehicle traffic, respectively.

To determine the effect of construction activities, GHG emissions are compared to the Provincial Inventory Report (PIR) and NIR totals. The PIR and NIR list total values for land clearing emissions but not for construction activities. Site preparation, which includes land clearing and biomass decay, will take place over four years. Therefore, if assumed to be evenly distributed, emissions affecting the PIR and NIR would be estimated at 104,836 tonnes CO_2e per year. Compared against the PIR and the NIR totals, it is estimated that site preparation (land clearing and biomass decay) activities would increase the PIR and NIR totals by 0.17% and 0.01%, respectively.

For operations, the Project design conservatively includes GHG emissions from natural gas fired compressor turbine drives and power generation turbines. It has been assumed that all power requirements will be generated onsite and no electricity will be imported from the BC Hydro grid. As the facility design advances through the detailed engineering (Pre-FEED and FEED) efficiencies and optimum equipment selections are expected to result in reduced overall project operation emissions.

During operation of the full build-out scenario, Project emissions are estimated at 6,669,335 tonnes CO_2e per year, which include emissions from stationary combustions, flares, thermal oxidizers, and domestic vessel traffic (i.e., tugs). The emissions from LNG carriers are excluded from the annual operation total as they are not used to calculate emissions intensity. Assuming total LNG production volume of 24 MTPA, the emission intensity of the Project is 0.28 tonnes CO_2e per tonne of LNG produced. When the Project's annual total GHG emissions are compared to the 2014 PIR and NIR, at full build-out, the Project would increase 2014 provincial and national inventory values by 10.6% and 0.9%, respectively.

It is acknowledged that GHG emissions from anthropogenic sources are likely to be altering the global climate. Since the Project will be contributing GHG emissions to a cumulative effect of global GHGs levels on climate change, the Project's GHG emissions are considered significant in the cumulative effects assessment case.

AS5.4 Acoustic Environment

The Acoustic Environment was identified as a VC because activities during construction, operations, and decommissioning of the Project will generate noise. The acoustic environment has been identified as a topic of concern to Aurora LNG, Aboriginal Groups, stakeholders, and the public. For the purpose of this assessment, noise is defined as unwanted sound and has the potential to affect the health and well-being of humans. The VC also considers effects on humans from vibration caused by blast-induced ground movement and air blast overpressure, as well as vibration from construction equipment and piling. Other VCs that are supported by components of this assessment are Wildlife Resources, Marine Mammals, and Marine Birds. Potential changes to underwater sound levels are addressed in the Marine Mammal VC and are also discussed in the Marine Fish and Fish Habitat VC.

Noise levels are regulated by provincial guidelines. Federal guidance provides additional direction on managing noise levels. The potential effects considered in this assessment are change in noise level, and change in vibration level.

The LAA for this assessment is an area extending 2 km out from the PDA. The RAA extends 5 km out from the PDA to capture potential cumulative effects. The RAA includes Metlakatla village to the north, Prince Rupert to the east, and Ridley Island to the south.

The existing acoustic environment of the LAA and RAA contains both natural sounds and those generated by human activities. Human activities include marine traffic, marine terminal operations, aircraft flyovers, rail traffic, residential and commercial activities, and vehicle traffic. Existing sounds levels were obtained from a monitoring program and from values established by the BC Oil and Gas Commission (BC OGC) for various noise receptors (e.g., residences, schools).

Noise levels were modelled to assess Project effects. In the construction phase, noise emissions from activities such as site preparation, onshore construction, dredging, and marine construction will result in a change in overall noise levels. During the operations phase, noise emitted from the LNG processing facility and hoteling of LNG carriers will result in a change in overall noise levels. Noise effects during the decommissioning phase are expected to be lower than those for the construction and operations phases.

Mitigation measures will be implemented to reduce potential noise and vibration effects during the construction and operations phases. With respect to noise, it is assumed that acoustical specifications can be achieved by equipment suppliers in order to achieve the required noise limits at receptors, or that equipment will be acoustically treated, if required. Industry-standard mitigation measures will be implemented; measures aimed at reducing high impulsive noise include:

- High disturbance Project related activities (e.g., blasting and pile driving) will occur between the daytime hours of 7 a.m. and 10 p.m.
- Drill piling will be considered where conditions permit for land-based construction
- Vibro-hammer piling equipment will be considered for use where conditions permit for marine based piling operations.

Mitigation measures to limit the change in vibration level include setting a maximum blast charge for different distances between blast and receptor, and implementing a process to address vibration complaints in a timely manner.

For change in noise levels and change in vibration levels, effects are considered significant when the predicted level does not meet the provincial and federal noise guidance and vibration guidance respectively. Noise effects from construction and operation of the Project will comply with the BC OGC Noise Guideline and Health Canada noise guidance. Vibration effects from construction of the Project will comply with provincial and federal vibration guidance. With mitigation and environmental protection measures, the residual effects on the acoustic environment are predicted to be not significant.

Noise and vibration levels from the Project, in combination with those of future BC OGC-regulated project and existing activities in the RAA, are expected to comply with provincial and federal thresholds for noise. The residual cumulative effects on the acoustic environmental are predicted to be not significant.

AS5.5 Water Quality

Although marine and freshwater are considered as one Water Quality VC, they have been assessed separately because the project interactions, assessment methods, project mechanisms for environmental change, mitigation measures, and potential cumulative effects differ between marine and freshwater. The freshwater quality assessment focuses on potential acidification and eutrophication effects related to air emissions from the proposed LNG facility. The marine water quality assessment focuses on potential effects of dredging and sediment disposal and of discharges to the marine environment.

Freshwater quality was selected as a VC because of the importance of freshwater for aquatic life and recreational and drinking water usage. Components of this assessment integrate information from the Air Quality VC because of potential for Project air emissions to interact with freshwater quality through changes in pH (acidification) or nutrient regimes (eutrophication), which may lead to adverse effects in receiving freshwater lakes and streams. Other VCs that are supported by components of this assessment are Wildlife Resources, Freshwater Fish and Fish Habitat, Marine Fish and Fish Habitat, Marine Mammals, Marine Birds, and Human Health.

Sulphur dioxide (SO_2) and total NO_x deposition from Project emissions could affect surface water (freshwater); the potential effect assessed is the change in chemical and physical composition of surface water (freshwater).

For surface water (freshwater) quality, the LAA is same as for the Air Quality VC, which uses a 30 km by 30 km square centered on the PDA. Similarly, the RAA is the same as for the Air Quality VC, which uses a 50 km by 50 km square centered on the PDA. The area of the LAA is 90,000 ha^2 and the area of the RAA is 250,000 ha^2.

Lake and stream water within the RAA generally has low conductivity, pH, alkalinity, and nutrients, with 93% of the 30 lakes and 9 streams studied having pH below the BC water quality guideline of 6.5. Naturally low pH levels for surface water may be influenced by surrounding geological and soil characteristics. More than half (62%) of the waterbodies assessed were characterized as having low to very low acid sensitivity; 18% were categorized as having high acid sensitivity and 20% were categorized as sensitive or moderate.

Dispersion models were used to estimate SO_2 and NOx deposition into lakes and streams, which were then used to assess acidification and eutrophication. Risk assessment frameworks were applied to characterize the categories of concern related to acidification and eutrophication. The Project has the greatest potential to affect freshwater quality during the operations phase, when the SO_2 and NO_x emissions generated from the facility and vessels may be large enough to result in acidification or eutrophication.

In addition to industry-standard mitigation measures, specific Project design mitigation measures are those aimed at limiting SO_2 and NOx emissions:

- Optimizing timber salvage
- Minimizing open burning of accumulated waste materials from the construction camp
- Developing and implementing an Air Quality Management Plan
- Adopting best commercially available equipment to maximum practical extent
- During normal operating conditions, operating combustion sources at optimal efficiency settings to reduce fuel consumption
- Recovering boil-off gas during storage and loading process, and re-injecting the recovered gas into the fuel/feed gas system.

Additional mitigation measures that will reduce the effects of the Project on surface water quality (freshwater) are included in the Air Quality VC assessment.

A significant adverse residual effect on freshwater ecosystems from acidification or eutrophication is one that is predicted to result in impaired conditions in waterbodies extending through the LAA and RAA. With mitigation, the Project residual effects on freshwater quality are predicted to be not significant because the significance thresholds will not be exceeded for acidification or eutrophication. No waterbodies represented in the dataset used for the assessment are predicted to have a biologically significant change in pH with critical load exceedances due to acidic input. One dystrophic lake on Digby Island had a predicted nutrient-nitrogen critical load exceedance, which is below the significance threshold.

Project cumulative effects on freshwater quality are considered to be not significant. Although three streams were modelled to have exceedances of the significance threshold for acidification, pH changes were considered to remain protective of aquatic biota. Site-specific conditions indicate the predicted changes in pH due to cumulative air emissions in the three streams will not be significant. For cumulative effects specific to eutrophication, the significance threshold was not exceeded.

Marine water was selected as a VC because of the importance of water quality in maintaining healthy marine ecosystems and supporting a wide range of recreational and cultural activities. The marine water quality section also addresses marine sediment, given that sediment and water quality are closely related and many marine organisms live in close association with the ocean floor. Other VCs supported by components of this assessment are Marine Fish and Fish Habitat and Human Health.

The potential effect assessed is the change in physical and chemical composition of marine waters. Contaminants and TSS may be mobilized during dredging and other marine construction work, and Project-related wastewater inputs have the potential to affect the marine environment.

The LAA for marine water quality is marine waters within 500 m of the proposed PDA, plus the proposed sediment disposal site at Brown Passage (an area 1 nautical mile in diameter), and an extension to the north end of Casey Cove. The RAA is the spatial extent of the Skeena River Estuary, as it encompasses marine waters where commercial, recreational, and Aboriginal fish species and important habitats are present and may be affected by the proposed Project.

Existing conditions reflect the long history of industrial activity in the Prince Rupert Harbour, which may influence water and sediment quality. Sediment quality in the proposed dredge areas is generally good, meeting the CCME Interim Sediment Quality Guidelines and disposal at sea screening criteria for the majority of parameters. Guideline exceedances were identified in surface sediment (top 0.2 m) for dioxins and furans (polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans; PCDD/Fs related to historical discharges of pulp mill effluent) and throughout the sediment depth profile for copper and arsenic (naturally occurring concentrations). No exceedances were noted for other metals, PAHs, or PCBs. Water chemistry in samples collected at the proposed dredge areas reflected existing conditions in the RAA. In the water samples collected for the Project, no physical parameters, anions, or nutrients exceeded their BC MOE water quality guidelines, except for boron (all samples, typical of BC water) and copper (one sample, just above the guideline). Water clarity was high at all sites.

Sediment dispersion and deposition at the dredge sites and the disposal site were modelled to identify whether dispersed sediment could result in a measurable change to water and sediment quality. Dredging has the greatest potential of all Project mechanisms to alter marine water quality. Other construction activities and discharges related to construction and operations may also alter marine water quality (e.g., pile driving, blasting, release of treated sanitary wastewater, marine outfalls, bilge water). During dredging, released sediment will result in increased TSS and turbidity levels in the water column before it settles again. Sediment released during dredging of the surface 0.2 m layer will contain PCDD/Fs, a small proportion of which will also disperse and resettle (surface sediment will be disposed of on land).

In addition to industry standard mitigation measures, specific Project design mitigation measures to reduce potential adverse effects on marine water quality include:

- A 30 m marine riparian disturbance buffer will be applied, except where infrastructure access to the marine environment is required (e.g. Marine Terminal, Material Offloading Facility), or for safety or security considerations. On the east side of Digby Island this buffer will be of variable width, extending beyond the 30 m minimum in some areas.
- Development of a water quality monitoring program to measure turbidity during dredging to identify exceedances of predicted TSS values outside the work area
- Use of dredge methods that reduce sediment spill and dispersion
- Use of silt curtains, where practicable, to reduce the spatial extent of suspended sediments in the water column during dredging activities
- Consideration for use of tugs equipped with propulsion systems that reduce sediment scour
- Disposal of the top layer of sediment (up to 0.5 m) of the dredge footprints on land at an identified area on Digby Island.

A significant residual adverse environmental effect on marine water quality is one that is predicted to result in a change in sediment or water quality that would result in a health risk to a local population of marine biota (toxicity for contaminants, habitat and physical damage to fish for suspended sediments). A health risk would be identified in consideration of water and sediment quality guidelines, the conservatism built into those guidelines, and spatial extent and duration of exposure to altered water quality.

With mitigation, the Project residual effects on marine water quality are predicted to be not significant. During construction, dredging will result in limited areas with TSS levels above the 5 milligrams per litre (mg/L) guideline for protection of marine life, with the highest concentrations localized to the immediate surroundings of the dredge area for short periods of time (TSS levels will return quickly to background levels when dredging stops each day). Disposal of dredged sediment is predicted to result in high TSS levels localized within the disposal site immediately following release from the barge. Contaminant (PCDD/F) mobilization during dredging will occur over a small area for a short duration and any change in surface sediment contaminant levels in the surrounding area will be minor and not of a magnitude to cause toxicity in aquatic life. Other project activities (other construction, effluent discharges, and vessel operation during operation) will have low magnitude effects.

Project cumulative effects are also predicted to be not significant because no spatial overlap of the Project residual effects with those of other projects is expected to occur. For the same reason, the Project is not expected to contribute to cumulative effects.

AS5.6 Vegetation and Wetland Resources

Vegetation and Wetland Resources was selected as a VC because of its potential to interact with Project activities during construction, operations, and decommissioning, and because of its ecological, economic, recreational, and cultural importance to Aurora LNG, regulators, stakeholders, Aboriginal Groups, and the public. For the purpose of this assessment, vegetation and wetland resources include all terrestrial and wetland vegetation above the high water mark as determined through terrestrial ecosystem mapping (TEM) and include estuarine wetland associations. Eelgrass is considered in the assessment on Marine Fish and Fish Habitat, as is marine riparian vegetation. Freshwater riparian vegetation is addressed in Freshwater Fish and Fish Habitat.

Plant species assessed are vascular and non-vascular plants and lichens. No floodplain ecological communities were identified in regional mapping or during field studies; therefore, they have not been included in the assessment. Other VCs supported by this assessment are Wildlife Resources, Freshwater Fish and Fish Habitat, Marine Birds, Visual Quality and Community Health.

Potential effects of the Project on vegetation and wetland resources will occur primarily as a result of site preparation during construction, including clearing and grubbing. These activities will lead to an unavoidable loss of vegetation and wetland resources. During operations, Project air emissions could result in direct damage to plants through elevated atmospheric concentrations of nitrogen dioxide (NO_2) or SO_2. These emissions could also indirectly affect vegetation through soil acidification (via acid deposition) or soil eutrophication (via nitrogen deposition). Three potential effects are assessed: change in abundance of plant species of interest; change in abundance or condition of ecological communities of interest; and change in wetland functions.

The LAA for potential effects of Project infrastructure and ground disturbance on vegetation and wetland resources is the PDA plus the land portion within a 1.5 km buffer of the PDA. The vegetation acidification local LAA (VALAA) for potential effects of high concentrations of NO_2 and SO_2 and soil acidification and eutrophication on vegetation and wetland resources is the area where the Cumulative Effects Assessment Case (CEA Case) CALPUFF air quality modelling results exceed the acid deposition critical load of $\geq$150 equivalent per hectare per year. The RAA is composed of the terrestrial portion of the Tuck and Kaien Landscape Units. The areas of the terrestrial LAA and VALAA are 2,793 ha and 34,088 ha, respectively. The area of the RAA is 102,126 ha.

The assessment areas are relatively undisturbed, with anthropogenic unvegetated area accounting for 4% or less in each assessment area: 2,462 ha of the RAA, 1,486 ha of the VALAA, 105 ha of the terrestrial LAA, and 4 ha of the PDA. These areas include a variety of disturbance types, including railway, roads, urban and rural areas, and industrial build-up.

During the TEM ground-truthing and rare plant surveys for the Project, 287 plant species were recorded. No *Species at Risk Act* (SARA) listed species were identified during field surveys or desktop search of known locations. One red-listed species (*Sphagnum majus*) was identified during geotechnical surveys, and one blue-listed species (*Sphagnum centrale*) was identified during rare plant surveys. Both of these peat moss species were identified in wetlands in the PDA. Within the LAA, there are 1,100.9 ha of wetlands (30.9 ha of ecologically important wetland). During field studies, 37 TU species were observed in the terrestrial LAA. No invasive species were found in the LAA during field studies.

Existing information about acidification and eutrophication conditions in the RAA, obtained from air quality and soil modelling results, indicated no exceedances of NO_2, SO_2, soil acidification, or soil eutrophication thresholds.

In addition to industry-standard best management practices, the following mitigation measures will be implemented:

- Pre-construction rare plant surveys will be conducted in the PDA, near known locations of rare plants.
- The red-listed non-vascular plant, *Sphagnum majus* (no common name), and blue-listed non-vascular plant, *Sphagnum centrale* (no common name), will be translocated from the known locations within the PDA.
- An Invasive Plant Management Plan will be implemented.
- The occurrence of CWHvh2/15 Sitka spruce / Oregon beaked-moss shoreline forest in the PDA will be avoided and clearly field-marked.
- Windthrow management (e.g., edge stabilization techniques) in forested areas will be implemented following BC windthrow management guidelines.
- Existing hydrological regimes and natural flow patterns will be maintained where practicable, and stormwater collection, treatment, and disposal will be managed during construction and operations.
- Where wetlands, waterbodies and watercourses can be successfully avoided in the PDA, wetland riparian buffers will be applied as per the Environmental Protection and Management Guide.
- Where modelling predicts effects to occur to vegetation from NO_2 and SO_2 atmospheric concentrations, soil acidification, or soil eutrophication, vegetation and soils will be periodically monitored as necessary in consultation with the BC MOE.
- A Wetland Compensation Plan will be implemented to meet the requirements of no net loss of wetland functions for those wetlands defined as ecologically important by Environment and Climate Change Canada.
- A wetland monitoring program will be implemented to determine the effectiveness of restored, enhanced, or created wetland habitat associated with the Wetland Compensation Plan.

Significant residual effects for vegetation and wetland resources are defined as follow:

- For change in abundance of plant species of interest - residual effects on plant species of interest are considered significant if the viability of these plant species is impaired within the RAA.
- For change in abundance or condition of ecological communities of interest - residual effects on ecological communities of interest are considered significant if they interfere with the sustainable persistence of these communities within the RAA.
- For change in wetland functions - residual effects on wetland functions are considered significant if they result in an uncompensated net loss of wetland functions of ecologically important wetlands as defined by guidance from Environment and Climate Change Canada.

