

FEDERAL REVIEW PANEL REPORT FOR THE
ROBERTS BANK TERMINAL 2 PROJECT



PREPARED BY
THE REVIEW PANEL FOR THE ROBERTS BANK TERMINAL 2 PROJECT

MARCH 27, 2020

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Project**

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March 27, 2020

The Honorable Jonathan Wilkinson, P.C, M.P.
Minister of Environment and Climate Change Canada
Office of the Prime Minister
Ottawa, Ontario
K1A 0A2

Dear Minister Wilkinson,

The Review Panel has completed its environmental assessment for the Roberts Bank Terminal 2 Project in accordance with its mandate issued on May 31, 2016 (updated April 2019). Herein, the Review Panel submits its report for consideration by the Government of Canada. The Review Panel's report is based on evidence and information provided to it up to August 26, 2019, when the Project record was closed.

Sincerely,

<Original signed by>

Jocelyne Beaudet
Panel Chair

<Original signed by>

Dr. David Levy
Panel Member

<Original signed by>

Dr. Douw Steyn
Panel Member

Introduction

The Vancouver Fraser Port Authority (the Proponent) has proposed the development of a new container terminal at Roberts Bank, in Delta, British Columbia, adjacent to the existing Deltaport Terminal and Westshore Terminals. The Roberts Bank Terminal 2 project (the Project) would involve the construction, operations, maintenance, and where relevant, decommissioning of a new three-berth marine container terminal, a widened causeway to accommodate additional road and rail infrastructure, and an expanded tug basin. The Project would provide an additional 2.4 million twenty-foot equivalent units (TEU) of container capacity per year. The operational phase of the Project would also result in an increase of marine shipping activities within the Project area and within the 12 nautical mile limit of Canada's territorial sea.

About this Report

This report presents the results of the federal Review Panel's (the Panel) assessment of the potential environmental effects of the Project, which includes the marine shipping activities incidental to the Project. This report has been completed in accordance with the *Canadian Environmental Assessment Act, 2012*, and with the Panel's Terms of Reference and sets out the rationale, conclusions and recommendations of the Panel relating to the environmental assessment of the Project, including proposed mitigation measures and follow-up programs.

The Summary of Findings provides the key findings of the Panel for the Project. All of the information that the Panel used in conducting the environmental assessment can be found on the Impact Assessment Agency of Canada's website at www.iaac-aeic.gc.ca, Reference Number: 80054.

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Summary of Key Findings

On May 30, 2016, the federal Minister of Environment and Climate Change Canada appointed a Review Panel to carry out an environmental assessment of the Roberts Bank Terminal 2 Project proposed by the Vancouver Fraser Port Authority. The following provides a summary of the Panel's key findings.

The Project would require the conversion of 177 ha of intertidal and subtidal habitat on Roberts Bank to construct a new three-berth container terminal, expand an existing causeway and enlarge an existing tug basin. The Project would be situated immediately adjacent to Tsawwassen First Nation Lands, existing port infrastructure and close to the community of Tsawwassen and the City of Delta, British Columbia. The Project is located on Roberts Bank in the Fraser River estuary, an ecologically productive and sensitive area of coastal British Columbia. Roberts Bank is located on the Pacific Flyway for migratory birds and is adjacent to a provincial wildlife management area and an international Ramsar site. Some of the largest salmon runs in the world utilize and migrate through Roberts Bank as juveniles and adults. Roberts Bank also encompasses critical habitat for the Southern Resident Killer Whale (SRKW) listed as endangered under the *Species at Risk Act*.

The Panel is of the view that construction and operation of the proposed Project do not pose major technical challenges. The purpose of the Project is consistent with Canada's role as a trading nation, and the Project would enable an increase in container terminal capacity on Canada's west coast. The Project would also support competitiveness for Canadian markets linked to a marine shipping supply chain facing important changes, such as: mergers of ocean shipping lines; ocean carriers' and terminal operators' economic sustainability; terminal modernization and an increase in container ship size. The City of Delta, Metro Vancouver, British Columbia and Canada would benefit from the employment, business opportunities and economic development resulting from the Project. Indigenous groups living in proximity to the Project, in Metro Vancouver and on Vancouver Island and the Gulf Islands would stand to benefit from training, employment, and contracting opportunities.

The Panel concludes that the Project would result in numerous adverse residual and cumulative effects. The proposed offsetting plan for aquatic species, totaling 29 hectares, would be insufficient to compensate for the reduction in productivity associated with a Project-induced habitat loss of 177 hectares of Roberts Bank. There would be significant adverse and cumulative effects on wetlands and wetland functions at Roberts Bank. One of the ecosystem components that drives the high productivity of Roberts Bank is biofilm, which is consumed by western sandpipers and other shorebirds during their migration stopovers. The Panel concludes that the Project would not have an adverse effect on biofilm productivity and diatom composition. However, the Panel cannot conclude with certainty about Project effects on polyunsaturated fatty acid production in biofilm, a potentially critical nutritional component for western sandpiper. Due to the recent and still-emerging scientific understanding of biofilm, the Panel is unable to conclude with reasonable confidence that the Project would or would not have a residual adverse

effect on western sandpiper. Barn owl, a species listed as threatened under the *Species at Risk Act*, would be subject to significant cumulative effects.

There would be significant adverse and cumulative effects on Dungeness crab as well as ocean-type juvenile Chinook salmon originating from the Lower Fraser and South Thompson Rivers. These juvenile Chinook reside temporarily in the vicinity of the Project and would be subject to migration disruption by the terminal footprint and Project-related effects on the underwater acoustic and light environments. The Project would cause significant adverse and cumulative effects on SRKW through a small loss of legally-defined critical habitat, reduced adult Chinook salmon prey availability and a minor increase in underwater noise. In the absence of mandatory mitigation measures to reduce underwater noise from marine shipping associated with the Project, there would be further degradation of SRKW critical habitat. Although unlikely, a lethal vessel strike on a single individual SRKW could have significant adverse population consequences.

Several Indigenous groups have traditional territories that overlap the Project area and the marine shipping area. The Project and the marine shipping associated with the Project have the potential to change various aspects of Indigenous current use and cultural heritage resources. The Panel concludes that the Project would likely result in significant adverse and cumulative effects on the current use of lands and resources for traditional purposes by Tsawwassen First Nation and Musqueam Indian Band in the Project area. The Panel also concludes that marine shipping associated with the Project would likely result in a significant cumulative effect on the current use of lands and resources for traditional purposes by Pacheedaht First Nation and Ditidaht First Nation.

In addition, the Project would cause significant adverse effects on cultural heritage for Tsawwassen First Nation and Tsleil-Waututh Nation in the Project area. While the Panel understands there would be relatively few ship movements associated with the Project, each ship travelling through the shipping lanes causes an incremental effect on the ability of Indigenous groups to access sites where they conduct cultural activities. The Panel concludes that there is an existing significant cumulative effect on cultural heritage and that any increase in ship movements would further contribute to this effect.

The Panel's assessment concludes that there would be effects on the quality of life of local populations, including health and quality of experience during commercial and recreational activities. The Project would result in a residual adverse effect on daytime and nighttime visual resources and on outdoor recreation as well as a significant cumulative effect. Residual adverse effects of the proposed expanded Navigational Closure Area during both construction and operations would combine with the adverse effects of the existing Navigation Closure Area and cause a significant cumulative effect on the Area I commercial crab fishery.

During the operational phase, the Project would result in a significant adverse effect and a cumulative effect on human health based on predicted exposures to 1-hour average NO₂ and other respiratory irritants. The Project would result in a significant adverse cumulative health effect due to noise. Elements of stress and annoyance related to light, noise and dust are already

present in the Local Assessment Area and the Project has the potential to exacerbate these conditions. The Panel further concludes that the Project would likely cause a significant adverse effect and a significant cumulative effect on agricultural land use due to the loss of a small area of land contained within the Agricultural Land Reserve.

Several types of accidents and malfunctions that could result from the Project were examined, both for land- and marine-based activities. The Panel concludes that additional measures would be required to adequately address effects from accidents and malfunctions that may occur in connection with land-based events. If a worst-case oil spill were to occur in the marine shipping area, it could result in potentially significant adverse residual effects for vulnerable species such as SRKW and marine birds, marine commercial and recreational activities, current use, cultural heritage and health of Indigenous groups.

A listing of the Panel's Conclusions and Recommendations is provided in Appendix H and further details are described in the main body of the report.

The Panel members are grateful for the support we received from the Secretariat during the four years of the Panel's work. We appreciate the professional and respectful participation offered by the Proponent and its team. We would like to acknowledge the involvement of the local citizens of Delta, the collaboration of all levels of government, the insights offered by non-governmental organizations and the constructive interactions and information provided by Indigenous groups.

1 The Environmental Assessment Review Process

1.1 The Legislative Framework for the Review

On January 7, 2014, the Minister of Environment and Climate Change (the Minister), announced that the Roberts Bank Terminal 2 Project (the Project) would undergo a federal environmental assessment by way of a review panel in a manner consistent with the requirements of the *Canadian Environmental Assessment Act, 2012* (CEAA 2012). In referring the Project to a review panel, the Minister set timelines for the environmental assessment of the Project as follows:

- Pre-panel Phase - The timeline for the review panel to be established was 150 days from the date of referral of the Project (January 7, 2014) up to the establishment of the review panel;
- Panel Phase - The timeline for the review panel to submit its report was 430 days from the date of establishment of the review panel on May 30, 2016, and did not include the time it took for the Vancouver Fraser Port Authority (the Proponent) to respond to requests for additional information or studies; and
- Post-panel Phase - The timeline for the Minister's decision statement is 150 days from the date of submission of the review panel's report.

The Project also constitutes a reviewable project pursuant to Part 8 of *British Columbia's Reviewable Projects Regulation*. On December 19, 2014, the provincial Minister of Environment issued a procedural order under section 14 of the *British Columbia Environmental Assessment Act* that established the scope, procedures, and methods concerning the environmental assessment for the Project.

Subject to subsections 45(3), (4) and (5) of CEAA 2012, all information received by the Review Panel (the Panel) is available to the Province of British Columbia. The province intends to rely on the information produced in the review panel process for its use in the provincial environmental assessment. The provincial environmental assessment and decision will be undertaken following the submission of the Panel report.

1.1.1 Environmental Effects under the Canadian Environmental Assessment Act, 2012

The Panel is required to consider all environmental effects defined in its Terms of Reference and under subsection 5(1) and 5(2) of CEAA 2012, and to determine whether the designated Project is likely to cause significant adverse environmental effects, taking into account the implementation of mitigation measures. The term “environmental effects” refers to environmental effects in areas of federal jurisdiction as described in section 5 of CEAA 2012:

- Effects on fish and fish habitat, shellfish and their habitat, crustaceans and their habitat, marine animals and their habitat, marine plants, and migratory birds;
- Effects on federal lands;

- Effects that cross provincial or international boundaries;
- Effects of any changes to the environment that affect Aboriginal peoples, such as their use of lands and resources for traditional purposes and physical and cultural heritage; and
- Changes to the environment that might result from federal decisions as well as any associated effects on health, socio-economic conditions, matters of historical, archaeological, paleontological or architectural interest, or other matters of physical or cultural heritage.

In this review, subsection 5(2) is triggered because the Port Authority is a federal authority, and would be exercising a power under the *Canada Marine Act* in constructing the Project. The Project would also require a permit, authorization, approval or license under the *Fisheries Act* and the *Species at Risk Act*.

1.1.2 Environmental Impact Statement Guidelines

In November 2013, the Canadian Environmental Assessment Agency (the Agency) issued draft Environmental Impact Statement Guidelines (EIS Guidelines) for the preparation of an environmental impact statement in order to assess the Project pursuant to CEAA 2012. The EIS Guidelines identified the nature, scope and extent of the information and analysis to be addressed by Proponent in its EIS for the Project.

The draft EIS Guidelines were subject to a 30-day public comment period. Following consideration of the comments received, the EIS Guidelines were finalized, issued to the Proponent and made available to the public in January 2014.

In April 2015, the EIS Guidelines were updated to include the information requirements and the analysis of potential environmental effects of marine shipping associated with the Project, as well as the potential provincial social, economic, heritage and health effects of the Project.

The EIS Guidelines were further updated in April 2019 to include marine shipping that is beyond the care and control of the Proponent and within the 12 nautical mile limit of Canada's territorial sea within the definition of the designated project.

1.1.3 Panel's Terms of Reference

On May 31, 2016, the Minister appointed Jocelyne Beudet as the Chair of the Panel and Dr. Diana Valiela and Dr. David Levy as members of the Panel. The Panel's Terms of Reference were issued the same day. On March 17, 2017, the Minister appointed Dr. Douw Steyn as a new member of the Panel, replacing Dr. Diana Valiela. A short biographical description of each Panel member is included in Appendix A.

The Terms of Reference established the mandate and authorities of the Panel, as well as the procedures and timelines for the review. Under subsection 19(1)(j) of CEAA 2012, the Minister has the authority to include additional factors, other than those listed under subsection 19(1)(a-i), as matters that are relevant to the environmental assessment.

As required by the Minister, the environmental assessment was mandated to consider:

1. The environmental effects of marine shipping associated with the project which is beyond the care and control of the Proponent and within the 12 nautical mile limit of Canada's territorial sea. Consideration includes the environmental effects of malfunctions or accidents and any cumulative environmental effects, the significance of those effects, suggested mitigation measures and the requirements of any follow-up program.
2. The potential economic, social, heritage and health effects of the project, including cumulative effects that may not be encompassed by the definition of environmental effects under CEAA 2012, and practicable means to mitigate such potential adverse effects.

On March 8, 2019, the Minister indicated her intention to amend the Panel's Terms of Reference to specify that marine shipping associated with the Project was an activity incidental to the Project and would be included as part of the designated Project under CEAA 2012.

On March 15, 2019, the Panel responded to the Minister acknowledging the proposed amendments. The Panel indicated that it welcomed the proposed change to the Terms of Reference and stated that from the beginning of its mandate, the Panel had considered the environmental effects of marine shipping associated with the Project as part of its assessment.

On April 24, 2019, the Panel's Terms of Reference were updated to include marine shipping associated with the Project that is beyond the care and control of the Proponent and within the 12 nautical mile limit of Canada's territorial sea as incidental to the marine container terminal and therefore part of the designated project for the purposes of the environmental assessment. As a result, the Minister's environmental assessment decision, under section 52 of CEAA 2012, will consider whether marine shipping associated with the Project is likely to cause significant adverse environmental effects.

In accordance with section 43 of CEAA 2012, the Terms of Reference require the Panel to include in its report:

- The rationale, conclusions and recommendations of the Panel on the environmental assessment of the project including any mitigation measures and follow up programs; and
- A summary of any comments received from interested parties.

A copy of the Panel's Terms of Reference is included in Appendix B.

1.2 The Review Panel Phase

1.2.1 Review of the Environmental Impact Statement and Marine Shipping Addendum

The Panel was mandated by its Terms of Reference to determine whether the Environmental Impact Statement (EIS) and the Marine Shipping Addendum (MSA) submitted by the Proponent

contained sufficient information to proceed to a public hearing. Following its appointment, the Panel held a public comment period from June 16, 2016 to October 28, 2016, on the sufficiency and technical merit of the Proponent's EIS and the MSA. In addition, Indigenous groups, the public, and government departments and agencies were invited to submit comments and make recommendations to the Panel on the type of additional information that it should request of the Proponent prior to proceeding to a public hearing. The opportunity for submission of comments and recommendations to the Panel occurred between July 6 and October 5, 2018, and December 4, 2018 and February 8, 2019.

On June 28 and September 16, 2016, the Panel held orientation sessions where information was provided by the Proponent and various participants, including federal and provincial government departments, the Tsawwassen First Nation and local municipalities on their responsibilities as they relate to the environmental assessment of the Project. The public was invited to attend and to provide follow-up questions and comments to the Panel for its consideration. On January 30, 2019, the Panel held an information session in Vancouver, British Columbia to collect additional information on the purpose of the Project and container shipping trends, capacity and terminals.

In July 2017, the Panel invited potentially-impacted Indigenous groups to submit any additional information on the potential environmental effects of the Project or marine shipping associated with the Project, proposed mitigation measures, follow-up programs, or any other aspects of the environmental assessment.

On March 1, 2019, the Panel determined that the EIS, MSA, and the additional information submitted by the Proponent contained sufficient information to proceed to the public hearing. To make its determination the Panel:

- Reviewed the EIS and the MSA and issued 14 packages of information requests, totaling 437 information requests;
- Solicited comments from Indigenous groups, the public, government departments and agencies on the adequacy and technical merit of the EIS and MSA and on additional information submitted by Proponent; and
- Reviewed responses submitted by the Proponent and all comments received.

On March 1, 2019, the Panel also announced that the public hearing would commence on May 14, 2019, in Delta, British Columbia. The Panel recognized that several outstanding concerns and questions remained, but considered that the most effective approach to complement the Panel's understanding of the potential adverse environmental effects of the Project was to rely on the public hearing process.

1.2.2 Public Hearing

The Panel released its draft Public Hearing Procedures on July 6, 2018, and invited the Proponent, Indigenous groups, government departments and agencies as well as the public to participate in a 90-day public comment period. Comments received on the draft procedures were considered and the Panel issued the final Public Hearing Procedures on March 1, 2019. The

Panel required that interested parties, as defined in CEAA 2012 register their intent to participate in the public hearing. The Panel considered those that had previously participated in the environmental assessment and those that would be potentially affected by or had knowledge related to the designated Project as interested parties.

The Panel held its public hearing from May 14 to June 1, 2019 in Delta, British Columbia and from June 11 to June 24, 2019 in Vancouver and in various locations on Vancouver Island, British Columbia. The public hearing provided an opportunity for the Proponent to present the designated Project and its assessment of the potential environmental effects. The public hearing was an opportunity for registered participants to share information on the environmental effects of the designated Project and ask questions of the Proponent and other registered participants.

The Panel held three types of hearing sessions over 24 hearing days: General, Topic-specific, and Community sessions. Participants were invited to give presentations on any aspect within the scope of the review as established by the Panel's Terms of Reference. All public hearing sessions were open to the public. All information the Panel used when conducting the environmental assessment, including verbatim transcripts of the public hearing were posted on the public registry.

The list of appearances at the public hearing can be found in Appendix C.

On May 14, 2019, the Panel opened the public hearing and heard motions on procedural matters submitted by registered participants. The Panel followed the Procedures for Filing a Procedural Motion issued by the Panel which was posted to the Public registry on April 23, 2019. Seven motions were filed, and the Panel rendered its decisions on May 15, 2019. Motions were filed by Global Container Terminals (GCT), Boundary Bay Conservation Committee, Fraser Voices, Roger Emsley, Don Paulsen, Susan World, and David Jones.

The Panel denied GCT's request for an adjournment of the public hearing, however the Panel granted GCT's request for a topic-specific hearing session on the topic of alternative means of carrying out the designated project that are technically and economically feasible. This session was held May 31, 2019 in Delta, British Columbia.

Although the Panel did not grant the Boundary Bay Conservation Committee and the Fraser Voices their request to suspend a submission received by the Proponent and postpone the deadline for public comments on marine shipping, the Panel extended the time for making closing remarks from three weeks after the close of the hearing (July 15, 2019) to nine weeks after the close of the hearing (August 26, 2019). This allowed participants additional time to prepare submissions on the potential effects of marine shipping and any other topic. All other motions were denied.

The Panel's decisions on motions filed during the public hearing can be found on the Project's public registry.

1.2.3 Government Decision and Next Steps

The Panel is an advisory rather than a decision-making body. The final decisions regarding Project approval will be made by the federal and provincial governments. Once submitted to the Minister, the Panel report is made available on the public registry. The Minister, considering the report, must decide if the Project is likely to cause significant adverse environmental effects. If the Minister decides that the Project is likely to cause significant adverse environmental effects, the decision is referred to the Governor in Council. When the Governor in Council is the decision maker, it has the authority to decide if the significant adverse environmental effects are justified in the circumstances.

If the Minister decides that Project is *not likely* to cause significant adverse environmental effects, or the Governor in Council decides that the significant adverse environmental effects *are justified in the circumstances*, a decision statement is issued to the Proponent. The decision statement includes any established conditions with which the Proponent must comply. The decision statement will be made available on the public registry.

1.3 Site Visits

During the sufficiency stage of the environmental assessment, the Panel conducted several visits to the project site and surrounding area. The Panel produced reports summarizing each visit and made them available on the public registry. The Panel notified participants that it would be conducting an aerial tour of the project area and portions of the marine shipping area on June 29, 2016. The tour provided aerial views of Roberts Bank including the intertidal zones and the Deltaport Terminal, Westshore Terminals and BC Ferries Tsawwassen Terminal, as well as portions of the Salish Sea.

On September 2, 2016, the Panel notified participants of its intention to undertake a marine tour of the waters surrounding the project site and a site tour of the Deltaport Terminal and Westshore Terminals. The site tour was recorded by video which was made available on the public registry.

On April 13, 2017, the Panel notified participants that it would undertake a guided tour of Brunswick Point, the shoreline near the inter-causeway area, and the George C. Reifel Bird Sanctuary. The tour took place on April 26, 2017, and a video of the tour was made available on the public registry. The Panel and the Panel Secretariat were accompanied by Dr. Colin Clark, who had knowledge of the bird ecology of the area.

1.4 Confidentiality Requests

During the review process, the Panel received five requests for confidentiality, pursuant to section 45 of CEAA 2012, which permits the Panel to order that information be received and considered but not disclosed publicly in certain circumstances. The Pacheedaht First Nation (Pacheedaht) requested that Appendix A of its *Traditional Marine Use and Occupancy Study*, which contained sensitive site-specific information, be protected as confidential. The Tsleil-Waututh Nation asked to submit a report on intangible cultural heritage in confidence to the

Panel. The Tsartlip and Pauquachin First Nation asked that Appendix A of the *WSÁNEĆ Traditional Use Study of the Roberts Bank Terminal 2 Project*, which contained a series of maps, be protected as confidential by the Panel. Before making its decision, the Panel solicited comments from the Proponent and other participants. In all cases, after considering all the comments received, the Panel granted the requests. Confidentiality Agreements were signed by the Panel, the Panel Secretariat and representatives of the Proponent who had access to the confidential information.

During the public hearing, Parks Canada requested that the map provided to the Panel in response to an undertaking be kept confidential. The map provided sensitive archaeological site location information, which if publicly disclosed, could lead to further damage and theft. The Panel agreed with Parks Canada's concern and granted the request.

The Proponent also requested confidentiality of information during the public hearing. The Proponent submitted that the *Record of Consultation and Engagement with the Tsawwassen First Nation*, along with Schedule 2 and Schedule 4 of that record of consultation, was within the mandate of the Panel. The Proponent also argued that the Port Authority and the Tsawwassen First Nation (Tsawwassen) would be specifically, directly and substantially harmed because the documents contained information regarding the discussion between Proponent and Tsawwassen regarding the 2004 Memorandum of Agreement and other possible commercial arrangements or agreements. The Panel determined that the information the Proponent wished to submit was not required to make conclusions and recommendations on the potential environmental effects of the Project and therefore denied the request.

Decisions rendered on confidentiality requests are found on the Project's public registry.

1.5 Participant Funding Program

The Agency administers the Participant Funding Program, which supports individuals, non-profit organizations and Indigenous groups interested in participating in federal environmental assessments. Funding was made available to assist participants review the draft EIS Guidelines, the draft Terms of Reference, the EIS and to prepare and participate in the public hearing. Additional funding was also made available to review and comment on the additional information provided by the Proponent on the potential environmental effects of marine shipping associated with the Project, and to participate in the public hearing on this matter. The Agency established Funding Review Committees, independent from the Panel, to review funding applications and to recommend funding allocations. In total, the Agency allocated funding to 28 participants.

2 Project Description

2.1 Project Setting

The Project would be located at Roberts Bank, in Delta, 35 kilometers (km) south of Vancouver, British Columbia. Roberts Bank is an undersea bank and a major part of the Fraser River estuary in the Salish Sea.

As illustrated in Figure 2-1 below, the Salish Sea consists of the Strait of Georgia (an arm of the Pacific Ocean between Vancouver Island, the southwestern mainland coast of British Columbia and the northwestern mainland coast of the United States), the Strait of Juan de Fuca and Puget Sound.

Roberts Bank is part of an established trade gateway that provides an important transportation corridor for sea-going ships en route to the South Arm of the Fraser River and the Port Authority's Roberts Bank terminals. This transportation corridor also serves the Port Authority's terminals located in Burrard Inlet, Vanterm and Centerm. In addition, Roberts Bank supports commercial, recreational, and Aboriginal fishing, marine-based recreational activities, and BC Ferries operations.

Roberts Bank is a diverse ecosystem of biologically productive intertidal and subtidal sand and mud flats, eelgrass meadows, and marshes. Roberts Bank and its surrounding areas, including Sturgeon Bank, Boundary Bay, the Lower Fraser River and upland areas of the mainland have locally and internationally recognized ecological and cultural importance and conservation-related designations.

The Project would lie adjacent to the Roberts Bank Wildlife Management Area (WMA), which was designated by the BC Ministry of Forests, Lands, and Natural Resource Operations for the management of critical habitat for fish, waterfowl, shorebirds, and other species. The Project would be located in close proximity to the Alaksen National Wildlife Area on Westham Island. The Alaksen site is also part of the broader Fraser River delta wetland of international importance, as designated under the Ramsar Convention. The Project would be located within the Fraser River Estuary Important Bird Area, which consists of a complex of interconnected marine, estuarine, freshwater, and agricultural habitats that support the greatest combined total number of global, continental and national bird species in Canada.

The proposed terminal and marine shipping associated with the Project would occur within Southern Resident Killer Whale critical habitat that is federally protected under the *Species at Risk Act*. The Project would lie within Fisheries and Oceans Canada's Area I crab management area and fisheries management area 29.

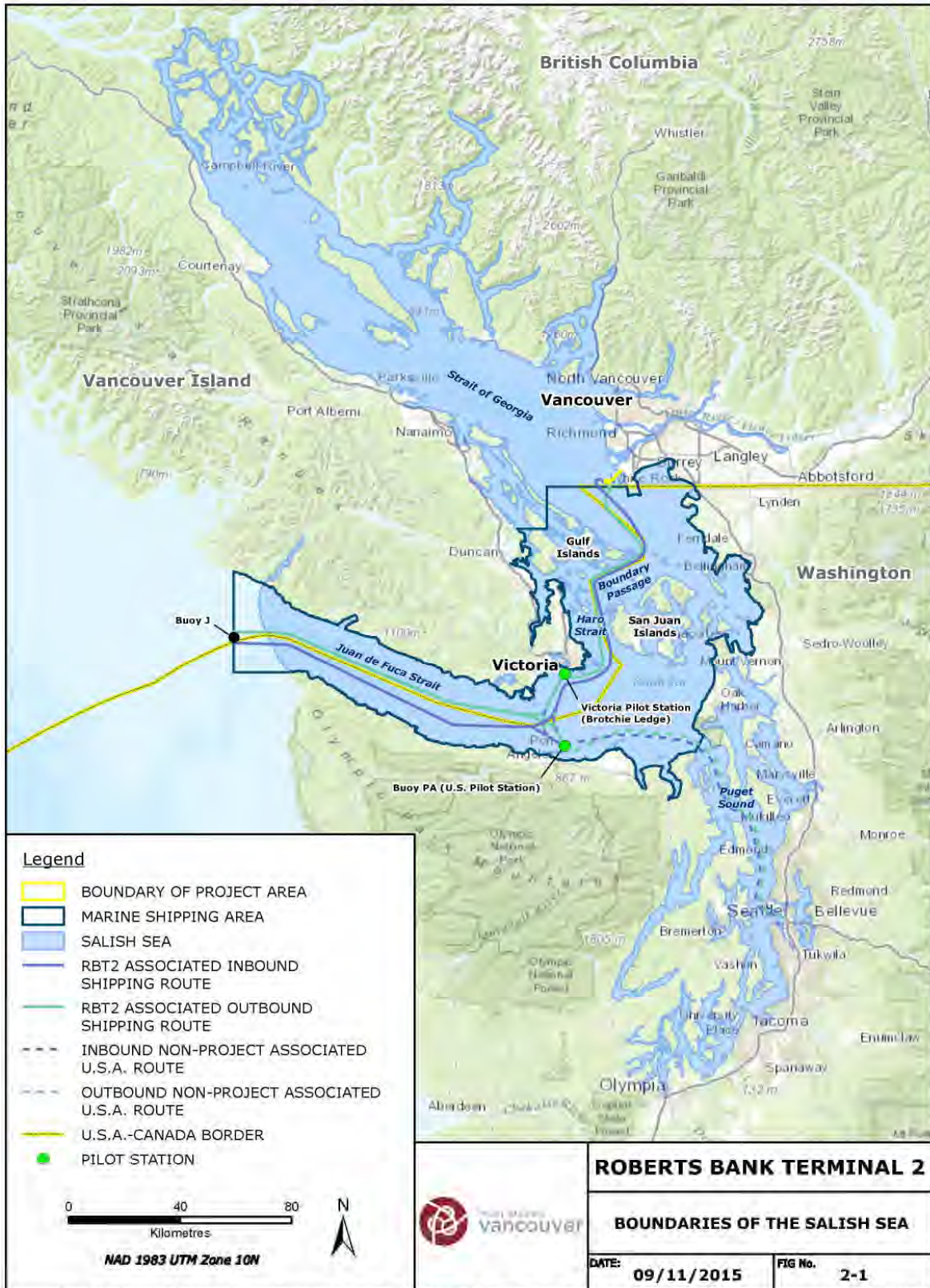


Figure 2-1: Boundaries of the Salish Sea (Source: MSA)

Inland of Roberts Bank, the Project would be bordered primarily by fertile agricultural lands and urban-residential development. The two closest residential areas to the Project are the City of Delta and Tsawwassen community, which are situated northwest of the existing Roberts Bank causeway. The City of Delta's population was 99,863 in 2011 and 190 Tsawwassen First Nation members and approximately 460 non-members currently live on Tsawwassen First Nation Lands. The closest American communities to the Project are Point Roberts and the City of Blaine in the State of Washington, which are immediately south of the Canada/USA border. Many Indigenous groups have asserted and established traditional territory that overlaps the Project area and the marine shipping area.

The Proponent is an agent of the Government of Canada and responsible for the stewardship of federal ports in and around Vancouver, British Columbia, as set out in the *Canada Marine Act*. The Proponent's jurisdiction extends over 16,000 hectares (ha) of water, more than a thousand ha of land, and approximately 350 km of shoreline. The Proponent's jurisdiction extends from Point Roberts at the Canada/USA border through Burrard Inlet to Port Moody and Indian Arm, and from the mouth of the Fraser River, eastward to the Fraser Valley, and north along the Pitt River to Pitt Lake, and includes the north and middle arms of the Fraser River. The Proponent's jurisdiction includes navigational authority throughout this area, as well as jurisdiction over certain real property in Burrard Inlet, Indian Arm, lands and waters east of the provincial bed of the Fraser River, and various federal holdings in the North, South and Middle Arms of the Fraser River.

The Proponent is responsible for vessels operating within defined vessel operating areas in its jurisdiction. The Proponent manages and has control over the port area, including nautical access and port infrastructure. Anything beyond these areas is outside the jurisdiction of the Proponent. The established shipping routes within the Salish Sea are governed by Transport Canada and the Canadian Coast Guard.

2.2 Project Components

The Project would be located on newly acquired and built federal land managed by the Proponent. The Project would consist of three main components as shown in Figure 2-2, below: 1) a new marine terminal, 2) a widened causeway to accommodate additional road and rail infrastructure, and 3) an expansion of the existing Roberts Bank tug basin to accommodate additional tugs for assisting with container vessel arrivals and departures. The total Project area would be 182.5 ha.

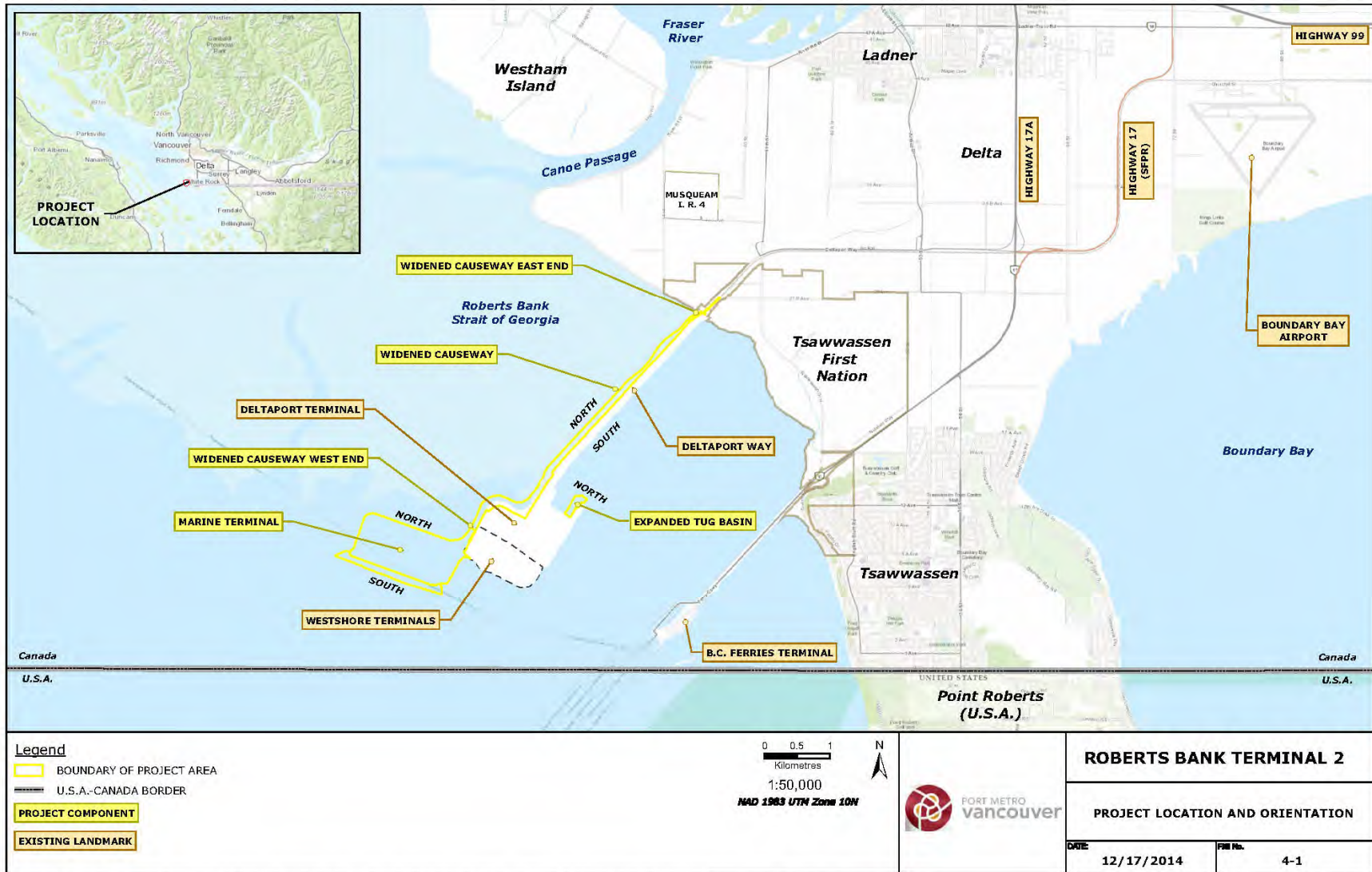


Figure 2-2: Project location (Source: EIS, Volume 1)

Marine Terminal

The marine terminal would be located immediately west of and adjacent to the existing Roberts Bank terminals: Deltaport Terminal and Westshore Terminals. The terminal would be oriented perpendicular to the causeway, approximately 5.5 km from the mainland. The marine terminal consists of four subcomponents: 1) a three-berth wharf structure and berth pocket, 2) a container storage yard on the south side, 3) rail intermodal yards on the north end, and 4) a support facility that includes truck gate facilities, buildings and security facilities located at the east end of the terminal. The marine terminal would cover 130 ha of marine habitat.

The three-berth wharf structure would be a total of 1,346 m long, to allow for the safe berthing and mooring of vessels that would call at the terminal for loading and unloading of containers. The wharf would be in deep subtidal waters to provide a minimum water depth of -18.3 m chart datum (CD) at the berth pocket. This depth would be enough to accommodate a future vessel draft of 17.5 m and was considered appropriate to accommodate 24,000 TEU vessels if they were to call at Roberts Bank. The wharf structure would be designed to accommodate the simultaneous moorage of one Maersk Triple-E-class vessel with a capacity of 18,000 TEU and two Panamax 2014-class vessels with capacities of 12,000 TEU.

The wharf would be constructed using prefabricated concrete caissons tied together at the wharf face with a concrete cope wall. The caisson height would be 27 m from the top of the cope wall to the base of the caisson. The cope wall would support the ship berthing fenders and mooring bollards and contain within its structure the utility corridors for shore power, potable water and other amenities. The wharf structure would be where 25 ship-to-shore gantry cranes move containers to and from ships.

The container storage yards would be in the center of the terminal and would include electric stacking cranes to transfer and sort containers. The container yard would have 33 blocks of container storage, each block being supported by two electrically powered automated stacking cranes. Each block would have the capacity to hold 39 rows of containers, each 10 containers wide by five containers high. In addition, the container yard would also provide for 11 blocks containing three rows each of refrigerated container capacity.

The two rail intermodal yards would have a total rail capacity of 15.06 km and would consist of six tracks in the south yard (1,265 m long) and six tracks in the north yard (1,245 m long). Each intermodal yard would have four electrically powered rail-mounted gantry cranes, or similar equipment, to transfer containers between railcars and mobile transfer equipment to move containers between the intermodal yards and container yards.

Widened Causeway

The causeway links road and rail networks to the Roberts Bank terminals. The existing causeway would be widened on the north side along its entire length of approximately 5.5 km, to accommodate the new rail yards and the overpass structure. At the east end of the causeway, rail infrastructure would extend eastward 450 m on the existing British Columbia Railway right-of-

way for tie-in purposes to the existing mainline rail network. In addition, the existing coal tracks adjacent to Roberts Bank Way North to Westshore Terminals would be repositioned to accommodate the proposed Roberts Bank terminal overpass and road access. The proposed Roberts Bank terminal overpass would be built on the north side of the existing causeway and extend onto the new widened causeway.

The widened causeway would include rail yards where trains are disassembled after entering the intermodal yard and assembled before departing. The rail intermodal yard would include electric rail-mounted gantry cranes to move containers on and off rail cars. The new overpass would be built on the north side of the existing causeway and would connect to a new three-lane access road to allow traffic to and from the Roberts Bank terminals. Causeway widening would require 49.4 ha of intertidal habitat.

Expanded Tug Basin

The existing tug basin would be expanded from 1.4 ha to 4.5 ha to accommodate two tug operators assisting with the arrival and departure of ships to the new marine terminal. The tug basin would be dredged to a depth of minus 6.5 m CD to allow under-keel clearances of the new tugs. The tug basin would be located on the east side of the existing causeway in the inter-causeway area.

2.3 Project Phases and Schedule

The Proponent designed the Project to have two phases; construction and operations. The Proponent did not plan to decommission or abandon the Project and it was assumed that the land would remain in perpetuity. The construction phase would be completed in 73 months. The first three years of construction would create the land mass of the terminal and widened causeway. The following three years would complete the wharf area. Installation of underground utilities and infrastructure such as the overpass, road and rail work and terminal buildings would continue after the completion of land development. The construction schedule was based on the Proponent's 2018 Project Construction Update.

In June 2017, the Proponent reported that, based on feedback from Indigenous groups and other stakeholders, it had investigated changes to project construction activities to mitigate potential effects. In June 2018, the Proponent submitted the Project Construction Update to reflect the revisions to the Project. The main change the Proponent announced was the use of tug basin dredge as fill instead of disposal at sea and the elimination of the intermediate transfer pit. The Panel, in its effects assessment, relied on the information provided in the 2018 Project Construction Update.

The Proponent anticipated that 12.3 million cubic meters ($M m^3$) and $0.7 M m^3$ of sand would be required to fill the terminal and causeway, respectively. The volume of material dredged from the terminal dredge basin (berth pocket, marine approach areas, and caisson trench), and the tug basin would be approximately $3.67 M m^3$. The material from the dredge basin would be combined with $6.1 M m^3$ of Fraser River sand acquired from annual maintenance dredging and

3.6 M m³ existing quarry sand to create suitable fill material for terminal and causeway land construction to the required heights.

The tug basin expansion would involve dredging approximately 164,000 m³ of marine sediment to a depth of -6.5 m CD. The tug basin expansion would be scheduled between August 15 to coincide with the end of the Fisheries and Oceans Canada's (DFO) juvenile salmon protection closure, and October 15 to coincide with the start of crab protection closure. The tug basin would be dredged in Year 2 and it was expected that a two-month duration would be feasible for the scale of work.

The overpass would be built upon 86 steel pipes driven -20 m deep using a vibrator and hammer. The land-based vibro-replacement densification of soils around the piled area and beyond the project footprint of the overpass structures would take up to 60 days, during day light hours.

The Proponent proposed to construct habitat offsets to increase biological productivity and mitigate adverse effects of the Project on environmental components. Onsite habitat offsetting construction work would commence at the beginning of Year 2.

Commercial operations would begin at month 81. Operational activities would involve inbound and outbound container ship maneuvers, marine terminal operations to move containers on and off ships, railway procedures and drayage by trucks. The Project would be fully operational by 2035 and the overall design life of the Project would be 75 years. The terminal would operate 24 hours per day, 358 days a year at the berth and 362 days a year at the container and intermodal yards.

Facilities to refuel ships do not exist at Roberts Bank, nor does the Project include facilities to support refueling. Tugs servicing the Project would refuel at the existing marine fueling station in Coal Harbour, Burrard Inlet.

3 Vancouver Fraser Port Authority Approach

This section describes the methods used by the Proponent to assess potential effects of the Project. The Proponent relied on various sources of information, including field studies, scientific literature, computer modelling, results of other environmental assessments, community knowledge, Indigenous traditional knowledge, and professional judgment.

3.1 Environmental Effects Assessment

Valued Components

The valued components (VC) selected by the Proponent were those aspects of the natural and human environment required by CEAA 2012 and that were important in the context of the Project. The effects pathways for which potential Project related effects could occur, the VCs that were likely to be a receptor of the effect, and the intermediate components (IC) through which the effect was transmitted were considered by the Proponent in its assessment. The Proponent assessed eight ICs and 16 VCs. The Proponent included current use of lands and resources for traditional purposes in the effects assessment although it did not consider it to be an IC or a VC. The potential for interactions between Project activities during construction and operations were evaluated for each IC and VC and the potential effect due to the interaction between the Project and the component was assessed. The Proponent predicted the significance of potential Project effects for VCs only, since they considered that significance was typically assessed in relation to those components that are most valued by society.

Spatial and Temporal Boundaries

For each VC, the Local Assessment Area (LAA) was defined as the area within which the Project was expected to interact with and potentially have an effect on the VC. The Regional Assessment Area (RAA) provided the regional context for the assessment of potential project-related effects.

To conduct the assessment of the Project's effects and cumulative effects, the Proponent used four different temporal cases:

- **Existing conditions:** described the current conditions of each component, and took into account the effects of other projects and activities that had been or were currently being carried out;
- **Expected conditions:** reflected changes that were expected to occur to existing conditions by the time Project construction or operations started and were taken into consideration before the effects of the Project were applied;
- **Future conditions with the Project [project effects]:** predicted the future condition of each component by examining how the Project would change the existing conditions or, where relevant, the expected conditions. The analysis took into account how the effects of the Project would combine with cumulative effects to date;

- **Future conditions with the Project and other certain and reasonably foreseeable projects and activities [cumulative effects]:** considered the effects of the Project in combination with other certain and reasonably foreseeable projects and activities that would be carried out.

The Proponent was required to assess how the existing environment would change once the Project was in place. In some cases, the requirement to predict environmental conditions with the Project was achieved by adding the Project effects to possible future baseline environmental conditions. For example, the Proponent assumed an overall decrease in air quality emissions for most contaminants in the atmospheric environment from existing to expected and future conditions. The Proponent stated the expected conditions for each VC accounted for any further changes from expected projects that have yet to occur in the existing conditions, but will have occurred by the time the Project proceeds, or from advances in technology or required standards.

Therefore, the expected conditions temporal case was characterized as the environmental conditions at the time of Project commencement, which for some components were expected to be substantively different from those observed at present. The Proponent stated that a comparison of Project-related changes to expected conditions allowed for a more realistic and accurate reflection of incremental Project changes.

Application of Mitigation Measures

Mitigation measures proposed to avoid or minimize adverse effects were integrated into project design and applied to specific environmental components as required. Because Transport Canada regulates marine shipping, the Proponent stated that any marine shipping associated with the Project was beyond their care and control and that the Proponent would therefore be unable to propose mitigation measures. The Proponent indicated that, while the Project itself would not contribute to an increase in vessel traffic in the marine shipping area, they recognised that there were a number of regional initiatives underway to address effects of marine vessel traffic. The federal regional initiatives and programs, while not mitigation measures under CEAA 2012¹, would act to reduce effects resulting from marine shipping.

Determining Significance of Residual Effects

The Proponent stated that if an adverse effect persisted after the application of mitigation measures, the residual effect was characterized using criteria described in the Agency's guidance documents. The Proponent indicated that it used integrity-based thresholds for the determination of significance rather than an historic temporal baseline to avoid a shifting baseline. The Proponent considered the integrity of the VC, including how it had been affected by natural

¹ Mitigation measures are defined by CEAA 2012 as measures for the elimination, reduction or control of the adverse environmental effects of a designated project and includes restitution of any damage to the environment caused by those effects through replacement, restoration, compensation or any other means.

processes and other projects and activities, and was rated in terms of the VC's sensitivity to future change, its resilience, and its ability to recover from adverse effects. Resilience was defined by the Proponent as the potential for biophysical and human communities to effectively adapt to stress and adversity.

The existing (or expected condition) of each VC was compared with the future condition predicted to result from the Project. The anticipated future condition of each VC with the Project was compared to a threshold of significance defined for that specific VC. If the threshold was exceeded in the future condition, the Project's effects were significant.

The Proponent stated that it applied the Agency's operational policy statement as well as the technical guidance for *Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012*. The guidance states that a cumulative environmental effects assessment should be conducted for those valued components for which a residual environmental effect was predicted, after taking into account applicable mitigation measures, regardless of whether the residual environmental effect was predicted to be significant. The VC on which there may be residual effects would then be assessed for the potential to be affected by past, present, and future physical activities that are certain and that are reasonably foreseeable.

The Proponent considered that the temporal boundary used for the cumulative effects assessment accounted for the effects of other past and existing projects and activities, because those effects were reflected in existing and expected conditions. As such, the Proponent considered that the residual Project effects assessment already included an important part of the assessment of future cumulative effects. The Proponent stated that because residual effects of the Project must necessarily combine with the effects of past projects and activities to further change the condition of the environmental component, the evaluation of an environmental component with the Project was a reflection of the cumulative effect of the Project in combination with other projects and activities that have been carried out.

3.2 Roberts Bank Ecosystem Model

3.2.1 Proponent's Assessment

The Proponent adopted an ecosystem-based approach to evaluate effects of the Project footprint and associated changes in coastal geomorphology. The Proponent noted that an ecosystem-based approach that evaluates the potential effects of the Project both at the species-level and among marine environmental components was the best practice for major projects that had the potential to result in ecosystem change. The Proponent developed and used the Roberts Bank Ecosystem Model (RBEM) to predict potential effects of the Project on the productive capacity of the ecosystem as a whole, and more specifically to inform the assessment of effects on marine vegetation, marine invertebrates, marine fish and coastal birds.

The RBEM is a mass balance scheme, which assumes that the total production of a functional group is equal to the accumulated biomass within the group, plus any biomass extracted from the group as a result of migration, predation, fishing, and other types of mortality. The energy

balance of each functional group is maintained by assuming that consumption is balanced by the sum of production, respiration and assimilation.

The study area for the RBEM covered an area of 54.68 km² and included the intertidal and subtidal zones between Canoe Passage and BC Ferries Tsawwassen Terminal, from the shoreline to the -100 m CD depth contour or Canada/USA international border, as illustrated in Figure 3-1 below. The RBEM study area boundaries are also the spatial boundaries for the LAA for marine vegetation, marine invertebrates, marine fish and coastal birds.

The RBEM was operated using measured bathymetry and flow inputs derived from the Proponent's coastal geomorphology assessment. The RBEM included 58 functional groups, of which 28 were biologically and socially significant focal species. The spatial domain of the model consisted of 8,694 100-metre by 100-metre cells. In order to understand the effects of the Project on ecosystem productivity for each functional group, the model was run for existing and future conditions, with and without the Project. The changes in productive potential of the ecosystem were expressed in tonnes as a metric to assess changes in biomass.

Overall, the RBEM predicted an increase of 4.4 percent ecosystem biomass with the Project and proposed offsetting measures. The Proponent noted that the RBEM did not capture the expansion of the tug basin, due to the model's resolution, and it did not capture any changes resulting from construction activities.

The Proponent stated that it was confident the RBEM conservatively assessed direct and indirect effects of the Project footprint on ecosystem productivity at Roberts Bank.

As part of its follow-up programs, the Proponent made a commitment to evaluate the accuracy of the RBEM predictions for select VCs, namely blue heron, marine vegetation, invertebrates utilized by the Western sandpiper as food, rockfish, and lingcod.

RBEM Process

The Proponent followed five main steps in the RBEM process:

1. Create a food web for Roberts Bank;
2. Model the food web over time and space to reflect conditions without the Project;
3. Model the effects of the Project footprint on biomass and production;
4. Predict the effects of the Project footprint with proposed offsetting on biomass and production; and
5. Conduct sensitivity analyses.



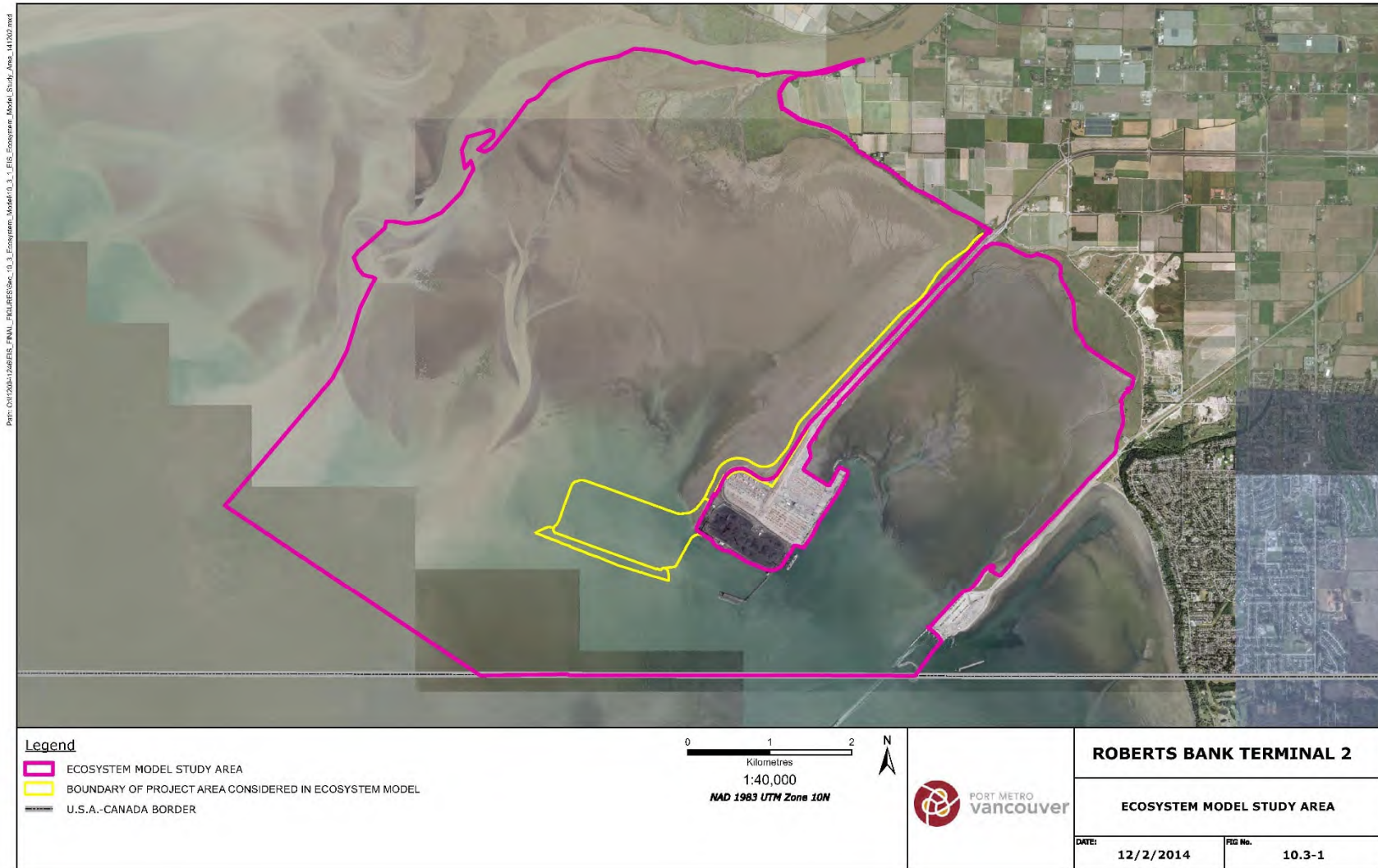


Figure 3-1: Ecosystem model study area (Source: EIS, Volume 3)

3.2.2 Views of Participants

Fisheries and Oceans Canada (DFO) provided the Panel with technical evaluation reports for the RBEM, and for the hydrodynamic and sediment transport models that informed the RBEM. DFO noted it consulted Environment and Climate Change Canada (ECCC) in its technical review of the RBEM. DFO advised that the Ecopath with Ecosim (EwE) model used as the basis for the RBEM was developed and best applied to ecosystems larger and with fewer external exchanges in biomass than Roberts Bank. DFO noted that the RBEM was a complex spatial ecosystem model, constructed for a relatively small and open system, and that the Proponent made many assumptions to address data limitations.

DFO recognized that the Proponent's objective for the RBEM was not to provide an assessment of Project effects for each functional group at a fine temporal scale, but to estimate longer term changes in the productive potential of each functional group that may result from the Project. As such, DFO considered that the RBEM outputs were useful to forecast the effect of the Project on the overall productivity of the entire ecosystem.

In reviewing the RBEM predictions, DFO advised that the RBEM was able to capture Project effects on the majority of the biomass at Roberts Bank, since 90 percent of the modelled biomass was composed of functional groups that are largely stationary and associated with bottom environments (i.e., benthic organisms). DFO commented that the RBEM predicted the distribution of most habitat forming groups with at least moderate accuracy or better, except for green algae which it predicted poorly.

DFO concluded that the abundance of functional groups at lower trophic levels and associated with benthic organisms was largely determined by their habitat preferences. DFO considered it unlikely that changes in productivity or in species composition at lower trophic levels would limit productivity of higher trophic levels. For functional groups that utilized Roberts Bank as a key feeding or nursery area for a specific life stage or migratory component of the population, such as juvenile Chinook and chum salmon and Western sandpipers, DFO considered the RBEM predictions to be unreliable due to the annual time step utilized in the model. For these functional groups, DFO recommended the use of other lines of evidence for predicting changes in productivity.

DFO recommended a follow-up and monitoring program be undertaken to verify the environmental effects predictions related to direct and indirect effects of the Project on vegetation, fish, and invertebrates, including the predictions of the RBEM.

3.2.3 Panel's Analysis

The RBEM was used as a central tool in the effects assessment of the Project on the productivity of the Roberts Bank ecosystem. In addition, the RBEM was used to predict effects of the Project on many environmental components.

The Panel accepts DFO's advice that the EwE model is internationally accepted and supported. The Panel notes that the use of this modelling suite as a basis for the RBEM was recommended by international leaders in the field of ecosystem modelling, and that those scientists led the application of the ecosystem modelling exercise to the Roberts Bank ecosystem.

The Panel shares DFO's concerns that aspects of RBEM implementation have led to inaccuracies and possibly biases in the resulting ecosystem productive potential, the most important concern being domain definition. As a result of the relatively small domain size of the RBEM compared to other applications of the EwE model, there is the potential for considerable openness and exchanges beyond the model boundaries. DFO noted there were 35 functional groups with ecotrophic efficiencies less than 0.5, meaning that more than 50 percent of their productivity is exported from the system. Based on this characterization, the Panel is of the view that modelled productivity has the potential to misrepresent the effects of the Project on certain functional groups.

Further, the RBEM did not account for seasonality and instead used averaged parameter values over the course of one year. The Panel notes that the use of an annual time step versus a monthly time step could result in a loss of both precision and accuracy in RBEM outputs.

The Panel acknowledges that the Proponent used multiple lines of evidence, in addition to the RBEM, to generate effects predictions for the Project. The Panel concludes that the RBEM provides credible results for lower trophic levels including primary producers and secondary consumers as well as stationary, habitat forming species. For species that have a short occupancy of the model domain relative to the annual time step, for example, juvenile salmon and Western sandpiper, the Panel did not rely on the RBEM predictions and instead relied more heavily on other sources of evidence provided by the Proponent and participants.

4 Panel's Approach

To facilitate navigation of the report, the Panel takes this opportunity to describe its approach to a number of matters.

Valued and Intermediate Components

The EIS Guidelines refer to valued components (VCs) as attributes of the physical, biophysical, and human environment that may be affected by the Project. The Proponent selected candidate VCs to provide a means of focusing the assessment on those aspects of the environment that were, in its view, of greatest importance in the context of the Project. The Proponent also identified intermediate components (ICs) to inform the effects assessment of the selected VCs.

In addition to assessing the Project activities that may interact with and result in a change to an IC, which can then result in an effect on a VC, the Panel made conclusions, and where appropriate recommendations, on the IC themselves. The Panel relied on all its conclusions on ICs to support its analysis and conclusions on VCs. Similar to the Proponent's approach, the Panel only made significant determinations on VCs.

To avoid confusion, the Panel has chosen to use the term 'environmental component' in its analysis to refer to ICs and VCs.

Determining Significance of Environmental Effects

The Agency's guidance document "*Determining Whether a Project is likely to Cause Significant Adverse Environmental Effects under CEAA 2012*" assists with determining the significance of residual adverse environmental effects and the likelihood of those effects. The Panel adopted the guidance documents key criteria for determining if a residual adverse environmental effect was significant as determined by its magnitude, spatial extent, frequency, duration, and reversibility.

The Panel notes that there were no benchmarks or thresholds for significance identified in the Agency guidance document, the Panel's Terms of Reference or the EIS Guidelines. In most cases, the Proponent proposed their own thresholds for significance in the EIS. Ultimately, it is the responsibility of the Panel to select and apply the thresholds it believes are most appropriate. Where the Panel determined that a different threshold or a different benchmark was more relevant, a rationale was provided.

Irrespective of the defined criteria and their application for assessing significance, the Proponent concluded that the Project would not result in significant adverse effects on environmental components. The Panel notes that by applying population viability and integrity thresholds as the final step to determine significance, the Proponent was able to rationalize why, in their view, the effect was not significant regardless of the magnitude or extent of the effect.

The Panel also took into account the ecological and social context of the environmental component when considering the key criteria to better characterize whether adverse effects are significant. For example, when an environmental component was designated as a 'threatened' or

‘endangered’ species under the *Species at Risk Act*, the Panel took into consideration how even minor effects of the Project on such species or on the habitat upon which such species relied on could adversely affect the species.

Acting in a Precautionary Manner

CEAA 2012 states that designated projects such as the Roberts Bank Terminal 2 Project are to be considered in a careful and precautionary manner to avoid significant adverse environmental effects. The EIS Guidelines required the Proponent to demonstrate that all aspects of the Project are examined and planned in a careful and precautionary manner in order to prevent serious or irreversible damage to the environment.

The Proponent’s primary method for incorporating precaution into the assessment was to adopt a conservative approach. The Proponent stated that its assessment was based on the most stringent applicable standards for environmental components, the incorporation of conservative assumptions into its technical analysis and models, and where possible, the Proponent confirmed their modelling through actual observation and measured data. The Proponent also identified any proposed follow-up and monitoring activities in areas where scientific uncertainty existed in the effects’ predictions.

In general, the Panel agrees with the Proponent that monitoring and follow-up programs designed to address uncertainties, in either the effects predictions or the effectiveness of mitigation, can provide greater confidence in environmental management and ensure that unexpected environmental consequences that may result from uncertainty are corrected in a timely fashion. While uncertainty is inherent in predicting the environmental effects in a complex ecosystem, future management plans were not considered as a substitute for providing technical and economical feasible mitigation measures nor was adaptive management appropriate as a response to uncertainty about the significance of environmental effects. Therefore, the Panel is also of the view that if there is uncertainty about whether the Project would be likely to cause a significant adverse environmental effect, a commitment to monitoring Project effects and to manage adaptively is not sufficient. The Panel is also of the view that, if evidence from the follow-up programs indicate unforeseen adverse Project-related effects, offsetting those effects is not the appropriate first line of corrective action for the elimination, reduction or control of the adverse environmental effects of a designated project.

Where there was a potential that the Project could result in significant adverse environmental effects, the Panel identified the likelihood and made recommendations to assist any subsequent regulatory review. In some cases, this included collecting additional information prior to regulatory approvals so monitoring and adaptive management during construction and operations could be more effective. If, taking into account the implementation of proposed mitigation measures, there remained uncertainty about whether the Project would be likely to cause a significant adverse environmental effect, the Panel proposed, when applicable, the requirement of additional measures or studies prior to the construction or operation of the Project.

In instances where there were uncertainties related to the data presented (e.g., number of ships in the marine shipping area presented in the EIS and the MSA), or where there were different standards or guidelines available, for instance provincial and federal standards, the Panel used the most stringent standards or adopted a conservative approach.

5 Marine Shipping Associated with the Project

The Panel's Terms of Reference require the Panel take into account the environmental effects of marine shipping associated with the Project within the 12 nautical mile limit of Canada's territorial sea. This coastal zone is included as part of the definition of a designated project for the purpose of this environmental assessment.

5.1 Marine Shipping Area

The Proponent delineated the marine shipping area from the limit of the Port Authority's jurisdiction, south to the 12 nautical mile limit of Canada's territorial sea, at Buoy J, as illustrated in Figure 5-1. To facilitate the effects assessment of marine shipping associated with the Project the Proponent divided the marine shipping area into seven Segments, A to G.

The Proponent and Transport Canada explained that several acts and regulations govern marine shipping in the marine shipping area. In addition to federal legislation, the Proponent stated that marine shipping is governed under the International Maritime Organization (IMO), which provides the marine shipping industry with requirements pertaining to traffic management and environmental protection. As well, the IMO requirements are often integrated within Canadian legislation related to marine shipping.

Transport Canada indicated that they work with other federal departments and agencies to carry out the mandate and responsibilities over marine shipping in the marine shipping area. Transport Canada's main partners include the Canadian Coast Guard, the Pacific Pilotage Authority, DFO and ECCC.

During the environmental assessment the federal government announced the Oceans Protection Program (OPP), a national \$1.5 billion dollar investment with several initiatives to be implemented in the marine shipping area. For example, under the National Anchorages Initiative, the federal government initiated a process to: ensure the safe anchoring of commercial marine ships; efficiently manage the use of anchoring sites; and, minimize the impact to the marine environment and surrounding communities, including the area of the South Coast of British Columbia.

The *Constitution Act, 1867* grants the federal government exclusive jurisdiction over navigation and shipping. The *Canada Shipping Act, 2001* is the principal statute that governs safety in marine transportation and protects the marine environment in Canada. This legislation gives Transport Canada its authority over marine shipping. Relevant regulations for marine shipping under the *Canada Shipping Act, 2001* include *Vessel Traffic Services Zones Regulations*, *Collision Regulations*, *Navigation Safety Regulations*, *Vessel Pollution and Dangerous Chemical Regulations*, and *Ballast Water Control and Management Regulations*. Other important legislation that apply in the marine shipping area include the *Canada Marine Act*, the *Marine Transportation Security Act*, the *Transportation of Dangerous Goods Act, 1992*, the *Pilotage Act*, the *Marine Liability Act*, and the *Fisheries Act*.

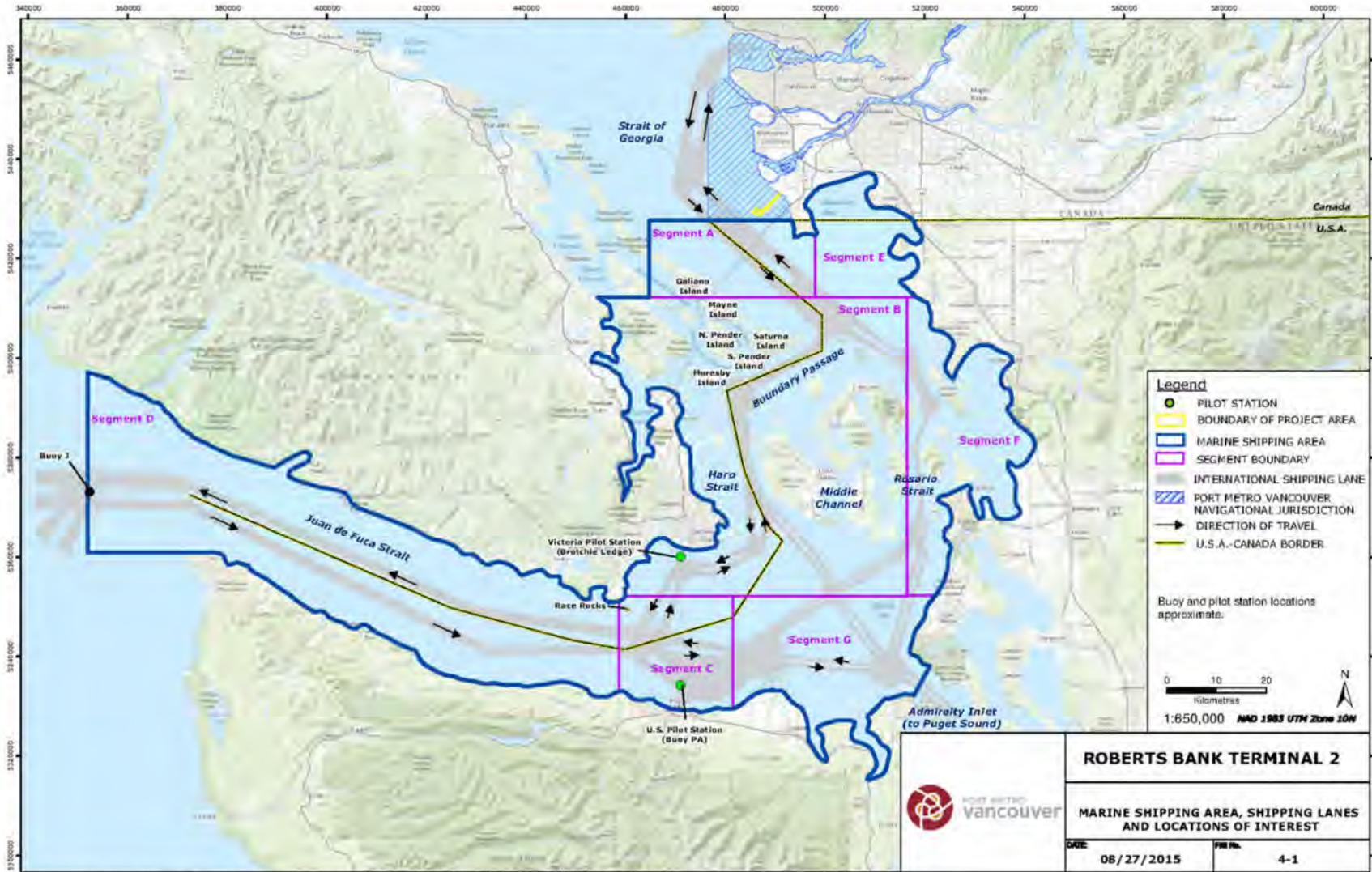


Figure 5-1: Marine shipping area (Source: MSA)

The Proponent committed to collaborate and assist agencies leading initiatives in the marine shipping area when requested, including being a part of the OPP working group. Within its assessment, the Proponent did not consider federal regional initiatives as mitigation measures applicable to the Project. The Proponent stated federal regional initiatives and programs would act to reduce overall effects resulting from marine shipping.

5.1.1 Vessel Traffic Transit

5.1.1.1 Proponent’s Assessment

In the EIS the Proponent stated that the Project would result in 260 additional container ships transiting in the marine shipping area on an annual basis. On a daily basis, the Proponent explained that the additional ships would correspond to an additional 1.5 vessel movements per day through the marine shipping area. The Proponent also identified that, independent of the Project, there was a trend towards larger vessels, which would result in fewer ship calls over time to meet a comparable or higher capacity in container shipping. Vessel sizes and classes are illustrated in Figure 5-2 below.

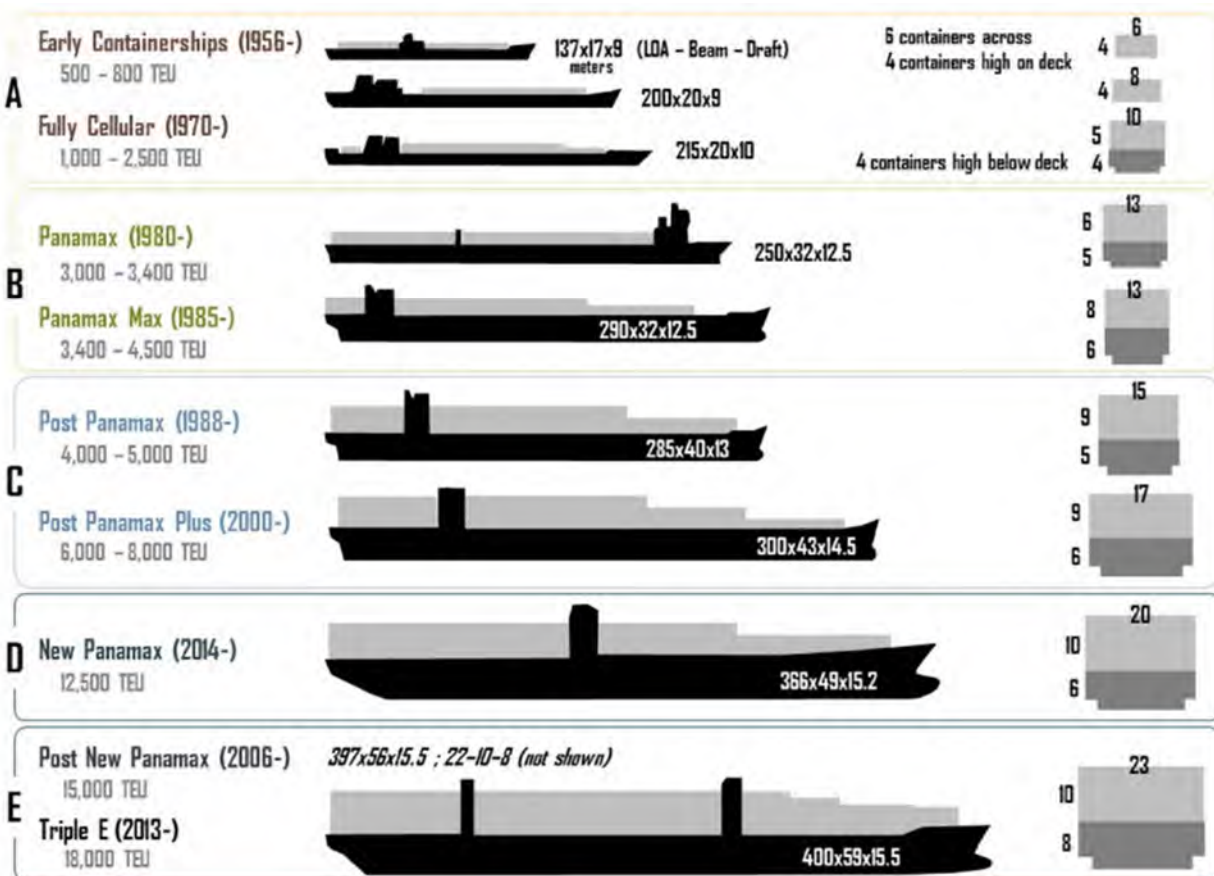


Figure 5-2: The evolution of container ship sizes (Source: MSA)

The Proponent commissioned a *Container Traffic Forecast Study* by Ocean Shipping Consulting (OSC 2016), which included a discussion on the drivers behind the trend to use larger vessels

and its implications for the Project. The OSC 2016 study reported that all major shipping lines had committed to developing vessels 18,000 TEU and above and would require water depth of up to approximately 16.5 m to accommodate their draught. The OSC 2016 study mentioned that even bigger vessels nearing 24,000 TEU were likely to be introduced over the next five to ten years in the Asia-Europe trade routes. This increase in TEU capacity would result in the larger sized vessels currently on those routes to be integrated in the transpacific route that would call on the proposed Project terminal. The OSC 2016 study noted that it would be realistic to anticipate a 22,000 TEU vessel on the transpacific route at some point in the future, while a shift to the use of 24,000 TEU vessels would involve significant infrastructure and container crane upgrades and investments. The Proponent indicated that the largest ship the Project could accommodate is a 24,000 TEU vessel referred to as a New Generation IIA design. In order to service a 24,000 TEU vessel designed with a wider beam, referred to as a New Generation IIB design, the Proponent stated that cranes and the terminal apron design would need to be modified.

The OSC 2016 study further explained that the largest vessels would only be accommodated at very few ports, which limited the opportunity to use such ships. However, it is the economies of scale that drives the demand for large ships. The OSC 2016 study concluded that the ultimate size of container vessels would likely be between 18,000 and 20,000 TEU, and that the ability to berth these vessels would be an important feature of the Port of Vancouver's competitive position.

The Proponent updated its predictions for vessel transit associated with the Project based on Mercator's 2018 *Roberts Bank Terminal 2 Container Vessel Call Forecast Study* (Mercator Report 2018). The Proponent indicated that it expected 234 ship calls annually by 2035, when the Project would be fully operational. The Mercator Report 2018 stated that the total number of container ships transiting in the marine shipping area was no longer predicted to increase as a result of the Project. The main difference between the OSC 2016 study and the Mercator's Report 2018 was the transition to a larger ship size in the forecast resulting from the formation of new service alliances earlier than expected for Asia – Pacific trades. The Proponent explained that the number of container ships in the marine shipping area would be reduced from present levels since larger ships could handle the projected container volumes for the Pacific Northwest. As highlighted in the OSC 2016 study forecast, the Project terminal would be able to accommodate larger ship classes, thereby providing it with a competitive advantage.

The Proponent noted that although larger ship classes would be calling at the proposed Project terminal, the Project itself would not influence the arrival of the larger ship classes in the marine shipping area. Based on the Mercator Report 2018, the Proponent concluded that there were no longer effects from a predicted increase in marine shipping associated with the Project in the marine shipping area.

The Proponent clarified that the only additional ships associated with the Project would be limited to the area of Deltaport Terminal and Roberts Bank Terminal 2. The Proponent explained that, without the Project, Deltaport Terminal would receive seven ship calls per week, out of a total 15 calling at terminals throughout Port of Vancouver in 2035. With the Project, both

terminals would receive a higher portion of the ships calling at terminals within the Port Authority's jurisdiction, and those would be larger ships. The Proponent predicted the Roberts Bank terminals would receive nine ships per week out of the total 15, representing an additional two ship calls per week. The other six ship calls would occur at Burrard Inlet and Fraser River container terminals within the Proponent's jurisdiction.

The Proponent also commissioned InterVISTAS Consulting to appraise if the forecast methodology used by OSC was acceptable and whether the forecast was reasonable. InterVISTAS concluded that the OSC forecast approach met the standard of a good forecasting methodology and provided a reasonable result. InterVISTAS also augmented the OSC base/low/high case approach of 2016 to allow for a greater range of risk factors that could influence the expected results for the Port of Vancouver.

The Proponent provided additional information on potential effects related to larger ships in the marine shipping area for underwater noise, air quality, light, and the wave environment. The Proponent concluded that the assessment of potential effects in the marine shipping area it had presented for the initial increase of 260 ships annually was either adequate or conservative. The Proponent suggested that the Panel rely on the Mercator Report 2018 with respect to the projected number of vessels that were expected to transit the marine shipping area to call on the proposed terminal.

The Proponent predicted the number of movements for all vessel types transiting in the marine shipping area, including cargo ships, containers ships, tug boats, service vessels, passenger vessels, recreational vessels, and whale watching boats. Table 5-1 shows the Proponent's initial forecasts for 2030 and updated for the year 2035, following submission of the Mercator Report 2018. Based on the predictions of the Mercator Report 2018, the Proponent found that in 2035, 3.8 percent of all vessel types using Segment B, and 2.1 percent of all vessel types using Segment D would be calling at Roberts Bank Terminal 2.

Table 5-1: Annual movements in Segments B and D of the marine shipping area by sector
(Source: Adapted from Project public registry document 1899)

Sectors	Segment B			Segment D		
	2012	2030	2035	2012	2030	2035
Cargo / carrier (excluding vessels bound for terminals within Proponent's jurisdiction)	2,822	3,344	3,514	4,431	5,112	5,373
Container ships bound for terminals within Proponent's jurisdiction (excluding vessels bound for the proposed terminal)	1,684	1,526	1,092	1,580	1,526	1,092
Container ships bound for the proposed terminal	0	520	468	0	520	468

Sectors	Segment B			Segment D		
	2012	2030	2035	2012	2030	2035
Tug	975	1,886	1,982	2,294	3,464	3,641
Service	850	1,017	1,069	2,189	2,618	2,752
Passenger	506	605	636	2,146	2,567	2,698
Tanker	391	1,278	1,411	1,197	2,430	2,683
Other / Unknown	1,368	1,637	1,721	2,240	2,680	2,817
Fishing	300	300	300	742	742	742
Total	8,896	12,113	12,193	16,819	21,659	22,265
Percentage increase by 2035 from 2012	37%			32%		

5.1.1.2 Views of Participants

Pacheedaht considered that the Mercator Report 2018 was unreliable because it provided few sources of data and the validity of the report's conclusions could not be tested. Pacheedaht stated that the Mercator Report 2018 conclusions were based on predictions made 15 years into the future within a volatile industry and must be treated with extreme caution. The First Nations of the Maa-nulth Treaty Society (the Maa-nulth) and the Pauquachin First Nation also expressed concerns with the Proponent's conclusion that the number of ships would not change, and anticipated that the Project could result in additional ships traveling through the Salish Sea.

Pacheedaht noted that marine shipping associated with the Project intersected with important Pacheedaht fishing grounds at Swiftsure Bank and recommended that the Government of Canada undertake an updated marine traffic risk assessment for the Strait of Juan de Fuca in collaboration with Pacheedaht and the Ditidaht First Nation (Ditidaht).

ECCC stated that the approach taken prior to the Mercator Report 2018 was appropriate and more representative of the potential effects on air quality from Project-related marine shipping. ECCC noted that it did not agree that the updated forecast would eliminate all predicted effects on air quality from marine shipping. ECCC highlighted that the forecast increase in ship numbers calling at Roberts Bank terminals meant that there would be more emissions at Roberts Bank, leading to impacts on air quality.

At the hearing, Global Container Terminals (GCT) reported on the fact that the ocean carriers and container shipping industry have undergone fundamental and rapid change over the past five years. Ocean carriers have struggled to find economic sustainability. In response to this instability the industry has undergone periods of consolidation; ocean shippers have exited the market through bankruptcies; and others have been absorbed through mergers and acquisitions.

5.1.1.3 Panel's Analysis

The Panel recognizes that a number of participants were concerned with the Proponent's conclusion that the Project would not result in additional ships associated with the Project. The Panel notes that ECCC and the Pacheedaht recommended that the Panel use the forecasts from the EIS and the MSA as the basis of its analysis, which consists of 260 additional ships annually and accounts for an additional 1.5 vessel movements per day through the marine shipping area. The Panel finds that the forecast in the EIS and the MSA provide a realistic and conservative assessment of the effects of marine shipping associated with the Project.

The Panel used the forecast from the EIS and the MSA as opposed to the Mercator Report 2018 for two reasons: First, the results of the InterVISTAS report confirms that the OSC 2016 base case is appropriate, and second, there are realistic indications of the changing pace in the marine transportation sector. The Proponent mentioned that five years in marine shipping was a long time. GCT also commented on the rapid change that ocean carriers and the container shipping industry had to go through over the past five years.

Further, the OSC warned that the current interest in very large ships will probably decline because filling such large ships takes time, which would be a disservice to customers who always expect or need their products to reach destinations quickly. The OSC emphasized that unless vessel speed is reduced to ten knots, operations would not be cost effective because of fuel costs. Although very large ships exist for trade between Europe and Asia, it remains speculative as to when and where these large vessels will operate in the Pacific.

Based on its decision to use 1.5 ship movements per day, the Panel notes that the number of movements associated with the Project provided in Table 5-1 for 2035 would be 520 instead of 468. The Panel notes that numbers provided by the Proponent in that table illustrate a trend towards increased traffic for all sectors in the marine shipping area. The Panel acknowledges the trends towards increased traffic in the marine shipping area, which was a concern expressed by several participants.

5.1.2 Vessel Routing

5.1.2.1 Proponent's Assessment

Container ship routing follows the international shipping lanes for deep sea vessels travelling to Vancouver and other regional ports. Vessels enter and exit the Strait of Juan de Fuca at Buoy J. The Proponent noted this course was set according to international agreements, domestic legislation and regulations and that the main restriction on vessel navigation was sufficient draught. The Proponent stated that container ships travelling to Roberts Bank would not create, or be exposed to, hazards different from other vessels in the region. The Proponent noted that container ships currently made up approximately 10 percent of the total commercial traffic transiting at Buoy J.

When inbound ships reach the Brothie Ledge pilot station, south of Victoria, a Canadian marine pilot takes over prior to continuing through Segment B. The ships travel through Haro Strait, turn

northeast at Turn Point, and travel through Boundary Passage before entering the southern Strait of Georgia. The route is situated in protected waters as ships pass through the channels of the Canadian Gulf Islands and American San Juan Islands. Past East Point, the ships bound for Roberts Bank Terminal enter Segment A and deviate from the general deep-sea vessel traffic bound for other terminals in the Port of Vancouver. Once they enter the Proponent's navigational jurisdiction, the ships pass the BC Ferries Tsawwassen Terminal before being met by tugs approximately one nautical mile offshore to begin berthing manoeuvres.

The Proponent reported that Rosario Strait route had not been used by container vessels for approximately 10 years because it is very narrow and included one-way passage restrictions. The movement of container ships through Rosario Strait would require dual pilots (one Canadian and one American) to be on board for the entire voyage since this route did not pass the pilot stations at Victoria and Port Angeles. This re-routing would increase shipping costs significantly. Therefore, the Proponent anticipated that the current established route through Boundary Passage and Haro Strait (Segment B) for trans-border bound container ships would continue to be preferred and used.

5.1.2.2 Views of Participants

Ecojustice stated that the Proponent had not examined the potential use of Rosario Strait and questioned if Haro Strait traffic and associated effects could be mitigated by re-activating Rosario Strait as an additional transit route, thus potentially lessening the effects in Haro Strait.

Pacheedaht noted that the international shipping lanes are located within their territory and intersected with important Pacheedaht fishing grounds at Swiftsure Bank. Pacheedaht requested that the Government of Canada work directly with them and the Ditidaht on any decisions regarding ship routing through the Strait of Juan de Fuca, such as on realignment of the shipping lanes. Pacheedaht indicated that the Government of Canada must also take steps to cooperate and collaborate with the United States on transboundary issues relating to the location of the shipping lanes, and include the Makah Tribal Council and U.S. Office of Marine Affairs in these discussions.

Transport Canada commented on the Traffic Separation Scheme in the marine shipping area and the concerns related to effects from container ships transiting in the shipping lanes on Indigenous fishing vessels and fishing grounds. Transport Canada reported on the work it had done with the United States to amend the Traffic Separation Scheme in 2002, in consultation with industry and the public, during which traditional fishing grounds off the entrance to the Strait of Juan de Fuca were examined. Transport Canada commented that although it was not possible to completely segregate the shipping lanes from the fishing grounds, the changes were intended to minimize potential conflicts and improve on the previous configuration. Transport Canada noted it would be undertaking a feasibility study in 2019 to consider the potential modifications to the traffic separation scheme in Strait of Juan de Fuca, in collaboration with Indigenous groups. Transport Canada acknowledged that any such modifications would require coordination through the IMO, including international and transboundary coordination.

The Canadian Coast Guard illustrated that, in 2018, approximately 293 container ships calling at Deltaport Terminal had traversed the Maa-nulth Domestic Fishing Area South and a smaller number had traversed the Maa-nulth Domestic Fishing Area North, located immediately west of Buoy J. The Maa-nulth noted that marine shipping associated with the Project that would use the Pacific Northwest – Asia trade routes would also transit through and across their Domestic Fishing Areas established through the Maa-nulth First Nation Final Agreement, as shown in Figure 5-3 and Figure 5-4.

5.1.2.3 Panel's Analysis

The Panel agrees with the Proponent that using Rosario Strait is not a technically viable option to mitigate potential effects related to increases in shipping. Therefore, for its analysis, the Panel assumes vessel transit would take place only in Haro Strait.

The Panel is of the view that the shifting of shipping lanes, in 2005, did not eliminate safety risks for small vessels intersecting the shipping lanes or harvesting within them. The Panel acknowledges efforts taken by Transport Canada to remedy the safety risks. While recognizing the complexity of actions required to modify the shipping lanes, the Panel views such changes essential, as recommended in Section 16.2.3.

The Panel notes that marine shipping associated with the Project would follow routes presently used by commercial vessels in the marine shipping area and after Buoy J. These routes traverse the Maa-nulth Domestic Fishing Area South and North. The potential effects are discussed in Section 16 - Current Use of Lands and Resources for Traditional Purposes and Section 19 - Socio-economic Conditions.

5.1.3 Anchorage

5.1.3.1 Proponent's Assessment

The Proponent reported on the numbers of vessels that required anchorage from 2012 to 2016. For Deltaport Terminal, three to four vessels per year utilized anchorages, while six to eight anchorages annually were predicted for both Roberts Bank terminals.

The Proponent explained that container vessels calling at terminals within the Port of Vancouver operate on a scheduled service and adjust their speeds to arrive at the terminal within an assigned berthing window. The use of anchorages was rare and occurred infrequently for safety reasons, or to accommodate unexpected issues related to maintenance, personnel, or operations. In such an unlikely event, the Proponent mentioned that the Port of Vancouver has five anchorages at English Bay that could accommodate the largest container ships of 400 m length overall and two at Sandheads for short-term emergency anchorage only. Sufficient draught would be a key limiting factor for anchorage site selection. Any site with the required draught could be used by 400 m length overall ships in English Bay. The Proponent indicated that the Port of Vancouver would place restrictions on use of the five anchorage sites in order to provide adequate operational space.

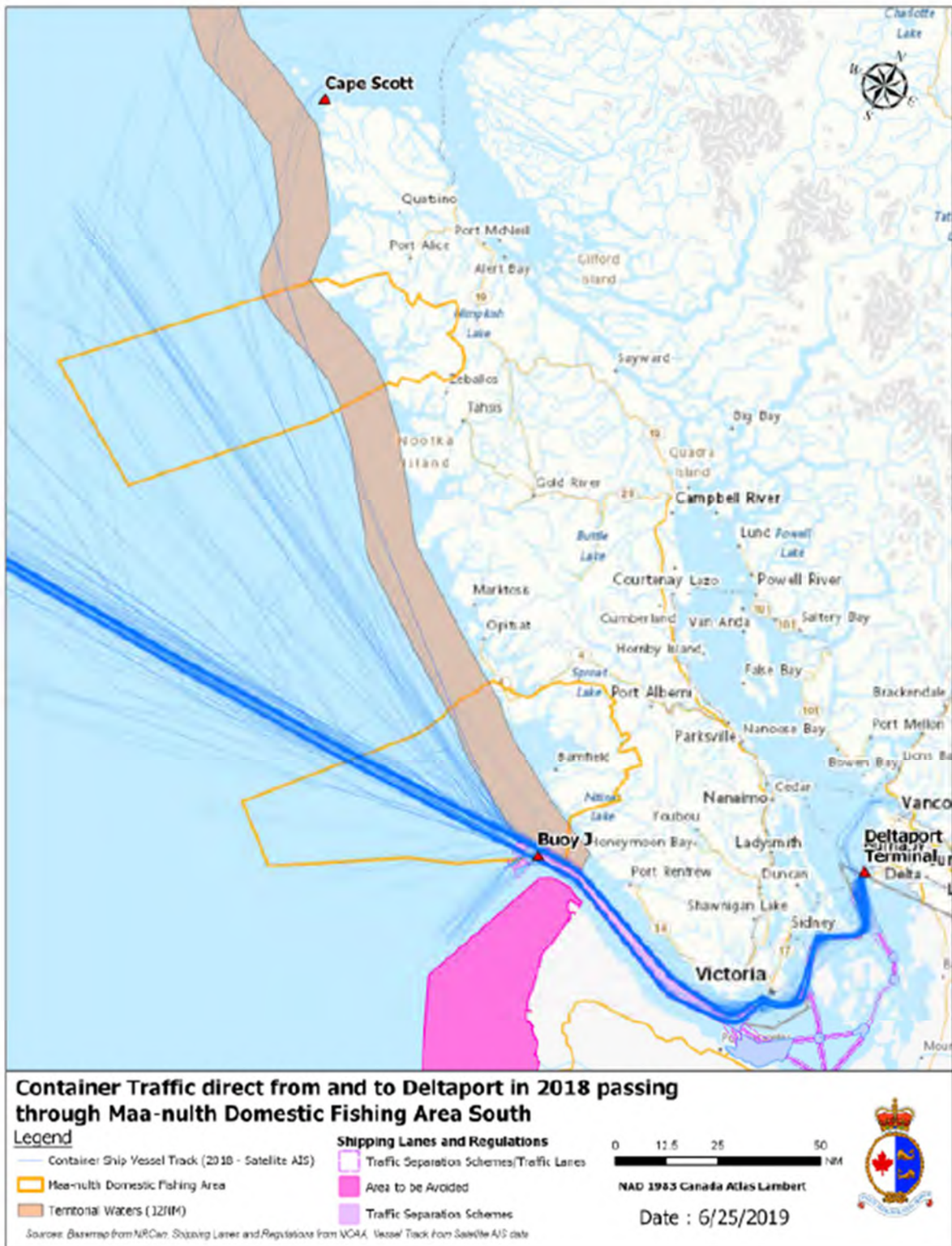


Figure 5-3: Container traffic passing through Maa-nulth Domestic Fishing Area South (Source: Project public registry document 1990)

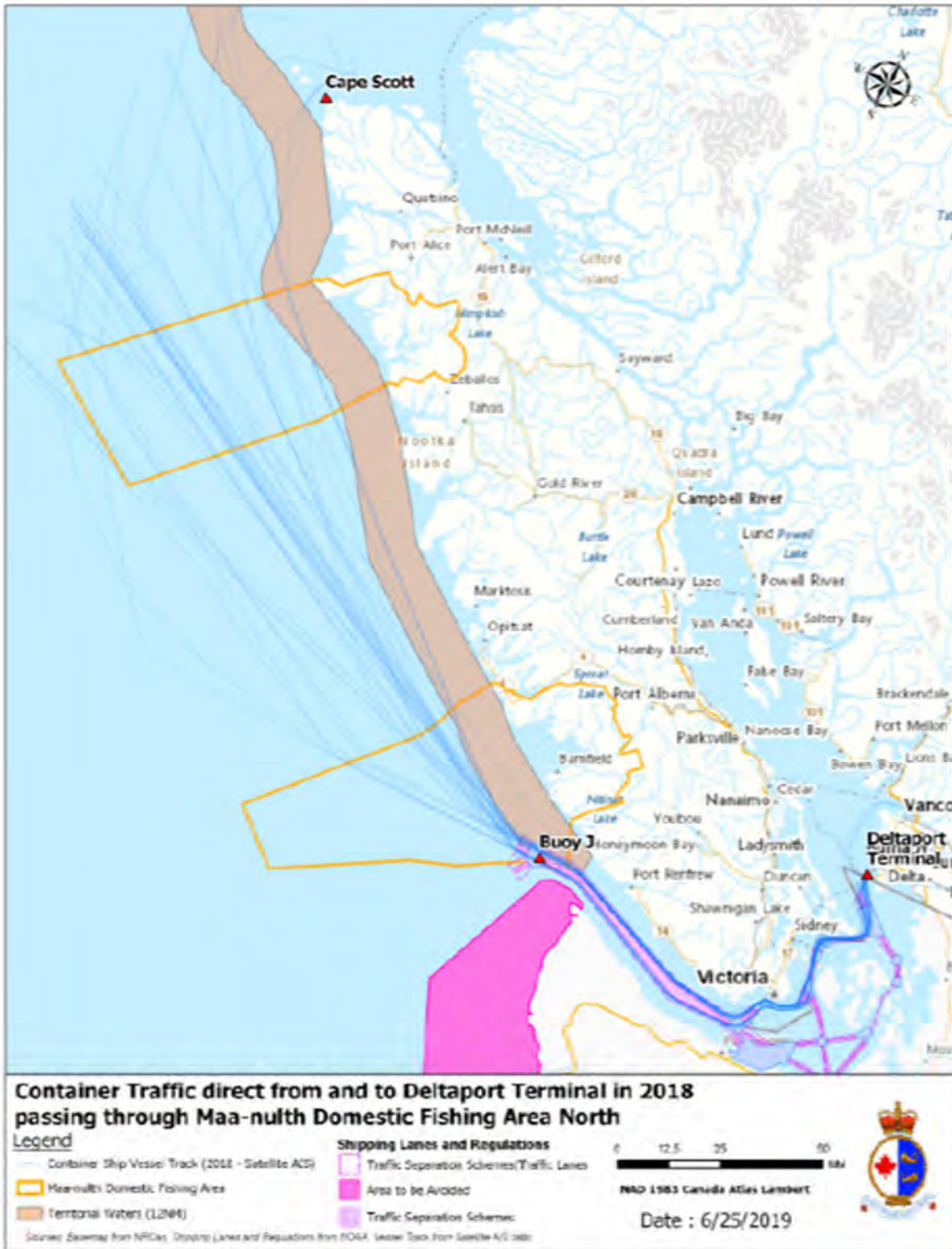


Figure 5-4: Container traffic passing through Maa-nulth Domestic Fishing Area North (Source: Project public registry document 1990)

To support the southern British Columbia anchorages under the OPP's National Anchorages Initiative, the Proponent committed to temporally manage the assignment of anchorage locations within its jurisdiction to ensure equitable rotation, in order to prevent overuse of a single location.

5.1.3.2 Views of Participants

Several participants commented on the use of anchorages in the marine shipping area. The British Columbia Great Blue Heron Society commented that ships use anchorages more frequently than stated by the Proponent. They noted that the ships were running while at anchor, which caused constant noise and air emissions.

The Islands Trust Council reported that usage of anchorage sites in the Gulf Islands had increased over the last ten years. They were concerned that large container vessels anchored in the Gulf Islands would pose a risk to the environment through oil spills or anchor dragging. They noted that activities caused light, noise and air pollution, and affected the marine environment and the enjoyment of the Gulf Islands for communities and visitors. The Islands Trust Council requested that the Government of Canada eliminate the 33 commercial freighter anchorages throughout the Southern Gulf Islands, and develop a twenty-year mitigation plan to reduce the need for vessels to go to anchor.

The Lyackson First Nation (Lyackson) raised several concerns about freighters anchored off the coast of Le'eyqsun on Valdes Island. Its members indicated that the sensory interferences caused by anchorage of large vessels disturbed their sense of serenity, as well as the ability to hear, see and sense natural cues. The anthropogenic light from large vessels anchored across the Strait of Georgia was highly visible from the shoreline of Le'eyqsun at night. This light source interfered with the natural night sky and affected their ability to conduct traditional practices. Lyackson members noted that rumbling, echoing sounds from large vessel engines and on board-maintenance work and construction have occurred at several locations of Le'eyqsun, including at the center of the island. Lyackson also raised concerns that the noise and light from freighters was interfering with behavioural patterns of salmon.

The Gabriolans Against Freighter Anchorages Society was of the view that the Project was the source of the demand for five new anchorage sites off Gabriola Island. The Society was concerned about the environmental consequences of new and existing anchorage sites beyond the boundaries and jurisdiction of any port authority. The Pacific Pilotage Authority submitted an environmental assessment on the five proposed anchorage sites in the vicinity of Gabriola Island, which outlined the potential for environmental effects associated with anchoring activities. Transport Canada stated that they did not establish the five anchorages sites proposed in the vicinity of Gabriola Island. An interim protocol to balance the use of anchorages in the South Coast of British Columbia had been put in place pending completion of the Anchorages Initiative.

Transport Canada commented that anchorages in the Port of Vancouver could not always accommodate vessels, which would then use other anchorage sites from southern Victoria all the

way up through the Gulf Islands. Transport Canada recognised that there were concerns from communities at those sites. Transport Canada noted the marine shipping industry would need more anchorage sites to be created. As part of the OPP's Anchorages Initiative, Transport Canada stated it would look at minimizing impacts from anchoring and the need to establish more anchorage sites.

5.1.3.3 Panel's Analysis

From the information presented by Transport Canada, the Panel acknowledges that the Proponent's reported use of anchorage sites was correct and container ships make less frequent use of anchorage sites than tankers and for shorter durations.

The Panel considers Transport Canada's interim protocol to balance the use of the various anchorages to be a temporary measure. Due to the limited number of anchorage occurrences per year by the Proponent, the Panel is of the view that existing anchorage locations would suffice, in the short term, to respond to Project needs. However, due to restrictions caused by large container ships, there would be a need for additional anchorage sites in the future.

In response to the issues raised in the context of anchored ships, the Panel is satisfied that there are existing procedures available to the public. The Proponent mentioned that people with concerns related to light and noise can notify the Harbour Master through the Port of Vancouver's website. This would trigger the Port Authority to follow up with the ship's agent and request corrective action. Such complaints are logged and monthly reports are sent to Transport Canada.

5.1.4 Pilotage and Tugboat Escort

5.1.4.1 Proponent's Assessment

The Proponent stated that pilotage services would be required to transit through the marine shipping area, and this activity would not be expected to result in any adverse environmental effects that have not been already considered in relation to the transit of container ships.

The Proponent stated that container ships do not require tugboat escort while transiting through Segments A to D of the marine shipping area. The required tugboat activity for the Project-associated container ships would only occur adjacent to the terminal, and therefore the Proponent did not further examine tugboat requirements in the marine shipping area.

The Proponent noted that the Government of Canada had adopted the recommendation from the National Energy Board related to the Trans Mountain Pipeline Expansion (TMX) Project to consider developing a regulatory framework for mandatory enhanced tug escort in the Salish Sea.

5.1.4.2 Views of Participants

Transport Canada commented on the review of the *Pilotage Act* that had been underway during the assessment of the Project. Transport Canada stipulated that marine shipping includes a compulsory pilotage area specified by the Pacific Pilotage Regulations, for which marine pilotage ensures licensed marine pilots guide ships to ensure safety and protect coastal environments. Transport Canada stated that, as part of the OPP, the federal government introduced new legislation to amend the *Pilotage Act* to enable improvements in the effectiveness, efficiency and accountability of Canada's pilotage system.

The Pacific Pilotage Authority commented on training required for larger ship sizes expected to be associated with the Project. The Pacific Pilotage Authority commented that it would require a six-month notice to prepare training for the pilotage of large ships such as Triple E class ships, which would be longer than 360 m in length.

The Panel heard from participants that increased tug capacity should be required for vessel traffic in the marine shipping area, especially in Haro Strait and Boundary Pass. The Washington State Department of Ecology recommended that tug escorts should be required for container vessels over 125,000 dead weight tonnes transiting on routes east of a line extending from Discovery Island Light south to New Dungeness Light.

5.1.4.3 Panel's Analysis

The Panel agrees with participants that Transport Canada should re-examine what is presently proposed to increase safety of other vessels in Segments B and C in terms of pilotage services and tug boats.

Regarding training of pilots to service ships longer than 360 m in length, the Panel has confidence in the Pacific Pilotage Authority to provide the relevant training. The Panel stresses the importance of communicating to the public the existing high level of rigour for the selection and training of pilots, in order to increase public confidence in the system.

5.2 Canada's Marine Protection Framework

In addition to the marine shipping activities described above, this section summarizes information the Panel received about activities in the marine shipping area that were not directly related to the Project or within the Proponent's jurisdiction.

5.2.1 Proponent's Assessment

The Proponent stipulated that it has legislative authority over navigation within its Navigational Jurisdiction Area, and that its authority is limited to control over navigation within designated port limits. The Proponent explained that marine transit in the marine shipping area outside its jurisdiction is managed according to Vessel Traffic Services Zones Regulations under the *Canada Shipping Act, 2001*. The Proponent provided the figure below which illustrates Vessel Traffic Services zones in the marine shipping area. They are managed under the *Co-operative*

Vessel Traffic Service, an agreement between the Canadian and the United States Coast Guards. The main purpose of the agreement is to provide a uniform approach and international efficiency in managing vessel traffic in adjoining waters. Vessel traffic management centers were established and are in communication with each other to ensure real time knowledge of the total vessel traffic pattern in the applicable waters.

Figure 5-5 further indicates which country serves as the first responder to public calls reporting a nautical hazard to a Marine Communication and Traffic Services officer.

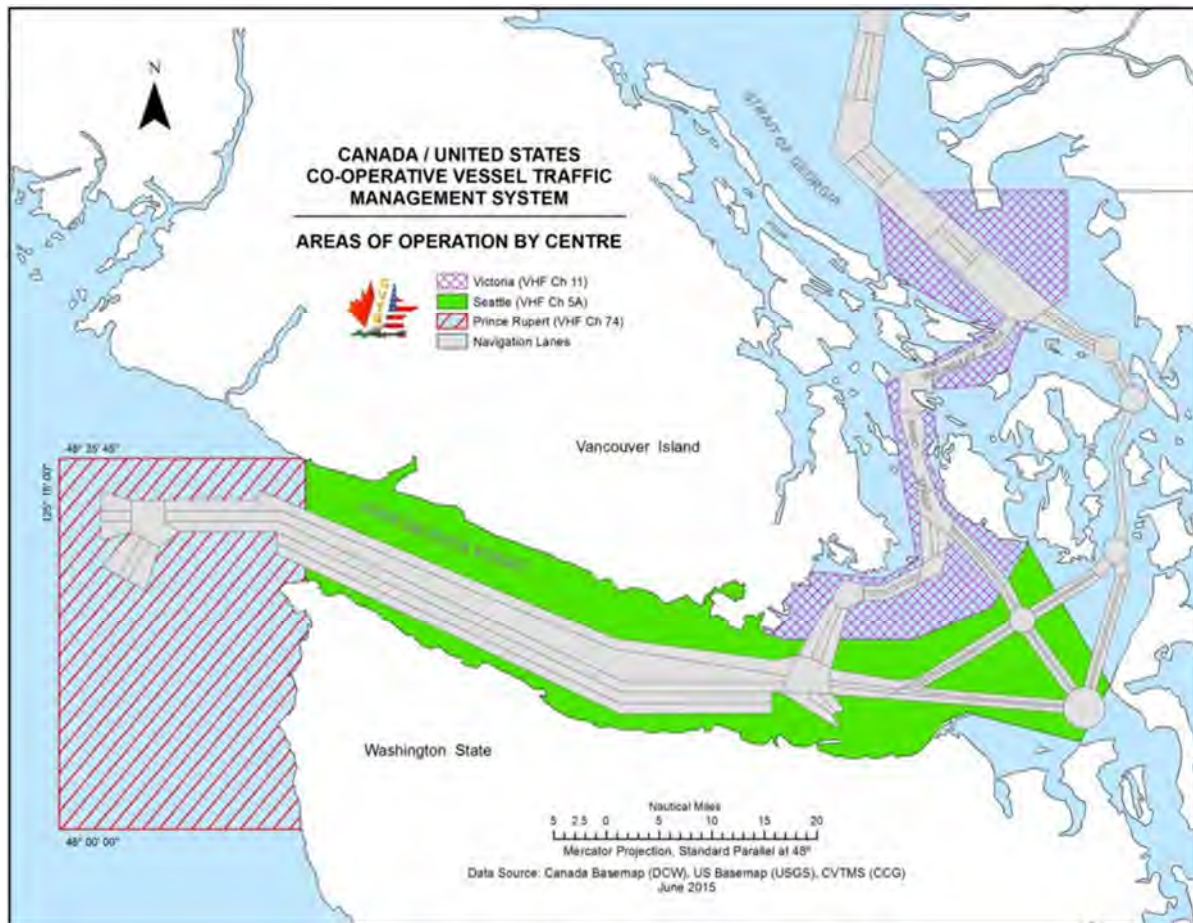


Figure 5-5: Canada / United States co-operative vessel traffic management system (Source: MSA)

The Proponent noted that potential effects from vessel transit on water quality in the marine shipping area from chronic oiling, the use of anti-fouling agents, and discharges of ballast water, bilge water, and sewage were adequately regulated by Transport Canada. The Proponent was of the view that Project-associated vessels would not degrade water quality in the marine shipping area.

5.2.2 Views of Participants

Transport Canada described relevant initiatives under the OPP that would increase general safety for marine traffic in the marine shipping area. Transport Canada highlighted the Enhanced

Maritime Situational Awareness initiative, which would consist of the development of a user-friendly system to increase access to local maritime data by users, including vessel traffic data. The Canadian Coast Guard spoke of the Collaborative Situational Awareness Portal initiative, which was related to the Maritime Situational Awareness initiative and would provide a web-based platform for Indigenous and Coastal communities to access information on local marine traffic. These initiatives would combine data sources to provide a single window for users on marine traffic in local waters. Transport Canada noted that they, along with ECCC, DFO, Canadian Coast Guard and Natural Resources Canada (NRCan) would continue to engage with Indigenous groups in the design and implementation of these measures. Transport Canada noted other OPP initiatives relevant to improve communications in the marine shipping area, such as investing in Automatic Identification System technologies and modernizing equipment at Marine Communications and Traffic Services centers.

Some Indigenous groups commented on the federal government's OPP to help mitigate effects from Project-related and other ships in the marine shipping area. Most of them commented on being engaged with federal officials in consultation on OPP initiatives. The Cowichan Nation Alliance noted concerns about the perceived reliance of the government on the OPP to resolve multiple issues. Pauquachin First Nation commented that the OPP was extremely broad and therefore that it was a difficult forum to have detailed discussions about the Salish Sea. Similarly, Esquimalt Nation indicated that the OPP was developed for three oceans and did not get into specific detail to address the Salish Sea.

A few participants commented on marine pollution in the marine shipping area. The Musqueam Indian Band (Musqueam) noted that ships traveling to and from the Project could affect marine organisms and fishing resources through pollutants washing off the ships, fouling of the water, and the release of polluted and contaminated ballast water into the region. The Tulalip Tribes of Puget Sound observed sludge presently accumulating on their nets and throughout the Salish Sea. Esquimalt Nation recommended the joint development of a plan to maintain and restore the quality of the Salish Sea. The Friends of the San Juans reported incidence of marine pollution related to inadequate discharge of oily sludge by vessels from the use of oil scrubbers. They also recommended that ships associated with the Project be required to use fuel with a 0.50 percent sulphur content limit to comply with IMO standards.

Transport Canada acknowledged concerns related to marine pollution in the marine shipping area, and described several domestic and international requirements in place for the safe management of ship discharges such as ballast and bilge waters. Transport Canada noted that ships are prohibited from releasing ballast waters brought in from outside Canada into Canadian waters, and were required to exchange ballast waters at specific distances and depths. Transport Canada outlined measures applicable to bilge water, which required treatment onboard through an oily water separator and discharge only if the oil content is not more than 15 parts per million. Transport Canada stated that it was highly unlikely that untreated bilge water would be discharged. Transport Canada and Health Canada noted that anti-fouling compounds had been found to have the potential to persist in the water column and affect the marine environment. However, they stated that Project associated marine ships would be party to the *International*

Convention on the Control of Harmful Anti-Fouling Systems on Ships, which prohibits the use of harmful anti-fouling compounds. With regards to use of heavy bunker oil in the marine shipping area, Transport Canada stated that vessels in Canadian waters have had to carry low sulphur content fuel in the marine shipping area since January 2015 to comply with IMO standards, which would decrease to 0.50 percent by January 2020.

Transport Canada further provided information on the Green Marine program, a voluntary environmental certification for the maritime industry in North America in which the Proponent is a participant. Participants in Green Marine include ship owners, ports, terminals, and shipyards to achieve levels of environmental performance that exceed regulatory requirements.

Transport Canada explained that it ensures compliance with Canadian law and international conventions through Port State Control inspections. If found non-compliant, Transport Canada explained that shippers would be subject to penalties, such as not being permitted to load cargo, which costs shippers time and money. Transport Canada reported on the number of inspections it carried out and noted that Port State Control inspections covered about 20 to 25 percent of all vessels in the Pacific Region, and that container ships represent about 10 percent of the ships inspected. Transport Canada explained that inspections are carried out on a risk basis, where a vessel is targeted for inspection based on its record of other inspections and when that record indicates the vessel poses a higher risk of violation. Transport Canada mentioned that inspection results for container ships were consistent with the general trend for all vessels. For example, of the 225 inspections of container ships conducted between 2012 and mid-2017 in the Pacific Region, Transport Canada recorded 114 contraventions of IMO standards, most of which were related to safety issues such as not meeting fire safety equipment standards.

Transport Canada noted that it also monitors vessels in Canadian waters through its National Aerial Surveillance Program, which allows for the use of remote sensors during times of reduced visibility and can detect oil spills of as little as one litre of oil on the surface of the water. Transport Canada stipulated that it could use evidence gathered by National Aerial Surveillance Program aircraft to help prosecute marine polluters or to issue administrative monetary penalties.

Transport Canada, ECCC and Bird Studies Canada (BSC) commented on chronic oiling, which was reported to have the potential to cause sub-lethal health effects on marine birds and indirect effects on their prey. Transport Canada advised that chronic oiling was not likely to be an issue for vessels associated with the Project with pollution controls in place under the *Canada Shipping Act, 2001*. ECCC commented that spill response programs did not address routine monitoring or tracking of potential chronic oiling. ECCC explained that the magnitude of impact from chronic exposure to fuel oil was currently unknown for a complex ecosystem such as Roberts Bank. ECCC noted that areas of importance to marine birds within the marine shipping area and the vicinity of the Project area were at risk of chronic oiling. ECCC stated that it was conducting a variety of research projects and monitoring of marine birds aimed at understanding the risk of exposure to low-level chronic oiling. Similarly, BSC noted that the Fraser River estuary and Saanich Peninsula were particularly vulnerable to chronic oiling. BSC recommended that the Proponent be required to contribute to efforts to monitor and quantify the cumulative risk

chronic oiling poses to the seabirds in the Salish Sea. BSC indicated that their beach bird survey could be used to help assess the effect of chronic oiling.

5.2.3 Panel's Analysis

The Panel acknowledges the importance of the Ocean Protection Plan (OPP) and is of the view that British Columbia requires a special focus in view of the relative complexity of the British Columbia coastline and the large number of coastal Indigenous communities.

For the protection of the sea, voluntary initiatives such as the Green Marine program are encouraged. However, voluntary measures do not suffice as mitigation for effects that may be caused by marine shipping activities associated with the Project.

The Panel notes that although there are numerous regulatory requirements in place for the protection of the environment and the safety of users, shipping activities can result in unreported discharges of oil and other substances in the marine environment. The Panel acknowledges instances reported by participants of unreported cases of pollution, such as from bilge water discharge and chronic oiling that may have the potential to result in significant effects on the marine receiving environments.

In response to participants' views that law and regulations exist but are not always observed, the Panel recommends that Transport Canada plan and implement an increased frequency of ship inspections and aerial surveillance coverage.

Recommendation 1

The Panel recommends that the Government of Canada review ship inspection and aerial surveillance activities to identify improvements that would reduce the discharge of oil and other pollutants in the marine shipping area.

Recommendation 2

The Panel recommends that the Government of Canada, in collaboration with Bird Studies Canada, develop a monitoring program to assess chronic oiling in the marine shipping area. The program should identify the most vulnerable bird species and locations in the marine shipping area that are at highest risk of oil exposure.

6 Alternative Means of Carrying Out the Project

6.1 Proponent's Assessment

The Project's overall objective was to meet long-term capacity growth by the mid-2020s. To meet this objective, the Proponent's consideration of alternatives included:

- Increasing capacity and efficiency at existing container terminals within the Proponent's jurisdiction;
- Converting existing terminals or properties within the Proponent's jurisdiction to handle containers;
- Building a new terminal within the Proponent's jurisdiction; and
- Utilizing other west coast terminals, not within Proponent's jurisdiction.

The Proponent's land use plan requires maximising the use of existing terminals before building any new facilities. The alternative means for increasing capacity and efficiency at the Proponent's existing container terminals included Deltaport Terminal at Roberts Bank, Vancouver's Inner Harbour terminals, Vanterm and Centerm, and Fraser Surrey Docks on the Fraser River. The Proponent determined that expansion of existing terminals could not address long-term capacity needs or facilitate multiple types of trade. Locations of marine container terminals considered by the Proponent are in Figure 6-1.

The Deltaport Terminal was expanded in 2010 with the addition of the Deltaport Third Berth, adding 600,000 TEU of container capacity. Planned terminal road and rail improvements in and around Deltaport Terminal would further increase capacity to 2.5 million TEU, but even with improved efficiencies, Deltaport Terminal was expected to reach its maximum capacity by 2017.

Finally, the Proponent stated that expansion at Deltaport Terminal was not an option because DFO had prohibited further development inland from Deltaport Terminal due to the environmental sensitivity of the intertidal habitat on the east side of the existing causeway. DFO indicated that because of the critical fish habitat in that area, they would not be able to issue a *Fisheries Act* authorization for the destruction of that habitat.

The Centerm terminal was expanded and upgraded in 2005 to increase container capacity to 900,000 TEU. With the closure of a cruise terminal adjacent to Centerm there would be an option to expand the terminal up to 1.5 million TEU. The Proponent stated that the expansion of Centerm alone could not address long-term capacity needs.

The Proponent stated that expansion of Vanterm onto adjacent properties would not be feasible because of the current lease tenures that would continue until the late 2020s. In addition, converting the properties to containers would displace other trade-related activities.

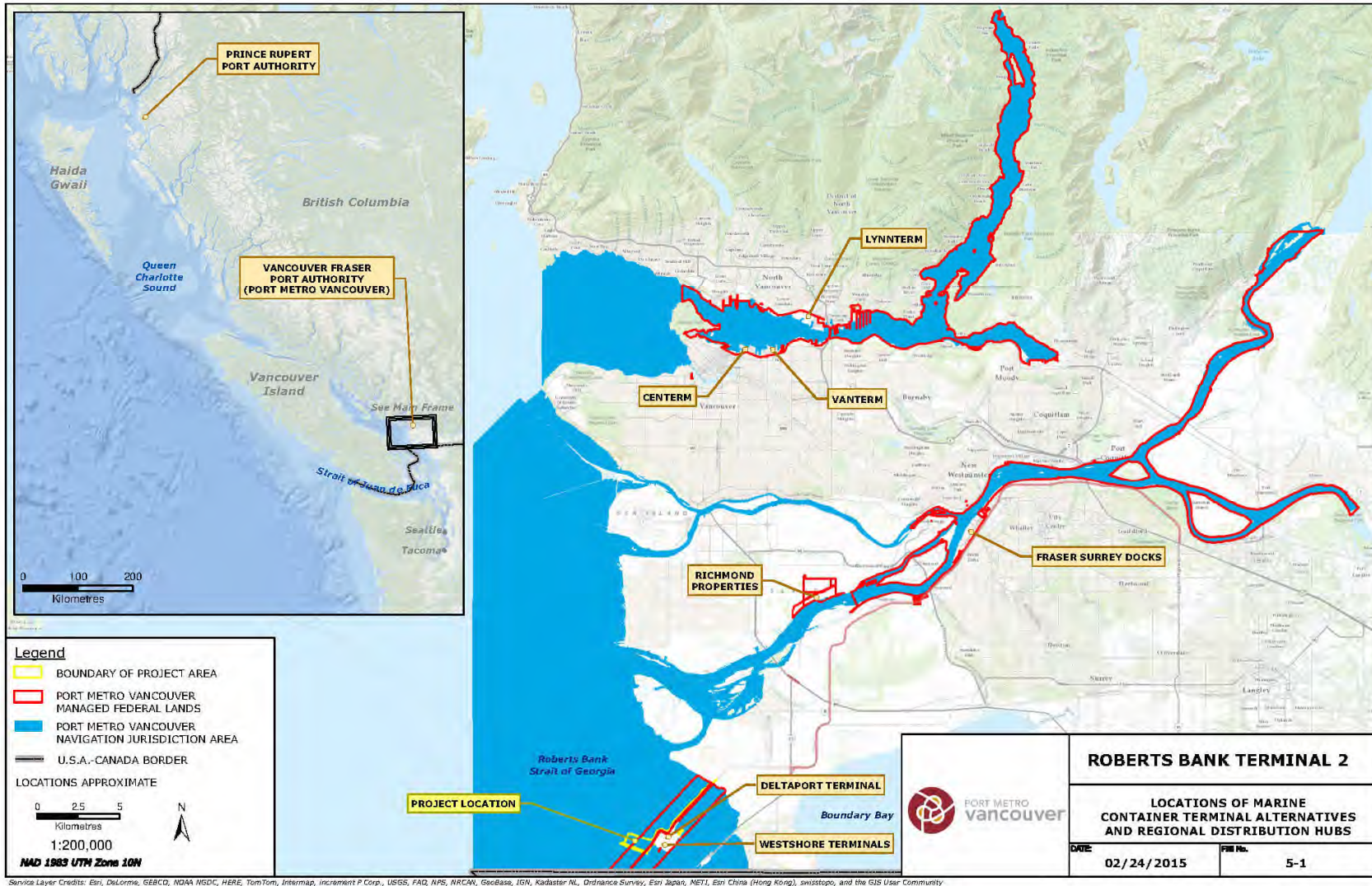


Figure 6-1: Location of marine container terminals considered by the Vancouver Fraser Port Authority (Source: EIS, Volume 1)

Fraser Surrey Docks was described as a multi-use terminal located on the south side of the Fraser River shipping channel in Surrey, British Columbia. Even with land available for re-development, the ability of the Fraser River channel to accommodate large vessel size was a constraint. Container ship size, specifically with respect to both the ability to reach the terminal due to draught, and the ability to turn around due to length, was determined to be a technical constraint which limits the economic viability of Fraser Surrey Docks.

As an alternative to expanding current terminals, the Proponent considered converting existing terminals or properties within its jurisdiction to create additional container capacity, including the conversion of Lynnterm terminal located in North Vancouver and the Fraser River properties in the City of Richmond. The Proponent determined that substantial road constraints would limit the ability of Lynnterm to accommodate the additional truck traffic needed for the Project. In addition, the Proponent stated that converting Lynnterm terminal would conflict with both the priorities of the terminal and the Proponent's commitment to facilitate multiple types of trade.

The Fraser River properties were described as off-dock transload and distribution centres located on lands managed by the Proponent on the north side of the Fraser River shipping channel in the City of Richmond. The Proponent reported that the ability to provide large-scale container capacity in this location was constrained by road congestion and limited rail capacity, its urban location, and navigation constraints for larger container ships. Further, port operators operate under long-term renewable lease agreements with the Proponent and could not be required to arbitrarily change their business.

The Proponent also considered the Fairview Terminal, Ridley Terminals and Watson Island, located in Prince Rupert, British Columbia, as an alternative to building a new marine terminal within its jurisdiction. The Proponent determined that the only other marine container terminal on the west coast of Canada with a direct connection to a national railway was Fairview Terminal. In 2007, the Prince Rupert Port Authority converted Fairview Terminal from break-bulk commodity handling to a container terminal with a design capacity of approximately 500,000 TEU. Subsequent improvements brought the capacity up to 1.35 million TEU and further growth was expected to increase capacity to 1.8 million TEU by mid-2020. The Proponent stated that even with planned improvements to increase capacity to 2.7 million TEU, capacity would still be required at both Prince Rupert and the existing Vancouver Fraser Port Authority container terminals to meet long-term forecast demand for containerised trade-handling capacity on the west coast of British Columbia. In addition, Projects which could provide additional container capacity outside of the Proponent's jurisdiction were considered not technically feasible since the Port Authority has no control of projects undertaken outside its jurisdiction.

Given the constraints associated with existing terminals and properties located in the Inner Harbour and Fraser River, the Proponent's inability to construct a new terminal outside its jurisdiction, and the forecasted future demand for long-term container capacity, the Proponent concluded that a new terminal at Roberts Bank was the only technically and economically feasible option.

The Preferred Alternative

When determining the technical feasibility of Project alternatives in British Columbia, the Proponent considered certain criteria such as the necessary road and rail connections to efficiently transport containers to and from the market, a minimum berth depth of approximately 18.4 m for safe navigation, and a terminal's ability to retain other uses in addition to container handling.

The Proponent stated that the Asia-Pacific Gateway was an established trade gateway making the Roberts Bank location well positioned to accommodate future growth in trade activity. The location had several competitive advantages, including the following:

- Deep water capable of handling large container ships;
- Proximity to major transportation corridors for both truck and rail movements;
- Proximity to the Strait of Juan de Fuca and Pacific Ocean shipping routes; and
- Direct access to numerous off-dock facilities.

Technical criteria specific to each alternative means were provided by the Proponent, such as the load-bearing capacity requirements and the ability to obtain permits from regulators. In determining the economic feasibility of Project alternative means, the Proponent considered a range of conceptual-level cost estimates, depending on the type of alternative means and the level of design information available. Alternatives means were ruled out as being not economically feasible if their capital cost estimates were an order of magnitude higher than the other options being considered.

The Proponent also assessed the location, orientation, layout and configuration of the marine terminal, the conceptual design of the causeway, rail and roads corridors, including the intermodal yard location, and the tug basin location for its expansion.

Location of the Terminal

The causeway and the initial Westshore Terminals were constructed in 1968-1969. Three additional terminal pods were constructed between 1981 and 1984. The Deltaport Terminal was constructed between 1994 and 1997. With Deltaport Terminal rapidly filling up by 1999, the Port Authority began planning for expansions of container terminal capacity at Roberts Bank. This involved a three-stage expansion process; expansion of the existing container terminal, the addition of a third berth, and the development of a new container terminal at Roberts Bank. In 2000, the Proponent expanded the Deltaport Terminal. In March 2003, the Proponent met with federal and provincial regulators to explore Deltaport Third Berth and Roberts Bank Terminal 2 as options.

During 2003-2004, the Proponent considered four potential marine terminal locations at Roberts Bank, as illustrated in Figure 6-2. These options were identified as E1, located on the east side of the existing Roberts Bank terminals and W1, W2, and W3, located on the west side of the

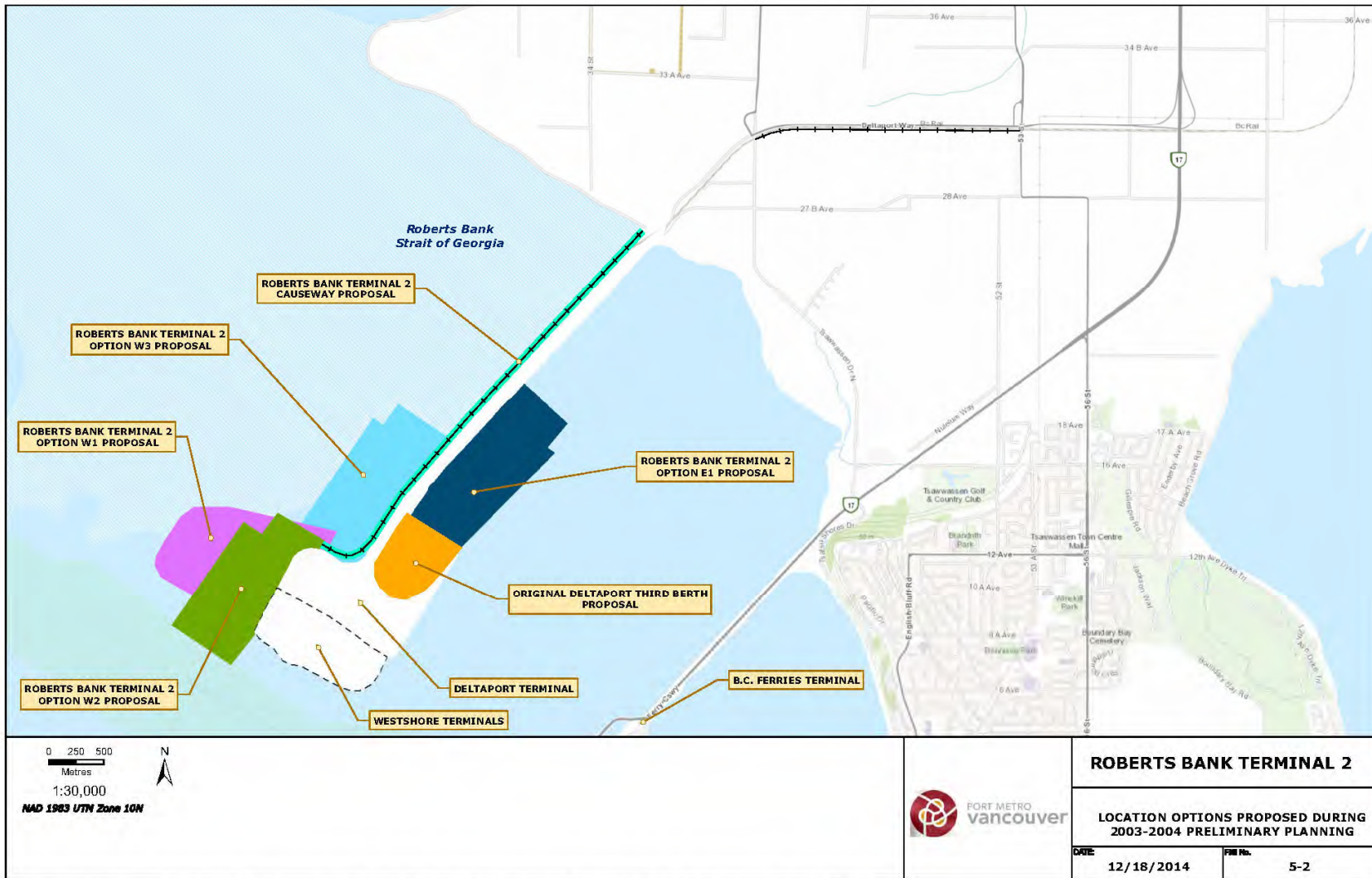
existing causeway. All four options included a widened causeway and a number of design options related to rail and road, the tug basin, and the intermodal yard.

Correspondence between DFO, the Canadian Wildlife Service and the Proponent indicated that the option designated E1 could result in increased adverse effects if a terminal was located in productive intertidal habitat areas, as compared to a location in deeper waters. Option W3 would also impact valuable fish habitat and would result in many of the same impacts on fish habitat as option E1. Notably, a letter from DFO to the Proponent in 2003 indicated that because of the critical fish habitat in the intertidal area, the department would not be able to issue a *Fisheries Act* authorization for the destruction of that habitat.

In a subsequent letter from the Minister, DFO reiterated that it would not consider issuing *Fisheries Act* authorizations for the destruction of that critical fish habitat, effectively eliminating options E1 and W3. The Minister recommended the Proponent pursue options W1 and W2, as these options were in deeper water and had a lesser likelihood of damaging critical fish habitat. The Proponent stated that since 2003, they have held dozens of meetings with DFO and the department never indicated that their direction had changed, nor have they done so in any of their submissions to the Panel. The Proponent stated that this approach was in line with the Canadian Environmental Assessment Agency's Operational Policy: *Addressing "Purpose of" and "Alternative Means" under the Canadian Environmental Assessment Act, 2012* which states that alternative means should be considered by the Proponent as early as possible in the planning of a designated project, even before the beginning of the environmental assessment process.

The Proponent pointed out that, in addition to DFO's direction in 2003, the environmental assessment for Deltaport Third Berth demonstrated that the effects on crab habitat could not be offset, which resulted in a significantly smaller footprint being built.

Following the elimination of E1 and W3 as technically feasible options, the Proponent determined that certain water lots along the east side of the terminal causeway would not be required for port expansion. In December 2004, the Proponent agreed to transfer those water lots to Tsawwassen on approval of the Project to settle outstanding claims the Tsawwassen had against the Proponent. If either the E1 or W3 options were pursued, the Proponent stated it would not be able to transfer those lots to Tsawwassen.



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Figure 6-2: Roberts Bank Terminal 2 location options considered by Vancouver Fraser Port Authority (Source: EIS, Volume 1)

The Proponent considered six alternative marine terminal layouts based on their configuration and setback distance; a W2 (500 m), W2 (275 m), W2 (0 m), W1 (500 m), W1 (275 m), and W1 (0 m). All six alternatives were determined to be technically and economically feasible. The Proponent considered the potential environment effects of each alternative in the context of the following:

- Ecological importance of Roberts Bank with respect to marine subtidal and intertidal habitats;
- Proximity of location to residential areas with respect to potential noise effects; and
- Feasibility of successfully mitigating Project-related effects.

The Proponent concluded that the W1 orientation, with 0 m set back and rounded northeast corner on a 120-m radius to reduce the scour area, was the preferred means for carrying out the Project. The W1 (0 m) terminal layout was the preferred configuration for a terminal at Roberts Bank due to fewer direct and indirect environmental effects relative to other alternatives considered. W1 (0 m) had the smallest area of intertidal habitat loss compared to all other configurations, limited to no susceptibility to future changes on the tidal flats, the least noise, and the least amount of dredging required.

Construction Alternative Means

The Proponent examined alternative means for dredging, temporary sand storage, construction of supporting land for the terminal and the causeway, construction of the terminal's three-berth wharf, disposal of sediments, and the construction of tug basin mooring wharves. No alternatives for dredging or construction of supporting land were considered technically or economically feasible. The Proponent later eliminated the need for temporary sand storage in the inter-causeway area and modified its option for disposal of sediment to use the dredgeate as general fill.

The Proponent brought forward the remaining construction alternatives for further consideration and comparison of potential effects on key environmental components. The Proponent concluded that use of a caisson wharf structure was the preferred option for construction of the three-berth wharf as it would have fewer noise effects and a shorter construction period than use of a pile and deck structure. The Proponent also determined that use of a floating wharf and piles for construction of the tug wharves was preferable because there would be a smaller footprint and less habitat loss than the filled wharf or pile and deck wharf options.

6.2 Views of Participants

DFO stated that the historical context of early correspondence between the department and the Proponent presented during the public hearing appeared correct. DFO agreed that the intent of the early meetings and correspondence was to assist the Proponent in identifying options that would have the least impact on fish habitat. In its 2003 letter, DFO stated that the option designated E1 would result in the destruction of critical fish habitat on the east side of the

causeway that DFO could not authorize at that time. DFO clarified that the department's decision was project specific and was made prior to legislative changes made in 2012 to the *Canadian Environmental Assessment Act*. Prior to CEAA 2012, environmental assessments were conducted by responsible federal authorities and at that time DFO provided advice on the Proponent's conceptual options and the feasibility of authorizing such options prior to the Proponent proceeding through an environmental assessment. DFO stated that under CEAA 2012 it reviews applications for permits and authorizations after the environmental assessment is complete and a government decision on a project was made.

ECCC expressed similar concerns in 2003 regarding potential impacts from the terminal footprint on eelgrass and mudflat habitats as well as potential effects on geomorphological processes. ECCC understood that it was those concerns that prompted further studies by the Proponent. ECCC stated that it recommended a project redesign because of the species level risk related to expected geomorphological processes being altered by the Project as currently proposed. ECCC stated that that it did not have a particular view on design. DFO stated that, based on the large-scale destruction of fish habitat, the high degree of uncertainty in predictions of incidental benefits, and the small scale of proposed offsetting, the ongoing productivity of fisheries would not be achieved. DFO recommended the Proponent reconsider Project design options in order to reduce impacts on fish and fish habitat. DFO further stated that any opportunities to reduce the scale of impacts on fish and fish habitat would reduce the risk and uncertainty associated with an application for authorization under the *Fisheries Act*, and thereby reduce the offsetting measures required to achieve the policy goal.

Global Container Terminals (GCT), a container terminal company that operates Vanterm Terminal and Deltaport Terminal at Roberts Bank under the authority of the Vancouver Fraser Port Authority, argued that while both the E1 option, which they referred to as Deltaport Fourth Berth, and the proposed W1 option presented environmental impacts, expansion into E1 was expected to have a smaller footprint and therefore less overall environmental impact on certain environmental components. GCT stated that there was limited or almost no biofilm on the east side of the causeway, as a result, E1 might have lesser impact than W1 on shorebirds that rely on biofilm. E1 would have a lower impact on crabs and crab harvesting resulting from a possible smaller navigational closure area. GCT acknowledged that there would be a higher impact on eelgrass, however, such impact could be successfully mitigated.

GCT argued that an incremental expansion of the Deltaport Terminal along the east side of the causeway should have been considered as a technically and economically feasible option, and the environmental effects of that option should have been assessed by the Proponent. In response to concerns identified by the Panel, in 2016 the Proponent provided a feasibility analysis for alternative means. This analysis upheld the selection of Roberts Bank Terminal 2 as the preferred means for carrying out the Project. GCT argued that the Proponent failed to provide additional supporting information and specific criteria for why an option was chosen or rejected due to technical and economic considerations. Further, GCT was of the view that the Proponent relied on historical feedback and regulations from 2003 to eliminate the expansion of the Deltaport Terminal as a feasible option instead of considering new information and regulatory changes.

GCT submitted that incremental expansion of the Deltaport Terminal could deliver up to 2 million TEU of additional capacity in two construction stages. Incremental expansion of Deltaport Terminal may also have lower environmental effects at a lower cost compared to the Project.

Prior to the commencement of the public hearing, two participants filed motions asking that the Panel require the Proponent to carry out a proper study of alternative means of carrying out the designated project that are technically and economically feasible, and the environmental effects of any such alternative means. During the public hearing, the Panel heard from one participant that Prince Rupert's long-term plan was to build a second container terminal at South Kaien Island to add 2.5 million TEU of capacity at some time in the mid-2020s. It was argued that Prince Rupert had a lot of expansion potential and there was no need for further expansion in the lower mainland at Roberts Bank, especially considering the recent expansions at Vanterm, Centerm and Deltaport Terminals.

A local resident stated that taking the Project to another port would remove pressures from the road systems, communities and infrastructure which would have untold benefits and add to the quality of life. The Boundary Bay Conservation Committee talked about the damage that had already occurred between the Roberts Bank and the BC Ferries Tsawwassen Terminal causeways emphasizing that it was important for the Panel to understand the ongoing negative cumulative impacts occurring in the inter-causeway area.

GCT argued that a feasible E1 expansion project could be completed at a lower overall cost than the Project. GCT stated that E1 expansion would be funded using private money and that the Proponent had failed to present any evidence that the Project would be commercially viable.

Many participants suggested that the Proponent breach the causeway or install culverts in the existing Roberts Bank causeway to allow water to flow through the causeway. Tsawwassen stated a land-based intermodal yard had the potential to reduce the size of the terminal footprint in the marine environment subsequently reducing impact on crabs, which was of interest Tsawwassen. Tsawwassen reported that the Proponent did not consider the land-based intermodal yard a feasible option because it was located outside of the Proponent's jurisdiction. During the public hearing the Proponent indicated that it was inefficient to have the container yard at the terminal and then transport containers to an on-land intermodal yard; it would be an economically feasible option but not commercially viable since intermediate steps in the supply chain bring additional operational costs. Further, the Proponent stated that if the intermodal yard was partially land-based it would be within the Agricultural Land Reserve compounding effects in the uplands.

The City of Delta stated that the Project provides a unique opportunity for the Canadian government to demonstrate its commitment to sustainable development by encouraging the use of inland ports. The City of Delta submitted that inland facilities could provide opportunities for port expansion, and that the lack of available land close to marine terminals could precipitate the need to push certain supply chain-related uses inland, highlighting that there are significant traffic, economic, social and environmental benefits associated with inland ports.

Ashcroft Terminal, an inland transload terminal company, believed the Project was needed to provide marine terminal capacity to move containers to and from ship to shore and to meet forecasted demand for increased container traffic. However, beyond loading or unloading containers to or from a ship, Ashcroft Terminal believed that inland ports provided a sustainable solution for Canadian exporters and importers requiring container handling services. Ashcroft Terminal stated that with the congestion facing public highways and municipal roads in the Lower Mainland, transporting import containers to Ashcroft Terminal via rail directly from the dock reduces truck trips and the need for container handling facilities within the Lower Mainland.

6.3 Panel's Analysis

The Panel must determine if the Proponent properly conducted an assessment of alternative means for carrying out the Project, which includes all technically and economically feasible alternative means and the environmental effect of such alternative means. A number of participants argued that the Proponent's alternative means assessment was inadequate.

The Panel concludes that it was not necessary for the Proponent to have considered additional capacity at Prince Rupert as an alternative means of carrying out the Project, because Prince Rupert is not within the Proponent's jurisdiction but within the jurisdiction of the Prince Rupert Port Authority. The designated project is a container terminal "located at Roberts Bank". Having regard to this, the Panel rejects the argument constructing a terminal at Prince Rupert is an alternative means of carrying out the Project.

As per section 19(1)(g) of the CEAA 2012, alternative means must relate to the "designated project" and must be "technically and economically feasible". The Agency's *Operational Policy Statement Addressing "Purpose of" and "Alternative Means" under the Canadian Environmental Assessment Act, 2012* provides the following guidance to project Proponents on addressing "alternative means" in an environmental assessment:

"Alternative means" are the various technically and economically feasible ways under consideration by the Proponent that would allow a designated project to be carried out. Identified by the Proponent, the alternative means include options for locations, development and/or implementation methods, routes, designs, technologies, mitigation measures".

The Panel does not believe that a designated project can be de-linked from the Proponent which proposes it. The word "Proponent" is defined in CEAA 2012 as meaning "the person, body, federal authority or government that proposes the carrying out of a designated project". For the term "alternative means" to have any meaning, it must refer to things that the Proponent could carry out instead of what it is proposing. Therefore, the Panel reasons that since Prince Rupert is outside the Proponent's jurisdiction, adding capacity at the Prince Rupert terminal does not constitute an alternative means by which the Proponent could carry out the designated project.

Further, in this case the "project" is described as the construction and operations of:

“a new three-berth marine container terminal located at Roberts Bank in Delta, British Columbia, approximately 35 kilometres south of Vancouver. Located next to the existing Deltaport and Westshore Terminals, the Project would provide an additional 2.4 million twenty-foot equivalent units of container capacity per year at Roberts Bank.”

One of the key facts relevant to this issue is that the Proponent is an entity with specific territorial jurisdiction over navigable waters and federal real property managed and/or occupied by the Port Authority.

To propose the construction of a new container terminal, the Proponent must have a location to put it. That means putting it on existing federal real property owned by the authority or acquiring property for the purpose of the *Canada Marine Act*. But practically speaking a port authority can only own or lease land that provides access to or supports its operations on the navigable waters within its jurisdiction.

The Panel acknowledges that Section 8 of the Updated EIS Guidelines provide that in its alternative means analysis, the Proponent will address “location of the marine terminal within British Columbia” as a project component. And the Proponent’s alternative means assessment does include a discussion of utilizing other west coast terminals, not within Proponent’s jurisdiction, including Prince Rupert.

Based on information concerning Prince Rupert’s master plan presented during the public hearing, the Panel cannot contest that Prince Rupert may have the capacity to meet increasing forecast demand for containerized trade on the west coast of Canada. However, the Panel agrees with the Proponent that it would not be a technically feasible option since the Proponent has no control of projects outside its jurisdiction.

While the Panel appreciates GCT’s position that current regulations should have been considered by the Proponent, the Panel notes that the Proponent relied on several factors to eliminate E1 and W3 as options:

- Discussions with Fisheries and Oceans Canada and Canadian Wildlife Service;
- Previous environmental field studies related to the construction of Deltaport Terminal and Deltaport Third Berth, which identified areas of valuable fish and marine invertebrate intertidal habitat;
- Monitoring conducted during implementation of the Deltaport Third Berth Adaptive Management Strategy; and
- The commitment to transfer water lots along the east side of the terminal causeway to the Tsawwassen First Nation on approval of the Project to settle outstanding claims by the Nation against the Proponent.

The Panel is of the view that the Proponent had reason to believe that, although the regulatory context had changed since 2003, the potential for environmental effects on critical fish habitat in the intertidal area had not changed, and the destruction of that critical habitat would potentially

not be permitted by DFO. The Panel cannot ignore the fact that sensitive fish habitat has been identified on the east side of the causeway and building E1 would destroy that habitat which may or may not be fully mitigable. The Panel recognizes that the Port Authority had continued conversations with DFO after 2003 and they never altered their position. After considering all arguments presented by GCT the Panel submits that GCT is proposing a competing Project, which the Panel has no mandate to review. The Panel has however, assessed alternative locations of the Roberts Bank Terminal 2, including E1.

The Panel agrees with the Proponent that breaching the causeway would create an insignificant flow restoration through a culvert between the inter-causeway area and north side of the causeway compared to daily tidal flow exchanges and that adverse environmental effects through the erosion or deposition of sediment associated with scour and dendritic channel formation could result.

Suggestions for a redesign of the Project to reduce the Project footprint and effects on fish and fish habitat were discussed at the hearing, such as a move of the intermodal yard onto adjacent lands or to an inland terminal, or reduce the berthing capacity. The Panel acknowledges that the Proponent considered different options, such as moving the inter-model yard onto adjacent lands, which had the potential to impact on the agricultural land reserve and commercial viability. The Panel is of the opinion that, in order to reduce the Project's effects on fish and fish habitat, different options should be examined during the regulatory phase.

The Panel considers the evaluation of alternative means appropriate and accepts the Proponent's rationale that components of the proposed Project must be under the Proponent's jurisdiction.

The Panel concludes that the Proponent's assessment of alternative means of carrying out the Project was appropriate.

7 Atmospheric Environment

7.1 Greenhouse Gas Emissions

7.1.1 Proponent's Assessment

The Proponent assessed project emissions of greenhouse gases (GHG) and climate forcing particulate matter (black carbon), both expressed as carbon dioxide equivalent (CO_{2e}). GHG emissions are carbon dioxide, methane, and nitrous oxide.

The major sources of GHG are mobile transportation sources and area sources such as agricultural activity, landfills, residential, and commercial space heating. The Project-related emission sources were expected to result from fuel combustion in diesel, propane, and gasoline-powered engines during terminal construction and from ships, cargo handling, employee vehicles and rail locomotives during operations.

There are no regulatory criteria in British Columbia for GHG or black carbon, although provincial and regional governments have GHG emissions goals that are relevant to the Project. The Proponent estimated GHG emission rates (as tonnes of carbon dioxide equivalent per year) using accepted statistical techniques relating emissions to activity intensity and emissions for that activity. Emissions of GHGs were estimated for the Roberts Bank terminals, the BC Ferries Tsawwassen Terminal and the proposed Roberts Bank Terminal 2 for existing, expected, and future conditions with the Project. Table 7-1 presents the annual GHG and black carbon emissions under the future conditions with the Project scenario. Emission calculations considered technology changes, activity level changes at Deltaport Terminal and Westshore Terminals, and regulatory initiatives.

Table 7-1: Future conditions with the Project – Annual greenhouse gas and black carbon emissions* (Source: EIS, Volume 2)

Terminal	Annual GHG Emissions (t CO _{2e} /y)		Annual Black Carbon Emissions (t CO _{2e} /y)	
	20-year	100-year	20-year	100-year
Roberts Bank Terminal 2	141,386	141,177	13,301	3,741
Delta Port Terminal	193,902	193,502	48,432	13,622
Westshore Terminals	20,707	20,731	4,368	1,229
BC Ferries Tsawwassen Terminal	51,588	51,400	1,648	464
<i>Total</i>	<i>407,584</i>	<i>406,810</i>	<i>67,750</i>	<i>19,055</i>

*Emissions do not consider benefits of shore power

The Proponent estimated that future annual emissions of GHGs would increase by 94 percent and black carbon would decrease by 47 percent over existing emissions. These estimates do not include the benefits of using shore power at the terminal.

In response to a Panel request, the Proponent reasserted their assumption that 100 percent of the switcher locomotives would meet Tier I emissions standards by 2025, and that a reassessment of GHG emissions was not needed. The Proponent placed the total annual emissions from the Project and marine shipping associated with the Project into context with the total greenhouse gas emissions in the Metro Vancouver region, British Columbia and Canada as a whole, as shown in Table 7-2.

Table 7-2: Comparison of Project-related GHG emissions with regional GHG emissions projections (Source: Project public registry document 1188, IR6-31)

	Project-Related GHG Emissions in 2025 (t)		Regional GHG Emission 2030 Projections (t)		
	Project	Marine shipping associated with the Project	Metro Vancouver	British Columbia	Canada
Total Annual GHG Emissions (t/y)	140,000	129,000	24,000,000	75,000,000	742,000,000
Percentage of Project compared to Regional Projection	---	---	0.58%	0.19%	0.02%
Percentage of marine shipping associated with the Project compared to Regional Projection	---	---	0.54%	0.17%	0.02%

The Proponent recognized the need for widespread cooperation in order to transition the transportation sector to clean, low-carbon technologies and were committed to the reduction of GHG emissions. The Proponent committed to a number of GHG emissions reduction initiatives that were relevant to the Project, as outlined in Table 7-3.

Table 7-3: Summary of GHG emissions reduction initiatives (Source: Adapted from Project public registry document 1188, IR6-32)

Sector	Emission Reduction Initiatives
Marine Vessels	<ul style="list-style-type: none"> EcoAction

Sector	Emission Reduction Initiatives
<ul style="list-style-type: none"> • Ocean-going vessels • Harbour tugs • River Dredging 	<ul style="list-style-type: none"> ○ Incentives for cleaner fuels, ship environmental programs, vessel and engine technology, or ship classification societies ○ VFPA Blue Circle Award, for participation in third party programs, such as the Green Marine environmental certification program for the North American marine industry • Shore Power • Liquid Natural Gas Fuel Studies and Use
<p>Rail</p> <ul style="list-style-type: none"> • Mainline locomotives • Switcher locomotives 	<ul style="list-style-type: none"> • Non-Road Diesel Emissions Program <ul style="list-style-type: none"> ○ Fees for operation of older less-efficient equipment ○ Incentives for fuel efficiency (i.e. through Green Marine Program) idle reduction, and opacity requirements from combustion sources • Fuel efficiency and engine replacement • Climate Smart <ul style="list-style-type: none"> ○ Training for port tenants to measure and reduce GHG emissions
<p>On-Road Vehicles</p> <ul style="list-style-type: none"> • Container trucks • Other vehicles 	<ul style="list-style-type: none"> • Smart Fleet Program <ul style="list-style-type: none"> ○ Truck Licensing System Age Requirements ○ GPS and scheduling efficiency measures ○ Alternative fuels and engine efficiency technologies • Climate Smart <ul style="list-style-type: none"> ○ Training for port tenants to measures and reduce GHG emissions
<p>Non-Road Vehicles</p> <ul style="list-style-type: none"> • Cranes and stackers • Loaders • Terminal tractors • Miscellaneous equipment 	<ul style="list-style-type: none"> • Non-Road Diesel Emissions Program <ul style="list-style-type: none"> ○ Fees for operation of older less-efficient equipment ○ Incentives for fuel efficiency (i.e. through Green Marine Program), idle reduction, and opacity requirements • Energy Action Initiative <ul style="list-style-type: none"> ○ Support for port tenants to access BC Hydro financial incentives for energy conservation measures • Climate Smart <ul style="list-style-type: none"> ○ Training for port tenants to measure and reduce GHG emissions
<p>Administrative Operations</p> <ul style="list-style-type: none"> • Heating, electricity 	<ul style="list-style-type: none"> • Hybrid vehicle fleet • Alternative fuels for port vehicles • Green Infrastructure Guidelines • Energy Action Initiative • Commuter Challenge

Sector	Emission Reduction Initiatives
<ul style="list-style-type: none"> Terminal lighting 	<ul style="list-style-type: none"> Climate Smart

The Proponent stated that it was committed to continued participation and collaboration with Metro Vancouver, who manage and regulate air quality in Metro Vancouver, and other stakeholders on regional programs. Some of these initiatives include Metro Vancouver's Integrated Air Quality and Greenhouse Gas Management Plan, Regional Ground-Level Ozone Strategy, and the Lower Fraser Valley Air Quality Coordination Committee. The Proponent also stated they were committed to reducing greenhouse gas emissions by actively supporting the development and implementation of GHG reduction measures related to marine shipping to align with the final International Maritime Organization Strategy by year 2023. For container ships at Roberts Banks, shore power would be available for ships that were equipped to connect to shore power facilities, enabling them to turn off their auxiliary engines.

The Proponent estimated that the maximum possible reduction of GHG emissions from ships at berth due to the use of shore power would be 21 percent. The Proponent estimated that annual greenhouse gas emissions from vessels in Segment D of the marine shipping area, where GHG emissions are presently greatest, was anticipated to increase 19 percent under cumulative conditions, compared to existing conditions. Of this 19 percent, the incremental contribution due to the Project was 6 percent, while the remaining 13 percent increase was related to emissions from other large marine vessels.

7.1.2 Views of Participants

The Panel heard a number of general concerns from municipal governments, members of the public and non-government organizations about Project-related emissions of GHGs and their contribution to global warming. The Great Blue Heron Society pointed to Canada's Changing Climate Report 2019 that shows annual average temperatures have risen 1.7 degrees Celsius since 1948. The White Rock and Surrey Naturalists stated that Project activities were expected to increase greenhouse gas emissions and should be taken very seriously. One participant stated that climate change needs to be addressed in a timely manner so that present resources are not lost in the next few decades.

Ecojustice, consisting of the David Suzuki Foundation, Georgia Strait Alliance, Raincoast Conservation Foundation and Wilderness Committee considered ship source emissions of GHG and other pollutants was a significant adverse effect of the Project. Ecojustice noted that the International Marine Organization's targets for ship source GHG emissions, relied upon by the Proponent, would fall short of the requirements set out by the Intergovernmental Panel on Climate Change, which was to halve carbon emissions by 2030 and de-carbonize by 2050. Ecojustice noted that, when taken in context, GHG emissions from local sources may be considered small compared with the much larger national and global emissions. They cautioned that the relatively small magnitude of local emissions should not be taken as a reason for not

reducing GHG emissions from sources at all scales. Ecojustice referred to the Intergovernmental Panel Report on Climate Change that states we need to take urgent, far-reaching and dramatic actions at all levels of government and across all sectors to address climate change.

Metro Vancouver advised the Panel that their Integrated Greenhouse Gas and Air Quality Management Plan has targets for greenhouse gas emissions in the region. The current plan was being updated to include targets for 2050, with interim points along the way. The updated Clean Air Plan's overall targets would be either an 80 percent reduction of regional emissions by 2050, or possibly a carbon neutral region by 2050. To achieve either of these goals would require GHG emission reductions across from all sectors in the region, including the Project.

British Columbia Ministry of Environment and Climate Change Strategy advised the Panel that the *British Columbia Climate Change Accountability Act* (Clean BC plan) has targets to reduce GHG emissions in the province by 40 percent by 2030, 60 percent by 2040, and 80 percent by 2050 relative to 2007 levels. The additional GHG emissions associated with the Project would necessitate an increase in emissions reduction in other parts of the economy by 0.56 percent in order to compensate for the Project emissions.

The Clean BC plan requires province-wide emissions reduction by 2030 to be 25.4 million tonnes carbon dioxide equivalent (Mt CO₂e) from 2007 levels. The additional 140,000 t CO₂e from the Project would increase this necessary reduction to 25.5 Mt CO₂e. The Ministry pointed out that Canadian Port Authorities in British Columbia had generally committed to working with the government of British Columbia on emissions reductions and have made substantial progress in implementing clean technology.

The Islands Trust, a federation of local governments serving islands in the Salish Sea, noted it had a responsibility for protecting the Islands' environment. As part of this responsibility, the Islands Trust had declared a climate emergency. The Islands Trust was urging the Proponent to reduce portside GHG emissions through actions such as electrification. The Islands Trust also called for the Proponent to reduce emissions from Project associated vessels when at anchor.

The Shipping Federation of Canada informed the Panel that the International Maritime Organization adopted an initial GHG reduction strategy in 2018 to reduce total annual GHG emissions from international shipping by at least 50 percent by 2050 compared to 2008, while simultaneously pursuing efforts to phase out GHG emissions as soon as possible this century. The Canadian Chamber of Shipping stated that climate change and GHG reduction was their sector's number one priority and they were working globally to keep additional GHG emissions to a minimum. This would be achieved in part by greater energy efficiency in ship design and the use of alternate fuels.

Lyackson stated that climate change threatens the security and way of life of Indigenous people in Canada. The Nation noted that the Project would support more ships in the Strait of Georgia, which would result in higher overall GHG emissions and was concerned that the Proponent had not appropriately considered the cumulative impacts to climate change.

The Tsleil-Waututh Nation stated that they were concerned with the potential impacts of climate change from the Project. Lyackson pointed out that the potential upstream GHG emissions linked to the Project were not clearly delineated, and that the Proponent should be required to conduct both upstream and downstream greenhouse gas assessment.

7.1.3 Panel's Analysis

The Panel notes that its mandate is to consider the direct GHG emissions attributable to the Project. The Panel considers the methods employed by the Proponent to estimate GHG emissions generally appropriate for the purpose of the environmental assessment. However, a comprehensive effects assessment that evaluates the Project effects on global warming would not be feasible in practice.

The Panel agrees with the Proponent's assessment that Project activities will increase GHG emissions. The Panel notes that many of the GHG emissions reduction measures proposed by the Proponent are driven by external regulatory factors, such as fuel quality and engine emission standards. The Panel further notes that some of the initiatives proposed by the Proponent are voluntary, such as the use of shore power. The Panel considers that, while the proposed mitigation measures have the potential to be moderately effective, they could be much more effective if the measures were mandatory, not voluntary, and if there was a plan in place to monitor the effectiveness of the mitigation measures. The Panel considers that all of the proposed mitigation measures are technically and economically feasible and many have been effectively applied elsewhere.

The Panel considers that the Project would contribute a very small amount of GHG emissions relative to regional, provincial and national sources. The Panel considers the contribution of GHG emissions from the Project will be ongoing and will contribute to the accumulation of GHG in the atmosphere and the oceans, and is effectively perpetual.

The Panel concludes that the construction and operations of the Project would contribute to additional greenhouse gas emissions in the Metro Vancouver area even after the application of mitigation measures. This contribution would result in a significant adverse cumulative effect.

Recommendation 3

The Panel recommends that the Proponent be required to:

- *Develop and publicize regular inventories of green house gas emissions from the Project, develop greenhouse gas reduction strategies for all components of the Project, and monitor and publicize the effectiveness of these strategies in reducing greenhouse gas emissions;*
- *Develop and implement a greenhouse gas emissions reduction plan for the Project in consultation with British Columbia Ministry of Environment and Climate Change Strategy and Metro Vancouver; and*

- *Require, through its contractual arrangements, the infrastructure developer and project operator to reduce greenhouse gas emissions aligned with British Columbia Ministry of Environment and Climate Change Strategy and Metro Vancouver greenhouse gas reduction strategies.*

7.2 Air Quality

7.2.1 Proponent's Assessment

Project Area

The objective of the air quality assessment was to predict potential changes in air contaminant emissions, the resultant changes in ambient concentrations, and their net effect on ambient air quality in the Project area. The Proponent used the results to inform the effects assessment of human health and current use of land and resources for traditional purposes.

The Project would result in air emissions from fuel combustion in diesel, propane, and gasoline-powered equipment and activities. To determine the Project-related emissions, the Proponent defined emission sources, and activity levels (number of pieces of equipment plus hours of operation) for averaging periods suitable for comparison to applicable regulatory standards and criteria. The Proponent included projected activities from the Deltaport Terminal, Westshore Terminals, and BC Ferries Tsawwassen Terminal because they were expected to be the primary contributors influencing air quality in the area. The Proponent used three scenarios for the operational phase, as illustrated in Table 7-4.

Table 7-4: Air quality study scenarios - Operation phase (Source: EIS, Volume 2)

Condition	Year	Averaging Period	Emissions
Existing Conditions	2010	1-hour Maximum	Emissions from the existing Roberts Bank terminals (Deltaport Terminal and Westshore Terminals) and BC Ferries Tsawwassen Terminal.
		24-hour Maximum	
		Annual Average	
Expected Conditions	2025	1-hour Maximum	Projected combined emissions from the existing Roberts Bank terminals and BC Ferries Tsawwassen Terminal.
		24-hour Maximum	
		Annual Average	
Future Conditions with the Project	2025	1-hour Maximum	Projected combined emissions from the existing Roberts Bank terminals and BC Ferries Tsawwassen Terminal in conjunction with the Project.
		24-hour Maximum	
		Annual Average	

The Proponent chose year 2010 to represent existing conditions because published data were readily available for comparative purposes and it was deemed to be a representative year for

meteorological conditions. The Proponent chose year 2025 for expected and future conditions, which accounted for decreased emissions at Deltaport Terminal and Westshore Terminals due to new emissions-reducing regulations and equipment replacement. The Proponent also described future conditions with the Project and other projects and activities (incremental effects), which included rail activity only because roadside emissions modelling had determined that emissions from container terminal traffic would result in ambient changes that would be indistinguishable from existing ambient concentration. The Proponent did not include coal dust from Westshore Terminals in its assessment.

The Proponent considered the following compounds of potential concern in the air quality assessment:

- Criteria air contaminants – carbon monoxide (CO), nitrogen oxides (NO_x), sulphur dioxide (SO₂), particulate matter (PM), inhalable particulate matter (particulate matter up to 10 micrometers in size) PM₁₀, fine particulate matter (particulate matter up to 2.5 micrometers in size) PM_{2.5}, and ground-level ozone; and
- Trace organic contaminants – Trace contaminants that are known to be emitted from combustion in engines, including acrolein, benzene, 1,3-butadiene, acetaldehyde, formaldehyde, naphthalene, polycyclic aromatic hydrocarbons represented by benzo(a)pyrene, and diesel particulate matter.

The Proponent stated they used a conservative approach to assess air emissions by assuming all operations would happen simultaneously. The Proponent also noted that, while shore power would be available at Roberts Bank Terminal 2 and at Deltaport Third Berth, no reduction in emissions was assumed in the assessment. The Proponent stated that the use of shore power could potentially reduce NO_x emissions by 24 percent, SO₂ emissions by 21 percent and PM_{2.5} emissions by 27 percent on an annual basis. The Proponent noted that in the modelling of maximum hourly nitrous dioxide (NO₂), they assumed only Tier I and Tier II vessels, or Tier II ships built before the 2016 IMO emission limits, and took into account the expected conversion of BC Ferries Tsawwassen Terminal to liquid natural gas.

The Proponent used air quality monitoring Station T39 in Tsawwassen to measure background air quality. In response to concerns raised by participants that Station T39 may not be representative of all background concentrations, the Proponent indicated that adding data from other monitoring stations would artificially inflate the background levels. The Proponent also reported that a 2014-2015 study on Tsawwassen First Nation Lands concluded that Station T39 was representative of air quality levels in overland areas at Roberts Bank and on Tsawwassen First Nation Lands. The Proponent clarified that their study had demonstrated that most future emissions from ships underway in the Strait of Georgia would be captured in background concentrations at T39 and that adding emissions from ships in transit would double count emissions.

To predict air contaminant concentrations, the Proponent integrated air emissions scenarios and meteorological data into an air dispersion model. The background concentrations measured at station T39 were then added to obtain the total air contaminant concentrations.

The meteorological dataset used by the Proponent was derived using the Weather Research Forecast Mesoscale Model (WRF-NMM). The model incorporated parameters that influence atmospheric conditions, such as turbulence, convection and cloud formation, precipitation, radiation, surface heat transfer, and moisture.

The WRF-NMM model combined large-scale weather information from initial and boundary meteorological conditions and a geophysical description of the surface to simulate local-scale meteorology. Geophysical inputs, such as land use characterization and terrain elevation, were set using a global geophysical data at approximately 1 km spatial resolution. The WRF-NMM output was processed and assembled onto a 2 km by 2 km model grid.

The Proponent then processed the WRF-NMM information using the CALMET modelling system. The Proponent explained that CALMET was an advanced non-steady-state diagnostic meteorological model that produces hourly, three-dimensional gridded wind fields from available meteorological, terrain and land use data. CALMET was deployed by the Proponent to produce meteorological fields over a 100 m by 100 m model grid. The Proponent processed the CALMET information with the CALPUFF modelling system to estimate the pollutant concentration for each source-receptor combination at each hour of input meteorology.

The Proponent ran the WRF- NMM/CALMET/CALPUFF modelling system over one year and chose 2010 as the representative year. The suitability of year 2010 as a modelling year was examined by comparing WRF-NMM model output with climatologic averages of wind speed and direction, temperature and precipitation at a meteorological station located at Vancouver International Airport over a period of five years (2008-2012).

Based on this comparison, the Proponent concluded that the 2010 model results were representative of typical meteorological conditions within the study area. The Proponent also noted that they had selected 2010 because it had the highest frequency of atmospheric calms. In the Proponent's opinion, the use of conservative assumptions in hypothetical worst-case emission scenarios had a far greater effect on predicted concentrations of COPC than variability in year-to-year meteorology. The Proponent disagreed with ECCC that modelling for more than one year would allow for a more comprehensive assessment. The Proponent was of the opinion that additional modelling would simply reproduce similar results to those already derived from the analysis completed and would not change the air quality conclusions.

The hourly surface data and vertical profiles were extracted from the WRF-NMM model outputs at 13 locations spread over the modelling domain and used in the CALMET meteorological processor as if they were actual meteorological observations. The locations of the "pseudo" observations were chosen to represent variability in the local conditions within the modelling domain.

The CALMET/CALPUFF model was run at three nested grids with spacing of 500 m, 200 m, and 50 m respectively. The full CALMET/CALPUFF modelling domain covers 26 km by 24 km as illustrated in Figure 7-1. The study results were however presented within the inner model

domain of 19 km by 16 km. This inner model domain thus forms the LAA for air quality effects assessment, including air quality effects on human health.

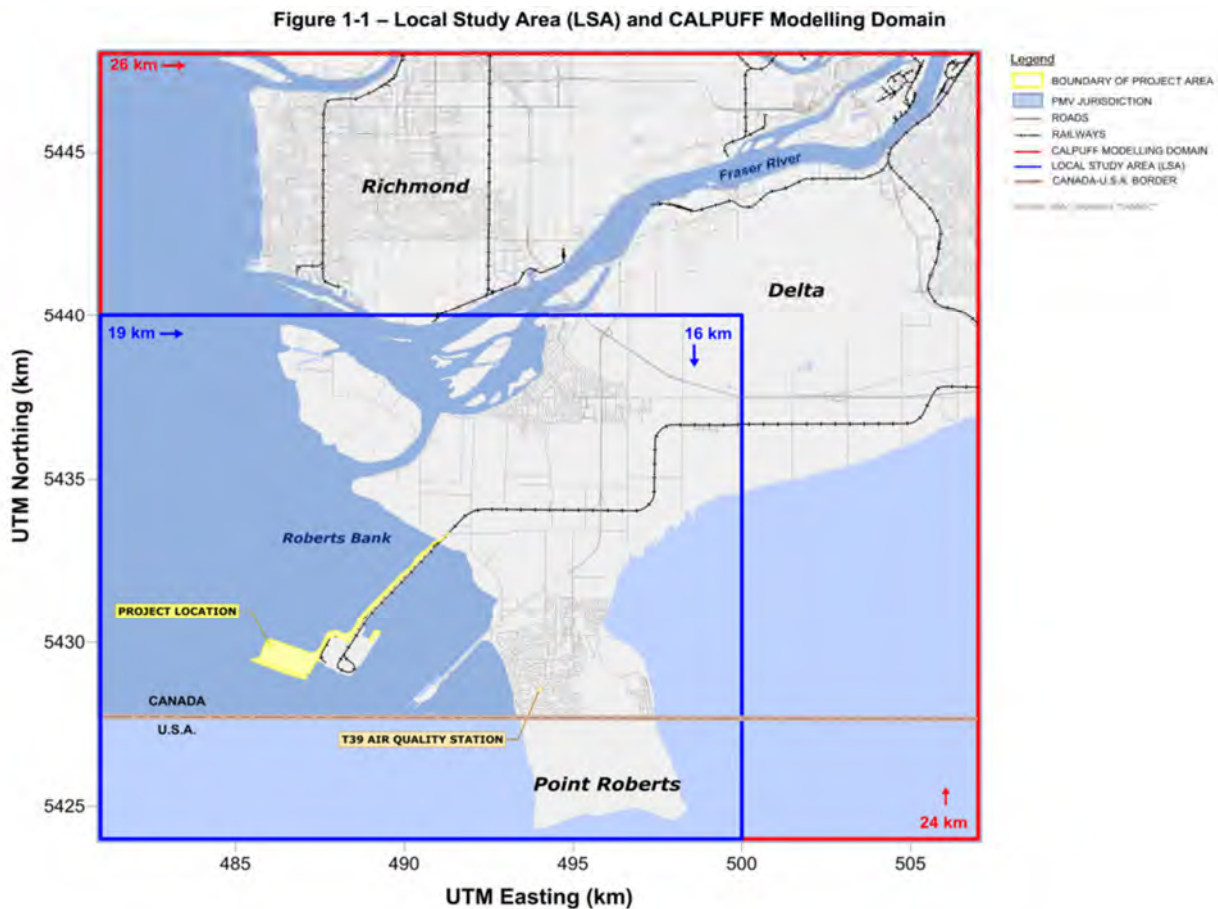


Figure 7-1: CALMET/CALPUFF modelling domain (Source: EIS, Volume 2)

The CALMET meteorological fields were evaluated to ensure that they captured the key meteorological features in the LAA. To achieve this, CALMET model outputs of wind speed and direction, temperature and precipitation for 2010 were compared to available meteorological observations within the LAA. Results of a statistical comparison suggested good model performance. The Proponent noted that wind speed statistics at both T39 and Westshore stations performed the most poorly and suggested that observations may not adequately represent local wind patterns.

In response to concerns from Metro Vancouver and ECCC, the Proponent performed a sensitivity analysis to test the effect of running the modelling analysis using the chosen domain size of 26 km by 24 km versus a larger domain size of 30 km by 30 km or 50 km by 50 km. The Proponent indicated that the results showed that using a larger domain size would not change the conclusions. The Proponent noted that the air quality study included all regional sources and captured recirculation in the study domain.

The Proponent employed the Ozone Limiting Method to convert emitted nitrogen oxide into nitrogen dioxide. The Proponent stated this method over-predicted NO₂ concentrations for all scenarios based on comparisons of measured and predicted concentrations at Station T39. The Proponent considered this method to align more closely with observations because of the complexity of the chemical processes of NO-to-NO₂ formation and destruction in the atmosphere as a plume is being transported downwind from a source.

The Proponent initially selected 18 discrete receptors as representative reference points to assist in the discussion of the assessment results. At the request of the Panel, the Proponent added 52 receptors representing recreational use areas and sensitive receptors such as schools and medical centers. The Proponent also provided results for the maximum over land and over water predicted concentrations.

The Proponent compared the air quality assessment results to the most stringent standards from federal, provincial, Metro Vancouver and USA Agencies in place at the time the assessment was undertaken (prior to November 2014). In response to a request from the Panel, the Proponent also compared the results of the assessment for NO₂ to the upcoming Canadian Ambient Air Quality Standard (CAAQS) that will come into effect in 2020 and 2025. The standards for the year 2020, when the Project would start construction, were 113 µg/m³ (1-hour) and 32 µg/m³ (annual). The standards for the year 2025, when the Project would be operational were 79 µg/m³ (1-hour) and 23 µg/m³ (annual). Those are reflected in Table 7-5 for the construction phase and in Table 7-6 for the corresponding 2025 operational scenarios.

The Proponent predicted overall decreases in emissions for most contaminants from existing conditions to expected and future conditions due to more stringent regulations and advancement in technology. The Proponent's results showed exceedances over land and over water for 1-hour NO₂ and annual NO₂ using the standards for year 2020 during construction. Exceedances were also expected over water in the vicinity of the Project for 24-hour and annual PM, PM_{2.5}, and PM₁₀ for the average day scenario. For the peak day scenario, the results showed exceedances over water and over land at the end of the causeway for all particulate matters and 1-hour NO₂.

Table 7-5: Contaminant exceedances* under construction phase scenarios, including influence of background (Source: Adapted from EIS, Volume 2)

Concentrations (µg/m ³)	Average day Project construction + operations of existing terminals			Peak day	
	1-hour	24-hour	Annual	1-hour	24-hour
NO₂					
Study Criteria	113 ^a		32 ^a	113 ^a	
Background	44.7		12.8	44.7	
Maximum over land	154.4^b		22 ^b	> 140^c	

Concentrations ($\mu\text{g}/\text{m}^3$)	Average day Project construction + operations of existing terminals			Peak day	
	1-hour	24-hour	Annual	1-hour	24-hour
Maximum over water	609.7		96	808.8	
PM					
Study Criteria		120	60		120
Background		46.2	20.6		46.2
Maximum over land		84.8	26.3		209.4
Maximum over water		241	333.6		3402.4
PM₁₀					
Study Criteria		50	20		50
Background		23.1	10.3		23.1
Maximum over land		40.2	12.6		101.8
Maximum over water		651	142.7		1707.2
PM_{2.5}					
Study criteria		25	8		25
Background		8.7	3.5		8.7
Maximum over land		15.6	4.0		28.4
Maximum over water		133.2	43.3		220.7

*Exceedances are denoted by the red, bolded font.

a - CAAQS for year 2020. Calculated for the 98th percentile of daily 1-hour maximum, over one year

b - Maximum for discrete receptor on land

c - Estimated from isopleth map

For all scenarios of the operational phase, the Proponent's results showed that there would be no exceedances of the standards over land with the exceptions of 1-hour NO₂ and annual NO₂ under the expected and future conditions with the Project scenarios (Table 7-6). The results showed exceedances overwater for:

- 1-hour and annual NO₂ under both the expected and future conditions with the Project scenarios;
- 24-hour PM₁₀ under both the expected and future conditions with the Project scenarios; and

- 24-hour and annual PM_{2.5} under both the expected and future conditions with the Project scenarios.

For ozone, results showed that 24-hour and annual background concentrations already exceeded the standards and that the project contribution would be incremental to those exceedances.

The Proponent stated that although the modelling suggested a potential exceedance of the NO₂ standards for future conditions with the Project and other projects and activities, actual exceedances of the criterion were unlikely, and any exceedances of criteria would not be caused by the Project because the exceedance of the criteria was almost exclusively attributed by the modelling to existing emission sources.

The Proponent stated that under existing conditions, Delta had some of the best ambient air quality in the Lower Fraser Valley and would improve in the future, with and without the Project. In the Port Authority's opinion, this trend was a result of anticipated reductions in emissions at the Roberts Bank terminals and improvements in engine technologies, use of cleaner fuels, and regional emission reduction initiatives.

The Proponent stated that the model-predicted concentrations at air quality monitoring Station T39 in Tsawwassen community were consistently higher than observations for the period of 2010 to 2016 and higher than observations made on Tsawwassen First Nation Lands in 2014 to 2015. The Proponent noted for example, the maximum measured 1-hour NO₂ concentration at Station T39 was 78.0 µg/m³, while the model-predicted maximum 1-hour average NO₂ concentration at Station T39 (including background) was 163.3 µg/m³, more than double the actual maximum measured concentration. The Proponent noted that since they used the same inventory and modelling approaches for existing and future conditions, it anticipated that actual future levels would be lower than model-predicted concentrations.

The Proponent also stated that the results did not take into account additional factors and initiatives that would continue to reduce NO_x emissions. These included the increasing use of shore power, which would significantly reduce NO₂ emissions from marine vessels, and the conversion to Tier III ships, which reduces NO_x emissions by 75 to 85 percent per ship when compared to Tier I and Tier II vessels, respectively.

The Proponent made a commitment to develop an Air Emission Management Plan for construction and operations in consultation with British Columbia Ministry of Environment, the Agency, City of Delta, ECCC, Health Canada, Metro Vancouver, Tsawwassen, Musqueam, and other interested Indigenous groups.

Table 7-6: Contaminant exceedances* under operational scenarios, including influence of background (Source: Adapted from EIS, Volume 2 and Project public registry document 1088, IR6-23; 6-27; and document 1465, 14-04)

Concentrations ($\mu\text{g}/\text{m}^3$)	Existing Year 2010			Expected Year 2025			Future with the Project Year 2025		
	1-hour	24-hour	Annual	1-hour	24-hour	Annual	1-hour	24-hour	Annual
NO₂									
Study criteria	200 (188 ^a)		40 (60 ^a)	79 ^b		23 ^b	79 ^b		23 ^b
Background	44.7	34.9	12.8	44.7		12.8	44.7		12.8
Maximum over land	197.1	115.5	24.8	168.7		20.9	292.1		29.2
Maximum over water	483.9	258.9	73.6	271.2		64.5	276.8		64.5
SO₂									
Study criteria	450	150	25	170		10	170		10
Background	7.7	5.1	1.4	7.7		1.4	7.7		1.4
Maximum over land	202.9	35.7	2.1	18.2		1.5	22.6		1.48
Maximum over water	1936	339.2	42.9	89.9		3.7	170.2		3.7
PM₁₀									
Study criteria		50	20		50	20		50	20
Background		23.1	10.3		23.1	10.3		23.1	10.3
Maximum over land		29.6	10.9		26.6	10.7		30.7	11.1

Concentrations (µg/m ³)	Existing Year 2010			Expected Year 2025			Future with the Project Year 2025		
	1-hour	24-hour	Annual	1-hour	24-hour	Annual	1-hour	24-hour	Annual
Maximum over water		129.1	20.4		87.1	16.3		87	16.3
PM_{2.5}									
Study criteria		25	6		25	6		25	6
Background		8.7	3.5		8.7	3.5		8.7	3.5
Maximum over land		14	4		10.6	3.7		12.8	4
Maximum over water		101.6	12.7		55.8	8.4		55.7	8.5

*Exceedances are denoted by red, bolded font.

a – Study criteria used by the proponent over water calculated for the 98th percentile of daily 1-hour maximum, over one year.

b – Calculated for the 98th percentile of daily 1-hour maximum, over one year.

c – Calculated for the 99th percentile of daily 1-hour maximum, averaged over three consecutive year.

The Proponent confirmed they were engaged in regional air management initiatives such as the Northwest Ports Clean Air Strategy, Metro Vancouver's Integrated Air Quality and Greenhouse Gas Management Plan and Regional Ground-Level Ozone Strategy, and the Lower Fraser Valley Air Quality Coordination Committee. The Proponent stated that they had partnered with the ports of Seattle/Tacoma and the Northwest Seaport Alliance, with input from ECCC, Metro Vancouver, and other USA Agencies, to reduce port-related air emissions in the shared Georgia Basin-Puget Sound air shed. The Proponent committed to continued participation and collaboration with Metro Vancouver and other stakeholders on regional initiatives.

The Proponent made a commitment to implement adaptive measures through the Air Emission Management Plan as well as adaptive and corrective measures through the Human Health Air Quality Follow-up Program, which would be informed by the monitoring results and compared to applicable health effect thresholds to be determined in consultation.

The Proponent stated that, based on hypothetical worst-case emission scenarios, no combination of activities from terminal operations could result in higher emissions and higher predicted ambient concentrations. Based on the conservative approach taken, the Proponent concluded that exceedances of air quality criteria were not expected from Project construction and marine terminal operations at Roberts Bank.

Marine Shipping Area

The Proponent modeled dispersion of ship emissions using generic dilution curves describing the decay of ambient pollutant concentration away from the ship track. These dilution curves were based on CALMET/CALPUFF modelling of ship emissions in Segment A. Different dilution curves were used for Segments B, C and D of the marine shipping area for different pollutants. Modelling was augmented by measurements of air quality at Saturna Island and data from various studies unrelated to the Project assessment.

Based on average ship emissions, the generic dilution curves were used to determine the ambient concentration of pollutants within 10 km of the shipping lanes in Segments A, B, C and D. The assessment focused on criteria air contaminants as in the EIS, with mention of some pollutants specific to ship emissions.

The Proponent indicated that overall, additional Project-associated vessels were anticipated to result in a modest change in annual emissions from vessels in transit in the marine shipping area through Segments A to D. The Proponent did not propose further mitigation measures because of the proven and anticipated benefits to air quality from the North America Emissions Control Area.

The Proponent concluded that, despite limitations of the methodology used, annual emissions of most compounds from large vessel sources would decline in the future, due to changes in engine technology and penetration of newer vessels into vessel fleets, as compared to existing conditions. All maximum 1-hour, 24-hour, and annual average concentration for criteria air contaminants from large marine vessel emissions were predicted to be well within the ambient

air quality objectives defined by the BC province and USA *Environmental Protection Act* standards. Annual emissions of trace organic contaminants for cumulative conditions were conservatively projected to increase by approximately 20 percent over existing conditions due to the overall increase in traffic levels for large marine vessels.

7.2.2 Views of Participants

Metro Vancouver and ECCC disagreed with the Proponent's choice of the air quality station to determine background air quality. Metro Vancouver reported that the Proponent had excluded a number of Metro Vancouver ambient air quality stations when developing baseline air quality concentrations for the Project, and instead opted to use a single station located in Tsawwassen community (station T39). In Metro Vancouver's views, the use of additional air quality stations which better represent industrial and port activities would have improved the assessment. ECCC recommended that background air quality should be determined using more than one air quality station, a more complete analysis of differences between monitoring stations, and more recent data, particularly given recent changes in emission controls and monitoring technology. BC Ministry of Health and Health Canada also questioned the adequacy of station T39 in providing appropriate background levels for coal dust and particulate matter especially for receptors that might be closer to the terminal than the T39 air quality station.

Metro Vancouver and ECCC stated that the Proponent should have used CAAQS coming into effect in 2020 and 2025. Metro Vancouver pointed out that they were required to have air quality objectives that were equivalent to or more stringent than the CAAQS and provincial objectives. Metro Vancouver considered that the air quality objectives should have been applied uniformly across the entire domain to ensure that any potential error in the spatial prediction was captured.

Considering the exceedances of CAAQS predicted for NO₂, as well as PM_{2.5} and, ozone concentrations in the air zone approaching the standard, ECCC recommended the Proponent do the following:

- Implement a local air quality monitoring program in multiple locations;
- Participate in local/regional air quality management initiatives where applicable; and
- Take an iterative approach to air quality management and adapt project equipment or procedures to prevent emissions from contributing to deteriorating air quality in the local and regional area.

ECCC also noted that the CAAQS were developed in consideration of both human health and the environment. They explained that the lack of a nearby human population within the estimated impact area of a Project was not a reason to discount the use of the CAAQS in an environmental assessment.

ECCC stated that the emissions for locomotive and cargo handling equipment may also have been underestimated by the Proponent. In ECCC's opinion, the Proponent was too optimistic in assuming that the majority of these components would meet the most stringent emissions

standards and the emissions of NO₂ may have been underestimated. ECCC recommended that the Proponent should:

- Where practicable, select equipment with low emissions that meet the latest applicable Canadian emissions standards and guidelines;
- Not remove emission control technologies from off-road equipment;
- Implement an emission control technology maintenance program, which may include combined use of individual equipment fuel usage indicators, equipment emission testing, provide employee training on minimizing off-road equipment idling and the importance of avoiding tampering with emissions control systems; and
- Commit to meeting the most stringent emission standards and turn equipment over to electric as soon as feasible.

Metro Vancouver and ECCC considered that the air quality modelling domain was too small and did not capture accurately dispersion of pollutants and the complex movement of pollutants in this region. Metro Vancouver also disagreed with the sensitivity analysis conducted by the Proponent to address this concern stating that the analysis further demonstrated that the domain was too small. ECCC noted that limiting the model domain size and representing all regional sources with one background value did not provide enough information to determine the full effect of the Project on regional air quality. ECCC recommended that a larger modelling domain coupled with inclusion of regional emissions sources would allow for a complete assessment of the Project's effects on air quality.

Metro Vancouver and ECCC were concerned that the Proponent had used only a single year of meteorological data, 2010, for the dispersion model. Metro Vancouver noted that 2010 appeared to not be representative of typical weather patterns in the region. Metro Vancouver stated that use of three years of meteorology would have addressed their concern, explaining that multiple years of meteorology was meant to capture a broad range of possible weather conditions that may impact dispersion of pollutants and increased the likelihood that expected weather patterns were captured at some point in the dispersion model. ECCC also disagreed with the Proponent's assumptions and methods used to calculate model bias. ECCC suggested that the air quality assessment should have applied a more rigorous statistical approach using time-matched values of observed and modelled concentrations of NO₂. ECCC noted that modelling of more than one year would allow for a complete assessment of the Project's effects on air quality.

Metro Vancouver stated that the Regional Ground-Level Ozone Strategy developed in 2014 highlighted the need for modelling work to improve the understanding of the impact of emissions on ozone formation given the complex flows of pollutants that affect ozone formation in the Lower Fraser Valley. Metro Vancouver noted that NO_x emissions for the magnitude estimated for the Project would exceed the preliminary threshold recommended in the Lower Fraser Valley for ozone modelling with recommended models.

Metro Vancouver stated that the likelihood of exceeding NO₂ objectives in the vicinity of the Project was increased by project-related emissions, which would offset emissions reductions

(and associated benefits) that have been achieved in the region. Metro Vancouver was concerned that backsliding in these emission reductions would result in new air quality management actions being triggered under the Canadian Air Zone Management Framework, potentially resulting in further regulatory burden for residents and local businesses. They noted that, as most of the emissions associated with the Project fall outside Metro Vancouver's regulatory jurisdiction, emission reduction requirements from external regulators may be required to assist Metro Vancouver in achieving the CAAQS.

Metro Vancouver recommended that a comprehensive air quality monitoring program be implemented to ensure that emissions from the Project are not causing exceedances of relevant air quality objectives. They concluded that based on the predicted concentrations, it was possible that the Project would result in the airshed being designated as a "red" air zone² management level, if the CAAQS are exceeded.

Participants had general concerns about air emissions near the shipping lanes due to an increase in vessels from the Project and from increased vessel traffic in general. Metro Vancouver stated that emissions from ships as they transit from the ocean to the port were not accurately modelled. They noted that dispersion along shipping channels was determined by applying generic dilution curves, which did not consider local meteorology.

7.2.3 Panel's Analysis

Project Area

The Panel considers that the dispersion models and modelling methods used by the Proponent are generally appropriate for understanding air quality effects of the Project. However, the Panel has concerns that the use of 2010 as the only modelled year has introduced biases in modelled ambient pollutant levels. Furthermore, the reliance on only one ambient monitoring station (the station T39) to determine baseline ambient pollution levels and for model evaluation purposes has introduced further biases and uncertainty. In addition, the Panel is concerned that the inner dispersion modelling domain is too small to capture all possible air quality effects of the Project. These concerns are supported by advice from ECCC and Metro Vancouver.

In building the emissions inventories for expected and future conditions, the Proponent has assumed that international, national, regional and local emissions reduction initiatives will mean that emissions sources will have substantially lower emissions rates than in Existing conditions. A simple comparison shows that for all pollutants, air emissions in 2025 are estimated to be reduced from existing air emissions by factors ranging from 0.08 to 0.73. The reduction factors are given in Table 7-7.

² The CCME Air Zone Management Framework provides guidance on the nature of the management, monitoring and reporting actions to be implemented at an air zone level under the Air Quality Management System. Management stringency increases as air quality deteriorates.

Table 7-7: Emission rates of gaseous and particulate criteria air pollutants emitted by Roberts Bank terminals and BC Ferries Tsawwassen Terminal (Source: Adapted from EIS, Volume 2)

Pollutant	Existing Conditions (t/y)	Expected Conditions (t/y)	Reduction Factor
CO	1,776	704	0.40
NO_x	2,233	1,419	0.67
SO₂	353	29	0.08
VOC	136	99	0.73
PM	104	63	0.61
PM₁₀	104	63	0.61
PM_{2.5}	95	55	0.58

The Panel is concerned at the possibility that the assumed emission reductions will not be achieved, and ambient pollution in expected and future condition temporal cases will be higher than those modelled by the Proponent. It is important to note that many of the initiatives driving the emissions reduction assumptions are not initiatives directly controlled by the Proponent.

Based on modelling results presented by the Proponent, the Panel concludes that ambient levels of some criteria air contaminants and trace organic contaminants are likely to be below air quality criteria on land during both Project construction and operations. However, the Panel concludes that NO₂, PM_{2.5} and ozone would likely exceed ambient air quality criteria.

Construction

Based on modelled ambient air quality results presented by the Proponent, the Panel concludes that applicable 2020 CAAQS are likely to be exceeded over land during construction as follows:

1. For average day and peak day emissions, PM, PM₁₀ and PM_{2.5} 24-hour concentrations are predicted to exceed applicable air quality criteria in a limited area in the LAA.
2. For average day and peak day emissions, 1-hour NO₂ concentrations are predicted to exceed CAAQ Standards 1-hour air quality criteria in a large portion of the LAA.
3. For average day and peak day emissions during construction, annual NO₂ concentrations are predicted to exceed CAAQ Standards annual air quality criteria in large portions of the LAA.