Project residual effects to vegetation and wetland resources are predicted to be not significant, given the implementation of mitigation measures and that significance criteria will not be exceeded. The change in abundance of plant species of interest will not impair viability of these species within the RAA (red- and blue-listed species will be translocated from the PDA and TU plants are abundant elsewhere in the RAA). The change in abundance or condition of ecological communities of interest will not interfere with the sustainable persistence of these communities in the RAA. The Project will add up to 763 ha of loss or disturbance to vegetated areas to the 6,371 ha already disturbed or lost due to past or present activities and projects in the RAA, an increase of about 1% for ecological communities of interest, which will not impair sustainable persistence of these communities within the RAA. Project-related effects of NO_2, SO_2, soil acidification, and soil eutrophication are predicted to be low magnitude. The anticipated change in wetland function will not result in uncompensated net loss of wetland functions of ecologically important wetlands.

Cumulative residual effects to vegetation and wetland resources are also predicted to be not significant. The total area of disturbance, including past, present and reasonably foreseeable future projects in combination with the Project, will result in a loss of approximately 9,187 ha (10%) of the vegetated area of the RAA. The viability of plant species of interest will not be impaired within the region and effects to ecological communities of interest will not interfere with the sustainable persistence of these communities within the RAA. No uncompensated net-loss of wetland functions will occur to ecologically important wetlands, as it is expected that other proponents of reasonably foreseeable future projects will also be required to compensate for the loss of such wetlands. The Project contributions will not cause a change to the residual cumulative effects that is expected to affect the viability or sustainability of the Vegetation and Wetland Resources VC.

AS5.7 Wildlife Resources (Terrestrial)

Wildlife Resources (Terrestrial) was selected as a VC because of its potential to interact with Project activities during construction, operation, and decommissioning, and because of its ecological, economic, recreational, and cultural importance to Aurora LNG, regulators, Aboriginal Groups, stakeholders, and the public.

For the purpose of this assessment, the Wildlife Resources (Terrestrial) VC includes all species of mammals, birds, amphibians, and reptiles that rely on the terrestrial environment for all or part of their life requisites. Species that also rely on marine habitats for part of their life requisites and have potential to interact with marine components of the Project (e.g., marbled murrelet [*Brachyramphus marmoratus*], great blue heron *fannini* subspecies [*Ardea herodias fannini*]) are discussed in Marine Birds.

Other VCs supported by components of this assessment are Land and Resource Use and Community Health.

Project activities such as vegetation clearing for construction of the LNG facility, and increased vehicle traffic, noise, and light disturbance produced during construction and operation of the LNG facility have potential to change habitat availability, change risk of injury or mortality, and change movement patterns of terrestrial wildlife. Three potential effects are assessed for Wildlife Resources (Terrestrial): change in habitat; change in mortality risk; and change in movement.

The LAA for Wildlife Resources is the PDA plus the terrestrial component of a 1.5 km buffer extending from the PDA. The RAA is the terrestrial portion of the Kaien and Tuck landscape units. The area of the LAA is 4,261 ha. The area of the RAA is 102,321 ha.

Wildlife habitat community modelling and wildlife habitat suitability modelling were used to characterize existing conditions for wildlife resources (terrestrial) and to estimate Project-related change in habitat. Field studies were completed to characterize the abundance, richness, seasonal distribution, and habitat use of terrestrial wildlife within the PDA and LAA. Important habitats for terrestrial wildlife within the LAA and RAA include those that support seasonal or year-round foraging, breeding, roosting, denning, staging, or overwintering activities.

Based on regional occurrence records, 17 terrestrial wildlife species (including subspecies) of management concern have potential to occur within the LAA or RAA. Of these, western toad (*Anaxyrus boreas*), great blue heron (*fannini* subspecies; *Ardea herodias fannini*), and barn swallow (*Hirundo rustica*) occur regularly within the RAA.

Six terrestrial wildlife species of management concern were detected during Project-specific field studies: band-tailed pigeon (*Patagioenas fasciata*), great blue heron (fannini subspecies), marbled murrelet (*Brachyramphus marmoratus*), barn swallow, little brown myotis (*Myotis lucifugus*)/long-legged myotis complex, and western toad. Important wildlife habitat features were detected within the LAA, including two occupied bald eagle nests located on the boundary of the PDA south of Casey Cove and near Philips Point, and a great blue heron rookery west of Dodge Cove approximately 500 m from the PDA boundary.

Mitigation measures based on, or consistent with, federal and provincial guidelines will be developed and implemented. These mitigation measures will be designed to enable the Project to comply with application legislation (e.g., the *Wildlife Act*, *Migratory Birds Convention Act*, the Federal Policy on Wetland Conservation, SARA), and include the following:

- A Wetland Compensation Plan will be implemented to meet the requirements of no net loss of wetland functions for those wetlands defined as ecologically important by Environment and Climate Change Canada
- A Noise Management Plan that includes mitigation measures to avoid or reduce sensory disturbance to terrestrial wildlife
- A Marbled Murrelet Management Plan to accord Project construction with recovery objectives outlined in Environment and Climate Change Canada's *Recovery Strategy for the Marbled Murrelet* (Environment Canada 2014a)

- A Bat Management Plan to accord Project construction with recovery objectives outlined in Environment and Climate Change Canada's *Recovery Strategy for Little Brown Myotis (Myotis lucifugus), Northern Myotis (Myotis septentrionalis), and Tri-colored Bat (Perimyotis subflavus) in Canada* (Environment Canada 2015a)
- With consideration to safety and security requirements, lighting at the LNG facility, marine terminal, supporting infrastructure and facilities will include measures to reduce risk of injury or mortality, and change in movement, for marine birds (e.g., direction lighting, limiting exterior lighting)
- Flaring will be periodic and only during maintenance and upset events. Maintenance flaring events will be scheduled during daylight hours, where practicable, to reduce risk of mortality of birds.
- The application of disturbance buffers and riparian vegetation buffers
- Clearly delineating and flagging clearing boundaries within the PDA prior to site preparation activities
- Guidelines for restricted activity periods to protect wildlife resources (terrestrial) will be followed where practicable
- Avoiding high-disturbance activities (e.g., blasting, pile driving) during the breeding window (i.e., January 15 through September 15) within 500 m of the great blue heron rookery at Dodge Cove, to the extent practicable
- Avoiding high-disturbance activities (e.g., blasting, pile driving) within 300 m of occupied bald eagle nests during the breeding window (i.e., February 5 through August 31)
- Permitted removal or relocation of raptor nests south of Casey Cove and near Philips Point (or any other raptor nests identified within the clearing limits of the PDA) if these nests cannot be avoided (Section 34 of the BC *Wildlife Act*)
- Educational materials will be provided to all employees and contractors to increase awareness of lighting effects on migratory birds.
- A Wildlife Management Plan that includes the following reporting requirements to avoid or reduce mortality risk:
  - Wildlife sightings, including species at risk sightings
  - Light-induced stranding's of migratory birds and bats at the LNG facility, marine terminal, supporting infrastructure and facilities, and on berthed vessels.

Significant residual effects for wildlife resources (terrestrial) are defined as follows:

- For change in habitat - effects are considered significant if the extent (hectares) of habitat change or sensory disturbance and displacement is expected to change the long-term viability of local or regional wildlife populations.
- For change in mortality risk - effects are considered significant if Project infrastructure or activities are expected to decrease the long-term viability of local or regional wildlife populations through increased mortality.
- For change in behaviour - effects are considered significant if Project infrastructure or activities are predicted to cause changes in wildlife movement, primarily due to the introduction of physical or perceived barriers that could limit wildlife movement to the extent that there is an adverse effect on the long-term viability of local or regional wildlife populations.

The Project will affect up to 779 ha of terrestrial wildlife habitat through reduction or alteration of primarily mature or old coniferous forest, or shrub-dominated bog habitat communities present within the PDA. With the implementation of mitigation measures, the partial loss of terrestrial habitat communities, and species they support, will be offset for the Project and reduce the net effect of change in terrestrial wildlife habitat removed by construction of the LNG facility and associated infrastructure.

Vegetation clearing and grubbing, road use and vehicle traffic, human-wildlife interactions, high-disturbance activities, and light infrastructure (including flare stacks) at the LNG facility and marine terminal have potential to increase mortality risk for wildlife, particularly during seasonal migratory, breeding, denning, overwintering, and roosting periods, and during inclement weather. Natural recruitment (e.g., through reproduction and in-migration), including recruitment of those species most sensitive to residual Project effects on mortality risk, is expected to offset the loss of a few individuals within a regional population. Project mitigation will limit clearing and grubbing activities within the PDA to the extent practical, avoid or reduce effects from vehicle traffic and human-wildlife interactions, reduce the temporal and spatial distribution of lighting infrastructure, and lower air emissions, thereby reducing mortality risk for terrestrial wildlife.

Activities during Project construction and operations have the potential to result in effects to terrestrial wildlife movement. The degree of sensory disturbance will vary by species based on habitat requirements and migration behaviour; however, wildlife species with secure populations are expected to be resilient to change in movement patterns.

With adherence to applicable legislation and regulations, and implementation of Project-specific mitigation and environmental protection measures, residual Project effects on change in habitat, change in mortality risk, and change in movement for terrestrial wildlife and combined residual effects on terrestrial wildlife resources are predicted to be not significant.

Cumulative change in mortality risk for terrestrial wildlife may result from existing and future incidental destruction of nests, dens, cavities, and roosts, human-wildlife interactions, collisions with vehicles, high-disturbance activities (e.g., blasting and drilling), routine flaring events, and attraction to anthropogenic light and associated collisions with lit structures and flares. Cumulative change in movement may be attributed to placement of infrastructure, and increased light and noise disturbance within the RAA, and may cause a change in wildlife movement patterns or use of preferred habitats. However, the Project contribution to cumulative effects on change in wildlife habitat, mortality risk, and movement will be localized to the LAA and expected to affect a small portion of regional wildlife populations, and the residual cumulative effects on wildlife resources are predicted to be not significant.

AS5.8 Freshwater Fish and Fish Habitat

Freshwater Fish and Fish Habitat was selected as a VC because of potential interactions with freshwater fish and fish habitat during critical life phases. Fish are important for economic, cultural, and environmental reasons; they contribute to recreational and commercial fisheries; and have cultural and ceremonial value for Aboriginal communities. Freshwater fish include all species that are part of a commercial, recreational, or Aboriginal (CRA) fishery, species that support such fisheries as defined by the *Fisheries Act*, and fish species of concern. For the purposes of this assessment, freshwater fish habitat does not include estuarine or brackish areas, or wetlands. Estuarine habitats are assessed in the Marine Fish and Fish Habitat VC, while wetlands are assessed as part of the Vegetation and Wetland VC.

Other VCs that are supported by components of this assessment are Land and Resource Use and Community Health (harvested foods).

The LAA is the PDA plus upstream or downstream anadromous reaches of watercourses flowing through the PDA or watercourses immediately adjacent to the PDA, or into which water would be diverted from the PDA to the ocean. The RAA includes the LAA and upstream non-anadromous reaches of watercourses in the LAA, and includes watercourses that meet the ocean within 10 km of the Project area and that support anadromous fish.

The assessment focuses on effects that may cause *serious harm to fish*, as defined under subsection 35(1) of the federal *Fisheries Act*. Fish habitat attributes, including habitat availability, overwintering and rearing habitat, substrates for spawning, water quality, cover, and habitat complexity, are required for the survival and function of healthy fish populations. The following potential effects have been assessed for freshwater fish and fish habitat: change in fish habitat; change in fish mortality or health; and change in fish abundance or relative abundance. Effects are expected to occur primarily during the construction phase, during site preparation activities, but may also occur during operations and decommissioning.

During habitat surveys conducted in or near the PDA, 80% of the watercourse reaches surveyed contained some critical or important fish rearing habitat. Six fish species were captured during field sampling: four CRA fish species and two non-CRA fish species. One species of concern, coastal cutthroat trout (*Oncorhynchus clarkii*), is known to inhabit the PDA, and was captured during field surveys. The Project design (i.e., site layout) facilitates the retention of important fish habitat located in six watercourse reaches within the PDA; these reaches contain 48% of the total available fish habitat in the PDA.

Residual effects of the Project on freshwater fish and fish habitat include a loss of freshwater instream and riparian habitat prior to offsetting, along with a reduction of fish abundance within the PDA. These environmental effects are expected to occur during the construction phase of the Project. Environmental effects from the Project operations are anticipated to occur in the LAA and RAA and include changes to water quality, changes to fish abundance and relative abundance, and changes to fish mortality or health.

Mitigation measures to reduce effects to fish and fish habitat include:

- Avoid sensitive periods (e.g. spawning, rearing, and emergence) during construction, where possible, or isolate areas and conduct a fish salvage prior to construction. Any salvaged fish will be relocated to suitable habitat downstream or in a nearby watercourse.
- Reduce disturbance to riparian areas, to the extent possible, and will not disturb watercourses and riparian areas outside the PDA. Exclusion fencing will be installed to delineate the protected areas.
- A Fish Habitat Offsetting Plan will be developed to mitigate any loss of freshwater fish habitat.
- A disturbance buffer defined as riparian reserve zone (BC Environmental Protection and Management Regulation) will be applied to the two freshwater streams which surround the proposed camp location. Where possible, the riparian management area will also be protected.
- An environmental monitor will be on-site during all instream works to monitor for potential harm to fish.
- Obtain all relevant environmental permits to conduct instream works or extract water, and adhere to best management practices and Guidelines indicated in the conditions of the permit.

- Prior to construction or salvage, Aurora LNG will block fish access to affected watercourses, to prevent harm to fish.
- Discharged water quality (e.g., TSS and turbidity) to meet guidelines for the protection of aquatic life. Erosion and Sediment Control facilities will receive diverted site run-off prior to discharge into existing watercourses/marine environment.
- Concrete works on site will be contained so that no untreated concrete water runoff or wash-water will enter the nearby freshwater or marine environment. Equipment to contain, and neutralize the pH (e.g., CO_2) will be kept on site at all times during these works.
- All construction equipment on site will be kept clean, free of leaks, and will have spill kits. Where possible, fuelling of construction vehicles will take place at least 30 m away from any watercourse or waterbody.
- While onsite, workers will be prohibited from recreational or commercial fishing within the LAA during all stages of the Project.

Significant residual effects related to freshwater fish and fish habitat are defined as:

- For change in fish habitat - residual effects on productive capacity of fish habitat of importance to key life stages of CRA fishes that would exist after mitigation and offsetting measures
- For change in fish mortality or health - residual effects that would exist after application of mitigation measures and are at a level that would cause interference with the natural ability of the fish populations to recover from the effects of the Project or disturbance.
- For change in fish abundance or relative abundance - a reduction in the population of resident fish that would reduce the ability of that population to be self-sustaining in the LAA, or a reduction in the population that would reduce overall numbers in the LAA, after application of mitigation and offsetting measures. A reduction in the availability of food and nutrient sources or reduction in availability of habitat critical for carrying out one or more life-cycle processes of the populations in the LAA.

After consideration of offsetting requirements, implementation of best management practices and mitigation measures for the Project, effects on freshwater fish and fish habitat are predicted to be not significant. The predicted changes to freshwater fish and fish habitat are anticipated to take place during the construction phase of the Project. These changes include removal of 10,857 m^2 of instream and 218,830 m^2 of riparian habitat potentially used by salmonids and other CRA fish species. The change in quantity of freshwater fish habitat and abundance of freshwater fish in the PDA is important locally; however, the small stream sizes on Digby Island would not support large populations of CRA fish species. After offsetting there is no expected decrease in the amount of available fish habitat in the RAA.

The assessment of acidification and eutrophication effects has been determined from the conclusions from the Water Quality VC (Section 4.5). Through conservatisms built into modelling for acidification and eutrophication, and the reversibility of the effects with decreases or cessation in air emissions, acidification and eutrophication during the operations phase are not predicted to cause a significant change in the amount or use of fish habitat, fish mortality or health, or fish abundance or relative abundance for the Project.

A small number of the freshwater streams in the RAA have been disturbed by past or present activities and projects. The Project is anticipated to contribute an additional loss (10,857 m^2) of instream fish habitat within the RAA prior to offsetting, representing a loss of 33.1% of fish habitat in the PDA, with no

additional loss of fish habitat in the RAA outside of the PDA expected from Project construction or acidification and eutrophication. With mitigation and environmental protection measures, the residual cumulative effects on freshwater fish and fish habitat are predicted to be not significant.

AS5.9 Marine Fish and Fish Habitat

The Marine Fish and Fish Habitat VC was selected because it may interact with Project activities during construction, operations, and decommissioning, and it has high cultural, ecological, and economic importance to Aurora LNG, regulators, Aboriginal Groups, stakeholders, and the public. The marine fish and fish habitat assessment focuses on potential effects to marine fish habitat (marine riparian, intertidal, and subtidal habitat, including marine plants) and marine fish that are part of, or support, CRA fisheries. Other VCs supported by components of this assessment are Marine Use and Navigable Waters and Community Health. Marine mammals are assessed in the Marine Mammal VC.

Construction activities (e.g., dredging and marine construction), underwater noise associated with in-water construction and shipping, light conditions, and components of Project operations (e.g., intake pipes) have the potential to affect marine fish and fish habitat. Four potential effects have been assessed: change in habitat; change in behavior; change in mortality risk; and change in health.

The LAA is a 500 m buffer around the proposed PDA, as well as 500 m on either side of the centreline of the shipping route from the LNG jetty to the Triple Island pilot boarding station. The RAA is largely bounded by the area defined as the Skeena River Estuary but also includes some marine waters out to Triple Island pilot boarding station.

Information characterizing existing conditions for marine fish and fish habitats in the PDA, LAA, and RAA was compiled from several sources, including TK, existing scientific literature and regional data sources, government sources, previous environmental assessments completed in the Prince Rupert region, and Project-specific field studies. Modelling studies also were undertaken (a sediment dispersion modelling study, an underwater noise monitoring and modelling study, and a hydrodynamic modelling study).

The Project is located in lower Chatham Sound, a highly productive area that supports a variety of marine fish (including numerous species of CRA importance) and fish habitats. Chatham Sound is influenced by two glacially formed rivers, the Skeena and the Nass. These rivers annually discharge large amounts of freshwater and sediment into Chatham Sound. Chatham Sound encompasses a major spawning area for Pacific herring (*Clupea pallasii*), supports dense aggregations of green sea urchins (*Strongylocentrotus droebachiensis*) and Dungeness crabs (*Metacarcinus magister*), and has a high diversity of shrimp species (Family Hippolytidae). The LAA overlaps with Important Areas (IAs) for Pacific herring, Dungeness crab, tanner crab, and green urchin.

A variety of fish and invertebrate species targeted by CRA fisheries occur within the LAA and RAA, including Pacific salmon (*Oncorhynchus* spp.), eulachon (*Thaleichthys pacificus*), Pacific herring, flatfish, molluscs (e.g., clams and scallops), crustaceans (e.g., shrimp, prawns, and crabs), and echinoderms (e.g., sea cucumbers and sea urchins). Specific life history stages that are considered to be sensitive for these species include adult spawner migration, spawning, and outbound juvenile migration (specific to fish), and larval release and planktonic larval stage (specific to marine invertebrates). Twelve marine fish species of management concern have the potential to occur within the RAA.