Operations

Based on modelling ambient air quality results presented by the Proponent, the Panel concludes that ambient levels of NO₂ are likely to exceed the applicable 2025 CAAQS one-hour air quality

criteria on land during Project operations. Advice from Metro Vancouver indicates that overly optimistic assumptions in the emissions modelling could mean that the level of exceedance of the standard could be greater than modelling indicates. The Panel agrees with the Metro Vancouver advice.

Ozone Pollution

Based on the results presented by the Proponent, the Panel concludes that background annual average and 24-hour average concentrations of ground-level ozone under all operating scenarios already exceed the applicable air quality criteria. Emissions from the Project under future conditions would be incremental over these background concentrations. The degree of incremental pollution is subject to uncertainty because of weaknesses in the ozone modelling approach employed by the Proponent. These concerns are supported by Metro Vancouver and ECCC.

Marine Shipping Activities

Marine shipping activities in the Project area contributes to air pollution through emissions from both container vessels and attending tugs. These emissions form a minor, but not negligible component of total Project emissions of air pollutants. The Panel is concerned that the Proponent's approach of assuming all pollutant emissions from ships underway are captured by the background air quality measurements made at station T39. Because of this assumption, the Proponent did not include these emissions in the air quality modelling estimates. This omission may result in an underestimate of pollutant concentrations in the LAA. This concern was supported by advice from ECCC.

The Panel remains concerned that the assumptions about future transitions to lower emitting vessels and regional air quality improvements are overly optimistic and have resulted in an under estimate of ambient pollution levels. These concerns are supported by advice from ECCC and Metro Vancouver.

The Panel concludes that construction and operations of the Project would result in exceedances of applicable air quality standards and guidelines for NO₂, PM_{2.5}, and contribute to exceedances of ozone.

Marine Shipping Area

The Panel considers the dispersion modelling methods (generic dilution curves) used by the Proponent in the assessment of pollutant concentrations in Segments B, C and D to be incomplete since they do not allow for differences in wind patterns caused by islands, channels, and bays along the various segments of the marine shipping area. The approach results in an unacceptable level of uncertainty in modelled pollutant concentrations in the marine shipping area Segments B, C and D. This conclusion is supported by advice received from Metro Vancouver.

The Panel was concerned that some of the assumptions about future transitions to lower emitting vessels are overly optimistic, and could result in an under estimate of ambient pollution levels in the marine shipping area. This conclusion is supported by advice received from Metro Vancouver.

In spite of the uncertainties regarding dispersion of pollutants, the Panel concludes that ambient air pollution conditions in the marine shipping area and adjacent coastal regions, including in transboundary waters, are unlikely to be materially affected by Project-associated marine shipping because it would emit a very small fraction of total pollutants in the marine shipping area.

Recommendation 4

The Panel recommends that the Proponent be required to:

- *Conduct emissions inventories during the construction phase of the Project to verify that assumed reductions of emissions of air pollutants from all sources in the Roberts Bank port complex over the time span between existing and expected conditions are correct; and*
- *Develop a comprehensive air quality monitoring and management strategy to effectively monitor air quality on the landward side of the Roberts Bank port complex during both construction and operations. This strategy must be designed in collaboration with Metro Vancouver and Environment and Climate Change Canada and be operational before construction commences. The monitoring must be designed to detect possible exceedances of pollutants according to applicable existing and future federal air quality standards, guidelines and objectives. The strategy should:*
 - *utilize data from existing regional air quality monitoring stations operated by Metro Vancouver, and at least two additional air quality monitoring stations;*
 - *include an adaptive management plan, designed to ensure that ambient air quality during construction does not exceed applicable standards, guidelines, and objectives and criteria. This plan must include measures for construction reduction or cessation when standards are exceeded;*
 - *transition after construction into a Follow-up Air Quality Monitoring Program;*
 - *verify the success of the proposed air quality emission reduction measures for the first five years of operations; and*
 - *include an adaptive management plan, designed to ensure that ambient air quality during operations does not exceed applicable standards and criteria.*

7.3 Light Pollution

This section addresses the potential effects of light pollution on the atmospheric environment. The potential effects of Project-related lights on biophysical and human environmental components are addressed in the relevant sections of this report.

7.3.1 Proponent's Assessment

Project Area

The Proponent described how the existing environment in the Project area was influenced by light from a variety of sources including the existing Roberts Bank terminals, BC Ferries Tsawwassen Terminal, nearby greenhouses, and road lighting. Project components that would contribute additional light included the high mast lighting associated with the terminal, additional lighting of the Roberts Bank causeway, and lighting from the 12 ship-to-shore gantry cranes.

The Proponent used light trespass and sky glow as indicators to assess potential changes in light due to the Project. The Proponent described light trespass as the amount of light or illuminance that strays from its intended purpose onto neighbouring areas. Sky glow is the unwanted illumination of the night sky due to the scattering and reflection of light rays by atmospheric aerosols present in the night sky, and of light rays radiated in directions above the horizontal plane or reflected from the ground and buildings. The Proponent used the Commission internationale de l'éclairage (CIE) environmental light classification to characterize light trespass, presented in Table 7-8, and the CIE's classification for sky glow, presented in Table 7-9.

Table 7-8: Light trespass classifications (Source: Adapted from EIS, Volume 2)

CIE Environmental Light Classification	Description of Environmental Light Classification	Examples	Illuminance (measured in Lux: lumens per m²)
E1	Area with intrinsically dark landscapes	National Parks or protected sites	0
E2	Areas of low ambient brightness	Industrial or residential rural areas	1
E3	Areas of medium ambient brightness	Industrial or residential suburbs	2
E4	Areas of high ambient brightness	Town centres and commercial areas	5

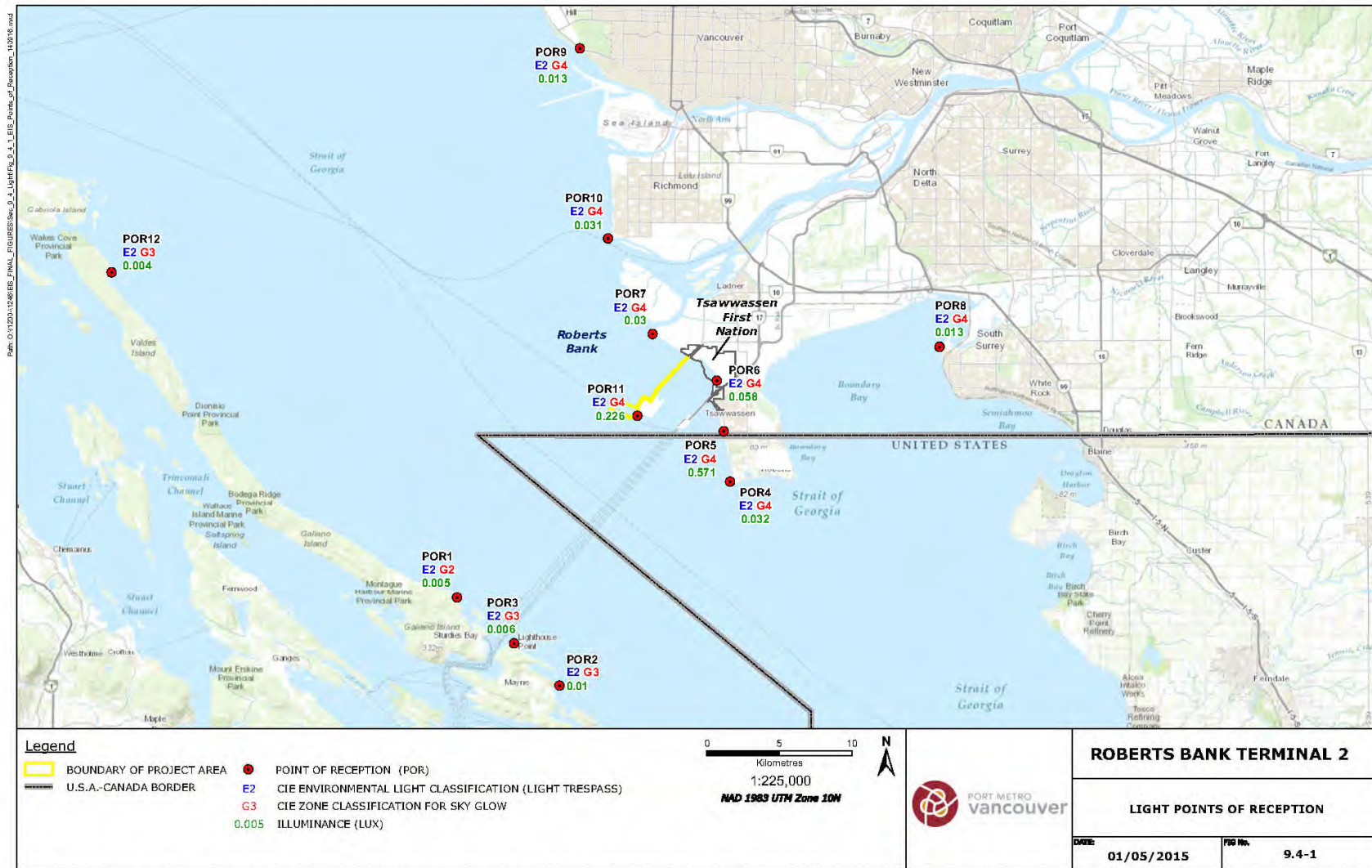
Table 7-9: Zone classifications for sky glow (Source: Adapted from EIS, Volume 2)

CIE Zone Classification³ for Sky Glow	Description of the Sky Glow Classification	Sky Glow (Percent brightness above natural dark sky)
G1	Areas with intrinsically dark landscapes: National Parks or areas with strict limits on light trespass and where roads are unlit	$0\% < x \leq 20\%$
G2	Areas of low district brightness: generally outer urban and rural residential areas (where roads are lit to residential road standard)	$20\% < x \leq 100\%$
G3	Areas of middle district brightness: generally urban residential areas (where roads are lit to traffic route standard)	$100\% < x \leq 200\%$
G4	Areas of high district brightness: generally urban areas having mixed residential and commercial land use with high nighttime activity	$x > 200\%$

The Proponent's light assessment study area was comprised of 12 points of reception (POR) to represent the light conditions in the Lower Mainland and some locations in the Gulf Islands, as seen in Figure 7-2. The Proponent compared the future predicted levels to the current CIE classifications for light trespass and sky glow, as measured at each POR. The Proponent predicted that the light levels during construction would be lower than during operations because most construction work would be completed during daylight hours. Based on this assumption, the Proponent focused the light effects on operational activities only.

Table 7-10 provides the existing and predicted classifications of light trespass and sky glow for all POR. For light trespass under existing conditions, all POR were classified as areas of low ambient brightness (CIE category E2) such as industrial or residential rural areas. For sky glow, POR1 was classified as an area of low district brightness (CIE Category G2); POR2, POR3 and POR12 were classified as areas of middle district brightness (CIE Category G3) and the remaining POR were classified as areas of high district brightness (CIE Category G4).

³ The CIE classified the sky glow zones as E1 through E4, however the Proponent re-labelled them G1-G4 to avoid confusion with the light trespass classifications.



Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAD, NRCAN, GeoBasis, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), Swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Figure 7-2: Light assessment study area and points of reception (Source: EIS, Volume 2)

Table 7-10: Predicted changes in light trespass and sky glow (Adapted from EIS, Volume 2)

Point of Reception (POR)	Location of POR	Existing Light Trespass CIE classification	Predicted future light trespass CIE classification	Existing Sky Glow CIE Classification	Predicted Sky Glow CIE Classification
POR1	Galiano Island	E2	E2	G2	G3
POR2	Mayne Island	E2	E2	G3	G3
POR3	Mayne Island	E2	E2	G3	G3
POR4	Point Roberts (USA)	E2	E2	G4	G4
POR5	Tsawwassen Community	E2	E2	G4	G4
POR6	Tsawwassen First Nation Land	E2	E2	G4	G4
POR7	Brunswick Point	E2	E2	G4	G4
POR8	Crescent Beach	E2	E2	G4	G4
POR9	Lookout location, University endowment Lands	E2	E2	G4	G4
POR10	Steveston Village	E2	E2	G4	G4
POR11	Existing Roberts Bank Terminals	E2	E3	G4	G4
POR12	Valdes Island (Lyackson First Nation)	E2	E2	G3	G3

The Proponent concluded that there would be a change in light trespass environmental light classification at POR 11 on the water next to the existing Roberts Bank terminals. The Proponent also concluded that there would be a change in the sky glow classification at one POR on Galiano Island. The Proponent did not predict a change large enough to affect either the light trespass or the sky glow classifications at any of the other POR. The Proponent concluded that the Project would not change the general light environment of the Project area or the Gulf Islands.

In response to a request from the Panel, the Proponent provided additional predictions for changes in sky glow under varying cloud cover such as mainly clear skies, partly cloudy skies, and mainly cloudy skies. The results predicted one additional potential change in classification under mainly cloudy skies: from G3 to G4 at POR 2, Mayne Island. The Proponent also conducted an additional assessment using the Bortle scale, a nine-point numeric scale for sky brightness commonly used by amateur astronomers. Their results predicted a change in Bortle scale at two POR: POR 7, Brunswick Point, and POR 11, the existing Roberts Bank terminal which was already predicted to have a change in light trespass using the CIE classification. The Proponent indicated that these additional assessments did not change their overall conclusions for light trespass and sky glow.

The Proponent stated that the Boundary Bay astronomical viewing site was located within the light assessment area, but was no longer used for viewing due to light pollution from greenhouses built in the past decade.

The Proponent committed to develop a Light Management Plan to reduce potential light-related effects on human health, marine fish, coastal birds, current use, and visual resources. The Proponent stated that the Light Management Plan would include mitigation measures to reduce excess light trespass and sky glow, including minimizing the number of light installations, orienting the lights away from residential and marine areas, and restricting the time of operation for exterior lights. The Proponent indicated that they would use the minimum light levels required to maintain employee safety. The Light Management Plan would be developed prior to construction, in consultation with the City of Delta, ECCC, DFO, and Indigenous groups.

In addition, the Proponent made a commitment to implement a Light Trespass and Sky Glow Effects Predictions and Mitigation Effectiveness Follow-up Program to verify the predicted changes in light trespass and sky glow. The Proponent committed to verify the levels of light trespass and sky glow before construction, during construction, and during operations at four of the PORs (POR 1, POR 2, POR 7, and POR 11).

Marine Shipping Area

The light assessment for the marine shipping area focused on the light resulting from marine vessel traffic. The Proponent conducted a desktop exercise to undertake its assessment and relied on the vessel description from the Woodfibre Liquid Natural Gas Project light assessment to define a representative ship for the Project. The Proponent predicted that the pass-by of a

container ship would have much lower light trespass and sky glow levels than the marine terminal and causeway lights because container ships had a lower luminous output.

The Proponent predicted that the incremental light contribution from marine shipping associated with the Project would be so low it would not affect the classifications for light trespass or sky glow at any POR in the marine shipping area. The Proponent explained that the light emitted from a container ship would be temporary and only 44 percent of all ships would pass at night when lights would be required. In addition, the Proponent stated that the Project-related vessels constituted a small proportion of the total number of vessels in the marine shipping area. The Proponent concluded that the potential cumulative light contribution from ships associated with the Project in combination with existing ships would be the same as the results for the Project ships alone.

7.3.2 View of Participants

The City of Delta raised concerns that the Project would increase light pollution in the city and exacerbate the existing conditions. The City noted that residents had existing complaints about sky glow and glare. The City recommended that stringent standards be employed to mitigate effects to the community from light. A few participants expressed their concern about the existing levels of light in Delta and how lights were visible everywhere. Additional participants were concerned about the effects of existing light and noise pollution levels on the quality of life and value of residential homes.

A few participants raised concerns about the effects of light from the Project on wildlife. They noted that wildlife would no longer be able to differentiate from other times of the day because there was no change in light or brightness. The light was constant and affected wildlife behaviour patterns. Tsawwassen also noted that the lights affected migratory birds and their behaviour.

The Delta Naturalists Society stated that the effects of light pollution from the Project had not been adequately assessed. The Delta Naturalists Society noted that light pollution in the region had been steadily increasing over the years, but the effects on marine wildlife had not been studied. The Delta Naturalists Society also noted that the Project would cause light pollution to extend further into the subtidal area.

The Islands Trust raised concerns that the shipping industry did not have adequate protocols in place to reduce light and other disturbances from ships, especially those at anchor. The Proponent responded that it would provide incoming ships with direction on light and noise abatement measures and noted that they were prepared to work directly with the Islands Trust and Transport Canada on additional initiatives to reduce light disruption from passing and anchored ships.

Indigenous groups raised concerns that light from the Project would affect their current use of lands and resources for traditional purposes and cultural practices. Tsawwassen was specifically concerned about the change in sky glow at Brunswick Point and the potential subsequent effects to human health, cultural practices, migratory birds, and harvesting. Tsawwassen stated that they

disagreed with the Proponent's conclusions that the changes predicted were not significant. Tsawwassen recommended that the Light Management Plan include measures, co-developed with Tsawwassen, to reduce the effects of light pollution at Brunswick Point.

Lyackson raised concerns regarding the additional light pollution (sky glow) from the Project and its interference with the visibility of night sky. Lyackson reported that the lights from the existing Roberts Bank terminals and BC Ferries Tsawwassen Terminal were visible from their commercial campground on the eastern side of Le'eyqsun (Valdes Island) at night and raised concerns about the potential adverse effects of Project-related lighting on the campground. Lyackson First Nation also indicated that they experience negative effects due to existing light pollution from freighters, despite improved Transport Canada regulations with respect to light pollution. Lyackson First Nation questioned the effectiveness of the light pollution regulations, as well as the adequacy of threshold levels and enforcement of the regulations. Lake Cowichan First Nation also indicated that the light from the Roberts Bank terminals caused excessive light pollution that could be seen across the Salish Sea.

7.3.3 Panel's Analysis

The Panel is of the view that the Proponent has employed appropriate methods for assessing light pollution effects. The Panel agrees that the Proponent has adopted an appropriate standard for effect: a change of one category in CIE classification for light trespass and sky glow. The Panel notes that the Proponent chose individual POR locations to be representative of light conditions at a wider surrounding area, and not just at a particular POR. The Panel views this approach as appropriate.

The Panel notes that the CIE classification systems for light trespass and sky glow employ categories of light trespass (E1 to E4) and sky glow (G1 to G4). The specified limiting boundaries of each category are defined by CIE experts using human perception of brightness. Each category is associated with a different level of perceived brightness. The assignment of a CIE category to a specific POR is achieved by measuring light trespass (in lux) or sky glow (in magnitude /arcsec²) at that POR, and placing it within the CIE classification. The Panel acknowledges that the CIE classification scheme for sky glow may not have sufficient resolution to detect sky quality deterioration that affects celestial viewing. This limitation of CIE will be particularly evident in areas of high sky glow (category G4).

The Panel agrees with the Proponent's statement that light trespass levels and sky glow during construction would be lower than during the operational phase of the Project because most of the work during construction would be performed during the day.

The Panel notes that the Proponent's assessment predicted that the existing conditions of sky glow are in CIE category G3 (greater than 100 percent above natural dark sky) at three PORs and in CIE category G4 (greater than 200 percent above natural dark sky) at eight PORs. These conditions reflect the contribution of other projects and activities that presently exist. The Panel acknowledges that Indigenous groups, the City of Delta and its citizens have continuing concerns

about present light pollution conditions and are concerned that the Project could further exacerbate these conditions.

The Panel agrees with the Proponent's assessment that the existing conditions of light trespass are typical of industrial or residential areas, and that expected conditions with the Project would result in increases in CIE light trespass classification from E2 to E3 at Roberts Bank, represented by POR 11. The Panel agrees with the Proponent's assessment that the existing conditions of sky glow are typical of outer urban and rural residential areas, and that expected conditions with the Project would result in an increase of CIE sky glow classification from G2 to G3 at Galiano Island, represented by POR 1. The Panel also accepts that the type, extent and height of cloud cover has a strong influence on the levels of sky glow.

With or without the Project, light trespass and sky glow will remain an issue in the regional area encompassed in the light assessment study area, as shown in Figure 7-2. If the Project is completed, some locations would likely experience a deterioration of environmental light conditions that would be detectable as changes in CIE classification.

The Proponent's assessment methods for light effects in the marine shipping area match those used for Project effects. The Panel accepts the Proponent's assessment that marine shipping associated with the Project would not increase light trespass and sky glow classification in the marine shipping area.

The Panel concludes that the light environment in the light assessment area has been degraded by existing light sources. In the immediate vicinity of the existing Roberts Bank terminals, the Project would contribute to an increase in light trespass. The Project would contribute to an increase in sky glow on the east shores of Galiano Island. The Panel notes the Proponent's proposed Light Management Plan and Follow-up Program, and proposes further recommendations.

The Panel concludes that without the implementation of effective mitigation measures and management plans the Project would result in further degradation of the light environment.

Recommendation 5

The Panel recommends that the Proponent be required to develop and implement its Light Management Plan and Follow-up Program, in collaboration with the City of Delta, Environment and Climate Change Canada, Fisheries and Oceans Canada and the Tsawwassen First Nation, to achieve the following objectives:

- *Monitor the select points of reception (POR) to ensure light trespass and sky glow predictions from the environmental assessment are correct (POR 1, POR 2, POR 7, POR 11);*
- *Employ technically and economically feasible light fixtures, shielding, location, scheduling and flashing frequency so as to ensure that the EIS predictions are achieved;*
and

- *Allow collaborating parties to review and approve draft plans for both construction and operations at a minimum of 90 days prior to construction.*

Recommendation 6

The Panel recommends that the Proponent be required to implement an adaptive management plan to ensure that the Commission internationale de l'éclairage (CIE) classifications are returned to those predicted, if the follow-up program measurements indicate that light trespass and sky glow exceed predicted classifications.

7.4 Noise and Vibration

This section discusses the potential changes in noise and vibration due to the Project and marine shipping associated with the Project.

7.4.1 Proponent's Assessment

Project Area

The Proponent noted that the existing environment surrounding Roberts Bank was already influenced by noise and ground-borne vibration from a variety of sources, including the existing Roberts Bank terminals, the BC Ferries Tsawwassen Terminal, and road and rail traffic. The Proponent stated that construction and operations would create noise and ground-borne vibration that would contribute to daily noise levels.

The noise and vibration study area for the Project consisted of an upland area and a marine area. Seven representative receptor sites were selected in the upland area, as shown in Figure 7-3. Different types of noise, including noise, impulsive and transient noise, low-frequency noise (LFN), and ground-borne vibration were assessed at each of these receptor sites based on the potential effect of the Project. The marine area included all above-water marine areas within a 10 km radius of the geometric center of the proposed marine terminal.

The Proponent predicted noise levels, LFN, impulsive and transient noise levels, and ground-borne vibration during Project construction and operations using the CadnaA three-dimensional sound propagation software. The Proponent stated that meteorological conditions could affect the propagation of noise from the existing and proposed Roberts Bank terminals within the LAA. The Proponent applied the LfU-Bayern method to calculate the meteorological correction factor that was used to estimate the influence of meteorological conditions on the outputs of the noise model.



Figure 7-3: Noise and vibration measurement sites (Source: EIS, Volume 2)

The Proponent used several metrics to characterize noise, including day-night average level (Ldn), daytime equivalent level (Ld), nighttime equivalent level (Ln), and maximum sound level (Lmax). These metrics are closely tied to the human health indicators presented in Section 21.2 - Exposure to Noise and Vibration. The Proponent expressed noise levels in terms of either A-weighted decibels (dBA), which is used to simulate the frequency response of human hearing, or C-weighted decibels (dBC) to determine the presence of LFN. Vibration levels were expressed in terms of the root-mean square average noise and vibration level (VdB).

Construction

The Proponent followed the 2006 United States Federal Transit Authority procedures to predict changes in noise exposure due to Project construction on a month-by-month basis for the 73 month construction period. The Proponent stated that the monthly average construction noise at sites 3, 4, and 5 would increase Ld, Ln, and Ldn by 0 to 5.7 dBA over expected conditions, and that these changes were expected to be perceptible. The Proponent stated that the highest noise levels were expected to occur during a three month period during Year 3 of construction when the densification of the east side of the causeway would take place. The Proponent predicted that noise levels (Ld) in the marine area during construction would range from 63.4 dBA at a 1 km setback distance from the centre-point of the marine terminal to 33.9 dBA at a 10 km setback.

The Proponent stated that impulsive noise during pile driving was not predicted to be measurably greater than the expected noise from other sources. However, the Proponent indicated that pile driving might be audible because the impulsive nature and low-frequency content was such that the noise distinguishable from other closer sound sources.

The Proponent estimated vibration levels during periods of dynamic soil compaction, which was the most vibration-intensive construction activity. The Proponent indicated that the maximum construction ground-borne vibration levels, during dynamic compaction, would not exceed 90 VdB, which was below the 93 VdB threshold of human perception. The Proponent concluded that Project construction was not expected to result in perceptible levels of ground-borne vibration at residences within the LAA.

Operations

To predict noise and vibration levels related to Project operations, the Proponent modelled Project activities taking place in the year 2025, which was when the Project was initially anticipated to be fully operational and noise emissions from the Project were expected to be the highest.

The Proponent predicted that the increase in annual average noise levels (Ld, Ln, and Ldn) at sites 3, 4, and 5 during operations range from 0.1 dBA to 2.0 dBA and were not expected to be perceptible. The Proponent predicted that increases would be lowest at site 3 since it was the farthest from the Project. The Proponent stated that although sites 4 and 5 had similar setbacks from the Project, site 4 had a lower noise level during expected conditions, and therefore the site

would be more affected by noise from the Project. The Proponent's predictions are summarized in Table 7-11.

Table 7-11: Predicted future daytime, nighttime, and day-night annual average noise levels with Project operations (Source: EIS, Volume 2)

Site	Predicted Future Noise Levels (dBA)						Project-related Increases (dBA)		
	Expected Conditions			Future with Project Operation					
	Ld	Ln	Ldn	Ld	Ln	Ldn	Ld	Ln	Ldn
3	51.9	51.5	58.0	52.0	51.7	58.1	0.1	0.2	0.1
4	48.4	44.5	51.7	49.5	46.5	53.5	1.1	2.0	1.8
5	52.3	48.5	55.7	52.8	49.6	56.7	0.5	1.1	1.0

Within the marine portion of the LAA, noise levels (Ld) during Project operations were expected to range from 38.4 dBA to 64.0 dBA depending on the setback distance from the Project.

In the EIS, the Proponent modelled existing LFN levels at site 4 on Tsawwassen First Nation Lands but was later asked by the Panel to measure LFN levels at the site. The Proponent found that the average nighttime LFN measured at site 4a was 63.9 dBC, which was 6.0 dBC higher than the modelled level. Site 4a was located in close proximity to site 4 and was expected to have a similar acoustic environment to that of site 4. The Proponent predicted that during operations, LFN at site 4a would be 67.7 dBC, representing an increase of 2.6 dBC over expected conditions.

The Proponent indicated that the Project would increase the number, but not the severity of impulsive and transient port and rail-related noise events such as train shunting and cargo handling. During operations, the occurrence of rail-related impulsive noise events at sites 4 and 5 would increase from 7.4 to 8 events per hour under expected conditions, to 10.3 to 16 events per hour. The Proponent stated that to predict transient and impulsive noise, it was reasonable to assess potential health effects associated with shorter-term exposure to elevated noise levels occurring simultaneously with meteorological conditions favourable to sound propagation (i.e., downwind/temperature inversion conditions). The Proponent predicted Lmax using actual meteorology as well as worst-case meteorology. The Proponent noted that using downwind conditions resulted in increased propagation of isolated noise events. Assuming downwind conditions, the Proponent predicted that the range of Lmax at sites 4 and 5 was 52.1-58.5 dBA and 48.2-59.1 dBA, respectively.

The Proponent stated that due to the large setback distances of receptors from the Project, operations would not measurably or perceptibly influence ground-borne vibration levels at any of the upland receptors.

The Proponent committed to the development of a noise and vibration management plan prior to the start of construction and operations, and indicated it would share the draft plan with Tsawwassen for input. The Proponent also stated it would minimize the impulsive noise and

construction noise generated outside of weekday, daylight hours. Other measures within the draft plan include the gradual ramping up of sound levels, regular maintenance of equipment, carrying out noise effects awareness training, and the use of adaptive equipment alarms as appropriate. The Proponent indicated that they would notify local residents and Indigenous groups of construction activities.

The Proponent stated that at sites 3 and 4, the additional traffic on off-causeway portions of Deltaport Way and the rail corridor were expected to result in incremental changes in noise levels compared to the future conditions with the Project temporal case. The total cumulative changes in Ldn at sites 3 and 4, relative to the Project operational phase, are predicted to be 1.7 dBA and 0.1 dBA, for a total of 59.8 dBA and 53.6 dBA, respectively. At site 5, the additional road and rail traffic was not expected to result in incremental noise levels.

Marine Shipping Area

Noise from marine shipping associated with the Project has the potential to affect both people and wildlife within marine areas and on shores adjacent to shipping lanes. The LAA consisted of a four km zone surrounding inbound and outbound shipping routes within Segments A to E of the marine shipping area. The Proponent indicated this zone was selected because noise from container ships was not expected to be audible beyond that distance.

The Proponent obtained information on existing noise levels from studies carried out as part of the Trans Mountain Pipeline Expansion Project (TMX). The Proponent used a methodology developed during the TMX assessment to predict noise emissions from tanker ships and adapted it to predict noise emissions of container ships. This methodology assumed that a ship's total noise emissions could reasonably be represented by noise emissions of the main diesel engine exhaust. To estimate noise from the main engine, the Proponent estimated engine load, which was related to the speed at which a vessel was travelling. The Proponent estimated an engine load of 80 percent for container ships transiting in the Strait of Juan de Fuca, and 40 percent in all remaining segments.

The Proponent stated that noise from vessels transiting the shipping lanes was not considered loud enough, nor present for a duration long enough, to be a major contributor to the existing acoustic environment. Using the CadnaA modelling software, the Proponent estimated the noise levels at various setback distances away from a transiting container ship under 40 percent and 80 percent engine load. Noise levels ranged from 65-68 dBA at a setback of 50 m, to lower than ambient nighttime noise levels at 2,300 m away. The Proponent estimated that the additional vessel movements associated with the Project would increase the annual average day or night equivalent sound level by no more than 0.4-0.5 dBA.

No mitigation measures were proposed by the Proponent as marine shipping associated with the Project was not anticipated to measurably or perceptibly effect annual average atmospheric noise levels in the LAA.

When assessing cumulative effects, the Proponent predicted that the future cumulative increase in marine vessel movements was expected to correspond to an increase in average noise levels due to vessel transit of approximately one dBA, which would not be perceptible.

7.4.2 Views of Participants

Many participants who lived in Delta and Tsawwassen expressed concerns regarding existing noise levels and exacerbation of the current problem by the Project. The City of Delta indicated that the majority of complaints received from Delta residents were related to noise. The City of Delta stated that the construction of Deltaport Third Berth caused significant noise disturbance for some Delta residents and it was expected that the construction of the Project would have similar, but longer duration impacts on the community.

The City of Delta stated that people living close to the shore, facing the port, were particularly vulnerable to noise disturbance from terminal operations and from ships' generators. The City of Delta encouraged the Proponent to develop policies to proactively address community noise disturbance from port operations, including incentive programs for ships to use shore power or quieter engines.

Tsawwassen stated that their members already experience disturbance from noise and LFN and that any future change would be significant and measures to minimize noise, especially at night, were required. Lyackson stated that the existing terminal was currently causing LFN that could be heard and felt for hours on the east coast of Valdes Island, particularly in the bay where the Lyackson campground was located.

Health Canada recommended that a complaint resolution process be put in place for the duration of the Project and information on the complaint investigation process should be provided to potentially impacted residents. Health Canada suggested that the Proponent engage in an ongoing dialogue with the identified residents prior to and during all phases of the Project to ensure that project-related activities do not result in increased sleep disruption or sleep disturbance. Health Canada also indicated that the Proponent should consider work slow-downs or stoppages during specific conditions (e.g. onshore winds, temperature inversions, night-time) in the event complaints are registered. Health Canada recommended that the Proponent work with Tsawwassen members to participate in further study to support the development of additional mitigations, including those for LFN.

The City of Delta expressed concerns about the increased number of vessels docking at the port, and their potential impacts from increased noise. When asked whether the main engine load used by the Proponent in estimating noise levels were appropriate, Environment and Climate Change Canada indicated that an assessment of the assumptions depends on whether the Proponent used the appropriate vessel speeds to estimate engine load. Environment and Climate Change Canada retrieved vessel speed data from the Canadian Coast Guard to verify the assumptions of the Proponent, and concluded that the engine loads assumed by the Proponent were too low, particularly for Segments A and C.

7.4.3 Panel's Analysis

Project Area

The Proponent's analysis reveals that the upland area and waters in close proximity to the Project are subjected to noise from a wide variety of sources, including existing port operation and road and rail transportation. The Proponent estimated that noise from the existing Roberts Bank terminals is conservatively estimated to account for approximately 8, 42, and 34 percent of the total noise experienced at site 3, 4, and 5, respectively. The Panel concludes that the Project would add to these conditions in both the construction and operational phases.

The Panel is of the view that the methods used by the Proponent to estimate future noise levels during Project construction and operations are adequately conservative. The Proponent's assessment was performed using the LfU-Bayern method, which the Panel considers to be an industry-standard approach. In addition, the Proponent adjusted noise propagation calculations for downwind propagation, propagation in atmospheric wind structures known as low-level jets and temperature inversions, and propagation over minimally absorbing surfaces such as water. The Panel is of the view that the use of downwind conditions was suitable for the prediction of transient and impulsive noise due to Project operations during worst-case meteorological conditions.

The Panel agrees with the Proponent's conclusion that noise conditions in the upland area would increase, particularly during periods of peak construction activity. The highest noise levels are expected to occur over a three-month period during the densification of the east side of the widened causeway. These sources would add to continuous noise levels as well as impulsive noise. Increases in noise levels due to terminal construction activities would also occur over marine surfaces in the immediate vicinity of the proposed terminal, especially during times of peak construction activity.

The Panel accepts the Proponent's conclusion that noise levels in the upland area are expected to increase as a result of Project operations, based on activities at the proposed terminal and associated increases in road and rail traffic on the Roberts Bank causeway. These sources would cause additional noise, LFN, and transient and impulsive noise during both day and night. In addition, operation of the proposed terminal would increase noise levels over marine surfaces in the immediate vicinity of the proposed terminal. The Panel notes that noise levels at sites 4 and 4a, which are located on Tsawwassen First Nation Lands, have the highest predicted increases in noise due to construction and operation of the Project.

The Panel concludes that the Project would increase noise levels in the upland area and over marine surfaces adjacent to the proposed terminal. The Panel concludes that the contribution of the Project would be the greatest at site 4 and surrounding areas.

Marine Shipping Area

Noise from marine shipping associated with the Project has the potential to result in a change to the acoustic environment in a narrow zone surrounding the shipping lanes, where ship noise is

expected to be audible. This includes a four km wide marine area, the shores of Saturna, South Pender, Moresby, Sidney, Stuart, Henry, and San Juan islands, and a portion of southern Victoria. The Panel acknowledges that the Proponent may have underestimated the engine load in some portions of the marine shipping area, but the Panel is of the view that this would not change the outcome of the noise assessment.

The Panel concludes that marine shipping associated with the Project would not measurably affect annual average atmospheric noise levels in the marine Local Assessment Area.

Recommendation 7

The Panel recommends that the Proponent be required to:

- *Develop and implement, in collaboration with the Tsawwassen First Nation and Health Canada, additional mitigation measures to reduce noise levels, including those for low-frequency noise, for the construction and operational phases of the Project; and*
- *Implement a solution-oriented complaint resolution process that is in place for the duration of the Project, and communicate the process, decisions, actions taken and outcomes achieved to potentially-impacted residents and communities.*

8 Marine Environment

8.1 Coastal Geomorphology

The Project may alter coastal geomorphology at Roberts Bank due to the placement of the marine terminal, dredging of the berth pocket, and expansion of the tug basin. These activities may cause further indirect changes to coastal geomorphology due to differences in currents and wave patterns, structure and height. Changes to coastal geomorphology are closely linked to changes in surficial geology, marine sediment and marine water quality.

8.1.1 Proponent's Assessment

The Proponent described Roberts Bank as a highly dynamic coastal environment that occupies the southern portion of the Fraser River Delta between Point Roberts and the Fraser River Main Arm. Natural processes driving geomorphological development at Roberts Bank include tidal currents, waves, Fraser River discharge and sediment supply, and tectonic processes. Anthropogenic activities have also driven geomorphological development at Roberts Bank including dyking, channelization, and river training over the past 150 years.

The Proponent noted that the coastal geomorphology of Roberts Bank has been altered by the construction of the BC Ferries Tsawwassen Terminal and causeway in 1960, and the construction of the Roberts Bank causeway and Westshore Terminals, completed by 1970. These projects created barriers to waves and re-directed tidal flows. Most notably, these activities have resulted in the dispersal of considerable amounts of sediment over the tidal flats between the BC Ferries Tsawwassen Terminal causeway and the Roberts Bank causeway, creating what is referred to as the “inter-causeway” area. Potential changes from the Project to coastal geomorphology would contribute to the ongoing natural processes and anthropogenic changes occurring at Roberts Bank.

The Proponent selected the LAA to include the Roberts Bank tidal flats extending from the seaward side of the of the flood protection dykes along the foreshore to -60 m CD depth, and extending from the BC Ferries Tsawwassen Terminal to Canoe Passage. The LAA represented the maximum extent of the likely zone of influence for the Project based on alterations in physical processes that are the key determinants of geomorphology.

The Proponent's coastal geomorphology assessment employed two years of field data collection to improve the understanding of the key processes in the Project area, interpretive geomorphology and analytical techniques to understand the morphodynamic evolution of the tidal flats, and numerical modelling to evaluate potential Project-related changes in coastal processes.

The Proponent used the TELEMAC-MASCARET-TOMAWAC-SISYPHE modelling system to provide information on tides as well as ocean current speed and direction in three-dimensions. The numerical model also provided the concentrations of transported quantities of salinity and sediment. This information was integrated into the TOMAWAC model for simulation of wave

and tidal conditions, which were then integrated in the SISYPHE model to simulate transport of sediment and changes in seabed morphology. Outputs from the SISYPHE model provided feedback to the TELEMAC-MASCARET model. The numerical model was applied over the Salish Sea. The model results were evaluated based on field measures of water levels, currents, wave heights, and salinity.

The results from the numerical modelling used to evaluate changes in coastal geomorphology served to further inform the design and inputs into the Roberts Bank ecosystem model. It also provided results for the assessment of changes in marine water quality, such as for potential salinity changes.

The Proponent used the River2D model to investigate the flow of tidal water through the semi-pervious causeway containment dyke during the construction phase. The semi-pervious containment dyke would be constructed in the intertidal zone and the drainage through the structure on the adjacent tidal flat was anticipated to result in small drainage channels. The Proponent expected that the channels would eventually infill once the area between the dyke and the causeway was filled and water no longer drained through the dyke. Channel formation from causeway widening on the north side would therefore be temporary and reversible. The Proponent made a commitment to include an element in the final design to ensure design and construction of the Project would reduce the potential for channel formation.

The Proponent explained that the presence of the Project footprint would alter coastal geomorphologic processes beyond the construction phase, and would result in changes to sediment transport, erosion and deposition, elevation of the seabed, and distribution of freshwater from the Fraser River. The Proponent noted that further changes to geomorphology were largely avoided by siting the marine terminal almost entirely within the subtidal zone. The Proponent stated that these changes could not be mitigated beyond its selection of terminal design and location.

The Proponent also examined the potential Project effects of sedimentation at Canoe Passage. Based on air photos dated between 1938 and 2012, the Proponent found that the location of Canoe Passage, although it had historically moved, was fairly stable over time. The Proponent's modeling showed that the only interaction between the Project and Canoe Passage would be in the area of predicted accelerated inflow for a small channel that was part of the 1949 location of Canoe Passage. The Proponent committed to a coastal geomorphology follow-up program, which it stated would include the Canoe Passage area.

The Proponent described the areas affected by geomorphological changes due to the Project footprint as: 5.8 ha of scour around the northwest corner of the terminal; 20 ha for sediment depositional area near the west edge of the terminal; 50 ha of accelerated tidal channel formation; 40 ha of increased deposition of fine sediment at the shoreward side of the terminal; 70 ha of decreased wave energy on the north side of the terminal; and, 1 ha of scour at the east face of the terminal. The Proponent also identified an unquantified area of increased turbidity and lower salinity north of the terminal along the west side of the causeway, due to increased influence from Fraser River freshwater flows. The Proponent did not provide a specific time

frame for the occurrence. Figure 8-1 illustrates the predicted changes to coastal geomorphology due to the Project footprint.



Figure 8-1: Spatial extent of potential changes associated with Project footprint (Source: EIS, Volume 2)

The Proponent incorporated the rounding of the northwest corner into terminal design as a mitigation measure to decrease the extent of scour caused by flow acceleration around the west side of the terminal. This Project design measure was incorporated early on in the assessment process based on coastal geomorphology studies.

In order to verify the predictions of effects on coastal geomorphology due to the terminal footprint, the Proponent committed to a follow-up program to monitor characteristics related to geomorphic features, sediment erosion and deposition, and eutrophication. In the development of this plan, the Proponent committed to consulting with DFO, NRCan, and interested Indigenous groups.

8.1.2 Views of Participants

ECCC reported that climate change predictions indicated an increase in Fraser River discharge in fall and winter seasons, which could affect coastal geomorphologic processes at Roberts Bank.

The British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD) stated that previous port developments appeared to have altered the flow of sediment across Roberts Bank, and it was likely that the Project would also alter the

deposition of sediment along the Roberts Bank foreshore. FLNRORD emphasized that the ecology of the area is not properly monitored and the current environment and biological processes within Roberts Bank are poorly understood.

DFO and NRCan indicated that the TELEMAC-MASCARET model selected to estimate the impact of the Project on ocean circulation, salinity, and wave climate, as well as changes from climate change on nearshore wave climate was appropriate. NRCan concluded that the results supported the notion that the Project structure would not adversely affect Roberts Bank morphodynamic equilibrium except in the direct vicinity of the structure. DFO's concerns rested primarily with the remaining uncertainty in predictions based on the modelling of ocean currents and salinity.

The Hwlitsum First Nation and Tsawwassen observed that Canoe Passage had become heavily restricted by sediment due to the existing Roberts Bank terminal and causeway. They raised concerns about the potential for the Project to result in further sedimentation at Canoe Passage, which may lead to cumulative effects at Canoe Passage on the ability to fish, hydrology of the foreshore, and juvenile salmon migration.

8.1.3 Panel's Analysis

Based on advice received from DFO and NRCan, the Panel accepts the TELEMAC-MASCARET-TOMAWAC-SISYPHE model used in the Proponent's assessment as appropriate for the purpose of predicting changes to coastal geomorphology. Furthermore, the Panel considers the Proponent's approach to model application, including domain definition, modelling mesh selection and resolution, and boundary condition specification as adequate. The Proponent's approach to model evaluation, including the number and location of model evaluation points, and variables chosen for evaluation is also acceptable to the Panel.

The Panel accepts the Proponent's model performance as appropriate for the assessment of Project effects. The Panel acknowledges DFO's concerns and considers that the Proponent's modelling is subject to moderate and unavoidable uncertainty because of the dynamic and complex nature of the Roberts Bank area.

The Panel heard from Indigenous groups that past projects have caused historical and ongoing changes to Roberts Bank geomorphology. Due to the location of Canoe Passage upstream of the Project, the Panel concludes that there is no Project effect on sedimentation at Canoe Passage, however, the effects from past projects on Fraser River dynamics was taken into account in the Panel's effects assessment on other environmental components, such fish and fish habitat, throughout the report.

The Panel acknowledges that the Proponent has reduced potential change in coastal geomorphology by the design of the Terminal's rounded northwest corner and adjacent seabed armouring to minimize bed scouring due to predicted accelerated tidal flows in this area.

The Panel concludes that the follow-up program proposed by the Proponent is required to address the Proponent's modelling uncertainties and must be developed and managed in collaboration with Fisheries and Oceans Canada and Natural Resources Canada.

Recommendation 8

The Panel recommends that the Proponent be required to monitor scour along the northwest corner of the terminal at 5-year intervals immediately following the completion of construction and extending for 20 years after the commencement of operations (i.e., 5 monitoring episodes). In the event that scour is detected, the Proponent should be required to remediate any such changes.

8.2 Surficial Geology and Marine Sediment

Surficial geology and marine sediment have the potential to be altered by Project construction activities and the presence of the marine terminal. The construction of the marine terminal and the expanded causeway would require the use of approximately 13 million m³ of sand and miscellaneous fill. This material would be dredged, transported, and imported as terminal or causeway fill, and a portion of the unsettled material would be discharged from the terminal and subsequently deposited in the Salish Sea.

8.2.1 Proponent's Assessment

Between 2010 and 2018, the Proponent collected and analyzed sediment samples from areas within the LAA and the Fraser River estuary that could be directly influenced by Project construction activities. Samples were collected from the following areas: the dredge basin, the tug basin, the tug basin expansion area, the former intermediate transfer pit area, the supernatant discharge area, and the Fraser River maintenance dredging sites. The Proponent analyzed the concentrations of various COPC. The results were compared with the Canadian Council of Ministers of the Environment (CCME) Interim Sediment Quality Guidelines for the Protection of Aquatic Life (CCME Guidelines), the CCME probable effect levels, and the lower action level screening criteria as presented in the Disposal at Sea Regulations under the *Canadian Environmental Protection Act, 1999*.

The Proponent's analysis showed that of the 79 samples tested for metals or polycyclic aromatic hydrocarbons (PAHs) in the dredge basin, the following exceedances in individual samples were detected: arsenic (5 samples); cadmium (1 sample); chromium (1 sample); mercury (1 sample); and PAHs (1 sample). In the tug basin expansion area, the Proponent analyzed 40 samples for metals and total PAHs and 53 samples for total polychlorinated biphenyls (PCBs). The Proponent stated that in the tug basin expansion area, exceedances of the CCME Guidelines were observed for arsenic and copper in 10 samples and 15 samples, respectively.

The Proponent's baseline characterization identified that across all of the sites sampled, copper was the only parameter where the 95 percent upper confidence limit of the mean (UCLM) concentration exceeded the CCME Guidelines. This exceedance was identified within the dredge basin and tug basin expansion area. The Proponent stated that copper routinely exceeded the

CCME Guidelines in sediments within the Fraser River and deposited on the delta due to naturally elevated concentrations of copper.

None of the samples collected exceeded the CCME Guideline for total PCBs. The Proponent stated that the maximum observed sediment concentration of total PCBs congeners in the tug basin expansion area (655 pg/g) exceeded the DFO Guideline for the Protection of Southern Resident Killer Whale (SRKW) of 12-200 pg/g. Of the 23 samples in the tug basin expansion area for which total PCBs were analyzed using the congener method, six of the samples exceeded the 200 pg/g upper limit of the DFO Guideline. The Proponent indicated that individual sediment samples in the tug basin expansion area that exceeded the DFO Guideline were concentrated in the upper 0.5 m of the seabed.

The Proponent indicated that the 95 percent UCLM concentration for total PCB congeners in the dredge basin, tug basin, and Fraser River maintenance dredging sites were all below the upper threshold for the DFO Guideline. The Proponent also stated that the 95 percent UCLM concentration was still far below that of the receiving environment of the Strait of Georgia. The Proponent noted that, based on recommendations from DFO in 2010 regarding disposal at sea in killer whale critical habitat, the disposal of materials with less than ambient concentrations of PCBs at a receiving site is not expected to increase PCB delivery to killer whales and may help to bury ambient PCBs. The Proponent concluded that sediments proposed to be dredged and placed during Project construction would not increase PCB concentrations in the receiving environment and adverse effects to SRKW would be unlikely.

The Proponent stated that historical coal deposits that originated from Westshore Terminals were generally no longer present in areas that would be disturbed during Project construction and most sediment samples had concentrations less than the analytical detection limit. Overall, the Proponent concluded that sediments proposed to be dredged and placed as part of Project construction were not contaminated and adverse effects to environmental components would be unlikely.

To investigate Project-related increases in sediment suspension and deposition from dredging and the discharge of supernatant, the Proponent used a three-dimensional hydrodynamic model. The Proponent estimated the percentage of sediment that would not be retained as fill within the terminal and would be discharged as supernatant, and referred to these as non-retention scenarios. The results of the hydrodynamic model revealed that the deposition of sediment was less than 1 mm for both the 3 percent and the 15 percent non-retention scenarios, but the distance the sediment would be deposited was greatly reduced under the 3 percent non-retention scenario. The Proponent stated that natural sedimentation rates were 2 mm to 30 mm per year in the Fraser River delta. Using a 15 percent non-retention rate, the spatial extent of sediment deposition due to the discharge of supernatant ranged from 0.1-170 km², and the depositional pattern under a 3 percent non-retention scenario would be much smaller and would remain relatively symmetric along the Roberts Bank drop-off. The Proponent concluded that changes in surficial geology and marine sediment during Project construction would be minimal or virtually undetectable relative to natural variability.

The Proponent made a commitment to employing specific environmental dredging practices such as environmental bucket or closed bucket dredging to handle the upper 0.5 m of sediments from the existing tug basin and tug basin expansion area. The Proponent indicated that this measure would avoid the discharge of fines in supernatant and would reduce the potential for increasing PCB concentrations in the receiving environment.

8.2.2 Views of Participants

ECCC stated that it was unclear whether supernatant discharge would increase PCB exposure in SRKW critical habitat, particularly when dredgeate from the upper layer of the tug basin would be placed as fill. ECCC recommended that either the supernatant should not be discharged when dredgeate from the upper layers of the tug basin would be used as fill, or that further information be provided to demonstrate that these sediments would not exceed the upper limit of the DFO Guideline for the protection of SRKW (200 pg/g), or increase ambient PCB concentrations in SRKW critical habitat. ECCC also requested that the Proponent use the congener-based analytical method (Environmental Protection Agency 1668) for all sediment analyses related to the Project.

ECCC agreed with the Proponent's assessment that sediment copper concentrations in excess of CCME Guidelines are representative of ambient background concentrations in the Project area and that adverse effects on environmental components related to copper were not expected.

8.2.3 Panel's Analysis

The Panel acknowledges that the Proponent has done extensive sediment sampling in the areas that could be affected by the Project. The Panel is satisfied that the Proponent appropriately evaluated the worst-case scenario in predicting sediment dispersion and deposition during construction.

Copper in sediment is statistically associated with fine sediment fraction, and hence is associated with sediments in the Fraser River plume. The Panel notes that some sediment samples exceeded the CCME Guidelines, particularly for copper, but agrees with the views of the Proponent and ECCC that they are representative of ambient concentrations. The Panel also notes that PCB concentrations in the upper 0.5 m of sediments in the tug basin expansion area were above the DFO Guidelines for the protection of SRKW of 200 pg/g. The Panel is concerned that the resuspension of this layer of sediment has the potential to increase the PCB burden of SRKW, notwithstanding the Proponent's statement that concentrations were far below that of the receiving environment in the Strait of Georgia. The Panel acknowledges that the Proponent's specific dredging practices and management of sediments in the upper layer of the tug basin expansion area to minimize the dispersal of sediments containing PCBs are appropriate, precautionary, and, warranted given the endangered conservation status of SRKW.

The Panel agrees with the Proponent's conclusion that sediment deposition as a result of construction activities would contribute slightly to natural sedimentation rates. Furthermore, because the 95 percent UCLM contaminants concentrations in the sediment that would be

mobilized by construction activities are below the CCME Guidelines, the Panel agrees that changes in contaminant concentrations are not anticipated.

The Panel concludes that changes to surficial geology and marine sediments due to the Project would be undetectable, relative to natural variability, in the context of the sediment load from the Fraser River.

Recommendation 9

The Panel recommends that during construction, the Proponent be required to employ specific dredging practices to handle the upper 0.5 m of sediments from the existing tug basin and tug basin expansion area in order to reduce the potential for increasing polychlorinated biphenyl concentrations in the receiving environment.

8.3 Marine Water Quality

8.3.1 Proponent's Assessment

Project Area

The Proponent described Roberts Bank as being exposed to mixed, semi-diurnal tides that alternate between high amplitude spring tides and less extreme neap tides⁴. This tidal variation results in water quality conditions that fluctuate on an hourly, daily and monthly basis. Roberts Bank is also influenced by the discharge of the Fraser River, which varies naturally between the peak of freshet, from May to July, and the low winter flows, referred to as the non-freshet period, from October to December.

The Proponent identified activities that may affect marine water quality beyond natural variability during the Project construction phase. These activities included construction of the terminal and causeway containment dykes and terminal caisson wall, dredging activities, vibro-densification, discharge of sediment-laden water, and stormwater discharge. The Proponent also assessed how nutrient and salinity conditions may change from the placement of the terminal.

The LAA for marine water quality included the Fraser River estuary intertidal areas, from the higher high-water mark to 0 m CD depth, at Sturgeon Bank, Boundary and Mud Bays, and Roberts Bank. The LAA also included subtidal and delta foreslope areas.

Total Suspended Solids

The Proponent stated that the majority of the fill material used to build the terminal landmass would be retained within the terminal footprint. However, a supernatant of seawater containing 3 percent of unsettled fines would be discharged to an area southwest of the terminal at depth -

⁴ Neap tides occur just after the first or third quarters of the moon when there is the least difference between high and low water.

45 m CD. The Proponent estimated that 0.31 million m³ of supernatant would be discharged from the terminal into the Salish Sea over the duration of construction activities.

The Proponent stated that dredging and discharge of supernatant had the potential to affect water quality by increasing total suspended solid concentrations and turbidity through the re-suspension of sediment. The Proponent noted that the background of total suspended solids concentrations in the receiving environment was highly seasonal and spatially variable due to fluctuations in Fraser River discharge. Total suspended solids ranged from 500-1,000 mg/L during freshet, from 100-200 mg/L in late summer and fall, and from 50-100 mg/L in winter.

Using a hydrodynamic model, the Proponent modelled several scenarios for different Project activities, and varied input model parameters including particle size, retention rates and discharge depths. The Proponent did not model effects from causeway widening and indicated that potential effects would be mitigated by standard management practices, such as silt curtains.

The Proponent used the CCME Guidelines as a reference for compliance. The guidelines specify that under clear flow conditions and for exposures lasting between 24 hours and 30 days, the maximum average increase is 5 mg/L from background levels. The Proponent conservatively considered this as the threshold for exceedance.

The Proponent noted that within 100 m of the discharge point there was an 80 percent probability of exceeding 10 mg/L. The Proponent indicated that at total suspended solids concentrations of 5 mg/L, the plume resulting from the discharge of supernatant would remain primarily confined near the bank face, extending approximately 4,000 m to the northwest and southeast of the outfall location. The Proponent stated that the plume could be dispersed over the Canada-USA border for short durations and at low concentrations. Figure 8-2 illustrates the maximum total suspended solids concentrations associated with the discharge of supernatant, assuming a non-retention rate of 3 percent during an ebb tide. This case was provided by the Proponent as a conservative prediction of effects from supernatant discharge on water quality.

The Proponent indicated that in all scenarios, supernatant discharge at depth would generate a larger total suspended solids plume than near-surface dredging operations. Levels in sub-tidal waters were expected to dissipate with distance from the discharge point and would drop drastically due to strong mixing along the Roberts Bank shelf. The Proponent stated that total suspended solids concentrations were expected to be within the ambient range of concentrations beyond the localized area of activity.

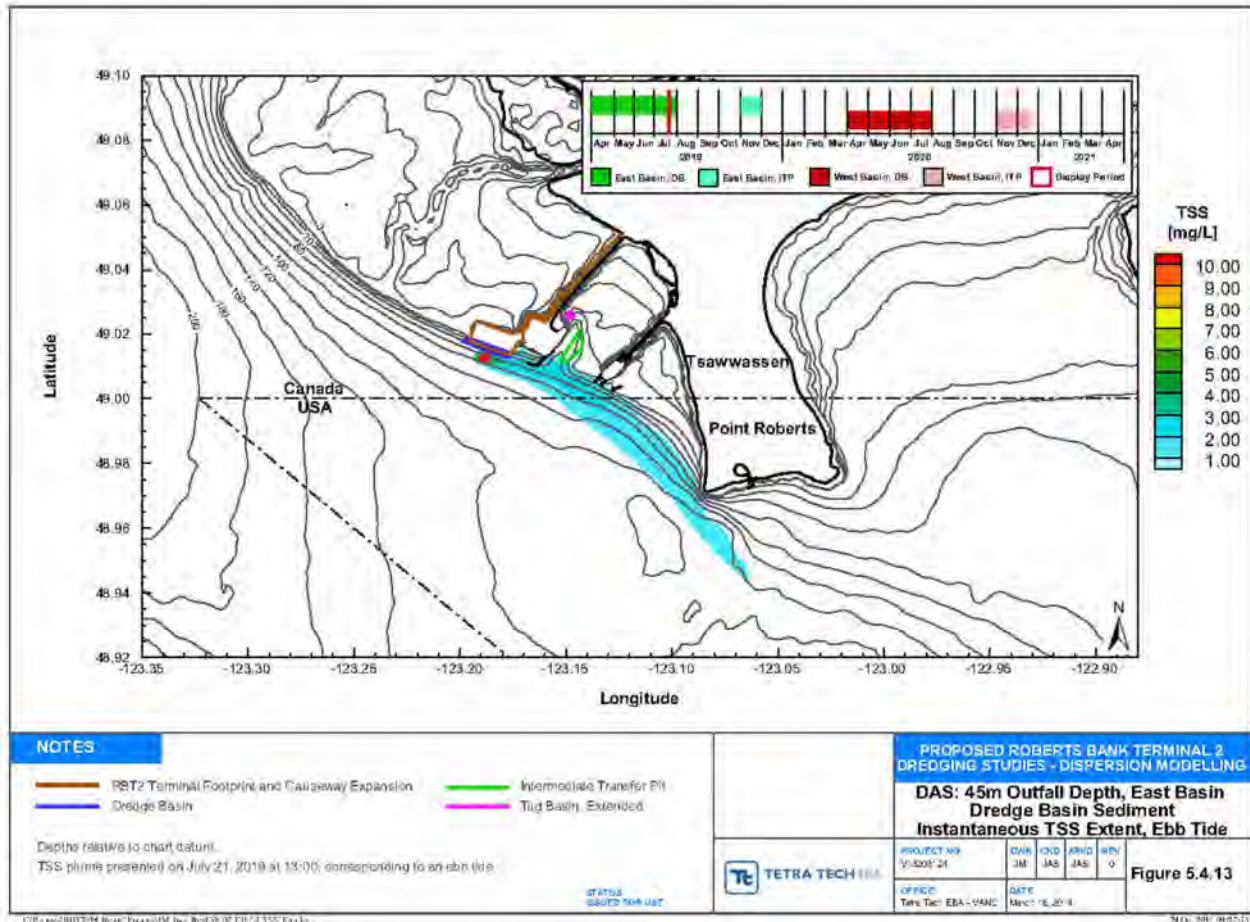


Figure 8-2: Maximum predicted Total Suspended Solids extent from discharge of supernatant during an ebb tide (Source: EIS, Volume 2)

The Proponent proposed a dredging and sediment discharge plan that would describe the management and timing of dredging activities and the discharge of sediment-laden water. Under this plan, the Proponent would establish site-specific water quality objectives and thresholds based on turbidity and total suspended solids models, and would establish criteria for the location of real-time monitoring of turbidity. The Proponent would also determine the criteria, protocol and procedures to stop construction activities to respond to non-compliances. The Proponent would implement a sediment and erosion control plan, and would carry out the installation and regular inspection of land-based erosion-control measures.

Salinity

The Proponent explained that salinity variations occurred throughout the water column at Robert Bank as a function of tidal exchange, and variable Fraser River discharge. The Proponent described daily salinity fluctuations over the LAA and noted they were most pronounced in the upper intertidal area, from nearly freshwater to marine conditions, and ranged from 0 to 32 practical salinity units (PSU). The Proponent predicted the potential changes in mean water column salinity during freshet and non-freshet conditions due to the Project by using

hydrodynamic modeling, as described in [Section 8.1 - Coastal Geomorphology](#). Figure 8-3 illustrates the predicted magnitude and extent changes in salinity after the proposed Project is built, both for freshet (May to July) and non-freshet (October to December) periods.

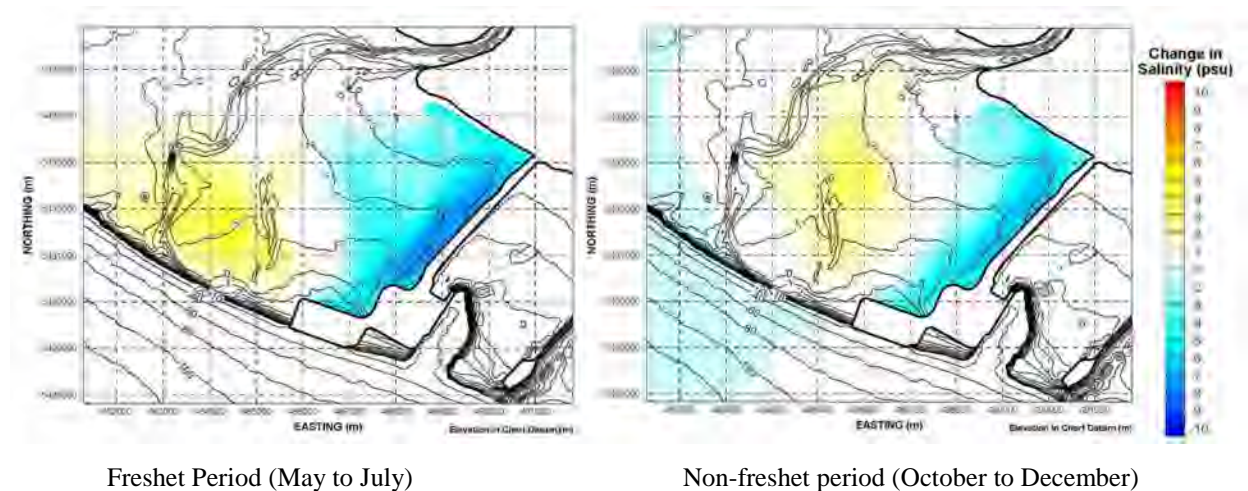


Figure 8-3: Predicted changes in 50th percentile salinity associated with the Project footprint (Source: Project public registry document 961, IR2-02)

The predicted changes in salinity resulting from the Project footprint would be greatest during the freshet period. Lower magnitude changes would persist during the non-freshet period with a smaller spatial extent. The Proponent predicted potential increases in average salinity in the area of the outer tidal flats and decreases in average salinity in the upper and mid-intertidal areas on the north side of the Roberts Bank Causeway.

The Proponent assessed the magnitude of change in salinity by using the 50th percentile salinity value. The magnitude of change across the LAA was predicted to range from -8 PSU to +4 PSU during the freshet period. The Proponent concluded water column salinity changes were not expected to occur within the inter-causeway area, given that it is largely protected from the influence of the Fraser River discharge.

To address recommendations from DFO, the Proponent conducted further comparisons between modelled and measured salinity values during 2016 and 2017 freshet and non-freshet periods. Although the modelled values varied slightly from measured values, the Proponent concluded that the effects from the Project on salinity were insensitive to any discrepancies especially in the vicinity of Brunswick Point.

The Proponent committed to a follow-up program to evaluate model predictions of salinity changes in the intertidal water column during and following Project construction. The Proponent would build upon the ongoing monitoring program at Robert Banks, using the ten monitoring stations already sited in the mid- and upper-intertidal flats, from beginning of construction up to five years thereafter.

Nutrients

The Proponent identified factors potentially causing eutrophication as nutrient availability, a surplus of organic matter, deoxygenation, and limited tidal flushing. The Proponent evaluated sediment organic carbon, sediment nutrients and water-related parameters and concluded that the Project would not alter the distribution of organic-rich sediments, affect dissolved oxygen levels, or water quality in general. The Proponent also referred to monitoring data, gathered through its Deltaport Third Berth Adaptive Management Strategy, which indicated eutrophication in the inter-causeway area was not observed.

Following recommendations by DFO, the Proponent committed to developing a final Offsetting Plan, which would include a description of how the design of offsetting habitats accommodated the potential for eutrophication or anoxia, and changes in water drainage. The Proponent also included monitoring for eutrophication in the coastal geomorphology follow-up program.

Marine Shipping Area

The Proponent considered that routine vessel transit activities associated with the Project were not expected to adversely affect marine water quality. The Proponent assumed that activities that may lead to water pollution complied with existing regulatory requirements.

Potential effects from accidents and malfunctions and marine water pollution are assessed separately in this report.

8.3.2 Views of Participants

With respect to potential exceedances in total suspended solids due to construction activities, ECCC recommended that if real-time monitoring detected exceedances of total suspended solids above established thresholds, then all contributing activities should be discontinued immediately and until exceedances were eliminated. ECCC requested that predictions in total suspended solids be compared to the clear or high flow guideline applicable to the background conditions present at the time of release.

The British Columbia Ministry of Environment and Climate Change Strategy recommended active environmental monitoring to ensure excessive levels of solids would not enter the receiving environment, although it noted it expected that temporary increases in total suspended solids would be minimal relative to existing natural variability. With regards to predicted changes in salinity, British Columbia Ministry of Environment and Climate Change Strategy commented that localized changes resulting from the terminal footprint would be within the current natural range.

Based on their technical reviews of the salinity modelling, DFO and NRCan concluded that the choice of the model was appropriate. DFO further commented on the Proponent's predictions and noted that while the general pattern of salinity changes appeared reasonable, the Proponent had provided insufficient information to assess the magnitude of the change. DFO advised that changes in salinity in the intertidal zone could be smaller or larger than those predicted by the

model. DFO stated that greater confidence could be placed in the model if it were demonstrated that it is capable of representing existing conditions accurately. DFO recommended the Proponent conduct additional simulations to verify predictions and quantify the magnitude of the salinity changes due to the Project with average, above-average, and below-average river discharges.

ECCC advised that the changes reported by the Proponent would result in a substantial decrease in average salinity and in salinity variability over the intertidal areas of Roberts Bank, especially during freshet periods. ECCC observed that these changes were not minor and would result in an overall regime shift in salinity across the intertidal areas towards freshwater compared to existing conditions. ECCC considered that predicted changes in the amplitude of seasonal, monthly, and daily fluctuations in salinity would have important implications on other environmental components, such as biofilm.

In relation to the potential for organic enrichment, DFO noted that the Proponent had not considered enrichment that would coincide with siltation processes within the upper tidal flats. DFO stated that unexpected changes in sediment topography and organic enrichment had been observed in association with previous port projects on Roberts Bank. DFO suggested that the proposed position and orientation of the new terminal may alter sediment deposition over the tidal flats, which may promote siltation and benthic organic enrichment. Despite the Proponent's conclusion that such an effect would be unlikely, DFO cautioned that it would be important to assess the uncertainty related to organic enrichment. Other relevant local environmental factors that may promote sediment deposition, accumulation, and organic enrichment would also need to be considered.

DFO recommended that potential scenarios leading to organic enrichment should be identified and considered in the design and evaluation of proposed offsetting habitat concepts for the Project. Follow-up monitoring of tidal flats should be designed to detect change in organic enrichment indicators at regional scales in order to verify the accuracy of the Proponent's environmental effects predictions.

8.3.3 Panel's Analysis

Project Area

The Panel understands that water quality conditions on Roberts Bank and throughout the Fraser River estuary reflect a dynamic interplay between freshwater inputs from the Fraser River and marine waters of the Pacific Ocean. The Panel recognizes that Fraser River and tidal hydrodynamics strongly affect water quality conditions in the LAA and provide context for measuring potential Project effects.

The Panel notes that increases in total suspended solids from construction activities are unlikely to exceed the CCME Guidelines outside of the areas proximal to construction activities. The Panel notes that total suspended solids levels are greatest due to discharge of supernatant, and that the resultant total suspended solids plume is largely dependent on the proportion of fine

sediment that would be retained within the terminal. The Panel notes that the discharge plumes have the potential to cross the USA border, particularly during an ebb tide, but that the total suspended solids concentrations would not exceed the CCME Guidelines in these areas.

The Panel agrees that Project effects on total suspended solids would largely be within the ambient range of turbidity at Roberts Bank. Effects would be temporary and localized to deep waters, with potential exceedances effectively mitigated by real-time monitoring and response measures.

The Panel notes that although there is a predicted change in salinity due to the Project, the range of salinity values experienced over the LAA would be minor because it remains within the natural variability under current conditions. The changes would be greatest during freshet periods and would be characterized by an increase in average salinity at the seaward extent of Canoe Passage and a decrease in average salinity in the intertidal area north of the Roberts Bank causeway.

The Panel also agrees with the Proponent that although there were slight discrepancies between the modelled and measured salinity values in 2016 and 2017, the modelling was adequate to assess potential Project effects due to changes in salinity.

The Panel notes that the Proponent's proposed follow-up monitoring of salinity is essential for verifying the prediction of effects from changes to salinity and for developing a framework for mitigating any detected effects of salinity change on other environmental components, such as biofilm and infaunal invertebrates.

The Panel acknowledges that the follow-up program proposed by the Proponent to monitor coastal geomorphic processes includes monitoring surface sediment and associated organic content. This program is essential to verify the accuracy of the environmental effects predictions related to eutrophication.

The Panel concludes that the Project would result in minor changes in salinity in the Local Assessment Area given that the Project would cause a reduction in salinity variability, especially during freshet periods.

Marine Shipping Area

The Panel concludes that marine shipping associated with the Project would not adversely affect marine water quality if regulatory safeguards to protect marine water quality in the marine shipping area are observed.

Recommendation 10

The Panel recommends that the Proponent, in consultation with Environment and Climate Change Canada and Fisheries and Oceans Canada, be required to:

- *Conduct a review of the spatial and temporal design of its existing salinity monitoring program; and*

- *Implement the new proposed salinity monitoring follow-up program, in order to verify its predictions of changes in salinity, during and following Project construction.*

Recommendation 11

The Panel recommends that the Proponent be required to:

- *Develop a follow-up program to verify the accuracy of the environmental effects predictions related to eutrophication due to the Project; and*
- *Implement adaptive management measures if monitoring indicates that there is evidence of eutrophication due to the Project.*

8.4 Underwater Noise

This section discusses potential changes to the underwater acoustic environment due to the Project and marine shipping associated with the Project. It also describes the methods used to predict underwater noise levels and presents the outputs of underwater noise models that were applied in the Proponent's assessment. Underwater noise is of concern due to the potential effects of the Project and marine shipping associated with the Project on marine mammals and marine fish. In particular, underwater noise has the potential to affect SRKW and is one of threats to SRKW survival and recovery.

8.4.1 Proponent's Assessment

Project Area

The Proponent stated that underwater noise currently exists in the Strait of Georgia, including Roberts Bank, and is caused by natural biophysical processes, construction and industrial activities, and current commercial and recreational vessel traffic. The Proponent indicated that construction and operation of the Project could result in increases in underwater noise. The Proponent used an acoustic model to predict potential changes in underwater noise during various construction activities and during operations in 2030, which was the year that the Project would be fully operational and at peak throughput.

Both the LAA and the RAA for underwater noise included the Strait of Georgia, but the RAA also extended to the western end of the Strait of Juan de Fuca.

To characterize existing noise levels, the Proponent deployed hydrophones within the LAA and RAA and determined that levels measured at Roberts Bank ranged from 98.1 to 149.8 decibels relative to one microPascal (dB re 1 μ Pa), with an average of 119.5 dB re 1 μ Pa. The Proponent stated that the acoustic environment at Roberts Bank was dominated by anthropogenic noise sources originating primarily from commercial vessel traffic.

Construction

The Proponent modelled thirteen scenarios to account for the underwater noise that could be produced during different construction activities. These scenarios modelled impact and vibratory

pile-driving, vibro-densification, and dredging at different locations around the Project site. One of the impact pile-driving scenarios modelled the reductions in underwater noise from the use of bubble curtains. The Proponent stated that during construction, vibratory pile driving methods would be used as much as possible so as to minimize the use of impact pile driving. If during detailed design it was determined that piles required capacity verification, vibratory methods would be used to drive the pile for the majority of its length, and the impact method would only be used for the final 1 to 2 m.

The Proponent produced isopleth maps for each scenario to display the underwater noise that originated from the different construction noise sources and compared it to injury and behavioral criteria for marine fish and marine mammals. The Proponent stated that impact pile driving was the only activity that could result in injury to marine fish and marine mammals and that the use of bubble curtain mitigation could substantially reduce underwater noise.

The Proponent predicted that underwater noise levels ranged from 160 dB re 1 μ Pa at less than 20 m for both vibro-densification and dredging, to 120 dB re 1 μ Pa at 1.7 km and 2.2 km, respectively. For the vibratory piling scenarios, underwater noise from vibratory sheet piling at the west end caisson extended the furthest from the terminal, with underwater noise above 120 dB re 1 μ Pa extending up to 14.5 km away from the noise source. For 100 minutes of impact pile driving, injury thresholds for marine fish and marine mammals were exceeded as far as 1.0 and 1.2 km away, respectively. The Proponent stated that during construction there would be increases in underwater noise at specific times, depending on the construction activity.

The Proponent committed to the development of an Underwater Noise Management Plan, which would be used to mitigate effects on marine fish and marine mammals. The plan would describe the roles and responsibilities for implementation and monitoring, the monitoring parameters to ensure sound levels remain below thresholds, the gradual start-up of construction activities, requirement for the deployment of hydrophones, procedures that would be implemented in the case of sound exceedances, and mitigation such as dampening methods or technologies to prevent injury and behavioral changes to marine mammals.

Operations

To assess the potential effects of operations, the Proponent modelled container ship approach and departure, as well as berthing and unberthing. The Proponent modelled a Triple E-class container ship (Emma Maersk design) berthing with four support vessels, travelling at four knots. The Proponent also modelled the approach of a Triple E-class container ship travelling at six knots with 4 support vessels approaching a container ship at 12 knots. Source levels for Triple E-class container ships were not available, so the Proponent derived source levels based on a container ship of 338 m in length and scaled up the source level to account for the larger size of Triple E-class container ships, which are 398 m in length.

The Proponent predicted that underwater noise levels ranged from 170 dB re 1 μ Pa at less than 20 m for both vessel approach and berthing, to 120 dB re 1 μ Pa at 14.2 km and 22.0 km for approach and berthing, respectively. The Proponent stated that ship berthing generated the

largest area of ensonification for operation activities. Sound levels during the berthing operations were assumed to originate primarily from the tugs, not the container ship, since tugs produced high levels of cavitation noise as they push the container ship into its berth.

The Proponent predicted the annual average underwater noise produced during 260 container ship calls at the terminal and compared this to the average underwater noise level measured with hydrophones for existing conditions. The Proponent estimated that one container ship call included 45 minutes of approach and departure, and one hour of berthing and unberthing. Using these assumptions, underwater noise levels from the Project would exceed average underwater noise levels during existing conditions approximately 5 percent of the year. For the remaining 95 percent of the time underwater noise from the Project would be within existing underwater noise levels.

In 2018 and 2019, the Proponent provided two updated underwater noise scenarios for Project operations using what they considered to be more realistic assumptions compared to what was presented in the EIS. The Proponent used different vessel sizes, and varied several model input parameters including number of support vessels, vessel speed, source level for tugs, and also modelled propagation in summer. The assessment provided in 2019 considered the predictions based on the Mercator Report 2018, which assumed there would be 104 container ships to call at Roberts Bank in 2035 instead of the initial estimate of 260 container ship calls. Both of the updated scenarios resulted in substantially smaller underwater noise footprints during operations than those presented in the EIS. The scenario that relied on the Mercator Report 2018 determined that underwater noise would be increased two percent of the year, as opposed to the 5 percent of the year predicted in the EIS.

The Proponent did not propose Project-specific measures to mitigate underwater noise during operations, but proposed a follow-up program to verify effects predictions during terminal operations.

Cumulative Effects of Underwater Noise

The Proponent also used an acoustic model to predict existing and future underwater noise levels produced from commercial vessel traffic. The Proponent found that additional traffic with the Project increased mean noise levels by less than 0.1 dB re 1 μ Pa near the international shipping lanes. The Proponent considered other certain and reasonably foreseeable projects, such as the TMX and several marine terminal projects to determine cumulative underwater noise conditions. The Proponent predicted that the average cumulative noise level in the RAA during January and July would be 122.22 dB re 1 μ Pa and 117.60 dB re 1 μ Pa, representing a 0.08 dB re 1 μ Pa and 0.06 dB re 1 μ Pa increase over existing conditions, respectively. The Proponent stated that future increases in commercial vessel traffic would make a relatively small contribution to overall underwater noise levels in the RAA due to the high density of existing commercial vessel traffic. However, the Proponent noted that the relatively small contribution of future developments relative to existing noise levels does not imply that their effects are benign. The Proponent stated that the prediction that these additional ship calls would increase existing noise levels by a small

amount reflects the high density of existing vessel traffic within the assessment area, and the already dominant contribution of vessel noise to the underwater soundscape.

Marine Shipping Area

The LAA for underwater noise included the southern Strait of Georgia and extended 4.2 km westward past the 12 nautical mile territorial sea limit in the Strait of Juan de Fuca.

The Proponent modelled the underwater noise level contributions from marine shipping associated with the Project for 260 vessel calls of a Triple E-class container ship in 2030 using a 1.67 dB source level adjustment. The Proponent identified that with marine shipping associated with the Project, average underwater noise levels in the LAA would increase by 0.03 dB re 1 μ Pa and 0.02 dB re 1 μ Pa in winter and summer, respectively, compared to existing conditions. The Proponent stated that the cumulative average underwater noise level in the LAA would increase by 0.08 dB re 1 μ Pa in winter and 0.06 dB re 1 μ Pa in summer compared to existing conditions.

Underwater noise levels for various segments of the marine shipping area under existing conditions and with the inclusion of marine shipping associated with the Project and other certain and reasonably foreseeable projects and activities are summarized in Table 8-1.

Table 8-1: Underwater noise levels for Segments A, B, C and D (Source: MSA)

Segment	Existing Conditions (Sound Pressure Level in dB re 1 μ Pa)		Existing Conditions + Marine Shipping associated with the Project (Sound Pressure Level in dB re 1 μ Pa)		Existing Conditions + Marine Shipping associated with the Project and Other Projects (Sound Pressure Level in dB re 1 μ Pa)	
	January	July	January	July	January	July
A	124.05	112.75	124.07	112.78	124.09	112.80
B	116.79	114.17	116.87	114.19	117.00	114.26
C	121.74	117.71	121.77	117.72	121.94	117.82
D	119.63	114.16	119.74	114.22	119.92	114.33

No Project-specific mitigation measures for underwater noise in the marine shipping area were proposed. The Proponent noted that there were numerous initiatives underway by the Government of Canada, such as the Oceans Protection Plan, that aim to reduce underwater noise from commercial vessel traffic.

Under the Enhancing Cetacean Habitat and Observation (ECHO) Program the Proponent studied the contribution of different categories of vessels to regional ocean noise. The modelling results show that, while many different vessel sectors contribute to ocean noise in the assessment area, the commercial vessel sector was the dominant source throughout the region.

The Proponent's EcoAction Program recognizes positive environmental practices of vessels operating within the Proponent's jurisdiction and offers discounted harbour dues to vessels that implement emission reduction measures, other environmental practices, and underwater noise reduction technologies. The Proponent noted that in 2018, 44 of the 866 vessel calls that received discounted harbour dues qualified because of an underwater noise reduction measure.

The ECHO Program, launched by the Vancouver Fraser Port Authority in 2014, involves shipping stakeholders, scientific experts, and regulators working to develop a better understanding of potential effects of existing and future commercial shipping traffic on at-risk cetaceans. The long-term goal of the ECHO Program is to understand the potential cumulative effects of commercial vessel traffic on at-risk cetaceans through the southern coast of British Columbia and to develop voluntary, practical, and effective mitigation measures that would lead to quantifiable reductions in threats to whales as a result of shipping activities. The ECHO Program has supported 17 projects in three vessel-related threat categories that are identified in Fisheries and Oceans Canada's Species at Risk Recovery Strategy and Action Plans, including acoustic disturbance, physical disturbance, and environmental contaminants.

8.4.2 Views of Participants

Many participants provided comments related to underwater noise, particularly with respect to the importance of the acoustic environment to SRKW. A common theme expressed by participants was that the Salish Sea was already too noisy for SRKW and that this noise was dominated by commercial shipping. DFO reported that background underwater noise levels have increased an average of 15 dB in the past 50 years throughout the world's oceans.

DFO stated that the acoustic model used by the Proponent to characterize the potential effects of underwater noise due to construction activities and local vessel traffic was state-of-the-art.

Ecojustice stated that the Proponent's modelled scenario and subsequent updated scenarios of Project operations shifted the assessment from precautionary to less-and-less conservative. Ecojustice indicated that it became increasingly difficult to ascertain and track all the assumptions embodied by each of the Proponent's additional modelled scenarios, and to assess the degree to which the new assumptions had been used to revise results from previous acoustic modelling efforts.

Ecojustice noted that there were uncertainties with the Proponent's approach to estimate the source level of larger classes of container ships when source level data were not available. To predict the source level of larger vessels, the Proponent applied an adjustment of 1.67 dB based on the assumption that the Triple E-class vessels were 21 percent longer than the reference ship

for which source levels were available. DFO noted the Proponent's use of a 1.67 dB adjustment reflected the best information that was available at the time and that it presented a conservative assumption or worst-case scenario. Ecojustice expressed concerns related to the estimation of source levels for Triple E-Class container ships, stating that neither the Proponent nor DFO had adequately considered other publications that investigated the relationship between source level and vessel length.

A few participants also expressed concerns that larger vessels would have higher source levels and that the Proponent did not adequately use conservative assumptions when determining the possibility of larger vessels calling at the Project. DFO noted that the general trend was that designers and builders of newer ships were actively working to make their ships quieter and it was likely that future large vessels would have lower source levels than the present fleet of vessels.

Ecojustice recommended that the underwater listening stations run by the Proponent's ECHO Program should continue to characterize the source spectra of modern container ships that frequent the Proponent's facilities. They indicated that the continuation of underwater listening stations would gain information on more accurate average spectra for existing ships, and experimental data describing how underwater noise levels vary with speed, loading, hull and propeller types, and other physical aspects of larger container ships.

An article entitled: *A key to quieter seas: half of ship noise comes from 15% of the fleet* provided by both Earthjustice and Friends of the San Juan Islands identified that half of the underwater noise from a selection of vessels transiting Haro Strait came from just 15 percent of ships, namely those with source levels above 179 dB. The article reported that more than two-thirds of these "gross polluters" were cargo and container ships.

DFO carried out an evaluation of the potential effectiveness of a number of measures aimed to reduce the effects of shipping-related underwater noise on SRKW. DFO identified the following possible measures: vessel speed reductions; relocation of shipping lanes; changes in timing of traffic; changes in shipping practices and ship design; retrofits to existing ships; redirection of traffic; changes in maintenance procedures such as hull cleaning; real-time notification of whale presence in hot spot areas leading to management action; operational responses to observed SRKW presence (i.e. slow down and course alteration); vessel convoying; and, creating periods of quiet/'no-go' areas (i.e. alternating active/inactive shipping periods).

DFO noted that source-based measures, including ship design or retrofit, had the greatest potential for improving the acoustic environment for SRKW. DFO stated that the effectiveness of operation-based measures was less certain because they require knowledge of whale presence, distribution, and behavior, and that they could have side-effects such as redistributing noise into other habitats and increasing duration of noise. DFO indicated that reducing ship speed, transit time restrictions, and convoying showed the most potential for improving the acoustic environment. Altogether, DFO stated that the most effective solution to reducing underwater noise would likely be a combination of measures.

Transport Canada stated it was leading efforts to identify, assess, and implement measures to mitigate the impacts of vessel traffic on marine ecosystems, including the impacts of underwater noise from vessels on at-risk whales. Transport Canada's assessment considered the following: effectiveness of reducing underwater noise; impacts on navigational safety; impacts on economic and supply chains; environmental consequences; and, Indigenous, provincial, and international considerations. Transport Canada noted that work to mitigate underwater noise was being carried out under the OPP, as well as the Whales Initiative. Further details regarding the initiatives being carried out under the OPP and the Whales Initiative are in Section 14 - Marine Mammals.

8.4.3 Panel's Analysis

Project Area

The Panel agrees with the advice of DFO that the acoustic model used by the Proponent was state-of-the-art. The Panel is of the view that the noise propagation model is appropriate for the assessment and is generally well applied.

Construction

The Panel notes that underwater noise from construction activities was predicted to occur intermittently throughout the construction phase. The sources of construction underwater noise are vibro-densification, vibratory and impact pile-driving, dredging, and use of support vessels. The Panel is of the view that vibratory and impact pile-driving would cause the greatest amount of underwater noise, and that sound dampening methods have the potential to decrease this underwater noise.

Average construction-related underwater noise is predicted to intermittently exceed the Proponent's assessment baseline noise level of 119.5 dB re 1 μ Pa, particularly during pile-driving where underwater noise above baseline would extend up to 14.5 km from the construction site.

The Panel acknowledges that the Proponent has committed to implement a comprehensive Underwater Noise Management Plan and Follow-up Program designed to monitor underwater noise during construction and mitigate the effects on marine mammals and marine fish.

Operations

The Panel notes that measurements show that underwater noise at Roberts Bank is dominated by anthropogenic noise sources, specifically from commercial vessel traffic (i.e., ferries, fishing vessels, container ships, coal ships, oil tankers and tugs).

The Proponent provided three separate scenarios presenting the underwater noise generated by Project operations in the vicinity of the proposed terminal. These three scenarios differed only in the level of conservatism implicit in the assumptions underlying the assessment, and as outlined by Ecojustice, the scenarios became less conservative with each of the Proponent's subsequent updates. Given the importance of underwater noise for SRKW, the Panel is basing its assessment

on the scenario presented by the Proponent in its EIS that relies on the most conservative (noisiest) set of assumptions for Project operations in order to adopt a precautionary approach.

The Proponent's most conservative scenario estimated that during operations, activities would increase underwater noise above existing conditions approximately five percent of the time. The Panel notes that berthing and unberthing activities would generate the greatest amount of underwater noise, and that noise from tugs would be the largest sources of noise during these operations. The Panel is of the view that electric tugs as opposed to conventional tugs could have underwater noise benefits and is a measure that could be employed by the Proponent within its jurisdiction.

The Panel concludes that during construction and operations of the Project, the underwater noise environment in the Local Assessment Area would intermittently become noisier than existing conditions.

Recommendation 12

The Panel recommends that the Proponent be required to design and implement an Underwater Noise Management Plan to achieve the following:

- *Ensure that the Underwater Noise Management Plan elements are in place before construction commences, and continue for the duration of the construction phase;*
- *In collaboration with Fisheries and Oceans Canada, select monitoring parameters and methods to ensure underwater noise levels remain below prescribed thresholds for marine fish and marine mammals, and develop procedures in case of sound exceedances;*
- *Ensure the use of vibratory pile driving methods as much as possible during construction, in order to reduce underwater noise. When impact pile driving methods are required, vibratory methods are to be used to drive the pile for the majority of its length, and the impact pile driving method is to be used for the final 1 to 2 m; and*
- *Implement mitigation measures for Project construction that would prevent injury and behavioral disturbance to marine fish and marine mammals during impact pile driving, including but not limited to sound dampening methods or technologies such as bubble curtains.*

Recommendation 13

The Panel recommends that Fisheries and Oceans Canada and Transport Canada, in collaboration with the Proponent, identify suitable locations for the placement of hydrophones to monitor changes in underwater noise due to the Project and marine shipping associated with the Project.

Recommendation 14

The Panel recommends that the Proponent be required to develop and implement an Underwater Noise Monitoring Plan and Follow-up Program, in collaboration with Fisheries and Oceans Canada and Transport Canada, that is built around deployed hydrophones that would be in

place for 60 days in winter and 60 days in summer for one-year pre-construction, annually during construction and for three years following the commencement of Project operations.

Recommendation 15

The Panel recommends that the Proponent and the terminal operator be required to investigate the use of electric tugs to reduce underwater noise generated during Project berthing and approach operations, and to adopt electric tugs when it is determined that they are technically and economically feasible. The Proponent should annually update the feasibility for adoption of electrical tugs.

Marine Shipping Area

In the marine shipping area, sources of underwater noise associated with the Project originate from transiting container vessels. Noise propagation models used in the EIS to assess underwater noise during the operational phase were also used in the marine shipping area.

The Panel notes that underwater noise generated by ships is dependent, among other things, on the speed of travel of ships, length of the ship, ship class, ship construction and main engine details which would affect noise conducted through ship hulls. DFO and participants have advised the Panel that these combined variables lead to considerable uncertainty in the Proponent's assessment of underwater noise levels.

Because source levels for Triple E-class container ships were not available, source levels were estimated by the Proponent using scaling relations for noise as a function of ship length developed from smaller container ships. The Panel is of the view that these scaling relations were based on decades-old measurements, and it is unknown whether the scaling relations accurately represent current noise emission levels.

The Panel accepts the Proponent's conclusion that marine shipping associated with the Project would make a small additional contribution to underwater noise in the marine shipping area. This conclusion is subject to uncertainty because of the lack of direct information about noise emissions from larger classes of ships that are anticipated to call at the Project in the future.

The Panel accepts the information on the record that indicates that underwater noise levels in the Salish Sea are already high, and are too noisy for SRKW. The Proponent presented a wide range of existing and currently used programs and initiatives to the Panel that could reduce underwater noise emissions from commercial vessel traffic in both the Project area and the marine shipping area. The Panel acknowledges that these measures have the potential to reduce levels of underwater noise, but notes that these measures are not specifically tied to the Project and are on a voluntary basis. The Panel is of the view that efforts undertaken by both the Proponent and the Government of Canada to reduce underwater noise levels should be continued and enhanced.

The Panel acknowledges that under the ECHO Program, the Proponent has obtained actual source level measurements of existing vessels and this program should be continued to further the understanding of underwater noise from existing and future classes of container ships.

Recommendation 16

The Panel recommends that the Proponent be required to continue efforts undertaken as part of the Enhancing Cetacean Habitat and Observation Program to measure the source level and underwater noise levels generated by existing and future classes of container ships, and report annually on their findings.

Recommendation 17

The Panel recommends that the Government of Canada evaluate, through a one year pilot project, compulsory measures to reduce underwater noise in collaboration with the Proponent and industry stakeholders.

8.5 Wave Environment**8.5.1 Proponent's Assessment**

In the MSA, the Proponent noted that waves arriving from open water were likely to interact with the shoreline in a variety of ways, including shoaling or the steepening and eventually breaking of waves as they travel from deep water to shallower water, reflection, and refraction, as the water depth decreases in the near-shore environment. The Proponent noted that the wave environment had the potential to interact with marine vessel traffic associated with the Project.

The Proponent explained that marine shipping associated with the Project would create vessel wake waves. Ship wake was considered in the assessment within the context of the existing wind-generated wave environment. The Proponent indicated that vessel wake had the potential to affect the physical environment of the shoreline and seabed, people, and the various ecological systems adjacent to shipping routes.

The Proponent noted that a potential change to the environment was anticipated if ship wake waves contributed to the total wave environment by adding to wind-generated waves, or if ship wake was generated during periods of calm such that people or wildlife would be affected by unexpected waves.

Wind Driven Wave Environment

The MSA acknowledged that the existing wind-wave climate was expected to vary greatly across the marine shipping area in response to differences in local wind conditions (i.e., wind speed, direction, and duration), variations in fetch length, and incoming swell from the Strait of Juan de Fuca. Specifically, the Proponent noted that the wave environment in the marine shipping area, including Segments A to C was dominated by wind-generated waves, and Segment D was dominated by both wind generated waves and swell from the Pacific Ocean. No field measurements of waves were conducted as part of the Proponent's assessment, rather existing information was used to characterize the wave climate.

In the absence of comprehensive wave measurements covering large areas of the Project area and the marine shipping area, the Proponent employed the University of Miami Wave Model, a two-dimensional, deep-water wave prediction model to generate simulated wave fields for the study year 2012. The wave field model required time dependent wind fields as primary input. These 2012 wind fields were determined by simple interpolation of wind data from seven available, government operated, meteorological stations in the study domain.

The resulting wave fields were evaluated by comparison with wave height data from three government-operated wave measuring stations in the deep-water model domain. Model output compared favourably with measurements, except at a station exposed to deep ocean swell at and near the mouth of the Strait of Juan de Fuca. The Proponent concluded that the model “meets or exceeds” the performance requirements to simulate the wave environment in the Salish Sea for the purposes of the assessing marine shipping associated with the Project.

The Panel requested further information with respect to the uncertainty of the model used to model wind-driven waves used in the assessment. In response to this request, the Proponent acknowledged that uncertainties were inherent in all models. The Proponent explained that uncertainty specific to this wave environment results from modelling a relatively complex environment with numerous islands and a complex shoreline; winds that vary in speed and direction on an ongoing basis; the use of hourly wind data to describe a phenomenon that naturally varies on the scale of minutes; and, the inability to capture the full complexity of the natural system.

The Proponent noted that the potential consequences of not including waves from passing vessels or waves generated in the open ocean in the characterization of the existing wave climate resulted in an under-representation of the magnitude and frequency of modelled background waves in the Strait of Juan de Fuca, particularly during the largest wave events. This constitutes an additional conservatism in estimating the effect of vessel wake waves from Project associated vessels.

Ship-Wake Driven Waves

Wake waves generated by a moving ship were not measured as part of the Proponent’s assessment. In the absence of direct measurements of ship wake waves in the marine shipping area, the Proponent employed the PIANC (1987) model, a ship wake wave model designed to simulate ship generated wake waves. The PIANC (1987) model is a scaling-level empirical model built from a wide collection of measured wake waves generated by actual ships and some scaled ships in towing tanks. Underlying the use of such models is the assumption that the ships being modelled are appropriately represented by ships in the model-generating data sets. The model calculates wake waves as a function of distance from the ship line of travel, and accommodates varying vessel speeds and water depths.

The Proponent examined the incremental changes to the wave environment from marine shipping associated with the Project using the PIANC (1987) model and concluded that vessel wake waves were a small component of the existing wave climate. The Proponent considered

that vessel wake less than 10 centimetres (cm) in height was well within the range of natural conditions and generally within the range of conditions described as calm. The Proponent indicated that container vessels generate waves that have similar height and structure characteristics to wind generated waves and wake from other passing vessels.

The Proponent indicated that the shorelines within the marine shipping area were exposed to wind-generated waves arriving from open water on an ongoing, long-term basis. Within the marine shipping area, the Proponent concluded ship wake waves of 10 cm or greater would only approach shoreline segments from deep water in Segment B, and only within three distinct zones of this segment. Within Segment D, the dissipation of wake waves was such that by the time wake waves reach the shoreline, the waves had either dissipated completely or had a height of less than 10 cm.

In Zones 1, 2, and 3, shown in the Figure 8-4 below, calm conditions were experienced about 40 percent, 46 percent, and 25 percent of the time, respectively; therefore, ship wake waves were expected to be exceeded by natural waves 60 percent, 54 percent, and 75 percent of the time, respectively. The Proponent's vessel-wake height modelling indicated that the majority of wake-related waves approaching shorelines from deep water in the LAA would be between 10 cm and 12.5 cm in height. The length of shoreline that falls within the zone of influence of existing vessel wake within Segment B was two percent of the total shoreline identified within the marine shipping area; the length of shoreline affected by vessel wake waves was not anticipated to change with future increases in the number of vessel movements.

The Proponent indicated that detailed investigations of the nearshore wave interactions such as shoaling, reflection, and refraction were not initially assessed since they considered these processes to occur in relation to the existing wave climate and would be unaffected by Project-associated vessels. In response to an information request from the Panel, the Proponent acknowledged that shoaling of vessel wake waves would result in larger shoaled vessel wake waves than shoaled wind-generated waves in Segment B of the marine shipping area.

The Panel requested the Proponent provide a discussion of the effects of vessel wake wave structure, rather than wave height alone, on small craft of various sizes. In response the Proponent indicated that the structure of wake waves generated by container vessels was not dissimilar from the wave structure of the spectra of local wind-generated waves currently recorded at the USA side of the marine shipping area, such as Neah Bay in Segment D and New Dungeness in Segment G.

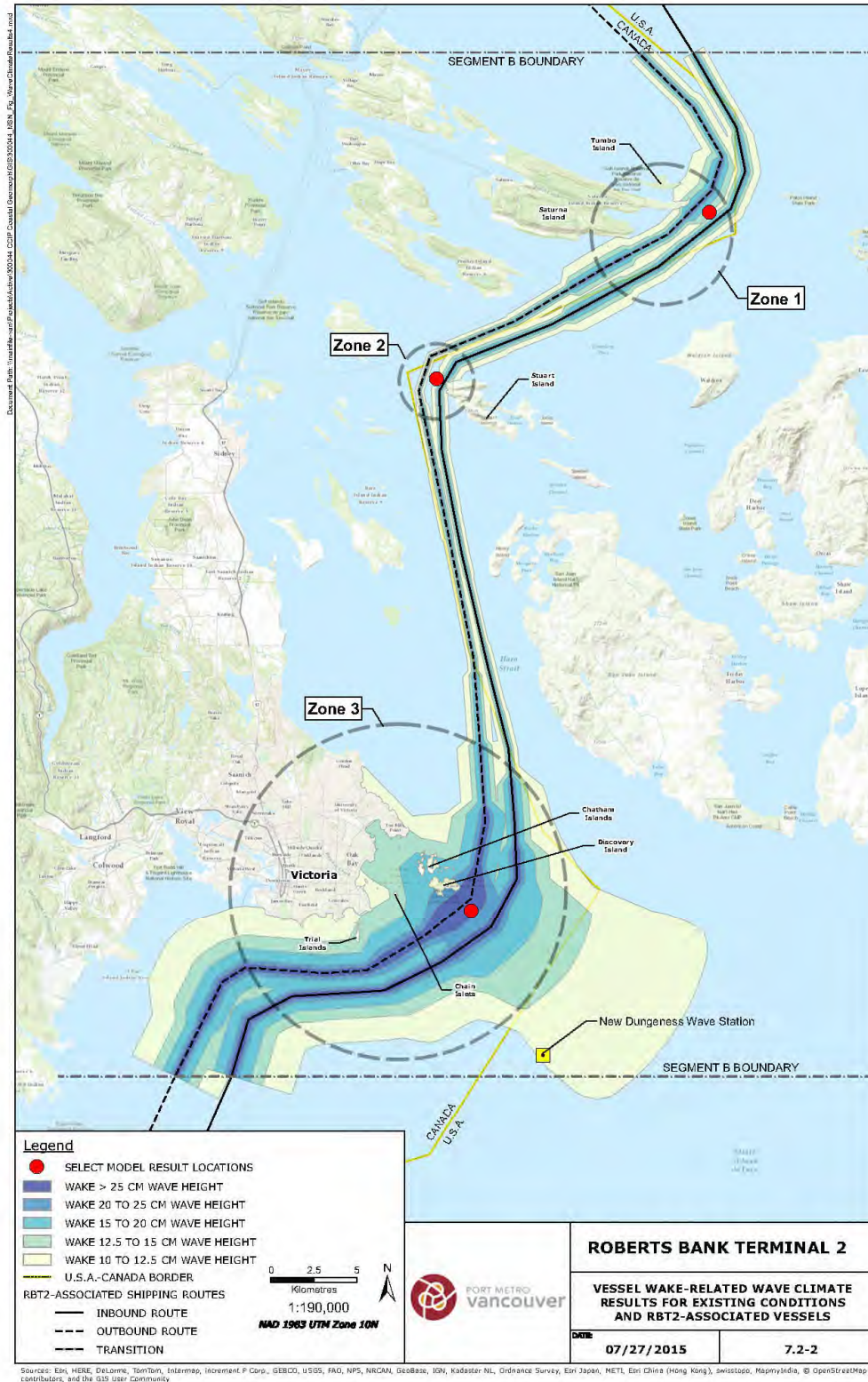


Figure 8-4: Vessel wake-related wave climate results for existing conditions and marine shipping associated with the Project (Source: MSA)

In response to further questioning at the public hearing, the Proponent acknowledged that a longer period wave was likely to have a greater influence on shoreline erosion than a shorter period wave. However, the Proponent submitted that shoreline processes in the marine shipping area were completely dominated by wind generated waves. The result was that vessels calling at the Project were not expected to contribute additional wake waves to the existing wave climate, and that the relative importance of wave period on shoreline erosion was already being expressed in the existing environment. The Proponent concluded that the Project would not influence shoreline erosion processes.

The Proponent concluded that in all cases, vessel wake wave heights were well within the range of natural conditions and would be indistinguishable from the spectrum of wind-generated waves except during calm conditions, at most shoreline locations in the study domain. The Proponent also concluded that Project-associated marine traffic was not expected to change how waves arriving from open water would interact with shorelines in the marine shipping area. Since the Proponent concluded that Project-associated marine vessels were not anticipated to measurably or perceptibly increase the wave climate available to interact with shorelines within the LAA, no mitigation measures were proposed.

Cumulative Effects Assessment

Waves generated by passing vessels contribute to the existing wave environment. Shorelines exposed to waves contributed by vessels transiting in the international shipping lanes were also exposed to wind-generated waves on an ongoing basis. During calm periods, the cumulative change in wake-related waves from all vessels transiting within the marine shipping area that would be perceptible in deep water in the vicinity of the shorelines was anticipated to increase by 36 percent over existing conditions but wave height would be unchanged from existing conditions.

The Proponent concluded that wake-generated waves from container vessels would not increase in the future with the Project. Additionally, larger vessels calling Port of Vancouver terminals in the future were expected to have lower cruising speeds and as a result would generate smaller waves.

8.5.2 Views of Participants

NRCan indicated that studies related to vessel wakes for Roberts Bank and other projects all show that wake-wave heights from large ocean-going vessels and escort tugs attenuate significantly with distance from the vessel. NRCan suggested that limiting vessel speed appropriately in the relevant section of the shipping lane would reduce wake-waves at the shoreline to undetectable (< 1 cm) levels. The additional waves experienced annually along the shoreline due to Project-associated vessels would be equivalent to the erosive effect slightly less than that of a single three-hour wind event. As predicted wave heights generated by vessels were well within the range of natural wave conditions, they would not have a significant cumulative effect on shoreline erosion.

Parks Canada's analysis of the wave environment relied on the Proponent's modelled predictions. Parks Canada stated that changes to the wave environment would have the potential to impact ecological integrity but would be limited to Tumbo Islands, East Point and Java Island in the Gulf Islands, and would generally be within the range of natural variability. Parks Canada did not anticipate residual impacts directly attributable to wake-generated waves from larger vessels associated with the Project of a severity or magnitude that would influence the ecological integrity of shorelines within the Gulf Islands.

During the public hearing, numerous Indigenous groups, including Pacheedaht, Ditidaht, and the Maa-nulth described the complex wave environment at Swiftsure Bank including the interaction of underwater topography, tide, existing swell, currents, and breaking of waves similar to shoaling and vessel wakes, even on calm days. The resulting unstructured and chaotic waves at Swiftsure Bank were described by fishers as "bucket slop", and "sideways" big waves. Fishers indicated that conditions could be unbearable in their small boats. Pacheedaht acknowledged that they must deal with strong winds, currents, and huge swells in their territorial waters, especially at Swiftsure Bank and along the rocky shoreline. Ditidaht presented a video of a 26-foot long fishing boat caught in the waves of estimated 4.5 m height arising from the wake of a passing container vessel.

Indigenous groups described traditional knowledge with respect to the predominant direction of natural waves in particular locations on the ocean, including at Swiftsure Bank and La Perouse Bank. A member from the Maa-nulth stated that he could detect the difference between wind-driven waves and ship wake waves: "The tides, the winds and the waves, I mean, those are the things that were handed down to me, knowledge from my father and from my grandfather, uncles."

Indigenous groups also expressed concern about amplification of ship wake waves at Race Rocks *XwaYeN* (meaning swift water) where the tidal complexities of Georgia Strait, Juan de Fuca Strait and Puget Sound intersect. Others noted that one can tell the waves from a ship wake because often they were in the opposite direction that the wind was blowing the natural waves, depending on which way the ship was travelling. Pauquachin First Nation expressed concerns about increased traffic and vessel size in the shipping lanes related to negative effects of vessel wake and wave action.

The Tsawout First Nation noted that "it is much rougher in winter as there are reefs there and it is shallower, so it gets rougher. There can be 12-foot swells". Tsawout First Nation also stated that when tankers go by, they create a large wake, even on a calm day.

The Cowichan Nation Alliance noted that the assessment within the MSA was based on the incorrect assertion that the energy from ship wake dissipates and was negligible when wind-generated waves were 10 cm or higher. The Cowichan Nation Alliance was of the view that the approach used by the Proponent was an oversimplification of assessing wave dynamics resulting in a neglect to address wave period, cumulative effects, and shoreline topography, all of which were critical factors in assessing the potential erosion effects of vessel wake. As described by the

Proponent, the Cowichan Nation Alliance was of the view that wake waves larger than 10 cm reaching the shoreline Zones 1 and 2 were not insignificant.

8.5.3 Panel's Analysis

The Panel considers that the University of Miami Wave Model selected for wind-wave modelling was appropriately implemented and the evaluation and modelling period were suitable. The Panel therefore concludes that the resulting assessment of existing wave climate provides an appropriate basis for an assessment of wave effects of Project associated shipping.

The Panel concludes that the PIANC (1987) wake wave model is an appropriate tool for assessing wake waves generated by Project associated shipping in the marine shipping area. The PIANC (1987) model, as applied by the Proponent in open water and deep bottom parts of the marine shipping area provides a reasonable modelling estimate of vessel wake wave height, structure, propagation and distance decay.

The Panel notes that data sets used in the generation of the PIANC (1987) model do not contain examples of container ships representative of ships associated with the Project. This feature implies that the modelled ship wake waves may not properly represent waves generated by container vessels such as those anticipated to be calling at the Project.

The PIANC (1987), and related ship wake wave models accommodate two specific cases – shallow- and deep-water applications. These two applications demand the appropriate use of a model parameter, which captures the distinction between wave heights generated in shallow or deep water. Wake waves generated by a ship travelling in deep water are considerably lower those generated by ships travelling in shallow water. The Proponent's PIANC (1987) modelling explicitly employed the deep-water application of the model in all parts of the marine shipping area, and did not apply the model in the shallow water mode, as is needed over the Swiftsure Bank, where waters are notably shallower than in the rest of the shipping lanes. The Panel is of the view that ship wake wave heights reported in the MSA are underestimated in parts of the marine shipping area where vessels are travelling over shallow waters, such as over banks, sea mounts, and other underwater topography. The Panel concludes that modelled ship wake wave height, where ships pass over shallower parts of the marine shipping area, would be substantially lower than wave heights that would actually occur.

Indigenous groups provided the Panel with information from their personal experiences of waves, many metres in height, arising from container ship wakes near Swiftsure Bank. The Panel takes this as direct evidence that, in shallower parts of the marine shipping area, and especially over Swiftsure Bank, the PIANC (1987) model, as applied by the Proponent, significantly underestimates wake wave height.

The Panel has considered the possibility that small boats traversing the deeper waters of Segment B could be affected by wake wave from Project-related container ships. Because wake waves dissipate strongly with distance from the ship line of travel, and small boats generally do not travel close to large ships, the possibility of a small boat being affected by large wake waves is

likely small. Notwithstanding these considerations, the Panel acknowledges evidence it received from various Indigenous groups that they have experienced waves in the marine shipping area that interrupt fishing or travel by creating a safety hazard. The Panel is of the view that ship wake waves experienced by small-craft operating in the vicinity of Swiftsure Bank will experience greater wake wave heights than those estimated by the Proponent.

The Panel concludes that actual ship wake wave height, where ships pass over shallower parts of the marine shipping area, would be substantially higher than those modelled by the Proponent.

The Panel notes that shoreline erosion in the marine shipping area is caused by waves driven by wind within the area, and waves originating in the Pacific Ocean entering the Strait of Juan de Fuca. In addition, erosion caused by wake waves from all classes of ships is superposed on this naturally occurring erosion thereby causing a cumulative effect.

The Panel notes that NRCan is of the view that effects on coastline erosion are unlikely, stating that studies related to vessel wakes show that wake-wave heights from large ocean-going vessels attenuate significantly with distance from the vessel. The Panel agrees with NRCan that limiting vessel speed appropriately in the relevant section of the shipping lane would reduce wake-waves at the shoreline.

The Panel has concluded that vessel wave wake heights are underestimated in parts of the marine shipping area where vessels are travelling over shallow waters, such as over banks, sea mounts, and other underwater topography. This would mean that waves generated in those waters, after propagating to shorelines, would be significantly larger at those shorelines than estimated by the Proponent. The Panel therefore expects that the modelled wake waves generated in shallower parts of the marine shipping area could lead to an underestimate of wake wave caused shoreline erosion due to Project associated vessels in parts of the marine shipping area.

The Panel acknowledges that all ship wake waves contribute to the total shoreline erosion that could occur in a given region. The effect will be most pronounced on shorelines of erodible substrate where shipping lanes approach within close proximity of shore. In the marine shipping area, such shorelines occur at the eastern ends of Tumbo and Saturna Islands; at the western end of Stuart Island; at the southeast corner of Vancouver Island in the vicinity of Victoria, at Discovery Island, and the island or islet groups of Chatham, Chain, and Trial.

The Panel accepts the advice of NRCan that Project associated vessels will not have a significant cumulative effect on shoreline erosion. In general, while ship wake waves do contribute to shoreline erosion, the Panel is of the view that the total long-term shoreline erosional effect of natural wind-driven waves will be far greater than cumulative erosion caused by ship wake waves of all ship movements in the marine shipping area.

The Panel concludes that ship wake wave height in shallower parts of the marine shipping area would constitute a safety hazard to small recreational and fishing boats.

The Panel concludes that ship wake waves from marine shipping associated with the Project would not contribute significantly to shoreline erosion in the marine shipping area beyond erosion caused by existing wind-driven waves.

These conclusions are used to support the Panel's conclusions on safety risks for small boats and on archaeological resources in Section 16 – Current Use of Lands and Resources for Traditional Purposes and Section 17 - Physical and Cultural Heritage Resources.

9 Effects of the Environment on the Project

This section describes how local environmental conditions and natural hazards, such as severe storms or extreme weather conditions and external events, could affect the Project. The section also addresses planning, design, construction strategies, and mitigation measures to address these effects.

9.1 Proponent's Assessment

The Proponent evaluated the potential environmental effects associated with interactions between natural phenomena and the Project. These included: climate change, extreme weather and weather-related events: seismic activity; sea-level rise, submarine landslides; tsunamis; and subsidence (land settlement). Within the assessment, the Proponent concluded that the potential environmental effects from underwater landslides, tsunamis and land settlement would be fully mitigated through design and management practices. The Proponent also took into account climate change and effects of the environment during Project planning, design and development of mitigation measures.

Climate Change and Extreme Weather Events

British Columbia's south coast has a temperate maritime climate with mild, wet winters and, moderate dry summers. Most precipitation falls as rain rather than snow, particularly at low elevations characteristic of the Fraser River estuary and Roberts Bank area. Extreme weather-related events that could affect the Project include heavy rain or snowfall, high winds, ice, fog, and storm-wave overtopping.

Heavy Rain and Snow fall

Heavy rain, freezing rain, or snowfall may increase the risk of vehicle accidents resulting in a release of deleterious materials into the marine environment. Heavy rainfall may also erode mobile granular surfaces or preload areas within the containment dykes at the terminal and along the widened causeway, carrying sediments into the marine environment. Prolonged heavy rain or the accumulation of snow, followed by rapid melt may result in a surge of increased surface runoff from paved areas, temporarily exceeding the capacity of the stormwater system.

The Proponent stated that it would conduct snow removal and surface de-icing measures as necessary in the event of a heavy snowfall during construction or operations. In the event of a motor vehicle accident along the causeway, initial spill response and containment measures would be implemented according to the Proponent's Spill Preparedness and Response Plan.

The Proponent indicated that the implementation of stormwater collection and, erosion and sediment control measures, to prevent the discharge of sediment-laden runoff from terminal and causeway work areas, would be standard management practices and work procedures during construction. During operations, the stormwater drainage system for the Project would accommodate flows generated during a 1 in 10-year rainstorm, with a 15-minute time of concentration. The Proponent has designed these facilities to allow for a 15 percent increase in

rainfall intensity over present conditions to account for future possible changes due to climate change. Collected drainage water would pass through interceptors, installed to CCME standards.

High Winds, Waves, and Storm Surges

The main driving forces for wave generation on Roberts Bank are storm wind speed and storm duration.

Storm surges occur when strong winds, low atmospheric pressures, and wave action generated during a storm event combine to create abnormally high sea levels. The potential effects of a storm surge on the Project would be greater if a severe storm coincides with an extreme high tide. Although the Project area is not at risk of coastal flooding associated with high Fraser River discharge during freshet, the Project could be subject to higher water levels, especially in the winter when high tides and storm conditions coincide.

High winds, waves and storm surges could interfere with construction activities such as dredging, barge movements, and equipment installation. High winds could also result in the airborne dispersion of fines from areas where sediments were exposed, affecting air quality or marine habitat due to the deposition of the fines into the marine environment. The Proponent stated that with the use of: weather forecasts; storm warning monitoring; temporary suspension of construction activities; and, of water spray or tarps, it would avoid weather-related incidents and minimise wind-borne dispersion of fines.

The Proponent indicated that during operations, vessels at berth could be damaged if wind and wave limits were exceeded. In addition, localised scour between the face of the terminal and the face of the existing Westshore Terminals complex could result from wave reflection and short-crested standing waves if wave heights were exceeded.

The Project design is based on the presumption that the present storm population is a good proxy for future storm population. Critical design features to mitigate potential effects include the ability of the terminal area to drain rainwater during high rainfall rate events. Environment and Climate Change Canada advise that with global warming, the frequency and intensity of atmospheric rivers on Canada's West Coast will increase and this will result in winter mean precipitation along the west coast increasing by 10 - 15 percent, with precipitation on extreme atmospheric rivers days increasing by 15 - 40 percent, by the end of this century.

The Proponent requires that all buildings and structures on Port Authority-managed lands be designed, constructed, and installed in compliance with relevant Canadian codes and standards, including the National Building Code of Canada. Where Canadian standards do not exist, other industry-recognized international standards and codes were utilized in the Proponent's designs and assessments.

The Proponent stated that compliance with the National Building Code of Canada and other applicable codes and standards would ensure that the Project was capable of withstanding a 1 in 50-year storm event. Performance criteria incorporated into Project design would ensure that the Project could withstand wave heights equivalent to a 1 in 100-year storm event. The Proponent

indicated that these design standards would address the effects of future storm events, including those due to climate change.

Sea-level Rise

The Proponent reported that global climate change would result in changes to weather patterns, including increased storm frequency and intensity, extreme summer and winter temperatures, and increased volume of water in the world's oceans. Over the life of the Project, sea level rise may amplify the effects of rainfall, wind, waves, and tidal action in the Project area. These effects may result in an increase in erosive forces on marine structures and surfaces, as well as increased stormwater runoff. Sea level rise driven by climate change could also affect the Project through overtopping of wharf structures, especially during high tides and under storm surge conditions. Since the Proponent would address these effects in Project design, interference with Project operations was not anticipated.

The Proponent stated that the Project's preliminary design provided for a net sea level rise of 0.5 m and for the drop in sea level associated with long-term settlement (0.5 m) that is anticipated to occur in the area within the same timeframe. Since the overall net change in sea level would be gradual, the Proponent does not expect sea level rise to adversely affect Project construction or operations. The Proponent acknowledged that the recently published Ministry of Environment report (Ausenco Sandwell, 2011) recommends a one-meter sea level rise be used for all coastal flood protection projects with a design life of 50 to 100 years. Since the Project was not categorized as a sea defence project and taking into consideration the probability of a 1-in-100 year extreme event occurring during the design life of the Project, the Proponent stated that a 0.5 m sea level rise adjustment to the 1-in-100 year estimated design still water level would be reasonable.

In response to concerns from BC Ministry of Environment and Climate Change Strategy, NRCan and the Panel, the Proponent confirmed that its analysis of sea level rise considered up to 1.4 m of global sea level rise and the effects of settlement of the terminal itself, roughly 250 mm. The assessment also took into account the settlement of the underlying Fraser Delta and the isostatic movement up to the year 2100, which corresponds to roughly 0.46 m of settlement. Therefore, the Proponent's assessment considered up to a total of 1.86 m of global sea level rise.

In order to accommodate future relative sea level rise, the Proponent has adopted project design criteria for the terminal based on the 2011 BC Ministry of Environment *Guidelines for Management of Coastal Flood Hazard Land Use*. The practical expression of these design guidelines is a long-term, staged risk-based approach, which explicitly includes 50 cm relative sea level rise and ability to implement adaptive phased management measures to accommodate relative sea level rise of 1 m or more by the year 2100. The design includes a perimeter bull wall that can be built up as needs arise.

The Proponent predicted that over the long term (50 to 100 years), sea level rise would have adverse consequences for intertidal habitat throughout the Fraser River delta, including Roberts Bank. In the Project area, intertidal habitat established on the north side of the causeway to

mitigate Project effects would be gradually inundated, altering the intertidal habitat to subtidal habitat. The Proponent stated that this gradual conversion to subtidal habitat was not unique to the Project and would occur at other intertidal locations within the Fraser River estuary and along the coast. Due to the presence of dyke structures and the widespread nature of sea level rise-related changes the Proponent stated it would not be possible to mitigate effects of the environment on the Project by establishing new intertidal habitat.

Seismic Activity

The Project site is located in southwestern British Columbia, a seismically active zone. There are active faults within 100 km of the Project site. The seismic risk in the Project area arise from the potential for three basic types of earthquakes: shallow crustal, deep intra-plate and subduction. The Proponent described that earthquake-related effects were associated with ground shaking, and in certain soil conditions, soil liquefaction. Seismic activity in the form of earthquakes could also affect the Project through shaking damage of buildings, cranes, wharves and the causeway overpass.

Ground-shaking levels at the Project site were established using a probabilistic seismic hazard models and seismogenic zones, developed by NRCan on a regional basis for use in the National Building Code of Canada. The Proponent updated values to reflect the 2015 National earthquake hazard model and confirmed that the Project would comply with that model, and would incorporate any revisions to the codes and standards applicable at the time of permit application. The Proponent stated that the seismic design criteria were achievable with standard design and construction practices as stipulated by the codes and standards. The Proponent stated it would apply a one in 2,475-year earthquake design level for the terminal buildings and bridge structures as well as a 1 in 1,000-year earthquake design level for the wharf structure.

The Proponent reported that deltaic soils in the vicinity of and underlying the Project were vulnerable to liquefaction during a large-magnitude earthquake.

Due to the Project's relatively short construction phase compared with the predicted return period of a significant seismic event, the Proponent considered the likelihood of an earthquake occurring during construction to be low. Should such an event occur however, its effects on the Project and the environment would depend on the magnitude of the seismic event and stage of construction. Potential effects on the Project may include sloughing of materials from containment dykes, or terminal and widened causeway preload areas, resulting in marine habitat loss or degradation. The potential for liquefaction of the soils underlying the Project terminal would be mitigated through ground improvement measures during construction.

During operations, damage may range from minor, resulting in a temporary interruption of onsite activities, to catastrophic, potentially resulting in the loss of main road access to the terminal due to failure of the existing causeway. Given seismic design requirements, the Proponent considered the collapse of terminal structures not likely.

The Proponent proposed measures to protect the Project during a seismic event, including the dredging of low-permeability soils and silts with poor seismic performance, followed by vibro-densification to improve stability. The Proponent stated that further investigation of measures to protect the Project during submarine landslides and tsunamis would be considered during detail design. The effects of a catastrophic natural event would be widespread in the Fraser River delta and would not be unique to the Project.

9.2 View of Participants

NRCan confirmed that southwestern British Columbia was very close to an active tectonic zone and the highest seismic hazard areas in the country. NRCan concluded that the Proponent adequately characterized the earthquake hazards of the region. NRCan was satisfied that the Project would comply with relevant statutes, regulations, policies and other laws applicable at the time of construction. During the review, NRCan noted that the Proponent did not discuss non-linear response analysis to assess soil response during strong shaking. In response, the Proponent indicated that this analysis would be conducted at the detailed design stage by the Infrastructure developer. NRCan was satisfied with the Proponent's proposal for future work during detailed design.

In a joint submission, the BC Ministry of Environment and Climate Change Strategy and NRCan reported that sea level rose in excess of one millimeter per year through the twentieth century and in the recent two or three decades to over three millimetres per year. The Fifth Assessment Report of the Intergovernmental Panel on Climate Change produced projections of global sea level rise through this century based on scenarios of projected future carbon dioxide concentrations in the atmosphere. The report predicted that sea levels would rise between 25 cm and one meter by 2100. NRCan developed an enhanced scenario that contributed an additional 65 cm of sea level rise. This high scenario gave a total of nearly 1.4 m of sea level rise by 2100.

NRCan clarified that global sea level rise; the average sea level rise over all of the ocean basins relative to the centre of the earth, is not what is experienced locally. Relative sea level rise was the amount of sea level rise that would be experienced relative to solid land. NRCan further indicated that the Fraser Delta is an area of natural subsidence of 1-2 millimetres per year due to thick deposits of shallow Holocene sediments and large amounts of subsidence, 3.5 mm per year in some locations, were occurring at the Roberts Bank terminals.

NRCan stated that 50 cm of relative sea level rise was projected between 2060 and 2070 (95 percentile) and one hundred centimeters was projected between 2090 and 2100. These values were in the absence of large manmade structures. If global sea level rises by 100 cm, and the land sinks by 50 cm at a specific location, then the relative sea level rise would be 150 cm. NRCan recommended that the Proponent confirm that they would account for post-construction settlement separately from the 50 cm of sea level rise.

Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD) submitted that, in addition to past port development, the proposed Project may impair the ability of the tidal ecosystems of Roberts Bank to remain resilient to the increase in sea level.

Communities throughout the delta rely upon the wave attenuation capacity of foreshore tidal marshes to contribute to coastal flood protection, in addition to the network of dikes. However, throughout the Fraser River Delta front, tidal ecosystems cannot migrate landward due to the presence of dikes. With sea level predicted to increase by one meter by 2100, sediment input and accretion would be necessary to ensure the foreshore marshes would be resilient and could exist with sea-level rise. FLNRORD's satellite imagery showed that the presence of the Deltaport causeway appears to have changed the delivery of sediment to Roberts Bank. FLNRORD concluded that if additional port development at Roberts Bank further inhibits sediment delivery to the foreshore southeast of the Delta causeway, the ability of tidal ecosystems to respond to sea level rise would likely be affected.

BSC stated that the Updated guidelines for the environmental impact statement required the Proponent to assess the "longer-term environmental effects of potential future sea level rise and other changes to the climate on the project and surrounding ecosystems". BSC pointed out that the Proponent had only done a partial job fulfilling this requirement. For instance, the Proponent reported, "while not considered directly in the assessment of Project-related effects, climate change will play an increasingly large role in shaping the Roberts Bank tidal flats into the future." With coastal squeeze a pervasive issue for all new projects proposed in coastal areas, including the Fraser estuary, BSC was of the view that this omission was a significant gap in the Panel's ability to understand how the region's ecosystem would change over the lifetime of the Project. BSC recommended that the Proponent be required to submit an assessment of climate related impacts on the LAA and how those impacts would interact with project related impacts.

A number of participants raised concerns on the effects of sea level rise on the Project. Tsawwassen stated that sea level rise would squeeze brackish marshes and eelgrass beds between deep water and landward dikes, narrowing their distribution. One participant reported that rising sea levels were resulting in a loss of intertidal marshes because the existing dykes presented a hard, fixed line along their rip rapped face and that proposals to construct hard faced causeways into the ocean were an outdated approach.

9.3 Panel's Analysis

The Project has relatively low vulnerability to effects from the external environment. This is because of the nature of the Project, and design features specifically chosen to minimize vulnerability. The following local conditions and natural hazards were considered as having potential to affect the Project: extreme weather and weather-related events; seismic activity; submarine landslides; tsunamis; subsidence (land settlement); and climate change and related sea level rise.

Based on explicit and implicit advice from NRCan, the Panel agrees with the Proponent conclusion that the risks of environmental effects on the Project from underwater landslides, tsunamis and land settlement can be fully mitigated through design and management practices. The Panel does consider risks from extreme weather events, seismic activity and sea level rise worthy of specific consideration.

Extreme Weather Events

Extreme weather events could affect the Project through wind damage, storm-wave overtopping and rainfall flooding.

The Project design is based on the presumption that the present storm population is a good proxy for future storm population. Critical features include the ability of the terminal area to drain rainwater during high rainfall rate events. ECCC advise that with global warming, the frequency and intensity of atmospheric rivers on Canada's West Coast will increase and this will result in winter mean precipitation along the west coast increasing by 10 to 15 percent, with precipitation on extreme atmospheric rivers days increasing by 15 to 40 percent, by the end of this century.

The terminal design with regard to drainage has incorporated a 15 percent increase in rainfall over the current rainfall amounts. The Panel accepts the Proponent's level of conservatism in terminal design as appropriate protection against terminal flooding in possible future increases in winter mean rainfall rates. The Panel concludes that extreme rainfall events under atmospheric rivers later in the present century may result in exceedances of the terminal storm-water drain capacity. The Panel accepts the Proponent's operational plans and design performance criteria as appropriate for protection and mitigation of effects due to extreme wind events.

Seismic Activity

Seismic activity in the form of earthquakes could affect the Project through shaking damage of buildings, cranes, wharves and the causeway overpass.

The Panel acknowledges the advice of NRCan that the Project design provides appropriate levels of protection against effects from foreseeable seismic events. The Panel notes that seismic design criteria will be consistent with relevant codes or standards for buildings, overpass structures and wharves that will be in force at the time of detailed design.

Sea-level Rise

Sea level rise driven by climate change could affect the Project through the overtopping of wharf structures, especially during high tides and under storm surge conditions. In order to accommodate future relative sea level rise, the Proponent has adopted project design criteria for the terminal based on the 2011 BC Ministry of Environment *Guidelines for Management of Coastal Flood Hazard Land Use*.

The practical expression of these design guidelines is a long-term, staged risk-based approach, which explicitly includes 50 cm relative sea level rise and ability to implement mitigation modification measures to accommodate relative sea level rise of 1 m or more. The design includes a perimeter bull wall that can be built up as needs arise.

NRCan advised the Panel that the Proponent's design for the 2050 to 2070 time-frame is compatible with projected relative sea-level rise, and that the Proponent's risk-based adaptive approach may incorporate about 100 cm of relative sea-level rise by 2100. In addition, a high-

end scenario could consider 140 cm or more of relative sea-level rise by 2100. The Panel accepts this advice and concludes that the Proponent proposed modifications of the current design will give adequate protection against effects of relative sea-level rise for the foreseeable future.

FLNRORD advised that BC Guidelines for Management of Coastal Flood Hazard Land Use are not applicable to the Project since they are land-based guidelines. The Panel notes that this advice notwithstanding, relative sea-level rise allowances and strategy are consistent with these guidelines.

The Panel concludes that the design of the Project adequately accounts for possible adverse effects of the environment on the Project in the short term and up until the year 2050.

10 Offsetting

This section addresses the Proponent's approach to offsetting as a mitigation measure for multiple environmental components. Offsetting as a mitigation measure for specific subcomponents of marine vegetation, marine invertebrates, marine fish, and coastal birds is discussed in more detail in the applicable sections of the report.

10.1 Proponent's Assessment

The Proponent proposed an offsetting framework for the creation and enhancement of habitats to mitigate adverse effects on the productivity of the Roberts Bank ecosystem that could not be fully mitigated through avoidance or reduction.

The framework was based on the following five principles:

1. Soften, to the extent possible, the proposed hard substrate perimeter of the Project to better match substrates that are ecologically representative of the estuary;
2. Enhance or create offsetting habitat that suitably replaces aquatic habitat affected by the Project but delivers higher ecological value or productivity;
3. Build habitat types for which there is a successful past precedent;
4. Consider physical changes arising from project development in determining the types of habitats to be built; and
5. Include habitats that provide benefits for species of concern to Indigenous groups.

The Proponent adopted recommendations from the technical advisory group it established on the topic of productive capacity, as well as current federal science advice and policy for major projects, and DFO's guidance on offsetting. The Proponent indicated that the design of the proposed offset habitats included features to ensure the habitats would function as intended, such as, mimic natural processes in the intertidal flats, avoid eutrophication via accumulation of organic carbon and nutrients and anticipate sea-level rise.

The RBEM informed the types and approximate amounts of offsetting required. Five habitat types, totalling 29 ha in extent, were developed at a conceptual level and would be constructed during years 1 to 5 of Project construction:

- 15 ha of intertidal marsh;
- 4.5 ha of sandy gravel beach;
- 3 ha of eelgrass;
- 4.5 ha of mudflat; and
- 2 ha of rock reef.

The offset habitats would be situated on site, as shown in Figure 10-1.



Figure 10-1: Overview of proposed onsite habitat concept locations (Source: EIS, Volume 3)

Based on the RBEM results, including the proposed offset habitats, the Proponent predicted an overall biomass increase of up to 4.4 percent compared to the biomass at Roberts Bank without the Project. This corresponds to an annual net increase of over 1,100 tonnes in biomass at Roberts Bank with the Proponent's proposed offset habitats.

In response to an Information Request from the Panel to quantify direct habitat loss due to the Project footprint, the Proponent tabulated habitat losses on an areal basis, as shown in Table 10-1. The habitat losses associated with construction of the Project would total 176.8 ha, across a number of habitat types.

Table 10-1: Direct habitat loss for each habitat type by Project component (Source: Adapted from Project public registry document 1360, IR11-13)

Habitat Type	Tug Basin (ha)	Causeway (ha)	Dredge Basin (ha)	Terminal (ha)	Total
Rockweed	0.45	4.80		0.58	5.83
Sand	1.13	0.37	1.40	35.36	38.26
Native eelgrass	2.8	0.47		2.79	6.06
Biofilm		0.01			0.01
Ulva		17.75		1.21	18.96
Grass		3.61			3.61
Intertidal marsh		12.26			12.26
Mud		0.21			0.21
Non-native eelgrass		2.97			2.97
Dense sea-pen			1.96	13.64	15.60
Sparse sea pen			10.55	62.53	73.08
Kelp				0.03	0.03
Total	4.38	42.45	13.91	116.14	176.88

The Proponent explained that based on expert advice and DFO's scientific advice and policy under the *Fisheries Act* it had used a productivity metric to assess the effects of the Project rather than using areal extent.

The Proponent committed to developing a final Offsetting Plan in collaboration with Indigenous groups and regulators. During development of the final Offsetting Plan, the Proponent would consider Indigenous Groups' priorities and focus on key species such as Chinook and chum salmon and high productivity habitats such as marshes and eelgrass beds. The final Offsetting Plan would also address and account for uncertainty in offsetting success and the associated time lag for the offset to become effective.

With offsetting, the Proponent predicted that the Project would not result in significant residual adverse effects on biophysical environmental components and would achieve a net increase in overall ecosystem productivity at Roberts Bank. The Proponent stated that it had a long track record of successful offsetting via habitat creation in the Fraser River estuary.

The Proponent made a commitment to develop follow-up programs to measure the effectiveness of eelgrass, intertidal marsh, sandy gravel beach, mudflat and subtidal rock reef offsets. The Proponent stated it would undertake monitoring and adaptive management to ensure that offsetting projects were successful over the long-term and that ecosystem and species productivity goals were met. Further, the Proponent would monitor invasive species to verify effects predictions of Project-related changes to geomorphic features and sediment texture, erosion and deposition. This element would support other follow-up activities related to the offsetting concepts by ensuring they fit in with the natural processes of the intertidal flats.

10.2 Views of Participants

DFO commented that the creation of eelgrass, tidal marsh, and rocky reef offsets were commonly proposed to offset project effects in the marine environment, and that there were many examples of successful construction of these habitat types. Mudflat and sandy gravel beach offsets were relatively uncommon and there was uncertainty whether these habitats were likely to be successful. DFO added that they were supportive of the creation of sandy gravel beach for forage fish spawning, but that success of the proposed sandy gravel beaches might be limited by the lack of natural erosion processes to supply sediments and lack of overhanging vegetation.

DFO discussed how some of the Proponent's offsets for Deltaport Third Berth were successful, while others did not function as intended. Successful examples included tidal channel restoration, refugia openings in the terminal caissons, subtidal reef and marsh creation. However, monitoring showed that some of the offsets constructed along the east side of the existing Roberts Bank causeway, which include marsh lagoons, marsh bench, sandy gravel beach, sand and silt beaches and upland riparian habitat, did not function as intended. Compliance monitoring indicated that the majority of the east causeway constructed habitats underperformed due to erosion, deposition of eelgrass wrack and woody debris accumulation.

DFO noted that an equivalency analysis was generally required to determine the extent to which offsetting would counterbalance productivity losses. DFO observed that using total functional group biomass as an equivalency metric was an unusual approach and didn't necessarily focus on specific taxa or habitat features of interest due to their relevance for conservation, cultural or harvest values. Ecosystem total biomass at Roberts Bank was dominated by primary producers, which might not serve as a reliable indicator for productivity responses of specific taxa or species of interest. Further, it may not capture other forms of ecological benefit such as habitat complexity.

DFO stated that the Proponent's assumptions in the calculation of offset benefits may have been inaccurate and remained unsubstantiated because the productivity of the offsetting habitats was assumed to be similar to the most productive habitats of the same type. DFO stated that the

RBEM was only one line of evidence and recommended that more than one approach be used to assess offsetting, such as productivity per functional group per habitat type. This would permit a more robust understanding of how the offsetting concepts counterbalance residual effects. DFO advised that offsetting measures should be increased in order to manage uncertainty associated with offset design, construction, time lags and effectiveness. DFO concluded that the Proponent should reconsider Project design to reduce the adverse effects of the Project and potential effects on fish and fish habitat or increase proposed offsetting in order to meet DFO's policy objectives under the *Fisheries Act*.

DFO commented on the use of offsite offsetting and habitat banks as options to supplement the proposed onsite offsetting. DFO noted offsite offsetting would need to meet objectives for the sustainability and ongoing productivity of fisheries, benefit species that would be adversely affected by the Project, and be located in the Fraser River estuary. DFO also stated that using habitat banks of fully functional productive habitat may reduce or eliminate uncertainty and time lags. DFO noted that the Proponent is a national leader in creation of habitat banks.

ECCC advised that the proposed offsets would not fully mitigate potential effects on wetland habitat and wildlife that rely on it. ECCC's views were based on the uncertainty associated with offsets, pertaining to adequate design, establishment of suitable vegetation and accounting for time lags. ECCC also identified additional uncertainty related to failed habitat restoration activities and the added time that would be needed to redesign and implement a functional offset.

ECCC commented that the Proponent possessed the capacity to successfully conduct the offsetting concepts it proposed but uncertainties remained in terms of the offset's abilities to fully compensate for residual effects on wetland functions and wildlife. To account for uncertainty and time lags, ECCC recommended a compensation ratio of 4 to 1 to offset loss of wetlands. ECCC stated that mudflat ecology was not well understood and that the compensation ratio required should account for the following factors: area loss, time lags, uncertainty and ecological role for sensitive wildlife. In addition, ECCC advised there was no known way to recreate the mudflat habitat found at Roberts Bank, which could have implications for biofilm and coastal birds.

FLNRORD advised the Panel that fish habitat compensation in the Fraser River estuary had been largely unsuccessful at creating, restoring, or enhancing fish habitat. FLNRORD referenced a 2016 report from the Community Mapping Network that found that only one third of sampled marsh habitat compensation sites in the Fraser River estuary created between 1983 and 2010 were compensating for habitat losses at acceptable levels. Although FLNRORD mentioned that the Proponent's Habitat Enhancement Program had attempted to incorporate the suggestions of the report, it advised that it would be more difficult to create a tidal marsh than to ensure the effective protection of existing marshes.

FLNRORD stated that sea-level rise may contribute to further coastal squeeze and recession of marshes towards the dykes at Roberts Bank, as observed for marsh habitats at Sturgeon Bank. FLNRORD emphasized that habitat creation projects within the Fraser River delta should

consider sea-level rise in their design and operations and be based on the prediction that sea-level rise was anticipated to drown over 33 percent of the tidal marshes of the Fraser River estuary.

Tsawwassen was of the view that there was a great deal of uncertainty about the success of the Proponent's proposal to build offset habitats and was unable to determine whether these were appropriate mitigation measures. Tsawwassen stated that the proposals must be developed and assessed in detail before a decision could be made on the Project.

Musqueam commented that without a substantial increase in offsetting measures there was great uncertainty in potential adverse effects on juvenile salmon, white sturgeon and eulachon, which may lead to potential infringement of their rights. Musqueam recommended that a "Major Fish Habitat Restoration Project on the Fraser River Delta" was necessary to maintain or recover population levels to satisfy their right to fish. Musqueam considered that an adequate offsetting ratio should be 10 to 1, rendering the Proponent's approach insufficient. A more ambitious restoration project could address uncertainties associated with time lags in the effectiveness of habitat offsetting. Musqueam proposed that the Proponent work with them and Tsawwassen to plan and implement a restoration project in partnership with relevant government agencies.

Ecojustice was of the opinion that the Proponent's assessment was not supported by past experience with respect to effectiveness of offsetting measures. Ecojustice referenced the South Marsh Inter-causeway Project undertaken in 2010 to mitigate effects of the Deltaport Third Berth project and noted that following remediation of certain offsetting types it was still unknown whether the habitat was fully functional. While Ecojustice acknowledged the Proponent's efforts to address offsetting failure, it remained concerned with additional time lags that could occur for future offsetting associated with the Project. Ecojustice stated that time lags in the achievement of functional offset habitats could have significant impacts, particularly on Chinook salmon and SRKW, due to the lack of resilience in both populations. Ecojustice concluded that the Proponent's proposed offsetting plan was not sufficient to mitigate the Projects' residual effects and that those effects could be significant.

10.3 Panel Analysis

The Panel acknowledges that the Proponent developed a relevant set of offsetting concepts that provide a means to potentially mitigate Project effects on marine environmental components, including juvenile salmon and crabs. The Panel agrees with participants that previously conducted offsetting projects in the Fraser River estuary have had mixed success. The Panel agrees with participants that monitoring and adaptive management would be essential to implement functional offset habitats over the life of the Project. The Panel notes that the Proponent is highly experienced in developing offsets in the Fraser River estuary and has remediated previous offsets that did not function as intended. The Panel is of the view that the Proponent's follow-up program and suggested approach to apply its experience for the development of the final Offsetting Plan for the Project are adequate.

The Panel notes that the Project would alter 176.8 ha of existing habitat and that the conceptual Offsetting Plan would generate 29 ha of offset habitat. The habitat equivalency metric adopted

by the Proponent was based on total ecosystem biomass, as a measure of productivity, with and without the Project. The Panel agrees with DFO that a productivity approach targeting ecologically and socially important functional groups would be preferable to a total biomass indicator as most of the biomass in the LAA is represented by primary producers and habitat forming organisms and is not necessarily representative of potential effects to species of interest.

Out of the five proposed offsetting habitat concepts, the Panel considers intertidal marsh, rocky reef and eelgrass habitats to be well-established concepts for offsetting, provided they are properly designed, monitored and remediated as required. Based on DFO and participants comments on past offsetting of sandy gravel beaches, the Panel is less confident that sandy gravel beach habitats would function as intended and be stable following construction. The Panel observes that the mudflat offsets are not proven concepts and have unknown chances of success.

The Panel was advised by DFO that during the permitting phase, should the Project proceed, they would rely on a habitat equivalency analysis to demonstrate that productivity increases via offsetting are commensurate with the scale of productivity losses due to the Project. The Panel agrees with DFO that the negative effects of the Project would need to be reduced, or alternatively the offsetting would need to be increased.

In terms of direct habitat loss, the Project would permanently alter 177 ha of Roberts Bank, most of which is in shallow sub-tidal sand flat habitat. The ratio required to offset productivity losses associated with direct and indirect effects on habitat would need to account for both time lags between offset construction and functionality, as well as uncertainty in their effectiveness. The Panel is of the opinion that it is unlikely that there are sufficient onsite offsetting opportunities in the vicinity of the Project in order to compensate for the loss of productivity.

The Panel concludes that the proposed offsetting plan, totaling 29 hectares, is not sufficient to compensate for the reduction in productivity associated with the habitat loss of 177 hectares at Roberts Bank.

Recommendation 18

The Panel recommends that the Proponent, in collaboration with Fisheries and Oceans Canada, Environment and Climate Change Canada, the Tsawwassen First Nation and the Musqueam Indian Band, be required to:

- *Develop an offsetting strategy that includes onsite and offsite offsets in adjacent areas of the Fraser River estuary, for example Sturgeon Bank; and*
- *Monitor the offset habitats until such time that it can be demonstrated that they are fully functional.*

11 Marine Vegetation

The Project footprint would result in the direct loss of marine vegetation and wetland habitat at Roberts Bank. The Project's effects due to changes in water quality, sedimentation and coastal processes have the potential to alter marine vegetation and wetland habitat. Such alterations could result in effects on marine invertebrates, marine fish, and coastal birds.

11.1 Methodology

The Proponent assessed the potential effects from the Project on the productivity of five subcomponents of marine vegetation: biofilm; intertidal marsh; eelgrass; macroalgae; and, biomat. The LAA spatial boundary for marine vegetation was similar to the study area for the RBEM.

The Proponent used terrestrial ecosystem mapping to define habitat types for marine vegetation, as well as hyperspectral imaging for biofilm. Based on the mapping of habitat classification, the Proponent estimated that the Project footprint would overlap with 177 ha of several habitat types, including marine vegetation, as shown in Figure 11-1. The effects on productivity of marine vegetation were primarily determined by the RBEM.

11.2 Biofilm

11.2.1 Proponent's Assessment

The Proponent assessed the potential direct and indirect effects of the Project on biofilm. The Proponent described biofilm as microphytobenthos dominated by diatoms, which combine with extracellular polymeric substances and sediment particles to form an important food source for grazers like the Western sandpiper and marine invertebrates. Biofilm on Roberts Bank is concentrated in the upper intertidal area of the LAA, as illustrated in Figure 11-2.

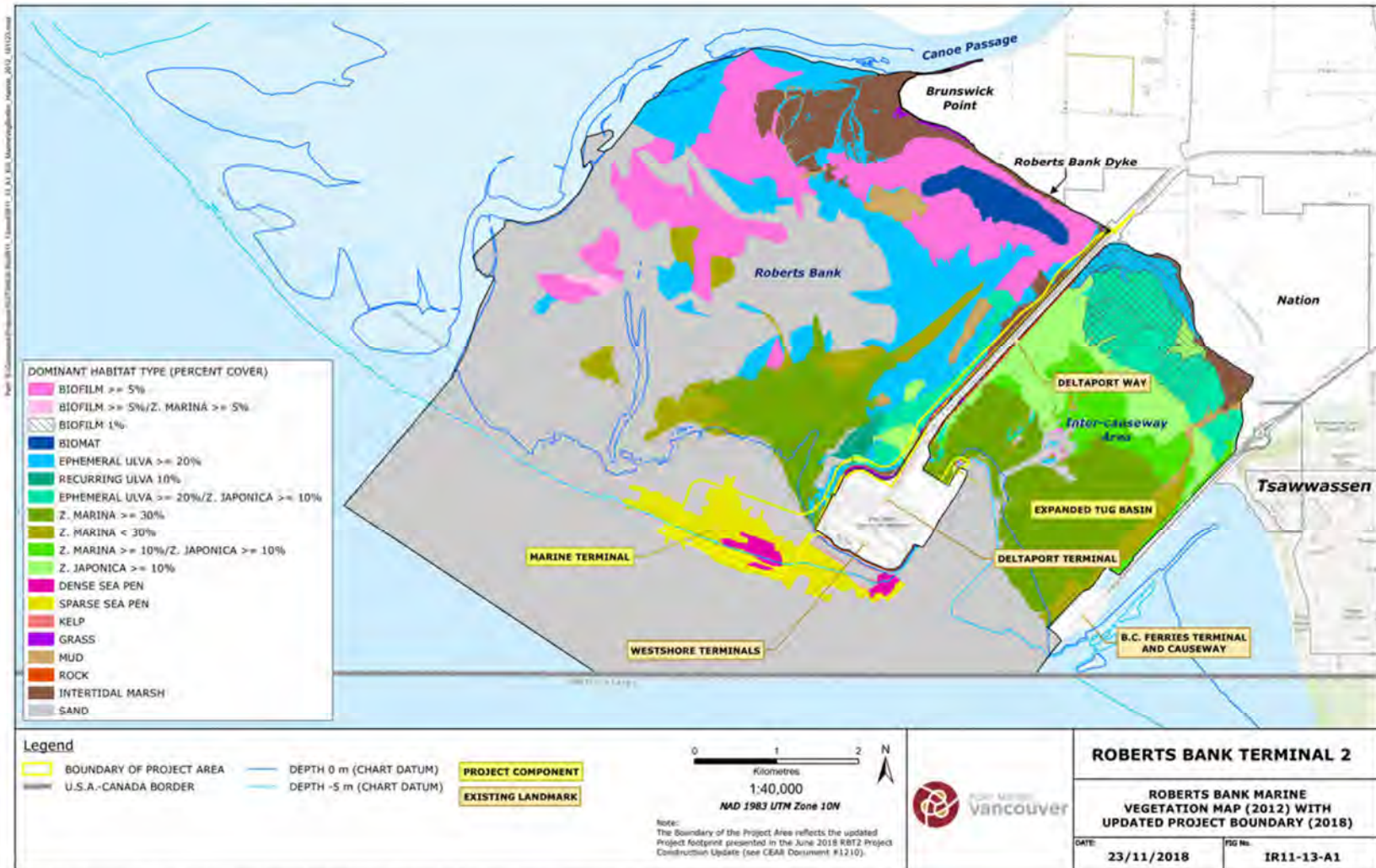


Figure 11-1: Marine vegetation at Roberts Bank (Source: Project public registry document 1360)

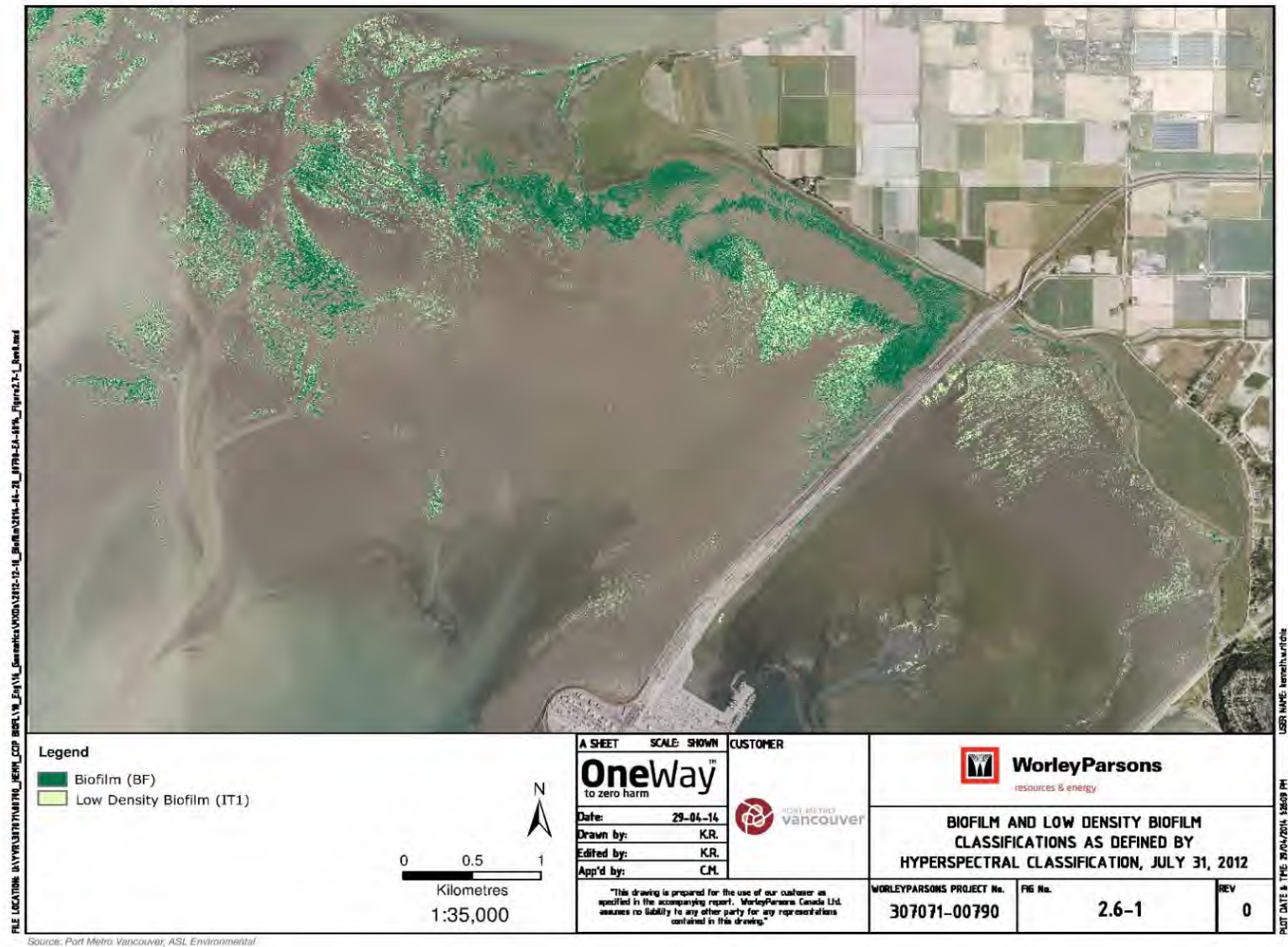


Figure 11-2: Biofilm and low density biofilm classifications as defined by hyperspectral classification (Source: Project public registry document 1329)

The Proponent noted that the ecological role of biofilm was poorly understood. The Proponent conducted several investigations to support its assessment of effects on biofilm. The studies served to map biofilm, assess the erosion threshold for biofilm in the LAA, identify the physical factors that influence biofilm distribution and to understand natural variability and regeneration potential following a disturbance. The Proponent reported the following key findings:

- Of the factors measured, both freshwater influence and sediment grain size had the strongest relationship with biofilm biomass;
- Biofilm could be experimentally perturbed and would rapidly return to an undisturbed state one to two weeks following physical disturbance;
- Natural biofilm biomass and diatom composition was influenced by the tidal cycle, with highs during spring tides and lows during neap tides; and
- Changes in diatom species composition occurred over the tidal cycle, indicating an influence from suspension/re-suspension within the water column.

The Proponent estimated that biofilm habitat loss due to the Project footprint would be 2.5 ha when considering all areas with traces of biofilm mapped by hyperspectral imaging. This would represent a loss of less than 0.1 percent of the biofilm biomass in the LAA.

The Proponent also assessed the indirect effects from predicted salinity changes due to the Project, as described in Section 8.3 - Marine Water Quality. The Proponent predicted that more than half of the biofilm at Roberts Bank would experience a minor shift in the spatial distribution of salinity towards more freshwater conditions. The magnitude and extent of the change would depend upon the magnitude of the Fraser River freshet. Other biofilm habitats would experience an increase in salinity. The Proponent predicted that the increased influence of freshwater would increase overall biofilm biomass, resulting in no adverse effect on biofilm productivity.

In its initial assessment, the Proponent considered biofilm composition to be dominated by diatom taxa, either associated with freshwater conditions or with more saline marine conditions. The Proponent assumed that biofilm communities experiencing mean water column salinity of less than 10 practical salinity units (PSU) would be characterised by freshwater diatom assemblages, as opposed to marine diatom assemblages under higher salinity conditions. The Proponent determined that during the freshet period there would be an increase in the area of biofilm exposed to salinities of less than 10 PSU from 53 percent to 61 percent of the LAA. This transition in biofilm composition from marine to freshwater diatom assemblages would be more pronounced in the mid-intertidal and upper intertidal areas of the LAA. The Proponent concluded that the salinity effect on the diatom assemblages was a residual adverse effect from the Project but would not affect long-term viability of biofilm on Roberts Bank and therefore was not significant.

The Proponent reported that since biofilm was a relatively recent area of study, there were sampling and methodological uncertainties for biofilm and there was no information on historical distribution and long-term trends for biofilm at Roberts Bank. The Proponent was of the opinion that changes from past development had the potential to influence soft sediment and water

column conditions at Roberts Bank and that the Project would add to past effects. Therefore, the Proponent concluded that the residual effect of the Project in combination with the effects of other projects and activities would result in an adverse cumulative effect on biofilm, which would not be significant.

The Proponent conducted additional studies in the spring and summer of 2016, 2017 and 2018 to evaluate the influence of abiotic factors on biofilm productivity and assemblage composition. The Proponent found that the biofilm community at Roberts Bank was adapted to different salinity conditions, was productive across the site's salinity gradient, and was best classified as "estuarine". In addition to reporting on productivity indicators, the Proponent tested for differences in the composition of biofilm across the salinity gradient within the LAA and found no difference in biofilm composition based on salinity. Based on these studies and the new understanding of biofilm dynamics at Roberts Bank, the Proponent concluded that the Project would not affect biofilm composition.

The Proponent's 2016, 2017 and 2018 biofilm studies provided additional information on the influence of abiotic factors on the production of fatty acids that were potentially important for the nutrition of migrating shorebirds, i.e., polyunsaturated fatty acids (PUFAs). As part of the additional studies, the Proponent examined how fatty acids, including PUFAs, were distributed across the salinity gradient at Roberts Bank. The Proponent observed that fatty acids were produced by biofilm across the salinity gradient. The Proponent noted that Project changes in salinity were small compared to natural variability in salinity in the LAA. The Proponent concluded that the Project would not adversely affect the quality of biofilm as nutrition for shorebirds. Potential Project effects on shorebirds that feed on biofilm are further discussed in Section 15 - Avifauna.

The Proponent stated that mitigation measures, such as the creation of mudflats, could be developed to offset effects in the unlikely event that biofilm would be adversely affected by the Project. The Proponent would develop a manual to identify and document best practices for developing biofilm habitat in the Fraser River estuary. The manual would be developed in consultation with international experts and shared with interested Indigenous groups prior to Project approval. The Proponent made a commitment to consult with ECCC to develop the best approach for the creation of mudflat habitat that would support biofilm.

The Proponent proposed a follow-up program to verify effects predictions on biofilm abundance and density, chlorophyll-a, fatty acid and carbohydrate concentrations.

11.2.2 Views of Participants

ECCC found the Proponent's studies on biofilm to be technically sound and noted the studies provided novel findings that contributed to the understanding of biofilm abundance and productivity. However, ECCC was of the view that the studies did not support the Proponent's conclusions regarding potential effects on biofilm. ECCC advised that the Proponent's approach could confound differences across the salinity gradient by incorrectly assigning importance to variables that would not be affected by the Project, such as station location, temperature and

mudflat exposure. ECCC noted that, after controlling for mudflat exposure time, the Proponent's information yielded positive relationships between salinity and the quantity and quality of biofilm.

ECCC presented additional information, derived from recent scientific studies, to support the hypothesis that a "salinity trigger" serves to induce fatty acid production in biofilm. ECCC was of the view that the trigger was caused by small salinity changes at Robert Bank that occur at the beginning of freshet. Certain diatoms in biofilm would respond to the trigger by shifting from a growth phase to a stationary phase, and start producing PUFAs, which are the fatty acids ECCC considered could be critical to fuel shorebird migration.

ECCC was of the view that in addition to the direct loss of 2.5 ha of biofilm habitat from the widening of the causeway, indirect effects would affect up to 558 ha of biofilm habitat. ECCC was of the opinion that offsetting high quality biofilm habitat was not feasible. ECCC advised that only a project redesign would avoid adverse effects on shorebirds as a result of changes in biofilm fatty acid production.

Dr. Patricia Baird, on behalf of the Kahiltna Research Group, commented on the importance of PUFAs, especially docosahexaenoic (DHA) and eicosapentaenoic (EPA) acids. Dr. Baird noted that the biofilm on Roberts Bank mudflats provided PUFAs, especially EPA and DHA, in high concentrations unavailable elsewhere for shorebird migration. Dr. Baird stated that many studies had shown that the PUFAs in freshwater diatoms were less concentrated than in marine diatoms and that, unlike what the Proponent had stated, not all PUFAs were similar. She mentioned that the Proponent had keyed out diatoms only to genus and stated that the Proponent should have focussed on diatom species. Dr. Baird stated that freshwater diatoms would not produce the high concentrations of EPA and DHA on which shorebirds depend.

Dr. Peter Beninger, on behalf of BC Nature, commented on the Proponent's biofilm studies. Based on his experience in mudflat ecology and his review of the studies' sampling procedures and statistical treatment, Dr. Beninger advised that the Proponent's 2018 report on biofilm could not be relied upon to predict effects on biofilm. Dr. Beninger explained that the report made assumptions regarding the energetic value of biofilm and other food sources as nutrition for shorebirds that are subject to uncertainty. He was of the opinion it was not yet possible to confidently understand how the Project would affect biofilm relative to all nutritional sources of importance to shorebirds, due to limited knowledge of mudflat ecology.

In addition to BC Nature and the Kahiltna Research Group, many participants had concerns regarding potential Project effects on biofilm. One participant noted that the Proponent had relied on the RBEM for its effect predictions, which did not capture the seasonal importance of biofilm quality as nutrition for migrating shorebirds. Another participant emphasized the importance of resolving scientific uncertainties regarding biofilm prior to project approval.

11.2.3 Panel's Analysis

The Panel finds that the two main pathways of Project effect on biofilm productivity are direct habitat loss of 2.5 ha and indirect changes to salinity, as reported by the Proponent. Another pathway of Project effect, such as a change in turbidity, is negligible for biofilm. Beyond biofilm productivity, predicted changes in salinity were also reported to have potential effects on biofilm composition and nutritional quality for shorebirds.

The Panel notes the Proponent predicted that direct habitat loss and reductions in salinity would not result in adverse effects from the Project on biofilm productivity. The Panel also heard from DFO that the modest salinity changes predicted in the vicinity of biofilm habitat were plausible. The Panel also heard from ECCC that the Proponent's studies regarding overall productivity of biofilm were technically sound. The Panel finds there is sufficient certainty in the Proponent's predictions and studies to conclude that the Project would not result in adverse effects on biofilm productivity at Roberts Bank.

The Panel further examined the question of biofilm quality as nutrition for shorebirds. The Panel notes that much of the biofilm information collected by the Proponent responded to concerns raised by ECCC and other participants related to the sensitivity of biofilm to Project-related changes in salinity and how the Project may affect the value of biofilm as nutrition for shorebirds. In view of the uncertainty around Project effects on biofilm from predicted changes in salinity, the Panel requested that ECCC define the information requirements that would be necessary to resolve key uncertainties in biofilm dynamics at Roberts Bank, including:

- Specific and detailed advice on how the key information gaps in biofilm and shorebird ecology at Roberts Bank could be filled; and
- If new studies must be undertaken to address gaps, outline the spatial and temporal boundaries and other required parameters for such studies.

In response, ECCC identified key information gaps that could be addressed by new studies over a minimum of three years. The Proponent undertook biofilm studies in 2016, 2017 and 2018 to address the information gaps and respond to the concerns identified by ECCC.

In order to further verify salinity predictions for the upper intertidal area and the area in the vicinity of Brunswick Point where Western sandpipers are reported to concentrate, the Panel requested that DFO verify the Proponent's salinity predictions. DFO reported that the pattern of change in salinity in the area of interest, shown in Figure 11-3, was plausible. The Panel notes that DFO recommended more work would be required to verify the accuracy of the predicted changes in salinity.

The Panel observes that the biofilm studies conducted by the Proponent between 2016 and 2018, indicate that diatom assemblages were demonstrated to be uniform across the salinity gradient in the LAA. As a result, the Proponent concluded that there were no differences in freshwater and marine diatom assemblages at Roberts Bank, and therefore no potential for Project effects. Based

on these recent findings, the Panel agrees with the Proponent that the Project would not affect diatom assemblages within biofilm.

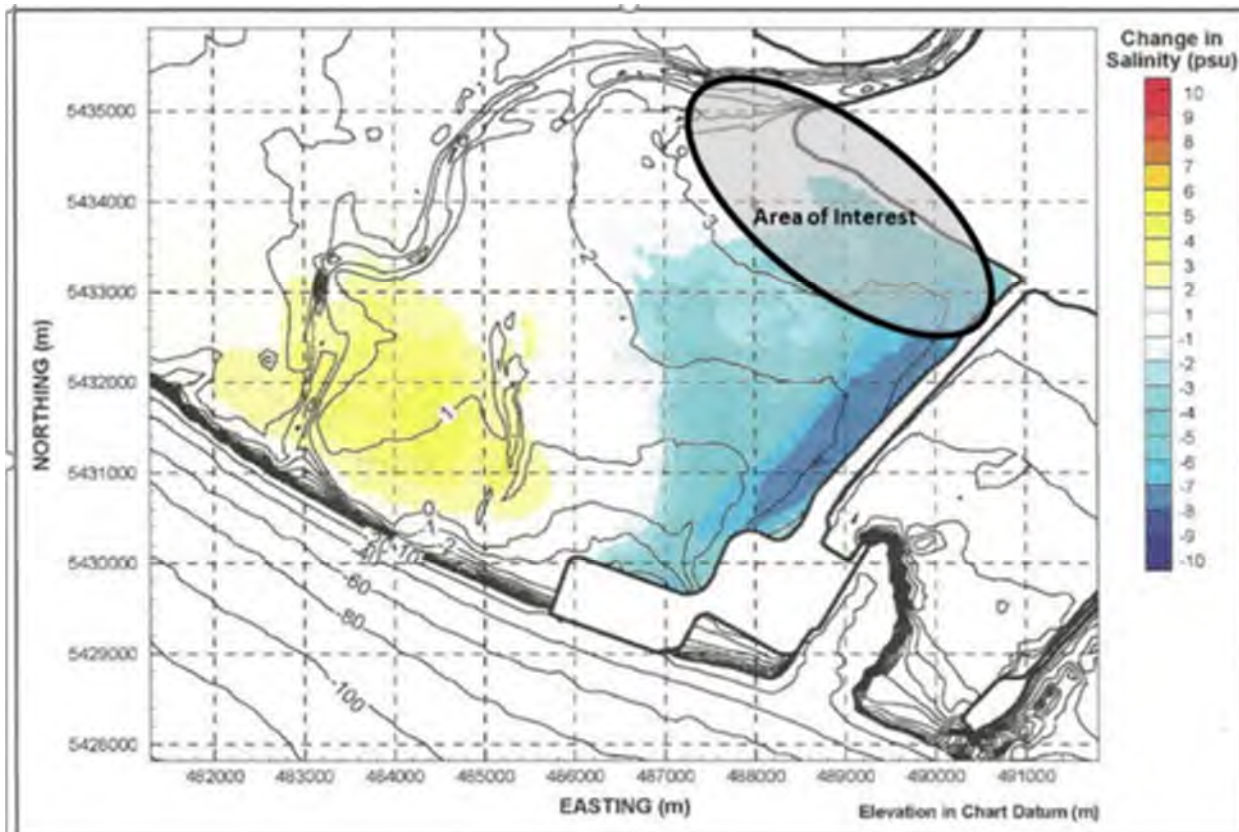


Figure 11-3: Area of interest for salinity changes and potential effects on biofilm based on 2016 Western sandpiper densities (Source: Adapted from EIS, Volume 2 and Project public registry document 1110, IR8-04)

The Panel concludes that the Project would not result in an adverse effect on biofilm productivity or composition and diatom assemblages at Roberts Bank.

Part of the research done by the Proponent in 2016, 2017, and 2018 also involved determining fatty acid concentrations and diatom composition across an existing salinity gradient where Western sandpipers forage at Roberts Bank. The Panel finds that the Proponent demonstrated that fatty acid production did not vary across the salinity gradient currently experienced at Roberts Bank in the area where shorebirds forage during northward migration at the end of April to early May. The results showed that duration of mudflat exposure was the primary driver of fatty acid concentration in the 2016 and 2017 studies. Total concentration of PUFAs was related to salinity during 2016. In the 2018 field study, salinity was shown to play a key role in determining fatty acid concentration and the duration of mudflat exposure played a secondary role. The Proponent therefore concluded that mudflat exposure and salinity affected biofilm productivity. The Panel agrees with this conclusion.

The Panel finds that the Proponent's studies on biofilm were technically sound, although uncertainty remains on how the results were interpreted to support the Proponent's conclusions on potential effects from the Project.

The Panel further examined the hypothesis presented by ECCC and other participants that, through a compression in the range of variability of salinity experienced at Roberts Bank, the Project may lead to an adverse effect on the production of PUFAs by biofilm. Although the Proponent reported that all diatoms species producing PUFAs are capable of withstanding a wide range of salinity concentrations, ECCC emphasized that it may be biofilm growth phases triggered by salinity that drive the production of PUFAs. The Proponent was of the view that the salinity trigger hypothesis was unfounded. Based on ECCC's explanations, the Panel views the operation of a salinity trigger at Roberts Bank as a new concept requiring further investigation.

Although the environmental assessment of the Project resulted in substantial advances in the recent knowledge of biofilm dynamics at Roberts Bank, substantial uncertainty remains with regards to the role of biofilm quality as nutrition for shorebirds. The Panel finds that there were conflicting interpretations of biofilm ecology by the Proponent and participants, which remain unresolved. The Panel concludes that the value of PUFAs produced by biofilm for migrating shorebirds and the role of small salinity fluctuations in the production of PUFAs is uncertain.

The Panel finds it is unable to conclude with sufficient certainty whether potential Project effects on the production of fatty acids that are nutritionally important for shorebirds would occur or not.

The Panel is unable to conclude with certainty that the Project would result in an adverse effect on polyunsaturated fatty acid production by biofilm.

The Panel notes that the Proponent proposed to create mudflat habitats as mitigation for biofilm productivity, should adverse effects be detected through follow-up programs. ECCC advised that mudflat creation was largely unproven and that the effect on biofilm quality for shorebirds could not be mitigated. The Panel agrees with ECCC that mudflat creation at Roberts Bank is unproven as a mitigation measure for biofilm and as such cannot be considered feasible until best practices can be developed.

Recommendation 19

The Panel recommends that the Proponent, in collaboration with Fisheries and Oceans Canada and Environment and Climate Change Canada, be required to include identification of sources and dynamics of polyunsaturated fatty acid production in its salinity and biofilm monitoring follow-up program.

Recommendation 20

The Panel recommends that the Proponent be required to, in partnership with Environment and Climate Change Canada, develop a plan to address potential adverse effects on polyunsaturated fatty acid production, which would include:

- *A plan to continue biofilm research during the northern migration period of Western sandpiper for the duration of construction and the first 3 year of operations;*
- *A review of biofilm sampling and statistical methodology used in past studies and integrating best practices in future studies;*
- *Open data sharing with other researchers in mudflat and biofilm ecology; and*
- *Continuation of public reporting on biofilm and Western sandpiper research.*

11.3 Biomat

11.3.1 Proponent's Assessment

The Proponent defined biomat as blue-green algae and associated diatoms. The Proponent assessed effects on biomat due to its role as a primary producer and for providing structure in the upper intertidal area of Roberts Bank. The Proponent described biomat as capable of reducing landward wave energy and enhancing the accumulation of fine sediments, thereby establishing a substrate conducive to biofilm colonization within biomat habitat.

There would be no overlap between the Project footprint and biomat. Potential adverse indirect effects from the Project on biomat were related to potential increases in predation by waterfowl. The Proponent concluded this increase was due to overestimating predation in the RBEM, and therefore concluded the adverse effect from the Project on biomat would be negligible.

11.3.2 Views of Participants

DFO reviewed the Proponent's predictions on potential effects from the Project on productivity of functional groups, including biomat. DFO noted that biomat was part of the functional groups judged to be adequately represented in the RBEM.

11.3.3 Panel's Analysis

The Panel accepts the Proponent's explanation that the RBEM overestimated grazing pressure and that the results from the coastal geomorphology studies show that biomat would continue to accrete in the upper intertidal area.

The Panel concludes that biomat at Roberts Bank is unlikely to be compromised by the Project, and that any Project effect would be negligible.

11.4 Macroalgae (*Ulva*, Rockweed, Kelp)

11.4.1 Proponent's Assessment

The Proponent described macroalgae as common forms of seaweed including sea lettuce, bull kelp and rockweed. The Proponent noted that macroalgae species are important primary producers that contribute to the high biological productivity of Roberts Bank. Kelp provides low-lying and canopy-forming three-dimensional habitat utilized by many marine fish species in the

low intertidal and subtidal areas of the LAA and sea lettuce provides important juvenile nursery habitat for Dungeness crabs.

The Proponent concluded the Project would result in negligible effects on *Ulva* and kelp from direct mortality. The Proponent noted that the terminal would create hard substrate that macroalgae could recolonize and that predicted decreases in productivity would be negligible.

The Proponent predicted a minor adverse effect on rockweed despite the increase in hard substrates provided by the terminal. The Proponent proposed to mitigate this effect primarily by creating subtidal rock reef offsets, which would provide additional habitat for rockweed and increase rockweed productivity beyond existing conditions. The Proponent also noted that the sandy gravel beach offset would provide substrate on which rockweed could attach itself.

11.4.2 Views of Participants

DFO reviewed the Proponent's predictions on potential effects of the Project on productivity of functional groups by the RBEM. The RBEM grouped kelp and rockweed in the brown algae functional group, and *Ulva* as green algae. DFO concluded that the RBEM adequately represented brown algae at Roberts Bank, but predictions for green algae were likely inaccurate.

11.4.3 Panel's Analysis

The Panel accepts the Proponent's prediction that there would be a minor decrease in macroalgae, specifically a decrease in rockweed biomass due to direct elimination by the Project footprint. The Panel agrees that changes in sea lettuce and kelp productivity would be negligible because the vegetation would naturally recolonize the terminal.

The Proponent concluded the minor effect on rockweed would be mitigated by subtidal rock reef offsetting. The Panel notes that the rock reefs adjacent to the existing terminal, developed as a form of mitigation for the Deltaport Terminal complex, have a subtidal depth distribution from 0 to -4 m CD. However, the Proponent reported rockweed-dominated algal populations were common within mid to low intertidal areas in moderately wave-exposed habitats. The Panel concludes that the proposed rock reef offsets may have minimal value for rockweed mitigation in view of the intertidal vertical distribution of rockweed.

The Panel notes that the construction of the proposed terminal and expanded causeway would require a substantial amount of armouring rip-rap (rock armour) within the intertidal area. In the Panel's view rockweed would colonize these substrates. Therefore, the Panel agrees with the Proponent's prediction of effects on macroalgae that there would be a no adverse effect from the Project.

The Panel concludes that the Project would not result in an adverse effect on macroalgae.

11.5 Eelgrass

11.5.1 Proponent's Assessment

The Proponent stated that widening the causeway would result in the direct reduction of 1.7 percent of the total non-native eelgrass biomass in the LAA, while the tug basin expansion would result in direct mortality of 0.7 percent of native eelgrass productivity.

The Proponent noted that increased sedimentation due to tug basin dredging during construction may result in minor adverse effects on native eelgrass. During operations, changes in coastal geomorphic processes may further affect native eelgrass productivity, with losses expected due to increased sedimentation and gains expected due to the terminal's wave shadow. The Proponent also considered the fact that eelgrass development at Roberts Bank had increased over 15-fold since 1994. The Proponent concluded that the potential effect of the Project on native eelgrass would be negligible, even without mitigation.

The Proponent noted that long-term increases in sedimentation and the terminal's wave shadow may favour establishment of non-native eelgrass. The Proponent concluded that Project effects on non-native eelgrass would not be measurable against natural variation, and therefore were negligible.

The Proponent noted that onsite eelgrass transplants planned to mitigate potential effects for other environmental components would also benefit eelgrass in the LAA and mitigate any potential effect from construction-associated mortality. The Proponent concluded that no specific mitigation was required for eelgrass.

11.5.2 Views of Participants

Tsawwassen commented that there had been cumulative effects on the foreshore marshes and eelgrass. They noted that there was much uncertainty in the success of planned offsets, including eelgrass transplants.

DFO evaluated the RBEM predictions for non-native and native eelgrass and found that non-native and native eelgrass were adequately represented by the model. DFO noted that creation of eelgrass offsets was commonly undertaken with proven success.

11.5.3 Panel's Analysis

The Panel agrees with the Proponent that native eelgrass at Roberts Bank has been increasing in the area over the past half century due to the construction of the Roberts Bank causeway which reduced turbidity in the inter-causeway area and created a wave shadow effect that facilitated native eelgrass colonization. The Panel agrees with the Proponent's assessment that Project effects are negligible for both native and non-native eelgrass species.

The Panel concludes that the Project would not result in an adverse effect on eelgrass.

11.6 Wetlands and Biodiversity Protection

11.6.1 Proponent's Assessment

The Proponent provided information on the regional distribution of wetlands at Roberts Bank and described the areas of ecological importance in the Fraser River estuary, as shown in Figure 11-4. The wetlands at Roberts Bank are recognized as being part of the Important Bird Areas, the Western Hemisphere Shorebird Reserve Network, and parts are covered under the Ramsar Convention.

The Proponent calculated that causeway widening would result in a loss of 12.3 ha of marsh habitat, which would consist of a loss of 0.1 percent of the existing intertidal marsh biomass within the LAA. The Proponent stated this loss would be counterbalanced by a biomass gain of 25 percent in the long-term due to geomorphic changes associated with the Project. Brackish and salt marsh communities in the LAA were predicted to experience improved growing conditions due to the reduction in salinity resulting from the Project placement. The Proponent stated long-term increase in sediment deposition may lead to increased intertidal marsh productivity by providing additional elevated habitats for intertidal marsh.

In accordance with the *Federal Policy on Wetland Conservation*, the Proponent prepared a wetlands functional assessment to supplement the assessment of effects on the five subcomponents of marine vegetation. The Proponent stated that it was confident in its spatial boundaries, which were defined in accordance to the *Canadian Wetlands Classification System* and the *Wetlands of British Columbia Identification Guide*. The Proponent also included eelgrass habitats in the wetland functional assessment.

The Proponent mentioned that the shallow subtidal area was not a wetland according to the classification guidance and disagreed with ECCC that wetlands should be assessed to -2 m CD. The Proponent stated it considered the boundary for wetlands extended to 0 m CD was appropriate to characterize and assess all wetlands at Roberts Bank.

Although the Proponent concluded that there were no residual effects on wetlands from the Project, it provided information on regional and historical trends in marsh accretion and recession. The Proponent commented that because marshes are dynamic ecosystems, trends depend on the location and timeframe under consideration. The Proponent mentioned that it continued to work with ECCC and FLNRORD to investigate trends in marsh dynamics at Sturgeon Bank, where both expansion and recession had been documented over different time periods.

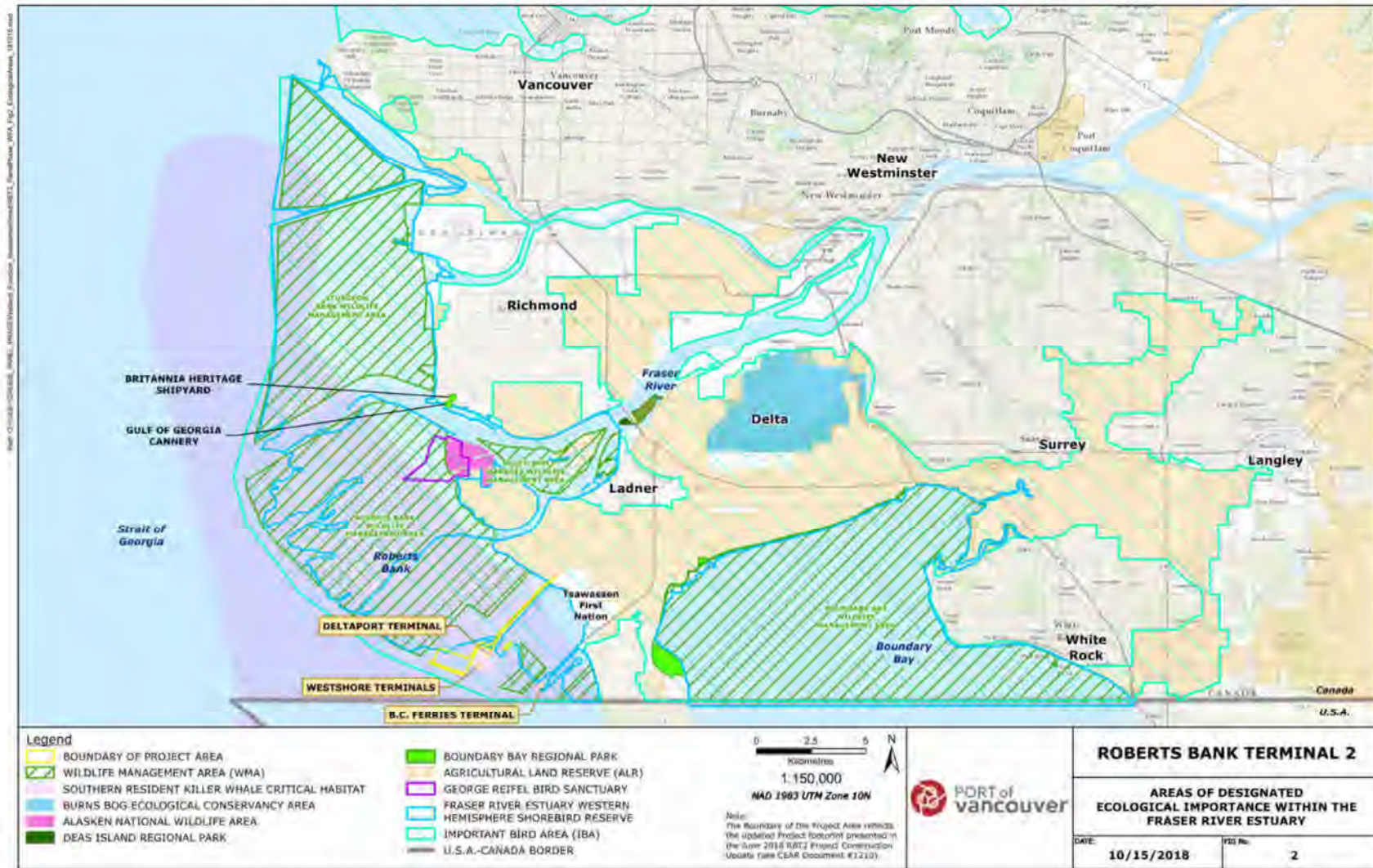


Figure 11-4: Areas of designated ecological importance within the Fraser River estuary (Source: Project public registry document 1360)

Red and Blue-listed Species

The Proponent identified eight provincially listed estuarine wetland communities within the wetlands' functions assessment. Three red-listed communities overlapped with the expanded causeway footprint, namely tufted hairgrass - Douglas' aster, Lyngbye's sedge and herbaceous vegetation and American glasswort - sea-milkwort marsh wetland communities, as illustrated in Figure 11-5.

The Proponent noted that every estuarine wetland vegetation type in British Columbia was red-listed (endangered or threatened) or blue-listed (special concern) because they were naturally rare, accounting for less than 2.3 percent of British Columbia's coastline. The Proponent indicated that the three wetland communities overlapping with the causeway also occurred elsewhere in the LAA and the RAA, the latter representing the lower Fraser River estuary. The Proponent concluded the Project would not eliminate the only communities present locally or regionally.

The Proponent assessed effects on the productivity of provincially-listed estuarine wetland communities within the intertidal marsh subcomponent and predicted a gain in productivity due to improved growing conditions.

Invasive Species

The Proponent provided information to address concerns regarding the spread of invasive species. The Proponent specifically assessed potential ways in which the Project could facilitate the spread and enhancement of English cordgrass (*Spartina anglica*) at Roberts Bank. The Proponent concluded that the Project would not result in further invasion of English cordgrass, especially due to the Proponent's ongoing collaboration with the BC Spartina Working Group. The Proponent considered that by working together with partners, the spread of invasive English cordgrass was successfully managed to the point that it was now decreasing in the Lower Mainland.

The Proponent made a commitment to develop a Marine Terrestrial Invasive Species Management Plan, which would include contributing to the control and eradication of English cordgrass at Roberts Bank by working with and funding the BC Spartina Working Group. The Proponent also stated it would monitor and manage invasive species within created offset habitats as part of its final Offsetting Plan.

11.6.2 Views of Participants

ECCC commented on the importance of conserving the remaining wetland habitats within the LAA and the RAA because of the serious decrease of wetlands in southern British Columbia, as indicated in Figure 11-6. ECCC advised that the loss of wetlands in the Fraser River estuary had reached critical levels.

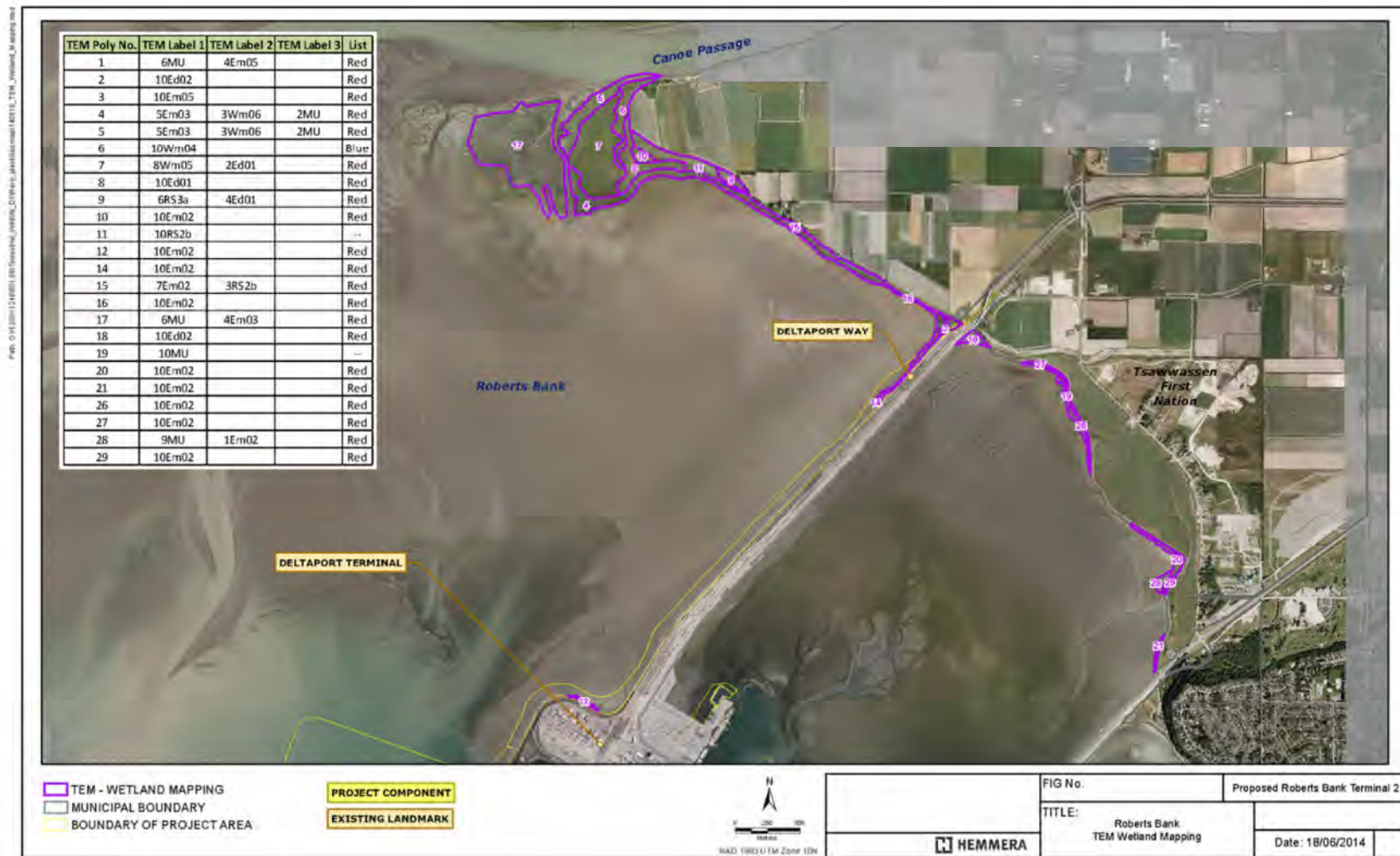


Figure 11-5: Terrestrial ecosystem mapping of wetland communities at Roberts Bank (Source: Project public registry document 388)

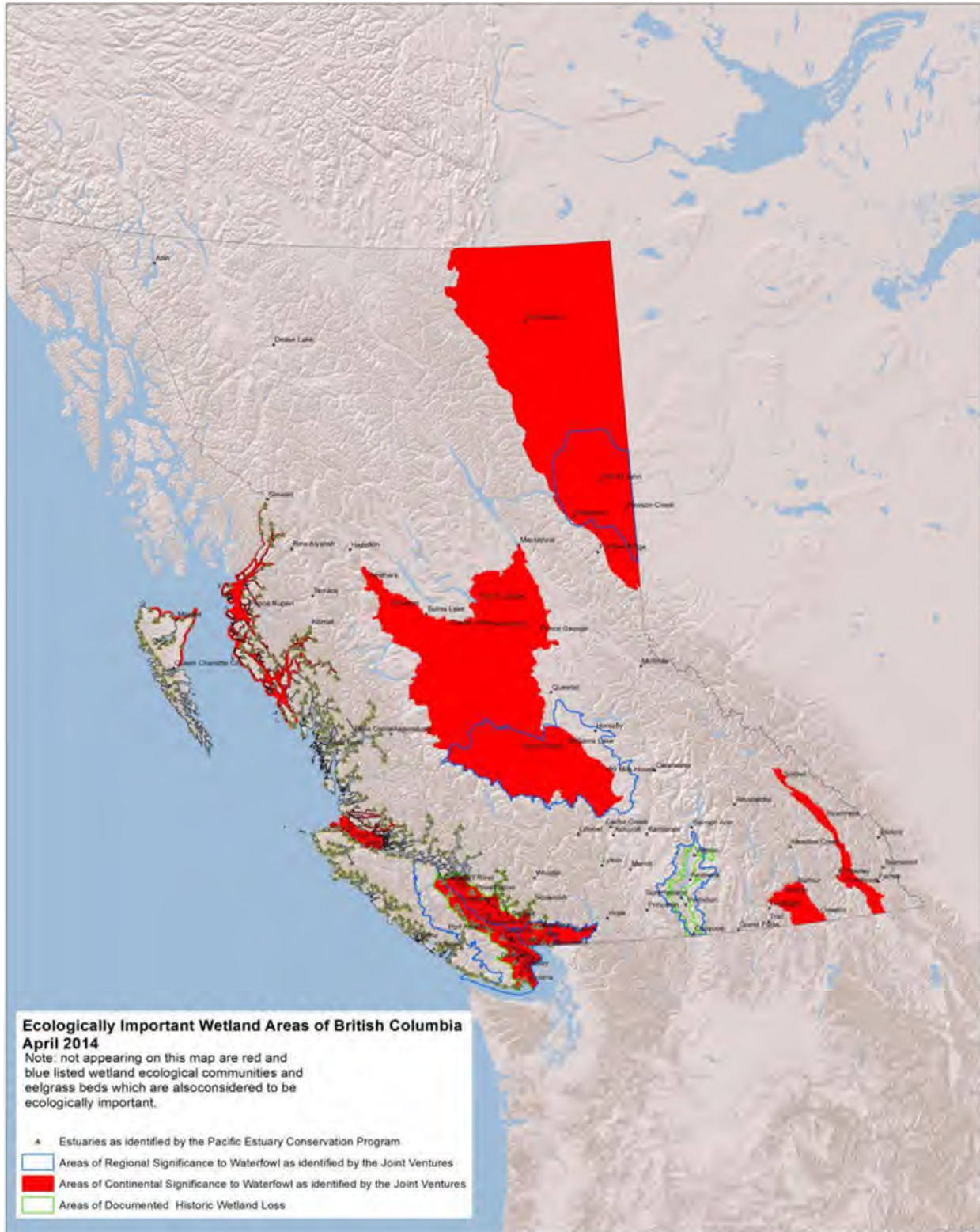


Figure 11-6: Ecologically important wetland areas of British Columbia (Source: Project public registry document 581)

ECCC reported that the Fraser River delta had been historically affected by the development of past projects, such as jetties, dykes, and other linear features that altered flow of the Fraser River. ECCC provided detail on bulrush marshes at Westham Island, which were reported to have receded since 1989. ECCC was of the view that change in the bulrush marshes was an example of how cumulative effects in the Fraser River estuary have occurred and continue to occur due to anthropogenic activities and climate change.