Construction of the marine components is expected to result in the permanent alteration of up to 176,584 m^2 of substrate, and the destruction, or loss, of up to 3,537 m^2 of marine riparian habitat, 6,180 m^2 of

eelgrass, and 78,675 m^2 of substrate. Project components and activities associated with dredging, construction of in-water infrastructure, operation of the LNG facility, LNG shipping, and dismantling of marine infrastructure may result in a change in fish behavior. Project components and physical activities during construction, operations and decommissioning have the potential to result in a change in mortality risk for marine fish (e.g., exposure to underwater noise from impact drilling or blasting). Changes in water temperature and salinity, as well as changes in the concentrations of nutrients and contaminants (e.g., PCDD/Fs) can affect marine fish health.

Key mitigation measures to limit effects to marine fish and fish habitat include:

- Development of a Fish Habitat Offsetting Plan
- Use of materials that promote colonization of marine algae and invertebrates during construction of in-water infrastructure
- Following trenching / backfilling for installation of the seawater intake and outflow pipes, intertidal and subtidal substrates will be returned to conditions similar to those prior to construction
- Industry standard best management practices will be applied for underwater blasting and pile installation, and bubble curtains will be installed around blast and pile areas.
- Underwater blasting, and dredging and disposal activities, will be conducted during DFO's least risk timing window (November 30 – February 15) unless otherwise approved by DFO
- During underwater blasting and impact pile driving, bubble curtains will be installed to provide noise attenuation and reduce underwater sound levels emitted into the marine environment
- A ramp-up procedure will be used for impact pile driving that will involve the steady and gradual build-up of underwater acoustic energy output from a lower energy level to full output
- Where practicable, without compromising the safety or efficiency of construction activities or operational works, artificial lighting used during the hours of darkness will include task oriented (directional) lighting, and hooded (or otherwise shielded) lamps, which are turned off when not in use
- Silt curtains will be used, where practicable, to reduce the spatial extent of suspended sediments in the marine water column during dredging activities
- An Environmental Monitor will be on site during active in-water impact pile driving and underwater blasting to monitor for fish kills.

A significant adverse residual effect on marine fish and fish habitat is defined as one that threatens the long-term persistence of a marine fish population.

Project construction will result in the permanent alteration or destruction of up to 264,976 m^2 of marine fish habitat (including up to 6,180 m^2 of eelgrass). Some of these changes are expected to constitute *serious harm to* fish, and will be offset through the implementation of a fish habitat offsetting plan. Underwater noise generated by in-water construction activities and Project-related vessels is expected to result in localized changes in fish behaviour. Temporary avoidance behaviour, altered swimming direction or startle response exhibited by fish in waters surrounding underwater sound sources are expected to be localized and not jeopardize the ability of a fish to complete one or more of its life processes. Some marine organisms (e.g., sessile or slow-moving benthic invertebrates), are expected to be killed through burial or crushing during in-water construction activities, while some fish may be injured or killed during impact pile driving and underwater blasting due to exposure to loud underwater noise. While avoidance and mitigation measures cannot eliminate the risk of mortality for marine fish, the loss of

a limited number of individuals is not expected to threaten the long term persistence of a marine fish population. During construction, some marine organisms, especially those with limited mobility (e.g., sessile or slow moving fish or invertebrates), are expected to be exposed to TSS levels above the 5 mg/L guideline for the protection of marine life, and as a result, may experience health effects. With the implementation of avoidance and mitigation measures, residual adverse effects for change in health during all Project phases are not expected to threaten the long-term persistence of a marine fish population.

With adherence to applicable legislation and regulations, and implementation of Project-specific mitigation and environmental protection measures, combined residual Project effects on marine fish and fish habitat are predicted to be not significant.

Marine habitats affected by the Project and other reasonably foreseeable marine development projects comprise a relatively small area of fish habitat in the RAA. Although some temporary reduction of productivity may be attributed to the permanent alteration or destruction of these habitats, habitat offsetting is expected to achieve an overall net gain of fisheries productivity. Habituation to underwater noise is expected to reduce the tendency of resident fish to exhibit behavioural avoidance, altered swimming direction, or startle response when exposed to a sound source. While fishery-induced mortality is widespread within the RAA, mortality associated with the Project and other marine development projects will be localized, occurring primarily within the development footprint of each project. Most species affected by marine construction activities (and CRA fisheries) have high intrinsic population growth rates, and their populations can sustain the removal of some individuals. Areas affected by elevated levels of TSS are expected to be limited to the immediate area affected (e.g., dredge and disposal area), and sediment plumes generated from the Project, and other projects, are expected to not overlap spatially, but may overlap temporally (construction schedules for other projects are currently unknown).

With the implementation of Project-specific mitigation and environmental protection measures, and the mitigation measures of other projects within the RAA, the combined residual cumulative effects on marine fish and fish habitat are predicted to be not significant.

AS5.10 Marine Mammals

Marine Mammals was selected as a VC because of its traditional, cultural, ecological, and recreational (including economic) importance and their potential to be affected by the construction, operations and decommissioning of the Project. Protection of marine mammals is regulated under legislation such as the federal *Fisheries Act* and SARA, and marine mammals have been identified as being important to Aurora LNG, regulators, Aboriginal Groups, stakeholders, and the public.

For the purpose of this assessment, marine mammals include all species of whale, dolphin, porpoise, seal, sea lion, and sea otter that may occur in northern BC and may interact with Project activities. Special consideration is given to those marine mammal species designated as endangered, threatened, or of special concern under Schedule 1 of SARA. The Marine Use and Navigable Waters VC is supported by components of this assessment.

Project-related construction (i.e., LNG jetty, MOF, pioneer facility) and operations (i.e., shipping activities) and decommissioning will introduce new sources of underwater noise to the marine environment, and Project-related activities will increase the amount of marine traffic during construction and

decommissioning (e.g., support vessels) and operations (e.g., LNG carriers and escort tugs). Three potential effects related to Project activities are assessed: change in health; change in behavior; and change in mortality risk.

The LAA is based on a 6 km buffer around the marine terminal and a 6 km buffer extending on either side of the shipping route, which extends from the marine terminal to the Triple Island pilot boarding station. The RAA extends from the marine terminal to west of the Triple Island pilot boarding station and encompasses Prince Rupert Harbour and most of Chatham Sound.

Literature review, TK, and field-based marine mammal surveys were completed to characterize the existing environment in the LAA and RAA. An underwater noise monitoring field study was undertaken to establish existing sound levels near the LNG jetty and shipping lanes. The RAA overlaps with IAs for humpback whale (*Megaptera novaeangliae*), northern resident killer whale (*Orcinus orca*), and Steller sea lion (*Eumetopias jubatus monteriensis*). Twelve species of marine mammals regularly occur within the RAA on either a seasonal or year-round basis. During field surveys, the humpback whale was the most frequently observed marine mammal species and was sighted year-round. Based on the results of ambient underwater sound monitoring conducted for the Project, vessel activity (i.e., transits of large ships, and small vessels like fishing boats, zodiacs and pleasure craft) is the primary source of underwater noise in the LAA and RAA, and these sound events dominate over sounds from weather events (such as heavy rainfall).

Project components and activities will introduce new sources of underwater noise to the marine environment. At high enough received sound levels, marine mammals may experience direct physiological effects, including changes to their hearing sensitivity (change in health). In-water blasting and pile driving activities, in particular, produce sudden, intense noises, with pressure pulses that can cause auditory injury to marine mammals close to the source. In-water blasting may also result in direct injury to marine mammals via shock waves, blast effects, or flying debris.

The introduction of anthropogenic sources of underwater noise can cause stress in marine mammals; of particular concern are sound levels that may trigger avoidance behaviours, disrupt migration, or adversely affect foraging patterns and foraging success.

Project-related vessel traffic during all phases of the Project has the potential to increase marine mammal mortality risk. Potential for change in mortality risk is considered greatest during operations (relative to other Project phases and vessel types). While strike risk is considered greatest for the larger whale species in the RAA (i.e., fin, humpback, grey, and minke whales), smaller cetaceans (e.g., killer whales) are occasionally struck by vessels.

The primary mechanism for reducing potential changes in health to marine mammals during in-water blasting and impact pile driving is by limiting the potential for exposure to injury. This is addressed during the engineering and design phase, by reducing the amount of underwater blasting and impact pile driving required, and by reducing the amount of underwater noise produced by these activities (e.g., through implementation of sound reducing technologies) and thereby the areal extent over which auditory injury is possible. Key mitigation measures are:

- In-water blasting guidelines recommended by DFO will be followed
- Inter-charge time delay between sequential detonations will be short (e.g., milliseconds)
- Bubble curtains will be installed around the blast area to provide noise attenuation and reduce the extent of underwater sound levels capable of exceeding thresholds

- In-water blasting and impact pile driving will occur only during daytime hours
- A marine mammal monitoring program will be implemented to enforce exclusion zones around the in-water blasting area and the impact pile driving area
- Confined bubble curtains will be installed around the impact pile driving area to provide noise attenuation and reduce the extent of underwater sound levels capable of exceeding thresholds
- An underwater noise field verification program will be conducted to verify predicted sound pressure levels and the size of the exclusion zones for in-water blasting and impact pile driving.

Project-related vessels will proceed at a safe speed and respect any regionally-defined or PRPA-specific speed profiles that are applicable at the time of operation, subject to navigational safety. Aurora LNG is willing to collaborate in regional programs planned and developed by government and in conjunction with other proponents, regarding regional management of effects of vessel strikes on marine mammals in the RAA.

A significant adverse residual effect is defined as one that threatens the long-term persistence of a marine mammal species or local population in the RAA.

Project effects on marine mammals are anticipated to occur in the RAA but will be reduced through the implementation of proposed mitigation measures. Residual effects may threaten the long-term persistence of localized harbour porpoise populations in the RAA (particularly in the vicinity of marine construction activities). The highest density areas for harbour porpoises were consistently observed to be the waters south of Digby Island, in Porpoise Channel, around Ridley Island, Lelu Island, and the northeast coast of Stephens Island. This porpoise high-use area shows a large degree of overlap with sound levels above the species-specific behavioural disturbance threshold predicted during marine construction activities. Given demonstrated avoidance responses by harbour porpoise during previous pile driving studies, the residual effect of change in behaviour may threaten the long-term persistence of this local population of harbour porpoise in this area and is, therefore, predicted to be significant.

From a cumulative perspective, increases in human development and use of marine waters in the RAA are expected to increase the potential occurrence of changes in health, changes in behaviour, and changes in mortality risk for marine mammals. It is assumed that DFO will require similar mitigation measures and exclusion zone requirements for all future projects and activities that are likely to produce intense levels of underwater noise. With the implementation of industry standard mitigation measures, residual cumulative effects of change in health are expected to be of low magnitude and not significant.

The temporal and spatial overlap of underwater noise from past, present, and reasonably foreseeable future projects and activities in the RAA may result in an overall reduction in availability of marine habitat that is not exposed to sound levels capable of causing a change in behaviour for marine mammals. This effect is considered to be of somewhat lesser relative concern for local populations that demonstrate a broad-scale distribution of habitat use (e.g., where there is suitable alternative habitat in the vicinity). With the implementation of mitigation measures, residual cumulative effects of change in behaviour are predicted to be significant for harbour porpoise, and not significant for other species of marine mammal.

Increases in cumulative shipping traffic levels in the RAA will result in a corresponding increase in mortality risk from vessel strikes. Based on current marine mammal population sizes and trends for species known to occur in the RAA, changes in mortality risk are considered unlikely to affect population viability, and are therefore not significant.

With mitigation measures, the combined residual effects on marine mammals are considered to be significant for harbour porpoise, and not significant for other species of marine mammal.

AS5.11 Marine Birds

Marine Birds was selected as a VC because of its potential to interact with Project activities during construction, operation, and decommissioning, and because they have been identified as being of concern to Aurora LNG, regulators, Aboriginal Groups, stakeholders, and the public. For the purpose of this assessment, marine birds include species expected to occur in the Prince Rupert region that rely on marine habitats for all or part of their life requisites. Other VCs supported by components of this assessment are Wildlife Resources (Terrestrial), Marine Use and Navigable Waters, and Community Health.

Site preparation, marine construction, dredging, marine terminal lighting, and noise and light associated with Project operations have the potential to result in adverse residual effects on marine birds. The potential effects assessed are: change in habitat; change in mortality risk; and change in behaviour.

The LAA for Marine Birds is a 1 km buffer extending on either side of the shipping route, a 1 km buffer around the marine terminal, a 500 m buffer along the western shore of Digby Island parallel to the PDA, and the area of the Prince Rupert Harbour that is within a 1 km buffer of the MOF. The RAA extends from the proposed marine terminal to the west of the Triple Island pilot boarding station. It includes a 6 km buffer extending on either side of the shipping route and important seabird nesting habitats on the Lucy Islands. The area of the LAA is 11,356 ha. The area of the RAA is 71,999 ha.

Based on a review of available information sources, 102 species of marine bird are known to occur within the Prince Rupert and Port Edward area. Important habitats for marine birds in the LAA and RAA include those that support seasonal or year-round foraging, breeding, staging, or roosting activities. Three Important Bird Areas are located within the RAA and provide important habitat used by congregating species of marine birds. There were 15 species of management concern recorded during field surveys, with red-necked phalarope (*Phalaropus lobatus*), surf scoter (*Melanitta perspicillata*), common murre (*Uria aalge*), and marbled murrelet detected in the greatest numbers.

Mitigation measures based on, or consistent with, federal and provincial guidelines will be developed and implemented. These mitigation measures will be designed to enable the Project to comply with application legislation (e.g., the *Migratory Birds Convention Act*, the Guidelines to Avoid Disturbance to Seabird and Waterbird Colonies in Canada). Marine birds will also benefit from recovery of foraging habitat and increased availability of prey species over time through implementation of the Conceptual Fish Habitat Offsetting Plan. Specific mitigation measures include:

- With consideration to safety and security requirements, lighting at the LNG facility, marine terminal, supporting infrastructure and facilities will include the following measures to reduce risk of injury or mortality, and change in movement, for marine birds: limiting exterior lighting, including portable lighting, and using directional or shielding lighting
- Educational materials will be provided to all employees and contractors to increase awareness of lighting effects on migratory birds
- Staff will be provided with information on how to handle and release migratory birds that become grounded on (berthed) vessel decks

- Facility staff will document or report bird injuries or fatalities related to Project activities
- Implementation of a Wildlife Management Plan that includes reporting requirements to avoid or reduce mortality risk: wildlife sightings, including species at risk sightings, light-induced strandings of migratory birds and bats at the LNG facility, marine terminal, supporting infrastructure and facilities, and on berthed vessels
- Flaring will be periodic and only during maintenance and upset events. Maintenance flaring events will be scheduled during daylight hours, where practicable, to reduce risk of mortality of birds
- Following Environment and Climate Change Canada guidelines for disturbance to marine bird colonies
- Implementing Noise Management and Marine Activities Plans
- Following guidelines for restricted activity periods to protect marine birds with potential to breed in shoreline habitats; where possible, clearing activities will occur outside of the breeding season for migratory birds
- LNG carriers, tugs, and barges will not exceed a speed of 16 knots within the LAA
- Blasting-related mitigation measures: following underwater blasting guidelines recommended by DFO; installing bubble curtains around the blast area; blasting during daylight hours.

Significant residual effects related to marine birds are defined as follows:

- For change in habitat - effects are considered significant if the extent (m^2) of habitat change or sensory disturbance is expected to adversely affect the long-term viability of local or regional marine bird populations.
- For change in mortality risk - effects are considered significant if Project infrastructure or activities are expected to adversely affect the long-term viability of local or regional marine bird populations.
- For change in behaviour - effects are considered significant if Project infrastructure or activities are predicted to cause changes in behaviour, primarily through changes in movement, due to the introduction of physical or perceived barriers that could adversely affect the long-term viability of local or regional marine bird populations.

The Project will affect marine bird habitat through reduction or alteration of shoreline and nearshore habitats within or in the vicinity of the PDA. With the implementation of mitigation measures, including the Conceptual Fish Habitat Offsetting Plan, the net loss of marine communities, and species they support, will be offset for the Project. This will reduce the net effect of change in marine bird habitat removed by construction of the marine terminal, MOF, and pioneer facility. Light infrastructure at the LNG facility and marine terminal has potential to increase the mortality risk for marine birds, in particular during seasonal migratory periods or inclement weather. Field surveys and regional datasets indicate that those species that are most responsive to coastal lighting cues are uncommon in the LAA and RAA.

The presence of marine infrastructure (including the marine terminal, MOF, and pioneer facility) is not expected to limit access to key breeding, foraging, staging, or roosting habitats for marine birds. Project activity in the vicinity of the marine terminal, MOF, and pioneer facility will increase during construction and may result in temporary displacement of birds from shoreline or nearshore habitats. With the implementation of Project-specific mitigation and environmental protection measures, residual Project effects on marine birds, including species listed on Schedule 1 of SARA, are not expected to

adversely affect the long-term viability of local or regional marine bird populations and combined residual effects on marine birds are predicted to be not significant.

Behavioural changes in marine bird populations may be attributed to increased vessel activity in the RAA causing displacement from preferred habitats; however, marine birds occupying habitats in the RAA are expected to exhibit habituation to vessel traffic and have access to similar habitats throughout the RAA for foraging, breeding, staging, or roosting. With the implementation of Project-specific mitigation measures, and the mitigation measures of other projects within the RAA, the combined residual cumulative effects on marine birds are predicted to be not significant.

AS6 ASSESSMENT OF POTENTIAL ECONOMIC EFFECTS

Economic Conditions is selected as a VC because of potential interactions between the Project and local, regional, and provincial economies during all phases of the Project. The assessment of economic conditions focuses on how the Project will affect local and regional economic activities and economic development. Specifically, it addresses local and regional employment, commercial economic activity, and resource-based economic activity. Other VCs supported by components of this assessment are Infrastructure and Services, Land and Resource Use, Marine Use and Navigable Waters, and Community Health.

Project hiring, spending, removal of lands for Project siting, and Project shipping have the potential to affect economic conditions in the Project area. Three potential effects have been considered in the assessment: change in labour supply and demand; change in activities for commercial businesses affected by project spending; and change in resource-based primary industries and subsistence economies.

For change in labour supply and demand, and change in activities for commercial businesses affected by Project spending the LAA includes communities within the mainland portion of the SQCRD including: City of Prince Rupert, District Municipality (DM) of Port Edward, Dodge Cove Improvement District, Crippen Cove, other communities within the SQCRD Electoral Areas (SQCRDA) A and C, S1/2 Tsimpsean Indian Reserve (IR) 2 (Metlakatla First Nation), Lax Kw'alaams IR 1 (Lax Kw'alaams Band), Dolphin Island 1 (Gitxaała Nation). For change in resource-based primary industries and subsistence economies the LAA considers the use of areas overlapped by the LAA for Land and Resource Use (see Section 6.4) and Marine Use and Navigable Waters (see Section 6.5) by persons within the above noted communities as well as Gitga'at First Nation.