ECCC indicated that the Proponent's wetland functions assessment was technically inadequate and that there was a potential for residual effects on wetland functions. ECCC concluded that it was not technically feasible to recreate shallow subtidal sand flat habitat and offsetting measures other than 'like-for-like' would need to be considered to address residual effects. ECCC recommended a minimum 4:1 compensation ratio for offsetting, particularly to mitigate effects on intertidal mudflats, and intertidal and shallow subtidal sandflats.

FLNRORD commented that the tidal ecosystems of the estuary were mostly under provincial jurisdiction in provincial wildlife management areas. FLNRORD anticipated both direct and indirect effects from the Project on environmental components within the Roberts Bank Wildlife Management Area. Direct Project effects would include the destruction of ecosystems and indirect effects would affect biofilm, tidal marsh, and sedimentation processes.

FLNRORD was of the view that the predicted increase in net productivity of intertidal marsh did not accurately reflect the risk level to the eight blue and red-listed wetland communities in the Project area, given the high site specificity of these communities. FLNRORD specified that Project effects on each community should be carefully examined because such effects could lead to adverse implications for the diversity of organisms these communities support. FLNRORD stated that predictions of red- and blue-listed communities' recovery were hindered by data deficiencies that prevented community-specific management plans from being developed. The lack of information rendered it difficult to determine the Project effects on these eight red- and blue-listed communities or the long-term consequences of their loss or degradation in the region. Due to this uncertainty, any decline in these communities or their integrity was viewed as harmful to their recovery and a precautionary approach that prioritizes the protection of all of these communities was recommended. FLNRORD recommended that mitigation measures and monitoring efforts should include the eight red- and blue-listed listed communities.

FLNRORD noted that there was uncertainty due to contradictory information presented on marsh lands by the Proponent and ECCC. The Proponent cited a study that found 123 percent increase in intertidal marsh at Brunswick Point from 1930 to 1994, while in the Sturgeon Bank Marsh Recession Project, FLNRORD and ECCC determined a decrease of approximately 50 ha in marsh extent at Brunswick Point since 1979.

FLNRORD commented that the Fraser River estuary had been heavily modified by past developments (urbanization and agriculture), which resulted in the majority of the lower Fraser River estuary being managed with dykes to prevent flooding. FLNRORD indicated that the delta had been further modified by developments such as the Vancouver International Airport and

different port-related activities, including maintenance dredging of the main arm of the Fraser River.

FLNRORD recommended potential conditions for the Project, such as monitoring the Brunswick Point and Tsawwassen tidal marshes ecosystem in order to understand the Project's effects and future effects from sea-level rise in comparison to baseline conditions of the marshes.

FLNRORD recommended a specific data gathering methodology and that the results be shared with them and other stakeholders.

Tsawwassen commented that the foreshore marshes were declining due to adverse cumulative effects caused by industrial developments, dredging, diking and drainage, grazing and grubbing by overabundant snow geese, and rising sea levels. Tsawwassen stated that a strategic marsh restoration program was needed for ecosystem protection, beyond project-by-project offsetting as presented by the Proponent. Tsawwassen also noted that they were interested in the possibility of breaching the causeway to help restore the conditions on the foreshore.

Tsawwassen recommended that the Proponent prioritize restoration of deteriorated marshland and foreshore in its habitat restoration and Offsetting Plan, as well as put sufficient funds for undertaking that work into escrow. Tsawwassen recommended that the Proponent list the areas for restoration, with confirmed costing, before a decision is made on the Project.

Several participants highlighted the importance of the Roberts Bank wetlands and commented on the omission of the Robert Bank WMA as part of the regional Ramsar designations. The Boundary Bay Conservation Committee, among other participants commented that the Roberts Bank WMA should be included in the designation and that the area should be protected.

11.6.3 Panel's Analysis

With regards to potential effects from the Project on intertidal marsh as a part of the wetlands in the LAA, the Panel agrees with the Proponent that the loss in productivity from the causeway widening would be counterbalanced by long-term gains resulting from geomorphic changes caused by the Project placement.

The Panel finds that the Proponent demonstrated its ongoing commitments to control and eradicate English cordgrass which would effectively prevent further spread of this species during construction and operation of the Project. The Panel notes that the Tsawwassen reported invasive species as a source of foreshore marsh degradation, which the Panel views as potentially affecting the success of the proposed marsh offsets.

The Panel notes that causeway widening would result in the partial loss of three provincially red-listed communities, but that gains were predicted by the Proponent due to improved growing conditions for intertidal marsh. The Panel finds that the Project has the potential to adversely affect provincially listed communities given that improved growing conditions may not uniformly benefit all marsh communities or replace red-listed communities. Further, the Panel finds that there is uncertainty in the effectiveness of the intertidal marsh offsets for at-risk communities. The Panel concludes that there is a residual adverse effect on the red-listed wetland

communities resulting from widening of the causeway. Given that these communities are provincially endangered, the Panel concludes that the residual effect is significant.

The Panel agrees with the Proponent that the Project could result in a minor loss of biogeochemical function for intertidal marsh and eelgrass and a minor loss of ecological function for intertidal marsh and mudflats. The Panel notes ECCC's advice on the wetlands function assessment and remaining uncertainties related to how wetlands have been defined and that mudflat and sandflat productivity and potential effects on their ecological functions may have been underestimated. The Panel has discussed in Section 10 - Offsetting that uncertainties also remained with regards to the effectiveness of the proposed offsets. In addition, the Panel does not consider ECCC's recommendation for a 4:1 offsetting compensation ratio for wetland loss in the LAA to be practical due to the limited areas available for offsetting. The Panel considers that Project effect on wetlands and wetland functions would not be fully mitigated, which constitutes a residual effect on wetlands that is high in magnitude, permanent and irreversible.

The Panel concludes that the Project would result in a significant adverse effect on wetlands. The Panel further concludes that the expansion of the causeway would result in a significant adverse effect on provincially red-listed marsh communities.

FLNRORD mentioned that it anticipated effects of the Project on the Roberts Bank WMA, which may be inconsistent with its management objectives. The Panel recognizes that potential effects on wetlands could adversely affect the WMA.

The Proponent concluded there were no residual effects on intertidal marsh and wetlands, therefore cumulative effects were not assessed. Similarly, cumulative effects were not assessed for red-listed marsh communities. The Panel considered the information provided by the Proponent, ECCC, FLNRORD and other participants on historical trends in wetlands and provincially listed communities and the potential for cumulative effects from the influence of past developments and activities in the RAA. The Panel finds it received sufficient evidence of past effects and ongoing developments to conclude that significant cumulative effects are already present in the Fraser River estuary. Therefore, Project effects would consist of an additional contribution to wetland losses and degradation regionally. The Panel concludes that the Project would result in a significant adverse cumulative effect on wetlands and on wetland functions, including provincially red-listed marsh communities.

The Panel concludes that the Project would result in a significant cumulative effect on wetlands and on wetland functions in the lower Fraser River estuary, including provincially red-listed marsh communities.

Recommendation 21

The Panel recommends that the Proponent, in collaboration with Fisheries and Oceans Canada, Environment and Climate Change Canada, BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development, the Tsawwassen First Nation and the Musqueam Indian Band, be required to include in its final Offsetting Plan:

- *Design for intertidal marsh offset habitats to promote the growth of native species that would compensate for the loss and degradation of listed marsh communities due to the expanded causeway; and*
- *An offsite Offsetting Plan that could include areas of the Fraser River estuary such as Sturgeon Bank and the foreshore of Westham Island where bulrush marshes have recently receded.*

Recommendation 22

The Panel recommends that the Proponent, in collaboration with Environment and Climate Change Canada, BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development, and in partnership the Tsawwassen First Nation and the Musqueam Indian Band, be required to include in its follow-up program for intertidal marsh offsets:

- *Monitoring of British Columbia red- and blue-listed communities in the Local Assessment Area;*
- *Monitoring of the tidal marsh communities at Brunswick Point and on Tsawwassen First Nation Lands, in order to better understand Project effects and effects from sea-level rise in comparison with the historical state of the marshes; and*
- *Measures for detecting and reporting the presence of invasive species in its onsite offsets and ensure their eradication if detected.*

12 Marine Invertebrates

The Proponent described Roberts Bank as providing habitat for over 200 species of marine invertebrates. To focus the assessment, the Proponent identified four subcomponents of marine invertebrates: infaunal and epifaunal invertebrate communities; bivalve shellfish; Dungeness crab; and, orange sea pen. These subcomponents were used to represent similar invertebrate species living in the LAA and RAA.

The Project components and activities that could interact with marine invertebrates in the LAA included the construction of containment dykes and wharves, expansion of the causeway and decommissioning of temporary construction infrastructure. The Proponent applied the RBEM to predict changes in marine invertebrate productivity associated with operation of the Project.

12.1 Infaunal and Epifaunal Invertebrate Communities and Bivalve Shellfish

12.1.1 Proponent's Assessment

Infaunal and Epifaunal Invertebrates

The Proponent selected infaunal and epifaunal invertebrates as a subcomponent to represent macrofauna and meiofauna. The Proponent stated that there would be 100 percent direct mortality of infaunal and epifaunal invertebrates under the Project's terminal footprint due to their immobility. The Proponent predicted that this would correspond to a short-term decrease in productivity and a perpetual loss of habitat at the terminal footprint. However, the Proponent stated that infaunal and epifaunal invertebrates were resilient to disturbance and would be able to re-establish and possibly expand their distribution following construction. Additionally, the Proponent noted that the terminal footprint would create a wave shadow, potentially improving habitat suitability for infaunal and epifaunal invertebrates in the LAA.

Overall, the Proponent concluded that there would be a net increase in the productive potential of infaunal and epifaunal invertebrate communities, largely due to improved habitat conditions in the immediate vicinity of the Project.

Bivalve Shellfish

The Proponent identified clams, cockles, oysters, and mussels as bivalves found in the Project area. The Proponent predicted that there would be direct mortality of bivalves within the Project footprint, but noted that they were widely distributed in the area, highly adaptable, and resilient to disturbance, which would help counter the losses in productivity. The Proponent estimated that project infrastructure would increase the availability of hard surfaces for epifaunal bivalves, but would decrease habitat for burrowing bivalves.

The Proponent stated that the Project would cause a minor decrease in bivalve shellfish productivity during both construction and operations, prior to the application of mitigation measures. To address effects on bivalve shellfish, the Proponent proposed offsetting to create additional habitat, including eelgrass, tidal marshes, mudflats, sandy gravel beaches, and subtidal

rock reefs. The Proponent committed to enhancing offsetting for priority invertebrate species that would be identified through consultation with regulators and Indigenous groups.

The Proponent predicted that the productivity losses associated with the Project would be of low magnitude because the Project would not cause productivity changes outside the range of natural variability. The Proponent concluded that the Project would result in a non-significant residual adverse effect on bivalve shellfish.

12.1.2 Views of Participants

There were no notable concerns raised by Participants on the effects of the Project on infaunal and epifaunal invertebrates or bivalve shellfish.

12.1.3 Panel's Analysis

The Panel acknowledges that the RBEM was an appropriate model for lower trophic level organisms and accepts the results of the model for infaunal and epifaunal invertebrates and bivalve shellfish. The Panel agrees with the Proponent's assessment and concludes that the Project would not result in an adverse effect on infaunal and epifaunal invertebrates.

The Panel agrees with the Proponent that there would be a non-significant adverse effect on bivalve shellfish. Due to the adaptability and wide distribution of bivalve shellfish in the area, the Panel accepts the Proponent's conclusion on the changes in productivity modelled by the RBEM.

The Panel concludes that the Project would not result in an adverse effect on infaunal and epifaunal invertebrates.

The Panel concludes that due to the adaptability and wide spread distribution of bivalve shellfish in the area, the residual adverse effect of the Project on bivalve shellfish would not be significant.

Cumulative Effects Assessment

In conducting a cumulative effects assessment for bivalve shellfish, the Panel only considered the LAA for its spatial boundaries. The Panel is of the view that future projects are unlikely to contribute to cumulative effects on bivalve shellfish, however, past projects and activities, including port infrastructure, have caused an adverse cumulative effect in the LAA. The Panel considers this cumulative effect to be non-significant for bivalve shellfish.

The Panel concludes that the Project would result in an adverse cumulative effect on bivalve shellfish. The effect would not be significant.

12.2 Dungeness crab

12.2.1 Proponent's Assessment

The Proponent described Dungeness crab as an important species in the LAA as both predator and prey at different life stages. The Proponent also outlined how Dungeness crabs occupy various habitats throughout their life stages. Juvenile crabs relied on intertidal and shallow subtidal habitats to provide cover and protection, while adult Dungeness crabs occur primarily in subtidal sand or mud. Gravid, or egg-bearing, female crabs, buried themselves in the sand and remain relatively inactive for 2-6 months until the eggs were ready to hatch.

The Proponent stated that the Project would cause a minor adverse effect on Dungeness crab productive potential due to direct mortality during construction. The Proponent stated that suitable habitat for adult, juvenile, and gravid female Dungeness crabs would be lost due to the footprints of the terminal, causeway, berth pocket, and tug basin. Total habitat losses for high and moderate crab habitat loss, as calculated by the Crab Suitability Model, were 11.2 percent, 13.1 percent, and 34.2 percent for juvenile, adult, and gravid female crab respectively.

The Proponent noted that eelgrass served as rearing habitat for juvenile crab, as well as foraging and reproductive habitat for adults. The suitability of juvenile, adult, and gravid female crab habitat and the overlap of proposed eelgrass offsets is shown in Figure 12-1, Figure 12-2, and Figure 12-3.

In the long-term, losses of high-suitability subtidal sand habitat would negatively influence productivity. However, the Proponent stated that Dungeness crab was a highly resilient species that replenished despite annual fishing activities that regularly depleted most of the harvest-eligible adult male population. The Proponent indicated that the recruitment of larvae from adjacent areas in the Salish Sea was a factor that contributed to the resilience of Dungeness crab.

To mitigate the potential Project effects on Dungeness crab, the Proponent proposed to develop a Marine Species Management Plan specific to marine invertebrates. The Proponent committed to align their construction activities to avoid annual fisheries-sensitive windows for Dungeness crabs and restrict work between October 15 and March 31. The Proponent also committed to a Habitat Offsetting Plan, which would include the creation of eelgrass and intertidal marsh to provide additional habitat and refuge for Dungeness crabs. The Proponent noted that use of standard mitigation practices outlined in the Project's Environmental Management Plans would mitigate effects from sediment and water quality on Dungeness crabs.

The Proponent identified additional mitigation measures that emerged following consultation with Indigenous groups. The removal of the intermediate transfer pit was identified as mitigation because it would reduce the proposed Project footprint by 33 ha. The Proponent also changed its proposed crab salvage program to an experimental baiting program to reduce handling of the crabs. The Proponent's proposed baiting would be applicable for all Project activities that had the potential to cause direct mortality of legal-size male and gravid female Dungeness crabs. The

Proponent committed to conducting a test program, in collaboration with Tsawwassen and Musqueam, to confirm the effectiveness of a baiting approach.

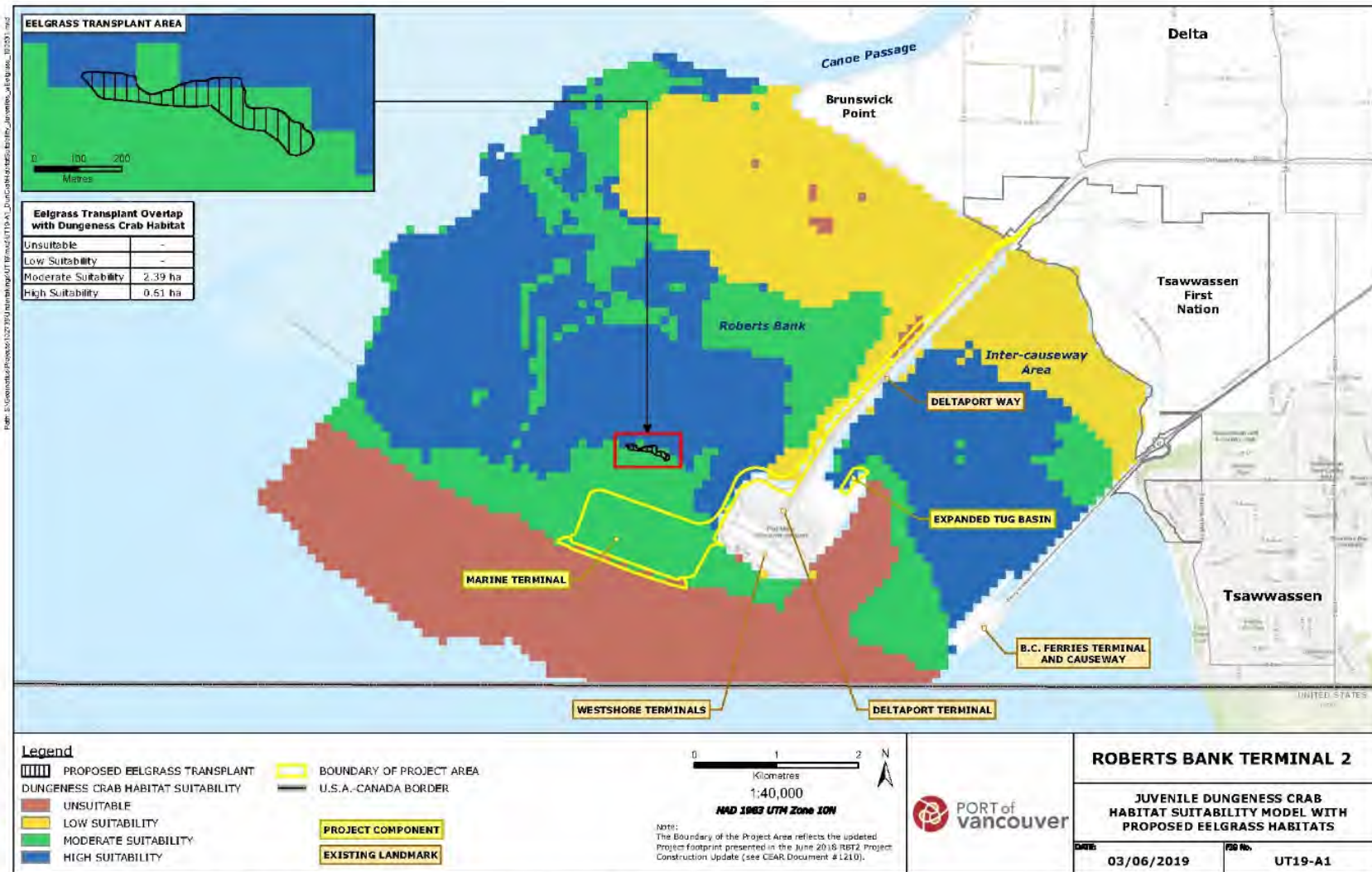
The Proponent acknowledged that gravid female crabs represented an important and vulnerable life stage for the species. The Proponent noted that the presence of gravid female crabs was difficult to confirm but conservatively assumed that gravid crabs were using the Project area to brood their eggs. The Proponent stated that the restriction of construction activities between October 15 and March 31 represented a longer period of time than crabs actually brood and therefore removed the pathway of effect for gravid crab. The Proponent indicated that the longer timing window for restricted activities eliminated the need for specific monitoring of gravid female crab. The Proponent stated that following construction, over 700 ha of suitable brooding habitat would remain at Roberts Bank.

The Proponent stated that their mitigation measures and commitments would also provide adequate protection of juvenile crabs. The Port Authority reported that timing windows would protect the juvenile Dungeness crab recruitment window. The Proponent also noted that the terminal placement in deeper water would avoid intertidal areas where juvenile crab distributed.

The Proponent determined that even with the application of mitigation measures, the loss of habitat would lead to a residual effect on Dungeness crab due to the loss of productivity. However, the Proponent was of the view that the productivity loss would still be within the range of natural viability. The Proponent concluded that residual effects on Dungeness crab was not significant because the effects of the Project would not compromise population integrity.

The Proponent did not identify any other projects or activities on a regional scale that would interact with the residual effects of the Project. The Proponent concluded that there would be no cumulative effect on Dungeness crab, or on other marine invertebrates.

The Proponent committed to a follow-up program to confirm the predicted effects on juvenile crab nursery habitat, as well as a follow-up program to assess the effectiveness of the created eelgrass bed(s) in providing productivity benefits for Dungeness crab.



Source: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, Swatch, IGN, swatch, IGN, Ordnance Survey, Esri Japan, METI, Esri Korea (Hong Kong), (C) OpenStreetMap contributors, and the GIS User Community

Figure 12-1: Juvenile Dungeness crab habitat suitability model with proposed eelgrass habitats (Source: Project public registry document 1873)

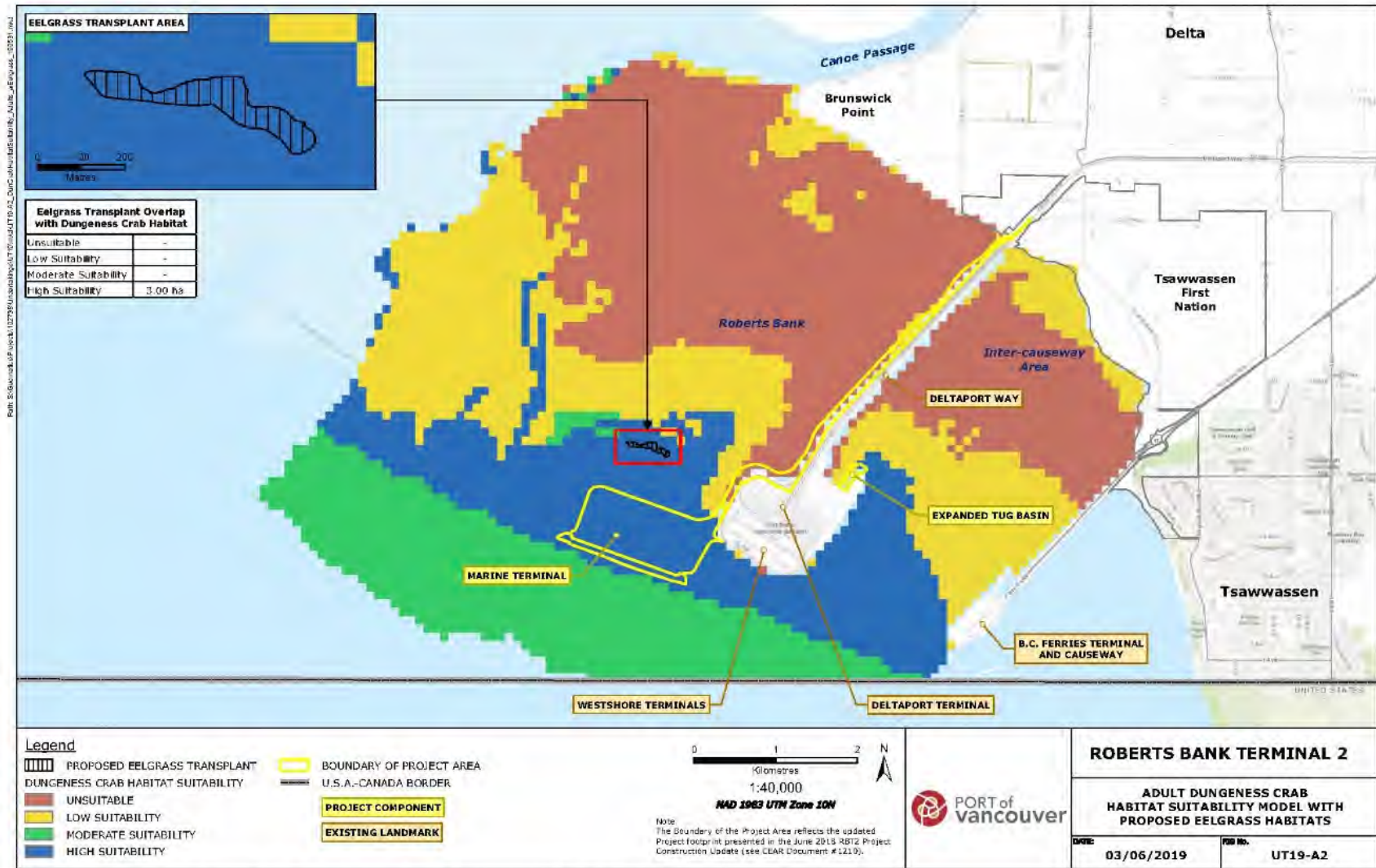


Figure 12-2: Adult Dungeness crab habitat suitability model with proposed eelgrass habitats (Source: Project public registry document 1873)

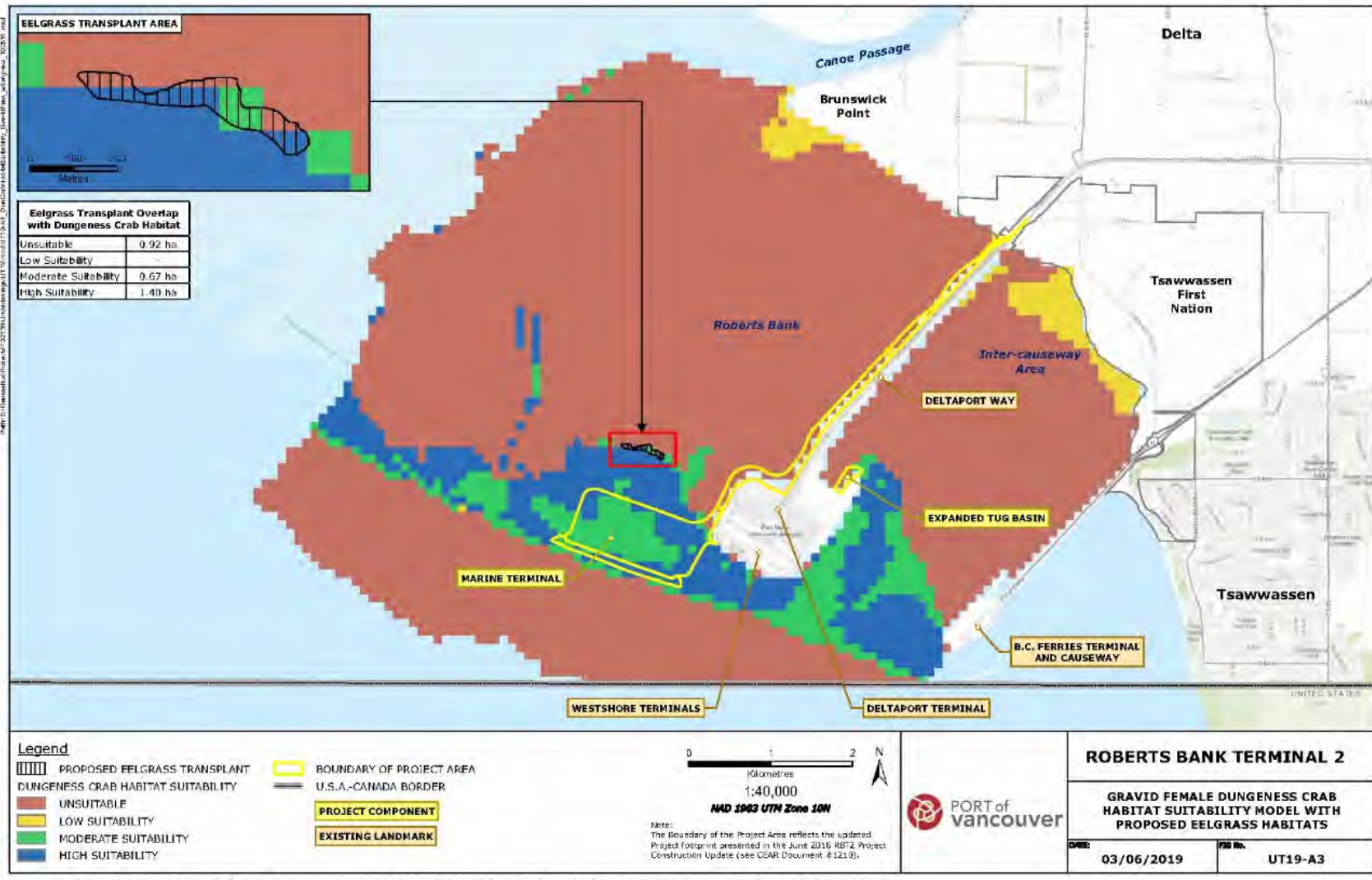


Figure 12-3: Gravid Female Dungeness crab habitat suitability model with proposed eelgrass habitats (Source: Project public registry document 1873)

12.2.2 Views of Participants

Many participants emphasized that Dungeness crab was an important species for commercial, as well as, food, social and ceremonial fisheries conducted by Indigenous groups. Participants also noted that the Project would be situated in productive crab habitat in an area that was important for crab harvesting.

Tsawwassen raised concerns about the Project's effects on crab populations and productivity, and the subsequent effects on their crab fishery. Tsawwassen conducted an independent crab study that identified the Project footprint as high quality crab habitat that would be lost due to habitat alienation. Tsawwassen noted that there was insufficient information to confirm whether the Project would affect the productivity of gravid female crabs, and stated that more work was required for their protection.

Musqueam Band indicated that the Project could disrupt crab lifecycles. Musqueam also recommended that the Proponent's habitat offsetting measures be greatly augmented. The Penelakut Tribe raised concerns regarding the uncertainty associated with the effectiveness of habitat offsetting and noted that the effectiveness could not be determined until the offsetting was undertaken by the Proponent.

DFO acknowledged the importance of Roberts Bank as a crab harvesting location for both Indigenous and commercial harvesters. DFO stated it was supportive of the Proponent's proposed mitigation measures to reduce effects on crab. DFO noted that the decision to place the terminal in a deeper, sub-tidal location was a key mitigation measure to reduce the significance of adverse effects on fish and invertebrates. DFO supported the Proponent's use of required timing windows as a mitigation measure and recommended monitoring to ensure their effectiveness.

DFO acknowledged the difficulty that the Proponent identified in the enumeration and assessment of gravid female crabs due to their avoidance of crab traps and their lack of visibility during SCUBA surveys. DFO noted that additional sampling would have helped to conclusively show whether gravid females show high site fidelity within the LAA.

DFO agreed with the Proponent that crab salvages were a feasible mitigation measure to reduce mortality during Project construction activities. However, it noted that a salvage would not mitigate all potential mortality of crabs from the Project. DFO pointed out that it was difficult to deplete a crab population by trapping because of the likelihood of both displaced and adjacent crabs recolonizing the Project area from bordering areas. DFO recommended that crab salvages occur immediately prior to construction to minimize the potential for crabs to recruit back into the Project site. DFO also noted that a salvage program would likely have minimal positive effects on gravid females as they rarely enter crab traps.

DFO concluded that the scale of fish and invertebrate habitat destruction, in relation to the smaller-scale of the Project's proposed offsetting measures, would not sustain the ongoing productivity of the fisheries, including those of fish and marine invertebrates. DFO noted that the

proposed offsetting measures did not appear to substantially benefit Dungeness crab, bivalves, or orange sea pen. DFO emphasized a need for further discussion on how the Proponent could effectively offset predicted loss of productivity for Dungeness crab during the development of the Project's final Offsetting Plan. DFO also highlighted the need to use multiple approaches to assess the benefits of proposed offsetting measures.

12.2.3 Panel's Analysis

The Panel agrees that a loss of habitat due to construction of the Project terminal would affect Dungeness crab and lead to a loss of productivity and that, even with the implementation of the proposed mitigation measures, there would be a residual effect on Dungeness crab.

The Panel is uncertain that "baiting away" would be an effective mitigation measure to reduce construction effects on crab productivity. As noted by DFO, crabs are highly mobile and would likely easily re-enter the depleted area. The Panel is uncertain whether the Proponent would be able to adequately remove crabs from the area of berth pocket dredging and also notes that gravid female crabs are not susceptible to baiting. The overlap in crab habitat distribution and the Project results in a loss of crab habitat for juvenile crab, gravid females and adult males in moderately to highly suitable habitats. This conclusion is also supported by the results of the Tsawwassen Crab Study. The Panel agrees that eelgrass and intertidal marsh offsetting measures, if suitably sized and located, would be sufficient to mitigate the effects on adult Dungeness crab. However, the Panel views these measures as less effective at mitigating for juvenile and gravid female Dungeness crab productivity losses. The Proponent has committed to considering more than one approach to assessing the benefits of offsetting measures to include estimating the production per functional group per habitat type.

The Panel agrees with DFO that the habitat offsetting measures proposed by the Proponent for the Project would not be adequate to compensate for the adverse effects on fish and Dungeness crab habitat. The Panel agrees with DFO's emphasis on the need to undertake habitat equivalency analyses to demonstrate that mitigation and offsetting measures benefits are similar or greater than the magnitude of Project effects.

The Panel concludes that the Project would cause a permanent loss of high- and moderate-quality Dungeness crab habitat. The Panel concludes that the loss of Dungeness crab habitat alone would cause changes in productivity outside the range of natural variability and therefore, the magnitude of the effect is considered to be moderate. The habitat loss would be permanent and the recovery of the population would be variable and dependent on a number of biophysical factors. The Panel is not confident that the Proponent's conceptual Offsetting Plan would adequately mitigate the loss of Dungeness crab habitat and crab productivity.

The Panel concludes that due to the habitat loss associated with the 177 hectare terminal footprint and reductions in productivity, and in the absence of adequate mitigation measures, the Project would result in a significant adverse effect on Dungeness crab.

Cumulative Effects Assessment

The Panel disagrees with the Proponent's methodology for conducting their cumulative effects assessment for Dungeness crab. Specifically, the Panel does not accept the Proponent's approach to combine crab, bivalve shellfish, and orange sea pen to conduct a single cumulative effects assessment for invertebrates. The Panel also disagrees with the Proponent's selected spatial and temporal boundaries. In particular, the Panel considers the year 1960 to be an appropriate baseline year and thereby would include the effects from existing terminal and causeway infrastructure on Roberts Bank. These past effects would combine with the significant adverse effect from the Project to result in a significant adverse cumulative effect on Dungeness crab.

The Panel concludes that the Project would result in a significant cumulative effect on Dungeness crab.

The Panel supports the Proponent's proposed follow-up program to confirm the predicted effects on juvenile crab nursery habitat as well as a follow-up program to assess the effectiveness of the eelgrass offsetting measures to provide productivity benefits to Dungeness crab.

The Panel agrees with DFO's follow-up program proposal that the Proponent gather additional information to assess whether gravid female crab show high site fidelity within the LAA.

Recommendation 23

The Panel recommends that the Proponent, in collaboration with Fisheries and Oceans Canada, the Tsawwassen First Nation and the Musqueam Indian Band, be required to:

- *Refine crab offsetting to ensure that the offsets are located in high suitability habitat for juvenile crab; and*
- *Develop a follow-up program for Dungeness crab that includes:*
 - *monitoring of juvenile crab nursery habitat;*
 - *monitoring of the effectiveness of the proposed eelgrass offsets for increasing Dungeness crab productivity; and*
 - *increase offsetting to match the productivity losses due to the Project.*

12.3 Orange Sea Pen

12.3.1 Proponent's Assessment

The Proponent described orange sea pen as soft corals that were widely distributed along the Pacific coast but noted that there was little information available about the abundance, distribution, or ecological role of orange sea pen. The Proponent stated that although orange sea pen beds appeared to provide habitat for a number of species, there was not enough evidence to demonstrate a link between such habitat and any unique functional role provided by orange sea pen. Figure 12-4 indicates the orange sea pen distribution in the LAA. Figure 12-5 provides anecdotal observations of orange sea pen distribution in the regional area.



Figure 12-4: Orange sea pen bed concentration (Source: Project public registry document 1145)



Figure 12-5: Anecdotal orange sea pen observations (Source: Project public registry document 388)

The Proponent acknowledged that orange sea pen would be affected by direct mortality and alienation of their habitat. The Proponent predicted direct mortality to be the major mechanism for mortality as 92 ha of moderate- to highly-suitable orange sea pen habitat would be permanently lost due to Project construction. The Proponent estimated that this would reduce the productive potential of orange sea pen by 55 percent. The Proponent concluded that orange sea pen would not be affected by Project-related changes in total suspended solids or salinity.

The Proponent concluded that the Project would cause a moderate adverse effect on orange sea pen because the decrease in productive potential was likely to be outside the natural range of variability. However, the Proponent suggested that the decrease was not expected to compromise population integrity overall. The Proponent predicted that despite the direct mortality of orange sea pen due to the Project footprint, 45 percent of orange sea pen would remain in the LAA at a colony near the southwest corner of the Westshore Terminals. The Proponent's modelling predicted over 230 ha of suitable orange sea pen habitat would be available post construction. The Proponent noted that orange sea pen are broadcast spawners so larvae from adjacent areas would support continued recruitment to Roberts Bank.

The Proponent proposed an orange sea pen transplant program to partially mitigate direct mortality. The Proponent committed to transplanting approximately ten percent of the sea pen colony from the Project footprint, amounting to tens of thousands of individual orange sea pens. The Proponent proposed the use of SCUBA divers to conduct the transplant. The Proponent acknowledged that this was a novel approach, but they conducted a pilot program that showed promising results.

The Proponent concluded that the residual effect on orange sea pen was not significant, but noted only a moderate level of confidence in that conclusion because the proposed mitigation was untested. The Proponent stated that their conclusion of significance was not dependent on the success of the transplant program, but they committed to a follow-up program to confirm the effectiveness of orange sea pen transplantation.

12.3.2 Views of Participants

Tsawwassen questioned whether the proposed orange sea pen transplant would be adequate to compensate for the mortality due to the Project. Tsawwassen noted concern that the transplant only had a moderate likelihood of success and there were no suitable alternative mitigation measures.

DFO noted that the ecological role of orange sea pen was likely to provide structural features and make minor contributions to food webs. DFO acknowledged that the proposed orange sea pen transplant strategy was a novel approach and its effectiveness was uncertain. However, the Department also stated that given the positive results of the pilot study, the proposed transplant appeared to be a feasible strategy to mitigate a small portion of orange sea pen loss at Roberts Bank.

DFO recommended monitoring in order to determine the success of the transplant program. Tsawwassen stated that additional work was required to study the effectiveness of the mitigation measures and to consider the potential outcomes of an unsuccessful transplant. Tsawwassen recommended that the Port include and fund Tsawwassen's participation in the determination of an appropriate target for transplantation of orange sea pen and an adaptive management strategy.

12.3.3 Panel's Analysis

The Panel notes that much of the existing orange sea pen habitat within the LAA would be unavoidably lost due to the large overlap with the marine terminal placement and the location of the orange sea pen colony adjacent to the existing Roberts Bank terminal. The Panel agrees with the Proponent that the Project would cause a decrease in productivity of orange sea pen and may affect the overall sea pen ecological functions in the LAA.

The Panel agrees that the Proponent's proposed orange sea pen mitigation via SCUBA salvage and transplantation could effectively transplant a small fraction of the orange sea pen colony on Roberts Bank.

The Panel agrees with the Proponent that the Project would cause a residual adverse effect on orange sea pen due to the loss of habitat, even after the transplant program is undertaken. The Panel acknowledges the impracticality of transplanting the entire colony into areas adjacent to the existing orange sea pen colony.

The Panel agrees with the Proponent that future recruitment of orange sea pen from other orange sea pen colonies in the Salish Sea is likely to occur. However, the Panel considers that orange sea pen recruitment from other colonies would likely occur at a slow rate, potentially spanning decades. This reflects the sparse distribution of orange sea pen colonies in the Salish Sea and the high likelihood that orange sea pen recruitment processes would be slow.

The Panel considers a decrease of 55 percent in productivity, estimated by the Proponent, to be beyond the natural variability of orange sea pen productivity variations.

The Panel concludes that the residual adverse effect of the Project on the orange sea pen colony in the Local Assessment Area, even after proposed mitigation, would be significant.

Cumulative Effects Assessment

The Panel is uncertain whether terminal construction, including Deltaport Terminal and Westshore Terminals, has played a role in the establishment of orange sea pen colonies within the LAA. As well, the recruitment rate of orange sea pen into new, suitable habitats is unknown. Therefore, the Panel cannot conclude whether or not the Project would have a cumulative effect on orange sea pen.

The Panel cannot conclude whether or not the Project would result in an adverse cumulative effect on orange sea pen.

Recommendation 24

The Panel recommends that the Proponent be required to:

- *Proceed with its proposed transplant program of orange sea pen; and*
- *Conduct monitoring annually through the construction phase of the Project to ensure viability of the transplanted individuals as part of the proposed follow-up program.*

13 Marine Fish and Fish Habitat

This section of the report assesses the interactions between the Project and marine fish and fish habitat and assesses the mitigation and follow-up programs for managing Project effects.

13.1 Methodology and Mitigation

13.1.1 Proponent's Assessment

The Proponent determined that the Project could affect marine fish by causing injury and direct mortality or by changes to the acoustic and light environment, water quality, sedimentation and coastal processes as well as habitats upon which fish depend.

The Proponent selected five subcomponents for marine fish to represent the diversity of fish at Roberts Bank: Pacific salmon; reef fish; forage fish; flatfish; and, demersal fish. The Proponent further identified species that represent each of the five subcomponents to focus the assessment on fish species of high importance to Indigenous groups, species of conservation concern, and species harvested in fisheries.

The LAA was similar to the study area of the RBEM. The Proponent described the RAA as the Fraser River estuary from Boundary Bay to Sturgeon Bank and from the high-water mark seaward to -100 m CD, plus the Fraser River North and Main Arms and main stem as far upstream as Hope, British Columbia.

The Proponent selected productivity as a key indicator for effects assessment on marine fish. To measure changes in productivity the Proponent applied the RBEM, collected other types of evidence, including field and literature studies, workshop outcomes with Tsawwassen and Musqueam and from Project-specific studies related to current use.

The Proponent proposed several mitigation measures, some of which were specific to mitigate potential effects on a particular subcomponent or species, while others would be applied more generally to increase productivity at Roberts Bank. The Proponent stated that it minimized adverse effects by selecting a sub-tidal terminal placement instead of an intertidal placement. Other design features such as use of rocky shorelines and rounding the northwest corner of the terminal were incorporated to reduce potential effects on marine fish. The rocky shoreline was predicted to partially control sedimentation and erosion in areas of stronger waves and ocean current and would potentially serve as refugia for fish.

Some of the more general mitigation measures the Proponent committed to develop in its Construction and Operation Environmental Management Plans included:

- Salvage of marine species prior to infilling of all containment dykes;
- Underwater noise monitoring and reduction practices;
- Water quality compliance monitoring of total suspended solids levels;
- Sediment and erosion control measures; and

- Use of lighting technologies to shield and divert light away from the marine environment.

A key mitigation measure proposed by the Proponent was its conceptual Offsetting Plan, which detailed the offsetting measures for effects that could not be avoided or reduced through other means. The Proponent committed to develop a final Offsetting Plan in collaboration with relevant agencies and Indigenous groups.

Prior to mitigation, the Proponent predicted a minor loss in productivity for all marine fish. With mitigation, the Proponent concluded that the Project would result in adverse residual effects on marine fish that were not significant, and that these residual effects would not lead to measurable adverse cumulative effects on marine fish.

13.1.2 Views of Participants

DFO agreed with the Proponent's selection of representative species. DFO also commented on the importance of mitigation measures and monitoring to ensure they would be effective at reducing harm or mortality of fish. DFO noted that mitigation is often costly and could result in project delays. For example, the strict use of construction timing windows could limit construction on Roberts Bank to a six-month window every year. DFO stated that these types of measures were typically discussed in detail during the regulatory process. DFO also noted that the selection of indicators for the follow-up program would be important for assessing the accuracy of predicted effects from the Project.

DFO commented on the use of total ecosystem productivity as a metric for the assessment of effects on fish and fish habitat in the RBEM. DFO considered that this was an unusual approach, and encouraged the use of other metrics, such as specific taxa of interest or habitat loss. DFO identified the need to determine how well proposed offsetting would fulfill mitigation requirements under the *Fisheries Act*.

The Tsawwassen considered that the Proponent's assessment did not sufficiently disaggregate species to allow an understanding of effects on Tsawwassen diet and cultural experience. Tsawwassen considered there was insufficient information to confirm that the Project was unlikely to have significant impacts on species of fish that were not directly evaluated by the assessment framework.

Several participants expressed concern with the development and application of the Proponent's final Offsetting Plan to mitigate adverse effects on fish and fish habitat. Notably DFO, ECCC, the BC Ministry of Forest, Lands, Natural Resource Operations and Rural Development (FLNRORD), and Ecojustice provided information pertaining to past successes and failures of offsetting projects in the Fraser River estuary.

13.1.3 Panel's Analysis

The Panel agrees with the selection of the five fish subcomponents and their representative species. The Proponent provided credible methodology for determining construction effects on fish and relied upon the RBEM and other sources of evidence to predict the effects of the Project

during operations. Advice was received from DFO to assist in the interpretation of the RBEM predictions. In particular the RBEM was determined to be most reliable for fish species that complete their life cycle within the LAA with minimal immigration and emigration across the RBEM spatial boundaries. DFO also pointed out that RBEM was less applicable to fish species with limited residence time within the spatial domain of the model, for example juvenile Chinook and chum salmon. In this situation both DFO and the Proponent identified the need to consider other forms of evidence, for example results of field studies, publicly available Indigenous traditional knowledge, literature reviews and expert opinion. The Panel raised concerns about the use of expert opinion to integrate other forms of evidence rather than considering expert opinion on an equal footing as the other forms of evidence. Despite this shortcoming the Panel concludes that the Proponent's approach to effects assessment on fish is reasonable.

Based on advice from DFO the Panel appreciates the necessity to achieve habitat equivalency such that offset productivity is commensurate with the adverse effects of the Project on fish productivity. The Panel considers the demonstration of habitat equivalency to be a relevant yardstick to measure mitigation effectiveness. This was not provided by the Proponent in response to information requests from the Panel, thereby introducing uncertainty into the ability of the proposed offsets to mitigate Project effects.

13.2 Pacific Salmon

13.2.1 Proponent's Assessment

The Proponent selected juvenile Chinook and chum salmon as representative species to assess the Pacific salmon subcomponent. The Proponent stated that these species were representative given that they were consistently present at Roberts Bank, they were the most estuarine-dependent of the five Pacific salmon species and as adults, were important prey species for the SRKW.

The Proponent predicted a minor positive effect on juvenile salmon productivity from the terminal footprint and the expanded causeway. The wave shadow of the terminal was predicted to dampen both the wave height and current speed behind the proposed terminal footprint, which would improve native eelgrass habitat conditions and increase benthic macrofauna productivity. The Proponent stated that predictions of effects on adult salmon productivity were conservative given that adult salmon migrate rapidly through Roberts Bank and therefore would be less sensitive to potential Project-related changes.

The Proponent predicted that the Project could disrupt migration behaviour of juvenile salmon and result in a minor loss of juvenile salmon productivity through two mechanisms: changes in the light environment and changes in habitat availability. The Proponent determined that changes in the light environment from terminal lighting and construction equipment may result in a minor loss of productivity by altering salmon behavior, thereby delaying out-migrating salmon between a few hours and a few days.

The Proponent explored how habitat loss caused by the terminal placement and widening of the causeway could adversely affect movement patterns of juvenile chum and Chinook salmon. The Proponent stated it took a conservative approach by assuming that juvenile salmon migrate in a linear fashion, implying that juvenile salmon keep to the shoreline as they transit through the Fraser River estuary. Based on this assumption, the Proponent considered the existing and proposed terminal structures could present an obstacle to migration. The Proponent further explained that linear movement may not accurately represent the movements of juvenile chum and ocean-type Chinook salmon that temporarily reside in the Fraser River estuary. From surveys conducted in 2012 and 2013, the Proponent reported that juvenile chum salmon were more closely associated with shore-tied intertidal habitats than juvenile Chinook salmon, which showed no preference for any particular habitat at Roberts Bank. The surveys indicated that juvenile salmon access food sources and seek refuge in the higher intertidal zone during flood tides, and use open water at subtidal locations when the flats are drained and where turbid conditions may serve as a refuge from visual predators.

To further evaluate the potential for migration disruption, the Proponent compared juvenile salmon densities to the north and south of the existing causeway. The results showed that there was no statistical difference in juvenile Chinook and chum salmon density at the two locations. However, the Proponent expected that the highly variable catch data would confound the detection of a difference between locations, even if such existed.

Based on its qualitative assessment of the potential effects that were not captured by the RBEM, in combination with the modelled increase in productivity, the Proponent determined that the Project's construction and operations may result in a minor loss in juvenile chum and Chinook salmon productivity prior to mitigation, and a negligible loss in productivity for adult chum and Chinook salmon.

The Proponent proposed shielding to divert light from terminal light installations away from the marine environment to mitigate potential effects caused by changes in the light environment. To offset potential effects on juvenile salmon migration, the Proponent committed to transplantation of native eelgrass and construction of tidal marsh habitat to provide additional food supply and refugia to increase juvenile salmon productivity. The Proponent also stated that restricting in-water construction activities above -5 m CD during the juvenile salmon fisheries-sensitive window, from March 1 to August 15, would benefit juvenile salmon, as well as other species that utilize intertidal and shallow subtidal waters at Roberts Bank. With mitigation, the Proponent determined that adverse effects on juvenile salmon productivity would be negligible.

The Proponent addressed the possibility of installing a culvert to open the causeway as an additional measure to mitigate potential effects on Pacific salmon migration. The Proponent concluded that it would be difficult to induce juvenile salmon to swim through shaded structures like culverts.

The Proponent made a commitment to explore the feasibility of a follow-up program for juvenile salmon that would verify assessment predictions using distribution and density as monitoring targets, to supplement proposed follow-up programs to evaluate the productivity of offset

measures. The Proponent committed to evaluate and incorporate other data sets from the Fraser River estuary into the program, such as those collected by the Raincoast Conservation Foundation. The Proponent committed, that if this follow-up program element could not reasonably attribute detectable change in juvenile salmon density to the Project, the Proponent would seek alternative approaches, including additional offsetting. The Proponent stated that they would identify and develop offsite opportunities as well as consider potential opportunities to address limiting factors for priority species such as Chinook salmon.

Chinook salmon

In order to address conservation concerns for Chinook salmon, the Proponent investigated potential effects on the 13 populations of Chinook salmon in British Columbia that originate from the Fraser River. The Proponent stated that of the 13 populations, 11 populations were 'stream-type' that migrate rapidly through the Fraser River Estuary as smolts before reaching marine waters. The two other populations were 'ocean-type' that reside temporarily as fry in the Fraser River estuary prior to marine migration.

Through genetic sampling, the Proponent found that the majority of the juvenile Chinook salmon that utilize Roberts Bank originate from ocean-type populations. Specifically, out of the 389 samples collected at Roberts Bank and Sturgeon Bank, the Proponent reported 71 percent originated from the Lower Fraser Chinook population, and 16 percent originated from the South Thompson population. The Proponent stated that ocean-type Chinook salmon would likely be more exposed to the Project than stream-type populations, but considered the Project effect negligible.

The Proponent added that there was no apparent correlation between declines in Fraser River Chinook salmon and placement of the existing causeways at Roberts Bank, and therefore urban and shoreline development were not primary drivers of declines in juvenile Chinook salmon productivity. The Proponent noted that its offset plan may contribute to the recovery of Fraser River Chinook salmon.

Sockeye salmon

The Proponent stated that there have been no reports of juvenile sockeye salmon in the LAA since the late 1970s. The Proponent stated the Project interaction with sockeye salmon would be minimal.

Sturgeon

The Proponent stated the assessment for Chinook and chum salmon was representative of sturgeon. The Proponent provided further information on white sturgeon as a species of importance for Indigenous groups and a species at risk. The Proponent reported the presence of white sturgeon throughout the Main Arm of the Fraser River, with concentrations around Canoe Passage and adjacent areas. The Proponent stated that marine excursions by white sturgeon from the Fraser River into the Fraser River estuary were rare, brief, and localized close to the river mouth. The Proponent noted that white and green sturgeon were demersal species that associate

with benthic habitats and therefore would not be subject to propeller strikes of container ships berthing at the terminal.

Mitigation measures proposed for Pacific salmon were considered applicable to mitigate potential Project effects on sturgeon. In order to address concerns around potential effects on sturgeon, the Proponent made a commitment to fund up to \$500,000 to build on recent and ongoing work related to eulachon and sturgeon in the lower Fraser River that would be undertaken in conjunction with Tsawwassen and Musqueam.

13.2.2 Views of Participants

DFO agreed with the Proponent about the importance of the Fraser River estuary for juvenile Chinook and chum salmon, particularly during their estuary residency phase which was considered to be critical for juvenile growth and survival before entering the ocean. DFO noted that, of the 13 Designatable Units (populations) of Fraser River Chinook salmon that had been assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), seven were endangered, four were threatened, one was of special concern, and one was not at risk. The COSEWIC Designatable Units in the Fraser River Watershed are listed in Table 13-1.

Table 13-1: COSEWIC Designatable Units in the Fraser River watershed (Source: Adapted from COSEWIC)

Designatable Unit	COSEWIC Status
Lower Fraser, Ocean, Fall population	Threatened
Lower Fraser, Stream, Spring population	Special Concern
Lower Fraser, Stream, Summer (Upper Pitt) population	Endangered
Lower Fraser, Stream, Summer population	Threatened
Middle Fraser, Stream, Spring population	Endangered
Middle Fraser, Stream, Fall population	Endangered
Middle Fraser, Stream, Spring population	Threatened
Middle Fraser, Stream, Summer population	Threatened
Upper Fraser, Stream, Spring population	Endangered
South Thompson, Ocean, Summer population	Not at risk
South Thompson, Stream, Summer 1.2 population	Endangered
North Thompson, Stream, Spring population	Endangered
North Thompson, Stream, Summer population	Endangered

DFO also considered the habitat loss related to the Project footprint of 177 ha, limitations regarding the performance of the RBEM for migratory species, construction activities that may

result in fish and invertebrate mortality as well as permanent alteration of intertidal and subtidal habitats. DFO concluded that, given the dependence of all salmon species on estuary habitat, the Proponent may have underestimated the significance of effects on fish and fish habitat, especially the effects on Chinook salmon.

DFO commented that the Proponent evaluated all feasible ways to minimize light disturbance to fish during construction activities and terminal operations. DFO recommended that the Proponent develop contingency measures for noise mitigation should underwater noise monitoring during construction reveal that mitigation measures were not effectively reducing noise to levels that would prevent injury and mortality of fish. DFO provided recommendations on the Proponent's follow-up programs to monitor effects predictions on juvenile salmon habitat and prey and on the final Offsetting Plan.

Other participants questioned the Proponent's conclusion of a negligible change in juvenile Chinook salmon productivity as a result of the Project. Ecojustice and Dr. Neilson considered that all 13 populations of Fraser River Chinook salmon use and depend on the estuary, inclusive of the area for which direct and indirect effects were predicted due to the Project.

Ecojustice, representing the Conservation Coalition, submitted information to the Panel about its concern for effects from the Project on Chinook salmon. Ecojustice considered the Proponent's conclusions about negligible effects to Chinook salmon to be scientifically indefensible as they did not address limitations in the ecosystem model for migratory species. Further, Ecojustice commented on the lack of quantitative analysis and baseline data, underestimation of effects from reduction in preferred food sources and interference to migration as well as the design and time lags related to the proposed offsetting plans.

Ecojustice was concerned that the Proponent did not properly assess the implications of the Project on Chinook salmon migration patterns in the estuary. Ecojustice considered the past effects from terminal and causeway construction to be unknown, but likely affected juvenile salmon migration on Roberts Bank. Despite the Proponent's follow-up program for juvenile salmon migration monitoring before and after construction, Ecojustice expressed concerns that there was no particular mitigation measure proposed to address adverse effects should an adverse effect be detected. Ecojustice advised that losses of Chinook salmon habitat needed to be considered in the context of the entire Fraser estuary that is already degraded by other human developments. Ecojustice explained that much of the land along the shore is already developed, and as sea level rises, extensive dyking would limit an inland shift of the intertidal zone, a phenomenon known as coastal squeeze. Ecojustice was of the view that, with sea level rise resulting from climate change, coastal squeeze would exacerbate the loss of fish habitat in the estuary. Ecojustice argued that Chinook salmon was subject to potential effects of the project, especially since some of the populations were classified as at-risk by COSEWIC.

Ecojustice explained that the Chinook populations most vulnerable to habitat loss in the estuary were the ocean-type Lower Fraser River population, which originates primarily in the Harrison River and the South Thompson River ocean-type population. These ocean-type fry extensively utilize the Lower Fraser River and estuary as primary juvenile rearing areas. When present on

Roberts Bank, juvenile Chinook migrating seaward towards the marine environment would encounter the proposed terminal which could affect their migration pathway. Additionally, the proposed terminal could reduce their access to inter-causeway habitats, prematurely expose them to more saline conditions, and potentially reduce their ability to acclimate to seawater.

Ecojustice noted that the proposed offsetting plans would not adequately mitigate effects from habitat loss and displacement nor did they adequately account for time lags between Project effects and fully functional offsets.

Ecojustice suggested breaching the Roberts Bank causeway for juvenile salmon passage or considering the design of a flow passage between the existing causeway and the proposed terminal. Ecojustice stated that the Proponent's feasibility study of a 1.5 meter-wide by 4 meter-long culvert should have considered at minimum a 5 to 10 meter-wide breach. Ecojustice reported that the Raincoast Conservation Foundation recently participated in successful breaching project at the Steveston Jetty.

Musqueam stated that the Proponent had not fully assessed effects on white sturgeon and juvenile salmon. To address uncertainties, Musqueam recommended the Proponent be required to undertake additional studies for these species prior to construction and finalization of requirements for mitigation, offsetting, and follow-up programs. Those studies would be conducted in partnership with Tsawwassen and completed at least 60 days prior to start of construction.

Because of their concerns regarding the Project effects on salmon and sturgeon, Tsawwassen recommended that the federal decision statement include a requirement for the Proponent to provide further detail on the proposed salmon Offsetting Plan and submit a notice confirming Tsawwassen consent to the planned offsetting measures.

With regards to sturgeon, FLNRORD presented evidence that sturgeon migration overlaps with the Project area. Recent monitoring data and traditional knowledge indicated that sturgeon used the estuary as an important feeding habitat prior to and after the breeding season. FNLROD recommended that additional information be collected by the Proponent to appropriately reduce the risk to sturgeon in the Fraser River estuary, and recommended that the Panel include specific conditions pertaining to monitoring methodology, research funding, consultation and data sharing with the Ministry, Indigenous groups, and DFO.

13.2.3 Panel's Analysis

The Panel agrees that the effects assessment directed at chum and Chinook salmon is highly relevant due to their respective juvenile life histories and their potential exposure to Project effects. The Panel notes that other salmon species, such as sockeye, are reported to transition relatively rapidly through the Fraser River estuary. The Panel finds that predictions for chum and Chinook salmon would be conservative for the species that are less reliant upon Roberts Bank habitats, such as coho, sockeye and pink salmon juveniles.

The Panel agrees with the Proponent and DFO that there would be minor decreases in chum and ocean-type Chinook salmon productivity due to mortality from changes in the acoustic and light environments. The Panel agrees with the advice from DFO that effects on fish behavior and predator-prey relationships during construction from change to light and noise environments are uncertain and difficult to quantify. The Panel finds that the proposed mitigation measures for light and noise are reasonable, but not proven to be fully effective. The Panel concludes that effects on juvenile chum and Chinook salmon due to light and underwater noise would not be fully mitigated and therefore would result in a residual adverse effect.

The Panel further examined the potential Project effect caused by disruption of juvenile salmon migration due to habitat fragmentation of Roberts Bank. The Panel notes that the Proponent could not detect a difference in juvenile salmon densities between the north and south of the existing causeway. The Panel finds that this result likely reflects the patchy distribution of juvenile salmon schools, and implies that a higher sampling intensity would be required to defensibly evaluate existing migration disturbance adjacent to the causeway and terminal.

The Panel concludes that while quantification of a migration disruption effect could not be undertaken, the presence of the Project footprint would add to any existing disruption effects from the existing terminal and causeway and further restrict the access of juvenile salmon to productive habitats within the inter-causeway area. The Panel notes that the Proponent's approach to mitigating potential migration disruption by in-water infrastructure relies upon proposed onsite offsetting.

The Panel agrees that onsite offsetting, including a native eelgrass transplant and reconstruction of intertidal marsh habitat north of the widened causeway, could potentially mitigate juvenile salmon productivity losses. However, it cannot be determined whether the scale of the proposed offsets would be commensurate with adverse effects of the Project.

The Panel notes that although it heard from a few participants that all Fraser River Chinook salmon depend on the estuary, the Proponent demonstrated that Chinook salmon dependence on the Fraser River estuary is nuanced. The Panel agrees with the Proponent that the greatest potential for Project-related effects are on Lower Fraser and South Thompson ocean-type Chinook salmon, while stream-type Chinook salmon would be less exposed and less vulnerable to Project effects.

The Panel concludes that the Project will have an adverse residual effect on juvenile Chinook salmon due to migration disruption, coupled with minor adverse effects in the acoustic and light environments during construction and operations. This effect would be high in magnitude, local in extent, permanent in duration, and irreversible. The Panel concludes that this effect would be significant.

The Panel concludes that the Project will have an adverse residual effect on juvenile chum salmon that is uncertain in magnitude, local in spatial extent, permanent in duration, and irreversible. The Panel concludes that this effect would not be significant, taking into account the high adult chum salmon population size in the Lower Fraser River.

The Panel notes that the Proponent concluded that breaching the causeway to allow for ecological restoration of the inter-causeway area and to increase juvenile salmon utilization of habitats at Roberts Bank was not technically feasible. The Panel understands that the primary direction of tidal flow is parallel to the causeway, whereas the desired direction of water flow to divert water and juvenile salmon into the inter-causeway area would be perpendicular to the causeway. This outcome could only be achieved by a major redesign of the existing and expanded causeway to encompass flow passage and to allow for the load bearing requirements of land-based container traffic.

The Proponent concluded that the Project would not result in residual effects on Pacific salmon, and no cumulative effects assessment was undertaken. The Panel heard from many participants, such as Ecojustice, Fraser Voices and the VAPOR Society about past and ongoing developments in the Fraser River estuary. The Panel finds it reasonable to expect that past effects on juvenile Chinook salmon would combine with the Project effects to result in a significant cumulative effect.

The Panel disagrees with the Proponent that an assessment for sturgeon can be represented by Pacific salmon. However, due to the small overlap of the Project with the distribution of sturgeon, the Panel concludes that it is unlikely that the Project would cause an adverse effect on sturgeon.

The Panel concludes that the Project would result in a residual adverse effect and an adverse cumulative effect on juvenile chum salmon. The effects would not be significant.

The Panel concludes that the Project would result in a residual adverse effect and an adverse cumulative effect on ocean-type juvenile Chinook salmon populations from the Lower Fraser and South Thompson Rivers. The effects would be significant.

Recommendation 25

The Panel recommends that the Proponent, in collaboration with Fisheries and Oceans Canada, the Tsawwassen First Nation and the Musqueam Indian Band, be required to:

- *Develop and implement a statistically defensible sampling program, to evaluate the abundance and distribution of ocean-type salmon in the Local Assessment Area prior to construction;*
- *Evaluate the extent of existing and future migration disturbance due to terminal placement;*
- *Develop additional offsets onsite and offsite to fully mitigate a potential loss in ocean-type Chinook salmon productivity; and*
- *Develop and implement a plan to support hatchery initiatives designed to increase the production of Lower Fraser ocean-type Chinook salmon from existing Fisheries and Oceans Canada facilities.*

13.3 Forage Fish

13.3.1 Proponent's Assessment

To determine the effects of the Project on forage fish the Proponent assessed Pacific herring, Pacific sand lance, surf smelt, and shiner perch. The assessment applied by proxy to other represented species, such as eulachon and Pacific sardine.

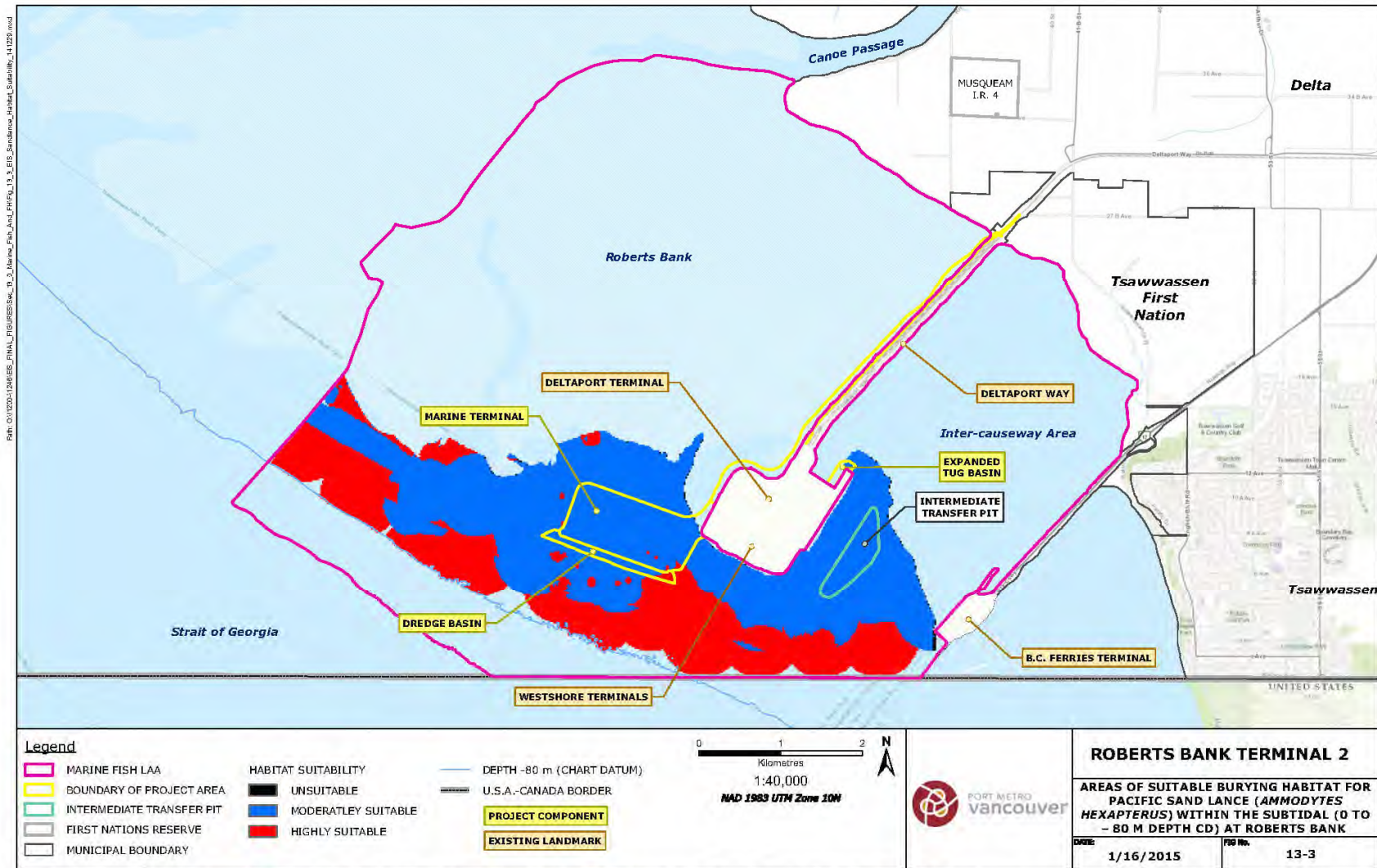
The Proponent determined that the Project would have a minor adverse effect on forage fish productivity prior to mitigation, primarily due to changes in the acoustic environment during construction and the reduction in the availability and quality of intertidal and subtidal sand habitat due to the Project footprint.

The Proponent assessed changes in Pacific sand lance habitat availability by modelling habitat suitability and mapping low, moderate and high suitability habitat over the LAA. Although the terminal footprint would represent a permanent loss of habitat, the Proponent reported that with the Project footprint, 99 percent of the highly suitable and 86 percent of the moderately suitable substrate in the LAA would remain available to Pacific sand lance, as illustrated in Figure 13-1.

The Proponent stated that although Pacific sand lance was reported to alter its behaviour based on light exposure, changes in the light environment were not expected to result in adverse effects. The Proponent considered that in the Fraser River estuary, light intensity was reduced by about 90 percent within 1 m from the surface due to naturally occurring turbidity. The Proponent therefore determined that light conditions on the seabed adjacent to the marine terminal would not change from ambient conditions.

The mitigation measures considered by the Proponent included the use of underwater noise monitoring, modifying construction activities such as using a vibratory hammer instead of pile driving, and ramping up construction activities to allow sound-sensitive species to habituate or temporarily leave the area. The Proponent also noted that Pacific sand lance, which overwinter buried within subtidal sediments, would benefit from the non-construction window period established to protect gravid Dungeness crab during construction.

The Proponent stated that proposed offsetting in the form of eelgrass transplants could increase productivity of forage fish. The creation of 4.5 ha of sandy gravel beaches was considered a key offset measure for forage fish to mitigate potential adverse effects by enhancing foraging and spawning habitat.



Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), Swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Figure 13-1: Areas of suitable burying habitat for Pacific sand lance within subtidal habitat at Roberts Bank (Source: EIS, Volume 3)

With mitigation, the Proponent concluded that there would be a minor residual adverse effect on forage fish. The Proponent characterised the effects as:

- Low in magnitude, within the range of natural variability experienced by forage fish at Roberts Bank;
- Local in extent;
- Permanent in duration for the Project footprint, while shorter term for acoustic disruption during construction;
- Partially reversible over time and after implementation of effective offsets; and
- With the frequency of effects depending on the activities that would result in the change, from intermittent and regular acoustic disturbance to infrequent sediment disturbance.

The Proponent concluded that the residual effect would not be significant given that the effects would not affect forage fish population integrity, and that recruitment and re-colonisation were expected to occur. The Proponent stated that, although not significant, this effect was likely to occur, and ascribed a moderate level of confidence to this prediction.

The Proponent concluded that the adverse residual effects of the Project on the productivity loss for forage fish, in combination with the effects of other projects and activities that have been and will be carried out, were anticipated to result in a residual cumulative effect on forage fish productivity. The Proponent noted that the Project would contribute to past effects by decreasing available habitat for forage fish, rather than through the anticipated change in underwater noise during construction and operations. Given that long-term integrity of forage fish in the RAA would not be compromised and that their function in the wider marine ecosystem would be maintained, the Proponent concluded that this cumulative effect was not significant.

The Proponent made a commitment to develop a follow-up program to verify light trespass predictions and to ensure that nighttime terminal lighting did not exceed 100 lux or greater on the adjacent sea bed, within 50 m of the terminal. The Proponent committed to monitor for Pacific herring to detect their presence during construction activities in areas that overlap with herring spawning habitats. For Pacific sand lance and surf smelt, the effectiveness of sandy gravel beach would be verified by monitoring its use as a spawning habitat and would include measures such as egg presence and abundance.

Eulachon

Due to the importance of eulachon to Indigenous groups and their status as ‘Endangered’ under COSEWIC, the Proponent provided a more detailed assessment of eulachon as a forage fish. The Proponent stated that adult eulachon were more likely to be affected by the Project than juvenile eulachon, given that adult eulachon transit through the Fraser River estuary on their way to spawning grounds in the lower Fraser River. The Proponent noted the Project therefore had the potential to affect adult eulachon through mechanisms such as injury and direct mortality, and changes in the acoustic and light environments. The Proponent determined that the terminal and widened causeway would not create an obstacle for migrating adult eulachon based on their ability to avoid obstacles they encounter during migration.

The Proponent proposed mitigation measures for Pacific herring and surf smelt, which would also benefit migrating eulachon, such as the use of the construction timing window for gravid Dungeness crab in the Project construction schedule, which would also protect migrating eulachon in February and March. Potential effects would also be mitigated through water quality compliance monitoring and underwater noise monitoring.

The Proponent made a commitment to develop eulachon-specific mitigation in collaboration with Indigenous groups and providing up to \$500,000 in funding to build on recent and ongoing work related to eulachon and sturgeon in the lower Fraser River. The Proponent also made a commitment to conduct hydroacoustic assessments during construction outside the timing window in order to detect eulachon and direct dredging activity away from migrating schools.

Views of Participants

13.3.2 Views of Participants

DFO noted that the nature and extent of behavioural effects of underwater noise on marine fish was not well understood, and that there was uncertainty in the Proponent's conclusion for the effect on Pacific herring with respect to acoustic disturbance. DFO pointed out that although the terminal site was not known as an important spawning site, it was located in close proximity to a local herring spawning population and that herring larvae and juveniles may be rearing in the Fraser River plume. Given the role of Pacific herring as a food source for a variety of important piscivorous species, DFO recommended that construction mitigation plans should consider the potential presence of spawning herring during construction.

DFO advised that the full extent of sub-tidal burying habitat for Pacific sand lance in and around the proposed Project footprint was unknown or inadequately assessed. DFO noted that visual absence of Pacific sand lance or lack of catch from an area did not necessarily infer unsuitable habitat or non-use of habitat, especially because Pacific sand lance can remain buried in the surface sediments of suitable habitat for several months in late autumn and early winter. DFO recommended that the Dredging and Sediment Discharge Management plan consider the potential for Pacific sand lance to be present in sediments during dredging activities, given the year-round potential for Pacific sand lance to occupy burying habitats and uncertainties surrounding the extent of suitable burying habitat in the LAA. DFO also recommended that terminal lighting should not result in lighting of greater than 100 lux near the sea bed.

DFO considered the Proponent's assessment of effects on eulachon to be inadequate because it did not account for the uncertainty in the occurrence of eulachon larvae and juveniles in the Fraser Estuary, including Roberts Bank and the Project area. DFO reported results of 2018 surveys which confirmed sub-adult or adult eulachon catches off the Fraser River delta. DFO commented that eulachon populations coast-wide have experienced a sharp downward trend with the Fraser River population reaching extremely low levels starting in the mid-2000s. Given the importance of eulachon within the Roberts Bank food web, as well as their Endangered COSEWIC status, DFO recommended that development of construction mitigation plans should consider the potential presence of eulachon during construction.

FLNRORD stated that eulachon interacted strongly with sturgeon due to their ecological role as a seasonal food supply but they had no information specific to eulachon despite hearing about its importance from First Nations. FLNRORD recommended the Proponent conduct eulachon studies in the Lower Fraser and to consult the Ministry for provincial expertise.

Musqueam and Dr. John Neilson raised concerns that eulachon was inappropriately assessed using Pacific herring and surf smelt as representative species, given that eulachon was a species of conservation concern and of high cultural importance to Indigenous groups. Musqueam also raised concerns that the Project footprint had the potential to directly block the migration trajectory of adult eulachon returning to Canoe Passage and the Main Arm of the Fraser River. To address uncertainties, Musqueam recommended the Proponent be required to undertake additional eulachon studies prior to construction and finalization of requirements for mitigation, offsetting, and follow-up programs. Tsawwassen expressed concern regarding potential effects on eulachon. Tsawwassen recommended that support was needed to conduct additional eulachon studies ahead of Project approval.

Both Musqueam and Tsawwassen requested that the Proponent's studies, including its proposed funding program of \$500,000 for sturgeon and eulachon studies, be conducted in partnership with them, and completed at least 60 days prior to start of construction.

13.3.3 Panel's Analysis

The Panel agrees with the Proponent that the Project would result in a residual effect on forage fish productivity, due primarily to permanent habitat loss, and direct mortality and disturbance during construction. The Panel finds that the proposed sandy gravel beach offsets could partially mitigate the Project effect. The Panel notes DFO advised sandy gravel beach mitigation was not common and that there is greater uncertainty as to whether this offsetting approach would be successful.

The Panel notes that the Proponent supported its assessment on the basis that Pacific sand lance was not habitat-limited within the LAA. The Panel finds that loss of spawning habitat is a high magnitude effect, regardless of how much potential habitat is available in the LAA. The Panel also finds the Project's effect on habitat loss and productivity to be potentially irreversible due to the uncertainty related to the effectiveness of the proposed offsets for forage fish. The Panel concludes the Project would result in a significant adverse effect.

The Panel agrees with the advice from DFO that to protect Pacific sand lance, terminal lighting should not result in lighting of 100 lux or greater near the seabed. The Panel agrees with DFO's recommendation that the final Dredging and Sediment Discharge Management plan should include measures to reduce the potential direct mortality of Pacific sand lance during dredging activities. The Panel acknowledges that the Proponent committed to address both these recommendations in its construction environmental management plans.

The Panel recognizes that the Proponent carried the Project residual effect on forage fish to a cumulative effects assessment in the RAA, and concluded that the Project, in combination with

the effects of other projects and activities, would result in a cumulative effect on forage fish productivity, which was not significant. The Panel agrees with the Proponent's conclusion given that the effect is limited to the LAA.

During the assessment, the Panel heard from many indigenous groups who expressed concern related to Project interactions with eulachon. The Panel observes that eulachon are listed as endangered under COSEWIC and were being reviewed for SARA listing at the time of the closing of the environmental assessment record.

The Panel further investigated effects on eulachon separately from Pacific sand lance and surf smelt. Unlike other forage fish like surf smelt and Pacific sand lance, eulachon do not spawn in the LAA. Eulachon spawning areas are located in Lower Fraser River tributaries. Fraser River eulachon migrate from the Pacific Ocean back to Roberts Bank and a small harvest is taken by Indigenous groups in Canoe Passage in the vicinity of the Project at the edge of the LAA. The Panel is of the view that the main concern with eulachon is related to potential migration disruption across Roberts Bank, not habitat loss.

The Panel concludes that there is potential for the Project to have a residual adverse effect on eulachon migration, but that substantial uncertainty remains in the degree to which mitigation will be effective to balance the effect. The Proponent has committed to a follow-up program in collaboration with Indigenous groups that includes testing the feasibility of assessing eulachon abundance, distribution and behaviour using hydroacoustic sampling. The Panel agrees with this approach. The Panel is unable to conclude if the Project would have an adverse effect on eulachon, due to limited available information related to eulachon migration

The Panel also notes that the Proponent committed to a funding program and studies on eulachon and sturgeon, if the Project is approved. The Panel agrees that those studies would be required, with the full involvement of Tsawwassen and Musqueam.

The Panel concludes that, due to the loss of spawning habitat, and in the absence of effective mitigation measures, the Project would result in a significant adverse effect on Pacific sand lance and surf smelt.

The Panel concludes that the Project would have an adverse cumulative effect on Pacific sand lance and surf smelt. The cumulative effect would not be significant because it would be spatially limited to the Local Assessment Area.

Recommendation 26

The Panel recommends the Proponent, in partnership with the Tsawwassen First Nation and the Musqueam Indian Band, and in consultation with British Columbia Ministry of Forest, Lands, Natural Resource Operations and Rural Development, be required to design and implement eulachon and sturgeon studies that would include:

- *Hydroacoustic assessment;*

- *An evaluation of the potential for eulachon migration disruption; and*
- *Measures for the identification of hydroacoustic targets, such as simultaneous net sampling.*

Recommendation 27

The Panel recommends that the Proponent be required to include in the final Dredging and Sediment Discharge Management Plan, measures to reduce direct mortality of Pacific sand lance during dredging of the berth pocket.

13.4 Flatfish

13.4.1 Proponent's Assessment

Flatfish fish were represented by English sole and starry flounder given their abundance at Roberts Bank. The Proponent noted that English sole are representative of deeper water flatfish, while starry flounder could serve as indicators of changes in shallower flatfish habitats. This assessment was considered to apply by proxy to other represented species, such as halibut and several species of sole.

The Proponent described flatfish as relatively sedentary and associated with bottom sediment, and determined that the Project would have a minor adverse effect on flatfish productivity. This effect was primarily due to changes in water quality during construction and reduction in the availability and quality of subtidal sand habitat due to the Project footprint. To mitigate these effects, the Proponent suggested that the gravid Dungeness crab construction window from October 15 to March 31 would reduce potential effects on flatfish. The Proponent noted that sandy gravel offsetting beaches would support the productivity of flatfish prey.

The Proponent determined that the Project would result in a residual adverse effect on flatfish, mainly due to loss of subtidal habitat. The Proponent concluded that the residual effect would not be significant given that the effects would not affect population integrity, and that recruitment and re-colonization were expected to occur. The Proponent stated that, although not significant, this effect was likely to occur. The Proponent further concluded the Project would result in a cumulative effect based on habitat loss, but that this effect would not be significant.

13.4.2 Views of Participants

DFO mentioned that construction mitigation such as fish salvage could help to reduce negative effects on flatfish. DFO stated that due to the Proponent's indication that no offset was feasible to mitigate the loss of suitable habitat for flatfish, further discussion of spatial and species trade-offs would be necessary in the development of the final Offsetting Plan.

13.4.3 Panel's Analysis

The Panel agrees with the Proponent and DFO that mitigation measures could reduce, but not fully avoid, adverse effects on flatfish productivity. The Panel agrees that residual productivity loss is anticipated by the removal of habitat due to the Project footprint.

The Panel notes that the Proponent concluded that residual productivity loss for flatfish was not significant since flatfish were not habitat-limited in the LAA. In contrast, the Panel finds that there is insufficient evidence to demonstrate that flatfish are not habitat-limited.

The Panel concludes that the residual effect on flatfish would be moderate in magnitude, local in extent, permanent in duration, and partially reversible due to the potential for partial recolonization. The Panel concludes that the effect would not be significant.

The Panel acknowledges that the Proponent undertook a cumulative effects assessment for flatfish in the RAA, and concluded that the Project would result in a cumulative effect on flatfish productivity, which was not significant. The Panel agrees with the Proponent's conclusion.

The Panel concludes that the Project would result in a residual adverse effect and an adverse cumulative effect on flatfish. The effects would not be significant.

13.5 Reef and Demersal Fish

13.5.1 Proponent's Assessment

Reef Fish

The Proponent determined that the Project would have a minor effect on reef fish productivity, primarily due to the loss of rockfish habitat, particularly where the proposed marine terminal overlaps with existing artificial reefs constructed as mitigation for existing terminals at Roberts Bank. The creation and enhancement of subtidal rock reefs was the main mitigation measure proposed to offset adverse effects on reef fish. The proposed rock reef sites would be constructed ahead of Project construction to eliminate any time lags associated with the establishment of functionality.

The Proponent's follow-up program would monitor the effectiveness of rock reef offsets, in terms of macroalgae cover, fish and invertebrate usage, abundance, and diversity as well as lingcod egg presence, volume and development.

Demersal Fish

The Proponent determined that the Project would have a minor adverse effect on demersal fish productivity, primarily due to changes in the acoustic environment if pile driving was used during construction. This activity would also reduce the availability and quality of subtidal and intertidal sand habitats.

The Proponent proposed to include fish refuge habitat in the design of the caisson structures at the wharf face to increase availability and connectivity of refuge habitat for marine fish and to provide a diversity of food sources. The Proponent was confident that this mitigation measure would be effective, based on previous experience at Deltaport Third Berth, and would contribute to increased productivity of demersal fish species.

The Proponent committed to monitor caisson refuge habitat effectiveness for demersal fish. As part of this program, the Proponent would monitor marine invertebrates and fish presence, including demersal fish abundance and diversity.

The Proponent also noted that the proposed eelgrass transplants would increase productivity of small demersal fish and could promote the productivity of juvenile rockfish. The Proponent noted that the proposed eelgrass transplants could promote productivity of juvenile rockfish. With mitigation, the Proponent concluded there would be no adverse residual effects on reef fish and demersal fish.

13.5.2 Views of Participants

DFO commented that mitigation in the form of rock reefs was a common offsetting approach that was known to be successful. Participants did not provide comments on potential effects on demersal fish.

13.5.3 Panel's Analysis

The Panel agrees with the conclusion of the Proponent that there would be no residual effect of the Project on reef fish following the establishment of rock reef offsets. The Panel notes that these structures would extend existing rock reef offsets that were found to be highly utilized by reef fish during monitoring of Deltaport Third Berth. The Panel also finds that the caisson structures proposed by the Proponent at the wharf faces would provide additional habitat for reef fish.

The Panel accepts that demersal fish are highly abundant at Roberts Bank. The Panel notes that the Proponent concluded a minor decrease in demersal fish and that this effect would be mitigated via timing windows, offsetting and environmental management plans. The Panel agrees with the Proponent that the Project would not result in a residual effect on demersal fish after mitigation.

The Panel concludes that the Project would not result in a residual adverse effect on demersal fish after the Proponent's mitigation measures are applied.

13.6 Marine Shipping Area

13.6.1 Proponent's Assessment

Potential effects of marine shipping associated with the Project on fish and fish habitat include erosion of shoreline habitats by vessel wake and underwater vessel noise.

The Proponent concluded that the effect of vessel wake waves would be negligible on marine fish in the marine shipping area because: only two percent of LAA coastline was within the wake-related zone of influence; and modelled wake heights at shorelines were well within the range of natural wave conditions to which fish and fish habitat were already adapted and therefore not distinguishable from existing conditions.

The Proponent rated the effect of underwater noise as negligible because: 1) noise associated with Project-related marine vessel traffic would not exceed injury thresholds for fish species even adjacent to container ships; 2) behavioural changes were possible for Pacific herring but only within less than 20 m of the source and for short duration as the ship passes by, and are thus unlikely to affect Pacific herring populations in the LAA; and 3) modeled noise would not exceed the 90 dB behavioural threshold for Pacific salmon even in close proximity to the container ships and therefore would not affect Pacific salmon populations in the LAA.

13.6.2 Views of Participants

DFO reviewed the Proponent's assessment of noise associated with marine shipping. DFO advised that there was uncertainty in the validity of the behavioural avoidance threshold for noise used to assess potential effects on Pacific salmon.

13.6.3 Panel's Analysis

The Panel agrees with the Proponent that there would be no effect from marine shipping associated with the Project on marine fish in the marine shipping area. The Panel acknowledges that although there is uncertainty in behavioural thresholds for noise in marine fish, the Proponent used best available science to assess Project associated shipping noise in the marine shipping area.

The Panel concludes that there would be no effect from marine shipping associated with the Project on marine fish and fish habitat.

14 Marine Mammals

This section discusses the potential effects of the Project and marine shipping associated with the Project on marine mammals. The Proponent identified a number of marine mammal species prevalent in the Project area and the marine shipping area, including toothed whales, baleen whales, and pinnipeds (seals and sea lions). The Proponent indicated that marine mammals play an important role in the marine ecosystem and have cultural and spiritual importance to Indigenous groups and to the public. The SRKW is a sub-population of killer whales of particular interest to the Proponent and to participants in the environmental assessment.

The Proponent used one species to represent each subcomponent of marine mammals and selected the representative species that had the greatest conservation status under the *Species at Risk Act* (SARA), as shown in Table 14-1 below. The Proponent stated that each representative species selected had similar hearing physiology and the potential to respond to Project effects in similar ways as other species within the same subcomponent.

Table 14-1: Marine mammal representative species (Source: EIS, Volume 3)

subcomponent	Representative Species	Conservation Status under the <i>Species at Risk Act</i>
Toothed Whales	Southern Resident Killer Whale (<i>Orcinus orca</i>)	Endangered
Baleen Whales	North Pacific Humpback Whale (<i>Megaptera novaeangliae</i>)	Special concern
Seals and Sea Lions	Steller Sea Lion (<i>Eumetopias jubatus</i>)	Special concern

The Proponent selected changes in the acoustic environment, water and sediment quality, availability of prey, and potential for vessel strikes as indicators of potential effects of the Project on marine mammals. In its assessment of the potential effects of marine shipping associated with the Project, the Proponent focused its assessment on changes to the acoustic environment from vessel traffic, and the potential effect of vessel strikes.

14.1 Southern Resident Killer Whale

14.1.1 Proponent's Assessment

Project Area

The Proponent stated that the SRKW were listed as Endangered under the SARA due to their small population size, low reproductive rate, and potential anthropogenic threats. The areas outlined in Figure 14-1, represent the legally protected critical habitat of SRKW under a SARA Critical Habitat Order as presented in the Recovery Strategy for the Northern and Southern Resident Killer Whales (*Orcinus orca*) in Canada. The Proponent stated that prey availability,

the acoustic environment, and water and sediment quality were features of SRKW critical habitat that support the life functions of foraging, mating, resting, and socializing.

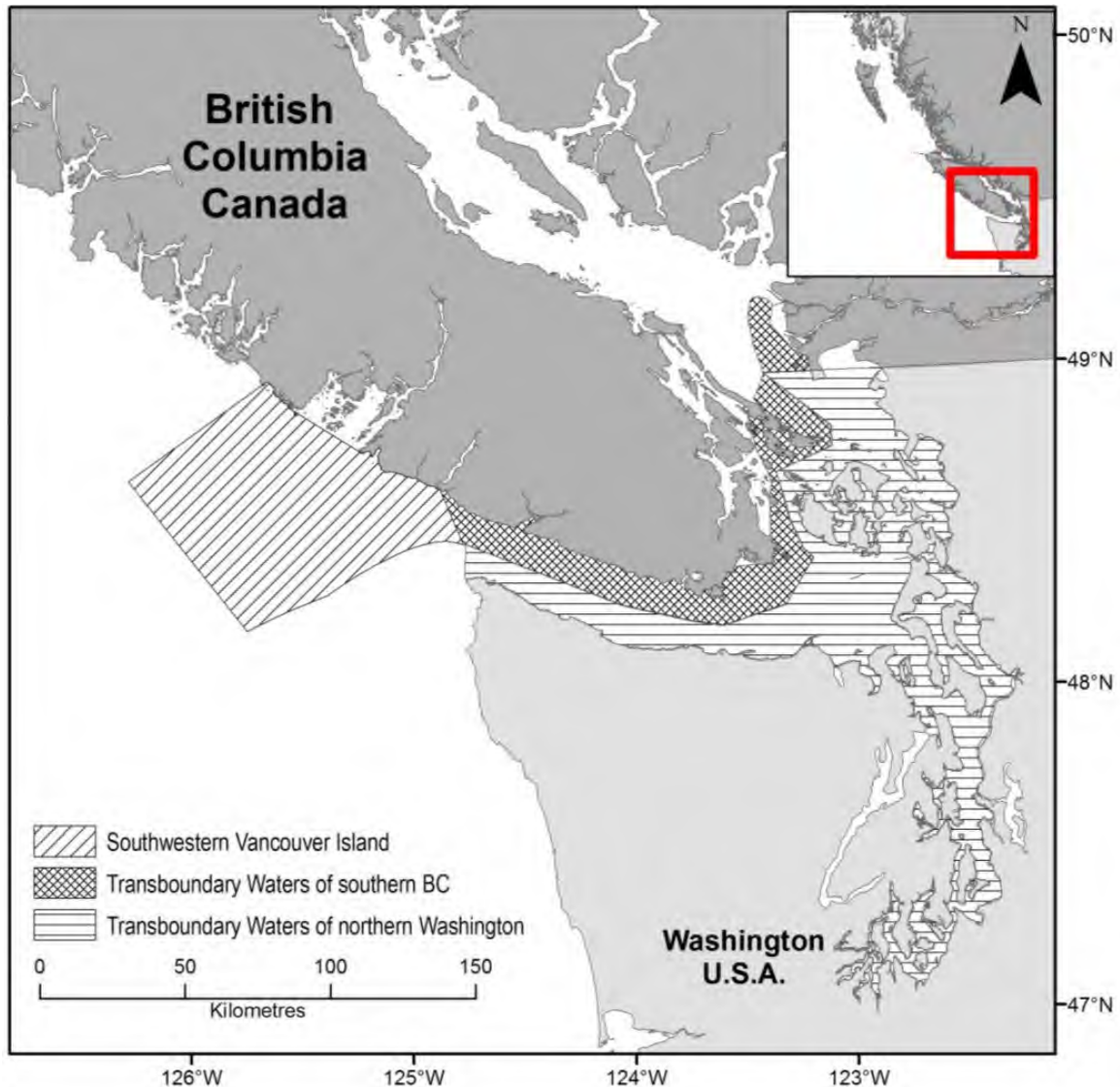


Figure 14-1: Map of Southern Resident Killer Whale critical habitat (Source: Project public registry document 1374)

In 2018, the Recovery Strategy for the SRKW reported that the population consisted of 74 animals across three pods: J pod, K pod, and L pod. J pod was the most commonly seen pod in the RAA throughout the year. The K and L pods were more often found in the western portion of the Strait of Juan de Fuca and off the outer coasts of Washington State and Vancouver Island.

Using an effort-corrected synthesis of SRKW sightings, the Proponent determined that SRKW are primarily found in the transboundary Canada and U.S. waters of Haro Strait, Boundary Pass, the eastern portion of the Strait of Juan de Fuca, and southern portions of the Strait of Georgia (Figure 14-2).

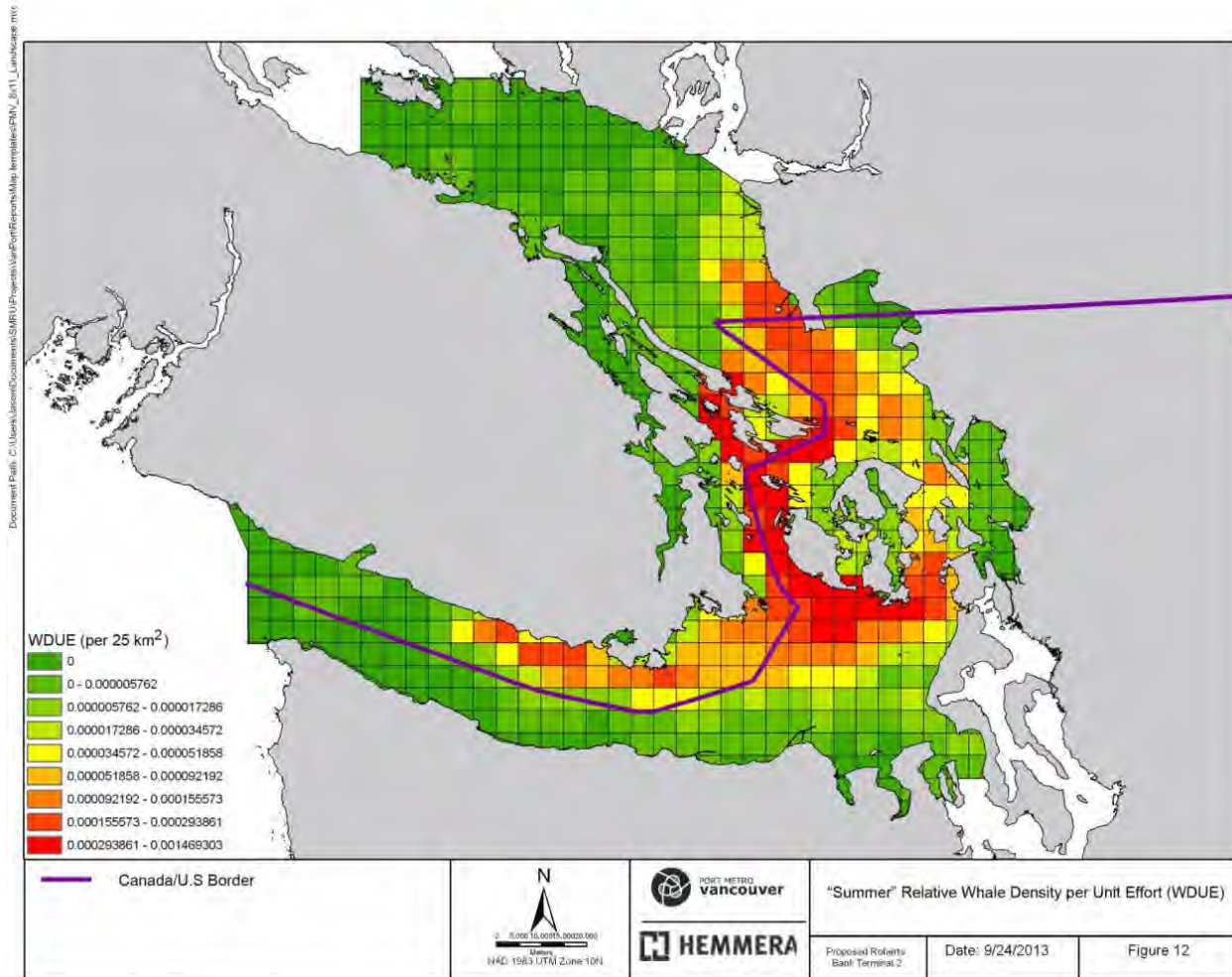


Figure 14-2: Effort-corrected density of Southern Resident Killer Whale in summer within Canadian and US critical habitat (Source: Project public registry Document 388)

The Proponent used the ‘zone of audibility’ to define the LAA for the assessment of potential effects of the Project on marine mammals, which was based on modelled underwater noise from Project construction and operation activities. The LAA consisted predominantly of the southern Strait of Georgia. The RAA for SRKW was based on a subset of its designated Canadian and United States critical habitat and included the southern Strait of Georgia, Haro Strait, Rosario Strait, the Strait of Juan de Fuca and its connecting waters.

Underwater Noise

The acoustic environment was identified in the Recovery Strategy as one of the features of SRKW critical habitat necessary for the survival or recovery of the species. The Proponent stated that potential acoustic effects of Project construction and operations include acoustic injury, behavioral effects, and acoustic masking of communication calls or feeding echolocation. The Proponent assessed the effects on SRKW and its critical habitat due to Project-related underwater noise by modelling sound propagation during construction and operation activities. The Proponent compared the noise output from impulsive and continuous noise sources with

known SRKW behavioral responses and various physical injury and behavioral disturbance thresholds for marine mammals. Further details on the underwater noise assessment are discussed in Section 8.4 - Underwater Noise.

Using the Southall severity score system, which ranked behavioral changes in increasing degree of severity, the Proponent developed SRKW-specific dose-response behavioral disturbance thresholds. These thresholds were then used to determine the probability of low- and moderate-severity behavioural responses of SRKW to continuous noise sources. Low severity behavioral responses were considered to be relatively minor and brief, while moderate severity responses would have a higher potential to affect foraging, reproduction, or survival. The Proponent indicated that high-severity responses, which are responses that have the potential to affect vital rates of SRKW, were not predicted to occur based on modelling of underwater noise produced during Project construction and operations.

The Proponent assessed the potential for behavioral disturbance and injury due to the construction of the proposed Project. The Proponent predicted that low-severity and moderate-severity behavioral responses could occur up to 22.2 km away and 5.42 km away from construction activities, respectively.

With respect to the potential for construction activities to cause injury, the Proponent stated that noise generated by impact pile driving was the only construction activity that had the potential to cause acoustic injury to SRKW. The Proponent determined that SRKW would have to be within 220 m of impact pile driving for the underwater noise to result in injury.

The Proponent indicated that it would use marine mammal observers and underwater hydrophones to reduce exposure of marine mammals to levels of underwater noise from construction activities that could potentially result in hearing injury or adverse behavioral responses. The Proponent would establish buffer zones, where activities could be suspended or modified to reduce or eliminate effects from underwater noise depending on the presence of marine mammals. The Proponent would use underwater noise reduction and dampening methods and technologies to avoid or reduce potential effects from underwater noise. The Proponent committed to daytime-only impact pile driving to ensure detection of all marine mammals within the prescribed buffer zone, and seasonal timing of impact pile driving activities to avoid periods of marine mammal occurrence.

The Proponent concluded that after the implementation of mitigation measures, underwater noise levels during construction would not result in residual adverse effects on SRKW.

During operations, the Proponent noted that underwater noise generated by container ships and support tugs approaching and departing the Project area and berthing at the proposed marine terminal had the potential to affect marine mammals. The Proponent stated that in Haro Strait, in areas of high commercial vessel traffic, it was estimated that SRKWs currently lose from 55 percent to 97 percent of their communication space as a result of acoustic masking in the mid-frequency bands used for social communication calls.

The Proponent determined that SRKW could exhibit low-severity behavioral responses up to 20.29 km away from an approaching container ship and up to 29.20 km away from a container ship while berthing. Moderate-severity responses could occur up to 6.37 km away during approach and 8.43 km away during berthing. The Proponent stated that there would be a predicted increase in underwater noise at specific times when container ships call on Roberts Bank Terminal 2. The Proponent stated that underwater noise from the Project exceeding average underwater noise levels during existing conditions would be realized approximately 5 percent of the year, and the remaining 95 percent of the time underwater noise from the Project would be expected to be within existing underwater noise levels.

The Proponent stated that with the addition of the Project and incremental container ship traffic associated with the Project, there would be an increase of ten low-severity and four moderate-severity behavioural responses per whale per year, which corresponded to 2.5 hours of acoustic disturbance per whale per year.

Using an acoustic masking model, the Proponent predicted an increase of 3.6 hours of acoustic masking per whale per year due to Project operations compared to existing conditions, for a total of 2.70 days of acoustic masking per year per whale.

The Proponent used a Population Consequences of Disturbance (PCoD) model to estimate reduced foraging time that could result from behavioural effects or masking of echolocation clicks. The Proponent stated that under existing conditions, the PCoD modelling results showed that existing underwater noise potentially affected individual foraging success and population recovery. The Proponent stated that, based on the results of the PCoD model for Project effects, behavioural responses and acoustic masking from increased noise exposure did not change the survival or reproductive rates of individual SRKW from existing conditions.

The Proponent did not propose Project-specific mitigation measures for operational noise, but indicated that it would continue to explore opportunities to support or participate in regional or multi-stakeholder initiatives that would inform effective management and recovery of SRKW. The Proponent determined that there was a residual effect due to underwater noise from operational activities.

The Proponent characterized the residual effect for acoustic disturbance from operational noise as low-moderate in magnitude, regional in extent, short-term in duration, frequent, and reversible. The Proponent defined a significant residual effect on SRKW as an effect on one or more individuals that resulted from a change in critical habitat such that a feature would not be available for SRKW function to the extent it jeopardized survival or recovery of the species. The Proponent concluded that underwater noise from the Project was not likely to result in significant adverse effects on SRKW.

The Proponent proposed a follow-up program to verify predicted changes in the acoustic environment from operational activities.

The Proponent stated that due to the endangered status of SRKW under the SARA and a lack of recovery of the population, it was reasonable to assume that past projects and activities that have been carried out have already had a significant adverse effect on SRKW. The Proponent indicated that cumulative effects on SRKW due to acoustic disturbance would remain significant.

When assessing cumulative effects, the Proponent predicted that there would be an increase of 105 low-severity (8.75 hours) and 33 moderate-severity (13.75 hours) behavioral responses from existing conditions, per whale per year in the RAA. The cumulative effects resulted in an increase of 4.63 hours of acoustic masking from existing conditions per whale per year in the RAA. When including the contribution of all certain and foreseeable projects and activities, the PCoD model indicated that there was no statistically significant difference in survival, reproduction rate, or population growth compared to existing conditions.

No measures were proposed by the Proponent to mitigate the cumulative effects of acoustic disturbance. The Proponent stated that the cumulative effects of acoustic disturbance were characterized as low-moderate in magnitude, regional in extent, short-term in duration, frequent, and reversible. The Proponent concluded that the cumulative effects on SRKW are significant. The Proponent highlighted that the Project would make a minor contribution to these cumulative effects.

Vessel Strikes

The Proponent stated that at least eight killer whales were known or suspected to have been struck by vessels off the Canadian west coast, with six of these occurrences since 2002. The Proponent indicated that killer whales were not commonly struck by vessels because they are fast swimming and agile, enabling them to avoid approaching vessels. The Proponent stated that vessels traveling at speeds of more than 14 knots provided the greatest threat of collision with cetaceans.

The Proponent concluded that the chance of a Project-related container ship, tug, or support vessel striking a SRKW within its jurisdiction and resulting in injury or mortality was very low.

The Proponent indicated that it would implement an Environmental Training Plan, and would distribute a marine mammal awareness pamphlet to marine pilots working within its jurisdiction to mitigate the potential effects of vessel strikes. The Proponent concluded that with the implementation of these mitigation measures no detectable or measurable residual adverse effect from vessel strikes were predicted for marine mammals.

Prey Availability

The Proponent reported that Chinook salmon comprised over 70 percent of the SRKW's annual diet and that trends in SRKW mortality rates are strongly related to fluctuations in the abundance of Chinook salmon. The Proponent noted that the availability of salmon returning to the Fraser River every spring through fall strongly influenced the movements and habitat used by SRKW. The Proponent stated that Chinook salmon originating from the Fraser River system were

considered to be of greatest overall importance in the diet of SRKW based on genetic stock identification data, with 58 percent of the Chinook salmon consumed by resident killer whales originating from the Fraser River system. The Proponent noted that, of the Fraser River stocks, SRKW primarily consume South Thompson River and Lower Fraser River Chinook. The Proponent concluded that with mitigation and offsetting measures, the Project would not affect SRKW's primary prey, Chinook salmon.

Water and Sediment Quality

The Proponent stated that Project activities, such as dredging and sediment discharge, would occur in SRKW critical habitat. These activities could result in the resuspension of sediment that could be ingested and magnified through the food chain, and could ultimately adversely affect the health of marine mammals. The Proponent's assessment focused on polychlorinated biphenyls (PCBs) because PCBs were the only substance in the Project area that approached or exceeded toxicological thresholds. The Proponent indicated that detected PCB concentrations in resident killer whales already exceed thresholds for the onset of adverse health effects determined for other marine mammals.

Using a SRKW food web model, the Proponent predicted that changes in SRKW PCB exposure due to construction activities were extremely low relative to existing conditions. The Proponent concluded that contamination risk for SRKW was negligible.

The Proponent stated while they were confident that sediments at Roberts Bank were not contaminated, they committed to employing specific dredging practices to handle the upper 0.5 m of sediments from the tug basin expansion area to avoid discharge of fines in supernatant and reduce any potential for increasing PCBs in the receiving environment.

Destruction of Critical Habitat

During the review of the EIS, the Panel requested that the Proponent describe the total area of SRKW critical habitat that would be temporarily or permanently degraded by the Project. In response, the Proponent stated that the terminal footprint and dredged berth pocket would be 179.9 ha, which represented 0.02 percent of the SARA Critical Habitat Order and 0.01 percent of all U.S. and Canadian transboundary critical habitat. The Proponent stated that Project-related underwater noise due to vessel traffic would move in space and time, and thus a calculation of an absolute area was not technically possible.

The Proponent concluded that the Project would not affect the acoustic environment, prey availability, and water and sediment quality in SRKW critical habitat. The Proponent did not anticipate the destruction of SRKW critical habitat and stated that the Project would not limit the survival or recovery of SRKW.

Marine Shipping Area

The LAA used by the Proponent in the Marine Shipping Addendum is similar to the RAA used by the Proponent in the EIS, and includes the waters of the Strait of Georgia, Rosario Strait, as

well as the Strait of Juan de Fuca. The Proponent focused its assessment of the potential effects of marine shipping associated with the Project on underwater noise and vessel strikes to SRKW.

The Proponent noted that transiting marine vessels associated with the Project had the potential to increase underwater noise levels in SRKW critical habitat, and could potentially result in behavioral effects, including displacement or avoidance of a portion of habitat, and acoustic masking of communication calls or feeding echolocation. The Proponent stated that existing levels of underwater noise from commercial vessel traffic in the marine shipping area already exposed SRKW to levels of underwater noise that could result in behavioral effects and acoustic masking.

The Proponent modelled underwater noise levels and zones of potential behavioral disturbance at four representative locations along the international outbound shipping lanes in the LAA. The Proponent determined that moderate-severity behavioral responses were predicted to occur up to 2.1 km away from a transiting container ship.

The Proponent used the same underwater noise exposure and acoustic masking model as they did in developing the EIS to determine the number of predicted behavioral responses, but incorporated additional model inputs on SRKW habitat usage in the western portion of the Strait of Juan de Fuca at Swiftsure Bank, which the Proponent referred to as the Extended Region. This region was included since acoustic monitoring by DFO indicated considerable habitat use by SRKW. SRKW were estimated to be present in this region between 53 and 64 days per year depending on pod, resulting in a median of 859 low-severity (71.6 hours) and 242 moderate-severity (100.8 hours) behavioral responses per whale per year under existing conditions. Marine shipping associated with the Project added an additional 13 low-severity (1.09 hour) and six moderate-severity (2.5 hours) behavioral responses and potential masking of echolocation clicks per whale per year.

To determine the effects of marine shipping associated with the Project in the entire LAA, the Proponent added the number of median low-severity and moderate severity behavioral responses in the Extended Region to the initial model area used by the Proponent in the EIS. In the entire LAA, the Proponent reported that the potential lost foraging time during existing conditions was 555.9 hours (23.2 days) per year per individual. With the addition of marine shipping associated with the Project, an additional 20.6 hours of foraging time was potentially lost to behavioral disturbance and acoustic masking of echolocation clicks due to increased underwater noise.

The Proponent did not propose any Project-specific mitigation measures to reduce underwater noise from marine shipping associated with the Project.

To determine the potential for vessels strikes to occur, the Proponent used an existing quantitative assessment undertaken for Aframax class tanker vessels and applied the results to container vessels that would transit the marine shipping area. The Proponent stated that the likelihood of a vessel strike causing serious or fatal injury to a marine mammal depended on the probability of encounter, the probability of a strike occurring, and the probability of the strike

resulting in severe or fatal injuries. The Proponent noted that vessel speed had been correlated with the probability and severity of vessel strikes.

The Proponent stated that killer whales had the highest probability of encounter with vessels along the shipping lanes in the LAA due to their higher use of the LAA compared to other marine mammal species. However, the Proponent added that this did not reflect actual strike risk, and stated that there had been no reported incidents or mortalities from container vessel strikes of SRKW. The Proponent stated that the chance of a vessel associated with the Project striking a SRKW within the LAA and resulting in injury or mortality was unlikely since container ships would be transiting slowly from the international shipping lanes under the care and control of a marine pilot. To mitigate the potential for vessel strikes, the Proponent committed to distributing a marine mammal awareness pamphlet to marine pilots working within the Proponent's jurisdiction. The Proponent indicated that education and awareness of pilots could reduce vessel strike outside of its jurisdiction.

The Proponent indicated that there would be residual effects on SRKW related to marine shipping associated with the Project due to both behavioral and acoustic masking effects from underwater noise, as well as physical disturbance from vessel strikes. The Proponent determined that the effects of underwater noise would be moderate in magnitude, local in extent, long-term in duration, frequent/seasonal, and fully reversible. The Proponent noted that SRKW were common in the LAA and there was a risk of vessel strike along shipping lanes, but the Proponent considered container vessel strike to be low due to the agile nature of toothed whales and the rare occurrence of SRKW vessel strikes from past and existing shipping traffic. The Proponent determined that the effect of vessel strikes would be low in magnitude, site-specific in extent, short-term to permanent in duration, infrequent, and fully reversible to irreversible. The Proponent concluded that effects from behavioral disturbance from underwater noise and physical disturbance from vessel strikes would be not significant.

The Proponent noted that the residual effect on SRKW from marine shipping associated with the Project could combine with the effects of other projects and activities within the LAA resulting in a cumulative behavioral effect. With the addition of future vessel traffic, including marine shipping associated with the Project, an additional 1.29 days (30.90 hours) of foraging time would be potentially lost in the LAA due to behavioral disturbance and acoustic masking due to underwater noise. The Proponent stated that due to the endangered status of SRKWs under SARA and a lack of recovery of the population, it was reasonable to assume that past projects and activities that have been carried out have had a significant adverse effect on SRKW, and therefore the cumulative effect was expected to remain significant.

Proponent Initiatives

The Proponent stated that although activities occurring within the marine shipping area were outside of its care and control, it would continue to support regional initiatives and programs that provide a better understanding, and reduce the effect, of marine shipping activities on marine mammals. The Proponent stated that these initiatives, while not directly connected to the Project,

would contribute toward recovery objectives defined in the SRKW Action Plan and the overall recovery of the SRKW population.

Through the ECHO Program, vessel slowdowns were identified as the most practical method to reduce underwater noise from commercial vessels. As part of the ECHO Program the Proponent conducted a voluntary vessel slowdown trial in Haro Strait in 2017 and 2018. The Proponent stated that the aim of the 2017 trial was to evaluate the level of noise reduction achieved through reduced speed, and to assess how this might affect the foraging behavior of the killer whales. During the slowdowns, large commercial vessels including container ships were asked to reduce their speed over a distance of approximately 16 nautical miles. Large commercial vessels were asked to slow to a speed of 11 knots between August and October, and there was a 61 percent participation rate. During the two-month trial period only nine days of SRKW presence were observed. According to the Proponent, the summer of 2017 was a uniquely low year for SRKW presence in Haro Strait, noting a 70 percent reduction in SRKW presence from 2016 to 2017.

The 2018 trial involved a slowdown to either 12.5 or 15 knots, depending on vessel class, and there was an 87 percent participation rate. The Proponent stated that there were statistically significant reductions in noise generated at the vessel source as well as total noise. The Proponent noted that based on the noise reductions achieved, they estimated that there was 22 percent and 15 percent reduced impact to foraging time in 2017 and 2018, respectively. The Proponent stated that the results of these trials demonstrate that vessel slowdowns implemented on a voluntary basis with the cooperation of the shipping industry could be an effective means of reducing the cumulative underwater noise effects of shipping on SRKW.

On May 10, 2019, the Proponent, along with industry partners and several shipping associations, entered into a section 11 SARA Conservation Agreement with the Government of Canada for a five-year term to continue its support for the recovery of SRKW. The Proponent noted that this agreement was the first of its kind, and confirmed the continuation of existing voluntary efforts under the ECHO Program for another five-year term.

14.1.2 Views of Participants

The Panel received a large number of submissions from members of the public, Indigenous groups, non-governmental organizations and government departments regarding potential effects of the Project and marine shipping associated with the Project on SRKW. These submissions highlighted the iconic and spiritual nature of these species and expressed concerns that the SRKW was already endangered and that the Project would further compromise the population.

Several participants stated that the SRKW may be at a tipping point, beyond which their population would not be able to recover. Many participants disagreed with the Proponent's conclusion that the Project and marine shipping associated with the Project would not result in significant adverse effects. Tsawwassen stated that even if the residual effect on SRKW was considered to be not significant, a small impact from the Project could be the tipping point that leads to population collapse, given its already small numbers. Ecojustice indicated that additional

threats, such as increase shipping traffic, would push the SRKW population into steady decline, and the status quo was not sufficient to protect SRKW.

DFO stated that additional levels of disturbance may reduce foraging efficiency below a threshold at which it was no longer energetically profitable to forage in the habitat, particularly in years with low prey availability. This could potentially lead to displacement or abandonment of critical habitat as well as reduced survival and compromised recovery. DFO noted that it was difficult to assess where this threshold may occur, and that SRKW may have little option or opportunity for displacement due to the movement and distribution of their prey.

Ecojustice stated that the acoustic environment of the Salish Sea was highly polluted with chronic shipping noise. They noted that SRKW critical habitat was already too loud for SRKW to efficiently carry out basic life functions. They indicated that under present-day median noise conditions in Haro Strait, SRKW were already losing 62 percent of their acoustic communication space, which imposed an extreme ecological cost on this population. They stated that recovery of the SRKW required reducing current noise levels.

DFO stated that the noise mitigation measures proposed for Project construction were standard approaches and appropriate. DFO noted, however, that if construction activities were undertaken when the buffer distance (or safety zone) was not visible to marine mammal observers due to darkness or fog, hydrophone detection could not be relied upon with complete certainty as a means to determine SRKW presence and exposure to high noise levels. DFO stated that SRKW frequently travel in silence, especially when resting, so passive acoustic monitoring would be an ineffective detection method at such times. DFO recommended that marine mammal observers coordinate with existing whale sighting networks to receive advance warning of SRKWs approaching the construction area to facilitate response. DFO recommended that no construction noise-generating activities should be conducted at night or during fog unless alternate technologies were proven effective and could be implemented to improve detection of SRKW during these activities. DFO stated that with the use of multiple appropriate mitigation measures, such as the use of bubble curtains, a buffer zone, and monitoring, that there would be no residual effect from construction underwater noise.

DFO stated that although the Southall severity scores and corresponding behavioral response categories relied on by the Proponent to develop SRKW-specific behavioural disturbance thresholds and behavioural responses were the best available, they had significant limitations. DFO stated that since the SRKW population was endangered, the value of Southall's behavioural response categories could be limited. DFO noted that in a nutritionally-stressed population such as the SRKW, additional loss of foraging opportunity or decreases in foraging success were detrimental to survival and recovery, and this was not adequately captured using a non-contextual application of a behavioural assessment of impacts. DFO recommended that a context-specific analysis of acoustic impacts on SRKW should be undertaken, since it would be expected to provide a more accurate and appropriate representation of the potential effects than the behavioral response analysis conducted by the Proponent.

DFO noted that the use of the PCoD model involved numerous compounding assumptions and limitations such that any results have a high level of uncertainty and low confidence, and must be interpreted cautiously. DFO stated that the Proponent's conclusion regarding significance should be of low confidence instead of moderate confidence, due to the limitations of the models applied.

DFO highlighted that shipping noise was identified as an activity likely to destroy critical habitat in the Recovery Strategy for the Northern and Southern Resident Killer Whales in Canada.

DFO stated that reduced prey availability was the main factor affecting SRKW survival and recovery. DFO indicated that the Proponent may have underestimated the significance of effects on fish and fish habitat, specifically effects on Chinook salmon. Ecojustice was of the view that the Project was likely to have significant adverse effects on Chinook salmon and, by extension, on prey availability for SRKW. DFO stated that since construction of the Project would impact Chinook salmon habitat, that it was their view that this would constitute destruction of critical habitat for SRKW. Ecojustice was in agreement with the view of DFO that terminal construction would destroy critical habitat by affecting Chinook prey availability for SRKW.

DFO noted that in May 2018, an Imminent Threat Assessment for SRKW was undertaken which concluded that the remaining population is facing an imminent threat to their survival and recovery. The assessment found that the SRKW was facing threats, which were considered imminent in the sense that intervention is required to allow for survival and eventual recovery. DFO stated that, based on the imminent threat to their survival and recovery, declining small populations and cumulative impacts to SRKW critical habitat, they were of the opinion that construction and footprint related impacts associated with the Project would likely require issuance of a SARA compliant *Fisheries Act* authorization for the destruction of SRKW critical habitat. Prior to issuing a permit, SARA requires that the Minister be of the opinion that section 73(3) preconditions could be met, including that the activity would not jeopardize the survival or recovery of SRKW. Based on the information available, DFO stated that they were uncertain that the section 73(3) preconditions could be met for the Project.

DFO noted that the Proponent's statement regarding the percentage of critical habitat that the terminal footprint and dredged berth pocket would occupy was an appropriate statement for physical disturbance, but was a limited interpretation with respect to acoustic disturbance associated with construction and operation of the Project. DFO noted that the Proponent's assessment indicated that lost foraging for SRKW already occurred from vessel traffic noise, which in itself represents destruction of critical habitat.

DFO stated that vessel strikes on SRKW could be lethal and affect population viability or recovery, and loss of a single individual could result in population level consequences. DFO advised that the likelihood of collisions between project-related vessels and SRKW ranged from low near the proposed terminal to medium and high in areas such as Boundary Pass or on Swiftsure Bank. DFO noted that the Proponent's conclusion that the high agility of SRKW would result in a low risk of ship collisions was not supported, since pathology reports mentioned blunt force trauma as the most probable cause of death of two individual SRKW in

2014 and 2016. DFO stated that the magnitude of effects of vessel strikes on SRKW should be revised to high. DFO concluded that vessel collision risk should be mitigated in areas of high strike risk given the impact that vessel strikes have on the population viability of SRKW. DFO recommended that further measures to reduce ship collision risk, such as reduction in vessel speeds, should be evaluated for possible implementation.

Several industry associations, including the Chamber of Shipping and the Shipping Federation of Canada, highlighted that the ECHO Program was award-winning and highly collaborative. These organizations are also signatory to the Conservation Agreement that was signed by the Proponent.

Many participants stressed the importance of the continuation of the research programs and voluntary initiatives under the ECHO Program. The Washington State Department of Ecology recommended the continuation of voluntary vessel slowdown measures, and stated that the Proponent should carry out further analysis of areas that would benefit from exclusion of vessel traffic or a slower speed. The Department stated that when SRKW are present, any vessel transiting to and from the Project should practice slower speeds. DFO stated that the continued evaluation of mitigation options such as vessel slowdown and lateral displacement within the context of the overall Project-related vessel noise was required to determine the effectiveness of these mitigation measures.

Transport Canada, DFO, ECCC and the Canadian Coast Guard all described how the Government of Canada was currently undertaking a number of initiatives aimed at addressing key threats to SRKW, including threats related lack of prey, physical and acoustic disturbance, and contaminants. DFO stated that in approving TMX, the Government of Canada committed to more than mitigate the impact of additional traffic on SRKW before any shipping associated with the Project begins. DFO noted that, while not directly linked to the Project or its potential effects, the Government of Canada had reconfirmed its commitment to protect and support the recovery of SRKW by advancing a comprehensive strategy with actions to protect and support the recovery of SRKW. DFO stated that initiatives such as the Oceans Protection Plan and the Whales Initiative were part of this strategy.

Following the Imminent Threat Assessment, the Minister of Fisheries and Oceans and the Minister of the Environment and Climate Change recommended under subsection 80(2) of the *Species at Risk Act* that the Governor in Council make an emergency order for SRKW. In consideration of the measures that have been taken, continue to be taken, and would be taken by the Government of Canada and other organizations to address the imminent threats to the survival and recovery of the SRKW, the Governor in Council declined to make an emergency order.

Additional Measures for the Recovery of the Southern Resident Killer Whale

The Government of Canada committed additional funding for further measures to protect SRKW, as well as several research programs. These measures include: enhancing compliance and enforcement; measures to protect and recover Chinook salmon stocks through fisheries management; expansion of vessel slowdown in the Haro Strait; the identification and protection of new areas of habitat necessary for the survival and recovery of the SRKW population; and developing agreements with marine industry partners to formalize current voluntary measures to reduce noise. In addition, Fisheries and Oceans Canada is advancing feasibility work on establishing SRKW sanctuaries within sub-areas of critical habitat a sanctuary that could be established as a Marine Protected Area under the *Oceans Act* and could prohibit activities (including vessel traffic) that are contrary to the conservation objectives established for the sanctuary.

Transport Canada stated that, as a result of recommendations from multi-disciplinary technical working groups convened in 2018 to address threats to the SRKW, several voluntary and mandatory measures would be implemented in 2019 that targeted both large commercial vessels, including container ships, and small vessels including whale watching and recreational boats.

Transport Canada further noted that an additional voluntary slowdown trial was planned for 2019. Transport Canada stated that a trial lateral displacement in the Strait of Juan de Fuca took place in 2018 where they requested that commercial vessels within the shipping lane move south within the shipping lane further away from key SRKW foraging areas. Transport Canada noted that they were also working with international partners and the International Maritime Organization to further the issue of underwater noise and increase our ability to influence international standards for quiet ship designs.

Several participants were concerned with the lack of Project-specific mitigation measures, highlighting that the voluntary measures and regional initiatives presented by the Proponent and the Government of Canada were inadequate to mitigate effects of underwater noise and vessel strikes to SRKW. Ecojustice stated that regional initiatives, such as the ECHO Program, did not constitute mitigation under CEAA 2012, and could not be relied upon to ensure measures to avoid or lessen adverse effects of the Project on SRKW.

Numerous participants indicated that the proposed measures were ineffective and additional research and monitoring was required to confirm that the measures had the predicted benefits for SRKW and did not displace effects to other species at risk. Ecojustice indicated that voluntary slowdown and lateral displacement trials were operational changes and not permanent reductions. They also indicated that vessel-slow downs could extend the duration of noise exposure and thereby reduce quiet time for SRKW. The Tsleil-Waututh Nation stated that lateral displacements may be possible in larger passages of the Salish Sea, but not in narrower passages

where any lateral movement was either not possible or not sufficient to adequately reduce noise exposure of SRKW. The Tsleil-Waututh Nation also noted that this could also increase noise exposure of other cetaceans such as Humpback Whales.

Several Indigenous groups expressed their desire to be more involved in the development and implementation of the measures proposed by the Government of Canada to promote the survival and recovery of SRKW.

DFO stated that with respect to synergistic effects on SRKW, responses to different threats, such as reduced prey availability, noise and physical disturbance and contaminants could lead the animal to a more rapid decline than would occur if each threat was taken as an individual impact. Ecojustice stated that each of these combined threats act synergistically to produce an even greater negative impact. DFO noted that when salmon are abundant, underwater noise is less of an issue because the potential for the animal to meet their nutritional needs is less compromised. DFO further noted that in the projected state of continued salmon declines, noise would become more of an issue and could lead to greater effects on the catch per unit effort of the population.

Ecojustice stated that the Proponent erred by looking at effects in isolation and as a result had underrepresented the Project's effects on SRKW. Ecojustice stated that the combined effect of the masking calls, acoustic interference, and the physical disturbance of displacing SRKW from their foraging activities, all interact synergistically and exacerbate the problem of reduced prey availability because they both reduce foraging time for a population that is already nutritionally stressed.

14.1.3 Panel's Analysis

Underwater Noise during Construction

The Panel determines that the main concern with the construction of the Project to be the potential for behavioral disturbance and acoustical injury of SRKW. The Panel notes that construction activities would occur within SRKW critical habitat, and the acoustic effects of construction are of particular concern during vibratory and impact pile driving activities, and to a lesser extent during vibro-densification, dredging, and the noise generated by support vessels. The Panel agrees with the Proponent's conclusion that impact pile driving is the only construction activity that has the potential to result in injury to SRKW. The Panel agrees with DFO that when used together, noise dampening methods, the adoption of a buffer zone, use of marine mammal observers, and avoidance of impact-pile driving at night would fully mitigate the potential adverse effects of construction noise on SRKW. The Panel is of the view that the measures proposed by the Proponent and DFO, and recommended by the Panel below, are necessary to eliminate any potential residual effects on SRKW during construction. The Panel notes that the ability of the mitigation measures to eliminate residual effects of construction noise on SRKW is highly dependent on the ability for SRKW to be detected within prescribed buffer zones.

Water and Sediment Quality

The Panel acknowledges that existing levels of PCB concentrations in SRKW already exceed thresholds for the onset of adverse health effects determined for other marine mammals, and that environmental contaminants pose a serious threat to killer whales, as highlighted in the Recovery Strategy.

The Panel is of the view that the main concern during construction is sediment resuspension and bioaccumulation due to dredging and discharge of supernatant, and the potential for increased biological availability of PCBs. The Panel notes that the measure committed to by the Proponent, and also recommended by the Panel, to employ specific dredging practices to handle the upper 0.5 m of sediments in the tug basin expansion area, is precautionary and warranted, given the endangered conservation status of SRKW. With the implementation of this measure, the Panel agrees with the Proponent that the Project would not increase contaminant uptake by SRKW.

Understanding the role and management of contaminants to protect SRKW is an important focus of the 2018 SRKW Recovery Strategy. The Panel notes that the Government of Canada is undertaking several initiatives that are investigating ways to reduce contaminants, and the Panel acknowledges that these actions are important in addressing the regional issues of contaminants within SRKW critical habitat.

Availability of Prey

The Panel acknowledges that there is a demonstrated relationship between Chinook salmon abundance and SRKW survival. During the environmental assessment, the Panel received information from the Proponent and numerous participants that SRKW are food-limited in their critical habitat and that Chinook salmon prey resources, especially Fraser River Chinook salmon, are declining.

In Section 13 - Marine Fish and Fish Habitat, the Panel concluded that two populations of Fraser Chinook salmon, the Lower Fraser and South Thompson River populations, are particularly vulnerable to Project effects due to their life history and extensive utilization of Roberts Bank habitat. As previously discussed, the Panel concluded that there would be a significant effect on the Lower Fraser and South Thompson River populations of ocean-type Chinook salmon. The Panel considers it important, as acknowledged by the Proponent, that Chinook salmon spawning runs originating from the lower Fraser River system and the South Thompson River are of greatest overall importance in the diet of SRKWs. Therefore, the Panel disagrees with the Proponent's conclusion that there would be no effect on SRKW's primary prey, Chinook salmon.

The Panel considers the advice of DFO to be important, particularly with respect to their statement that construction of the Project would result in impacts to Chinook salmon habitat, and would therefore result in the destruction of SRKW critical habitat. The Panel notes that sufficient availability of Chinook salmon is one of the features of critical habitat necessary for the survival

or recovery of SRKW, and DFO highlighted that reduced prey availability is the main factor affecting SRKW survival and recovery.

The Panel concludes that the Project would result in a residual adverse effect on prey availability for SRKW, and the effect would be moderate in magnitude due to the nutritionally stressed state of the population. The effects would be regional in extent, permanent in duration, irreversible, and continuous. This residual effect would result in the partial loss of legally defined critical habitat for SRKW.

Vessel Strikes

The Panel agrees with the Proponent's conclusion that the likelihood of a container vessel strike with SRKW is low, however the Panel notes that DFO advised that the loss of even a single SRKW could have population consequences. The Panel notes that vessel strikes are considered to be an emerging threat as outlined in the Recovery Strategy for SRKW, and participants have provided evidence indicating that vessel strikes with SRKW have occurred. The Panel concludes that the magnitude of a vessel strike could range from low to high, depending on the severity and lethality of the strike, and the effects of such a strike, although unlikely to occur, could be irreversible and could lead to population consequences.

The Panel considers it important to recognize that vessel speed has been correlated with the probability and severity of vessel strikes. The Panel notes that vessel slowdowns, such as those proposed under the ECHO program, would assist in reducing the likelihood of vessel strikes with SRKW and would also provide benefits in terms of reducing underwater noise.

Underwater Noise during Operations/Marine Shipping

As previously described in Section 8.4 - Underwater Noise, the Panel has relied on the Proponent's most conservative set of assumptions and has based their assessment assuming that there would be 260 container ship calls to Roberts Bank Terminal 2. The Panel concludes that underwater noise generated by marine shipping associated with the Project would increase behavioural disturbance and acoustic masking within SRKW critical habitat. The Panel is of the view that while there are limitations with the models used by the Proponent, as highlighted by DFO, the underwater noise from marine shipping associated with the Project has the potential to reduce SRKW foraging efficiency. Further, the Panel notes that acoustic disturbance from vessels in and of itself could be considered destruction of critical habitat.

The Panel acknowledges that the ECHO program has the potential to reduce underwater noise in SRKW critical habitat, but is of the opinion that these measures are not mitigation measures as defined under CEAA 2012 since they are not being implemented specifically to mitigate the effects of the proposed Project. Similarly, the Panel recognizes that the Government of Canada is making considerable effort under the Oceans Protection Plan, the Whales Initiative, and other programs to support the survival and recovery of SRKW. While the Panel encourages the continuation of efforts under the ECHO program, initiatives undertaken by the Government of Canada, and renewal of commitments to the SRKW Conservation Agreement, it also recognizes

that many of these initiatives are voluntary, and cannot be relied upon to mitigate the effects of marine shipping associated with the Project. The Panel concludes that in the absence of mandatory mitigation measures to reduce underwater noise generated by marine shipping associated with the Project, there would be a residual adverse effect on the acoustic environment that is moderate in magnitude within SRKW critical habitat.

Synergistic Effects of the Project and Marine Shipping Associated with the Project

The Panel notes that the Proponent did not consider the synergistic effects of the Project, since it determined that the only residual effect of the Project was due to underwater noise from operations. However, the Panel is of the view that there are several pathways of effects on SRKW due to the Project and marine shipping associated with the Project. The Panel determined that there would be potential effects of the Project on Chinook salmon, and therefore a reduction in prey availability for SRKW. The Panel is of the view that the effects of underwater noise on SRKW from marine shipping associated with the Project would be of low magnitude when Chinook salmon prey are abundant, but this magnitude increases when Chinook salmon are scarce, which is presently the case. The Panel has also determined that although a vessel strike with SRKW due to marine shipping associated with the Project would be unlikely, it is one of the emerging threats identified in the Recovery Strategy and could result in population consequences if such a strike were to occur. Furthermore, the construction of the terminal and underwater noise generated by marine shipping associated with the Project would result in the destruction of SRKW critical habitat. All of these potential effects have the potential to interact synergistically, and would result in an effect that is greater than if each threat were to occur individually.

Based on the effects due to the Project and marine shipping associated with the Project on underwater noise, Chinook salmon prey availability and potential ship strikes, and in the absence of effective and mandatory mitigation measures, the Panel concludes that there would be a significant adverse effect on the Southern Resident Killer Whale.

Cumulative Effects Assessment

The Proponent undertook a cumulative effects assessment for SRKW related to underwater noise and concluded that due to the endangered status of SRKW under the SARA and a lack of recovery of the population, it was reasonable to assume that past projects and activities that have been carried out have already had a significant adverse effect on SRKW. The Proponent concluded that with the contribution of acoustic disturbance from Project operations, effects were anticipated to remain significant. The Panel agrees with the Proponent that the cumulative effects of the Project and marine shipping associated with the Project would be significant. The Panel concludes that a reduction in prey availability due to the Project, exposure to underwater noise and risk of vessel strike due to marine shipping associated with the Project have the potential to interact synergistically with the effects of past, present, and future Projects and activities, and would result in a significant adverse cumulative effect.

The Panel concludes that the Project and marine shipping associated with the Project would result in a significant adverse cumulative effect on the Southern Resident Killer Whale.

The Panel recognizes that several participants have highlighted that the Salish Sea is already highly noisy and there should be, at a minimum, no future net gain in underwater noise. The Panel also notes DFO's recommendation that a context-specific analysis of acoustic impacts on SRKW should be undertaken, since it would provide a more accurate and appropriate representation of behavioral responses to underwater noise. The Panel is of the view that these issues should be addressed by the Government of Canada with the collaboration of the Proponent and other commercial traffic vessel operators since they are collectively responsible for the cumulative effects of commercial vessel traffic on SRKW.

Recommendation 28

The Panel recommends that the Proponent, in collaboration with Fisheries and Oceans Canada and the Indigenous Advisory Committee, be required to develop and implement a Marine Mammal Management Plan and follow-up program during construction that includes the following:

- *Establish buffer zones for different species of marine mammals (other than harbour seals and sea lions) where construction activities would need to be reduced or ceased if a marine mammal(s) enters a zone;*
- *If a marine mammal is sighted within the prescribed buffer zone, specify that work should not restart until the marine mammal(s) has moved out of the buffer zone for at least 30 minutes;*
- *Establish a decision protocol that describes the circumstances (type of marine mammals sighted, proximity to civil works, type of activities being undertaken) in which underwater noise-producing activities would be reduced or ceased;*
- *Use marine mammal observers to monitor the prescribed buffer zones;*
- *Coordinate marine mammal observers with whale sighting networks to receive advance warning of marine mammals approaching the construction area;*
- *Establish an efficient system of communication between the Environmental Monitor and the marine mammal observers for when underwater noise-generating activities should be reduced or ceased;*
- *Limit the timing of impact pile driving to daytime only to ensure the detection of all marine mammals within the prescribed buffer zones;*
- *Limit the seasonal timing of impact pile driving activities to avoid periods of marine mammal occurrence that could result in injury or behavioural disturbance;*
- *Specify the location and number of hydrophones to be deployed to detect marine mammals, including during times of darkness or low-visibility at the onset of construction; and*

- *Use additional technologies to detect marine mammals in darkness and during times of poor visibility, if deemed to be technically feasible.*

Recommendation 29

The Panel recommends that the Proponent be required to:

- *Continue initiatives carried out as part of the Enhancing Cetacean Habitat and Observation Program to reduce the potential effects of commercial vessel traffic on at-risk cetaceans throughout the southern coast of British Columbia, and report annually to summarize the outcome of the initiatives;*
- *Make arrangements for the renewal of the ‘Species at Risk Act Section 11 Conservation Agreement to Support the Recovery of the Southern Resident Killer Whale’ for an additional five-year term;*
- *Promote, through annual communication activities addressed to stakeholders of the Conservation Agreement, the adoption of voluntary, practical, and effective mitigation measures that would lead to quantifiable reductions in threats to whales as a result of shipping activities, and to encourage stakeholders to renew their commitment to the Agreement; and*
- *Generate an annual public report that summarizes compliance with voluntary measures and the reasons for non-compliance.*

Recommendation 30

The Panel recommends that Fisheries and Oceans Canada and Transport Canada renew their commitment to the ‘Species at Risk Act Section 11 Conservation Agreement to Support the Recovery of the Southern Resident Killer Whale’ for an additional five-year term.

Recommendation 31

The Panel recommends that the Government of Canada, in collaboration with the Proponent, and other commercial traffic vessel operators:

- *Achieve an objective of net overall decrease in underwater noise by commercial vessel traffic, and report annually on their progress; and*
- *Identify those portions of the Salish Sea where marine shipping overlaps most strongly with Southern Resident Killer Whale both spatially and temporally so as to maximize the benefits of underwater noise reductions.*

Recommendation 32

The Panel recommends that Fisheries and Oceans Canada undertake a context-specific analysis of acoustic impacts on Southern Resident Killer Whale from commercial vessel traffic in the Salish Sea, and make the results available to the Proponent and to the public.

14.2 North Pacific Humpback Whale

14.2.1 Proponent's Assessment

Project Area

In 2017, North Pacific Humpback Whales (Humpback Whales) were reclassified from threatened to special concern under the SARA due to substantive increases in the population.

The Proponent stated that noise generated by impact pile driving was the only construction activity that had the potential to cause acoustic injury to Humpback Whales, and with the implementation of mitigation measures there would be no residual effect.

The Proponent stated that Humpback Whales were not common in the LAA or RAA, but if they were present they would be exposed to Project-related underwater noise, which could potentially result in behavioural responses. The Proponent concluded that these responses would be of short duration and reversible and that residual effects from the Project were not significant.

The Proponent indicated that due to the observed population growth and continued recovery of Humpback Whales in British Columbia, past projects and activities no longer had a significant effect. The Proponent stated that since Humpback Whales were uncommon in the LAA and cumulative effects were not anticipated to affect the Humpback Whale population and its recovery, cumulative effects of underwater noise on Humpback Whales were not significant.

Marine Shipping Area

As with SRKW, the underwater noise levels and zones of potential behavioral disturbance to Humpback Whales were predicted at four representative locations along the international outbound shipping lanes in the LAA. The Proponent predicted that behavioral responses were predicted to occur 2.41 to 4.79 km away from a transiting container ship.

The Proponent stated that Humpback Whales spend a considerable amount of time at the surface putting them at increased risk of vessel strikes. The Proponent stated that Humpback Whales were the most common species of cetaceans struck by vessels in British Columbia and the more likely to be hit in shipping lanes. The Proponent stated that the addition of approximately three container ship movements every two days over existing conditions would not result in population-level effects on Humpback Whales since the population was growing.

The Proponent did not propose any specific mitigation measures to reduce underwater noise or to reduce the risk of vessel strikes to Humpback Whales from marine shipping associated with the Project. The Proponent stated it would distribute a marine mammal awareness pamphlet to marine pilots calling on the Project.

The Proponent noted that Humpback Whales concentrate in a small portion of the westernmost part of the LAA, particularly during the summer months. The Proponent stated that if a Humpback Whale does occur in the LAA during the summer months, it may be exposed to underwater noise, however behavioral responses and acoustic masking were not predicted to

harm an individual or adversely affect its life functions. The Proponent considered that the effects of underwater noise would be moderate in magnitude, local in extent, long-term in duration, frequent/seasonal, and fully reversible. The Proponent stated that vessel strikes could potentially harm an individual and these effects could be severe, but current population growth trends indicate that vessel strikes were not affecting overall population viability. The Proponent determined that the effects from vessel strikes would be moderate in magnitude, site-specific in extent, short-term to permanent in duration, infrequent, and fully reversible to irreversible. The Proponent defined a significant adverse residual effect on Humpback Whales as one that affects one or more individuals, or results in a change to critical habitat such that a feature would not be available when needed for a life function, to the extent which could jeopardize survival or recovery of the species. The Proponent concluded that effects from behavioral disturbance from underwater noise and physical disturbance from vessel strikes would be not significant.

The Proponent noted that the residual effect on Humpback Whales from marine shipping associated with the Project could combine with the effects of other projects and activities within the LAA resulting in a cumulative behavioral effect. The Proponent also noted that Humpback Whales made a dramatic recovery in British Columbia with a growth rate of 4.9 to 6.8 percent annually and cumulative effects were not anticipated to affect population recovery. The Proponent determined that the cumulative effects on Humpback Whale from behavioral disturbance would be moderate in magnitude. The Proponent indicated that the effects would regional, long-term, and frequent/seasonal however, effects would be fully reversible.

With respect to vessel strikes, the Proponent stated that encounter risk was 7.03 percent along the shipping lanes under existing conditions and with the addition of all future marine shipping traffic, the encounter risk increased to 9.06 percent. Potential effects of vessel strikes on Humpback Whales could interact cumulatively with the effects of other projects and activities, including increased risk of strikes, behavioral disturbance from noise, entanglement, toxic spills, and prey reduction. The Proponent noted that residual behavioral effects from marine shipping associated with the Project would not jeopardize the survival or recovery of Humpback Whales in British Columbia. The Proponent determined that the cumulative effects due to vessel strikes on Humpback Whales would be moderate in magnitude, site-specific in extent, short-term to permanent in duration, infrequent/seasonal in frequency, and would be fully reversible to irreversible. The Proponent concluded that the cumulative effects on Humpback Whales of behavioral effects and vessel strikes would not be significant.

14.2.2 Views of Participants

Ecojustice submitted that the results of a necropsy carried out for a Humpback Whale that was found near the BC Ferries Tsawwassen Terminal in 2018 indicated that the whale had injuries consistent with catastrophic vessel strike with propeller injuries. DFO stated that the low speed of vessels in waters near the proposed terminal does not completely prevent a potential vessel strike with a Humpback Whale, as has been shown by recent incidents where Humpback Whales surfaced near slow moving or almost stationary vessels.

DFO stated that the Proponent's assertion that effects on Humpback whales were unlikely due to the low occurrence and slow speeds of transiting vessels in waters under the Proponent's jurisdiction was reasonable. DFO also stated that the Proponent's conclusion that effects on Humpback Whale were expected to be short-term and reversible with no long-term population consequences and the assigned high confidence level in this conclusion were reasonable.

Pacheedaht indicated that they were concerned about potential impacts to Humpback Whales, given their common presence in the shipping lanes and in particular at the J-buoy station on Swiftsure Bank, vulnerability to vessel strikes and the close proximity between proposed shipping routes and humpback habitat and migratory routes. Pacheedaht noted that bigger ships posed a greater risk of vessel strikes to Humpback Whales at Swiftsure Bank.

DFO stated that the information source used by the Proponent for predicting the impact of vessel strikes arising from marine shipping associated with the Project was not suitable, since it was based on tanker traffic, which is a slower class of vessel than the container ships that would be associated with the Project. DFO noted that given the higher speeds of container class vessels (often greater than 20 knots), whales were less likely to avoid these ships and any collision would very likely be lethal. DFO noted that vessels traveling at speeds exceeding 12 knots were likely to cause mortality, whereas strikes from vessels traveling at speeds greater than 18 knots were almost certain to be fatal. DFO stated that the magnitude of potential effects on Humpback Whales due to vessel strikes should be adjusted to high because of the high likelihood of lethal strikes from project-related vessels, due to their travel speed.

DFO stated that the likelihood of collisions between project-related vessels and Humpback Whales ranged from low, near the proposed terminal, through medium and high in areas such as Boundary Pass or on Swiftsure Bank. DFO indicated that the western portion of the Strait of Juan de Fuca and its approaches were amongst the highest risk regions for vessel strikes, with an average risk of a lethal collision between a vessel and a Humpback Whale that was 35.2 times greater than other areas off western Vancouver Island. DFO stated that Swiftsure Bank was an area of particularly high relative risk due to the high densities of Humpback Whales.

DFO stated that vessel collision risk should be mitigated in areas of high strike risk in recognition of the uncertainty regarding breeding stock of individual Humpback Whales. DFO recommended that further measures to reduce ship collision risk, such as reduction in vessel speeds, should be evaluated for possible implementation. DFO also recommended that vessel strike likelihood (lethal and non-lethal) based on updated and effort-corrected information on Humpback Whale density in the area affected by Project-related vessels should be evaluated.

DFO stated that, given the evidence that sound may be important to foraging Humpback Whales and that Humpback Whales demonstrate considerable site fidelity to specific feeding grounds, the conclusion of the Proponent that acoustic masking would have no effect on the ability of individual Humpback Whales to successfully obtain prey was not supported. DFO indicated that the potential impacts could not be quantified since there was no region-specific information available. DFO indicated that undertaking an acoustic masking study for this area required the

use of published information from the other regions, coupled with assumptions about Humpback Whale distribution and abundance in the area, relative to marine shipping.

14.2.3 Panel's Analysis

The Panel agrees with the Proponents' selection of Humpback Whale as a representative species for baleen whales and the Proponents' framework for assessing effects of Project construction and operations and marine shipping associated with the Project. The Panel is of the view that the measures proposed by the Proponent and DFO to mitigate underwater noise during construction have the potential to eliminate the residual effects of construction on Humpback Whales.

The Panel acknowledges that there are uncertainties with respect to whether Humpback Whales could experience acoustic masking effects from marine shipping associated with the Project. The Panel agrees with the Proponent that marine shipping associated with the Project would result in a residual effect due to acoustic disturbance on Humpback Whales and that the effect would be of moderate magnitude and localized.

The Panel recognizes that vessel speed is correlated with both underwater noise and strike risk and that the voluntary slowdown trials as previously undertaken as part of the ECHO Program could also provide dual benefits to reduce strike risk. The Panel notes that container ships travel at some of the highest speeds among all vessel classes and that there are certain areas in the marine shipping area, such as Swiftsure Bank, where there are higher densities of Humpback Whales and therefore a higher likelihood of vessel strikes. The Panel recognizes that if efforts under the ECHO Program were continued, there are opportunities to also reduce strike risk on both Humpback Whales and SRKW. The Panel is of the view that further efforts should be undertaken by the Government of Canada, in collaboration with the Proponent and Indigenous groups, to evaluate the potential benefits and trade-offs of slowdowns in areas of high Humpback Whale density and site-fidelity.

The Panel concludes that the Project and marine shipping associated with the Project would result in a residual adverse effect on Humpback Whales. Since the population of Humpback Whales in the Salish Sea is increasing, the effects would not be significant.

Cumulative Effects Assessment

The Panel considers the information provided by the Proponent regarding population growth of Humpback Whales to be important, particularly with respect to the fact that the current annual growth rate of the Humpback Whale population is approximately five percent, despite existing levels of marine shipping and underwater noise levels in British Columbia. The Panel agrees with the Proponent and DFO that the potential effects from existing marine shipping are not affecting overall population viability despite existing levels of underwater noise. The Panel acknowledges that there is a cumulative effect of the Project and marine shipping associated with the Project with past, present, and future projects and activities, but these effects are not significant.

The Panel concludes that the Project and marine shipping associated with the Project would result in an adverse cumulative effect on Humpback Whales. The effects would not be significant.

Recommendation 33

The Panel recommends that the Proponent, in collaboration with Fisheries and Oceans Canada, Transport Canada, and the Indigenous Advisory Committee, continue efforts under the Enhancing Cetacean Habitat and Observation Program to implement and evaluate the effectiveness of voluntary slowdowns in areas of high Humpback Whale and Southern Resident Killer Whale density and site-fidelity, such as Swiftsure Bank, to reduce underwater noise and the risk of fatal vessel strikes to Humpback Whales and Southern Resident Killer Whales.

Recommendation 34

The Panel recommends that Fisheries and Oceans Canada determine the likelihood of lethal and non-lethal vessel strikes based on updated and effort-corrected information on Humpback Whale density in the areas utilized by Project-related vessels, and communicate the results to the Proponent and pilots to reduce the potential for vessel strikes.

14.3 Steller Sea Lion

14.3.1 Proponent's Assessment

Project Area

The Proponent stated that potential effects on Steller Sea Lions include acoustic injury and disruption of behaviour due to changes in the acoustic environment during construction and operation activities. The Proponent indicated that, with the implementation of mitigation measures, which are the same as those specified in the section on SRKW, that there would be no residual effect of construction on Steller Sea Lions.

The Proponent noted that previous monitoring of underwater and in-air disturbance of seals and sea lions indicated that behavioral changes due to acoustic disturbance, including movement off a haul-out, would be short term with little or no long-term consequence for long-term use, suggesting that they were resilient to disturbance.

The Proponent predicted that there would be a residual effect of operational noise on Steller Sea Lion. Overall, the Proponent stated that operational acoustic effects on Steller Sea Lion would be short-term and reversible and would not result in residual effects that would threaten the survival of the population. The Proponent concluded that residual effects from Project operations on Steller Sea Lion would not be significant.

The Proponent indicated that due to the observed population growth and continued recovery of Steller Sea Lions in British Columbia, it was determined that past projects and activities that have been carried out no longer have a significant effect. Further, the Proponent stated that there

is evidence of habituation of Steller Sea Lions to regularly occurring, predictable noise sources. The Proponent determined that cumulative effects on Steller sea lion would be short-term and reversible and would not result in residual cumulative effects that would threaten the survival of the population, therefore, cumulative effects of underwater noise on Steller Sea Lions were considered not significant.

Marine Shipping Area

As with SRKW and Humpback Whales, the underwater noise levels and zones of potential behavioral disturbance to Steller Sea Lions were predicted at four representative locations along the international outbound shipping lanes in the LAA.

The Proponent stated that only one record of a pinniped strike has been reported in B.C, which involved a whale watching vessel at Race Rocks Marine Reserve. The Proponent highlighted that vessel strikes were not identified as a potential threat in the DFO Management Plan for Steller Sea Lions. The Proponent noted that the likelihood of a container ship associated with the Project striking a seal or sea lion within the LAA and resulting in injury or mortality to individuals that result in a population-level effect was very low.

The Proponent did not propose any specific mitigation measures to reduce underwater noise or to reduce the risk of vessel strikes to Steller Sea Lions from marine shipping associated with the Project but would distribute a marine mammal awareness pamphlet to marine pilots calling on the Project.

The Proponent noted that no breeding colonies occur in the LAA, and major and winter haul-outs would not be exposed to underwater noise levels predicted to result in behavioral effects. The Proponent considered that the effects of underwater noise would be low in magnitude, local in extent, long-term in duration, frequent/seasonal, and fully reversible. For effects from vessel strikes, the Proponent determined that the effect would be low in magnitude, site-specific in extent, short-term to permanent in duration, infrequent, and fully reversible to irreversible. The Proponent defined a significant adverse residual effect on Steller Sea Lion as one that would jeopardize the survival or recovery of the species. The Proponent concluded that effects from behavioral disturbance from underwater noise and physical disturbance from vessel strikes would be not significant.

The Proponent noted that the residual effect on Steller Sea Lions from marine shipping associated with the Project could combine with the effects of other projects and activities within the LAA resulting in a cumulative behavioral effect. The Proponent reiterated that pinnipeds in the water have been shown to tolerate close vessel approaches. They also highlighted that since Steller Sea Lions have poor underwater hearing and are sensitive only below 1,000 hertz, that most underwater noise from marine shipping would not be audible to Steller Sea Lions. The Proponent determined that the cumulative effects on Steller Sea Lion would be low in magnitude, since there were no rookeries in the LAA and since the noise introduced from the Project would be within the range of existing conditions. The Proponent indicated that the extent would be regional, the duration would be long-term, the frequency would be frequent/seasonal,

and would be fully reversible. The Proponent concluded that the cumulative effects on Steller Sea Lion would not be significant.

14.3.2 Views of Participants

Pacheedaht First Nation noted that Steller Sea Lions are of cultural and spiritual importance to their nation. In addition, several Indigenous groups noted the importance of the harvest of seals and sea lions, which Steller Sea Lions are meant to represent.

DFO stated that the proposed criteria rating of low in relation to magnitude of effects of underwater noise on Steller Sea Lions is appropriate. DFO stated that no data on vessel strikes of Steller Sea Lions were available, but the Proponent's conclusion that ships pose a very low risk of causing injury or mortality to Steller Sea Lions through collision was reasonable.

DFO stated that populations of Steller Sea Lions were presently increasing under current conditions of underwater noise. DFO outlined that behavioral responses to vessel noise for Steller Sea Lions and pinnipeds in general were poorly understood, but that any behavioral shifts were likely subtle. DFO indicated that Steller Sea Lions were expected to habituate to some extent to cumulative underwater noise levels due to marine shipping, which was based on observations of continued use of areas that experience regular disturbance. DFO determined that the Proponent's conclusion that effects on Steller Sea Lions were expected to be short-term and reversible with no long-term population consequences was reasonable.

14.3.3 Panel's Analysis

The Panel accepts the Proponents' selection of Steller Sea Lion as the representative species for pinnipeds. The Panel agrees that the Proponent provided a relevant assessment framework for evaluating potential effects on Steller Sea Lion due to acoustic injury during construction, disruption of behaviours due to changes in the acoustic environment during construction and operations, and vessel strikes. The Panel is of the view that the measures proposed by the Proponent and DFO to mitigate underwater noise during construction have the potential to eliminate the residual effects of construction on marine mammals, including Steller Sea Lion.

With respect to vessel strikes, the Panel agrees with the Proponent that the likelihood of a container ship striking a Steller Sea Lion is very low due to their agility and swimming behaviour. The Panel agrees that there would be a residual effect of low magnitude on Stellar Sea Lions due to marine shipping associated with the Project. The Panel agrees with information provided by the Proponent and DFO that populations of Steller Sea Lion are increasing under current levels of underwater noise.

The Panel concludes that the Project and marine shipping associated with the Project would result in a residual adverse effect and an adverse cumulative effect on Steller Sea Lion. The effects would not be significant.

14.4 Species at Risk

14.4.1 Proponent's Assessment

The Proponent stated that 13 marine mammal species with conservation status were identified as potentially occurring in the LAA, as listed in Table 14-2. The Proponent noted that while the assessment focused on effects on representative species, mitigation would be applied to reduce potential adverse environmental effects on all marine mammal species.

Table 14-2: Marine mammal species at risk potentially occurring in the Local Assessment Area (Source: Adapted from EIS, Volume 3 and MSA)

Species	Species at Risk Act Status
Toothed Whales	
Killer Whale – Southern Resident Population (<i>Orcinus orca</i>)	Endangered
Killer Whale – Northern Resident Population (<i>Orcinus orca</i>)	Threatened
Killer Whale – Transient (Bigg's) Population (<i>Orcinus orca</i>)	Threatened
Killer Whale – Offshore Population (<i>Orcinus orca</i>)	Threatened
Harbour Porpoise (<i>Phocoena phocoena</i>)	Special Concern
Baleen Whales	
North Pacific Humpback Whale (<i>Megaptera novaeangliae</i>)	Special Concern
Eastern Pacific Grey Whale (<i>Eschrichtius robustus</i>)	Special Concern
Fin Whale (<i>Balaenoptera physalus</i>)	Threatened
Sei Whale (<i>Balaenoptera borealis</i>)	Endangered
Blue Whale (<i>Balaenoptera musculus</i>)	Endangered
North Pacific Right Whale (<i>Eubalaena japonica</i>)	Endangered
Seals and Sea Lions	
Steller Sea Lion (<i>Eumetopias jubatus</i>)	Special Concern
Sea Otter (<i>Enhydra lutris</i>)	Special Concern

14.4.2 Views of Participants

DFO stated that the choice of SRKW, Humpback Whales and Steller Sea Lions as representative species for the major marine mammal subcomponents was reasonable.

Ecojustice noted that the Proponent had not done individual assessments for SARA-listed species and questioned how it determined that effects on these species would not be significant.

Ecojustice stated that there is as a requirement under SARA section 79(2) to implement measures to avoid or lessen adverse effects that applies to each one of these listed species for the Project.

They indicated that the Proponent failed to address effects on each of these species or apply mitigation measures for those effects in its assessment.

14.4.3 Panel's Analysis

As seen in Table 14-2 above, there are numerous marine mammals listed under SARA that have the potential to occur in the LAA. The Panel generally accepts that SRKW, Humpback Whales, and Steller Sea Lions are representative of their subcomponents. The Panel is of the view that although there may be differences in prey preference, occurrence and behavior between the representative and represented species, the Proponent has adopted a precautionary approach by assessing the potential effects on the species that had the greatest conservation status when preparing the EIS and MSA. As stated by the Proponent, mitigation proposed would also benefit other marine mammal species, not just the representative species.

The Panel is of the opinion that the recommendations made by the Panel for the SRKW and the Humpback whale would also benefit other marine mammal species at risk that could occur in the marine shipping area.

15 Avifauna

15.1 Proponent's Assessment

The Proponent reported that an estimated 1.4 million birds representing more than 250 species use Roberts Bank and the Fraser River estuary annually. To focus the assessment, the Proponent grouped coastal bird species using the Project area into seven categories, or subcomponents, as shown in Table 15-1 below.

Table 15-1: Coastal bird subcomponents and representative species (Source: Adapted from EIS, Volume 3)

Subcomponents	Representative Species
Shorebirds	Pacific dunlin and Western sandpipers
Waterfowl	American wigeon and Brant
Hérons	Great blue heron
Diving birds	Surf scoter and Western grebe
Raptors	Bald eagle, Barn owl and Peregrine falcon
Gulls and Terns	Caspian tern and Glaucus-winged gull
Passerines	Barn swallow

The Proponent stated that the abundance of birds varied throughout the year with many species being most abundant either during the northward (April to May) and southward (September to November) migratory periods or during winter (November to March). It was noted that shorebirds were the most abundant bird group in the Fraser River estuary, with over one million birds documented in the LAA in a single day.

The Proponent used the RBEM to assess changes in productivity of coastal birds. The Proponent stated that, due to the transient nature of birds, changes in coastal bird productivity were viewed as changes in the ability of the LAA to support subcomponent populations and not necessarily changes in the actual number of birds that used the LAA. The Proponent stated that the Project had the potential to directly affect coastal bird productivity from loss of habitat caused by terminal placement and causeway widening and indirectly by altering coastal geomorphic processes that influence nutrient dynamics and trophic interactions. The Proponent noted that potential effects would vary by coastal bird subcomponent, the effectiveness of mitigation measures, and the availability of alternative habitats within the LAA.

The Proponent predicted a 2.9 percent increase in coastal bird biomass associated with changes due to the Project. Depending on the subcomponent and the species, biomass changes ranged from approximately -8 to +31 percent. The Proponent concluded that changes in coastal bird productivity would be negligible or within the range of natural ecosystem variability.

The Proponent predicted a minor, short-term negative effect on coastal birds from acoustic and visual disturbance adjacent to the Project during construction. The Proponent stated that all subcomponents, with the exception of barn owl, appeared to be habituated to the existing disturbance and would not be affected in the long term. The Proponent also noted that a large amount of alternative habitat would be available if coastal birds were displaced during construction both within the RAA for barn owl and within the LAA for the remaining subcomponents.

To mitigate the potential effects of the Project, the Proponent proposed measures specifically designed for coastal birds. The Proponent stated that other measures put in place for the Project, such as the Marine Species Management Plan, would incidentally mitigate effects on coastal birds. With the implementation of the mitigation measures, the Proponent concluded that residual effects on coastal bird productivity, with the exception of coastal diving birds, would be negligible or so small as not to be measurable.

General mitigation measures proposed by the Proponent included the following:

- Project placement and design to avoid encroachment into the intertidal zone; minimize changes to habitats important for coastal birds, and reduce the amount and area of dredging required;
- Project design including capping hollow steel piles; avoiding the use of vibro-replacement techniques in the marine environment; ensuring that the material dredged from the tug basin was placed within the Project footprint; and designing the project to reduce the combined number of dredge equipment and tug/barge movements;
- Construction and operations environmental management plans containing measures to mitigate effects on coastal birds, such as: Construction Compliance Monitoring; Environmental Training; Noise, Light, Land and Marine Traffic Management; Sediment and Erosion Control; Spill Preparedness and Response; Underwater Noise Management and; Hazardous Materials and Waste Management Plan; and
- An Offsetting Plan to address productivity loss due to changes in habitat area.

The Proponent defined a significant adverse residual effect on coastal birds as one that would negatively affect food resources or associated habitats to the extent that it compromises the long-term productive potential of the LAA to support coastal bird productivity. The Proponent reported that the permanent loss of subtidal soft-bottom habitat for foraging by diving birds equates to the removal of approximately seven percent of similar subtidal habitat within the LAA and one percent of habitat within the RAA. Given the amount of alternate habitat within the RAA and in close proximity to the Project, and the lack of evidence that diving birds were habitat limited in the LAA, the Proponent considered the removal of subtidal habitat to be unlikely to negatively affect the long-term productive potential of diving birds within the LAA.

15.1.1 Diving Birds

The Proponent described how during migration and winter, the Fraser River estuary was home to approximately 15 species of diving ducks, five species of grebe, three species of cormorant, four

species of loon, and several species of pelagic seabirds. Diving bird abundance in the LAA was highest in spring, with subtidal waters within 1 km of the Roberts Bank terminals supporting the highest use. The Proponent stated that habitats used by diving birds included sandy substrate, sparse orange sea pen habitat, rocky intertidal and native eelgrass with cover greater than 30 percent.

The Proponent reported that diving birds present in the LAA could be divided into two categories largely based on feeding strategy and diet. Piscivores, such as loons, cormorants, grebes and guillemots, feed mainly on fish, while seaducks, such as scoters, scaup, bufflehead and long-tailed duck, feed primarily on marine invertebrates.

The RBEM predicted a five percent decrease in the productive potential of the LAA to support piscivorous species, which was within the model's margin of error and interpreted by the Proponent as indicative of little to no change due to the Project. For seaducks, the RBEM predicted an eight percent decrease in productive potential. The Proponent explained that this was largely driven by the removal of 133 ha of subtidal foraging habitat due to terminal placement. Since diving birds are highly mobile the Proponent considered that they would move to other areas of the LAA if adverse conditions were encountered.

Further, the Proponent predicted an increase of approximately 22 vehicle-related additional mortalities annually (one percent) to be minor compared to the number of diving birds using the LAA annually. The Proponent concluded that diving birds would be the only coastal bird subject to a minor residual effect but with the mitigation measures proposed for coastal birds, the effect would not be significant.

The Proponent's cumulative effects analysis for coastal birds focused on changes in diving bird productivity resulting from loss of sub-tidal sand habitat. The Proponent determined that coastal birds had been positively and adversely affected by past and present projects and activities and that those effects were reflected in the existing conditions of the environmental component. The Proponent expected that the residual effect of the Project and potential interaction with other certain and reasonably foreseeable projects and activities would be small, and any combined effects would be negligible or not measurable.

When considering the future condition of diving birds, the Proponent stated that the long-term integrity of the diving bird population and community would not be compromised since the population and community function in the wider marine ecosystem would be maintained. Further, the species expected to be affected by the Project were not formally designated by the *British Columbia Wildlife Act* or listed under the federal SARA. The Proponent indicated that such formal designation would indicate that the government considers the species had already been significantly adversely affected. For those reasons, the Proponent concluded that the residual effect of the Project in combination with the effects of other projects and activities would not be significant.

The Proponent committed to a follow-up program to verify the predictions of the effects assessment for diving birds.

15.1.2 Barn Owls and Other Raptors

The Proponent reported that 26 raptor species had been documented in the RAA, of which 14 species had been recorded in the LAA. The Proponent selected peregrine falcon, barn owl, and bald eagle to represent project effects on raptors.

The Proponent reported that the agricultural areas in southwest Delta had some of the highest densities of barn owl in Canada. Barn owls are listed as threatened under SARA and face ongoing loss of foraging, nesting, and roosting habitats from urban and industrial development of agricultural lands, and decay and demolition of wooden barns and outbuildings. The Proponent indicated that barn owls had been documented in low numbers in the LAA, accounting for four percent of roadside observations. The Proponent reported that barn owls were not known to nest or roost within the LAA, however, as of 2011, there were five active nests within 2.5 km of its border. In 2015, three of these nests were destroyed due to development. The Proponent noted that approximately 818 ha of moderate to high-quality foraging habitat was located in the RAA, whereas approximately four ha of moderate to high-quality foraging habitat was located near the east end of the Roberts Bank causeway, associated with agricultural habitats adjacent to Deltaport Way.

Barn owls are particularly vulnerable to vehicle collisions as they often hunt from perches such as fence posts and fly low (less than four m) over suitable habitat adjacent to roads while hunting. Two barn owl mortalities associated with vehicle collisions had been documented by the Proponent near the east end of the causeway associated with agricultural habitats adjacent to Deltaport Way, indicating barn owl activity close to the Project. Without mitigation, the Proponent anticipated that adverse effects on barn owl productivity due to vehicle collisions were likely.

In addition to the general mitigation measures identified for coastal birds, the Proponent committed to additional measures specific to barn owl. Those would be part of the Terrestrial Vegetation and Wildlife Management Plan and would include the following:

- Collaborating with transportation authorities and Canadian Wildlife Service to develop and implement measures, including speed management within the LAA to the extent that the authorities having jurisdiction are able, to decrease the potential for bird-vehicle collisions;
- Identifying, installing, and maintaining artificial nest structures (e.g., nest boxes) within the RAA to enhance barn owl productivity, with the installation of five nest boxes during the first year of construction;
- Support the establishment/maintenance of barn owl foraging habitat close to barn owl nest sites through contribution to third party programs; and
- Increase education and driver awareness of bird-vehicle (including barn owl) collisions.

The Proponent explained that the installation of physical barriers as mitigation would not be technically and economically feasible. The Proponent considered that only a chain-link fence design would have a sufficiently small footprint and could withstand anticipated wind loads. This

fence however, would not be feasible along the Deltaport Way overpass. The Proponent also explained that this measure would require the removal of road verge barn owl habitat and would have an effect on visual quality. The Proponent also considered the cost of such a measure to be too high for the potential benefits.

The Proponent expected that effects on barn owl would be fully mitigated and concluded that the Project would result in no measurable residual effect on barn owl and other raptor populations.

The Proponent also committed to a follow-up program for barn owl to verify the effectiveness of mitigation measures and the prediction of the negligible project effect.

15.1.3 Shorebirds

The Proponent reported that the Fraser River estuary was one of the five most heavily used migration stopover sites along the Pacific coast flyway for the Western sandpiper. During northward spring migration, over 500,000 Western sandpipers had been observed in the Fraser River estuary on a single day. This constituted 14 percent of the total population estimated at 3.5 million.

The Proponent noted that, based on data collected by ECCC, 14 to 21 percent of the Western sandpiper population stops over at Roberts Bank in a typical year. The Proponent pointed out that consequently most Western sandpipers do not stop over at Roberts Bank in a given year and more than half skip over the Fraser River estuary entirely during a typical northward migration. The Proponent disagreed with ECCC's view that 42 to 64 percent of the global Western sandpiper population uses Roberts Bank during northern migration, which was an estimate derived from surveys in 1994 where a peak of 1.8 million Western sandpipers were observed. The Proponent noted that the 23-year median population estimate was instead 600,000 Western sandpipers stopping at Roberts Bank.

The Proponent reported that, although some surveys over the past 30 years indicated an apparent decline in shorebirds that breed in North America, other surveys showed no meaningful trend in the Western sandpiper population at Brunswick Point. The Proponent stated that approximately half of the use within the estuary occurs outside of the LAA, indicating that alternative high-quality foraging habitat was available within the estuary. During winter and migration periods, the Fraser River estuary also supports a greater number of dunlin than most, if not all, other sites in western North America and the largest wintering population of shorebirds in Canada. The Proponent reported that, overwinter, the estuary annually supports on average 20 percent of the overall population of dunlin estimated at 550,000 and that on a single day, up to 150,000 dunnins have been observed. The Proponent undertook several field and modelling studies including biofilm dynamics, its relationship with environmental variables, and composition of biofilm consumed by Western sandpipers, changes in habitat, and disturbances and mortality. The Proponent also assessed the potential effects of the Project on biofilm as a food source for shorebirds, especially for Western sandpipers.

The Proponent reported that the Western sandpiper diet was composed primarily of invertebrates and biofilm. The Proponent noted that the Western sandpiper had evolved to thrive in highly variable estuarine environments such as Roberts Bank. According to the Proponent, Western sandpipers feed on freshwater and marine-dominated areas at Roberts Bank in approximately equal proportions, with some of the highest concentrations of shorebird usage documented in the freshwater dominated areas near Canoe Passage at Brunswick Point.

In addition, the Proponent indicated that models conservatively estimated that, with the Project, there would be a surplus of food, including biofilm, for the Western sandpiper and other shorebirds. The Proponent's Shorebird Foraging Opportunity Model estimated that biofilm alone at Roberts Bank could support one million Western sandpipers on a single day during northward migration, except on a small fraction of days of extreme demand in the northward migration. The Proponent also noted that modelling results indicated excess capacity within the invertebrate community to support the Western sandpiper during northward migration. Subsequent studies conducted in 2018 documented high fatty acid levels within these invertebrate communities, providing an additional source of these nutrients for migrating sandpipers.

The Proponent's studies determined that the only pathway potentially affecting biofilm was change in salinity from the Project, but that this change would not adversely affect biofilm and would consequently not adversely affect Western sandpiper prey availability, as discussed in [Section 11.2 - Biofilm](#). The Proponent committed to offset the direct loss of biofilm by creating biofilm habitat. The Proponent concluded that the Project would have negligible residual effects on the Western sandpiper. The Proponent committed to a follow-up program to verify the predictions of the effects assessment on the Western sandpiper and their food supply. The Proponent has also committed to the preparation of a biofilm habitat creation manual.

15.1.4 Marine Birds

The Proponent chose five subcomponents namely sea ducks, pelagic birds, waterfowl, gulls and terns, and shorebirds to represent marine birds in the marine shipping area, as illustrated in Table 15-2 below.

Table 15-2: Marine bird subcomponents and representative species (Source: Adapted from MSA)

Subcomponents	Representative Species
Sea ducks	Surf scoter
Pelagic Birds (and other piscivorous diving birds)	Marbled murrelet and fork-tailed storm-petrel
Waterfowl	Brant
Gulls and Terns	Glaucus-winged gull
Shorebirds	Red knot

The Proponent reported that at least 184 bird species are part of the Salish Sea marine ecosystem. Within the marine shipping area, 49 avian species were designated a species of conservation concern at either the Canadian or USA federal or provincial/state level. The Proponent indicated that marine bird abundance and distribution varies throughout the year. Many subcomponents are most abundant either during northward (April to May) and southward (July to November) migratory periods or during winter (November to March). For most groups, summer (June to August) represents a time of lowest use of the area. Exceptions are herons, some gulls and terns, and some diving bird species, which are more common during the summer breeding season, with a large proportion concentrated in breeding colonies within the marine shipping area.

The Proponent assessed the effects of vessel wake, atmospheric noise and visual disturbance from vessel in transit, underwater noise, and bird collisions with vessels based on existing sources of information. The Proponent determined that all effects would be negligible except for the potential loss of productivity from collisions with transiting vessels. The Proponent stated that effects would be localized and occur only as the ship passes by. The Proponent noted that birds have habituated to existing conditions. The Proponent concluded that the effect from collisions with transiting vessels would not be significant because no known reports of marine bird collisions with vessels existed, indicating that the issue was not widespread or frequent. However, the Proponent indicated that there was no requirement for vessel operators to report bird strikes, meaning that the lack of information did not indicate that no collisions had occurred. The Proponent indicated that given that the loss of productivity from collisions with transiting vessels was unlikely, no cumulative effects were likely to occur. No mitigation or follow-up program was proposed for marine birds.

15.1.5 Bird Species with Listed Conservation Status

The Proponent identified 19 species listed on the *Species at Risk Act* or designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) that use the Project area or the marine shipping area, as indicated in Table 15-3. The Proponent did not assess each individual species at risk but relied instead on the effects assessment it conducted for each subcomponent using the identified representative species. In addition to the general mitigation measures proposed for coastal birds and the measures proposed to mitigate effects on barn owl, the Proponent proposed a follow-up program for Great blue heron to verify the effects predictions of negligible effects to Great blue heron abundance in the LAA, including the RBEM forecast. The follow-up program proposed for diving birds would also be applicable to Marbled murrelet and Western grebe.

Table 15-3: Coastal and marine birds with federal conservation status (Source: Adapted from MSA)

Species	SARA or COSEWIC Status
Raptors	
Barn owl (<i>Tyto alba</i>)	Threatened (Schedule 1)

Species	SARA or COSEWIC Status
Peregrine falcon - <i>anatum</i> subspecies (<i>Falco peregrinus anatum</i>)	Special Concern (Schedule 1)
Short-eared owl (<i>Asio flammeus</i>)	Special Concern (Schedule 1)
Passerines	
Band-tailed pigeon (<i>Patagioenas fasciata</i>)	Special Concern (Schedule 1)
Barn swallow (<i>Hirundo rustica</i>)	Threatened (COSEWIC 2010)
Black swift (<i>Cypseloides niger</i>)	Endangered (COSEWIC 2015)
Pelagic Birds (marine)	
Ancient murrelet (<i>Synthliboramphus antiquus</i>)	Special Concern (Schedule 1)
Black-footed albatross (<i>Phoebastria nigripes</i>)	Special Concern (Schedule 1)
Cassin's auklet (<i>Ptychoramphus aleuticus</i>)	Special Concern (COSEWIC)
Horned grebe (<i>Podiceps auritus</i>)	Special Concern (Schedule 1)
Marbled murrelet (<i>Brachyramphus marmoratus</i>)	Threatened (Schedule 1)
Pink-footed shearwater (<i>Puffinus creatopus</i>)	Threatened (Schedule 1), Endangered (COSEWIC 2016)
Red-necked phalarope (<i>Phalaropus lobatus</i>)	Special Concern (COSEWIC 2014)
Short-tailed albatross (<i>Phoebastria albatrus</i>)	Threatened (Schedule 1)
Western grebe (<i>Aechmophorus occidentalis</i>)	Special Concern (COSEWIC 2014)
Shorebirds (marine)	
Great blue heron - fannini subspecies (<i>Ardea herodias fannini</i>)	Special Concern (Schedule 1)
Long-billed curlew (<i>Numenius americanus</i>)	Special Concern (Schedule 1)
Red Knot (<i>Calidris canutus</i>)	Threatened (Schedule 1)
Other	
Common nighthawk ⁵ (<i>Chordeiles minor</i>)	Threatened (Schedule 1)

15.2 Views of Participants

The majority of comments received were related to shorebirds, specifically the Western sandpiper. Most participants raised general concerns about the potential for the Project to affect biofilm needed by shorebirds for their migration. Many participants emphasized the importance

⁵Some species including the Common Nighthawk are unlikely to occur in the Project or the marine shipping area.

of the Fraser River estuary, including Roberts Bank, as part of the international Pacific Flyway and expressed concerns about the potential effects of the Project on shorebird migration.

15.2.1 Barn Owl

ECCC noted that at full operations, the Project was predicted to increase daily port-related truck movements by 100 percent, train movements by 38 percent, and other vehicles by 83 percent. ECCC anticipated that this would result in increased avian mortality rates relative to baseline conditions. ECCC also noted that the implementation of non-vegetative barriers rather than vegetative barriers designed specifically for barn owls would also benefit other avian species, such as barn swallows, in the Project area. ECCC was concerned about the Proponent's proposed mitigation to reduce roadside owl habitat suitability given that loss of owl foraging habitat was one of the main threats to the species. ECCC pointed out that the effects of project-related vehicle collisions would extend beyond the LAA as vehicle collisions were expected to increase on all major roads and highways connected to Deltaport Way, where mitigation was not proposed. ECCC was of the view that the Project contribution to cumulative effects in the RAA would not be fully addressed by the Proponent's proposed mitigation measures. ECCC recommended that physical barriers to conserve barn owl roadside grass verge habitat be implemented in the RAA. ECCC also recommended that a plan be developed in collaboration with relevant authorities to design the physical barriers and to verify the effectiveness of the nest boxes proposed by the Proponent.

BSC stated that the proposed mitigation measures would not be fully effective and that the Project would result in significant residual effects on barn owls. BSC explained that the restricted geographic boundaries of the assessment undermined the conclusions and did not allow for a proper evaluation of the majority of area where barn owls and the Project would interact, which was outside the LAA. BSC cited the Proponent's study that reported six dead barn owls along a portion of the Deltaport Way in 2013, and argued that the study was omitted from the EIS because the area was outside the LAA. BSC pointed out that the Proponent had not committed to implement the most meaningful mitigation measures, non-vegetative screens, despite the recommendations of ECCC. BSC also recommended that habitat loss be compensated with a ratio of 1:1 and that the offsets should take place along Deltaport way and associated feeder routes. BSC explained that South Delta was a very important area for barn owl and that with all the development going on, the birds did not have anywhere else to go. BSC advised that, given the threatened status of the species, a cumulative effects assessment throughout the RAA was required.

BSC stated that a study conducted in 2007 to 2008 showed that grass cover had decreased by 53 percent and urban cover had increased by 113 percent within a one kilometer-radius of active barn owl nest and roost sites since the 1990s. Traffic volume on major highways intersecting these areas had also increased by 33 percent. BSC explained that these trends have continued throughout the region and that habitat loss and road mortality have been identified as the two key local threats to the species. BSC indicated that the barn owl population in all of Southern British Columbia was estimated between 250 to 1000 individuals, with the lower mainland including the

Fraser Valley being the stronghold of the population. Those numbers are referenced in the Provincial Recovery Plan which considers the current population size to be in the low-to mid-range of this estimate. As for the population of barn owls in South Delta, south of Panorama Ridge and the west side of Highway 91, BSC estimated that there are 73 active nests which would equate to 146 breeding adults.

15.2.2 Shorebirds

ECCC reported that the entire species population of Western sandpipers, approximately 3.5 million birds, migrate northward along the Pacific Flyway and that an estimated 42 to 64 percent of Western sandpipers rely on Roberts Bank to refuel. ECCC noted that fatty acids, especially Polyunsaturated Fatty Acids (PUFA), accessed by grazing biofilm directly or through the consumption of invertebrates, appear critical to migrating shorebirds. ECCC stated that elevated levels of fatty acids in biofilm during spring coincide with the arrival of Western sandpipers on their northward migration. Given the importance of fatty acids as energy rich nutrients for migrating birds, the capacity of Roberts Bank to furnish these essential nutrients was directly tied to its importance as a stopover site.

ECCC was also concerned by the spatial shift in optimal salinity for biofilm biomass towards lower elevation areas with sandy substrate. ECCC stated that given the sandpiper tongue morphology, biofilm could be inaccessible for foraging in these areas. ECCC was of the view that in addition to the direct loss of 2.5 ha of intertidal mudflats from the widening of the causeway, indirect effects would affect up to 558 ha of intertidal flats. ECCC was of the opinion that it was not possible to recreate high quality biofilm habitat and therefore the Proponent's proposed mitigation measures would not be effective. ECCC stated that changes to Roberts Bank would constitute a species-level risk to the Western sandpiper and to shorebirds more generally, due to the predicted disruption to the salinity regime that optimizes fatty acid production for biofilm that could not be mitigated. ECCC explained that given the high shorebird usage at Roberts Bank, even low probability events carried a high risk of adverse consequences because nutrient shortfalls during breeding migration could have species-level consequences. ECCC advised that only a project redesign would avoid adverse geomorphological processes at Roberts Bank impacting biofilm and shorebirds.



The **Pacific Flyway** is a major north-south flyway for migratory birds in America, extending from Alaska to Patagonia. Every year, migratory birds travel some or all of this distance both in spring and in fall, following food sources, heading to breeding grounds, or travelling to overwintering sites.

Dr. Patricia Baird, on behalf of the Kahiltna Research Group explained that Roberts Bank was a critical stopover for migrating shorebirds in April because it supplied essential nutrients not easily found elsewhere in such high concentrations. Dr. Baird noted that these bioactive molecules, which are only obtained through feeding, are necessary for reproduction and

migration and are responsible for a myriad of physiological cascades that enhance flight success and metabolism. Dr. Baird stated that it would be illogical to believe that Western sandpipers were generalists and could forage anywhere.

Dr. Baird stated that freshwater diatoms do not suffice for the high amounts of EPA and DHA that shorebirds depend on. She mentioned that the Proponent had keyed out diatoms only to genus, but that one genus could contain both marine and freshwater species. She noted that the availability of the correct fatty acids for shorebirds is driven by the suite of diatom species present.

Dr. Baird mentioned that if only freshwater were available, or if sand, opposed to mud, was exposed, shorebirds would not be able to process the biofilm or be able to obtain the correct form of PUFA. Dr. Baird expressed concerns that the Project could possibly lead to a severe decrease or elimination of the marine and estuary diatoms with high EPA and DHA that support the entire marine food web, resulting in a decreased number of shorebirds, and an irreversible species-level impact to shorebirds on Pacific Flyway.

BSC indicated that over 50 percent of the birds observed in the entire estuary use Roberts Bank. BSC stated that this preferential use of the area suggests that there are unique features of this site that make it superior to other adjacent mudflat habitats for the Western sandpiper. BSC stated that one possible hypothesis to explain these patterns was the community assemblage of primary producers and the current abiotic conditions at Roberts Bank which trigger the production of essential nutrients.

BSC pointed out that their study demonstrated that biofilm feeding does occur throughout the estuary and yet, despite biofilm availability elsewhere, the majority of Western sandpipers forage at Roberts Bank. BSC stated that it was not sufficient to demonstrate that there would still be biofilm at the site following construction; it was necessary that the same habitat quality was maintained. In order to do so, the driving factors causing Western sandpipers to preferentially feed at Roberts Bank and support a unique dietary composition required identification. BSC explained that, without this understanding, the Proponent's predicted changes to the abiotic conditions at Roberts Bank posed a risk to the Western sandpiper population.

15.2.3 Marine Birds

ECCC also commented on the Proponent's assessment of artificial light for both marine and coastal birds. ECCC noted that the statement that birds were habituated to artificial lighting and that cumulative effects would not occur was not supported by scientific data and literature. ECCC was of the view that the continued presence of birds in the region did not ensure that they are fully habituated to the increase level in vessel traffic and artificial lighting. ECCC recommended that the Proponent design a follow-up program to address data gap and inform adaptive measures should they become necessary.

ECCC advised that the Project might result in adverse environmental effects on marine birds because marine shipping might disturb or result in collisions with marine birds. BSC further

noted that results from ongoing surveys showed that bird populations of the Salish Sea were declining and not resilient to local disturbance as presented by the Proponent. BSC believed that local marine stressors, such as shipping traffic, were chronic to bird populations.