The RAA includes the LAA plus Hartley Bay (Gitga'at First Nation), Terrace and adjacent communities, including: Terrace Census Agglomeration Area (City of Terrace, Kitimat-Stikine E [Thornhill] and Kulspai IR 6 [Kitselas First Nation]), Kitselas IR 1 (Kitselas First Nation), Kitsumkaylum 1 IR (Kitsumkalum First Nation), and Kitimat-Stikine C (Part 1), Regional District Electoral Area (RDA). The RAA for the assessment of change in resource-based primary industries and subsistence economies considers the use of areas overlapped by the RAA for Land and Resource Use (see Section 6.4) and Marine Use and Navigable Waters (see Section 6.5) by persons within the above noted communities.

From 2006 to 2011 the population of the LAA decreased by 2.4% from 14,695 to 14,394. Combined, the City of Prince Rupert and the DM of Port Edward account for 91% of population in the LAA (87% and 4% respectively). Eight percent of the LAA population lives on-reserve (S1/2 Tsimpsean IR 2 [<1%], Lax Kw'alaams IR 1 [5%], and Dolphin Island IR 1 [3%]).

From 2011 through July 2016, annual average unemployment rates for the North Coast and Nechako economic regions were higher than the annual average provincial unemployment rate and trended upward, opposite to the trend experienced by the province. From 2006 to 2011 the labour force (aged 15 years and older) of the LAA decreased 10.8% (from 7,445 to 6,640) while the population of the LAA (aged 15 years and older) decreased 0.6% (from 11,035 to 10,965). A similar trend has occurred in the RAA. In 2010 the median income of persons living in the LAA was less than that of the RAA ($19,337 vs. $28,432), which was more closely aligned with median provincial incomes ($28,765).

Among the Aboriginal population of the LAA median incomes were less than that of the RAA ($14,763 vs. $19,006), which more closely aligned with provincial median Aboriginal incomes ($19,264). Sales and service-related occupations accounted for the greatest number of employed LAA and RAA residents, followed by trades, transport and equipment operators, and related occupations.

Aurora LNG will implement mitigation measures to avoid or reduce potential adverse effects on local and regional economic conditions and enhance potential benefits. Key mitigation measures include:

- Inform local residents and Aboriginal Groups of job and procurement opportunities during all Project phases. Develop work packages that consider the capacity and capabilities of local and regional businesses.
- Require that all workers (not inclusive of summer students) 19 years and younger complete grade 12 or have an appropriate equivalency in order to prevent young people from leaving school prematurely.
- Workers will be paid wages consistent with the Western Canadian labour market.

A significant adverse residual effect on the economic environment is defined as an adverse effect that is distinguishable from current conditions and trends and cannot be managed or mitigated through adjustments to programs, policies, plans, or through other mitigation measures.

Effects on labour supply and demand and commercial businesses will be largely positive; the economy within the LAA has shrunk within the last 15 years, and the region experiences an unemployment rate substantially higher than the provincial average. There is potential that local businesses could be adversely affected due to competition for, and cost, of labour. However, the application of mitigation measures, as well as provincial and regional initiatives to develop a skilled labour force, including the BC Natural Gas Workforce Strategy and Action Plan (BC Natural Gas Workforce Strategy Committee 2013) and Northwest Regional Skills Training Plan (NWRT 2012), will mitigate adverse effects on local businesses.

The natural resource value of the part of Digby Island that would be affected by the Project is low relative to resources available elsewhere in the region; it is expected that the Project will have a negligible to low effect on the sustainability of industries dependent on such resources. The Project will also have a limited effect on subsistence economies because of its limited effect on terrestrial or marine based resources upon which economies depend, limited interference with sustainable harvesting practices, widespread availability of resources for sustainable harvesting throughout the LAA, and Project commitment to allow Aboriginal workers time off from work to engage in traditional harvesting practices.

Overall, while the Project may result in some adverse effects that are distinguishable from current conditions and trends, these effects are expected to be effectively managed by identified Project mitigation measures and by identified government programs, policies, and plans. Therefore, adverse residual effects on Economic Conditions are predicted to be not significant.

If the currently proposed, reasonably foreseeable projects were to be built and operated, there would be a dramatic re-shaping of the economy within the RAA. There would be some adverse economic effects, including localized labour shortages and potentially increased cost of labour. However, it is reasonably expected that proponents of large capital projects will implement mitigation measures, and participate in government-led initiatives to address adverse effects on the labour market. While the Project, in combination with other past, present, and reasonably foreseeable projects, may result in cumulative adverse effects that are distinguishable from current conditions and trends, these effects are expected to

be effectively managed by identified Project mitigation measures, mitigation measures reasonably expected from other project proponents, and identified government programs, policies, and plans. Therefore, cumulative adverse residual effects on Economic Conditions are predicted to be not significant.

AS7 ASSESSMENT OF POTENTIAL SOCIAL EFFECTS

AS7.1 Social Background

Section 6.1 of the Application summarizes the existing social environment in the vicinity of the Project and surrounding region.

AS7.2 Visual Quality

Visual quality is a human response to views of a landscape. It is influenced, positively or negatively, by human interventions such as industrial development. The Visual Quality VC was selected for assessment because visual quality in the area may be affected by construction, operations, and decommissioning of the LNG facility. Visual quality has been identified as being of concern to regulators, stakeholders, Aboriginal Groups, and the public. Visual quality may be affected through vegetation clearing, construction and presence of human-made structures, and changes in ambient light.

Other VCs supported by this assessment are Land and Resource Use, Summary of Statutory Requirements under CEAA 2012, and Aboriginal Interests.

The assessment considers change in visual quality from the LNG facility with carriers docked. The assessment relies on computer modelling, based on conceptual design, to simulate how the Project will appear when constructed. The nearest residential receptors to the Project are in Dodge Cove, located less than 1 km north of the proposed location of the MOF, and in Prince Rupert, approximately 2.4 km from the MOF. Topographical and vegetation screening are expected to intersect sight lines between Dodge Cove and the Project.

The LAA includes lands within 8 km of and with a potential view of the LNG facility and marine terminal. The LAA represents the foreground (0-1 km) and mid-ground (1-8 km). The RAA includes the LAA plus lands with a potential view of the LNG facility and marine terminal beyond 8 km (LAA boundary) to a maximum of 20 km from the PDA.

In addition to industry-standard mitigation measures, Project-specific measures include:

- A 30 m marine riparian disturbance buffer will be applied, except where infrastructure access to the marine environment is required (e.g. Marine Terminal, Material Offloading Facility), or for safety or security considerations. On the east side of Digby Island this buffer will be of variable width, extending beyond the 30 m minimum in some areas.
- With consideration to safety and security requirements, lighting at the LNG facility, marine terminal, supporting infrastructure and facilities will include the following measures:
  - Limiting exterior lighting, including portable lighting.
  - Using directional or shielded lighting; the vertical or horizontal distribution of light will be reduced (Jones and Francis 2003).
- Select lighting to reduce spill-over light and include shielded “dark sky” fixtures, where appropriate.

The residual effect on visual quality would be considered significant if the average post- development existing visual condition (EVC) within the LAA exceeds the range of disturbance within the Partial Retention visual quality class where:

- The average baseline EVC was either Preservation, Retention, or Partial Retention
- The viewpoints from which the change is viewed are of moderate to high importance
- Visual quality is documented as an important planning objective for government authorities in the LAA.

The Project will increase the proportion of industrialized landscape within the LAA; however, this will not result in an overall change in visual character, which has already been affected by waterfront developments within the Port of Prince Rupert. Because of topographic screening, the Project will not be visible to most residents of Prince Rupert, and will not be visible from Port Edward. Because of topographical and vegetation screening, the Project will not be directly visible from nearby on Digby Island, including Dodge Cove and Crippen Cove.

The Project will affect identified priority views towards Digby Island, including views from marine approaches to Prince Rupert Harbour, Mount Hays, and Mount Comblain. The Project will be most evident from Mount Hays, but will be less visibly dominant at other priority viewpoints due to a combination of distance and vegetation screening. The Project will have moderate to high magnitude effects that will persist over the course of construction and operations. With the application of mitigation measures, light emissions from the Project are expected to result in low magnitude adverse effects on residents in the LAA. Because of the distance between the Project and the nearest residential receptors, it is predicted that direct effects of Project lighting, such as glare and light spill, will be avoided. However, it is predicted that the Project will contribute to skyglow caused by industrial, commercial, and residential lighting in the LAA. Upon decommissioning, the effects are anticipated to reverse when LNG plant components are removed, the PDA is re-contoured, vegetated, and the vegetation has reached visually effective green-up.

The preservation of visual quality is an important provincial planning objective with respect to the effects of forestry activities on visual resources; methods and standards used to evaluate visual quality for this Project were based partly on guidance developed by BC Ministry of Forests and currently implemented by BC MFLNRO. Based on these standards, the Project will cause changes to two visually sensitive units that exceed current visual quality objectives. While not legally enforceable, these exceedances have been considered in the prediction of adverse effects. The Project does not conflict with visual quality objectives of other identified land and marine use plans.

It is predicted that the Project will cause changes to visual quality from some viewpoints of importance that will be of concern to viewers; however, it will not result in changes to visual quality overall in the LAA that will exceed the significance threshold. Project effects on visual quality are therefore predicted to be not significant.

Reasonably foreseeable projects within the RAA that have potential to cumulatively interact with the Project include terminals, port developments, utility and transportation corridors, forestry activity, and other industrial developments. The Project will contribute to cumulative effects on visual quality within the RAA; however overall, the cumulative effects scenario will result in only a moderate change in visual quality within the RAA. Changes to visual quality will be concentrated mostly within the Prince Rupert and

Port Edward area, with most of the RAA relatively unaffected. Cumulative effects on visual quality are predicted to be not significant.

AS7.3 Infrastructure and Services

Infrastructure and Services was selected as a VC because construction and operations of the LNG facility has potential to create the in-migration of temporary and/or permanent populations, which may lead to increased demand for infrastructure and services. Project-related business growth and increased incomes for residents, as well as Project activities, may also increase demands for infrastructure and services during the construction and operation phases.

Other VCs supported by components of this assessment are Economic Conditions, Community Health, Summary of Statutory Requirements under CEAA 2012, Aboriginal Interests, and Public Consultation.

The potential effects addressed in the Infrastructure and Services assessment are change in community infrastructure and services, change in accommodations, change in transportation infrastructure and services, and change in health care infrastructure and services. The assessment involved both quantitative and qualitative methods. A population forecast was prepared, based on baseline forecasts available from BC Stats, to which the potential population increase in the LAA associated with the Project was added. Potential effects were estimated by calculating additional demand associated with population change and/or direct Project requirements. The quantitative analysis was supplemented with information obtained from primary research and literature review.

The LAA includes communities within the mainland portion of the SQCRD including: City of Prince Rupert, DM of Port Edward, Dodge Cove Improvement District, Crippen Cove, other communities within the SQCRD Electoral Areas (SQCRDA) A and C, Lax Kw'alaams IR 1 (Lax Kw'alaams Band), S1/2 Tsimpsean Indian Reserve 2 (Metlakatla First Nation), Dolphin Island 1 (Gitxaala Nation). Highway 16 up to and including the Northwest Regional Airport Terrace Kitimat (YXT) and Mills Memorial Hospital (Terrace) are also included. The RAA Includes the LAA plus Hartley Bay (Gitga'at First Nation), Terrace and adjacent communities including: Terrace Census Agglomeration Area (City of Terrace, Kitimat-Stikine E [Thornhill] and Kulspai IR 6 [Kitselas First Nation]), Kitsumkaylum 1 IR (Kitsumkalum First Nation), Kitselas IR 1 (Kitselas First Nation), and Kitimat-Stikine C (Part 1), RDA.

In addition to industry-standard mitigation measures, Project-specific measures include:

- Require all staff and contractors to undertake worker orientation, including communication of expected behaviours when transiting to/from local communities (a worker code of conduct) and cross-cultural awareness to help build awareness and respect of local concerns and customs to reinforce the importance of respectful conduct when in communities.
- The construction camp will include a potable water, wastewater collection and treatment system, fire water system, medical centre, fire-fighting equipment, and heliport for medivac transfers to reduce potential demand on community infrastructure and services.
- A Social Management Plan will be developed and implemented that focuses on managing potential direct Project-related effects on community level infrastructure and services.
- A Worker Lodging Plan will be included in the Social Management Plan and will be implemented to manage camp needs during all Project phases.

- A Health and Medical Services Plan (HMSP) will be included in the Social Management Plan and will be based on Northern Health's Health and Medical Services Best Management Plan Guide.
- Provide an onsite medical clinic with first aid equipment, supplies, and trained first aid personnel and support staff for primary care including health promotion, injury/illness prevention, and injury/illness management, to manage potential impacts on the local public health care system.

A significant adverse residual effect on infrastructure and services would be an exceedance of available capacity, or a substantial decrease in the quality of a service provided, on a persistent and ongoing basis, which cannot be mitigated with current or anticipated programs, policies, or other mitigation measures.

Project construction will require a peak labour force of 5,000. Most of the non-resident construction labour force will work on a fly in fly out basis, and will be accommodated at the Project's work camp. However, it is assumed that a small proportion of the labour force will re-locate into the LAA. During the peak year of construction, the LAA's population is estimated to increase by approximately 4,620 persons, or 30% over the baseline population forecast. Once operational, it is expected that the majority of the operators and management personnel will reside within the Prince Rupert area. The Project will hire and retain local residents for operations positions; but, due to the specialized nature of LNG plant operations, it is estimated that approximately 88% of the operations staff will be brought in from outside of the region. With training and experience, it is anticipated that local residents will make up a larger proportion of plant operations staff over time.

A peak workforce of up to 1,000 will be sustained for the duration of major Project turn-arounds, while minor turnarounds will involve a workforce of approximately 200. Most of these workers are anticipated to be non-local residents and they will be lodged in on-site accommodations. Major turnarounds will occur every five years following full build-out, while minor turnarounds will occur every two years following full build-out. During operations, average camp bed requirements will be between 300 and 600, with peaks of up to 1,000 for up to two months for turnarounds.

During construction, non-local resident workers will arrive for and depart from their shifts via charter aircraft, and be shuttled by bus and crew-cab truck to and from the LNG facility and construction camp. Using multi-passenger vehicles will reduce effects of transporting workers on traffic and transportation infrastructure. Due to the length of the Project shift (12 hours) and the services available at the construction camp, non-local Project workers are not expected to travel from the camp to the local communities. During operations, some of the approximately 400 non-local workers may choose to live in LAA communities with their families and they will add to the local traffic. This will increase demands on transportation infrastructure and services, although these increases are expected to be relatively small.

During operations, approximately 400 non-local workers will reside in the LAA, potentially with spouses and children. These additional residents will increase the demands on health care infrastructure and services, though these effects will likely be small because of the relatively small size of the non-local workforce. It has been recognized that the existing demand for health care infrastructure and services in the LAA is frequently not met and therefore hospitals will not be able to accommodate additional demands created by a larger population without an increase in services.

Direct effects on infrastructure and services are predicted to be not significant as Project-related demands are not expected to exceed the available capacity or lower the quality of services on a persistent basis. The majority of infrastructure and services have capacity to accommodate the increased population associated with the Project. Mitigation measures, particularly the use of an accommodation complex that

will provide housing, medical, and recreation services, will reduce the need for Project construction workers to use infrastructure and services elsewhere within the LAA. Over time, the LAA communities will adjust to the increased permanent population associated with Project operation. Aurora LNG will communicate Project requirements to municipalities to aid in planning for increased demands. With implementation of Project-specific mitigation and environmental protection measures, combined residual Project effects on infrastructure and services are predicted to be not significant.

Assessing the conservative scenario where all projects identified as likely to act cumulatively with Project residual effects proceed to construction, the total population (including fly in fly out workers) in the RAA is forecast to reach 49,500 persons by 2021 (a 38% increase over baseline projections) and the permanent population to increase by approximately 4,000 persons (a 10% increase over baseline projections) by 2025. While proposed resource and infrastructure projects will contribute to beneficial economic and social development in the RAA over the long term, overall cumulative residual effects over the short term are anticipated to be adverse and not significant with respect to community infrastructure and services and transportation infrastructure and services. This is due to the available capacity of most of the community and transportation infrastructure and services, and the standard mitigation that will likely be put in place by other project proponents. The residual effects are expected to be adverse and significant with respect to accommodations and health care infrastructure and services because the demand associated with the large population increase may exceed the existing capacity on an ongoing basis.

AS7.4 Land and Resource Use

The Land and Resource Use VC was selected because of the anticipated interactions between the Project and a variety of land and resource use activities. Land and resource use was identified as a topic of concern to Aurora LNG, regulators, Aboriginal Groups, stakeholders, and the public. For this assessment, tenured land use is an area of Crown land in which the government has granted rights to the tenure holder to exploit/harvest a particular resource, whereas non-tenured land use does not involve such tenure rights. The Project will interact with areas currently used for both tenured (e.g., forestry, trapping and guide outfitting) and non-tenured (e.g., outdoor recreation activities such as hiking) land use.

Other VCs that are supported by components of this assessment include Economic Conditions, Community Health, Summary of Statutory Requirements under CEAA 2012, and Aboriginal Consultation.

The potential effects assessed are change in tenured land use and private property and change in non-tenured land use. Potential project effects are quantified through spatial analysis, to estimate the reduction of land available for use within the LAA, supplemented with baseline research.

The LAA encompasses the entirety of Digby Island as well as Metford Island, Spire Island and Tuck Island. The RAA consists of the urban and rural communities, including Aboriginal communities, in the mainland portion of the SQCRD.

The Project will be located mainly on provincial Crown land, and on one private lot owned by the Aurora LNG joint venture partners. The Project overlaps with 49 ha (13%) of the Dodge Cove OCP area. The overlapping area is undeveloped land which the OCP identifies as “rural” and “watershed” lands.

In addition to industry-standard mitigation measures, Project-specific measures include:

- Aurora LNG will continue to engage with holders of affected tenures overlapped by the PDA and with affected private property owners within the LAA. Aurora LNG will endeavour to discuss implications of the proposed Project and develop methods to reduce effects.
- A fiber utilization plan will be implemented. Aurora LNG will adhere to cutting permits or authorization agreements and conditions for clearing activities.
- Strategies for managing access to the PDA will be implemented.
- Workers will be prohibited from storing hunting or fishing gear onsite (includes camps).
- Inform local communities with the LAA and identified stakeholders of the location and timing of Project activities, and other Project-related information.
- Where the PDA and the Dodge Cove OCP overlap, Aurora LNG will seek to develop in a manner that is consistent with the objectives of the "rural" and "watershed" land uses identified within the Dodge Cove OCP. Where required, Aurora LNG will seek any applicable variance or amendment to the Dodge Cove OCP in accordance with the Local Government Act and through collaboration with the SQCRD. In addition, Aurora LNG will continue to engage with the community of Dodge Cove to attempt to address their concerns.

A significant adverse residual effect on land and resource use is defined as one where the Project does not comply with established federal, provincial, or municipal/regional land use plans, policies or bylaws; and/or the Project will create a change or disruption that restricts or degrades present land use capabilities to a point where the activities cannot continue at or near current levels and where compensation is not possible.