15.2.4 Species at Risk

ECCC commented that they were satisfied with the Proponent's assessment and the proposed mitigation measures for most migratory birds and species at risk, with the exception of shorebirds, barn owl, Great blue heron, Western grebe and barn swallow. ECCC recommended that the Proponent include any SARA or COSEWIC listed species found in the LAA in the follow-up program to verify the accuracy of the effects assessment and the effectiveness of mitigation measures. ECCC also pointed out that although it would be unlikely that the Project would elevate the status of any implicated species, any Project-related impacts that are not adequately mitigated would have the potential to contribute to the status elevation of these species.

ECCC noted that the largest and most significant colony of Great blue herons in Canada was located in the Tsawwassen area adjacent to the Project. A minimum of 462 nests were counted by ECCC in 2017. ECCC stated that while 27 ha of onsite marine habitat restoration might be considered 'beneficial' to herons, these measures might not adequately mitigate the potential adverse effects to Great blue herons. Given the importance of intertidal habitats for this species, ECCC recommended that the Great blue heron be incorporated in the offsetting framework.

ECCC also expressed concerns about the effectiveness of mitigation measures for the Western Grebe. Given the predicted loss of orange sea pen, ECCC stated that it was unclear whether the orange sea pen transplant strategy would take into account the habitat requirements of Western Grebe and other diving birds. ECCC also mentioned that the offset plan for wetlands was not sufficiently explicit to ensure that piscivorous diving birds would benefit from it.

15.3 Panel's Analysis

The Panel notes that the Project area and the marine shipping area overlap with the habitat of numerous bird species including 19 species listed under SARA or designated by COSEWIC. This spatial overlap has the potential for the Project to affect avifauna. The effects pathways are widely varied, depending on the avian species, their habits, and the Project characteristics. Below, the Panel focusses its discussion on bird subcomponents or species that could potentially be affected by the Project and marine shipping associated with the Project.

15.3.1 Diving Birds

Western Grebe was used as the representative species for all piscivorous diving birds, at least as far as foraging in sub-tidal habitat is concerned. Surf scoter was used to represent invertebrate-eating diving birds. The Panel accepts the Proponent's assessment that changes in productive potential to support diving birds in the LAA would be minor. The effect would not be significant because the Project footprint comprises a small fraction of total diving bird habitat in the Salish

Sea. The Panel notes that although the Proponent concluded that diving birds would be the only subcomponent of coastal birds that would have a residual effect, the Proponent did not propose measures designed specifically to mitigate effects on diving birds. However, the Panel recognizes that the Construction and Operations Environmental Management Plans proposed to mitigate effects on coastal birds contain measures that could indirectly benefit diving birds. The Proponent's Offsetting Plan designed to address productivity loss due to changes in habitat quantity could also indirectly benefit diving birds. The Panel notes the concerns expressed by ECCC that these proposed mitigation measures may not be adequate. The Proponent has proposed a follow-up program to verify the prediction that the Project effect on diving birds would be minor and that the effect would not be significant.

The main effect of concern is the removal of diving bird subtidal foraging habitat through the placement of the proposed terminal. The earlier placement of the BC Ferries Tsawwassen Terminal and causeway, and the Deltaport and Westport Terminals and causeway would also have removed diving bird subtidal foraging habitat, and so the addition of the proposed terminal and widened causeway would be cumulative to already existing effects. Diving birds in the Fraser River estuary are not habitat-limited so the cumulative effect would not be significant.

The Panel concludes that the Project would result in a residual adverse effect and an adverse cumulative effect on diving birds. Since diving birds are not habitat-limited in the Project area the effects would not be significant.

15.3.2 Barn Owl

The Proponent anticipated that projected increases in vehicle traffic due to the Project would result in increased barn owl mortality rates due to vehicle collisions. In order to mitigate effects on barn owls, the Proponent committed to a wide-range of mitigation measures designed to reduce roadway collision mortality among barn owls, and to generally increase productivity. BSC advised the Panel that the LAA employed by the Proponent does not adequately capture the breeding and hunting range of barn owl in the lower Fraser Valley. In consequence, the assessment provided by the Proponent underestimated the extent of the Project effect on the barn owl population. BSC suggested the effect would be regional rather than local.

The Panel notes that ECCC advised that the mitigation measures were highly unlikely to reduce the collision mortality rate to zero. The Panel concludes that there would be a residual effect on barn owl, even after mitigation. The Project effect would be low in magnitude since the Project would directly affect only a small fraction of total roadway in the barn owl habitat; regional in extent since the Project would indirectly result in an increase in regional traffic; irreversible; and, permanent.

The Panel concludes that the Project effect would be significant because of the already depressed population of barn owl due to foraging habitat loss, reduced breeding opportunities, and road mortality. The Project has the potential to further exacerbate the factors that have led to a depressed population status. The Panel conclusion also relies on the barn owl's SARA status and concentrated presence in the LAA. The Panel notes that in addition to mitigation measures, the

Proponent has committed to a follow-up program to verify the effectiveness of mitigation measures and the predictions of the Project's negligible effect on barn owl population.

The Panel concludes that the Project would result in a residual adverse effect on the barn owl. The effect on the barn owl would not be significant if both the Panel's proposed recommendations and the Proponent's mitigation measures are applied.

The main effect of concern is direct mortality of barn owl from collision with vehicles (i.e., cars, trucks and trains) in the RAA. The Proponent predicted minor effects to the productive potential of the LAA to support barn owl. The Proponent further stated that Project-related mitigation measures developed to avoid collisions between barn owls and vehicles within its jurisdiction in the LAA would effectively minimise the risk to barn owl populations. Based on this assessment, the Proponent concluded that the Project is not expected to result in any adverse residual effects on coastal birds, including barn owl, due to vehicle collision. As a result, the Proponent declined to perform a cumulative effects assessment for coastal birds, including barn owl.

The Panel requested that the Proponent perform a cumulative effects assessment for coastal bird subcomponents, including barn owl. In making this request, the Panel stated that the Proponent had not adequately substantiated the conclusions that the Project would not have residual effects, since the relationship between the effectiveness of the mitigation measures and their capacity to reduce the effects was neither clearly nor systematically described. The Proponent did not perform the requested cumulative effects assessment.

The Panel concludes that the Project would result in a significant residual adverse effect on barn owl, and considers it necessary to undertake a qualitative cumulative effects assessment based on material available on the record.

The Panel notes that the EIS outlines current mortality to barn owl due to vehicle collision and that an increase in traffic along the Roberts Bank causeway would likely increase the number of avian mortalities. The Panel accepts the Proponent's assessment that, if the vehicle-bird collision rate remains unchanged when the Project is operating at design capacity, approximately 155 additional vehicle-related deaths of all listed bird species would occur annually. A fraction of this number would be barn owl.

The Panel notes that the projected future increases in the human population in the Lower Fraser Valley and general increases in urbanization would increase traffic volume and density in the RAA, thus increasing barn owl mortality due to vehicle collision. The noted increase in vehicle traffic from the Project would add to existing traffic. The effect would be high in magnitude because of the expected mortality rate in relation to the barn owl population; the effect would be regional in extent; continuous; long-term in duration; and possibly reversible.

The Panel concludes that increases in vehicle traffic due to the Project in combination with existing traffic and projected increases in human population and urbanization would result in a significant adverse cumulative effect on the barn owl population in the regional area.

15.3.3 Shorebirds

The Panel notes that the pathway linking Project effects on tidal current dynamics, coastal sediment deposition and erosion and near-shore salinity on Roberts Bank biofilm biomass and nutrient richness is a primary concern. These can affect both nutrient status of biofilm and population viability of Western sandpiper and Pacific dunlin. The Proponent predicted that, with mitigation, the Project would result in a negligible adverse effect on Western sandpiper and Pacific dunlin. This prediction was based on extensive field studies including three years of field work specifically designed to understand the influence of salinity on biofilm on Roberts Bank. It also relied on detailed hydrodynamic modelling designed to understand effects of the Project on coastal tides and currents, and salinity variability over tidal cycles.

ECCC advised the Panel that Project effects on biofilm would be immediate, irreversible and could not be mitigated. ECCC advised that changes in salinity regimes on Roberts Bank would present a high risk of reducing the quality and quantity of marine-type biofilm with high fatty acid content, an essential nutrient source for Western sandpiper and Pacific dunlin during their northward migration. ECCC predicted that these changes would have species-level consequences for sandpipers; meaning a substantial population decline difficult to predict.

The Panel notes that analysis of shorebird population calling at Roberts Bank in their northward migration by BSC indicates a long-term decline of the Western sandpiper population of 2 percent per annum. The Panel notes that the Western sandpiper population data provided by BSC shows a present population of 225,000 stopping at Roberts Bank. The Panel has analyzed these data, and concludes that the average linear population decline over the past decade is approximately 60,000 birds per year. This is much greater than the noted 2 percent per year. ECCC was unable to provide an explanation of the factors driving this apparent population decline as observed at Roberts Bank.

The Panel acknowledges that there is disagreement between the Proponent, ECCC and BSC on the proportion of the total Western sandpiper population that utilize Roberts Bank as a stopover in their northward migration. Western sandpipers can also utilize an inland migration route and an unknown fraction of the Western sandpiper population bypasses Roberts Bank during their annual migration.

Given the number of views on the record that Panel determines that the following information is of particular relevance:

- In Section 11 - Marine Vegetation, the Panel concludes that the Project would not have an adverse effect on biofilm productivity or on biofilm assemblage composition;
- The Panel was unable to conclude with any certainty that the Project would have an effect on biofilm fatty acid production as a food resource for migrating Western sandpipers;
- The Panel acknowledges that the ecology of biofilm and its importance in the Western sandpiper diet are relatively recent scientific findings. The newness of these observations, and the still-developing scientific understanding, such as the ‘salinity trigger’ hypothesis,

introduces considerable uncertainty for the Panel's consideration of the role of biofilm for Western sandpiper foraging at Roberts Bank;

- The Panel notes the recent steep decline of Western sandpipers calling at Roberts Bank during their northward migration. The protected status of the Western sandpiper under the Migratory Birds Convention Act, 1994 in the context of an apparent steep population decline mandates a highly precautionary approach in relation to the Project; and
- There exists considerable uncertainty around the possibility that loss of productive biofilm habitat could be mitigated by the large-scale re-creation of biofilm habitat capable of supporting shorebirds, including appropriate bottom sediment characteristics and salinity conditions.

Due to the uncertainty with respect to fatty acid production in biofilm, the Panel is unable to conclude with reasonable confidence that the Project would or would not have an adverse effect on the Western sandpiper.

15.3.4 Marine Birds

The distribution of sea ducks and other marine avifauna overlaps the marine shipping area. Possible effects pathways include interactions with vessel wakes, atmospheric noise, underwater noise, and collision with vessels in transit.

Participants raised concerns with the Proponent's assessment for marine birds in the marine shipping area. These concerns include effects related to collision and generalized disturbance of marine birds by shipping. The Panel accepts these concerns and recommends a follow-up program to monitor possible effects.

The Panel accepts the Proponent's assessment that there will be only negligible effects due to vessel wakes, atmospheric noise, and underwater noise. Neither mitigation measures nor follow-up programs are required.

The Panel agrees with the Proponent that bird collision rates with transiting vessels are difficult to assess because strikes are unreported. The Panel accepts the Proponent's assessment that effects on marine birds in the marine shipping area are likely not significant.

15.3.5 Birds Species with Listed Conservation Status

A number of additional avian species with listed conservation status present in the Project and in the marine shipping area have the potential to be affected by the Project and marine shipping associated with the Project. The Panel accepts the Proponent's assessment for species with listed conservation status and notes that ECCC supports this assessment.

Peregrine Falcon

The Proponent predicted negligible to minor effects on the productive potential of Peregrine falcon before mitigation. Based on the advice of ECCC, the Panel accepts the Proponent's

assessment for this species and that general mitigation measures designed for birds would contribute to offset the potential for minor adverse effects on their productive potential.

Great Blue Heron

The Proponent has predicted a negligible decrease in productive potential for Great blue heron, before mitigation and has proposed no direct species-specific mitigation measures.

The most significant Great blue heron colony in Canada is adjacent to the Project area. The Great blue heron is dependent on a complex food web for its main prey of forage fish and demersal fish. In Section 13 - Marine Fish and Fish Habitat, the Panel concludes that there would be no residual effect on demersal fish but a significant adverse effect on forage fish. It is possible that the proposed marine habitat offsetting could serve as an indirect mitigation measure that would be beneficial for the Great blue heron. However, it is not clear that these measures would adequately mitigate the full extent of potential adverse effects on Great blue heron. Given the importance of intertidal habitats for this species, ECCC recommended that the Great blue heron be explicitly incorporated in the Final Offsetting Framework.

Barn Swallow

The Proponent predicted negligible to minor effects on the productive potential of barn swallows before mitigation but did not propose species-specific mitigation measures.

Barn swallows are highly abundant in the Project area and vegetative structures such as hedgerows have been shown to increase their mortality. One consequence might be that hedgerows erected as mitigation for barn owl collisions would increase collision mortality for barn swallows. ECCC recommended that any mitigation measure proposed for the barn owl should be planned and implemented so as to reduce impact on the survival of barn swallows. ECCC suggested installing non-vegetative barriers, rather than vegetative barriers as a more effective mitigation measure for both the barn owl and the barn swallow. The Panel concludes that the ECCC recommendation is reasonable, and could be of benefit to both the barn owl and the barn swallow.

The Panel concludes the Project would result in a residual adverse effect on the Great blue heron and the barn swallow if the mitigation measures proposed by the Proponent and the Panel are not appropriately applied and fully effective.

Recommendation 35

The Panel recommends that the Proponent be required to, in consultation with Environment and Climate Change Canada, Bird Studies Canada and BC Ministry of Transportation and Infrastructure:

- *Design and install physical barriers in the Local Assessment Area to reduce road-associated mortality risk for barn owls. Further, the physical barriers should be designed to:*

- *not attract other avian species and therefore increase vehicle collision risk. This includes species with conservation status or protected under the Migratory Bird Conservation Act, 1994; and*
- *conserve suitable barn owl roadside grass verge hunting habitat where the road and the verge habitat are co-located; and*
- *Develop a barn owl conservation plan that includes:*
 - *the type(s) of physical barriers to be installed, locations, and maintenance requirements;*
 - *the number of nest boxes that would be installed and their locations in the Local and Regional Assessment Areas;*
 - *post-installation nest box effectiveness monitoring, to assess usage and productivity, for the first five years of operations; and*
 - *a system for annual reporting to assess mitigation effectiveness and any need for adaptive management measures.*

Recommendation 36

The Panel recommends that the Proponent be required to include as part of the offsetting framework objectives, solutions that focus specifically on the Great blue heron that would compensate any loss of productivity of foraging habitat in the intertidal zone of the Local Assessment Area that is used by the species.

Recommendation 37

The Panel recommends that the Proponent be required to include in its Wildlife Management Plan:

- *Any SARA-listed or COSEWIC designated bird species found in the Local Assessment Area, to verify the accuracy of the effects assessment and the effectiveness of mitigation measures. This should explicitly include the Great blue heron and the barn swallow; and*
- *Contingency or adaptive management measures in the event that monitoring results indicate the Project effect on diving birds to be greater than predicted.*

16 Current Use of Lands and Resources for Traditional Purposes

This section of the report evaluates, with respect to Indigenous peoples, the effects of the Project on the current use of lands and resources for traditional purposes (current use). The Panel notes that in its assessment of effects on current use the Proponent did not develop criteria to evaluate the significance of adverse environmental effects because residual effects were not predicted to occur. In circumstances where the Panel concluded the Project would have a residual effect on current use, the Panel uses the criteria recommended by the Agency's guidance document *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under CEAA 2012*, and establishes its own thresholds and measures for each criterion. The criteria and the Panel's definition of the measure or thresholds are defined in Appendix D: Current Use Criteria Tables. Using the information provided by Indigenous groups, the Panel evaluates whether there could be a pathway of effect between the Project and current use using the four indicators established by the Proponent as described below.

The Panel includes all Indigenous groups identified as being potentially affected in its assessment on current use. This includes those Indigenous groups that signed agreements with the Proponent. Appendix E: Indigenous Summaries presents additional information received by the Panel on Indigenous groups' traditional territories, population, harvesting, and cultural activities.

Confidential information provided to the Panel is reported at a high level to protect the Panel's confidentiality agreements with the Tsleil-Waututh Nation, the Pacheedaht First Nation, the Tsartlip First Nation, and the Pauquachin First Nation.

16.1 Project Area

16.1.1 Proponent's Assessment

The Proponent anticipated that the construction and operations of the Project would interact with marine areas and resources that are currently used for traditional purposes. The Proponent noted that Project interactions could also affect the quality of the current use experience in upland areas adjacent to Roberts Bank. The Proponent did not anticipate any effects on the current use of terrestrial or freshwater resources.

The Proponent defined both the LAA and the RAA as each Indigenous group's asserted or established traditional territory or other defined area of use. Recognizing that the assessment of effects on current use was informed by the likelihood of Project effects on biophysical resources, the Proponent used the LAAs for each relevant biophysical environmental component as the focal area for the effects assessment on current use. The Proponent stated that mitigation measures aimed at addressing the effects of the Project on biophysical environmental components were also evaluated to determine how effectively they would address effects on current use.

The Proponent identified four potential pathways of effects on current use: changes in access to preferred locations; changes in availability of preferred resources; changes in quality of preferred resources; and changes in quality of experience.

As requested in the EIS Guidelines, the Proponent assessed the following Indigenous groups in the Project area:

- Tsawwassen First Nation
- Musqueam Indian Band
- Semiahmoo First Nation
- Tsleil-Waututh Nation
- Stz'uminus First Nation
- Cowichan Tribes (Quamichan (Kwa'mutsun), Comiaken (Qw'umiyiqun), Koksilah (Xwulqw'selu), Somena (S'amuna"), Clemclemluts (Lhumlhumuluts"), Khenipsen (Xinupsum) and Cowichan Bay (Tl'lupalus))
- Halalt First Nation
- Lake Cowichan First Nation
- Lyackson First Nation
- Penelakut Tribe
- Métis Nation British Columbia
- Stó:lō Tribal Council (Seabird Island First Nation, Scowlitz First Nation, Soowahlie Band, Kwaw'Kwaw'Apilt First Nation, Kwantlen First Nation, Shxw'ow'hamel First Nation, Chawathil First Nation, Cheam Indian Band)
- Stó:lō Nation (Aitchelitz First Nation, Leq'a:mel First Nation, Matsqui First Nation, Popkum First Nation, Skawahlook First Nation, Skowkale First Nation, Shxwha:y Village, Squiala First Nation, Sumas First Nation, Tzeachten First Nation, Yakwekwioose Band)
- Hwlitsum First Nation
- W̱SÁNEĆ First Nations (Tsawout First Nation, Pauquachin First Nation, Tsartlip First Nation, Tseycum First Nation, Malahat First Nation)

Changes in Access to Preferred Current Use Locations

The Proponent concluded that there would be no effect on access to preferred locations for the current use of marine vegetation, marine mammals, or coastal birds given there was no current use of those resources in the immediate area of the Project footprint. The Proponent did not expect that the Project would affect Tsawwassen's ability to harvest migratory birds within their Migratory Bird Harvesting Area based on their understanding of the locations used by Tsawwassen for bird harvesting. The Proponent stated that the Project would require the no-shoot zone to be extended along the causeway.

The Proponent stated that Canoe Passage and the Fraser River appeared to be the preferred areas for fishing by Indigenous groups and the potential Project effects would not extend to those areas. As a result of continued access to Canoe Passage and the Fraser River by Indigenous groups, the Proponent concluded that the Project would not result in adverse effects on the current use of marine fish.

The Proponent concluded that Project construction and operations would not result in an adverse effect on access to the foreshore fronting the Tsawwassen community for the purposes of bivalve shellfish harvesting or other traditional activities.

The Proponent identified Tsawwassen and Musqueam as the primary harvesters of crab in the Project area. The Proponent stated that the expansion of the existing navigational closure area would only apply to commercial harvesters, as discussed in Section 20.4 - Marine Commercial Use. Indigenous harvesters would have exclusive access within the closure's boundaries for food, social and ceremonial (FSC) purposes. The Proponent stated that Indigenous domestic and FSC harvest would benefit from this exclusive access for crab harvesting.

The Proponent noted that the full extent of Project-related displacement effects on the current use of preferred locations by Indigenous groups was difficult to measure in quantitative terms. Nonetheless, the Proponent concluded that access to preferred domestic or FSC crab harvesting locations by Tsawwassen and Musqueam would be subject to a potential adverse effect during Project construction and operations due to their high level of use of the area.

To mitigate effects on current use, the Proponent proposed the following:

- To abide by the Memorandum of Agreement in place with the Tsawwassen First Nation;
- To negotiate a Memorandum of Agreement with the Musqueam Indian Band;
- To consult with Indigenous groups and Fisheries and Oceans Canada on the terms of licensing for the use of the navigational closure area for domestic or FSC crab harvesting;
- To implement the mitigation measures proposed for marine commercial use, outdoor recreation and land and water use; and
- To develop and implement an Indigenous Advisory Committee as a communications mechanism to support dialogue and issue resolution.

With the application of mitigation measures, effects on Tsawwassen and Musqueam would be negligible. The Proponent stated that the evidence suggested considerably lower levels of current use by other groups in areas. As a result, the Proponent concluded effects on access to preferred locations for current use by other Indigenous groups occupying the area would also be negligible.

The Proponent committed to developing various construction and operational management plans in consultation with Indigenous groups. The Proponent also made a commitment to implement an Indigenous Monitors Plan that would outline the approach for incorporating Indigenous monitors into the monitoring framework for the Project's biophysical components.

The Proponent stated that the proposed mitigation measures would effectively address Project-related effects on access to preferred locations for the current use of lands and resources for traditional purposes.

Changes in Availability of Preferred Current Use Resources

The Proponent predicted that the Project would not affect the availability of preferred marine resources, including marine vegetation, marine mammals, marine fish, marine invertebrates, and coastal birds. In addition, the Proponent noted that Indigenous groups did not appear to harvest marine resources, other than crab, in the Project area. The Proponent predicted a non-significant adverse effect on the population of Dungeness crab. However, the proposed mitigation measures would address Project-related effects on the availability of crab as a preferred current use resource.

Changes in Quality of Preferred Current Use Resources

The Proponent stated that the Project would not affect the quality of preferred resources for any Indigenous group using the Project area during construction or operations. In its Human Health Risk Assessment, the Proponent concluded there would be no contamination of marine resources although there was the potential for Indigenous groups to perceive contamination of preferred resources. The Proponent noted that measures identified to mitigate the potential effects on access to preferred resources, as well as measures proposed in its Human Health Risk Assessment would serve to alleviate concerns regarding perceived contamination.

The Proponent stated that while productivity increases in some traditionally used species were expected, ongoing concerns with the quality of the resource may result in avoidance by Indigenous groups.

Changes in Quality of Current Use Experience

The Proponent identified the following indirect or intangible changes that could affect the quality of the experience for Indigenous groups: changed sense of place; risks to safety and security; sensory disturbance from light, noise and vibration; air emissions; and reduced opportunities to transmit Indigenous traditional knowledge. This information was further used by the Proponent to assess effects on cultural heritage in [Section 17 - Physical and Cultural Heritage Resources](#) for Indigenous people by reviewing whether important cultural purposes associated with current use remained reasonably achievable.

The Proponent stated that the existing Roberts Bank terminals had previously modified the visual landscape. The Proponent concluded that the changes to the environment that could affect the quality of experience were negligible. However, the Proponent acknowledged that the Project could affect the quality of experience for one or more Indigenous groups because the current use experience was community-specific. The Proponent identified its proposed communication protocol as mitigation to address community-specific concerns.

Overall, the Proponent concluded that there would be Project-related effects on the current use of lands and resources for traditional purposes for Tsawwassen and Musqueam. With the implementation of measures designed to mitigate specific biophysical environmental components, as well as those designed specifically for current use, the Proponent concluded

there would be no residual adverse effect on current use and that the Project would not contribute to existing cumulative effects on current use.

In addition to developing communication protocols prior to the start of construction and operations, the Proponent would develop a follow-up program on effects prediction and mitigation effectiveness for current use and intangible cultural heritage. The Proponent stated that the follow-up program would include collaboration with a Follow-up Advisory Committee, an Indigenous Advisory Committee, individual Indigenous groups and applicable regulatory and permitting agencies, such as DFO and Transport Canada. The Proponent noted that this program would determine the approach to continued dialogue between the Port Authority and Indigenous groups during construction and operations.

The Proponent advised the Panel that it had negotiated mutual benefit agreements with a number of Indigenous groups that would provide meaningful and tangible benefits to the signatory communities. The Proponent further noted that it did not rely on those agreements in making its conclusion of no residual effects on current use. The Proponent also stated that the following Indigenous groups provided letters of support and consent for the Project:

- Tseycum First Nation
- Lake Cowichan First Nation
- Tsartlip First Nation
- Lyackson First Nation
- Métis Nation British Columbia
- Cowichan Tribes
- Stz'uminus First Nation
- Halalt First Nation
- Malahat Nation

16.1.2 Views of Participants

Tsawwassen First Nation

Tsawwassen indicated that the area around the Project was particularly important for harvesting activities. Tsawwassen members spoke of how their foreshore had traditionally supported an abundant range of natural resources and they would harvest clams and other shellfish where Deltaport is currently situated. Tsawwassen stated that harvesting activities built their community and supported camaraderie. Tsawwassen noted that despite diminishment of some species, fish and other marine resources continued to provide for cultural and social processes that were very important to Tsawwassen identity and were integral to the past and future of the Nation.

Tsawwassen members spoke extensively of their concerns regarding the existing state of their traditional territory and how the Project was likely to add to the effects that already made it challenging for Tsawwassen members to maintain their way of life. Tsawwassen members provided evidence describing how their traditional resources were in decline. Members indicated

they could no longer walk along their foreshore or gather marine resources for communal activities due to a “black sludge”. Tsawwassen stated that the ability to play in the ‘front yard’ of the Nation had been taken from their youth and future generations.

Tsawwassen stated that the mitigation measures proposed by the Proponent were insufficient to address the adverse effects on current use and the associated lands and resources. Tsawwassen stated that some of the critical mitigation measures proposed were lacking detailed information, making it difficult for the Panel to determine whether effects could be mitigated.

Access to Preferred Current Use Locations

Crab Fishery

Tsawwassen reported that the Project area was of high importance for the Tsawwassen’s FSC crab fishery. Tsawwassen noted that the decline of the Fraser River salmon over the years had forced them to increase their crab harvesting. Tsawwassen stated that reduced availability of, and access to crab, as a result of the Project footprint would have serious impacts on the Nation.

Tsawwassen commissioned an independent crab study which concluded that exclusive Indigenous harvesting in the navigational closure area would not adequately offset the loss in FSC fishing opportunity and catch. A key concern was that the terminal footprint would cause the loss of high-quality crab habitat, while much of the expanded navigational closure area was located in deep water that was inaccessible to Tsawwassen fishermen due to gear limitations. The study concluded that 73 percent of the proposed navigational closure area was either too deep or too shallow for crab harvesting.

Tsawwassen also raised concerns with respect to the ban to use floats within the navigational closure area by Transport Canada. DFO requires that all harvesters attach floats to their crab traps. In order to use the area, fishers had to place floats outside of the navigational closure area with traps on the seabed within the closure area. At the hearing, Tsawwassen identified concerns with this practice, including the tangling of lines and challenges in abiding by the regulations; concerns that would be exacerbated with an increase in the size of the navigational closure area. Tsawwassen noted that their members had faced loss or theft of traps when floats were used.

Tsawwassen noted that the proposed mitigation measure allowing Indigenous harvesting in the navigational closure area was not supported by adequate information to demonstrate how they would benefit. They also noted that the issues surrounding harvesting in the navigational closure area could put Tsawwassen members in physical danger or at risk of harvesting contrary to the regulations.

The Proponent noted that they were unaware of the extent of the concerns prior to the Panel’s hearing and committed to specific consultations with Tsawwassen, Musqueam, and DFO.

Tsawwassen recommended that the Panel conclude that the Project was likely to have significant adverse effects on crab and on the ability of Tsawwassen to harvest crab. Tsawwassen also recommended that the Proponent and Canada design measures to address Tsawwassen’s

concerns with the navigational closure area and to work with Tsawwassen in developing a process for monitoring effects on crab and crab harvesting.

Tsawwassen recommended that the Proponent and Canada, particularly DFO:

- Design measures to address Tsawwassen's concerns with the navigational closure area, prior to the federal decision on the Project;
- Confirm Tsawwassen's consent to the measures developed to address crabbing-related concerns to be issued before the granting of any *Fisheries Act* authorizations for the Project; and
- Develop, with Tsawwassen, a process for monitoring effects on crab and crab harvesting and to require concrete mitigation and adaptive management responses to Project effects identified in Tsawwassen's crab study.

Fishing

Tsawwassen referred to themselves as "salmon people" which reflects the critical importance of salmon as a staple food for the Nation. Sockeye and Chinook salmon were identified as the species most harvested by Tsawwassen, generally in Canoe Passage. Tsawwassen was concerned that there was not enough information about the effects of the Project on all species significant to Tsawwassen's culture, especially eulachon and sturgeon.

Tsawwassen was concerned that the Project would affect their ability to fish, stating that any additional adverse effect, even if small, should be considered significant. Tsawwassen noted that they relied on each fish species for different FSC activities and that this nuance was not appropriately considered in the Proponent's assessment.

Tsawwassen described how access to sockeye salmon was in decline due to the reduced availability of Fraser River sockeye and that salmon fishing was changing from an annual tradition to a practice they could only participate occasionally. Tsawwassen stated that they had difficulty filling their allocation of sockeye and Chinook salmon, and that eulachon no longer met their needs. Eulachon was now reserved for elders who traditionally relied on this species. Tsawwassen indicated that they had been unable to harvest sturgeon for some time.

Tsawwassen stated that sedimentation of the Fraser River, especially at Canoe Passage, would reduce their ability to fish. Tsawwassen noted that the creation of rock walls and jetties and dredging activities had pushed sediment into Canoe Passage and had closed it up. Tsawwassen also noted that their members were once able to harvest eulachon in Canoe Passage, but they were no longer able to engage in this traditional activity. Tsawwassen stated that the Project would add to the adverse effects that were already occurring and that their concerns related to geomorphology and sedimentation had yet to be addressed in a satisfactory manner.

Hunting

Tsawwassen reported that areas available to harvest migratory birds in the Fraser River Delta, Roberts Bank, and Boundary Bay had been reduced due to a series of hunting closures and

firearms restrictions imposed by municipalities and provincial and federal governments. Tsawwassen noted that if the Project resulted in more restrictions on firearm use on Tsawwassen Lands, the result would be fewer opportunities for their members to harvest migratory birds. Tsawwassen also noted that the effects of the Project within the Tsawwassen Migratory Bird Harvest Area had to be adequately addressed.

Plant harvesting

Members of Tsawwassen described how invasive plant species displaced plants traditionally used for medicine and other purposes. A Tsawwassen elder described how blackberries had taken over thimbleberries and huckleberries. Tsawwassen was concerned about further introduction of terrestrial invasive species to Tsawwassen Lands by truck and rail and of marine invasive species to the ocean by ships. Tsawwassen stated that measures such as monitoring, reporting, adaptive management and eradication should be put in place to address invasive species. Tsawwassen recommended that the Proponent develop a Marine and Terrestrial Invasive Species Management Plan.

Quality of Current Use Experience

Tsawwassen noted that the Project had the potential to affect their ability to enjoy the lands, waters, and traditional practices within their territory that are central to their culture. Tsawwassen stated that noise pollution could affect their ability to enjoy their experiences out on the water. In Tsawwassen's view, even small additions to noise would be incremental to an already significant adverse effect.

Tsawwassen also indicated that concerns for safety on the water would make it difficult for members to teach their youth Tsawwassen culture out on the water. Tsawwassen stated "the Project will have an immediate effect on Tsawwassen's ability to transmit knowledge across generations."

Tsawwassen members spoke of the importance of the foreshore for current use and recommended that the damaged foreshore be rejuvenated, instead of enhancing new areas to offset the Project's effects.

Cumulative Effects Assessment

Tsawwassen indicated that existing development has already disrupted their lands and culture. Tsawwassen indicated that after decades of unrestrained development within and around their Territory, the foreshore, rivers, landscape and plants and wildlife had been irreparably altered. Tsawwassen noted that their members lived within the centre of multiple large-scale works, including BC Ferries Tsawwassen Terminal, highways and the Roberts Bank terminals. Tsawwassen indicated that the Project effects on Tsawwassen are particularly grave given that the marine area has taken on increased significance over the last century in light of the heavy development of the terrestrial portion of Tsawwassen territory.

Tsawwassen expressed support and advocated for a cumulative effects assessment conducted on a regional basis for the entire Fraser River Lowland, not only to describe the environmental state of the present situation, but also to guide management decisions to ensure the sustainability of environmental components of crucial importance to them.

In addition, Tsawwassen stated that there was a need for the Proponent to develop a cumulative effects monitoring and mitigation plan for the life of the Project that would include the following:

- A list of Tsawwassen-supplied environmental components including components such as cultural identity and language;
- An identification of monitoring parameters;
- A specification of the role of the Tsawwassen;
- An identification of required funding and adaptive management strategies; and
- An identification of thresholds for triggering adaptive management or mitigation strategies, including evaluation and possible implementation of project-specific mitigation to halt an adverse trend.

Musqueam First Nation

Musqueam stated that they had witnessed a severe decrease in natural resources within their territory, a decrease in the overall quality of those resources and a decrease in access to the harvestable resources that did remain. Musqueam stated that their members had been alienated from the use of most of their traditional territory, with only portions of the Fraser River estuary and the Salish Sea remaining, in diminished capacity, as locations where harvesting practices could be meaningfully exercised.

The Musqueam Knowledge and Use Study of the Roberts Bank Terminal 2 Project (the Musqueam Study) showed that Musqueam members use or have used the Project footprint for a range of rights-based activities, including fishing, collecting shellfish, hunting and harvesting plants. The Musqueam Study also described how Project effects would occur in a context of existing, long-term, multi-source, and large-scale adverse impacts on Musqueam territory, rights, and interests. The Musqueam Study indicated that the additional Project interactions had a high potential to further constrain Musqueam activities in the LAA and the RAA over multiple generations.

Access to Preferred Current Locations

Fishing

Musqueam identified fishing as “an essential activity and supply line that feeds the Musqueam community physically, spiritually, and mentally.” The Musqueam Study referenced many participants who communicated the importance of fishing in the ocean and the Fraser River. Sharing the catch was also described as a common practice, especially the supply of fish and crabs to elders, which helped to build social ties among Musqueam members.

Musqueam identified salmon, steelhead, sturgeon, eulachon and other fish as particularly important for Musqueam people but noted that many key fish species had declined markedly in the region due to industrialization and urbanization. Musqueam noted that they fished in the Project area for all species of salmon. Sturgeon and eulachon especially were noted by Musqueam as “highly limited” yet still vital to Musqueam culture.

Many Musqueam members voiced concern that the sound and movement from shipping would scare fish away and disrupt this key part of salmon migration, with potential effects occurring further upriver in areas that are heavily used by Musqueam fishers. Musqueam members communicated that shipping associated with the Project would also directly affect fish and crab resources, leading to a decline in the abundance of wild seafood available to them.

Musqueam stated that regulations, sometimes self-imposed, aimed at conserving some species limited their ability to harvest fish. Musqueam noted that the shortening of openings for salmon was a serious regulatory restriction experienced by their fishers. Musqueam participants discussed how the increasingly shorter windows for fishing restricted the amount of fish they could obtain. One participant also noted how the allowable catch had not kept pace with the needs of the community. In addition, the restrictions reduced the time available to transmit traditional fishing knowledge. Musqueam fishers stated that institutional restrictions on time, space, and gear have alienated the Musqueam from their traditional fishing practices and put pressure on their cultural continuity.

Musqueam raised concern that vessel traffic posed a hindrance to safe and effective fishing in the Salish Sea. Musqueam members noted that disruption of fishing was common due to the need to pick up their nets and evade oncoming traffic. Musqueam noted that encounters with larger ships such as tugboats, dredgers, and freighters resulted in persistent safety concerns, causing them to favour locations such as Canoe Passage. A few Musqueam members reported being exposed to hazards from the wakes of large shipping vessels, and being at risk of being run over when in the path of larger ships. Musqueam fishers also recounted having lost their catch and gear to large ships or having had close encounters that threatened their personal safety.

Musqueam recommended the Proponent develop a marine shipping follow-up program that would monitor interactions between Musqueam fishing vessels and other traffic and contain mitigation strategies to minimize interactions.

Crab Harvesting

Musqueam noted that crabbing was a major fishery for many Musqueam members in the Project area and that the Project would cause a loss of access to a preferred crab harvesting area. A Musqueam member stated that the Project area was not that of big an area for harvesting crab at present and any additional development that would reduce the area would have negative effects.

Musqueam also raised concern with respect to their inability to use floats within the navigational closure area. In order to use the area, fishers place floats outside of the closure area with traps on the seabed within the closure area. Musqueam stated that allowing FSC fishers to harvest in the

navigational closure area without floats, currently a DFO licensing requirement, would alleviate their concerns regarding the navigational closure area. Musqueam recommended that the Proponent be required to secure written commitment from DFO that for the duration of the Project, Musqueam crab harvesters be able to “engage in unrestricted FSC crab harvesting within the navigational exclusion zone without having to attach floats to their crab traps.” In response to Musqueam’s concerns, the Proponent committed to specific consultations with Musqueam, Tsawwassen and DFO to address the concerns.

Coastal Harvesting

Musqueam noted that while harvesting shellfish and plants in the coastal zone was an important traditional activity, more recent generations of Musqueam have not had the benefit of harvesting shellfish close to home. Musqueam members articulated a desire to learn about this aspect of their culture and to collect shellfish if the opportunity was available. Musqueam also noted that their namesake plant, *məθkʷəy*, could no longer be found on the Musqueam Indian Reserve, symbolizing the poor state of foreshore plant resources available to the community.

Hunting

Musqueam noted that their hunting in the LAA primarily targeted waterfowl, including many different species of duck, geese and pheasants. Musqueam stated that hunting waterfowl occurred by boat and on land and provided an important supply of food for members. Musqueam raised concerns about the Project’s effect on waterfowl and the subsequent access and availability of waterfowl for Musqueam hunting. Musqueam also raised a number of issues regarding the current state of the resources available for them to hunt. Musqueam members reported that waterfowl populations had experienced precipitous drops, especially saltwater varieties. They stated that a loss of waterfowl habitat, in part as a result of the Westshore Terminals and proliferation of log booms, was to blame for the decline in waterfowl populations. Musqueam also noted that hunting activities in their territory had been severely affected by access restrictions and regulations concerning the use of firearms as a result of residential and industrial developments.

Quality of Current Use Experience

Musqueam underlined how the Project would contribute to increased alienation from harvesting fish, coastal plant, shellfish and, hunting resources due to the additional industrialization and settlement in their traditional territory. This disruption would affect the historical, social and cultural values associated with the harvesting activities. Musqueam stated that the Project would result in lost opportunities for the transmission of traditional knowledge and practices.

Cumulative Effects Assessment

Musqueam clearly described how their access to and use of Roberts Bank was already heavily impacted and constrained by existing port development. Industrialization, residential development and settlement, pollution, and other drivers of change were all identified by the Musqueam affecting their ability to harvest and hunt.

The Musqueam Study concluded that due to historical alienation from previous industrial development in Musqueam territory, the additional interactions from the Project would likely further constrain Musqueam harvesting practiced in the area over multiple generations.

Musqueam raised concerns that the Proponent did not undertake a cumulative effects assessment of Musqueam current use since in their view there was “irrefutable evidence” that the Project would have residual effects.

Semiahmoo First Nation

The Semiahmoo First Nation (Semiahmoo) described the abundance of resources that previously existed in their territory noting that historic village sites at Point Roberts and Cannery Point were the traditional harvesting locations for shellfish, finfish, and various other traditional foods of the Semiahmoo people.

Chief Chappell stated that “we’re always told by our ancestors and by our elders that when that tide goes out the table’s set. That’s our abundance.” However, Chief Chappell explained that Semiahmoo members had been “off the beach” for two generations. In Chief Chappell’s view, Semiahmoo was losing its culture and identity as a result of urbanization, small population size, and a loss of ability to practice culture and harvest within their traditional territory. Semiahmoo noted that they could no longer harvest birds due to urbanization, clams due to contamination, or fish as many of their traditional fishing sites are now situated in international [American] waters.

Semiahmoo expressed concern that the projected increase in truck and rail traffic associated with the Project would significantly impact Semiahmoo and the surrounding communities.

Semiahmoo noted that the Project would add to the volume of rail traffic through their territory, which was already, in their view, at an unacceptable level. Semiahmoo indicated that the increased rail traffic has resulted in increased risks to pedestrian and community safety.

Semiahmoo noted that Boundary Bay and Semiahmoo Bay had not been included in any cumulative effects studies to date as they were enclosed by American waters. Semiahmoo also expressed their view that the sedimentation, contamination, comes around the ‘tip’ of Roberts Bank and into Semiahmoo Bay.

Tsleil-Waututh Nation

Tsleil-Waututh Nation (Tsleil-Waututh) noted that the Fraser River estuary had been extremely important for their food and cultural use since time immemorial, but that it was heavily threatened by industrialization, pollution, habitat destruction and climate change effects which in turn had ecological and cultural consequences.

Tsleil-Waututh indicated that their fisheries in and around the Lower Fraser River were their primary source of traditional marine food. Tsleil-Waututh stated that they viewed the effects of the Project as “the straw that broke the camel’s back” effect that could sever their Nation from the most important remaining source of traditional marine food: sockeye salmon. Tsleil-Waututh

was concerned that “displacement”, meaning fishing elsewhere, could be considered a mitigation measure.

Tsleil-Waututh noted that fishing licenses at the mouth of the Fraser River provided much of the Nation’s FSC crab. Tsleil-Waututh stated that they held commercial communal crab licenses near the Project area that supported their FSC fishery. They clarified that neither communal commercial crab nor FSC crab were fished within the navigational closure area. The Nation noted that they were seldom able to achieve their allocation of salmon for the FSC fishery. Tsleil-Waututh stated that the Project would result in the “loss of one of the most productive crab fishing areas with the highest returns”, in turn causing increased competition. Tsleil-Waututh noted that this loss would make it harder for their community members, including youth, to aspire to cultural fishing practices.

Tsleil-Waututh stated that the use of proxy species by the Proponent in its fish assessment did not allow an adequate reflection of the potential effects of the Project on their current and future use of the area. Tsleil-Waututh also noted that the Proponent did not ensure it had the best possible information when making their conclusions and Tsleil-Waututh disagreed that the effects on current use would be negligible.

Cowichan Nation Alliance (Cowichan Tribes, Halalt First Nation, Stz’uminus First Nation)

Cowichan Nation Alliance identified fishing as an important traditional activity, noting “fishing and harvesting are also critical avenues through which we educate younger generation about our culture and way of life.” The Cowichan Nation Alliance noted that due to poor returns, they had been unable to harvest any salmon for FSC purposes between 2015 and 2017. The Cowichan Nation Alliance stated that the onus should not be on community fishermen to move out of the way of shipping traffic when they only have a short opening in the summer months to provide fish for their communities.

Cowichan Nation Alliance stated that they strongly disagreed with the Proponent’s assessment that potential effects on current use would be negligible. Cowichan Nation Alliance stated that an aboriginal communal fishing licence was held in the Project area for multiple fisheries including crab, salmon, and herring. Elder Ray Harris of Stz’uminus First Nation highlighted the importance of fishing locations beyond just the harvesting of resources: “those places we fished were not places to fish, but they were places for us to teach our sons and our grandsons the way of our people”. Elder Harris also noted that the location of the existing Roberts Bank terminals was an area where his family taught him to fish. Elder Harris noted that the cumulative impacts of industry had already pushed them out of some of their fishing area.

Lake Cowichan First Nation

Lake Cowichan First Nation described how much of their traditional fishing, hunting, and harvesting in the Salish Sea was carried out from Sturgeon Bank to Roberts Bank and the approaches to the Fraser River. Lake Cowichan First Nation noted that their traditional activities

had been curtailed or adversely affected by the development that had taken place in the Lower Mainland.

Lyackson First Nation

Lyackson First Nation (Lyackson) described the importance of fishing to their community, and noted that they traditionally travelled to the mainland to fish for salmon on the Fraser River and at Point Roberts. They noted that due to poor returns they did not receive any FSC allocation of Fraser River sockeye or chinook for three years, between 2015 and 2017. Lyackson raised concern that the Project would further limit their ability to access Fraser River salmon for FSC purposes because their fishers would have difficulty accessing the area due to the Project-related vessels.

Lyackson noted that they have traditional harvesting areas near Tsawwassen and that they faced serious inconveniences when they had to move to accommodate larger shipping vessels. Lyackson noted that this could “reduce our ability to get our food fish as we have to pull our nets and move away from ideal fishing spots, sometimes numerous times during a fishing event”.

Lyackson stated that they disagreed with the Proponent’s conclusions that the effects on their current use would not be measurable. Lyackson also noted a concern that no cumulative effects assessment was conducted for current use. They stated this was unacceptable given the magnitude of the cumulative effects already being felt.

Penelakut Tribe

Penelakut Tribe stated that historically they regularly engaged in traditional activities such as fishing, plant harvesting, trapping, and hunting in the Roberts Bank, Fraser Delta, and Fraser River areas. Penelakut Tribe raised concerns that the Project would have adverse effects on its FSC fishery in the Roberts Bank area.

The Penelakut Tribe described the Roberts Bank area as “one of the most productive, non-contaminated, crab fishing areas remaining within Penelakut territory”. Penelakut Tribe was of the view that the Project would displace them from this important crab fishing area, both during construction and operations. In addition, the Penelakut Tribe stated that vessel traffic associated with construction and operations of the terminal would increase navigational conflicts for the Penelakut Tribe members engaged in marine harvesting and fishing at Roberts Bank. The Project would also increase navigational conflicts for members travelling across the Salish Sea to marine harvesting sites at Roberts Bank.

The Penelakut Tribe noted that the Proponent “sought to characterize the potential impacts to Penelakut’s crab fishery as minimal, compared to the Musqueam and the Tsawwassen.” Members indicated however that the effects of the reduced crabbing area would be significant on Penelakut, as a result of cumulative effects on access to marine resources and habitat in Penelakut Territory.

Penelakut Tribe concluded that the proposed navigational closure area would not be effective to mitigate the loss of crab harvesting area. Penelakut Tribe also noted that the implementation of communication protocols, did not mitigate the reduction in available crab fishing area. Penelakut Tribe concluded that there would be an effect on their ability to harvest which should be addressed through accommodation.

Penelakut Tribe noted that an important part of their traditional culture was the hunting of marine birds to create ‘duck soup’. Penelakut Tribe noted that the Roberts Bank area was one of the areas where marine birds were harvested, from November through March. Penelakut members harvest migratory birds, primarily mallards in fresh water and “Black tux” and geese in estuarine waters. Penelakut Tribe stated that their members hunt duck primarily by boat, and primarily in the Canoe Passage area.

The Penelakut Tribe raised concerns that the cumulative effects of the Project on current use were not assessed. They noted that as a result of cumulative impacts throughout the Penelakut Tribe’s core marine territory, the effects of the Project on the Penelakut Tribe would amplify beyond the conclusions reflected in the EIS.

Métis Nation British Columbia

The Métis Nation British Columbia (Métis Nation) participated in the environmental assessment on behalf of their communities.

The Métis Nation identified use clustered along the shores of the Fraser River, Roberts Bank, Boundary Bay, Delta, and on and around the Gulf Islands (Galiano, Mayne, Saturna, Valdes, Pender, and Saltspring). The Métis Nation stated that they actively engaged in land- and marine-based activities, including harvesting of food, as they believed it was important to harvest their own food for health reasons.

According to Métis Nation, several harvest sites intersected directly with the Project area. These sites included salmon, crab, and oyster harvest sites, as well as firewood sites. In the nearby surrounding area, Métis Nation harvesters also documented bird kill sites. The Métis Nation noted that they harvested aquatic species and birds heavily at the Project area. Crab and ducks were identified as the predominant species.

Stó:lō Tribal Council and Stó:lō Nation

The Stó:lō Tribal Council and Stó:lō Nation asked the Proponent, during the preparation of the EIS, to be represented by the Tsawwassen and the Tsleil-Waututh. In July 2017 the Panel wrote to groups represented under the umbrella of Stó:lō Tribal Council and Stó:lō Nation requesting that they provide any additional information on the potential environmental effects of the Project or marine shipping associated with the Project. The Panel only received a reply from the Seabird Island Band stating that they wanted to “defer this project”, although this referral was within Seabird Island Band’s asserted traditional territory. Therefore, the Panel did not assess potential effects on the Indigenous groups represented under the umbrella of the Stó:lō Tribal Council and Stó:lō Nation, since it received no further information before the close of the record.

Hwlitsum First Nation

The Hwlitsum First Nation identified Canoe Passage as an especially important site within the Fraser River estuary, both traditionally and for current use. Hwlitsum First Nation described how Roberts Bank and Canoe Passage had been changed by industrialization. They noted that aquatic, intertidal and terrestrial habitats were lost and the flow of the river was changed.

The Hwlitsum First Nation was concerned that the Project would further influence the flow regime in Canoe Passage. Chief Jim Hornbrook stated the whole main channel of Canoe Passage used to be navigable, but now it shifts because of sedimentation and the tidal flow. Chief Hornbrook stated that the Hwlitsum First Nation's biggest concern was the disappearance of critical fish habitat, river foreshore, and marshlands that had been lost to the industrialization of the Fraser River ecosystem. He noted that the area's many sloughs and deeper pockets of water had been overwhelmed by sediment, so much so that sacred fishing spots and holes were no longer viable. Chief Hornbrook noted that the effects of the sedimentation had allowed invasive species to take over some areas, having a direct and harmful effect on traditional and native plant species.

WSÁNEĆ First Nations

The Tsartlip First Nation, Pauquachin First Nation, Tsawout First Nation, and Tseycum First Nation provided information to the Panel as the WSÁNEĆ Nations. In their traditional use study, the Nations identified harvesting locations, place names, habitation sites, and other culturally significant areas within the study area. This included fishing sites and travel routes near the Project area and at the mouth of the Fraser River. They did not provide information about current use of the Project area but provided information about their use of the marine shipping area.

Malahat First Nation

The Malahat First Nation noted that they harvest crab and seafood directly from the Project site. They stated that effects on their commercial crab harvesting, described in [Section 20.4 - Marine Commercial Use](#), would affect their FSC harvesting. Malahat First Nation noted that the distinction between commercial and FSC fishing was imposed and not representative of their traditional harvesting practices. They stated that the potential effects on their commercial crab license did not exist in isolation and could have negative implications for the intergenerational transmission of knowledge and connections to place.

16.1.3 Panel's Analysis

The Panel agrees with the Proponent that there would be no added effect from the Project on the quality of preferred current use resources. As concluded in [Section 21 - Human Health](#), the Panel does not anticipate that the resuspension of sediments during construction would contaminate marine resources. Additionally, as discussed in the [Section 8.3 - Marine Water Quality](#) the Panel is of the view that Project effects on total suspended solids are negligible.

The Fraser River and Canoe Passage were highlighted as important harvesting locations for several Indigenous groups. The Panel does not expect the Project to influence the flow regime of Canoe Passage or result in any sedimentation affecting access to Canoe Passage. The Panel notes that sedimentation is a result of strong tidal currents and input of new upstream-origin sedimentary material deposited by the Fraser River spring freshets, which is discussed in Section 8.2 - Surficial Geology and Marine Sediment.

The Panel examined quality of experience through the loss of sense of place and disruption of access to harvesting activities or transmission of knowledge. Other elements that may affect quality of experience include potential increases in sensory disturbances from noise, degradation of air quality, and perceived contamination of crab. These elements are discussed in Section 21 - Human Health and the findings within are used to support the Panel's conclusion on the quality of experience. In addition, the Panel concludes that there would be no exceedance in noise and light in Canoe Passage therefore the Project would not result in sensory disturbances on Indigenous groups harvesting at Canoe Passage.

Tsawwassen First Nation

The Panel heard that the main species of concern for Tsawwassen are salmon, crab, eulachon and sturgeon. The Panel also heard that Tsawwassen was concerned about their ability to continue harvesting migratory birds in the LAA. The Panel realizes that traditional resources remain a key part of Tsawwassen's identity and continue to be an important part of their culture.

Change of Access to Preferred Current Use Locations

The Panel is aware that the Project footprint overlaps with Tsawwassen's traditional territory and includes an important and heavily-used crab harvesting site. The new terminal will permanently eliminate a substantial portion of crab habitat used by Tsawwassen as a crab harvesting area. The Panel recognizes that Tsawwassen disagree with the Proponent's proposal to expand the navigational closure area, which in turn would be an exclusive area for Indigenous harvesters. The Panel agrees with Tsawwassen that expanding the navigational closure area does not adequately offset the loss in FSC crab opportunity and catch since more high-quality harvesting area would be lost than gained. The Panel understands that Indigenous groups are challenged to comply with the regulatory requirements to harvest with floats while respecting the navigational closure area. The Panel further notes that ships approaching and leaving the berth would continuously interrupt Tsawwassen harvesting activities.

The permanent loss of an important crab harvesting area, combined with the challenges faced by Tsawwassen to harvest in the navigational closure area would likely substantially alter access to preferred harvesting locations. The Panel is of the view that the Proponent's proposed Indigenous Advisory Committee and consultation would not serve to mitigate the effects of the Project on Tsawwassen's ability to harvest crab resulting in irreversible effects that would last the duration of the Project. Further, the Panel does not consider communication plans, sharing of monitoring results, or memoranda of agreement to be forms of mitigation.

The Panel notes that Tsawwassen identified Canoe Passage as one of their main salmon harvesting area. The Panel does not expect the Project would affect access to Canoe Passage and therefore concludes that there would not be an effect from the Project on Tsawwassen's ability to access their preferred current use location for salmon harvesting.

As reported by Tsawwassen, areas available to harvest waterfowl in the Fraser River delta, Roberts Bank and Boundary Bay have been reduced in size due to a series of hunting closures and firearms restrictions imposed by municipalities and provincial and federal governments. The expansion of the causeway and placement of the terminal would further restrict use of firearms. Given that the Proponent did not propose measures to mitigate the additional loss of hunting areas, the Panel is of the view that a shrinking hunting zone will have a minor negative effect on Tsawwassen's ability to harvest migratory birds. Overall, the Panel concludes that the Project would have a high magnitude effect on Tsawwassen's ability to access preferred harvesting locations.

Changes in Availability of Preferred Current Use Resources

In Section 12 - Marine Invertebrates, the Panel concludes that the Project would cause a significant adverse effect on crab due to the loss of habitat. The Panel is not confident that the Proponent's conceptual Offsetting Plan would adequately mitigate the loss of Dungeness crab habitat and crab productivity and concludes that the Project would cause a significant adverse effect on crab. It is possible that the effect on crab productivity would correspond to an effect on the availability of crab as a preferred resource for Tsawwassen.

The Panel recognizes the importance of fishing to Tsawwassen and their concern that any effect on fishing would be detrimental. The Tsawwassen noted that their preferred species was sockeye salmon both culturally and economically but that they harvest Chinook salmon as well. The Panel concluded, in Section 13 - Marine Fish and Fish Habitat that the Project would have an adverse effect on ocean-type juvenile Chinook salmon, but effects on sturgeon or sockeye salmon would be unlikely. The Panel was unable to conclude whether or not the Project would have an effect on eulachon but is of the view that the Proponent's recommended eulachon study would address some of Tsawwassen's concerns on the current use of eulachon. Overall, the Panel is of the view that the Project would have a minor effect on the availability of ocean-type Chinook salmon as a preferred resource for Tsawwassen.

Changes in Quality of Current Use Experience

The Panel heard from Tsawwassen that the Project would cause changes to their sense of place, safety and security in the marine environment, contribute to existing noise and light pollution, and reduce opportunities to transmit Indigenous traditional knowledge. In Section 7 - Atmospheric Environment the Panel concludes that the Project would contribute to noise levels and light pollution in the Project area. The Panel is of the view that increased ship traffic or vessel size would pose safety hazards to Tsawwassen vessels and that members would be required to adapt their activities to avoid large inbound and outbound ships. The ability for

Tsawwassen to safely and peacefully use the lands and waters for traditional purposes affects their quality of experience.

Tsawwassen have a demonstrably high use of the Project area for crab harvesting and for hunting waterfowl. The Panel acknowledges that the navigational closure area was implemented for marine safety reasons and the Proponent has made a commitment to find a solution to allow its continued use for crab harvesting. The Panel encourages the Proponent to continue its engagement with Tsawwassen and DFO to find an effective solution. However, with the permanent loss of crab habitat and a reduction in crab harvesting area, both the availability of preferred resources and Tsawwassen's ability to access preferred harvesting locations would combine to cause an effect that is high in magnitude. The Project would lead to additional vessel traffic in the Project area that would cause a continuous constrain on Tsawwassen water-based activities and a long-term sensory disturbance. An increase in safety risks would also affect Tsawwassen's quality of experience. The Panel concludes that there would be noticeable disturbances to Tsawwassen's current use of land and resources for traditional purposes that cannot be fully mitigated.

The Panel concludes that the Project would result in a residual adverse effect on the current use of lands and resources for traditional purposes for the Tsawwassen First Nation that cannot be fully mitigated. The effect would be significant.

Musqueam Indian Band

The Panel recognizes that the Project overlaps with Musqueam traditional territory, including fishing areas and their main crab harvesting sites. The construction and operations of the Project have the potential to cause disturbances to current use activities identified by Musqueam. The Musqueam identified fishing, coastal harvesting and cultural continuity as the Project's main interactions likely to result in adverse effects on their current use.

Changes in Access to Preferred Resources

Crabbing by Musqueam occurs in the shallow areas of the Salish Sea, including Roberts Bank adjacent to the existing terminals. The terminal footprint would cause the permanent loss of a portion of Musqueam's crab harvesting area. The Panel understands that Musqueam fishers also use the Fraser River for fishing and harvesting, which the Panel has concluded will not be affected by the Project. The Panel acknowledges that harvesting would still be allowed in the navigational closure area but would be challenged by vessel traffic and DFO float requirements. The Panel encourages the Proponent to continue to engage with Musqueam and DFO to identify a workable solution for crab harvesting within the navigational closure area. However, without a solution the magnitude of the effect on crab harvesting would be high.

The Panel heard that ultimately, threats to Musqueam fisher's safety, the increased potential of gear losses, and the navigational and fishing restrictions imposed by the presence and movement of Project-associated marine traffic are likely to lead to avoidance, lost access, and hindrance of Musqueam fishing activities. In the absence of effective mitigation measures, beyond communication protocols designed to ensure the distribution of information about planned and

unplanned construction and operations activities, the Panel agrees with Musqueam that the Project would have effects on access to a preferred resource.

The Panel understands that local hunting of waterfowl occurs on the Musqueam Indian Reserve, Canoe Passage and in other areas in the immediate vicinity of the terminal footprint and causeway. The Panel understands that for Musqueam, hunting for game is important for food and in its role for ceremonies, art, and is part of a broader connection for members to their history and the land. Musqueam described to the Panel how existing restrictions and regulations adversely affect their hunting activities.

The Panel concludes that the Project would affect Musqueam's ability to access preferred crab harvesting and waterfowl hunting locations for the duration of the Project. However, the effect would only occur over a moderate portion of the area presently used by Musqueam. With no plans to decommission the Project the effect would likely be irreversible, either in whole or in part, and would persist beyond one generation. Spatially, access to other preferred resources in the North Arm of the Fraser River, and Canoe Passage are not likely to be affected by the Project.

Changes in Availability of Preferred Current Use Resources

The Panel is of the view that Musqueam adequately demonstrated that the Project area is heavily used as a preferred harvesting area. This high-quality crab habitat would also be permanently lost due to the Project footprint. The Panel concluded that the Proponent's conceptual Offsetting Plan would not adequately mitigate the loss of Dungeness crab habitat and crab productivity and the Project would cause a significant adverse effect on crab resources. There is a potential for the effect on crab productivity to generate an effect on the availability of crab as a preferred resource for Musqueam.

Changes in Quality of Current Use Experience

The Panel heard from Musqueam that ongoing development and sensory disturbances in their traditional territory, including at the Project site, were causing alienation from their traditional practices and disrupting their ability to transmit intergenerational knowledge. The Panel also heard that at times, Musqueam had to interrupt and adapt their activities to avoid large commercial ships. Based on the Panel's conclusion that the Project would contribute to existing noise levels and light pollution in the LAA, the Panel accepts that these realities described by Musqueam would affect the quality of their current use experience. The amount of change Musqueam members would experience relative to existing conditions would be detectable and ongoing. The Panel is of the view that Musqueam also has adequately demonstrated that harvesters would need to adapt their activities to avoid large incoming and outgoing ships over the life of the Project. With no plans to decommission the terminal the effect on the quality of experience would be permanent.

The Panel considers that access to preferred resources, availability of preferred resources and quality of experience all demonstrate a clear pathway of effects on the current use of lands and

resources for traditional purposes by Musqueam. Although some indicators show a higher magnitude or larger extent than others, the Panel has determined that all effects would likely be irreversible and permanent. The Panel concludes that the Project would have a significant adverse effect on current use.

The Panel concludes that the Project would result in a residual adverse effect on current use of lands and resources for traditional purposes for the Musqueam Indian Band that cannot be fully mitigated. The effect would be significant.

Other Indigenous groups

The Panel heard from several other Indigenous groups who described traditional harvesting activities at Roberts Bank and the surrounding area. It was clear that the lower Fraser River and Roberts Bank were extensively used by Indigenous groups from the Lower Mainland and Vancouver Island both pre- and post- contact with Europeans. It is less clear to the Panel how many Indigenous groups, besides Tsawwassen and Musqueam, currently use the Project area and to what extent. A few Indigenous groups identified current harvesting practices around Roberts Bank and in Canoe Passage.

The Métis Nation identified harvesting sites intersecting with the Project area and identified salmon, crab, oyster, and birds as heavily harvested species. The Penelakut First Nation identified Roberts Bank as an important crab harvesting location while Lyackson First Nation noted that they have members who harvest near Tsawwassen. Other groups also spoke broadly about harvesting at Roberts Bank. It was unclear to what extent, if at all, their harvesting activities would be directly affected by the Project.

The Panel is of the view that the Project would cause a residual adverse effect on current use for any Indigenous groups that harvest at Roberts Bank in the vicinity of the Project footprint. For clarity, the Panel considers the ‘vicinity of the Project footprint’ to include the areas around Roberts Bank from the BC Ferries Tsawwassen Terminal up to Canoe Passage, and from the high-water mark on the shore west to -100m depth chart datum. Any group harvesting in the vicinity of the Project footprint would experience effects to access as well as associated sensory disturbances resulting in changes to the quality of the experience. For those groups that currently harvest crab, the availability of the resources would be reduced. The following groups identified potential current use of the Project area: the Métis Nation, Penelakut Tribe, the Cowichan Nation Alliance, Lyackson, and the Pauquachin First Nation. The effects would be low in magnitude, local in extent as only a small zone of the total harvesting area would be affected, intermittent but would likely last beyond one generation.

The Panel concludes that the Project would result in a residual adverse effect on current use of lands and resources for traditional purposes for Indigenous groups who harvest in the vicinity of the Project. The effect would not be significant.

Cumulative Effects Assessment

The Panel asked the Proponent to undertake cumulative effect assessments on the current use using three of the indicators identified by the Proponent: access to preferred locations, quality and availability of preferred resources, in particular on crab and marine mammals, and on quality of current use experience. The Proponent maintained that its conclusions reflected no residual effects and thus there was no need to undertake a cumulative effect assessment.

As the Panel indicates in Section 25 - Cumulative Effects Assessment, the Proponent's use of existing conditions of an environmental component to reflect past effects results in a shift in baseline that could mask residual and potentially significant effects that have historically occurred or could occur in combination with effects of the Project. The Panel believes effects from past and existing projects on an environmental component must be described and considered on their own and not as reflection of the current condition of the environmental component. The Panel is of the view that this is particularly important where Indigenous groups have witnessed first-hand changes to the landscape that have directly and indirectly affected current use and physical and cultural heritage. Below, the Panel evaluates the potential cumulative effects on Indigenous groups, using qualitative information available on the historic context of past and previous projects and the criteria table developed by the Panel.

The Panel heard from Tsawwassen that a cumulative effects monitoring and mitigation plan for the life of the Project was needed to confirm and monitor effects on Treaty rights, culture and way of life. The Panel agrees that this is needed, and, for clarity, also understands this monitoring and mitigation plan includes current use as described in this section.

The Panel is of the view that infrastructure developments, including the existing terminals, tug basin and causeways within the RAA have affected preferred practice of current use for Tsawwassen and Musqueam and that these developments have disrupted the availability of resources along the Tsawwassen foreshore and more broadly, throughout adjacent areas of the Fraser River estuary. The Panel heard from Tsawwassen and Musqueam that noise and light pollution, crabbing and hunting restrictions, and risk to safety on the water have altered the quality of experience over the years. The Panel understands there are multiple other land and marine uses, including BC Ferries Tsawwassen Terminal, Roberts Bank terminals and road and rail infrastructure that could affect these communities current use.

The Project would interact with current use in an area highly valued given the cumulative context. The traditional activities which may be affected by the Project are not currently practiced in the preferred manner because of conservation issues, lack of access, or government policy/programs. The Project would contribute to amplifying effects that already exist related to access to and availability of preferred resources for Tsawwassen and Musqueam. The Panel does not have sufficient information on how past projects have affected the current use of the Project area for other Indigenous groups, or how potential effects of the Project would combine with other past effects to reasonably conclude on the cumulative effects of the Project on their current

use. Due to increased shipping in the Salish Sea, the Panel considers that the Proponent's follow-up program should also address cumulative effects.

The Panel concludes that the Project would result in an adverse cumulative effect on the current use of lands and resources for traditional purpose for the Tsawwassen First Nation and the Musqueam Indian Band. The effects would be significant.

Recommendation 38

The Panel recommends that Transport Canada and Fisheries and Oceans Canada, in collaboration with the Proponent, be required to address safety concerns and the practicality for the Tsawwassen First Nation and the Musqueam Indian Band to harvest crabs for food, social and ceremonial purposes within the existing and expanded navigational closure areas using floats. Utilization of floats during crab fishing could occur during short-term berthing windows or when container ships are absent from Port facilities.

Recommendation 39

The Panel recommends that the Proponent, in collaboration with the Tsawwassen First Nation and the Musqueam Indian Band, be required to develop and implement a cumulative effects monitoring and mitigation plan for the first five years of operation of the Project. The plan should include the:

- *Identification of monitoring parameters for incremental adverse effects on the cumulative effects of environmental components, such as crab and juvenile salmon, resulting from the Project;*
- *Specification of Tsawwassen's and Musqueam's roles and provision of funding for their involvement in monitoring and reporting on cumulative effects of chosen environmental components;*
- *Identification of mitigation and protocols to reduce cumulative effects, including management plans on required specific environmental components; and*
- *Identification of thresholds that would trigger the need to implement adaptive management measures.*

16.2 Marine Shipping Area

16.2.1 Proponent's Assessment

To assess the potential effects on current use in the marine shipping area the Proponent used the same four indicators as for the Project area. The Proponent defined the LAA as the area of overlap between the marine shipping area and Indigenous groups asserted or established territory or otherwise defined area of use. The groups identified in the EIS Guidelines as being potentially affected by the Project and are located in the marine shipping area are:

- Pacheedaht First Nation
- Ditidaht First Nation
- The First Nations of Maa-nulth Treaty Society (representing the

- Huu-ay-aht First Nations, the Ka:'yu:'k't'h'/Che:k'tles7et'h' First Nations, the Toquaht Nation, the Uchuklesaht Tribe, and the Yuułu?iŋ?ath First Nation, also known as the Ucluelet First Nation
- Tsawout First Nation
 - Pauquachin First Nation
 - Tsartlip First Nation
 - Tseycum First Nation
 - Malahat First Nation
 - Scia'new First Nation (Beecher Bay Indian Band)
 - Esquimalt Nation
 - Songhees Nation
 - T'Sou-ke Nation
 - Tsawwassen First Nation
 - Semiahmoo First Nation
 - Cowichan Nation Alliance (representing Stz'uminus First Nation, Cowichan Tribes, Halalt First Nation and Penelakut Tribe)
 - Lake Cowichan First Nation
 - Lyackson First Nation
 - Métis Nation British Columbia
 - Musqueam Indian Band
 - Tsleil-Waututh Nation

The Proponent summarized the input it received from Indigenous groups and noted that groups generally described similar concerns with respect to the existing conditions in the marine shipping area. The Proponent noted that Indigenous groups identified a decreased willingness or ability to access preferred current use sites around the marine shipping lanes due to existing safety concerns and sensory disturbances. Indigenous groups also described how displacement from areas of importance was causing alienation from existing patterns of traditional harvesting and that any further risk or displacement would be unacceptable. Indigenous groups underlined to the Proponent that their current use, or lack thereof, was not necessarily reflective of the community's desired use.

The Proponent also relied on information from the public record for the TMX to support its characterization of existing and future conditions of current use in the marine shipping area. This included written and oral evidence provided by Indigenous groups to the TMX review process. The Proponent summarized the information and shared the summaries with each Indigenous group prior to submission of the MSA.

The Proponent identified vessel transit as the only Project-related activity that could affect current use in the marine shipping area. Overall, the Proponent concluded that marine shipping associated with the Project would not measurably affect the existing quality of the current use experience. The Proponent acknowledged that there were existing cumulative effects on current use and that Project associated shipping activities would not measurably contribute to existing cumulative effects.

Throughout the environmental assessment, the Proponent emphasized that because marine shipping was beyond the care and control of the Port Authority it was not in a position to adequately address many of the concerns raised by Indigenous groups in the marine shipping area. The Proponent also acknowledged that the location and operation of the international

shipping lanes were not within their jurisdiction. The Proponent committed to participate in collaborative efforts to address concerns, but noted that the efforts should be led by government.

Access to Preferred Current Use Locations

The Proponent acknowledged that there were pre-existing effects on the ability of Indigenous groups to access traditional use locations in the marine shipping area. The Proponent identified that vessel-generated wake waves could affect the access to locations for traditional use by Indigenous groups and that the presence of ships could temporarily displace traditional activities taking place in the shipping lanes.

The Proponent concluded that the effect of vessel-generated wake waves would result in negligible effects on Indigenous groups' ability to access current use locations. The Proponent noted that vessel wake waves from Project-associated marine shipping were not expected to be distinguishable from existing wind driven wave height except in calm conditions. The Proponent argued that current use activities would not always occur during calm conditions, and that for most occasions the wake waves would have dissipated to a height below 10 cm by the time the wake reached the location(s) where current use activities would be taking place.

The Proponent identified a minor incremental effect on access to current use locations as a result of an overlap between current use activities and ship pass-bys. The Proponent acknowledged that Project-associated shipping activities would temporarily displace current use activities taking place at the same time in, or near, the shipping lanes, noting that it was unlikely those activities would overlap with every ship movement associated with the Project. The Proponent identified that the most likely areas of interaction between Project-related ship movements and Indigenous activity would be within Pacheedaht and Ditidaht First Nations' exclusive fishing area at Swiftsure Bank and a portion of the Maa-nulth's treaty-protected fishing area. The Proponent stated that it was difficult to quantify the exact number of interactions and determined that the incremental effect could be either negligible or unmeasurable, but if it was measurable it would be only minor relative to existing conditions.

To address Project effect on current use, the Proponent committed to collaborate with appropriate regulatory authorities and Indigenous groups to support the provision of real-time information about the movement of ships associated with the Project. The Proponent committed to identify measures that may reduce the impact of shipping lanes on fishing by Indigenous groups. Further, the Proponent committed to participate in relevant regional federal government initiatives and programs to coordinate their consultation with Indigenous groups.

The Proponent also stated that the federal government was implementing similar initiatives that involved communication and engagement with Indigenous groups as a mechanism to resolve issues. The Proponent concluded that, with mitigation, the residual effects from marine shipping associated with the Project would be negligible.

Availability of Preferred Current Use Resources

The Proponent concluded that there would be a negligible effect on the availability of preferred current use of marine resources by Indigenous groups, including fish, mammals, and birds because there were no measurable incremental effects on those resources, or their productivity, in the marine shipping area due to the Project.

The Proponent concluded that there was an existing cumulative effect on the SRKW that was significant. The Proponent stated that the residual effects due to marine shipping associated with the Project on the SRKW was very small and would not further affect any use of the SRKW for traditional purposes.

Quality of Preferred Current Use Resources

The Proponent stated that while there were a few shellfish restrictions or closures in place in nearshore intertidal areas, the existing levels of contaminants in edible marine resources within the marine shipping area were below the thresholds for human health protection. The Proponent concluded that the effect of marine shipping associated with the Project on the quality of current use resources would be negligible. The Proponent stated that Project-associated marine shipping would not be expected to change the existing quality of marine resources through changes to air quality or marine water quality.

Quality of Current Use Experience

The Proponent identified sensory disturbances, perceived increases in risks to safety, and alterations to cultural landscapes could change the experience of current use, noting that these changes could lead to associated changes in use patterns.

The Proponent concluded that noise due to marine shipping associated with the Project was expected to have a negligible effect on the quality of current use experience for both marine and land-based activities in the marine shipping area. The Proponent noted that most current use activities that overlapped with a transiting ship would involve a motorized boat, such as a fishing vessel, that would also be generating noise, masking the noise of a ship. Interactions with ships from non-motorized vessels, such as canoes during Tribal journeys, would occur infrequently. The Proponent also concluded that changes to the light environment were expected to have a negligible effect on the quality of current use because two ships passing at the same time, at night, would be unlikely as approximately 56 percent of container ships were expected to transit during the day.

The Proponent acknowledged that safety was a concern but concluded that the relative contribution of the Project was small enough that there would be a negligible effect on safety during current use activities. However, the Proponent acknowledged that there were potential effects from a perceived change in safety. To address perception of changes in safety, the Proponent proposed collaboration with appropriate regulatory authorities and Indigenous groups to support the provision of real-time information about the movement of ships associated with the Project. The Proponent would identify measures that may reduce the impact of shipping lanes

on fishing by Indigenous groups. The Proponent further committed to participate in relevant regional federal government initiatives and programs and to coordinate their consultation with Indigenous groups with those initiatives.

16.2.2 Views of Participants

Many Indigenous groups continue to rely on fishing as a means of feeding their communities. They described how fishing was an important social and cultural activity, historically and at present. Indigenous groups described how their ability to collect and harvest marine resources was “in peril”. They underlined that the Project would exacerbate the situation. Many Indigenous groups described how development and industrialization had caused existing cumulative effects on their ability to practice current use in the marine shipping area.

Several Indigenous groups described how vessel generated wake waves and the threat of collisions with large commercial vessels affected their ability to safely access and enjoy preferred current use locations. These groups proposed creative solutions with respect to regulation of marine traffic, such as eliminating or reducing weekend traffic to reduce the chance of accidents with small craft, or setting a maximum amount of traffic permitted through the marine shipping area at any given time.

Pacheedaht First Nation

Pacheedaht First Nation (Pacheedaht) noted that fishing was both an important traditional activity and a social event that enabled them “to connect with each other, with the water and with the marine life.” Chief Jeff Jones described how the Pacheedaht would hold a yearly community coho fishery where the community members came together to fish. Pacheedaht also described how they held weekly community lunches where community members would bring what they had to share and members would take home any extras for their families.

Pacheedaht repeatedly described how Swiftsure Bank was the primary area utilized to meet their social, economic, and cultural needs, both currently and traditionally. Pacheedaht referred to Swiftsure as their “dinner plate” and the “gemstone of Pacheedaht”. Pacheedaht described Swiftsure as a highly productive area that they relied upon heavily for fishing and providing for their community and families. Halibut, black cod, rockfish, salmon and ling cod were identified as resources harvested at Swiftsure Bank. Pacheedaht noted that access to harvesting at Swiftsure Bank was “critical” to sustaining their way of life.

Pacheedaht stated that the government had relocated Buoy J and the inbound and outbound international shipping lanes northward in 2005, and that they now intersected an exclusive Indigenous FSC fin-fishing area (i.e., an area closed to commercial and recreational fin-fishing) at Swiftsure Bank. This had impacted members’ use of the area. Pacheedaht noted that 112 km of the shipping lanes now transected Pacheedaht territory. Pacheedaht had urged the federal government to move the shipping lanes off Swiftsure Bank for many years and stated that the government should work with them, Ditidaht First Nation, and the Makah Tribe in the USA on proposals to realign the shipping lanes.

Pacheedaht members described how large vessels transiting the shipping lanes had created hazardous conditions due to the number and size of ships, as well as the wake from those ships. Members stated that the foggy and windy conditions at Swiftsure Bank impaired their visibility and distorted sounds making it difficult to know when vessels were approaching. Pacheedaht members explained the challenge for small fishing boats to move quickly out of the way of a large ship when their fishing gear was deployed. Community members also described the challenges in communicating clearly with large commercial vessels, adding to the stress of potentially dangerous situations. Pacheedaht members also described the fear caused by vessel generated wake wave from large passing ships. A member noted that the wake wave would cause their fishing vessels to take on “big, sloppy, uncomfortable water” and make their fishing experiences “downright scary”. Pacheedaht was very concerned that increased vessel traffic would exacerbate the existing dangerous conditions and make it increasingly difficult for their members to harvest at Swiftsure Bank.

Pacheedaht members described how the ship traffic affected their experiences at Swiftsure Bank. They noted that the noise from the ships combined with the safety concerns had “detracted from the joy and cultural experience of being on the water and engaging in ancient and essential practices.”

Swiftsure Bank was described by Pacheedaht as the key location where intergenerational knowledge was transferred. Pacheedaht noted that safety concerns were preventing people from bringing their children and youth to Swiftsure Bank. They stated that the existing vessel traffic had created challenges and uncertainties for safety and well-being. They described how this was leading to lost opportunities to transfer knowledge of “where you go, why you go, who you go with, what you harvest, what you don’t do” on to their children.

Ditidaht First Nation

The Ditidaht First Nation (Ditidaht) members described the importance of the ocean and noted that they traditionally harvested fish, whales, and seals. Ditidaht described Swiftsure Bank as a “crucially important traditional fishing area.” A Ditidaht fisherman noted that Swiftsure Bank always had high amounts of halibut to fish.

Ditidaht members shared fears and concerns regarding their safety on the water due to the large vessels passing by. Councillor Darryl Tate shared a personal video that demonstrated how dangerous and unsettling it could be when a passing ship’s wake wave hits a smaller vessel. Councillor Tate noted that since that incident he has adjusted his fishing practices. Councillor Tate noted that he has been forced to use jigs, rather than a long-line because it was easier to get out of the way of large ships. Ditidaht noted that the Proponent did not adequately capture or describe Ditidaht’s perspective of fishing at Swiftsure Bank when ships pass by. Councillor Tate noted that when he was out fishing one morning seven ships went by in a six-hour period.

Ditidaht stated that the safety concerns were preventing people from bringing their children and youth to Swiftsure Bank. They described how this was leading to lost opportunities to pass on traditional knowledge to the next generation.

Ditidaht noted that the Proponent did not meaningfully respond to their specific questions or concerns during the environmental assessment and the Proponent's proposed mitigation measures were generic and problematic. Ditidaht stated that the Proponent's proposed communications plan would not be effective because Ditidaht fishers did not have the technical capacity to engage in real-time communication. Chief Councillor Joseph noted that while communication was helpful it would not be adequate and there was a need to anticipate and monitor vessel traffic as well. Ditidaht proposed to regularly monitor conditions over time to confirm the Proponent's predictions, identify unexpected outcomes, and prevent further cumulative effects, particularly at Swiftsure Bank.

The First Nations of the Maa-Nulth Treaty Society

The First Nations of the Maa-nulth Treaty Society (the Maa-nulth) noted that a portion of the Maa-nulth's treaty-protected fishing area overlapped the shipping lanes both in the marine shipping area and within the 12 nautical mile limit of Canada's territorial sea along the west coast of Vancouver Island. The Maa-nulth stated that the harvesting, processing, consuming, and trading of fish and other ocean resources were integral to their culture. The Maa-nulth described salmon as the "heart of our people" and spoke extensively of the importance of fishing to their communities. The Maa-nulth raised concerns about the effect of the Project on fish, and the subsequent effect on their culture, health and wellbeing which they linked to their ability to fish.

Maa-Nulth also described safety concerns for First Nation fishers when they were travelling in small vessels and would come up against larger commercial vessels. Mr. Larry Johnson shared a story of a large ship pulling down the anchor line of a smaller fishing boat, forcing the fishers to cut their anchor line to get away. The Maa-nulth noted that even good equipment was inadequate for small fishermen when they encounter large commercial vessels.

Scia'new First Nation

The Scia'new First Nation noted that harvesting, processing, consuming, and trading fish and other marine resources was integral to their culture. Scia'new First Nation described how they still had a clean bay at Beecher Bay and wanted to be able to protect the bay and the Salish Sea. A member of Scia'new First Nation described how plentiful the fish were when growing up, stating that the Nation used to eat "like kings". Another member of Scia'new First Nation confirmed that they fish at Swiftsure Bank noting that the halibut was plentiful there.

Scia'new First Nation raised concerns that shipping associated with the Project would affect them by restricting the times and locations in which they could harvest, and would disrupt the travelways used by its members. Members described how scary it could be when they encounter large ships out on the water. Chief Russ Chips described how he was almost thrown out of his boat by a large ship wake wave. Other members spoke of the importance of having a knife with them when out on the water so they could cut their anchor should they need to move quickly to avoid an oncoming ship or large wake.

Scia's new First Nation member Sharon Jay described how Indigenous groups felt that commercial vessels were pushing them out of their traditional territories. Mrs. Jay stated "here we are sitting there fishing, minding our own business like we have done for years and years and years and now we have to get out of the way. Move over. We're going to bring a big tanker through. We're going to bring a big ship through. Move over. Get out of the way."

T'Souke Nation

During the environmental assessment, the T'Sou-ke Nation (T'Sou-ke) submitted that there was no information before the Panel on T'Sou-ke's marine traditional uses that may be affected by the Project. In October 2016 and again in October 2018, T'Sou-ke stated that the Proponent had not arranged and resourced the preparation of a Project-specific Marine Traditional Use Study but rather, without T'Sou-ke's consent and against its strenuous objections, relied on a Marine Traditional Use Study prepared for the Trans Mountain Expansion Project. T'Sou-ke Nation pointed to the Agency's guidance "*Considering Aboriginal traditional knowledge in environmental assessments conducted under the Canadian Environmental Assessment Act, 2012*", which establishes, among other things, that "only the community can decide if they are willing to provide access to their [traditional knowledge]".

The Panel was aware that the information used by the Proponent in the Marine Shipping Addendum was current and publicly available however, as requested by Chief Gordon Plains during the public hearing, the Panel requested permission from the T'Sou-ke Nation to use the information contained in the Marine shipping Addendum. This request was denied. To respect T'Sou-ke's decision, the Panel based its conclusions and recommendations of effects on T'Sou-ke solely on the information presented directly by the T'Sou-ke in their written submissions to the Panel and the information they presented during the public hearing.

T'Sou-ke reported that vessels from the Project would transit directly "through the heart of T'Sou-ke's Territory." T'Sou-ke raised concern about ships from the Project causing destruction of their members' fishing gear. T'Sou-ke also noted that their community was already facing curtailment of their traditional activities due to the existing shipping taking place through their territory. They stated that additional ships would hinder their members in travelling by boat in their territorial waters to reach preferred harvesting areas and culturally significant sites.

Esquimalt Nation

The Esquimalt Nation described themselves as "ocean people" and noted that harvesting, processing, consuming, and trading fish and other marine resources was integral to their culture. Esquimalt described how the cumulative impacts of industrial and urban development had greatly affected their ability to harvest and conduct traditional activities in their traditional territory. Esquimalt Nation raised concerns that shipping associated with the Project would affect them by restricting the times and locations in which they could harvest, and would disrupt travelways used by the Esquimalt Nation members. They also noted that it was dangerous for members to travel near the shipping lanes due to the commercial ships.

Esquimalt Nation noted that ships associated with the Project would pass through their traditional territory and raised concern that the Proponent had not adequately considered all of Esquimalt Nation's traditional marine use areas. Esquimalt Nation also noted that in the absence of an Esquimalt marine traditional use study, the Panel did not have sufficient information to determine the full extent of the effects of the Project on Esquimalt Nation.

Songhees Nation

The Songhees Nation (Songhees) noted that they were deeply connected to the sea and they traditionally harvested all types of seafood and fish. Songhees expressed concern about the Project's potential to adversely affect their ability to harvest fish, wildlife and culturally-important plants. Songhees described the cumulative effects assessment conducted by the Proponent as "deficient". Songhees stated that sensory disturbances such as noise and vibrations interfered with wildlife and the exercise of water-based activities, including those related to traditional economies. Songhees noted that their members visit Tl'ches (Chatham and Discovery Islands) to harvest Camas bulbs, gather medicinal plants, fish and carry out other culturally-significant practices.

Lyackson First Nation

The Lyackson First Nation (Lyackson) stated that their identity as a people was defined by their ability to be part of the food chain through harvesting and sustaining a livelihood based on what the land and waters provide. However, Lyackson noted that their ability to uphold their traditional livelihood and rely on a natural diet was continually challenged. Lyackson described how some of their preferred intertidal resources such as clams, and Dungeness crabs were no longer available to them and vessel wake associated with increased shipping would only exacerbate damage to the resources.

Lyackson stated that large vessels impose a navigation hazard to members that use small boats or canoes for transportation and harvesting purposes. Lyackson noted that members avoided or were unable to travel on the Salish Sea using their preferred mode of transportation, due to high risks of collisions with large vessels and possible capsizing in freighters wakes. The navigation hazards imposed by the large vessel traffic prevented Lyackson members from accessing preferred harvesting sites within their marine use area and traditional territory.

WSÁNEĆ First Nations

The Tsartlip First Nation, the Pauquachin First Nation, the Tsawout First Nation, and the Tseycum First Nation provided input to the Panel as the WSÁNEĆ Nations. The WSÁNEĆ described fishing as an important activity that allowed for cultural teaching across generations. Tsartlip First Nation noted that they were deeply tied to salmon as a food and spiritual resource, and that they continue to use salmon for social and ceremonial purposes throughout the year. In their Traditional Use Study, WSÁNEĆ harvesters noted that they were not satisfied with the amount of marine resources currently available.

The Pauquachin First Nation identified travel routes throughout the Gulf Islands and Salish Sea, and identified harvesting locations within the marine shipping area. Pauquachin First Nation noted their concern that vessel wake waves would affect their harvesters, especially considering their fishermen were small boat harvesters. They also noted that the shipping vessels increased the possibility of collisions or accidents. Pauquachin First Nation noted that an increase in large container ships would change the sensory experience while conducting their traditional practices in certain locations. Pauquachin First Nation stated that the existing commercial shipping was already having an effect on their harvesting experience in the Salish Sea.

The Pauquachin First Nation asserted that the Panel did not have the required information to properly assess the effects of the Project on their current use of land and resources. Similarly, Tsartlip First Nation noted that the Proponent had failed to undertake an adequate assessment of the effect of vessel traffic on access to traditional harvesting areas, and questioned the Proponent's conclusion of no residual effect on current use.

A member of the Tsawout First Nation described how the cumulative effects of development were affecting their traditional lands and seas. He noted concern that the salmon were disappearing and that there was no bull kelp left. He also stated that while Roberts Bank Terminal 2 was "a drop in the bucket" it would still have a lasting impact due to its cumulative effect.

Malahat First Nation

The Malahat First Nation (Malahat) stated that they harvested marine resources in their territory, including fish, shellfish, seabirds, and marine vegetation. Malahat also noted that they relied on the Salish Sea for food and transportation, and by carrying out those practices they shared their teachings and transmitted their culture to younger generations. Malahat encouraged the Panel to consider the ability of the Salish Sea, and in turn the Indigenous peoples who rely on it, to support any further effects.

Malahat raised concern with how the Proponent characterized effects on Malahat and other Indigenous groups. Malahat stated that ongoing consultation should not be considered a mitigation measure and that there was no guarantee that consultation would lead to the implementation of mitigation that the Nation would find acceptable. Malahat also noted that the assessment generalized the levels of importance of sites and practices across different indigenous groups.

Malahat noted that the Proponent should commit to funding community-based monitoring programs. Malahat also stated that monitoring and follow-up initiatives should have greater Indigenous authority and oversight.

Cowichan Nation Alliance (Cowichan Tribes, Halalt First Nation, Stz'uminus First Nation)

The Cowichan Nation Alliance noted that they used the Project shipping lanes, both historically and currently, for fishing and harvesting activities. They noted that marine resources such as fish and vegetation were important for FSC purposes.

The Cowichan Nation Alliance stated that their Aboriginal communal fishing licence overlapped slightly with Segment A of the marine shipping area. The Cowichan Nation Alliance also noted that they had traditional shellfish harvesting locations in Segment B of the marine shipping area, mainly off the coasts of Tumbo and Saturna Islands.

The Cowichan Nation Alliance stated that the existing development and activity in the Salish Sea was affecting their communities. The Cowichan Nation alliance noted that they were no longer guaranteed their FSC fish quota or total allowable catch every year due to the low abundance of salmon. They also described how they had to move out of the way of larger commercial vessels when out on the water.

Musqueam Indian Band

Musqueam concluded that there would be residual effects from Project-related marine shipping on Musqueam harvesting in the Salish Sea and noted that the cumulative effects of large vessel traffic were an ongoing hindrance to safe and effective fishing activities. Musqueam stated that there was a need for better communication between their fishers and large commercial vessels. They also noted that the idea that Musqueam fishers could just get out of the way was “wrong-minded.”

Musqueam recommended that a marine shipping follow-up plan be required to address these concerns. Musqueam proposed that the plan include monitoring of interactions between Musqueam fishing vessels and other traffic, mitigations to minimize interactions, and a communication plan for marine vessel operators.

Tsawwassen First Nation

Tsawwassen has Treaty lands and Treaty harvest areas within the marine shipping area (Segment B). Tsawwassen raised concern about safety hazards for their members due to increased ship traffic or vessel size out on the water. Tsawwassen specifically noted concerns about vessel collisions, loss of fishing gear, and reduced access to preferred fishing sites. Tsawwassen did not agree with the Proponent’s mitigation as in their view it would cause Tsawwassen fishers to change their behaviour, as opposed to the Project being changed to accommodate them. Tsawwassen noted that their members have constitutionally-protected rights to fish in their Territory, and therefore forcing Tsawwassen fishers to move out of a ship’s way did not represent mitigation.

16.2.3 Panel’s Analysis

The Panel agrees with the Proponent that ship pass-bys are the only source of potential effects resulting from marine shipping associated with the Project for all Indigenous groups using the marine shipping area. The Panel acknowledges that it is difficult to quantify the increase in potential interactions between current use activities and ships associated with the Project, but agrees with the Proponent that not every additional Project-associated ship would lead to an interaction with a current use activity. The Panel also agrees with the Proponent that

Pacheedaht's and Ditidaht's exclusive fishing area at Swiftsure Bank as well as a portion of the Maa-nulth's treaty-protected fishing area are the most likely areas of interaction with ship movements.

Based on the Panel's conclusions on biophysical environmental components occurring in the marine shipping area, the Panel agrees with the Proponent that marine shipping activities would not alter the availability or quality of preferred resources for Indigenous groups using the marine shipping area. Further, the Panel has determined that the Project is unlikely to result in adverse effects on the quality of current use experience resulting from nuisances related to air quality, light pollution, or noise levels. However, the Project would affect the quality of current use experience as a result of safety concerns.

The Panel is of the view that the Proponent's proposed mitigation measures would not effectively mitigate effects on current use. The Panel considers the Proponent's communications plan and consultation with Indigenous groups a courtesy that does not constitute mitigation measures for Project effects. Further, the Proponent's commitments do not provide adequate information to determine the effectiveness of the mitigation measures. These commitments are to collaborate with appropriate regulatory authorities and Indigenous groups to support the provision of real-time information about the movement of ships associated with the Project and to identify measures that may reduce the impact of shipping lanes on fishing by Indigenous groups. The Panel did not learn how the Proponent planned to implement its commitments, the expected efficacy of the mitigation measures, cost involved or timelines. Additionally, there was no specific information provided on the role of Indigenous groups, other than to note that they would be consulted. The Panel heard many proposed mitigation measures from Indigenous groups that were not addressed by the Proponent.

The Panel also views the Proponent's commitment to participate as a key stakeholder in relevant federal government initiatives and programs, and to coordinate their consultation with Indigenous groups on those initiatives, to be inadequate to reduce Project-related marine shipping effects on current use.