In terms of tenured land and resource use, the Project will not require access or use through or use of private lands at Dodge Cove or Crippen Cove. There will be regular communication between Aurora LNG and owners and occupants within the LAA communicating project activities, schedule and activities. The PDA overlaps 694 ha of the North Coast Timber Supply Area that will be cleared during Project construction activities. Clearing will result in a net loss of available land and timber for harvesting, and a consequential reduction of the annual allowable cut. The PDA overlaps 779 ha (11.3%) of trapline TR0614T029. The Project will occupy 23% of the LAA, and thus remove a substantial proportion of Digby Island from potential recreational use. Additional areas, for example beaches along the west side of Digby Island, may be affected due to reduced accessibility. Project residual adverse effects on tenured land use and private property are considered not significant because the Project is not anticipated to change or disrupt present tenured land use capability to a point where the activities cannot continue at or near current levels, or where compensation is not possible.

With respect to non-tenured land and resource use, the PDA overlaps 779 ha (0.1%) of wildlife management unit 6-14, which will be unavailable for hunting throughout the life of the Project. There are several streams located within the PDA; however, the small stream sizes on Digby Island would not support large populations of CRA fish species. Limited information is available for non-Aboriginal persons engaged in vegetation and marine plant harvesting and gathering; however, it is conservatively assumed that this activity occurs within areas overlapped by the PDA and LAA. Project residual adverse effects on non-tenured land use are predicted to be not significant.

Cumulative effects on forestry will occur in multiple events during land clearing for each future project. The Project will result in a 0.04% reduction in the forested area within the North Coast Timber Supply Area, and thus will have a negligible contribution to cumulative effects on forestry. There are 138 traplines within the RAA, and some of these are overlapped by reasonably foreseeable projects. However, the area occupied by these projects is small compared to the total trapline area within the RAA. The Project's contribution to cumulative effects on land and resource use is expected to be low in magnitude and to extend throughout the LAA. With mitigation and environmental protection measures, the residual cumulative effects on the land and resource use are predicted to be not significant.

AS7.5 Marine Use and Navigable Waters

Marine Use and Navigable Waters was selected as a VC because Project components and activities have the potential to interfere with navigation and other commercial, recreational, and traditional marine uses. Marine use and navigation have been identified as topics of concern to Aurora LNG, regulators, Aboriginal Groups, stakeholders, and the public.

Other VCs that are supported by the assessment of Marine Use and Navigable Waters are Economic Conditions, Community Health, Summary of Statutory Requirements under CEAA 2012, and Aboriginal Consultation.

The potential effects included in the assessment are change in marine navigation and change in marine fisheries and other uses. The assessment of marine navigation compares the proportion of the navigable area occupied, and the width of the channel currently, and after construction of Project infrastructure. The assessment of marine fisheries evaluates the potential for Project-related shipping traffic to reduce fishing opportunities, by determining if there is overlap between fishing grounds and the shipping route and in consideration of the fishing techniques used in each fishing ground. The assessment of other marine uses, specifically recreation and tourism, evaluates the potential for Project-related shipping to reduce access to established marine sites.

The LAA includes waters around the marine terminal and MOF where interference with navigation could occur, and a 5 km buffer on each side of the centre line of the shipping route from the terminal to the pilotage station near Triple Island; where the shipping route is confined by geography and is less than 10 km wide the LAA is taken to be the entire width of the shipping route. The RAA includes the entire Pacific Fishery Management Area 4 plus a 16 km extension westward of Triple Island to include the expanded pilot boarding area.

The Project marine infrastructure is located in the Port of Prince Rupert, a federal port managed by the PRPA. Current vessel traffic in the area includes large shipping traffic, cruise ships, ferries, fishers (commercial, recreational, and Aboriginal), recreational boaters, commercial tour operators, military, coast guard, tugboats, and barges. The PRPA has extensive experience managing large vessel traffic, and is proactive in developing and implementing port initiatives to improve navigational safety and efficiency.

The Project is entering into the Technical Review Process of Marine Terminal Systems and Transshipment Sites (TERMPOL) for the marine shipping and marine terminal operations associated with the Project. It is anticipated that relevant and appropriate recommendations from the TERMPOL process will be incorporated into the proposed mitigation measures. In addition to industry-standard mitigation measures, Project-specific measures include:

- LNG carriers, tugs, and barges will not exceed a speed of 16 knots within the LAA.

- Project-related marine traffic, including LNG carriers, will use the Coast Guard Marine Communication and Traffic System to provide notice of planned arrival time at Triple Island. Aurora LNG will encourage Aboriginal Groups and stakeholders to use the system to plan their routing and scheduling.
- A Marine Activities Plan will be developed and implemented to communicate Project construction activities with mariners.
- Aurora LNG will install navigational aids within the vicinity of the MOF and marine terminal, and any additional navigational aids determined by the federal government to be necessary for safety within the LAA as a result of the Project.
- Aurora LNG will conduct safe-shipping workshops aimed at promoting safe navigation around shipping traffic for mariners.
- Aurora LNG will use escorts tugs within PRPA boundary and Digby Island during all LNG carrier transits.
- LNG carriers will strictly adhere to the prescribed route and passing restrictions.

A significant residual effect for marine use and navigable waters is one where the Project-activities are not compatible with established marine use plans or policies, or where the Project will create a change or disruption that widely restricts or degrades present marine uses to a point where the activities cannot continue at current levels and for which this change cannot be mitigated.

Change in marine navigation will occur through the construction of new marine infrastructure and shipping traffic. The marine terminal infrastructure will not impede the main shipping area, and only 2% of the infrastructure will protrude into the adjacent small vessel corridor. The MOF will be constructed almost entirely in Casey Cove, leaving most (over 80%) of the small vessel corridor unaffected and available for use by small vessel traffic. The effects of shipping traffic on marine navigation are considered long-term and will occur as multiple regular events. Effects will occur at a port that has high resilience, because of the proactivity and experience of the PRPA and involvement of other agencies such as the Pacific Pilotage Authority. With the implementation of mitigation measures, the Project will result in low magnitude residual effects on marine navigation.

Change in marine fisheries and other uses could occur from Project-related shipping physically interfering with access to fishing grounds or recreation and tourism sites. Most fisheries do not overlap with the LAA or use gear or practices that preclude interactions with shipping traffic. Recreation and tourism activities are not concentrated along the shipping route. Overall, with the implementation of mitigation measures, the Project-related LNG shipping traffic will result in low to moderate magnitude residual effects on marine fisheries and other uses. The effects of shipping traffic are considered long-term and will occur as multiple regular events (one ship per day at full build out). Residual effects will be limited to a well-established shipping route that has high resilience (because of a long shipping history and the size of available fishing areas in the region).

With implementation of Project-specific mitigation measures for marine construction and those aimed at promoting safe shipping along the route, and adherence to international and national maritime laws and regulations, it is unlikely that Project-related shipping will create a change or disruption that widely restricts or degrades the Marine Use and Navigable Waters VC to a point where the activities cannot continue at current levels and for which this change is not mitigated. Consequently, residual Project effects on marine use and navigable waters are predicted to be not significant.

With respect to the assessment of cumulative effects, all the marine infrastructure proposed for the Port of Prince Rupert is outside of the main shipping area, with very little of the infrastructure expected to overlap with the small vessel corridor. When past, present, and reasonably foreseeable projects or activities are considered, large vessel traffic in the region might increase up to 5.4 times the historical average. This predicted traffic volume (approximately 3,800 large vessels) will be spread across multiple ports (i.e., those in Prince Rupert, Kitimat, and proposed terminals north of Prince Rupert). The total shipping traffic heading to Prince Rupert would be 25% less than the volume currently handled at the Port of Vancouver; the Port of Prince Rupert is a federal port with similar infrastructure and systems in place to deal with similar types of vessels and cargo. The Project will conservatively contribute approximately 8.4% of the total annual large vessel traffic to the region. Residual cumulative effects on marine use and navigable waters are predicted to be not significant, and the Project's contribution to cumulative effects will be incremental when it is operating at full capacity and will not change the significance determination (i.e., cumulative effects are predicted to be not significant).

AS7.6 Community Health

Community Health was selected as a VC because construction, operations, and decommissioning of the Project could affect health outcomes, social determinants of health and accessibility and availability of harvested food. These issues are of concern to Aurora LNG, regulators, Aboriginal Groups, stakeholders, and the public.

The potential effects assessed are change in community health and wellness and change in harvested foods. The assessment of change in community health and wellness examines potential adverse effects on physical and mental conditions (health status) and on select social determinants of health, using qualitative and quantitative methods. The assessment of change in harvested foods uses qualitative methods to examine potential effects on the volume and consumption of foods. Quantitative estimates are made for workplace incidents and motor vehicle incidents based on estimated person-years of employment and changes in populations.

The LAA for community health and wellness includes communities within the mainland portion of the SQCRD including: City of Prince Rupert, DM of Port Edward, Dodge Cove Improvement District, Crippen Cove, remaining communities within the SQCRD Electoral Areas (SQCRDA) A and C, S1/2 Tsimpsean Indian Reserve 2 (Metlakatla First Nation), Lax Kw'alaams IR 1 (Lax Kw'alaams Band), Dolphin Island 1 (Gitxaala Nation), as well as Mills Memorial Hospital (Terrace). For change in harvested foods, the LAA includes communities within the mainland portion of the SQCRD including: City of Prince Rupert, DM of Port Edward, Dodge Cove Improvement District, Crippen Cove, other communities within the SQCRDA A and C, Lax Kw'alaams Band, Metlakatla First Nation, Gitxaala Nation, Kitsumkalum First Nation, Kitselas First Nation as well as, Gitga'at First Nation.

For change in community health and wellness, the RAA includes the LAA plus Terrace and adjacent communities, including: Terrace Census Agglomeration Area (City of Terrace, Kitimat-Stikine E [Thornhill] and Kulspai IR 6 [Kitselas First Nation]), Kitselas IR 1 (Kitselas First Nation), Kitsumkaylum 1 IR (Kitsumkalum First Nation), and Kitimat-Stikine RDA C (Part 1). For change in harvested foods, the RAA includes the LAA plus Terrace and adjacent communities, including: Terrace Census Agglomeration Area (City of Terrace, Kitimat-Stikine E [Thornhill]), Kitselas First Nation, Kitsumkalum First Nation, and Kitimat-Stikine RDA C (Part 1).

On average, regional life expectancies, perceived health, and median incomes are lower than provincial averages, and rates of children on income assistance are greater than provincial averages, leading to challenges with local and regional community health and wellness. Aboriginal and non-Aboriginal harvesting and consumption of country foods is known to occur within the LAA and RAA; however, publicly available information regarding non-Aboriginal consumption of harvested foods is limited. The assessment considers information published by the First Nations Health Authority to describe health benefits of harvested foods as applicable to non-Aboriginal consumers.

The following mitigation measures are proposed to manage potential Project effects on community health:

- Aurora LNG employees will be provided with access to an employee assistance program. The program will promote holistic worker health from a physical, mental, cultural and social perspective. Aurora LNG will encourage its subcontractors to make available similar programs.
- An infection control policy will be developed and included in the HMSP. The policy will outline infectious disease control procedures not limited to prevention measures and outbreak response. The development of the policy will be informed through Northern Health's Infection Control Plan Best Management Guide for Industrial Camps.

Significant adverse effects to community health and wellness are those that are highly distinguishable from current conditions and trends and cannot be managed or mitigated through adjustments to programs, policies, plans, or other mitigation. Significant adverse effects to harvested foods are characterized by a persistent and substantial decline in availability and/or perceived quality of harvested foods.

Project-related effects on community health and wellness are predicted to be both beneficial and adverse. Beneficial effects will occur to the extent that increased family income due to Project-related employment improves health status, strengthens social support networks, and leads to improvements in personal health practices and coping skills. Adverse effects on community health are predicted particularly during the construction stage, when there will be a rapid increase in population within the LAA and a demographic shift due to the predominantly male construction workforce. Adverse effects on community health and wellness are predicted to be not significant.

Adverse effects on terrestrial, freshwater, and marine harvesting will occur continuously throughout all Project phases. These effects will be long term, beginning with construction, through operations and decommissioning, and will extend to the LAA. Adverse changes in the availability of country foods and in access to and use of areas within and affected by the PDA are reversible following decommissioning and site remediation. Alternative areas of hunting, trapping, fishing, and gathering exist within the LAA and RAA where the harvesting of country foods can occur; therefore, localized changes in use can be accommodated. Adverse effects on harvested foods are predicted to be not significant.

With mitigation, the Project's contribution to cumulative effects on community health and wellness and cumulative change in harvested foods are expected to be low to moderate in magnitude (dependent on the number of reasonably foreseeable projects constructed and operated) and to extend throughout the RAA. With implementation of Project-specific mitigation and environmental protection measures, and the mitigation measures of other projects within the RAA, the combined residual cumulative effects on community health are predicted to be not significant.

AS8 ASSESSMENT OF POTENTIAL HERITAGE EFFECTS

The assessment of the Archaeological and Heritage Resources VC is based primarily on background research and technical field data gathered during the Archaeological Impact Assessment (AIA) of the PDA (conducted under Heritage Inspection Permit 2015-0007) and a desktop review of paleontological potential. This assessment also incorporates information gathered during consultation with Aboriginal Groups and other knowledgeable stakeholders.

Archaeological and heritage resources were selected as a VC for the following reasons:

- Archaeological and heritage resources may be affected by construction of the facility.
- The provincial *Heritage Conservation Act* (HCA) automatically protects archaeological and heritage resources that pre date AD 1846 as well as Aboriginal rock art and human remains, regardless of their age. The HCA also protects heritage wrecks (e.g., aircraft and ships) more than two years old. Sites that post-date AD 1846 may also be protected by the HCA if they have heritage value, whether designated or not, for BC, a community or an Aboriginal Group.
- The provincial *Land Act* protects palaeontological resources (fossils), which are administered by the Land Tenures Branch. Fossils are the preserved remains, traces, or imprints of organisms from the geological past (Land Tenures Branch 2016).
- Section 5(1)(c) of CEAA 2012 requires consideration of Aboriginal physical and cultural heritage and of any structure, site, or thing that is of historical, archaeological, paleontological, or architectural significance.
- The archaeological and heritage resources assessment supports the assessment of Aboriginal Consultation (see Section 12). Archaeological sites, including culturally modified trees (CMTs) that pre-date AD 1846 and CMTs that post-date AD 1846, provide a record of TU of the land by Aboriginal Groups.

Both the LAA and RAA for archaeological and heritage resources are the PDA because potential Project effects on the VC would be site-specific and limited to locations directly affected by vegetation clearing and/or ground disturbance during construction.

Archaeological and heritage resources are non-renewable and highly susceptible to disturbance. During construction, activities that could have adverse effects on heritage resources in the LAA/RAA are anticipated. The potential effect assessed is the loss of information about or alteration to site contents or context.

Through the AIA and previous archaeological research on Digby Island, there are 62 sites recorded within the LAA/RAA that are subject to automatic protection under the HCA. These include 51 CMT sites, four shell midden sites, two multicomponent sites, two petroform sites, two marine shipwrecks, and one historic grave site.

Where feasible and practical avoidance of archaeological sites through Project detail design is the primary mitigation strategy. Where avoidance is not feasible or practical, mitigation will focus on systematic data recovery. Work will be undertaken in adherence to an approved Archaeological and Heritage Resources Management Plan.

While there are archaeological or heritage resources within the LAA/RAA, Project activities are anticipated to wholly or partially avoid most of the archaeological or heritage resources with the highest significance (e.g. Archaeological sites GbTo-14, GbTo-28, GbTo-172). Effects to archaeological or heritage resources that cannot be avoided will be mitigated through regulated mitigation measures such as Systematic Data Recovery and/or archaeological monitoring of development activities to verify that the data are recovered, analyzed, and reported. Residual effects on archaeological and heritage resources are predicted to be not significant.

The implementation of regulated mitigation will result in the absence of Project residual effects; therefore, there is no Project contribution to cumulative effects and cumulative effects are predicted to be negligible and not significant.

AS9 ASSESSMENT OF POTENTIAL HEALTH EFFECTS

Human Health is a VC because the Project may change the environmental quality of the air, land, water, and biota, which may result in a change in health to the local population. Human health, in the context of the assessment, is defined as the physiological health of a population resulting from exposure to chemicals in the environment. The protection of human health is important to Aurora LNG, regulators, Aboriginal Groups, stakeholders, and the public. The Community Health VC is supported by this assessment of Human Health.

The construction, operations, and decommissioning phases include physical activities that may change the environmental quality of the air, land, water, and biota of the region. Emissions of airborne chemicals of potential concern (COPC) may affect the health of local people during all phases of the Project, and may also affect surface waters that may be used for domestic drinking water. Dredging and propeller wash from LNG carriers will disturb marine sediments, which can change the dynamics of chemical movement in the environment and subsequently increase or decrease levels of chemicals in aquatic life. People consuming marine harvested foods from areas influenced by dredging may experience a similar change in their exposure to these chemicals.

As a result of these potential changes, three potential effects have been assessed: changes to human health from changes in air quality; changes to human health from changes to surface water quality; and changes to human health from changes in harvested food quality.

The LAA and RAA for the VC coincide with those used for the air quality assessment – a 30 km by 30 km square and a 50 by 50 km square centred on the proposed Project footprint, respectively. Both the LAA and the RAA include the individual study areas for the topics considered under Human Health (i.e., air quality, harvested food quality and surface water used for drinking).

Existing conditions for human health are the current levels of health risk defined by the concentration ratio (CR), the incremental lifetime cancer risk (ILCR) and the hazard quotient (HQ). Airborne COPCs (i.e., NO_2, SO_2, $PM_{2.5}$ and PM_{10}) and food-borne COPCs (PCDD/F, PAH, and copper) are present in the environment from natural and human-derived sources. The baseline CR, HQ, and ILCR associated with current levels of COPC exposure from the environment serve as benchmarks when determining the change in human health risk associated with Project activities. The assessment evaluated the plausible interaction pathways where physical activities related to the Project could result in changes to human health from the exposure to COPCs in the environment.

The mitigation measures described for the Air Quality VC will reduce emissions of NO_2, SO_2, $PM_{2.5}$, and PM_{10} during the construction, operations, and decommissioning phases of the Project. These mitigation measures reduce the change in air quality associated with the Project and also reduce the potential health risk to people living in the LAA. No mitigation measures specific to the protection of human health through the consumption of marine harvested foods are recommended during the construction and operations phases. Project activities related to dredging are designed to reduce the potential for adverse environmental effects. The design of the dredging program includes the initial removal of the upper 0.5 m of sediment for disposal on land to mitigate the potential for resuspension of sediments containing higher concentrations of PCDD/Fs and PAHs relative to the underlying sediment.

There are three significance thresholds considered for residual effects to human health:

- Changes to human health from changes in air quality – Non-carcinogenic health risk:
  - If the Base Case CR for air inhalation is less than 1.0, the significance threshold is reached when the Application or CEA Case CR is greater than 1.0.
  - If the Base Case CR for air inhalation is greater than 1.0, the significance threshold is reached when the Application or CEA Case CR is greater than the Base Case CR + 0.2.
- Changes to human health from changes in harvested food quality or changes in surface water quality – Non-carcinogenic health risk:
  - If the baseline HQ for food or water ingestion is less than 0.2, the significance threshold is reached when the Project or cumulative case HQ is greater than 0.2.
  - If the baseline HQ for food or water ingestion is greater than 0.2, the significance threshold is reached when the Project or cumulative case HQ is greater than baseline HQ + 0.2.
- Changes to human health from changes in harvested food quality or changes in surface water quality – Carcinogenic health risk:
  - The significance threshold is reached when the carcinogenic health risk from exposure to carcinogenic chemicals is greater than 10^{-5} (i.e., the cancer risk is greater than 1 in 100,000 people).

Project activities are not expected to have direct effects on surface water quality in a manner that would affect human health; there are no Project interactions that could result in changes to drinking water.

The determination of significance for Project residual effects on human health considers the change in human health risk as defined by the CR for changes in air quality, and by the HQ and ILCR for changes in marine food quality.

There are no significant short-term (1-hour and 24-hour) or long-term (annual) effects to human health for residents of Dodge Cove, Digby Island, Prince Rupert, Port Edward, Georgetown Mills (no residents) and the Metlakatla village from their exposure to airborne COPCs. Therefore, for changes to human health from changes in air quality, the Project residual effect is not significant. Although there is a change in the health risk to people living within the LAA, the low magnitude of change will not change the health status of the general population.

The quality of marine foods will improve during and after dredging during the construction phase due to removal (and disposal on land) of the surface 0.5 m of sediment, some of which contain PCDD/Fs and PAHs. The baseline HQs for toddlers and adults are currently below the health risk threshold for all COPCs and are predicted to decrease after this surface sediment is removed and disposed of on land. For changes to human health from changes in marine food quality, the Project residual effect is also not significant. The baseline HQ and ILCR associated with consuming marine foods is well below the significance threshold.

Potential cumulative effects to human health are limited to potential changes from changes in air quality, as there is no residual Project effect on marine food quality to overlap with the potential residual effects of other projects.

Contributions of airborne COPCs from other projects do not meaningfully affect the health risk and would not alter the health status of the general population in Digby Island, Prince Rupert, Port Edward, Georgetown Mills (no residents) and Metlakatla village. The air quality within the RAA for all project phases and the Cumulative Effects Assessment (CEA) Case is predicted to be within the applicable BC MOE human health-based AAQO. Residual cumulative effects are considered to be not significant, as the short-term and long-term CRs for NO_2, SO_2, $PM_{2.5}$, and PM_{10} are less than the significance threshold.

AS10 ACCIDENTS OR MALFUNCTIONS

Aurora LNG's Environmental Management Plan (EMP) and the Emergency Response Plan (ERP) will include potential accident or malfunction scenarios that apply to the operations phase of the Project. Nexen's Safety First culture emphasizes safety and environmental responsibility. The Project will be designed, constructed, and operated with a focus on environmental protection and human health and safety.

Accidents and malfunctions considered in the assessment are motor vehicle collisions, facility impact from aircraft, on-shore fires or explosions, LNG plant malfunctions, on-shore hazardous spills, vessel grounding or collision, and releases from LNG carriers. In addition to standard best management practices, the EMP and ERP, Aurora LNG will implement the following to prevent and mitigate accidents and malfunctions:

- Design, location, installation and operation of the Project in accordance with Canadian Standards Association (CSA) code Z276-2011
- Nexen's North American Gas and Tight Oil Emergency Management Plan
- Compliance with the CSA Z276-15 code (emergency shutdown systems, fire and leak control, fire protection systems, emergency equipment, security and personnel safety codes specific to the LNG production, storage and handling industry)
- Emergency response equipment that will meet applicable codes and standards designed to respond to fires or explosions.
- Compliance with codes and standards from the CSA, National Building Code of America, American Society of Mechanical Engineers, American Concrete Institute, and American Petroleum Institute
- A Transportation Management Plan
- Listing of products classified as dangerous goods under the federal *Transportation of Dangerous Goods Act* and/or those defined as controlled products under the provincial and federal Workplace Hazardous Materials Information System legislation
- Consideration of the Society of International Gas Tanker and Terminal Operators and Oil Companies International Marine Forum guidelines regarding Project siting, design, and operations.

The application of the Transportation Management Plan will mitigate the probability of motor vehicle collisions through the management of Project-related traffic in the PDA and through the reduction of motor vehicles on the road. There is no significant residual effect to any VC anticipated from motor vehicle collisions.

In general, the severity of an aircraft collision to the facility and resulting injuries will determine the risk and significance of residual effects to community health. Best practices, regulatory requirements, and company standards will be in place to limit the potential for and effect of an aircraft collision to the facility. Although the probability of facility impact from aircraft is very low, there is potential for a significant effect on Community Health if the scenario involves the loss of life.

The LNG plant will meet stringent regulations, standards, and codes and implement controlled ignition, gas leak detection, fire control, and fire suppression technologies. Aurora LNG will perform fire and explosion analyses as per company requirements and produce a quantitative risk analysis for the facility. The Project will comply with the CSA Z276-15 code. The implementation of best practices, regulatory requirements, and company standards, will reduce the probability of an accident or malfunction scenario involving small-scale on-shore fires and explosions. However, in the event of an incident there is still the potential for significant residual effects to the Community Health and Archaeological and Heritage Resources VCs. Large-scale on-shore fires and explosions may result in significant residual effects to Vegetation and Wetland Resources, Wildlife Resources, Community Health, and Archaeological and Heritage Resources VCs.

LNG plant malfunctions include the partial or full emergency shutdown of a maximum of one production train with associated flaring. The LNG plant will be designed to shut down in a safe and controlled manner in response to upset conditions (i.e., protecting against high pressure, high and low temperatures, and low flow conditions), or in the event of an emergency. No significant residual effects to any VCs are anticipated from LNG plant malfunctions.

In the event of an on-shore accidental spill, the ERP will be implemented, if necessary. Canadian Standards Association code Z276-2011 requires that LNG storage systems be located far enough from the facility boundary to mitigate the levels of radiant heat flux from fires and to mitigate the potential for spills to generate vapour concentrations beyond acceptable limits at the facility boundary. The implementation of best practices, regulatory requirements, and company standards will reduce the probability of an on-shore hazardous spill. However, in the event of an accident or malfunction scenario involving a small-scale or large-scale on-shore hazardous spill there is still the potential that it will result in a significant residual effect to Vegetation and Wetland Resources (specifically, wetland resources). An accident or malfunction scenario involving a large-scale on-shore spill that reaches the marine environment may have significant residual effects to Marine Mammals (large-scale spill resulting in acute effects on marine mammal species at risk, or effects to marine fish that adversely affect foraging opportunities for marine mammal species at risk), and Marine Birds (acute toxic effects).

Although very unlikely, LNG carriers and MOF-bound vessels servicing the marine terminal have the potential to become grounded in shallow waters, collide with another vessel along its shipping route, or collide with marine terminal infrastructure. A credible worst case scenario with a potential consequence of concern is a hull breach and containment failure of one LNG membrane tank (up to 48,000 m^3 in volume) and one marine fuel tank (up to 2,500 m^3 in volume). Factors contributing to the LNG industries long-standing safety record include engineering design and construction of the LNG carrier cargo containment systems, equipment maintenance planning, industry standards, regulatory oversight, and personnel training in the context of applicable operational procedures. With the implementation of best practices, regulatory requirements, including mandatory pilotage while in Canadian waters (*Pilotage Act*) and adhering to speed limits established by PRPA, an accident or malfunction scenario involving an LNG release at the loading facility may have significant residual effects to Marine Mammals and Community Health (if the event results in a serious injury or loss of human life).

The likely worst case scenario for an LNG carrier while loading would be a separation of the LNG loading arm or loading line from the carrier, resulting in the release of non-pressurized LNG and liquid pool formation on water, with a subsequent vapour cloud of natural gas. Design controls and preventative measures will be in place, and will include equipping the marine terminal with safe-guarding instruments, including process alarms, gas detection and fire detection systems, and considering the Society of

International Gas Tanker and Terminal Operators and Oil Companies International Marine Forum guidelines. With the implementation of best practices, regulatory requirements, and company standards, an accident or malfunction scenario involving an LNG release at the loading facility is highly unlikely. However, if such an event were to take place, it may have significant residual effects to Marine Mammals and Community Health (if the event results in a serious injury or loss of human life).

By implementing mitigation and response measures (e.g., EMP, ERP, port traffic management, land-based radar and real-time tidal current sensors, and operating at safe speeds for the given marine area and marine conditions), the probability of a vessel-to-vessel collision is effectively reduced. However, if a vessel-to-vessel collision were to occur, the potential cumulative effects are expected to be significant for Marine Mammals and Marine Birds if the event results in a release of diesel and/or bunker oil. Cumulative effects associated with other accidents and malfunctions are considered to be highly unlikely given the low probability of these scenarios occurring, and the low probability of temporal or spatial overlap with other projects and activities.

AS11 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

The Project's land based facilities could be affected by seismic events and meteorological conditions. Marine components could be affected by seismic events and by meteorological and oceanographic conditions.

The Project could be subject to the following adverse environmental factors:

- Extreme Weather (as per historical records):
  - Temperatures
  - Precipitation and related flooding events
  - Wind, tides and storms.
- Other Environmental Factors
  - Seismic events
  - Slope instability (underwater slope failure and mass wasting)
  - Tsunamis
  - Forest fires
  - Climate change (long-term changes in temperature, precipitation, and sea levels).

The primary mitigation tools to prevent or reduce the severity of adverse environmental effects of the environment on the Project are rigorous engineering designs and planning, including adherence to up-to-date design codes, to enable facility infrastructure and systems to withstand normal and extreme environmental conditions without loss of containment or danger to personnel.

Further assessments will be conducted during the FEED stage of the Project; the purpose of those studies will be to inform the design and to predict, prepare, and appropriately control risks and their potential effects.

AS12 SUMMARY OF FACTORS IDENTIFIED IN SECTION 19 OF CEAA 2012

Table AS12-1 summarizes how the CEAA subsection 19(1) factors have been considered by Aurora LNG. The table also summarizes Section 5 environmental effects and the significance of these effects.

Table AS12-1 CEAA 2012 Summary Table – Section 5 and Section 19

CEAA 2012 Section 5 Effect or 19(1) Factor	Conclusion of the Assessment
Section 5(1)(a)	
Fish as defined in section 2 of the *Fisheries Act* and fish habitat as defined in subsection 34(1) of that Act	Residual Project-related and cumulative effects are predicted to be significant for harbour porpoises, and not significant for other species of marine mammal and freshwater and marine fish and fish habitat.
(ii) Aquatic species as defined in subsection 2(1) of the *Species at Risk Act*	Residual Project-related and cumulative effects for aquatic species as defined in subsection 2(1) of the *Species at Risk Act* are expected to be not significant.
(iii) Migratory Birds as defined in subsection 2(1) of the *Migratory Birds Convention Act*, 1994	Residual Project-related and cumulative effects for Migratory Birds as defined in subsection 2(1) of the *Migratory Birds Convention Act* are expected to be not significant.
Section 5(1)(b)	
A change to the environment that would occur on (i) Federal Lands (ii) In another province (iii) Outside of Canada	**Federal Lands** The marine terminal and marine access to the terminal are located on federal Crown lands (water lot) that are within the jurisdiction and administration of the PRPA. Changes to the environment on federal lands relate to air quality, GHG emissions, sound, marine fish and fish habitat, marine mammals, and water quality **Another Province** A change to the environment in a province other than BC as a result of the Project is limited to the contribution of GHG emissions to national emissions estimates. **Outside of Canada** A change to the environment outside of Canada as a result of the Project is limited to the contribution of GHG emissions to global estimates. Project residual effects and cumulative effects for all components except GHG emissions are predicted to be not significant. For GHG emissions, the precedence set by regulators for similar projects within the industry profile, in combination with the high magnitude evaluation based on CEA Agency guidance (2003) and professional judgement lead to the conclusion that the Project-alone case is significant for GHG emissions. The Project's GHG emissions are also considered significant in the cumulative case.
Section 5(1)(c)	
A change to the environment that may affect health and socio- economic conditions, with respect to Aboriginal Groups	The effects of potential changes to the health and socio-economic conditions of Aboriginal Groups were assessed for issues related to changes in air quality, harvested food quality, noise levels, harvested food availability, and visual quality. Taking into consideration the combined magnitude, geographic extent, duration, and context of the potential residual adverse effects on Aboriginal groups health and socio-economic conditions, the overall effects are expected to be not significant.
A change to the environment that may affect physical and cultural heritage, with respect to Aboriginal Groups	The effects of potential changes to the physical and cultural heritage of Aboriginal Groups were assessed for issues related to the loss of information about, or alteration of archaeological and heritage resources and the results from the assessment of the current use of lands and resources for traditional purposes; specifically the loss of spiritual and culturally important sites, the reduction in access to spiritually and culturally important sites and the change in experience of using sites for cultural and spiritual practices. Taking into consideration the combined magnitude, geographic extent, duration, and context of the potential residual adverse effects on Aboriginal groups physical and cultural heritage, the overall effects are expected to be not significant.
A change to the environment that may affect current use of lands and resources for traditional purposes, with respect to Aboriginal Groups	The effects of potential changes to the current use of lands and resources for traditional purposes were assessed for issues related to changes in consumptive and non-consumptive forms of current use. For consumptive use, this entails to such current uses of hunting, fishing, trapping, and vegetation gathering. For non-consumptive, use this entails changes in current uses of relevant spiritual or culturally important species and sites. Taking into consideration the combined magnitude, geographic extent, duration, and context of the potential residual adverse effects on Aboriginal Groups Current Use of lands and resources, the overall effects are expected to be not significant.
A change to the environment that may affect any structure, site or thing that is of historical, archaeological, paleontological or architectural significance, with respect to Aboriginal Groups	The effects of potential changes to any structure, site or thing that is of historical, archaeological, paleontological, or architectural significance for Aboriginal Groups were assessed for issues related to the loss of information about, or alteration of site contents or context and the results from the assessment of the current use of lands and resources for traditional purposes; specifically the loss of spiritual and culturally important sites, the reduction in access to spiritually and culturally important sites and the change in experience of using sites for cultural and spiritual practices. Taking into consideration the combined magnitude, geographic extent, duration, and context of the potential residual adverse effects on Aboriginal Groups' structures, sites or thing that is of historical, archaeological, paleontological or architecturally significant, the overall effects are expected to be not significant.

Table AS12-1 CEAA 2012 Summary Table – Section 5 and Section 19

CEAA 2012 Section 5 Effect or 19(1) Factor	Conclusion of the Assessment
Section 5(2)(a)	
A change (other than covered under section 5(1)(a) or (1)(b) above) that is directly linked or necessarily incidental to a federal authority's exercise of power that would permit the proposed Project, or part of the proposed Project, to proceed	Changes to the environment that are directly linked or necessarily incidental to federal decisions may result from Project activities during construction, operations, and decommissioning, including changes to sound, air quality, GHG emissions, water quality, and lighting. With the implementation of Project-specific mitigation and environmental protection measures, and the mitigation measures of other projects within the RAA, the residual effects of changes to sound, air quality, water quality, and lighting are predicted to be not significant. For GHG emissions, the precedence set by regulators for similar projects within the industry profile, in combination with the high magnitude evaluation based on CEA Agency guidance (2003) and professional judgement, lead to the conclusion that the Project-alone case is significant for GHG emissions. The Project's GHG emissions are also considered significant in the cumulative case.
Section 5(2)(b)	
An effect, other than those referred to in paragraph (1)(c), of any change referred to in paragraph (a) on: (i) health and socioeconomic conditions, (ii) physical and cultural heritage, or (iii) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance	The effects of potential changes to the environment were assessed for issues related to changes in harvested foods and community health and wellness, reductions in visual quality and effects on marine users, changes in recreational freshwater fishing, marine plant harvesting and gathering, changes in navigation, marine fisheries and other uses, and loss of information about or alteration to archaeological and heritage sites. Based on the assessment of not significant residual effects for all socio-economic components, no significant residual effects to health and socio-economic conditions, physical and cultural heritage, and any structure, site, or thing that is of historical, palaeontological, or architectural heritage as a result of the Project were identified.
Section 19(1)	
Accidents or Malfunctions	Hypothetical, credible, high consequence events for each type of accident or malfunction were identified based on professional judgment, experience with similar projects, and input from regulators and the Working Group. Potential adverse residual effects were assessed as significant for the following VCs: **Motor vehicle collisions** – Community Health. **Facility impact from aircraft** – Community Health. **On-shore fires or explosions** – Vegetation and Wetland Resources, Terrestrial Wildlife Resources, Community Health, and Archaeological and Heritage Resources. **On-shore hazardous spills (small-scale spills)** – Archaeological and Heritage Resources and Human Health. **On-shore hazardous spills (large-scale spills)** - Water Quality, Vegetation and Wetland Resources, Freshwater Fish and Fish and Fish Habitat, Marine Fish and Fish Habitat, Marine Mammals, Marine Birds, Archaeological and Heritage Resources, and Human Health. **Vessel grounding or collision** – Marine Mammals, Marine Birds, Community Health Archaeological and Heritage Resources. **Releases from LNG carriers during loading**- Marine Mammals and Community Health. Regarding potential residual cumulative effects, after mitigation, which includes adherence to the Environmental Management Plan and the Emergency Response Plan, the cumulative residual effects from spills of diesel and/or bunker oil from vessel-to-vessel collisions are assessed as not significant. In summary, significant residual effects on VCs from the assessed accident and malfunction scenarios, including consideration of cumulative effects, are predicted to be unlikely.
Comments from the public	Public consultation related to the Project was focused on identifying and addressing community issues throughout the development of the Project Description, the AIR and the Application for an EAC. Key issues raised by the public included: ▪ Quality of Life/Community Identity ▪ Social Cohesion ▪ Property Values ▪ Cost of Living Aurora LNG will continue to consult with the public to understand issues.

Table AS12-1 CEAA 2012 Summary Table – Section 5 and Section 19

CEAA 2012 Section 5 Effect or 19(1) Factor	Conclusion of the Assessment
Purpose of the designated Project	The purpose of the Project is to convert natural gas from the WCSB of northeast BC into LNG, through a cooling process, for shipment by LNG carriers to markets in Asia. At full build-out, the facility will produce 24 MTPA of LNG. Once delivered to markets in Asia, the LNG will be regasified and distributed, where it may reduce reliance on other non-renewable energy sources such as coal and nuclear fuels, in some markets. The Project is consistent with provincial policies and priorities to promote the development of the LNG industry in BC. Specifically, the Project will: ▪ Enhance the business capacity of the joint venture participants ▪ Meet increasing customer demand for LNG ▪ Provide benefits to BC and Canada through creation of employment and business opportunities, as well as through payment of taxes and royalties to the federal and provincial governments.
Alternative Means	Alternative means of carrying out the Project that are technically and economically feasible, and the environmental effects of any such alternatives were assessed for the following Project components: ▪ Water supply ▪ Power supply ▪ Orientations of onsite LNG facilities ▪ Marine terminal locations ▪ Disposal of marine sediments and terrestrial overburden ▪ Access road routing ▪ Flare design and locations ▪ Temporary construction camp(s) locations ▪ Construction camp operations (i.e. water use, employee transportation and waste disposal). The preferred alternative designs were selected using the following criteria: ▪ Technical requirements ▪ Feedback received from Aboriginal Groups, government, and the public ▪ Economic feasibility ▪ Reducing adverse effects on environmental and heritage resources ▪ Industry safety standards and regulatory requirements. In some instances the preferred design (i.e. flare design) has not been determined for the Project and further assessment and evaluation is underway using the criteria described above.
Changes to the proposed Project that may be caused by the Environment	Environmental factors that have the potential to affect the Project were assessed in the context of existing site conditions and Project-specific mitigation measures proposed to avoid or reduce the potential adverse effects. Environmental factors include: ▪ Temperature ▪ Precipitation and flooding ▪ Wind, tides and storms ▪ Seismic events and tsunamis ▪ Slope instability (underwater slope failure and mass wasting) ▪ Forest fires ▪ Climate change (long-term changes in temperature, precipitation, and sea levels). Tsunami waves may pose a risk to the Project, and a seismic hazard study and a terrain stability study is required to assess the level of risk a seismic event could have on the Project. For all other environmental factors, the severity of potential changes to the Project is very low; therefore, risk is assessed as remote and the effects are predicted to be not significant Additional engineering studies during the FEED phase will assist in limiting the risk, and all land and marine based Project components will be built as per the requirements of the National and Provincial Building Codes (NBCC 2015, Government of BC 2012) and the Canadian Standards Association documents for LNG production, storage and handling and marine structures (CSA Z276-15 2015a, CSA EXP276.1-2015).
Follow-up Programs	The follow-up programs listed below will be implemented to verify the accuracy of the environmental assessment conclusions and to determine the effectiveness of any mitigation measures. ▪ A Wildlife Management Plan will outline a follow-up program to monitor potential effects of the Project on a great blue heron rookery located west of Dodge Cove. ▪ An acidification and eutrophication follow-up program will monitor freshwater quality, vegetation and soils to document potential effects from increased atmospheric NO_2 and SO_2 concentrations, soil acidification, or soil eutrophication in areas where deposition is predicted to occur.

Table AS12-1 CEAA 2012 Summary Table – Section 5 and Section 19

CEAA 2012 Section 5 Effect or 19(1) Factor	Conclusion of the Assessment
Environmental Effects, Mitigation Measures, Cumulative Effects, Significance of Environmental Effects of the proposed Project	With the implementation of the preliminary mitigation measures summarized in Section 16.0, the Projects residual environmental effects and cumulative effects summarized in Sections 4.12 are predicted to be not significant for all VCs, with the exception of GHG emissions and marine mammals. For GHG emissions, the precedence set by regulators for similar projects within the industry profile, in combination with the high magnitude evaluation based on CEA Agency guidance (2003) and professional judgement lead to the conclusion that the Project-alone case is significant for GHG emissions. The Project's GHG emissions are also considered significant in the cumulative case.

AS13 PART C ABORIGINAL CONSULTATION

Aurora LNG's approach to consultation is divided into four stages:

- Early Engagement – from Project inception to the filing of the original Project Description with the BC EAO and CEA Agency.
- Pre-Application Consultation – from filing of the original Project Description June 27, 2014 to September 15, 2016, the proposed Application submission date for screening, and the time until it is formally accepted by the EAO.
- Application Review Consultation – from formal acceptance of the Application by the EAO to receipt of the Minister's decision on the issuance of the EAC.
- Ongoing Engagement – the period covering the life-cycle of the Project.

To date, Aurora LNG has consulted with Aboriginal Groups using a variety of methods, including formal Working Group meetings, Project-related open houses, technical workshops, site tours, meetings, e-mails, letters, and phone calls. During these consultation activities, Aurora LNG has:

- Disseminated information about the Project to assist with understanding how the Project could potentially impact Aboriginal Interests
- Worked to develop an understanding of how each Aboriginal Group has traditionally exercised, and are currently exercising, their Aboriginal Interests in the Project vicinity
- Discussed and worked towards obtaining group-specific existing conditions information to inform the assessment in the Application
- Documented and responded to concerns expressed by each Aboriginal Group.

Consultation with Aboriginal Groups influenced the assessment of the VCs discussed in Part B of the Application. Each VC section contains a section titled "influence of consultation" which describes how this feedback influenced the assessment.

Aurora LNG designed the consultation program to obtain Project-specific TK/TU information directly from Aboriginal Groups. The available information was used to inform the assessment methods used to prepare this Application, particularly with respect to the assessment of VCs in Part B, the requirements of CEAA 2012 5(1)(c) in Part B, and in the assessment of Aboriginal Interests.

Aurora LNG is committed to on-going consultation with Aboriginal Groups during the remainder of the environmental assessment and through the life of the Project to broaden and deepen its understanding of each Aboriginal Groups interests and concerns.

Aurora LNG submitted a final Aboriginal Consultation Plan to the BC EAO in September, 2015. Aboriginal Consultation Reports (ACR) have been developed by Aurora LNG. The purpose of these reports is to:

- Summarize the efforts undertaken by Aurora LNG to consult with Aboriginal Groups
- Record in tracking tables, feedback received during consultation
- Identify the potential adverse effects of the Project on Aboriginal Interests

- Identify how the potential adverse effects of the Project on Aboriginal Interests will be avoided, mitigated, addressed, or otherwise managed
- Outline steps or future consultation activities, other than those outlined in the approved ACP.

In accordance with the Section 11 Order issued by the BC EAO for the Project, Aurora LNG is required to submit an ACR at the following phases of the environmental assessment: with the submission of the final draft of the AIR and VC Selection Document (ACR #1); at the time of submission of the Application (ACR #2); and 120 days after the commencement of the Application review stage, and at any other time specified by the EAO Project Assessment Lead.

ACR #1 (Aurora LNG 2016) was submitted to the BC EAO on January 20, 2016, and updated on July 19, 2016. ACR #1 summarized Aurora LNG's consultation and engagement with Aboriginal Groups up to submission of the final Draft AIR and VC Selection Document.

ACR #2 was submitted to Aboriginal Groups for comment on August 12, 2016. Comments provided by Aboriginal Groups were incorporated into the final draft of the ACR #2, which is appended to the Application (Appendix S1).

Aurora LNG will continue to engage with Aboriginal Groups through the Application review period and the permitting, construction, operation, and decommissioning phases of the Project. Aurora LNG will continue to facilitate this communication through workshops, open houses, and participation in relevant committees.

AS14 PART C ABORIGINAL INTERESTS

AS14.1 Key Findings for the Assessment of Aboriginal Interests

Part C of the Application explains how Aurora LNG has consulted with Aboriginal Groups listed in the Section 11 Order. The assessment describes potential effects of the Project on the exercise of rights associated with Aboriginal title, focusing on the rights that would be held by Aboriginal Group title holders if title were established. As set out in the Section 11 Order, the following six Aboriginal Groups have Aboriginal Interests that could potentially be affected by the Project:

- Gitga'at First Nation
- Gitxaala Nation
- Kitselas First Nation
- Kitsumkalum First Nation
- Lax Kw'alaams Band
- Metlakatla First Nation.

Aurora LNG's approach to preparing the Part C assessment of potential Project effects on asserted Aboriginal rights, including title, or such determined Aboriginal and treaty rights ("Aboriginal Interests"), is based on six principles:

1. All information received from Aboriginal Groups regarding the Project will be meaningfully considered by Aurora LNG
2. Aurora LNG will treat all asserted rights as "Aboriginal Interests" for the purposes of this Application
3. For each Aboriginal Group, Aurora LNG will consider and discuss residual effects that may interfere with ability of the Aboriginal Group to exercise their Aboriginal Interests within the Project vicinity. For the purposes of Section 12, the term "Project vicinity" means the spatial and temporal area where interactions between predicted Project-related effects and an Aboriginal Interest is anticipated to occur
4. Consider and discuss the ability of each respective Aboriginal Group to continue exercising those related rights across their traditional territory, in the context of potential interference from the Project
5. Aurora LNG will make best efforts to identify and discuss with Aboriginal Groups appropriate mitigation measures designed to avoid or reduce adverse effects on the exercise of Aboriginal Interests
6. Aurora LNG will determine the degree of predicted adverse residual effects for each Aboriginal Interest asserted by an Aboriginal Group.

Table AS14-1 through Table AS14-6 summarize the key findings for the assessment of Aboriginal Interests for each Aboriginal Group. The key findings focus on potential Project-related interference on Aboriginal Interests, and include a statement regarding the importance of the Project vicinity to the Aboriginal Group's ability to exercise an Aboriginal Interest.

Table AS14-1 Key Findings of Effects on Lax Kw'alaams Band Aboriginal Interests

Aboriginal Interests Assessed	Project-Related Interference with the Aboriginal Interest	Importance of the Project Vicinity to the Exercise of the Aboriginal Interest
Aboriginal title	The Project is anticipated to interfere with Lax Kw'alaams Band's ability to use, make decisions over, or enjoy economic benefits associated with the Project Development Area (PDA) if Aboriginal title is established.	Aurora LNG understands that the PDA may be important because it falls within Lax Kw'alaams Band's court-filed claim area (see Figure 12.2-1).
Harvesting (includes hunting, trapping, fishing, intertidal harvesting, and vegetation gathering)	The Project is anticipated to interfere with Lax Kw'alaams Band members' ability to access terrestrial, intertidal and marine resources within the PDA. Harvesters may also experience some interference to fishing grounds within the shipping route. Lax Kw'alaams Band members may experience some noise and visual quality effects while undertaking harvesting activities.	Aurora LNG assumes the Project area may be important to Lax Kw'alaams Band's exercise of harvesting-related Aboriginal Interests because of its proximity to Lax Kw'alaams Band communities.
Cultural wellbeing	Archaeological sites within the PDA, but outside of the proposed riparian and shoreline buffer, will be permanently altered and inaccessible to Lax Kw'alaams Band members. Lax Kw'alaams Band members may experience some noise and visual quality effects while participating in cultural activities on the landscape. Employment associated with the Project may hinder the ability of Lax Kw'alaams Band members to attend some cultural events.	Aurora LNG understands that the Project vicinity is important to Lax Kw'alaams Band's cultural wellbeing because Lax Kw'alaams Band describes the area as having "high cultural and archaeological significance" (LKIB 2004).
Traditional governance	The Project may interfere with the ability of some house groups to exercise traditional governance within the Project vicinity.	Aurora LNG understands that the Project vicinity may be important to Lax Kw'alaams Band's traditional governance because of its history of being traditionally-shared between five tribes.
Right to self-determination and self-governance	The Project appears to be inconsistent with the current definition of allowable activities within the *Kxeen* Special Management Area, as described by Lax Kw'alaams Band's marine management plan. In this context, the Project may interfere with the implementation of future land or marine planning objectives.	Aurora LNG understands that the Project falls within an area important to Lax Kw'alaams Band's self-governance because it is within the *Kxeen* Special Management Area.

NOTE:
Aurora LNG anticipates receiving an Aboriginal Interest and Use Study (AIUS) and socio-economic study from Lax Kw'alaams Band during Application review. Aurora LNG is committed to working with Lax Kw'alaams Band to incorporate this additional information into the environmental assessment.

Table AS14-2 Key Findings of Effects on Metlakatla First Nation Aboriginal Interests

Aboriginal Interests Assessed	Project-Related Interference with the Aboriginal Interest	Importance of the Project Vicinity to the Exercise of the Aboriginal Interest
Aboriginal title	The Project is anticipated to interfere with Metlakatla First Nation's ability to use, make decisions over, or enjoy economic benefits associated with the PDA if Aboriginal title is established.	Aurora LNG understands the PDA to be important as Metlakatla First Nation has described Digby Island as the "geo-political centre" of its traditional territory (DMCS and MSS 2016).
Harvesting (includes hunting, trapping, fishing, intertidal harvesting, and vegetation gathering)	The Project may interfere with Metlakatla First Nation members' ability to access terrestrial, intertidal and marine resources within the PDA. In particular, the Project may interfere with Metlakatla First Nation's ability to harvest stink currants. Metlakatla First Nation harvesters may also experience some interference to fishing grounds within the shipping route. Metlakatla First Nation members may experience some noise and visual quality effects during harvesting activities.	Aurora LNG understands that the Project vicinity is an important area for the harvest of many resources. During consultation with Aurora LNG, Metlakatla First Nation has made statements regarding the importance of Digby Island and the PDA with respect to harvesting and relative to the broader region and Metlakatla First Nation traditional territory. Metlakatla First Nation has indicated that Tree Nob Group of islands is "critically important" for harvesting (MFN 2011).
Cultural wellbeing (called "cultural distinctiveness and integrity" by Metlakatla First Nation)	Archaeological sites within the PDA, but outside of the riparian and shoreline buffer, will be permanently altered and inaccessible to Metlakatla First Nation members. Metlakatla First Nation members may experience some noise and visual quality effects participating in cultural activities on the landscape. Employment associated with the Project may hinder people's ability to attend some cultural events. The Project may interfere with the home of the mythical being called "Txamsem" at Dodge Cove. Aurora LNG did not assess interference to Txamsem as it is not possible to meaningfully measure, predict, or mitigate potential adverse effects associated with a mythical being. However, this has been identified as an outstanding Aboriginal Interest issue.	Aurora LNG understands that the Project vicinity is important to Metlakatla First Nation's cultural wellbeing because Metlakatla First Nation has stated that Digby Island's "importance cannot be overstated" (DMCS and MSS 2016).
Traditional governance	The Project may affect the traditional governance structure of the five house groups.	Aurora LNG understands that the Project vicinity is important to Metlakatla First Nation's traditional governance because of its history of being traditionally-shared between five house groups and because Metlakatla First Nation has described Digby Island as the "geo-political centre" of its traditional territory (DMCS and MSS 2016).
Right to self-determination and self-governance	The Project appears to be inconsistent with the current definition of allowable activities within the Tree Nob Group and Melville Island Management Areas as described by Metlakatla First Nation's marine management plan. In this context, the Project may interfere with the implementation of future land or marine planning objectives.	Digby Island is not designated as a Management Zone in Metlakatla First Nation planning documents. Therefore, Aurora LNG assumes it may not be particularly important to Metlakatla First Nation's right to self-determination and self-governance.
Trails and travelways	Project-related vessels may interfere with (but not prevent) travel through the passage between Digby Island and Kaien Island by Metlakatla First Nation members. Some boaters may choose to use Metlakatla Pass to enter Prince Rupert Harbour instead of the passage between Digby Island and Kaien Island because of the presence of the Project.	Aurora LNG understands that the channel between Digby and Kaien and travelways to Tree Nob Group of islands are important and well-used by Metlakatla First Nation boaters.
Right to the enjoyment of the highest attainable standard of physical and mental health	The Project is unlikely to interfere with Metlakatla First Nation's enjoyment of the highest attainable standard of mental and physical wellbeing. The Project may result in positive changes to the physical and mental well-being of members of the community. The Project may result in an adverse effect on Metlakatla First Nation's "community fabric". Aurora LNG believes that it is appropriate to identify this as an outstanding Aboriginal Interest issue due to its intangible nature. However, Aurora LNG is committed to working with Metlakatla First Nation to further discuss this concern during the remainder of the environmental assessment.	Aurora LNG understands that the Project vicinity is important to Metlakatla First Nation, including for activities that may be associated with members' ability to enjoy the highest available standard of mental and physical health. Aurora LNG recognizes that potential effects are not geographically-based and are part of a broader Metlakatla First Nation concern with development in the Prince Rupert Harbour area.
Right to economic opportunities	Aurora LNG was unable to identify any potential adverse economic effects not already assessed elsewhere in the Application. As such, no additional interference is anticipated beyond the anticipated effects predicted for Aboriginal harvesting and the characterizations in Section 5 and Section 11.3.	The importance of the Project vicinity is captured in referenced sections.

Table AS14-3 Key Findings of Effects on Gitxaala Nation Aboriginal Interests

Aboriginal Interests Assessed	Project-Related Interference with the Aboriginal Interest	Importance of the Project Vicinity to the Exercise of the Aboriginal Interest
Aboriginal title	The Project is expected to interfere with Gitxaala Nation's ability to use, make decisions over, or enjoy economic benefits associated with the PDA if Aboriginal title is established.	Gitxaala Nation has a view that the Project vicinity has the same importance as the whole of the Prince Rupert Harbour area.
Harvesting (includes hunting, trapping, fishing, intertidal harvesting, and vegetation gathering)	The Project is expected to interfere with Gitxaala Nation members' ability to access terrestrial, intertidal and marine resources within the PDA. In particular, the Project may interfere with Gitxaala Nation's ability to harvest stink currants, high-bush cranberries, and horse clams. Gitxaala Nation harvesters may also experience some interference to fishing grounds within the shipping route. Gitxaala Nation members may experience some noticeable noise and visual quality effects or wake waves (much less than 0.4 m over a short duration) while out harvesting.	Aurora LNG understands that the Project vicinity is an important area for the harvest of many resources, and may be particularly unique for the presence of stink currants, horse clams, and high bush cranberries.
Cultural wellbeing	Archaeological sites within the PDA but outside the shoreline buffer will be permanently altered and inaccessible to Gitxaala Nation members. Gitxaala Nation members may experience some noise and visual quality effects while participating in cultural activities on the landscape. Employment associated with the Project may hinder people's ability to attend some cultural events. Project-related shipping traffic may interfere with (but not prevent) access to a historic Gitxaala Nation village at Casey Point.	Aurora LNG understands that the Project vicinity is important to Gitxaala Nation's cultural wellbeing because Gitxaala Nation has identified cabins, a historic camping area, places associated with place-names, a spiritual site, and a historic village in the Project vicinity (Calliou Group 2016a).
Traditional governance	The Project is unlikely to interfere with a specific house group's ability to exercise traditional governance within the PDA as the area may have been historically shared among some or all the Gitxaala Nation house groups. The shipping lane interacts with two identified Gitxaala Nation house territories. The Project is anticipated to increase the amount of shipping through the existing shipping lanes within these two areas.	Gitxaala Nation has the view that the Project vicinity is as important to Gitxaala Nation's ability to exercise traditional governance as any other areas in and around the Prince Rupert Harbour or the traditional territory.
Right to self-determination and self-governance	The Project may interfere with Gitxaala Nation's ability to exercise control, including the implementation of planning objectives and decision making over the lands and waters within the Project vicinity, as outlined through previous agreements or in terms of Gitxaala Nation's right to self-determination.	Gitxaala Nation has stated the importance of the Prince Rupert Harbour area, including Digby Island, for Gitxaala Nation members. Aurora LNG notes that Digby Island has been included in the Tuck Landscape Unit of the Great Bear Rainforest Land Use Objectives Order, though no specific objectives were available for the area at time of writing.
Trails and travelways	Project-related vessels may interfere with (but not prevent) travel through the passage between Digby Island and Kaien Island by Gitxaala Nation members.	Aurora LNG understands that the channel between Digby Island and Kaien Island is important and well-used by Gitxaala Nation boaters.
Right to economic opportunities	Aurora LNG was unable to identify any potential adverse economic effects not already assessed elsewhere in the Application. As such, no additional interference is anticipated beyond the anticipated effects predicted for Aboriginal harvesting and the characterizations in Section 5 and Section 11.3.	The importance of the Project vicinity is captured in referenced sections. Gitxaala Nation has identified that economic benefits related to the exercise of Aboriginal title are important.

Table AS14-4 Key Findings of Effects on Kitsumkalum First Nation Aboriginal Interests

Aboriginal Interests Assessed	Project-Related Interference with the Aboriginal Interest	Importance of the Project Vicinity to the Exercise of the Aboriginal Interest
Aboriginal title	The Project is expected to interfere with Kitsumkalum First Nation's ability to use, make decisions over, or enjoy economic benefits associated with the PDA if Aboriginal title is established.	Aurora LNG understands that the PDA is important to Kitsumkalum First Nation's Aboriginal title as has asserted Aboriginal title to the Prince Rupert Harbour and surrounding area.
Harvesting (which includes marine and terrestrial resources)	The Project is expected to interfere with Kitsumkalum First Nation members' ability to access terrestrial, intertidal and marine resources within the PDA. Kitsumkalum First Nation harvesters may also experience some interference to fishing grounds within the shipping route. Kitsumkalum First Nation members may experience some noticeable noise and visual quality effects during harvesting activities.	Aurora LNG understands through consultation that Kitsumkalum First Nation members use the PDA for the harvest of resources. Kitsumkalum First Nation reported that halibut fishing grounds within the shipping route are of particular importance to Kitsumkalum First Nation.
Cultural wellbeing	Archaeological sites within the PDA but outside the buffer will be permanently altered and inaccessible to Kitsumkalum First Nation members. Kitsumkalum First Nation members may experience some noise and visual quality effects while out on the landscape participating in cultural activities. Employment associated with the Project may hinder the ability of Kitsumkalum First Nation members to attend some cultural events. Project-related shipping traffic may interfere with (but not prevent) access to a historic Kitsumkalum First Nation village at Casey Point that is associated with Robin Woman. The Project has the potential to create disunity and disjuncture between community members, neighbouring nations, and other Aboriginal Groups. Aurora LNG believes that it is appropriate to identify this as an outstanding Aboriginal Interest issue due to its intangible nature. However, Aurora LNG is committed to working with Kitsumkalum First Nation to further discuss this concern during the remainder of the environmental assessment.	Aurora LNG understands that the Project vicinity is important to Kitsumkalum First Nation's cultural wellbeing because Kitsumkalum First Nation has stated that the Project vicinity is integral to Kitsumkalum culture and the ability for members to engage in spiritual activities (KIB 2013).
Traditional governance	The Project may affect the traditional governance structure of specific house groups.	Kitsumkalum First Nation has indicated to Aurora LNG that the Project vicinity falls within the use or stewardship areas of specific houses.
Right to self-government	The Project may interfere with the implementation of future land or marine planning objectives.	Aurora LNG is not aware of any planning objectives specifically for the Project vicinity. Aurora LNG understands that the Project vicinity is important to Kitsumkalum First Nation's history and connection to the Prince Rupert Harbour area, and that this relates to aspects of self-government.
Use of *Sm'algyx* language	In addition to the interference on cultural wellbeing and harvesting, employment associated with the Project may interfere with people's ability to attend some language classes or community gatherings at which Sm'algyx is being spoken.	Aurora LNG understands that the Project vicinity is important to the use of Sm'algyx language as it relates to harvesting and cultural activities.
Trails and travelways (which includes marine transportation and traffic routes)	Project-related vessels may interfere with (but not prevent) travel through the passage between Digby Island and Kaien Island by Kitsumkalum First Nation members.	Aurora LNG understands that the channel between Digby Island and Kaien Island is important and well-used by Kitsumkalum First Nation.
Right to economic opportunities (which includes commercial fishing)	Aurora LNG was unable to identify any potential adverse economic effects not already assessed elsewhere in the Application. As such, no additional interference is anticipated beyond the anticipated effects predicted for Aboriginal harvesting and the characterizations in Section 5 and Section 11.3.	The importance of the Project vicinity is captured in referenced sections.

Table AS14-5 Key Findings of Effects on Kitselas First Nation Aboriginal Interests

Aboriginal Interests Assessed	Project-Related Interference with the Aboriginal Interest	Importance of the Project Vicinity to the Exercise of the Aboriginal Interest
Aboriginal title	The Project is expected to interfere with Kitselas First Nation's ability to use, make decisions over, or enjoy economic benefits associated with the PDA if Aboriginal title is established.	Aurora LNG understands that the PDA is important to Kitselas First Nation's Aboriginal title, as it has asserted "shared Aboriginal title to traditional village sites on Digby and Kaien islands" (Pulla 2015). Kitselas First Nation has also argued that it has a strong claim to the Prince Rupert Harbour area in consultation on other projects in the region.
Harvesting (includes hunting, trapping, fishing, intertidal harvesting, and vegetation gathering)	The Project is expected to interfere with Kitselas First Nation members' ability to access terrestrial, intertidal and marine resources within the PDA. In particular, the Project may interfere with Kitselas First Nation's ability to harvest stink currants. Kitselas First Nation harvesters may also experience some interference to fishing grounds within the shipping route. Kitselas First Nation members may experience some noticeable noise and visual quality effects while undertaking harvesting activities.	Aurora LNG understands that the coast generally is important to Kitselas First Nation members, however Aurora LNG does not have evidence that the PDA itself or the shipping route is of particular importance for Kitselas First Nation harvesting.
Cultural wellbeing	Archaeological sites within the PDA but outside the buffer will be permanently altered and inaccessible to Kitselas First Nation members. Kitselas First Nation members may experience some noise and visual quality effects while participating in cultural activities on the landscape. Employment associated with the Project may hinder people's ability to attend some cultural events.	Kitselas First Nation historically used village sites on Digby Island during the seasonal transit between Kitselas Canyon and Red Bluff. Kitselas First Nation has not shared additional information about the importance of the Project vicinity to cultural wellbeing with Aurora LNG.
Right to self-government	The Project may interfere with the implementation of future land or marine planning objectives.	Aurora LNG is not aware of any Kitselas First Nation's land or marine use planning objectives or processes that specifically consider or set out management and planning measures for the Project vicinity.
Use of Sm'algyx language	In addition to the interference on cultural wellbeing and harvesting, employment associated with the Project may interfere with people's ability to attend some language classes or community gatherings at which Sm'algyx is being spoken.	Aurora LNG understands that the Project vicinity is as relevant to Kitselas First Nation's use of the Sm'algyx language as any other area where traditional practices, knowledge transfer or other cultural activities occur within Kitselas First Nation's traditional territory or harvest area.
Trails and travelways	Project-related vessels may interfere with (but not prevent) travel through the passage between Digby Island and Kaien Island by Kitselas First Nation members.	Aurora LNG understands that the channel between Digby Island and Kaien Island is important and well-used by Kitselas First Nation boaters.

Table AS14-6 Key Findings of Effects on Gitga'at First Nation Aboriginal Interests

Aboriginal Interests Assessed	Project-Related Interference with the Aboriginal Interest	Importance of the Project Vicinity to the Exercise of the Aboriginal Interest
Harvesting (includes hunting, trapping, fishing, intertidal harvesting, and vegetation gathering)	The Project is expected to interfere with Gitga'at First Nation members' ability to access terrestrial, intertidal and marine resources within the PDA. Harvesters may also experience some interference to fishing grounds within the shipping route. Gitga'at First Nation members may experience some noticeable noise and visual quality effects or wake waves (much less than 0.4 m over a short duration) while out harvesting.	Gitga'at First Nation members harvest a variety of resources within the Project vicinity.
Cultural wellbeing	Archaeological sites within the PDA but outside the buffer will be permanently altered and inaccessible to Gitga'at First Nation members. Gitga'at First Nation members may experience some noticeable noise and visual quality effects while out on the landscape participating in cultural activities. Employment associated with the Project may hinder people's ability to attend some cultural events.	The proximity of the Project to Prince Rupert, one of the two primary communities of Gitga'at First Nation members, may make it one of the most accessible and relied upon areas of the coast for Gitga'at First Nation cultural use. There are several known culturally, historically, or spiritually important sites within the Project vicinity.
Traditional governance	The Project is unlikely to interfere with a specific house group's ability to exercise traditional governance. Interference with access to terrestrial, intertidal and marine resources within the PDA and fishing grounds within the shipping route may interfere with traditional governance structures.	Gitga'at First Nation has not indicated to Aurora LNG whether the Project vicinity falls within the use or stewardship areas of specific houses. Gitga'at First Nation has indicated that wealth generated from the harvest and trade of resources in the Prince Rupert area affects traditional governance structures currently in place.
Marine Travelways	Project-related vessels may interfere with (but not prevent) travel through the passage between Digby Island and Kaien Island by Gitga'at First Nation members.	The passage between Kaien Island and Digby Island is the most commonly-used passage into Prince Rupert Harbour by Gitga'at First Nation boaters (Inglis 2016). Gitga'at First Nation has identified marine travelways through nearly every channel in the Project vicinity.
Right to economic opportunities	Aurora LNG was unable to identify any potential adverse economic effects not already assessed elsewhere in the Application. As such, no additional interference is anticipated beyond the anticipated effects predicted for Aboriginal harvesting and the characterizations in Section 5 and Section 11.3.	The importance of the Project vicinity is captured in referenced sections.

AS14.2 Other Matters of Concern

Part C, Section 12.7 of the Application discusses matters of concern raised by Schedule B Aboriginal Groups related to potential adverse environmental, economic, social, heritage and health effects that are not addressed in other sections of the Application.

During consultation with Aboriginal Groups, Aurora LNG sought to address all concerns raised by Aboriginal Groups either in the assessment of a specific VC, as a component of the assessment of the requirements under CEAA 2012 5(1)(c), or to consider the concern as an Aboriginal Interest discussed in Part C.

AS15 PART D PUBLIC CONSULTATION

Aurora LNG's consultation and engagement program followed a staged approach through the various phases of the Project. During the Early Engagement (Project inception to filing of the original Project Description (PD) with the BC EAO) and Pre-Application Engagement and Consultation (filing of PD to Application submission for screening) phases, Aurora LNG used a variety of methods, including small group meetings, stakeholder meetings, Project-related open houses, public notifications, e-mails, letters and phone calls. These consultation efforts helped Aurora LNG to obtain an understanding of community members' interests and concerns.

As a result of these activities Aurora LNG has:

- Disseminated information about the Project to assist with understanding how the Project could potentially impact surrounding communities
- Evaluated and updated the Aurora LNG development plan based on public and stakeholder input
- Documented and responded to concerns expressed by community members
- Held one open house during the public comment period as required by the Section 11 Order
- Held two open houses outside of the public comment period in Prince Rupert and Port Edward
- Hired a local community member in the community office to hold regular office hours and attend community and business events, as well as to provide an additional opportunity for information sharing and feedback mechanism with local stakeholders
- Created and maintained an external website to share information and engage with the general public
- Developed and distributed *Community Matters* newsletters to provide the public with Project updates and on-going site activities.

In accordance with the Section 11 Order and the Public Consultation Plan (PCP), Aurora LNG has compiled two Public Consultation Reports (PCRs). Public Consultation Reports #1 details the early engagement and pre-application consultation and engagement that occurred prior to August 14, 2015. Public Consultation Reports #2 covers the remainder of the pre-application stage, from August 14, 2015 until August 12, 2016. Additional consultation information from August 12, 2016 until formal acceptance by the BC EAO will be captured in subsequent reports.

Aurora LNG is committed to on-going consultation with the public and stakeholders during the remainder of the environmental assessment to broaden and deepen its understanding of concerns and issues, the Project's potential to affect those matters and discuss potential mitigation measures.

AS16 PART E SUMMARY OF PROPOSED ENVIRONMENTAL AND OPERATIONAL MANAGEMENT PLANS

A summary of environmental and operational management plans (EMPs) that will be developed for the Aurora LNG Project during the construction and operations phases is provided in Section 14. Contractors completing work on the Project may be required to develop their own site-specific management or environmental work plans in addition to the plans described.

The EMPs will be developed in accordance with industry best management practices and standards, applicable regulations, commitments made in the Application for an EAC, and BC EAC and permit conditions. These EMPs will supplement site-specific environmental work plans developed for the Project, and will be updated as needed.

Each EMP will include the following:

- Purpose and scope of the plan, including which Project phases it applies to
- Relevant regulatory background, environmental issues, and environmentally sensitive areas
- Roles and responsibilities
- Key emergency and Aurora LNG contact information
- Project and site orientation and training requirements
- Mitigation measures and written procedures, specifications, and controls that direct Project activities
- Monitoring (e.g., compliance and/or effectiveness) and reporting requirements.

The implementation of EMPs will be overseen by environmental professionals to confirm compliance with monitoring and reporting requirements.

The EMPs that will be developed for the Project are as follows:

- Air Quality Management Plan
- GHG Management Plan
- Noise Management Plan
- Invasive Plant Management Plan
- Wetland Compensation Plan
- Wildlife Management Plan
    - Marbled Murrelet Management Plan
    - Bat Management Plan
- Marine and Freshwater Resources Management Plan
- Conceptual Fish Habitat Offsetting Plan
- Marine Activities Plan

- Social Management Plan
  - Community Engagement Plan
  - Worker Lodging Plan
  - Transportation Management Plan
  - Health and Medical Services Plan.
- Archaeological and Heritage Resources Management Plan
- Waste Management Plan
- Health and Safety Management Plan
- Emergency Response Plan
- Decommissioning and Abandonment Plan.

AS17 PART E SUMMARY OF FOLLOW-UP PROGRAMS AND COMPLIANCE REPORTING

Follow-up programs will be implemented, where warranted, to assess the accuracy of environmental assessment predictions and the effectiveness of mitigation measures; compliance monitoring will also be required to verify the implementation of mitigation measures. Follow-up and compliance monitoring programs are summarized in Table AS17-1 and Table AS17-2.

Table AS17-1 Follow-Up Programs

Follow-Up Program	Project Phase	Valued Component	Application Section
Great Blue Heron Rookery ▪ This follow-up program will monitor potential effects of the Project on a great blue heron rookery located west of Dodge Cove, approximately 500 m from the PDA boundary. The purpose of the follow-up program will be to determine if herons in the colony are being affected by Project activities in a manner that is inconsistent with expectations outlined in the Application and to assess effectiveness of mitigation measures.	Construction	▪ Wildlife Resources	▪ 4.7
Acidification and Eutrophication ▪ The proposed acidification and eutrophication follow-up program includes monitoring of freshwater, vegetation, and soils. The specific requirements of a follow-up program will be determined through consultation with BC MOE.	Operations	▪ Vegetation and Wetland Resources ▪ Wildlife Resources ▪ Freshwater Fish and Fish Habitat ▪ Water Quality	▪ 4.6 ▪ 4.7 ▪ 4.8 ▪ 4.5
Marine Sediment Deposition and Monitoring Program ▪ This program will monitor potential marine sediment deposition along the shoreline at Charles Point before, during and after construction of the concrete caisson MOF. If monitoring indicates measurable changes to fish habitat that are considered to constitute *serious harm to fish*, the potential need for additional offsetting will be discussed with DFO.	Construction Operations	▪ Marine Fish and Fish Habitat	▪ 4.9

Table AS17-2 Compliance Monitoring Programs

Compliance Monitoring and Reporting	Project Phase	Valued Components	Application Section
Wetlands Compensation ▪ A Wetland Compensation Plan will be implemented to achieve the goal of "no net loss" of wetland function for ecologically important wetlands within the region as identified in the Federal Wetland Policy. The plan will include a commitment to monitor affected wetlands to confirm that compensation occurs in accordance with the plan and that habitats are functioning as intended.	Construction Operations	▪ Vegetation and Wetland Resources ▪ Wildlife Resources ▪ Marine Birds	▪ 4.6 ▪ 4.7 ▪ 4.11
Invasive Species ▪ An invasive species monitoring program will be included as part of the Invasive Plant Management Plan.	Construction Decommissioning	▪ Vegetation and Wetland Resources	▪ 4.6
Air Quality ▪ Project emissions will be monitored and reported to confirm compliance of emission discharge with requirements of a permit condition under the *Environmental Management Act*.	Operations	▪ Air Quality	▪ 4.2
Greenhouse Gas Emissions ▪ A GHG Management Plan will be prepared that includes a description of relevant GHG emissions reporting requirements for the Project and describe the BMPs, policies and mitigation measures that will be implemented.	Operations	▪ Greenhouse Gas	▪ 4.3
Fish Habitat Offsetting ▪ A Fish Habitat Offsetting Plan will be developed in consultation with Fisheries and Oceans Canada, Aboriginal Groups, and key stakeholders to offset instances where serious harm to fish, as defined in the federal *Fisheries Act*, will occur or is deemed to have occurred as a result of the Project.	Construction Operations	▪ Freshwater Fish and Fish Habitat ▪ Marine Fish and Fish Habitat	▪ 4.8 ▪ 4.9
Marine Water Quality ▪ The purpose of the marine water quality monitoring program will be to monitor turbidity associated with dredging, parameters in effluent discharges according to permit requirements, and implementation of mitigation measures for compliance and effectiveness.	Construction Decommissioning	▪ Marine Fish and Fish Habitat	▪ 4.9

AS18 PART F CONCLUSIONS

With the implementation of mitigation measures, best management practices and follow-up and monitoring programs, residual Project and cumulative effects are expected to be not significant for the majority of VCs with the exception of greenhouse gases, harbour porpoises and infrastructure and services. The effects of Project emission during operations on greenhouse gases are considered significant for residual Project and cumulative effects based on the predicted magnitude of effect and because the scientific community acknowledges that an adverse effect on cumulative global releases of greenhouse gases on climate change currently exists. The effects of Project activities on change in behaviour of marine mammals are considered significant for harbour porpoise, given their known sensitivity and previously demonstrated avoidance responses to underwater noise. This change in behaviour may threaten the long-term persistence of the local population of harbor porpoise in the vicinity of construction activities. Lastly, the cumulative effect of Project activities in conjunction with other proposed projects and activities are considered significant for infrastructure and services given that demands on accommodations and health care infrastructure and services may exceed the existing capacity on an ongoing basis should all identified project proceed (a highly conservative assumption).

The Aurora LNG Project is well positioned to enable economic growth in Prince Rupert and the surrounding area, as well as in BC and the rest of Canada. The Project supports the current provincial government's strategic interests in developing an LNG industry and getting an abundance of natural gas to international markets. As the Project continues to evolve Aurora LNG looks forward to continued engagement with interested stakeholders and Aboriginal Groups to facilitate development of a Project that is socially and economically beneficial to the region.

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