The Panel acknowledges there are initiatives that would improve vessel tracking and strengthen marine communications for vessel traffic and management between mariners and the Canadian Coast Guard as provided in Section 5 - Marine Shipping Associated with the Project. The Panel notes that many Indigenous groups have limited access to existing or proposed services and equipment. The Panel is of the view that there is a need to continue consultation with Indigenous groups on the relevance of these services to them, and to ensure Indigenous groups are equipped to benefit from the increase safety provided through these initiatives. This is particularly applicable to Segment D.

The Panel considered the potential mitigation measures proposed by Indigenous groups with respect to the regulation of marine traffic and is of the view that all feasible solutions must be explored by the federal government in collaboration with Indigenous groups, including the relocation of the international shipping lanes. The Panel understands Transport Canada is

presently in discussion with the USA and intends to undertake a feasibility study related to the relocation of the shipping lanes. The Panel understands that any relocation of the shipping lanes would require coordination through the International Maritime Organization.

The Panel concludes that some Indigenous groups would experience changes to the ability to access marine lands and resources and changes to the quality of experience due to increased safety risk which would result in an adverse effect on their current use.

Pacheedaht First Nation

The Panel recognizes that the marine shipping area overlaps Swiftsure Bank and that Swiftsure Bank is the primary harvesting area used by Pacheedaht. The Panel is of the view that Pacheedaht adequately demonstrated that they harvest extensively in the shipping lanes at Swiftsure Bank and travel across the shipping lanes to access other harvesting locations and to visit relatives at Neah Bay, USA.

The Panel agrees with Pacheedaht that large commercial vessels that transit through Swiftsure Bank pose challenges to Pacheedaht. This is most notable in their ability to safely harvest at Swiftsure Bank, practice cultural activities, and transfer Indigenous traditional knowledge to their youth.

The Panel is of the view that the Project-associated marine shipping would cause a minor adverse effect on Pacheedaht's ability to access preferred current use locations at Swiftsure Bank. The Project would also affect the quality of their current use experience at Swiftsure Bank. The Panel accepts that the safety concerns expressed by Pacheedaht are preventing Pacheedaht members from bringing children and elders out to a culturally important area, and that this is disrupting the intergenerational transfer of knowledge. The Panel disagrees with the Proponent that the safety risk is only perceived. The Panel is of the view that the interference of Project-associated vessels with Pacheedaht vessels harvesting at Swiftsure Bank or travelling across the shipping lanes poses a real risk to the safety of Pacheedaht members affecting both access and quality of experience.

While there is a potential for individual harvesters to interact negatively with a large commercial ship, not all fishing activities would take place in the path of a ship, or occur during a ship pass-by. Given this observation, the Panel determined that the effect on access and the quality of experience would be of low magnitude. The additional ships associated with the Project would cause a noticeable change to Pacheedaht's experience when they do interact, however the added number of ships is not enough to affect the quality of experience of each Pacheedaht harvester, making the effect sporadic. The effect on the quality of experience would last beyond a generation given the lifespan of the Project and would cover a large spatial area used by the Pacheedaht.

Given the overall low likelihood of an interaction between Pacheedaht harvesters and Project-associated ship pass-bys the Panel concludes the Project would not result in a significant adverse effect on Pacheedaht's current use.

The Panel concludes that marine shipping associated with the Project would result in a residual adverse effect on the current use of lands and resources for traditional purposes for the Pacheedaht First Nation. The effect would not be significant.

Ditidaht First Nation

The Panel recognizes that Swiftsure Bank is an important harvesting area used by Ditidaht. The Panel accepts the concerns raised by Ditidaht regarding the safety risks that large commercial vessels pose on Ditidaht's ability to harvest at Swiftsure Bank. The Panel agrees that the transit of large vessels through Swiftsure Bank also affect Ditidaht's ability to transmit Indigenous traditional knowledge resulting in lost opportunities to pass on current use practices to the next generation. The Panel recognizes that the Project does not prevent the Ditidaht from using Swiftsure Bank, however the safety risk and challenges Ditidaht users face are a cause for concern and highlight the need for more effective mitigation measures.

The video shared by Ditidaht during the public hearing provided the Panel with clear insight into the fear felt by harvesters, and the challenges they face when they encounter large ships in the shipping lanes. It was evident that ship-wake waves and the ability to quickly get out of the way of a passing ship were both challenges. The Panel is of the view that additional ships from the Project will exacerbate safety concerns that are preventing Ditidaht members from bringing children and elders to a key harvesting area, disrupting the intergenerational transfer of knowledge.

The Panel expects that the addition of three ship movements every two days would cause a minor effect on Ditidaht's quality of experience at Swiftsure Bank due to real safety concerns caused by each ship transit. The additional ships would cause a slight noticeable change in Ditidaht's quality of experience when they interact with Ditidaht vessels, but the added number of ships due to the Project is not large enough to interact with, and therefore affect, each harvester. The Panel is aware that Ditidaht does not have the capacity to engage in real-time communication proposed by the Proponent to mitigate concerns related to safety. The Panel concludes that marine shipping associated with the Project would affect both access and the quality of experience beyond one generation given the lifespan of the Project. Given that these effects are only likely to cover a moderate spatial extent relative to Ditidaht's harvesting area the Panel concludes that the Project would result in an adverse effect on current use that is not significant provided the Proponent provides Ditidaht with the capacity to effectively communicate in real-time.

The Panel concludes that marine shipping associated with the Project would result in a residual adverse effect on the current use of lands and resources for traditional purposes by the Ditidaht First Nation. The effect would not be significant.

First Nations of the Maa-nulth Treaty Society

The Panel is aware that the marine shipping area intersects with the portion of the Maa-nulth Domestic Fishing Area as defined in the Maa-nulth First Nations Final Agreement. The Panel recognizes that ship traffic travelling through that area could have an effect on the Maa-nulth's right to fish by affecting their ability to access part of their Treaty area and in their ability to enjoy the experience. The Panel heard evidence from the Maa-nulth that fishing is an integral part of their culture and that large commercial ships raise safety concerns for their members out on the water. As presented in Section 5 - Marine Shipping Associated with the Project, in 2018 approximately 293 container ships calling at Deltaport Terminal had traversed with the Project Maa-nulth Domestic Fishing Area South, and a smaller number had traversed the Maa-nulth Domestic Fishing Area North.

The Panel concludes that Project-related marine shipping would have an effect for the Maa-nulth in terms of access and the quality of experience, resulting in a moderate adverse effect on their current use of the marine shipping area. The marine shipping area overlaps with a small portion of the Domestic Fishing Area and the number of ship pass-bys is only three movements every two days. Therefore, the Panel considers the residual effect to be not significant.

The Panel concludes that marine shipping associated with the Project would result in a residual adverse effect on the current use of lands and resources for traditional purposes by the Maa-nulth Nations. The effect would not be significant.

Cumulative Effects Assessment

The Panel heard extensively from Pacheedaht, Ditidaht, and the Maa-nulth that they were experiencing adverse effects on their current use due to the cumulative effects of the existing ship traffic travelling through their traditional territories. The Panel agrees that the addition of ships will exacerbate these effects.

The Panel heard Pacheedaht and Ditidaht members describing how the existing ship traffic was affecting their ability to harvest at Swiftsure Bank. In Pacheedaht's view they have already reached a safety risk threshold and any increase in vessel transit would be unacceptable. Pacheedaht also described how the existing physical presence of large vessels and associated dangers detracted from their joy of being on the water and engaging in fishing practices. For many Pacheedaht people, this is presently resulting in avoidance of harvesting at Swiftsure Bank or in the vicinity of the shipping lanes throughout Pacheedaht Territory. The Panel also heard convincing evidence from Ditidaht that fishers are encountering a large number of ships when harvesting on the water, and the subsequent safety concerns are preventing them from bringing youth and elders out on their boats.

The Panel is of the view that there would be a cumulative effect on current use for Pacheedaht and Ditidaht at Swiftsure Bank. At present, traditional activities are not currently practiced in the preferred manner because of existing marine shipping, which has been exacerbated by the

shifting of the shipping lanes. While the Panel has already acknowledged efforts taken by Transport Canada to remedy the safety risks, the Panel stresses that immediate changes are needed to reduce interactions between commercial vessels and smaller fishing vessels and to improve communication to mitigate cumulative effects.

The Panel acknowledges that there has been a cumulative loss in the ability to transmit Indigenous traditional knowledge at Swiftsure Bank that will continue for an extended period of time with the addition of the Project-associated shipping and may not be reversed. The cumulative effect on both access and quality of experience would be permanent and would last beyond a generation as ships will continue to pass by indefinitely. The Panel concludes that Project's associated marine shipping in combination with other ship movements at Swiftsure Bank would result in significant cumulative effects on access and quality of experience for Pacheedaht and Ditidaht.

The Panel acknowledges that the Maa-nulth are currently experiencing adverse effects on their current use in their Domestic Fishing Areas due to the existing volume of commercial ships. The Maa-nulth shared information with the Panel about the importance of ocean resources to their society and culture, and their concern about how those resources continue to be eroded, diminishing the ability of the Maa-nulth to harvest them.

The Panel also concludes marine shipping associated with the Project would cause a cumulative effect on the current use for Maa-nulth within the portion of the Domestic Harvesting Areas that overlap with the marine shipping area. While marine shipping associated with Project alone would not have a large effect on Maa-nulth's current use, the Panel is of the view that all of the ships passing through the Maa-nulth Domestic Harvesting Areas constitute a cumulative effect on current use of moderate magnitude given the total number of ships transiting through each day. The Panel concludes that effects on access and quality of experience would result in an adverse cumulative effect on current use within the Maa-nulth's Domestic Harvesting Area. In view of the small area affected, the effect would not be significant.

The Panel concludes that marine shipping associated with the Project would result in an adverse cumulative effect on the current use of lands and resources for traditional purposes by the Pacheedaht First Nation, the Ditidaht First Nation and the Maa-nulth Nations. The cumulative effects would be significant for the Pacheedaht First Nation and the Ditidaht First Nation.

Other Indigenous groups

The Panel acknowledges that all of the Indigenous groups in the marine shipping area provided evidence of extensive traditional use of areas that overlap with the marine shipping area. However, the extent of most groups' current use of the marine shipping area and interaction with commercial ships, was less clear. A few Indigenous groups identified current harvesting practices in the Gulf Islands or at Swiftsure Bank where they would interact with the shipping

lanes. For example, the Panel heard from Pauquachin First Nation that they continue to harvest in the marine shipping area, using small vessels in Segment B. Tsawwassen has Treaty harvesting areas that extend to Galiano Island and thus overlap Segment B. Scia'new First Nation indicated that they fish at Swiftsure Bank. Cowichan Nation Alliance indicated that they hold communal fishing licences that overlap with Segment A of the marine shipping area. However, the groups did not specify the extent to which they currently accessed those areas

Although the Panel does not have clear evidence on the extent of current use, the Panel heard clearly from Indigenous groups their concerns around the potential effects of marine shipping in their traditional territories. The Panel heard from several Indigenous groups about the safety concerns they face out on the water due to both the wake from commercial ships and the threat of collision. The Panel was informed by Indigenous groups that fishermen do not take unnecessary risks. However, many Indigenous peoples underlined the fact that it has become more difficult to travel in the marine shipping area or to cross the shipping lanes due to safety risk. The Panel was made aware that, in general, boats used are small compared to container ships that are between 320 to 400 meters long or 1050 to 1300 feet. For instance, the Pauquachin use 18-foot power boats and the Musqueam use 16 to 38 foot boats. The Panel accepts the concerns raised in relation to safety in the marine shipping area, and agrees that marine shipping associated with the Project would cause an effect when there are interactions with Indigenous people engaged in current use activities.

Overall, the evidence the Panel received was not clear as to how the Project would affect other Indigenous groups harvesting activities in the marine shipping area. Regardless, the Panel is of the view that the Project would affect the quality of experience due to safety concerns for any group harvesting in the shipping lanes or traversing the shipping lanes to reach preferred harvesting sites, resulting in a residual effect. Additional ships in the marine shipping area would cause safety concerns due to vessel wake and increased possibility of accidents. Because the extent of current use is unclear, the Panel cannot determine the significance of the effect.

The Panel concludes that the marine shipping associated with the Project would result in a residual adverse effect on the current use of lands and resources for traditional purposes by Indigenous groups that harvest in, or traverse, the marine shipping area. The significance cannot be determined.

Cumulative Effects Assessment

The Panel acknowledges that the Indigenous groups across the marine shipping area expressed concern with the existing state of the resources in their traditional territories. The Panel heard the assertions from Indigenous groups across the marine shipping area that they had been pushed out of their traditional territories, existing conditions had alienated them from their patterns of traditional harvesting, and that their current use of their traditional territories was generally lower than desired. Several groups noted that they were already facing a threshold where any further development would irreversibly harm their culture and traditional practices. The Panel

recognizes the importance that Indigenous groups place on being able to continue their traditional uses and activities within their traditional territories. The Panel agrees with the Proponent that the Indigenous groups in the marine shipping area are already facing cumulative effects from the existing development and marine traffic in their traditional territories. The Panel disagrees however with the Proponent's assertion that marine shipping associated with the Project would not measurably contribute to the existing effects.

The Panel accepts the assertion of some Indigenous groups that a threshold of harm has already been reached and that the marine shipping associated with the Project would exacerbate existing adverse residual effects. The Panel understands that for all Indigenous groups using the marine shipping area, the quality of the current use experience is degraded with each commercial ship that passes by while members are undertaking current use activities. Interactions with commercial ships cause both real and perceived safety concerns and fear among Indigenous harvesters as well as boaters participating in traditional activities on the water. The ship traffic also impedes Indigenous group's ability to safely access preferred harvesting sites or travel routes. As a result, the traditional activities which may be further affected by the Project are already not currently practiced in the preferred manner because of marine traffic.

In many instances, it is not possible for Indigenous groups to follow traditional routes, or use alternative routes, without traversing the shipping lanes. In this instance, the Panel finds that current use practices are likely to be disrupted or limited as a result of the cumulative effects of past, existing and future projects or activities as displacement of practice to another area is not possible. The Panel finds that the potential cumulative effect on current use could occur over a moderate to extensive portion of the area presently used by Indigenous groups.

The Panel concludes that there is a cumulative effect on current use for Indigenous groups who traverse the shipping lanes to practice traditional activities. However, because the overall extent of current use for each individual Indigenous group is unclear, the Panel cannot determine the significance of the cumulative effect.

The Panel concludes that the marine shipping associated with the Project would result in an adverse cumulative effect on the current use of lands and resources for traditional purposes by Indigenous groups that harvest in, or traverse, the marine shipping area. The significance of the effect cannot be determined.

Recommendation 40

As part of the Ocean Protection Plan initiatives the Panel recommends that Transport Canada, in collaboration with the Proponent, Indigenous groups and other stakeholders, develop and implement a program that facilitates safe harvesting in and around shipping lanes in the Project area and the marine shipping area (Segments A, B, C, and D). The Program should include:

- *An evaluation of conditions affecting Indigenous groups' ability to safely access and harvest in fishing areas prior to construction of the Project and for the first five-year*

period of operations in order to determine the effects from marine shipping activities associated with the Project;

- *An identification of measures to prevent further cumulative effects, particularly at Swiftsure Bank, the Gulf Islands and the Salish Sea;*
- *A proposal to map out different options for the relocation of the shipping lanes and the need for the addition of tug escorts and any resulting effects; and*
- *An assessment of the needs for maritime technical capacity for the Pacheedaht First Nation, the Ditidaht First Nation, the Pauquachin First Nation and the Maa-nulth Nations. This should include the capacity to anticipate and monitor vessel traffic and to engage in real-time communication with large commercial ships and the Marine Communication and Traffic Service.*

17 Physical and Cultural Heritage Resources

In this section, the Panel examines the effects of the Project on physical and cultural heritage and any structure, site, or thing that is of historical, archaeological, paleontological or architectural significance.

The Panel recognizes that an Indigenous group's spiritual and cultural practices are often integrally linked to specific locations, harvesting practices, and surrounding landscape features, as well as objects of social and cultural significance. Although the views of participants were not duplicated in this section of the report the Panel emphasizes that it took those views presented in Section 16 - Current Use of Lands and Resources for Traditional Purposes into consideration when assessing physical and cultural heritage.

17.1 Physical Resources - Project Area

In this section, the Panel reviews the potential effects on physical heritage resources as a result of the construction of the Project, most notably the placement of the marine terminal and the expansion of the causeway.

17.1.1 Proponent's Assessment

The Proponent completed an assessment of archaeological and physical heritage resources in general conformance with the *B.C. Archaeological Impact Assessment Guidelines* (B.C. Archaeology Branch 1998). The Proponent also assessed effects on culturally important sites, structures, objects, and viewscapes as part of current use of lands and resources for traditional purposes and impacts on Aboriginal and Treaty rights. Paleontological, historical, and architectural resources were excluded by the Proponent because none were identified in the assessment area.

Land-based Sites

The Proponent identified that the RAA comprised of five previously identified land-based sites, four of which were listed as cultural and historic sites of significance to Tsawwassen in the *Tsawwassen First Nation Final Agreement* (2009) and were to be designated as Provincial Heritage Sites. Four of the archaeological sites are located between 2.8 and 3.8 km away from the Project, and one heritage site is 1.2 km away. The Proponent did not expect effects from the Project on any of the five land-based sites (DgRs-2, DgRs-9, DgRs-11, DgRs-35, and DgRs-55).

Onshore Zone

The Proponent stated that there was low potential for archeological material to be present in the narrow onshore area due to previous development of the existing causeway and rail yard facilities. As a result, no effects from the Project were expected.

Subtidal Zone

The Proponent stated that the deep water and subtidal areas had a very low potential for archaeological material due to the distance from shore and active depositional nature. As a result, no effects from the Project were expected.

Intertidal Zone

The Proponent's archaeological and physical heritage resources study focused on areas, primarily within the intertidal zone, previously undisturbed by development that either contained recorded archaeological sites or exhibited the potential for new, unrecorded, archaeological sites. The Proponent indicated that past differences in sea level and the progression of the Fraser River delta heavily influenced past human occupation and land use patterns, and influenced the current state of preservation of human occupation. The Proponent expected Project-related effects on archaeological and heritage resources would be limited to the Project footprint within the intertidal zone. However, the Proponent acknowledged that ongoing geomorphological change at the boundary between the Fraser River delta and the Tsawwassen upland could result in changes in tidal currents and sediment mobilization and exposure of buried archaeological sites in the intertidal and subtidal zones.

The Proponent reported that, based on Indigenous traditional knowledge indicating the locations of sturgeon fish traps, or *tqep*, the most likely occurrence of archaeological features would be around an infilled historic tidal channel that previously drained Canoe Passage and cuts across the Roberts Bank causeway approximately 300 m to 400 m from shore, as indicated in Figure 17-1. The Proponent expected that the wooden remains of tidal sturgeon weirs would be the only artifact that could be present in the intertidal area. The Proponent reported that previous large-scale ethnographic and archaeological studies in the area have provided information on the size, use, approximate location of the tidal weirs, in addition to the associated harvesting practices.

The Proponent noted other methods of traditional fishing, including bag or trawl nets, and harpooning from drifting canoes and reef netting, were unlikely to leave archaeological evidence where they were used. Isolated artifacts that were dropped or lost could also be present, but the potential was considered very low.

The Proponent noted that any fish trap stakes located in the intertidal area were likely preserved by anaerobic conditions in the sediment layers, however it could not determine whether fish weir remnants were present within the Project footprint. The Proponent stated that construction could indirectly expose fish trap stakes, if present, if the predicted increase in tidal flows eroded sediments surrounding fish trap stakes causing them to be exposed. Exposure of the fish traps stakes would result in a degradation of the artifact.



Source: Eldridge and Blackburn (2014)

Figure 17-1: Intertidal zone moderate potential for fish trap remains and location of historic drainage channel (Source: EIS, Volume 4)

The Proponent identified three pathways of effects on fish trap stakes, if present, from construction of containment dykes and filling and preloading causeway areas:

- Crushing or biological degradation of fish trap stakes;
- Reduced access for future archaeological study or preservation of potential fish trap stakes; and
- Exposure of fish trap stakes.

As mitigation for these effects, the Proponent proposed to excavate a test trench, or series of trenches, across the eastern end of the causeway expansion area. The Proponent stated that the excavation of the test trench would enable development of an inventory of the potential presence of artifacts such as fish trap stakes and would help mitigate future Project-related effects from crushing or biological degradation of fish trap stakes. The Proponent noted that while the test trench would largely mitigate reduced access for archaeological study it would not completely mitigate the effect.

The Proponent also proposed erosion monitoring of the historic tidal channel over a period of four years in case of an occurrence of fish trap stakes. The Proponent noted that annual tidal erosion monitoring would provide an opportunity for further archaeological sampling and investigation if fish trap stakes were found or exposed; however, it would not mitigate the exposure and subsequent degradation of fish trap stakes.

The Proponent concluded that, despite mitigation proposed, crushing or degrading of fish trap stakes, if present, would result in a permanent and irreversible residual effect that was of high magnitude. The Proponent also concluded that the Project would result in a low magnitude residual effect on access to areas of archaeological potential, and that effect was fully reversible because the overburden of fill material could be completely removed at a future date. The Proponent concluded that there would be an effect of moderate magnitude on fish trap stakes near the historic drainage channel resulting from predicted scour.

The Proponent committed to implementing an Archaeological Monitoring and Management Plan, which included a chance find procedure to appropriately manage any inadvertent discovery of cultural materials or artifacts. The Proponent stated that the chance find stop-work procedure would include seeking professional archaeological advice from the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD) when suspected cultural materials or artifacts were found during construction, notifying regulators and Indigenous groups of any chance finds, assessing the find for significance, and determining mitigation strategies on a case-by-case basis.

The Proponent concluded that all identified residual effects on physical heritage were not significant because the proposed mitigation measures would provide an opportunity for recovery of scientific evidence about fish trap stakes, if discovered.

Cumulative Effects Assessment

The Proponent stated that the assessment of residual and cumulative effects considered effects on archaeological and heritage resources within the context of cultural areas and traditional territories of Indigenous groups. The Proponent noted that existing developments near the Project that have caused previous disturbance in similar physical environments included the following:

- BC Ferries Tsawwassen Terminal, in operation since 1959;
- Westshore Terminals, in operation since 1970;
- Deltaport Terminal, originally in operation in 1997, and the Third Berth, in operation in 2010; and
- Vancouver Island Transmission Reinforcement Project, commissioned in 2008.

The Proponent noted that there were no previously recorded archaeological sites identified in the LAA, and no remnants of intertidal fish weirs or fish trap stakes were documented as exposed or affected by past or present projects and activities. The Proponent stated no information available on archaeological sites from the construction of the BC Ferries Tsawwassen Terminal and no archaeological materials were encountered for the Deltaport Way Extension or the Deltaport Third Berth Expansion projects. The Proponent explained that intertidal areas of archaeological potential near historic drainage channels had been capped by the existing causeway, possibly crushing or degrading fish trap stakes that were present.

The Proponent concluded that there were no anticipated incremental effects of other certain and reasonably foreseeable projects and activities that could interact with a Project-related residual effect on archaeological and heritage resources to result in a cumulative effect. As a result, no cumulative effects were identified.

17.1.2 Views of Participants

Several Indigenous groups raised concerns with respect to the possible presence of archeological sites and cultural heritage sites in the vicinity of the Project, including the potential for sites other than the fish trap stakes noted by the Proponent.

FLNRORD agreed with the Proponent that greatest potential for archaeological resources within the Project footprint was confined to the intertidal zone consisting of the remnants of former fish weirs or traps.

FLNRORD noted that the relevant provincial legislation for the management and protection of archaeological values was the *Heritage Conservation Act*. FLNRORD confirmed that all archaeological sites identified by the Proponent on provincial lands would be protected under this legislation. For proposed developments, such as the Project, the legislation did not apply to those parts on federal lands.

Parks Canada, which has a mandate to protect and preserve archaeological resources found on federal lands, noted that they concurred with the Proponent's findings and were of the view that the mitigation measures proposed were reasonable and appropriate for the Project.

17.1.3 Panel Analysis

The Panel agrees with the Proponent's conclusion that the Project would not have an effect on paleontological, historical, or architectural resources, as none were identified in the LAA by the Proponent or FLNRORD.

The Panel agrees with the Proponent, FLNRORD, and Parks Canada that the area of greatest archaeological potential is the intertidal zone consisting of the remnants of former fish weirs or traps, and that the mitigation proposed is appropriate. The Panel agrees with the Proponent that the Project would not result in an effect on land, onshore, or subtidal archaeological sites. The Panel agrees with the Proponent's conclusions that the residual effect of the Project on crushing or degrading potential fish trap stakes would be high in magnitude and site-specific, but restricted to the intertidal zone.

Since access to areas of archaeological potential outside of the Project footprint will remain, the Panel is of the view that the effect can be considered site-specific and would occur only once with construction. The Panel disagrees with the Proponent's statement that the effect would be fully reversible by removing the overburden of fill material. The Panel is of the view that it is unrealistic to remove fill material and thus the effect is irreversible.

The Panel agrees that the effects of the Project related to exposure and subsequent degradation of fish trap stakes are moderate in magnitude, local in extent, and frequent as exposure would occur gradually and repeatedly. The potential adverse effect would be permanent and irreversible.

The Panel is aware that if there is a chance find during construction which is located under provincial crown land tenures, the Proponent must inform FLNRORD. The Panel is of the view that for all finds located in areas under Crown federal tenures, the Proponent should report this find to both FLNRORD and Parks Canada so the governments can coordinate the most effective plan of action with the Proponent and Indigenous groups.

The Panel agrees with the mitigation and monitoring plan proposed by the Proponent to avoid the destruction of fish trap stakes, preserve any samples found and provide for further scientific archaeological information. Although the test trench will sample the area of archaeological potential, the Panel notes it will not completely investigate the entirety of the Project area of possibly containing fish trap stakes; thus, the potential remains for crushing or degradation of fish trap stakes not identified during the test trench mitigation. In addition, the Panel anticipates that four years of annual tidal erosion monitoring would offer an opportunity to undertake further archaeological sampling and investigation if fish trap stakes are found or exposed, such as in the historical channel near Canoe Passage.

The Panel concludes that while the proposed mitigation only partially mitigates the effect on physical heritage from the Project, since there is existing archeological, ethnographic, and

Indigenous traditional knowledge on tidal fish traps, the residual effects on physical heritage would not be significant.

The Panel concludes that the Project would result in a residual adverse effect on physical heritage if fish trap stakes are present. With implementation of proposed mitigation this effect would not be significant.

Recommendation 41

The Panel recommends that the Proponent prior to construction be required to:

- *Excavate a series of trenches, across the eastern end of the causeway expansion area within the area of moderate archaeological potential, and within the historic channel, located northwest of the terminal, formerly draining Canoe Passage; and*
- *Provide an inventory of fish trap stakes found and ensure their protection and archaeological investigation.*

Recommendation 42

The Panel recommends that the Proponent be required to:

- *Monitor annually during construction and for five years of operations, the erosion of the historic tidal channel that lies northwest of the terminal, formerly draining Canoe Passage; and*
- *Manage chance-find artifacts including undertaking further archaeological sampling and investigation as appropriate.*

Cumulative Effects Assessment

The Panel recognizes that intertidal areas of archaeological potential may have been covered by the existing causeway possibly crushing or degrading fish trap stakes that were present. Past projects such as the Roberts Bank terminal and causeways may have affected other potential archaeological sites. There is, however, a lack of publicly available information with respect to the effects of previous projects on marine archaeological sites. The Panel agrees that there are no future projects in the RAA that would interact with Project-related residual effects either due to their distance from the Project area or the nature of the activities. For these reasons the Panel cannot assess potential cumulative effects on marine-based sites.

17.2 Physical Resources - Marine Shipping Area

In this section, the Panel looks at effects due to erosion on archaeological and ethnographical sites located in the marine shipping area. The Panel also examines effects from the marine shipping associated with Project in relation to national parks and historic sites, national marine conservation areas, and related heritage areas, and transboundary effects.

17.2.1 Proponent's Assessment

The Proponent evaluated archaeological and heritage resources above and below sea-level, as well as heritage shipwrecks within the marine shipping area. The Proponent noted that archaeological sites and areas of archaeological potential could be found at various locations throughout the marine shipping area. The Proponent stated that, with the exception of shipwrecks, no marine shipping activities were anticipated to interact with paleontological, historical, or architectural resources.

The Proponent indicated the sensitivity of shoreline archaeological sites potentially affected by marine shipping was largely related to the geological composition of the shoreline (rock or erodible sediment) and the extent to which the shoreline was exposed to, or protected from waves. The Proponent indicated that wind-wave and current activity remain the dominant forces shaping shorelines facing the marine shipping lanes. The Proponent stated that historical and architectural resources present in the marine shipping area were assumed to have been constructed to withstand physical effects from marine shipping, such as from wakes within the range of naturally occurring wave conditions.

The focus of the Proponent's archaeological and heritage resources assessment was on the shore zone environment within Segment B based on the following:

- The distance that wake waves from marine shipping associated with the Project were considered to have potential measurable changes; and
- Where a potential for interaction between effects from marine shipping and archaeological and heritage resources intersects with predicted vessel wake wave heights of 10 cm or greater.

This area encompassed a number of islands and shorelines in British Columbia and Washington State, USA. In British Columbia these included three specific zones of vessel wake-wave interaction with the shoreline: the eastern ends of Tumbo and Saturna islands; the western end of Stuart Island; and the Victoria coastline including Discovery, Chatham, Trail, and Chain Islands. In Washington State this included the west portion of Stuart Island.

The shoreline types along Segment B are largely bedrock and resistant to erosion.

The Proponent noted that archaeological sites and areas of archaeological potential could be found at various locations throughout the RAA, particularly along shorelines in proximity to freshwater sources and/or marine resources. These sites included: burial cairns, canoe runs, clam gardens, cultural depressions, culturally modified trees, defensive sites, fish traps, lithic scatters, pictographs, petroglyphs, wet sites, and middens which are the most abundant type of site, typically along coastlines, and marked camps and settlements where household refuse accumulated.

Specifically, the Proponent stated the following with respect to sites of archaeological importance to Indigenous groups:

- Ditidaht reported that there are archaeological sites along the foreshore just north of the shipping route, including burial sites and pictographs.
- Pacheedaht identified important sites, such as villages and camps, in and around the western aspect of Strait of Juan de Fuca. Pacheedaht reported that their historical villages were integral to their culture and their marine resource harvesting activities. These villages were located at Jordon River, Boulder Beach (between Magdalena and Simon Points), Sombrio River, Botanical Beach, Port San Juan, Robertson Cove, Port Renfrew, and other locations near marine, river, or lake shorelines.
- Semiahmoo reported burial grounds along shorelines in the San Juan and southern Gulf islands and archaeological sites, including petroglyphs at Crescent Beach.
- Scia'new First Nation reported that the coast and islands of Strait of Juan de Fuca, within the marine shipping area, are lined "from Race Rocks to Port Renfrew, and again on the US side," with registered archaeological sites, burial sites, and sacred sites.
- Esquimalt Nation identified historic village sites at Portage Inlet and Victoria Harbour, as well as Flemming Bay and multiple locations in the Gorge waterway connecting Victoria Harbour with Portage Inlet. Burial sites were also identified for Small Pox Island, D'Arcy Island, Brothers Islands, and Inskip Island.
- Tsartlip First Nation reported burial sites and midden sites within the marine shipping area, but specific locations were generally not identified.
- Tseycum First Nation reported that marine traffic is affecting grave sites along shorelines and, grave robbing has occurred at some that are eroded.
- Tsawout First Nation reported grave sites at Scull Island (south of Pender Island), in the Salt Spring Island area and village sites in the San Juan Islands.
- Malahat First Nation reported cultural use sites in the Gulf Islands, on Mayne Island (burials), North and South Pender islands, the San Juan Islands (Orcas and San Juan), and on Moresby Island.
- The Cowichan Nation Alliance reported numerous sites of importance in the marine shipping area.
- Lyackson reported sites on Valdes Island and at Montague Harbour.

In addition, the Proponent noted that reef-net fishing sites, as evidenced by accumulated anchor stones used to hold this type of fishing net, are located throughout the RAA and have been reported near Sooke, Beecher Bay, Victoria, San Juan Islands, Gulf Islands, Point Roberts, and Lummi Island.

The Proponent further noted that a shipwreck, the *Rosalia*, was located 200 m southwest of Sea Bird Point, on the south side of Discovery Island and another shipwreck, the *Fanny*, was located at the east entrance to the channel between Chatham and Discovery islands. The Proponent indicated that neither wreck would be affected by wake-waves related to marine shipping associated with the Project because of their depth. The Proponent stated the potential for discovery of underwater archaeological sites, from past periods of lower relative sea level, would be limited to sheltered bays or locations related to specific types of use such as reef-net anchors and shipwrecks.

The Proponent provided detailed descriptions of archaeological sites along the marine shipping area and inside the zones where wake-waves of heights in the range of 10 to 12.5 cm, 12.5 to 15 cm, 15 to 20 cm, and 20 – 25 cm were expected. The Proponent noted that many of the recorded sites had and would continue to be impacted by wind-wave exposure and erosion.

The Proponent stated that the archaeological potential was:

- Low or moderately low for most of the shoreline of Stuart Island;
- High for specific areas of Saturna Island and Tumbo Island; and
- High for most of the Victoria coastline.

The Proponent noted that two archaeological sites on Saturna Island are reportedly being impacted by wave exposure at a slow rate and a third at a moderate rate, but this last site was sheltered from wake-wave effects. In the Victoria area, four sites in the 10 to 12.5 cm zone were currently being impacted by wave erosion and none are being impacted in wake-wave height zones higher than 12.5 cm.

The Proponent presented no specific archaeological data, as none was available, for Discovery Island and Chatham Island. The Proponent also reviewed archaeological site locations in the San Juan Islands and indicated that only the Turn Point Lighthouse on Stuart Island was within the greater-than-10 cm wake-wave height zone. The Proponent indicated that, as this historical site is located on a steep rocky shoreline with high wave exposure, no effects by vessel wake waves related to Project-associated marine shipping were anticipated.

The Proponent concluded that vessel wake effects on archaeological sites and heritage resources could result in an increase in breakage and water-rolling of artifacts in intertidal sites as a result of increased movement of on-shore sediments or disturbance of site integrity from increased shoreline erosion. This in turn may result in exposure of shoreline sediments, disturbance of sediment layers, features, and artifacts, or redistribution of cultural materials along the shoreline. The Proponent indicated the vessel wake effects would be negligible as a result of the following:

- A very small percentage (two percent) of the coastline was within the wake-related zone of influence;
- Modelled wake heights at shorelines were well within the range of natural wave conditions; and
- While the added wave energy could be modelled and the number of sensitive sites along exposed shorelines could be identified, the potential wave effect is so minor relative to wave effects from many other sources, particularly winter storms during high tide, that the potential effect on archaeological and heritage resources from vessels associated with the Project cannot be measurably distinguished.

The Proponent concluded that the only physical mechanism for Project-related effects on archaeological sites was vessel wakes, which were predicted to be within the natural variation in size of wind waves and would reflect only a small percentage of the annual maximum storm wave energy. Further, most shores in the assessment area were rocky and erosion resistant and the occurrence of archaeological sites in exposed sites with soft substrate were rare. The

Proponent stated that, given tidal ranges, the only time vessel wakes would have a minor contribution to erosion of archaeological sites along the shoreline was when waves arrived at seasonal high tides. However, this occurrence would be rare considering the limited number of ship wake wave events generated per day and the limited time that water levels were at seasonal high tide.

The Proponent concluded that the contribution of wake waves from marine shipping associated with the Project to erosion of shoreline sediments containing known or unrecorded archaeological sites was negligible. The Proponent also concluded that underwater features made from rocks, such as reef-net anchors, and shipwrecks, were not likely to be affected by wake waves from marine shipping associated with the Project.

The Proponent stated that while it may be possible to measure the rate of erosion at a particular site, it would be impossible to isolate and measure the effect attributable to marine shipping associated with the Project. The Proponent concluded that the potential effects of the Project associated marine shipping on archaeological and heritage resources was negligible, and that no measurable residual effects were expected.

No mitigation measures were suggested by the Proponent for vessel wakes from marine shipping associated with the Project given that the potential wake-related effects on archaeological and heritage resources were rated as negligible.

Cumulative Effects Assessment

The Proponent indicated that there was insufficient data to evaluate historical projects or activities and that it was not possible to measure any effect as a result of wake-wave effects specifically attributable to marine shipping. The Proponent indicated that the erosion of shoreline sites in exposed areas was mainly, or wholly attributable, to erosion from natural wave conditions, particularly seasonal storms occurring at high tides. As a result, the contribution of wake waves from shipping associated with the Project to erosion of shoreline sediments containing known or unrecorded archaeological sites would be negligible.

Transboundary Effects Assessment

The Proponent stated that effects on archaeological and heritage resources were expected to be similar in USA and Canadian waters, given the similar types of marine shipping activities and the similar types of archaeological sites. An assessment of cumulative effects on archaeological and heritage resources was not conducted as routine marine shipping associated with the Project was not expected to result in any measurable change in archaeological and heritage resources that would be likely to interact cumulatively with changes caused by other projects or activities that have been or will be carried out.

17.2.2 Views of Participants

Pacheedaht noted concern that the wake from Project-related vessels could erode and damage shoreline archaeological sites. Tsleil-Waututh noted that erosion was already occurring at some

archaeological sites along the shipping routes, and would only get worse with the Project. Similarly, Malahat First Nation noted that the effects on shoreline archaeological and heritage resources from Project-related vessel wake would add to those which already occurred due to wind waves. The Tsawout First Nation reported that important sites included locations associated with their culture, such as SENĆOTEN named places, reef-net sites, anchorages, gravesites, archaeological sites, longhouse sites, special or sacred story locations, or clam gardens. Tsawout First Nation's proposed for funding to protect shoreline sites and to assist with reburial ceremonies; this concept was also supported by the Malahat First Nation.

Songhees Nation was concerned about adverse effects on important cultural and spiritual archaeological sites on Tl'ches, an archipelago located a few kilometers off Oak Bay in the Strait of Juan de Fuca, encompassing both Chatham and Discovery Islands. Songhees Nation noted that Tl'ches was once the site of an important Songhees village and it contained middens, burial cairns, and other sacred sites, as well as the important creation site of the Lekwungen peoples. Songhees Nation stated that the intertidal zone had a very high potential for undisturbed archaeological deposits. Songhees Nation indicated that further subsurface testing in intertidal zones would be necessary to understand the extent of the archaeological resources at Tl'ches.

Pauquachin First Nation noted that there were a number of sites of significant importance containing ancestral remains in the Gulf Islands and expressed concern that shoreline erosion was affecting these sites. Dr. Peter Evans indicated that WSÁNEĆ people frequently expressed concern about coastal erosion of sacred sites, burial sites, and middens in the southern Strait of Georgia. Dr. Evans further noted that there were people in the WSÁNEĆ communities, called grave diggers, whose role was to properly deal with human remains, and they spend time in places where sacred sites and burial sites have been affected by erosion. Dr. Evans noted that the most exposed areas were around Saturna Island. Chief David, of the Pauquachin First Nation noted that "we always have a hard time in terms of moving our spiritual ancestors and there has to be a ceremony that goes along with it." Chief David stated that ancestral history was being washed away as a result of vessels in the Salish Sea.

Semiahmoo noted that significant archeological sites were at risk from coastal climate change as well as increased shipping in the Salish Sea. The Lake Cowichan First Nation and Lyackson First Nation expressed concern with respect to erosion of culturally important sites along the shoreline. They proposed to introduce a slow bell, as an audible signal for ships to reduce their speed, to help mitigate impacts of shoreline erosion from ship wake on culturally important sites (e.g., burial grounds) and other sites that knowledge holders could identify. Friends of San Juan complained about the effects of increase shipping on their conservation areas and the impact on tourism.

NRCan indicated that studies related to vessel wakes for vessels associated with the Project and other projects all showed that wake-wave heights from large ocean-going vessels and escort tugs attenuate significantly with distance from the vessel. NRCan stated that a reduction in vessel speed could reduce the effect of wake-waves at the shoreline to undetectable levels. They noted

that limiting vessel speed appropriately in the relevant section of the shipping lane would reduce wake-waves at the shoreline to undetectable (less than 1 cm) levels.

NRCan also indicated that the additional waves experienced annually along the shoreline due to Project-associated vessels were equivalent to slightly less than that of a single three-hour wind event, so that predicted wave heights generated by vessels were well within the range of natural wave conditions and would not have a significant cumulative impact on shoreline erosion.

FLNRORD reported that they were aware coastal erosion was an issue. FLNRORD stated that they did not currently have a field program that would permit them to assess or monitor the changing conditions of archaeological sites. FLNRORD stated that they were limited to regulating impacts of specific projects on archaeological sites on provincial lands. FLNRORD also indicated they had no ability to monitor the effects of erosion or a model to predict it.

Parks Canada provided detailed information and a confidential map on archaeological sites located within the marine shipping area, including Gulf Islands National Park Reserve, Pacific Rim National Park Reserve, and Fort Rodd Hill National Historic Site and Fisgard Lighthouse National Historic Site and, the proposed Southern Strait of Georgia National Marine Conservation Area Reserve. Parks Canada identified recorded archeological, Indigenous, or historic sites in all those parks and sites.

Parks Canada stated that shoreline erosion was a significant issue for coastal archaeological sites and wake action was a contributing factor to the risk. Parks Canada further explained that, in addition to shoreline erosion, increased frequency of wave activity from vessel-wake could result in accelerated deterioration of artifacts as wave action tumbling of intertidal stone and bone artifacts could result in surface wear and ultimately render artifacts to be indistinguishable from natural beach material.

While portions of the proposed shipping route are adjacent to the Gulf Islands National Park Reserve, the entirety of the Reserve is within the marine shipping area. Parks Canada noted that the archaeological record of the Gulf Islands National Park Reserve area was not completely known, however there are recorded sites as old as ca. 5500 years and older sites were almost certain to exist. Parks Canada noted that of 234 archaeological sites recorded in the Gulf Islands National Park Reserve, at least 57 sites are being affected to some extent by shoreline erosion, and 20 are highly threatened by erosion. Parks Canada Agency noted that, based on the Proponent's assessment, only Tumbo Island, East Point on Saturna Island, and Java Islets in Gulf Islands National Park Reserve fall within the zone of influence, and may experience 10 to 20 cm wave height related to vessel-wake.

Parks Canada stated that anticipated changes in wave environment were spatially limited within federal lands, and on the low end of the range of natural variability. Parks Canada Agency did not anticipate residual effects directly attributable to wake generated waves from larger vessels associated with the Project of a severity or magnitude that would influence the ecological integrity of monitored measures within Gulf Islands National Park Reserve.

Parks Canada indicated that the added wave energy from project associated marine shipping, even if very minor when considered in isolation, would remain one of many factors contributing to cumulative effects on the shorelines of national parks and historic sites along the shipping route. Parks Canada stated they anticipated negative impacts on archaeological sites and areas of archaeological potential resulting from the cumulative effect of increased wave activity related to vessel-wake.

17.2.3 Panel Analysis

The Panel agrees with the Proponent's conclusions that there would be no wake-wave effect from shipping associated with the Project to the shipwrecks *Rosalita* or *Fanny* due to their subtidal depth. The *Storm King* shipwreck is located on the northeast side of Trial Island. There is a line of scattered metal artifacts from that wreck that runs from the beach to a distance of 70 m to the southeast. The Panel concludes that there would be no Project effect on the *Storm King* shipwreck because the effects from Project-associated ship wake-waves would be negligible compared to effects from natural wind waves.

The Panel agrees with the Proponent's view that the marine shipping associated with the Project is unlikely to interact with paleontological and architectural resources. The Panel reviewed the information provided by Parks Canada on historical sites and concludes that marine shipping associated with the Project would not affect those historical sites.

In Section 8.5 - Wave Environment the Panel concludes that wake waves generated by shipping associated with the Project would not result in an effect on shoreline erosion. The Panel concludes that there would be no effect on physical heritage due to Project associated ship wake waves in the Gulf Islands National Park Reserve area.

The Panel concludes that marine shipping associated with the Project would not result in an adverse effect on archaeological sites due to coastal erosion.

Although the Panel has determined that there is no effect on archaeological sites due erosion caused by marine shipping associated with the Project, the Panel acknowledges that there are ongoing concerns about coastal erosion and the subsequent effects on archaeological resources. The Panel is of the view that coordinated monitoring would help to identify and protect sites at risk of degradation.

Recommendation 43

The Panel recommends that Parks Canada and the Archaeology Branch of the British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development establish an erosion monitoring and protection program for coastal archaeological sites and areas of archaeological potential in the zones of influence identified in Segment B of the marine shipping area. The archaeological monitoring and management plan should:

- *Establish a baseline by documenting the condition of previously known archaeological sites and by assessing areas of archaeological potential concurrently with the construction of the Project;*
- *Document any changes from the established baseline;*
- *Document and collect, where applicable, the findings of archaeological resources that are exposed during the course of the monitoring program; and*
- *Identify and implement site protection measures.*

Transboundary Effects Assessment

In Section 8.5 - Wave Environment, the Panel concludes that there would be no residual effect due to the Project on erosion from wake-wave effect. This conclusion would apply to transboundary sites as well. The Proponent assessed shorelines in the USA that had erosion potential and concluded that there would be no effect in transboundary waters. The Panel agrees.

The Panel concludes that ship-wake waves from marine shipping associated with the Project would not result in a residual adverse effect on archaeological or historical sites in the USA.

Neither FLNRORD nor Parks Canada have means for tracking effects on USA conservation areas. The only agreement between British Columbia and the USA for tracking effects of a project is through a memorandum of understanding. Under this agreement the Province of British Columbia and the State of Washington agreed to provide each other with information on environmental assessment and review processes for major projects within its own jurisdiction to facilitate mutual understanding of the environmental assessment and review laws, policies and processes of each jurisdiction.

The Panel encourages the British Columbia Environmental Assessment Office, under its memorandum of understanding with the Washington State Department of Ecology, to discuss the provision of sharing specific information on potential residual and cumulative effects resulting from major projects in the marine shipping area.

17.3 Cultural Heritage - Project Area

In this section, the Panel assesses tangible and intangible heritage elements of Indigenous peoples, such as sacred places, oral traditions and practices, and impairments to the transmission of traditional knowledge of cultural practices in relation to the Project.

17.3.1 Proponent's Assessment

To assess effects on cultural heritage for Indigenous people the Proponent explained that its assessment of current use reflected the cultural heritage of Indigenous people, which could have both physical (e.g., villages, burial sites) and intangible dimensions. The Proponent stated that its assessment of current use also focused on intangible heritage – the value or meaning associated

with the use of place or landscape for traditional purposes by Indigenous peoples, including consumptive and non-consumptive uses.

The Proponent noted that effects pathways on intangible cultural factors were complex and layered.

The Proponent assessed two cultural heritage effect pathways:

- Indirect cultural heritage effects that Indigenous peoples could experience as a result of a change in sense of place (i.e., cultural landscape, perceptions of risks to safety and security, or the sensory environment (e.g., noise, light), and specifically effects that may not be captured by only looking at potential effects on access to current use locations, availability of current use resources, or quality of current use resources); and
- Indirect cultural heritage effects that Indigenous peoples could experience as a result of changes in access to current use locations, the availability of current use resources, the quality of current use resources, or the quality of current use experience.

The Proponent indicated that indirect or intangible changes to the experience of current use at preferred locations, including whether important cultural purposes associated with current use remain reasonably achievable, have been attributed by Indigenous groups to a range of factors that could result from Project construction or operations, including:

- Changed sense of place;
- Risks to safety and security (e.g., from increased vessel traffic on the water and food insecurity due to perceived contamination of food sources from the Project and previous projects);
- Sensory disturbance from light, noise, and vibration; and
- Reduced opportunities to transmit Aboriginal Traditional Knowledge.

The Proponent did not present any standards, guidelines, or thresholds that would apply to assessing residual effects, or significance for tangible or intangible cultural resources. The Proponent acknowledged that “that there is a high level of subjectivity associated with establishing the degree to which Project-related changes may be experienced as measurable or non-measurable by a given Aboriginal group.”

Overall, the Proponent concluded that effects on cultural heritage as a result of a changed sense of place, a change in perceived risks to safety and security, sensory disturbance, or change in physical heritage would be negligible for all Indigenous groups before mitigation. Regardless, the Proponent proposed mitigation measures such as developing an Indigenous cultural landscape.

The Proponent did not expect Project components and activities to interact with known archaeological or other physical heritage sites in upland or marine areas. The Proponent acknowledged that even though the Project was not expected to disturb these sites themselves, it was possible the Project may incrementally disturb the setting or sense of place, recognizing that

the setting was already highly modified. The Proponent stated that while the Project would modify an already modified landscape, the Project would not result in a measurable change on the sense of place.

The Proponent noted that while the risk of a marine incident as a result of increased vessel traffic was very low or negligible the perception of risk relating to safety and security on the water would likely persist.

The Proponent examined the potential for the Project to result in sensory disturbance on the quality of current use experience in both upland and marine areas and whether this disturbance could result in avoidance of preferred locations. Overall, the Proponent concluded that sensory disturbance associated with Project-related light, noise, vibration or air quality would not be expected to affect the experience of current use in a way that might lead to its avoidance, or result in effects on quality of experience beyond that which Indigenous groups may already be experiencing.

The Proponent indicated that the quality of current use experience was likely linked to traditional understandings of a pre-modified landscape; therefore, further modification of visual and nighttime resources had the potential to interfere with cultural uses and knowledge transmission related to visual quality, such as visibility of points on the landscape. These were used for navigation, were tied to stories, or were used for conducting certain cultural activities, including ceremonies.

The Proponent indicated that where an effect on the current use of an Indigenous groups was identified, a proportionate effect on the retention and transmission of cultural heritage was inferred. For instance, the Proponent concluded that Tsawwassen and Musqueam would experience measurable effects on crab harvesting from reduced access and displacement. The Proponent inferred that the Project would cause an indirect effect on cultural heritage if reduced access also led to reduced opportunities to retain and transmit the knowledge at a primary crab harvesting location. In this example, the Proponent considered the effect on intangible cultural heritage was measurable for Tsawwassen and Musqueam but with implementation of mitigation measures, the effect would not be significant on opportunities for the transmission of Indigenous knowledge and practices. The Proponent concluded the effect on intangible cultural heritage related to current use was non-measurable for all other Indigenous groups.

To mitigate effects on current use and cultural heritage the Proponent proposed a communications protocol to address community-specific concerns. To address effects of the Project on the quality of experience, the Proponent pointed to its proposed mitigation measures for other interrelated environmental components including visual resources, human health, and archaeological and heritage resources. The Proponent considered that mitigation measures to address changes in access to preferred current use locations would also address the effects of the Project on the quality of the current use experience. In addition, the Proponent committed to identify opportunities for the development of Indigenous cultural landscape features with an Indigenous Advisory Committee and individual Indigenous groups. The Proponent indicated that

this might take the form of public artwork, Indigenous place name' signage or an architectural element to acknowledge and support cultural values and practices in the Roberts Bank area.

The Proponent made commitments to include Indigenous groups in the development of various construction and operations management, training and compliance monitoring and follow-up programs.

17.3.2 Views of Participants

Tsawwassen First Nation

Tsawwassen stated that the sea had always been the backbone of their culture. They described how the Project would become a permanent feature of Tsawwassen's landscape, in turn, alienating generations of Tsawwassen members from an important part of their territory. Several members noted that they could not move to avoid the Project since it was situated right in front of their community. Chief Baird stated, "the port doesn't just lie in our territory, it is directly adjacent to our homes and where we fish and gather our food. Tsawwassen will feel the most impact among those who may be affected by a terminal expansion". Chief Baird stated, "we're going to be known as the people facing Deltaport, and we're no longer the people facing the sea."

Tsawwassen noted that their language was indelibly linked to the lands and waters of their Territory. Tsawwassen was concerned the Project footprint would affect the natural systems and the river dynamics, and, in turn the knowledge and language associated with traditional uses of the waterways. In their view the Tsawwassen language expresses a way of life and an expression of identity. In addition, it was noted that the Tsawwassen language – *hun'qum'i'num* – had been eroded by Canada's colonial history and institutions which left members reluctant to teach their language for fear that others would face persecution.

Tsawwassen described how its intangible cultural heritage was a pillar of Tsawwassen's way of life and that it was at risk from significant adverse impacts due to the Project. A Tsawwassen Elder stated, "we use the ocean to cleanse our spirit and to bathe". Tsawwassen presented recommendations for the protection of their intangible cultural resources, their continued access to the sea as holders of a sea-based culture, and for the protection of their language including a recommendation that the Port Authority submit a Tsawwassen-specific cultural and community mitigation and offset plan, co-developed with Tsawwassen, prior to the federal decision on the Project.

Musqueam Indian Band

Musqueam stated that the location of Musqueam at the mouth of the Fraser River delta was deeply entwined with Musqueam oral histories, cultural identity, and position in historical trade networks. Musqueam stated that oral tradition established ancestral connections to the lands and waters of the region from time immemorial. Musqueam noted the four largest archaeological sites in the Fraser River delta represented harvesting and dependency on the delta's ecological

resources by Musqueam people dating back at least 3,500 - 4,000 years and cultural history in their traditional territory dating to at least 8,000 years.

Musqueam indicated they were concerned with the potential disruption and constraint of ceremonial and spiritual practices dependent on access to and harvest of natural resources. Musqueam noted that the Project had the potential to interact with continuity of their culture by causing multigenerational exacerbation of the existing pattern of disruptions to cultural continuity caused by industrialization, settlement, and institutional policies.

Musqueam defined cultural continuity as including identity, sense of place, and knowledge transmission. The Musqueam Knowledge and Use Study of the Roberts Bank Terminal 2 Project (Musqueam Study) indicated that there were numerous areas within the Project LAA and RAA used for the inter- and intra-generational transfer of knowledge and skills that support the cultural continuity of Musqueam.

Musqueam members noted a decreased willingness and ability to access the Project area due to increased marine traffic and increased regulations. Musqueam members also noted increased anxiety and fear regarding safety in the Project area, and the potential for disruptions to Musqueam members' sense of place, identity, and spirituality. Musqueam described lost opportunities for the transmission of traditional knowledge and practices, especially in the vicinity of the Project and described their fear of disruptions to the social fabric of their community built from and around the practice and transmission of traditional activities.

Tsleil-Waututh Nation

Tsleil-Waututh described themselves as long-term stewards of the land who witnessed the arrival of the transformation of the landscape to the current land forms and a people whose entire culture and history was tied to that land and waters.

Tsleil-Waututh presented information to the Panel with respect to their intangible cultural heritage, such as transformation and spiritually-charged sites, in a confidential report *Intangible Cultural Heritage – Potential Impacts to Sacred Tunnels from the Proposed Roberts Bank Terminal 2 Project*. Tsleil-Waututh stated they strongly believe that the information in this Report indicated that the Project could reasonably result in damage to Coast Salish heritage and/or cultural sites, and cause harm to continued cultural practices. They further noted that release of information regarding sacred knowledge and practices, including intangible cultural heritage, to a wider audience, might cause irreparable harm to the historical, current, and desired future uses of the sites or intangible cultural heritage and practices of Tsleil-Waututh.

Lyackson First Nation and Lake Cowichan First Nation

The Lake Cowichan First Nation noted that from the Hul'q'umi'num' speaking First Nations cultural perspective, culturally referencing the night sky is of considerable importance to the legends. Lyackson noted that they had sacred oral traditions and practices relating to the night sky. Lyackson and the Lake Cowichan First Nation indicated that they believed that the

disturbance of the night sky further interferes with the “little people”, who according to cultural stories, came from the stars.

Lyackson stated that ‘Le’eyqsun’ (Valdes Island) is their cultural homeland, one of the primary locations of Lyackson’s villages and oral histories, and one of the few remaining islands in the Salish Sea that remains largely undisturbed by development or contamination from residential or industrial sources. Lyackson indicated that their members retreat to Le’eyqsun to “ground their senses and reconnect with Mother Earth”.

Hwlitsum First Nation

The Hwlitsum First Nation stated that, pursuant to their laws and spiritual beliefs, they are charged with special rights and responsibilities as stewards of their Traditional lands, which include Canoe Passage and the Lower Fraser River estuary. The Hwlitsum First Nation members, Elder McCystal and Chief Hornbrook provided Indigenous traditional knowledge and accounts of their connection to the lands and waters and changes that have occurred in and around Roberts Bank as a result of industrialization. The Hwlitsum First Nation indicated that, since time immemorial, and to the present day, their ancestors depended on Canoe Passage to survive at their summer village on the banks of the Fraser River noting that “our people have raised their families and fished in Canoe Passage long before any BC Ferry terminal and jetty were built.”

17.3.3 Panel Analysis

To assess effects on cultural heritage for Indigenous people the Proponent examined indicators related to the indirect or intangible changes to the experience of current use at preferred locations, including whether important cultural purposes associated with current use remained reasonably achievable. The Panel disagrees with the Proponent’s approach, which appears to have been based on the assumption that a change to an indicator for current use could reasonably be used to determine effects on cultural heritage. The Panel further notes that in its assessment of effects on current use the Proponent presented criteria to evaluate the significance of residual adverse environmental effects on physical heritage (e.g. archaeological sites), but did not provide criteria for the evaluation of cultural heritage, as no residual effects were predicted.

In contrast to the Proponent’s approach, the Panel’s assessment first identified the existence of an interaction between the Project and elements of the Indigenous group’s cultural heritage and resources, as described by the Indigenous groups. Only when a pathway of effect was identified did the Panel further evaluate the effect of the Project on that Indigenous group’s cultural heritage. In circumstances where the Panel concluded the Project would have a residual adverse effect on cultural heritage, the Panel used the key criteria recommended by the Agency’s guidance document *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under CEAA 2012*. The Panel’s definition of the criteria and the associated thresholds are defined in Appendix F: Cultural Heritage Criteria Tables.

The Proponent submitted that the mitigation measures proposed for current use, would also mitigate effects on cultural heritage. The Panel disagrees with this approach as the Panel does not agree that mitigation measures for current use can necessarily be applied as mitigation for cultural heritage. In addition, the Panel does not consider the Proponent's proposed communication protocol to be a form of mitigation. The Panel acknowledges that the Proponent has committed to work with Indigenous groups to identify opportunities for the development of an Indigenous cultural landscape feature, such as public artwork, Indigenous place name signage, or an architectural element, to acknowledge and support cultural values and practices in the Roberts Bank area. The Panel supports this initiative but emphasizes that in addition to acknowledging cultural values there needs to be greater protection of those cultural values. The Panel is of the view that there is a need for the Proponent and the Government of Canada to engage further with Indigenous groups to identify and protect cultural values, and has recommended the Proponent develop a cultural and community mitigation plan.

The Panel acknowledges that Indigenous cultures are complex and the knowledge embodied in culture is passed down through particular practices and teachings as well as through the celebration of the land, water, plants and animals, with songs, dances, prayers, legends, stories and rituals. As such, the Panel recognizes that examination of specific aspects of culture may not adequately represent the holistic view of the culture of Indigenous peoples or the cascading consequences of multiple effects.

Tsawwassen First Nation

The Panel is of the view, given the high value placed on Roberts Bank by Tsawwassen, and the proximity of the community to the Project, that the Project may affect the ability of Tsawwassen to maintain their connection to the resources within their territory. The Panel finds that the Project will interact with Tsawwassen's cultural heritage in a highly-valued area, further removing the community's immediate connection and access to the sea. The Panel concludes that Tsawwassen is likely to experience a loss of cultural landscape and identity as a result of the Project. The potential effect on cultural heritage would be high in magnitude, permanent and would persist beyond one generation. Intergenerational transfer of cultural knowledge, as well as transmission of place-based language, could be interrupted for an extended time period and may not be reversed either in whole or in part. The Panel notes that Tsawwassen has made recommendations to help mitigate effects on Tsawwassen's culture and way of life, including a cultural and community mitigation and offset plan, and commitments to support Tsawwassen language protection. The Panel supports these proposed mitigation measures and has recommended they be implemented.

Musqueam Indian Band

The Panel accepts that the Project would result in a decreased willingness and ability among Musqueam members to access the Project area due to increased marine traffic and activity in the area. The Panel is of the view the Project will also result in a loss of sense of place, identity, and spirituality for Musqueam members. The effects would be moderate in magnitude, permanent and would persist beyond one generation. The Panel recognizes that the Project area is one of the

areas used by Musqueam to practice their culture. Musqueam, however also use other areas along the Fraser delta and near the mouth of the Fraser River for cultural practices so the Project would be a relatively small contributor to Musqueam's alienation from the lands and waters. The Panel acknowledges that there will be a residual Project effect on cultural heritage for Musqueam, however that effect would not be significant.

Tsleil-Waututh Nation

The Panel accepts that Tsleil-Waututh cultural landscape includes specific Transformer sites and sacred tunnels or portals that converge in the Tsawwassen and Roberts Bank area, connecting far-reaching areas of the broader region together. The Panel understands that, within this cultural landscape, a Stl'áleqem site is also present in the waters to the southwest of the Project area, off the west shore of Point Roberts and that the places inhabited by Stl'áleqem are understood to be spiritually charged.

The Panel believes that if the Project were to proceed, Tsleil-Waututh Nation would face a potential loss of preferred cultural and spiritual areas and the potential interruption of cultural practices resulting in reduced ability to transmit a way of life to future generations. Additionally, the Panel is of the view that the potential impairment of land use would result in an associated diminishment of cultural and spiritual experience including reduced ability to practice culture in a preferred manner, and reduced confidence in strength or power of cultural practices, particularly those associated with Transformer sites and sacred tunnels.

The Panel recognizes that as a result, Tsleil-Waututh Nation may experience a loss of land and water-based opportunities for language transmission and loss of specific vocabulary associated with particular places or specific place-based orally transmitted cultural stories. The Panel understands that the resulting loss of knowledge would affect the entire Tsleil-Waututh Nation, and their desire to use their cultural practices to heal their community.

The Panel concludes that there is a residual effect on Tsleil-Waututh Nation's access to preferred cultural heritage locations that encompass the cultural landscape of the Transformer sites and sacred tunnels within the Fraser River estuary and the Salish Sea, and more specifically the Stl'áleqem site near Roberts Bank. The potential effect on cultural practices may persist beyond one generation given the intergenerational transfer of knowledge required to continue the practice, and may be permanent.

The Panel concludes that there is a residual effect on the intangible cultural heritage of the Tsleil-Waututh. The potential effects of the Project are likely to cause an interference with the preferred manner of practice, including limiting use of, or access to sites that maintain a high community cultural and spiritual value despite previous industrial development in the Fraser River estuary. The marine shipping associated with the Project would also interact occasionally, but on a repeated basis in an area that overlaps with this cultural practice.

Lyackson First Nation and Lake Cowichan First Nation

Lyackson First Nation and Lake Cowichan First Nation identified a potential adverse effect on cultural heritage related to sensory disturbances in the ability to clearly view the stars. The Panel recognizes that there are existing cumulative effects on sky glow from past projects and general industrialization and urbanization of the Salish Sea. As discussed in Section 20.2 - Visual Resources, the Proponent's results indicate an existing deterioration of celestial viewing. The Panel concludes that the Project is not expected to have an effect on nighttime cultural practices. The Panel concludes the Project would not result in an adverse effect on cultural heritage for the Lyackson First Nation or the Lake Cowichan First Nation.

Hwlitsum First Nation

The Panel has determined that Project effects would not extend to the South Arm of the Fraser River and Canoe Passage where these Indigenous groups' cultural practices takes place, as discussed in Section 8.1 - Coastal Geomorphology. In addition, the Project would not affect access to these areas or the quality of experience, or result in the loss of traditional villages of these Indigenous groups. The Panel concludes the Project would not result in an adverse effect on cultural heritage for the Hwlitsum First Nation.

The Panel concludes that the Project would result in residual adverse effect on cultural heritage for the Tsawwassen First Nation, the Musqueam Indian Band and the Tsleil-Waututh Nation. The effects would be significant for the Tsawwassen First Nation and the Tsleil-Waututh Nation.

Cumulative Effect Assessment

The Panel examined increased disturbance in the Project area from past, present and future projects. The Panel takes the view that cumulative effects are significant if there is a loss of a cultural practice or an avoidance of a site used for cultural resources.

The Panel accepts that Tsawwassen has experienced ongoing, cumulative effects on their cultural heritage and landscape as a result of past projects at Roberts Bank. The Panel is of the view that the Project is likely to contribute cumulatively to the erosion of Tsawwassen's ability to practice and transmit language and culture, and their connection to the landscape. The Panel finds that there are other land uses, including proposed or existing projects, which affect the community's cultural heritage, including cultural landscape. The cumulative effect on cultural heritage for Tsawwassen occurs over an extensive portion of their traditional territory, and the community is unable to move, or change their viewscape. The cumulative effect would be permanent as the effect would last longer than one generation. The Panel concludes that the Project would cause a significant adverse cumulative effect on cultural heritage for Tsawwassen.

Musqueam described how they already faced multigenerational disruptions to their cultural continuity due to the existing cumulative effects of development in their traditional territory and stated that the Project had the potential to exacerbate this existing pattern of disruption. Musqueam members noted a decreased willingness and ability to access the Project area due to

increased marine traffic and increased regulations. Because of existing alienation, the Panel agrees that the Project in combination with other projects in the area would exacerbate the situation. The Project would interact with Musqueam's cultural heritage in an area highly valued by Musqueam members and the effect would be permanent. The Panel concludes that the Project would cause a significant adverse cumulative effect on cultural heritage for Musqueam.

The marine shipping associated with the Project would interact occasionally, but on a repeated basis in an area that overlaps with Tsleil-Waututh cultural landscape of the sacred tunnels. The Panel is of the view that increase presence of marine traffic and induced marine and land-based infrastructure and industry in the Project area are already affecting Tsleil-Waututh's preferred cultural practices. The Panel expects that sensory disturbances including increased human presence, noise, lighting, and infrastructure in the nearshore and offshore environment and visual changes in and around the Project may result in a decreased sense of privacy. This, in addition to the physical exclusion of small vessels from the waters around the terminal, may alter the willingness of Tsleil-Waututh members to continue their cultural practice in the Roberts Bank area.

The Panel concludes the effects of the Project in combination with past, present and future projects are likely to exacerbate existing interference with Tsleil-Waututh's preferred manner of practice, including limiting use of, or access to sites that maintain a high community cultural and spiritual value despite previous industrial development. The Panel concludes that there would be a permanent cumulative effect on the intangible cultural heritage of Tsleil-Waututh.

The Panel concludes that the Project would result in a significant adverse cumulative effect on cultural heritage for the Tsawwassen First Nation, the Musqueam Indian Band and the Tsleil-Waututh Nation.

Recommendation 44

Before construction starts, the Panel recommends that the Proponent, in collaboration with the Tsawwassen First Nation, the Musqueam Indian Band, and the Tsleil-Waututh Nation, be required to prepare a cultural and community mitigation plan. The plan should include:

- *For all groups: cultural monitoring and thresholds to assess residual effects and their significance for tangible or intangible cultural resources of the Nation or Band;*
- *For the Tsawwassen First Nation: in collaboration with Transport Canada, implementation of measures that would support Tsawwassen's continued access to the sea and practice of their sea-based culture. These measures should include consideration of additional safe marine access point(s) in the Project area; and*
- *For the Tsleil-Waututh Nation: implementation of measures provided by the Tsleil-Waututh Nation in confidence to the Panel and the Proponent.*

Recommendation 45

The Panel recommends that the Government of Canada, in collaboration with the Proponent and Tsawwassen First Nation, co-develop a plan to protect cultural heritage, including support for their language protection efforts and sea-based learning activities.

17.4 Cultural Heritage – Marine Shipping Area

In this section, the Panel examines potential effects of marine shipping associated with Project on cultural resources in the marine shipping area.

17.4.1 Proponent's Assessment

The Proponent considered the potential direct effects of the Project and marine shipping associated with the Project on locations identified as important by Indigenous groups, including locations used for ceremonial and cultural practices. This assessment included access to and the quality of use experience at those locations, as well as the availability and quality of resources. This information was then reviewed in relation to potential indirect effects on intangible cultural heritage, such as sense of belonging, identity, and spirituality associated with the cultural landscape. The visual resources and archaeological and heritage resources assessments also considered elements of Indigenous heritage related to a sense of place and identity, beliefs, cultural landscapes⁶ and cultural continuity, which were in turn carried forward in the Proponent's assessment of current use assessment. The Proponent stated that the methods it used to assess effects of the Project and marine shipping associated with the Project on cultural heritage, including intangible cultural heritage, were reasonable and consistent with federal guidance.

The Proponent concluded that there was an existing cumulative effect on the SRKW that was significant however, the Port Authority stated that the residual effect due to marine shipping associated with the Project on the SRKW was very small and would not further affect the cultural heritage related to SRKW.

The Port Authority identified sensory disturbances, perceived increases in risks to safety, and alterations to cultural landscapes as potential changes to the quality of experience of current use, and noted that these changes could lead to associated changes in use patterns. The Proponent concluded that noise due to marine shipping associated with the Project would have a negligible effect on the quality of current use experience for both marine- and land-based activities in the marine shipping area.

The Proponent noted that most current use activities that overlapped with a transiting ship would involve a motorized boat (e.g., fishing vessel) generating noise that would likely mask the noise

⁶ Combined works of nature and humankind, cultural landscapes express a long and intimate relationship between peoples and their natural environment and can teach how this relationship shapes culture and identity, and enriches cultural and biological diversity (UNESCO).

of a ship. The Proponent stated that interactions with ships from non-motorized vessels (e.g., canoes during Tribal journeys) would occur infrequently. The Proponent also concluded that changes to the light environment would have a negligible effect on the quality of current use because most ships would be transiting during the daylight hours.

The Proponent acknowledged that Indigenous groups described existing safety concerns when practicing traditional activities in the marine shipping area, specifically with respect to marine travel sites and corridors. In the *Voluntary Vessel Slowdown Trial Summary Findings* (2018), the Proponent indicated that one of the benefits of commercial vessel speed reduction was safety of Indigenous fishers and traditional canoe paddlers. The Proponent noted that as a result of the speed reduction in Haro Strait, vessels would generate lower wake waves and potentially improve safety for Indigenous fishers and canoe paddlers, if and when they were in the vicinity. The Proponent concluded that the relative contribution of Project-related traffic was small enough that there would be a negligible effect on safety risk and therefore no measurable change in safety risk during current use activities. However, there could be effects from a perceived change in safety risk. To address the perceived change in safety risk, the Port Authority proposed: a Communication Plan to communicate real-time information on shipping movements and the location of the shipping lanes in relation to potential effects of marine shipping associated with the Project; and, consultation with Indigenous groups on the communication of real-time information and data on marine traffic, such as Enhanced Maritime Situational Awareness and Common or Collaborative Situational Awareness Portal.

17.4.2 Views of Participants

Access to Cultural Sites

Songhees First Nation (Songhees) expressed concern that increased traffic and erosion may affect their spiritual and ceremonial connections to their lands and waterways. Songhees provided their Marine Use Plan to the Panel, which was developed to protect and restore TI'ches as one of the last remaining undeveloped areas in Songhees Territory. Songhees stated that the outbound shipping route for the Project passed directly by, and very close to, the eastern boundary of a protective zone around TI'ches proposed in the Marine Use Plan. Songhees noted that wave disturbances may limit access to culturally important areas.

Songhees explained that wave disturbances resulting from ongoing shipping are currently causing further erosion to areas of cultural and spiritual importance to Songhees as well as the loss of archaeological artifacts. This erosion of sites of cultural and spiritual importance is hindering the ability for Songhees to understand and preserve its culture.

Songhees also raised concerns about the effect of the Project on TI'ches due to human interference with the coastal and intertidal marine environment, including cumulative impacts. Songhees also noted that the Project would contribute to climate change, which would have human health impacts as well as impacts on sea levels, directly threatening access to Songhees' land and culturally important sites.

Pauquachin First Nation have highlighted the importance of the Salish Sea and stated that it continues to be an integral part of Pauquachin First Nation culture and way of life. Pauquachin stated, “The ocean has been more of our homeland just as such as the land itself. And we always say you can't separate the land and the water itself. We as First Nations people always have connections to both.” Pauquachin First Nation members indicated that they travel all though the Gulf Islands for harvesting but also for cultural practices as well, such as using a sacred bathing/cleansing site on Tumbo Island.

Canoeing and Canoe Voyages

Many Indigenous groups noted the historical and current importance of canoes for harvesting and other cultural practices. Musqueam indicated that canoe races were also considered to be sacred ceremonies. Most Indigenous groups described the use of traditional canoe routes within their traditional territory. Canoes and canoeing also played a central role in some groups' oral histories and origin stories. The W̱SÁNEĆ Nations stated that the canoe was so integral that their cultural practice was to name places and locations as they would appear to people approaching by canoe, illustrating of how fundamental their traditional marine territory was to the W̱SÁNEĆ worldview and traditional way of life. Maa-nulth stated that “the ocean was our highway because it was much faster to travel by canoe than it was to walk to the next village. There were paddle songs that were distinct to each community, so we always knew who was coming by the songs that they sang”.

Indigenous groups also spoke of the role of modern canoe races in maintaining their cultural heritage, and they raised concern about the effects of the Project on their ability to conduct tribal canoe journeys. Pauquachin First Nation reported that they continue to use historical canoe routes for marine travel, including a route from their community on the eastern side of Saanich Peninsula through Active Pass (between Mayne Island and Galiano Island) to Point Roberts, where they say they still access fishing sites. A traditional knowledge site at the southwestern corner of the Traditional Marine Use Area or Local Study Area reported as directly between Active Pass and the Project, “marks the spot where knowledge-holders report catching and riding the inbound tide all the way to the mouth of the Fraser River”.

Tsartlip First Nation members reported traditional knowledge of tides and contemporary travel routes across the current shipping lanes from the Saanich Peninsula to the settlements and traditional use sites throughout the southern Gulf and San Juan Islands, as well as use of this knowledge during their lifetimes.

Scia'new First Nation described a traditional tribal journey that continues to occur once a year were Nations from Vancouver Island participate. Elder Gordon Charles of the Scia'new First Nation described how the ship traffic affected their tribal canoe journeys and described the difficulties with crossing the Strait, due to rough weather conditions and his concern for safety by not being able to see large ships in the fog. Elder Charles stated that at times they have had to wait on shore, and have had canoes and support boats washed by the wake-wave from the large container ships. He noted that there had been ‘near misses’ with big container ships.

Chief Gordon Planes of T'Sou-ke Nation described the community's connection to the other communities on Vancouver Island and the USA by way of canoe voyages. Chief Planes expressed the Nation's pride that T'Sou-ke Nation's 24-year old canoe was built by the community from a single log. Chief Planes stated, "it's a part of who we are as Coast Salish having that canoe and being on those waters is a teacher."

Semiahmoo First Nation expressed concerns that the wake from shipping activities associated with the Project could affect the ability to safely practice traditional forms of transportation such as via dug- out canoes in preferred maritime travel routes, namely in Active Pass, an important travel route to the Gulf Islands and Victoria.

Importance of Whales

Many of the Indigenous groups described their special relationships with whales, and several groups described the orca as their relatives. Many of the groups noted that killer whales were an essential part of their culture and identity, and they had traditional art, stories, and songs centered on the orca. When asked about their relationship to killer whales, Esquimalt Nation responded that "As children we were handed down stories, generations from generation, that our people came from the killer whales. They became sea wolves. They became wolves. Then they became the people. So that's the story that I was handed down as a child." Malahat First Nation considered the whale sacred and believe they embody the spirit of Malahat Nation members who have passed away. T'Sou-ke identified SRKWs as "supernatural beings" that often "act as important messengers who communicate vital information that informs T'Sou-ke's stewardship of the marine environment in its Territory". Orcas also feature in many W̱SÁNEĆ stories, often as spiritual intermediaries between families and the sea.

Indigenous groups expressed concern that the Project effects on the orca could further affect their sacred relationship with the killer whales. Tsawwassen expressed concern that the Project may impact their relationship with killer whale through disruption of critical habitat, the addition of cumulative effects, and the presence of the Project more generally. The Penelakut Tribe expressed "grave" concerns about the potential impact of the Project on the SRKW and the effects that a population level extinction may have on the balance of the remainder of the ecosystem. The Cowichan Nation Alliance stated that "the loss of a single killer whale is devastating, and the possibility of their extirpation is unthinkable". T'Sou-ke concluded that the Project would cause significant adverse effects on their Indigenous use of the whales.

In addition, several Indigenous groups, including Pacheedaht, Ditidaht, Maa-nulth, Lyackson and T'Sou-ke noted the historical importance of Indigenous hunting of baleen whales. Sacred Pacheedaht ceremonies involved cleansing and other rituals to prepare for the rigorous and dangerous whale hunt. Pacheedaht indicated that whaling rituals were considered highly sacred, and the details were the carefully guarded secrets of individual whaling chiefs' families. Most of the cleansing and other rituals were performed at special locations where specific geographic features and other qualities exist such as remoteness, supernatural power, caves, streams, and lakes. The Panel notes that whales are not currently being harvested by Canadian Indigenous groups however, there was a desire expressed by Pacheedaht and Ditidaht, and other whaling

nations, to restore the whale hunt, an activity central to both culture and identity, should whale populations and circumstances allow this.

17.4.3 Panel Analysis

The Panel heard from many Indigenous groups that traditional marine resources are culturally and spiritually important and that they are concerned about the loss of cultural heritage sites, traditions, and beliefs.

The Panel is of the view that Project's associated marine shipping would not affect atmospheric noise or air quality and therefore would not contribute to sensory disturbances that would result in an effect on cultural heritage in the marine shipping area.

The Panel is of the view that vessel pass-bys associated with the Project would disrupt the cultural landscape in the marine shipping area and potentially prevent some Indigenous groups' ability to safely access or practice aspects of their culture heritage. Further, effects resulting from the Project and its associated marine shipping activities on the sensory experience may affect cultural practices.

Quality of Experience in Access to Cultural Sites

The Panel is of the view that marine shipping associated with the Project would not affect safety from wake-wave height, except at Swiftsure Bank. However, Indigenous groups may experience a change on their quality of experience in accessing cultural sites due to safety hazard as a result of crossing the shipping lanes in small craft during container ship pass-bys. This effect is most likely for groups travelling through the Gulf Islands, such as Pauquachin First Nation travelling to Tumbo Island and, Songhees traveling in the vicinity of the islet groups of Chatham, Chain, and Trial. The Panel notes that this effect would only occur on a very infrequent basis, as small crafts used by indigenous groups must actually cross paths with a Project-associated container ship for the effect to occur.

To address the perceived change in safety risk, the Port Authority proposed mitigation measures, including Communication Plans that would provide updates regarding Project activities. The Proponent's commitments do not provide adequate information to determine the effectiveness of the mitigation. The Panel is of the view that the Proponent's proposed mitigation measures would not effectively mitigate the effect on cultural heritage, because the safety hazard remains. The Panel considers a communications plan and consultation with Indigenous groups to be a courtesy that does not mitigate effects.

Cultural Heritage Connected to Canoeing and Canoe Voyages

Historical canoe travel routes, the pride in building such a boat, the holistic importance given to canoe uses and a revival of canoe journeys and races are all important aspects of cultural heritage that were described by many Indigenous groups in the marine shipping area. Safety concerns are an issue for Indigenous groups still using this means of transportation or taking part in traditional

canoe races. The Panel is concerned about the impairment or loss of intergenerational knowledge transmission on how to build a canoe, its uses and related travel corridors.

Considering the Panel's conclusion that ship wake wave height in shallower parts of the marine shipping area and residual wake wave from a container ship when crossing the shipping lanes would constitute a safety hazard to small recreational vessels, there is a risk for canoers when they are in the presence of a Project container vessel and having to adjust their activities for safety reasons. The Panel notes that this effect only occurs on a very infrequent basis, as the canoe must intersect with a Project-associated container ship for the effect to occur. However, the Panel acknowledges that the perception of risk leads to an effect on Indigenous groups' practices and potential impairment of transmission of knowledge.

Cultural Heritage Connected to SRKW

The Panel heard how the orca, especially the SRKW, is a species of tremendous cultural importance and a sacred animal at the base of most of the participating Indigenous groups' cosmology and their set of knowledge, beliefs, interpretations and practices explaining their origins and evolution of their universe and relation to nature. Numerous Indigenous groups reported the importance of the SRKW as being an iconic species at the heart of their spiritual and cultural identities. The Panel acknowledges the importance of this species to Indigenous groups.

The Panel notes that SRKW are primarily found in the transboundary Canada/USA waters of Haro Strait, Boundary Pass, the eastern portion of the Strait of Juan de Fuca, and southern portions of the Strait of Georgia. In Section 14 - Marine Mammals, the Panel concludes that the Project would have a significant adverse effect and would further contribute to a significant cumulative effect on SRKW. The Panel recognizes that there is no defined threshold for the population size of SRKW necessary for the continuity of a culture or its related transmission of knowledge. In the absence of a defined threshold, the Panel acknowledges that there would be an adverse effect that would be difficult to mitigate.

Further, the Panel is of the view that orca is so intimately tied to Indigenous cultural practices that an effect on SRKW populations would result in an effect on cultural heritage. The Panel concludes that changes to cultural practices related to canoe journeys and SRKW, and changes to the quality of experience related to access to cultural sites and their associated cultural practices would result in an adverse effect on cultural heritage.

The Panel concludes that marine shipping associated with the Project would result in a residual adverse effect on cultural heritage for Indigenous groups that use the marine shipping area for cultural practices. The effect would not be significant.

The Panel recognizes that over the years there has been a marked increase in ship movements in the marine shipping area. Some Indigenous groups consider ship traffic to have already reached a threshold and any increase in ship movement was unacceptable. The Panel acknowledges that although there are relatively few ships associated with the Project, each ship travelling through the shipping lanes causes an incremental effect on the ability of Indigenous groups to conduct

cultural activities on the water, including canoeing and canoe voyages, access to cultural sites, and associated cultural practices. The Panel is of the view that there is an existing significant, cumulative effect on cultural heritage and that any increase in ship movements would further contribute to that significant cumulative effect. The effects would be high in magnitude as the practice and beliefs are important for many Indigenous groups; extensive in its spatial extent; permanent as they may last beyond one generation; intermittent and partially reversible if future measures are implemented for ship slowdowns. It would be a significant cumulative effect for all groups crossing the shipping lanes due to the increase in all vessel movements of 27 percent in Segment B and, 24 percent in Segment D by 2035 from 2012.

The Panel concludes that marine shipping associated with the Project would result in a significant adverse cumulative effect on cultural heritage for Indigenous groups that use the marine shipping area for cultural practices.

Under the cultural account of the *Voluntary Vessel Slowdown Trial Summary Findings* (2018), the objective was to identify the benefits and implications of the trial for coastal Indigenous people's cultural interests, values and objectives. The report concluded that there were safety spin-offs to Indigenous canoe paddlers and fishers. From the perspective of some Indigenous groups, the trial was an opportunity to raise industry and public awareness of the cultural significance of SRKW to Indigenous peoples. The Panel is of the view that the slowdown trial provided an opportunity to raise awareness of the cultural, emotional, psychological and spiritual importance placed on canoeing by Indigenous groups. The Panel believes that vessel speed reduction could benefit other cultural practices and the transmission of associated knowledge in the marine shipping area.

Recommendation 46

The Panel recommends that Transport Canada, with the collaboration of concerned stakeholders and Indigenous groups, develop and implement a monitoring program to determine the overlap of Indigenous use and vessel traffic within the shipping lanes. Monitoring components should include safety and potential loss of cultural heritage due to the interference with cultural practices and knowledge transmission in the shipping lanes. The results of the monitoring program should be used to develop mitigation measures that would reduce any adverse effects identified through the monitoring program. Consideration of mitigation measures should include the feasibility of speed reductions in areas of high overlap and provision of funds for safety improvements.

18 Potential or Established Aboriginal and Treaty Rights

The Panel's Terms of Reference mandates the Panel to accept information on potential or established Aboriginal or Treaty rights (Aboriginal or Treaty rights) and interests as part of the environmental assessment. This information includes input provided by Indigenous groups on the extent to which their Aboriginal or Treaty rights would be impacted by the Project including, where appropriate, identification of the specific Treaty provisions at issue or potential or established Aboriginal title claims, and information about proposed measures to mitigate or avoid impacts on those Aboriginal or Treaty rights. The Panel is required to summarize the information it received regarding Aboriginal or Treaty rights in its report.

The Panel considered the information it received on potential impacts to Aboriginal or Treaty rights when making recommendations designed to avoid or mitigate environmental effects that might adversely impact Aboriginal or Treaty rights. The Panel did not have the mandate to make any conclusions or recommendations regarding the validity of Aboriginal or Treaty rights asserted by Indigenous groups or whether the Project would be an infringement of Aboriginal or Treaty rights. The Panel notes that its Terms of Reference specifically state that the duty to consult rests with the Government of Canada (the Crown).

The Agency, in its role as Crown Consultation Coordinator, wrote to the Panel stating that the Crown, to the extent possible, was making best use of the environmental assessment process for the Project to fulfil the Crown's duty to consult with Indigenous Peoples. The Agency established that the Crown would rely on the information collected and analyzed by the Panel for the purpose of the environmental assessment, in order to inform the Crown's assessment of potential impacts of the proposed Project and marine shipping associated with the Project on the exercise of Aboriginal or Treaty rights. In its submission, the Agency included the Crown's methodology for assessing impacts on the exercise of Aboriginal or Treaty rights.

The Panel understood from its mandate that:

- The information provided by the Proponent and received from Indigenous groups through the review process, would contribute to the Crown's understanding of any potential adverse impacts of the Project and its associated marine shipping on Aboriginal or Treaty rights;
- The information it received, including information that relates to Aboriginal or Treaty rights, may inform the Panel's assessment of environmental effects of the Project; and
- The Panel may use the information received to make recommendations to avoid or mitigate the environmental effects of the Project, including those environmental effects that might adversely impact Aboriginal or Treaty rights.

The Panel is of the view that its assessment is limited to the potential environmental effects of the Project as defined in section 5 of CEAA 2012 and that its assessment may inform the Crown in its subsequent consultation with potentially impacted Aboriginal groups. Throughout the Report, the Panel has summarized the information it received and has made recommendations on measures to avoid or mitigate the potential effects of the Project.

To facilitate the collection of information, the Panel invited Indigenous groups potentially affected by the Project and marine shipping associated with the Project to share their perspectives and traditional knowledge on the potential environmental effects of the Project. Indigenous groups also provided information related to the nature and scope of their Aboriginal or Treaty rights and interests throughout the review process. This included the opportunity for groups to present those views to the Panel at community public hearing sessions.

This section contains a summary of the information received by Indigenous groups regarding their Aboriginal or Treaty rights. Additional information regarding groups' Aboriginal or Treaty rights can be found in Appendix E: Indigenous Summaries. During the environmental assessment process, the Panel received a considerable amount of information from Indigenous groups regarding their Aboriginal or Treaty rights, how those rights have been impacted to-date, and how the Project may further impact their rights. The Panel notes that this section includes information presented by Indigenous groups specific to the potential impacts of the Project, as well as other information presented on the historic and cumulative effects of industrialization and marine shipping on their Aboriginal and Treaty rights. The Panel is of the view that all information presented here is important for the Crown to consider in order to fulfill its duty to consult.

The Panel notes the following topics that were brought forward repeatedly by Indigenous groups and are, in the Panel's view, key considerations for impacts to Aboriginal or Treaty rights:

- The importance that Indigenous groups place on their responsibility as 'stewards of the land';
- The maintenance of a governance role in their traditional territories;
- The importance of the *United Nations Declaration on the Rights of Indigenous People* (UNDRIP) and the link between its implementation and the protection of their way of life, or a viable participation in a modern economy; and
- The importance of applying traditional knowledge in environmental assessments to better understand the issues from an Indigenous perspective and their significance when examining projects effects.

Throughout the report, the Panel has made recommendations on the biophysical environmental components, as well as, with respect to Indigenous peoples, on current use of land and resources for traditional purposes, physical and cultural heritage and any place, structure or thing of historical and archaeological importance, and health and socio-economic conditions. These recommendations are made to mitigate or avoid potential environmental effects of the Project, which, in turn, could avoid or mitigate Project impacts on Aboriginal or Treaty rights.

18.1 Proponent's Assessment

The Vancouver Fraser Port Authority (the Proponent) noted that an Aboriginal right must be an "element of a practice, custom, or tradition integral to the distinctive culture of the Aboriginal group claiming the right" and explained that the right must have continuity with the practices and

traditions that existed prior to European contact. The Proponent stated that agreements negotiated between the Crown and Indigenous groups established Treaty rights.

The Proponent assessed the potential impacts on Aboriginal or Treaty rights of the Indigenous groups potentially affected by the Project, both in the Project area and in the marine shipping area. The Proponent based its assessment of potential impacts on Aboriginal and Treaty rights on the results of its current use analysis and effects assessment, as well as information received through its consultation with Aboriginal groups. The Proponent acknowledged that current use, or the absence thereof, was not necessarily reflective of where Aboriginal or Treaty rights existed.

Project Area

The Proponent submitted that the Project would likely impact Tsawwassen's Treaty right and Musqueam's asserted right to harvest crab based on the potential changes in access to a primary crab harvesting location.

The Proponent did not predict any Project-related impacts to Tsawwassen's other Treaty rights to harvest fish, migratory birds, wildlife, and renewable resources, or to gather plants. The Proponent also stated that the Project would not impact Tsawwassen's right to practice their culture because the meaningful use of Tsawwassen's "preferred locations for the preferred purposes" was intact.

To address the potential impacts on Tsawwassen's Treaty right and Musqueam's asserted right to harvest crab, the Proponent proposed the same mitigation measures put forward to address potential effects on current use, including a communication protocol, an Indigenous Advisory Committee, and mitigation measures to address effects on relevant environmental components. The Proponent also noted that its memorandum of agreement with Tsawwassen would accommodate effects from the Project. The Proponent committed to negotiate a memorandum of agreement with Musqueam. The Proponent stated that the proposed mitigation measures would mitigate the impacts on Tsawwassen's and Musqueam's Aboriginal and Treaty rights.

The Proponent did not predict any Project-related impacts on any other Indigenous group's asserted Aboriginal or Treaty rights in the Project area. The Proponent based this prediction largely on their conclusion that there would be no effect on the groups' current use of the Project area.

Marine Shipping Area

The Proponent acknowledged that there were existing cumulative effects that likely impeded the exercise of Aboriginal or Treaty rights in the marine shipping area. The Proponent noted that because routine vessel transit was linear through the marine shipping area, potential interactions between project-associated shipping and the exercise of Aboriginal or Treaty rights would be experienced generally the same way by all Indigenous groups using the marine shipping area.

The Proponent predicted that shipping traffic associated with the Project could result in a minor impact on Aboriginal or Treaty rights due to an increase in temporary displacement in access to preferred locations for the exercise of Aboriginal or Treaty rights. The Proponent noted the most impact would occur in preferred fishing locations (i.e., near the shipping lanes). The Proponent also noted that Indigenous groups had expressed a desire to increase their rights-based activities, and that resultant potential interactions with shipping traffic could negatively impact this.

The Proponent proposed two measures to mitigate impacts on Aboriginal or Treaty rights:

- Collaborate with regulatory authorities and Indigenous groups to support the provision of real-time information about the movement of Project-associated ships and the identification of measures that may reduce the impact of shipping lanes on fishing by Indigenous groups; and
- Participate in relevant regional federal government initiatives and programs and to coordinate their consultation with Indigenous groups with those initiatives.

The Proponent concluded that with implementation of mitigation measures the effects on Aboriginal or Treaty rights would be negligible.

18.2 Views of Participants

A number of Indigenous groups shared their views on how the Project could impact their Aboriginal or Treaty rights which the Panel has grouped under the following general themes: Impacts on traditional territory; Government decisions; governance; sharing of wealth; United Nations Declaration on the Rights of Indigenous People; and, use of traditional knowledge.

Impacts on Traditional Territory

Tsawwassen First Nation

Tsawwassen concluded that the Project would likely result in significant impacts on their Treaty rights and raised the following specific issues:

- The effect of the Project on crab and on Tsawwassen's ability to exercise their right to harvest crab in the waters immediately contiguous to Tsawwassen First Nation Lands;
- The effect of the Project on Tsawwassen's right to harvest migratory birds. It was noted that if the Project resulted in more restrictions on firearms use there would be fewer opportunities for Tsawwassen members to harvest within the Tsawwassen Migratory Bird

Harvest Area. Tsawwassen stated that effects of the Project within the Tsawwassen Migratory Bird Harvest Area must be adequately considered and the significance of this loss must be acknowledged;

- Tsawwassen has a right to gather plants, including marine plants, in areas that overlap the Project footprint and noted concern that the Project would cause an effect on marine vegetation;
- The impact on Tsawwassen’s right to harvest fish in their traditional harvesting areas – a right described as deeply connected to their identity and culture. The Tsawwassen First Nation Final Agreement was negotiated with the view of ensuring that Tsawwassen would have continued access to salmon. However, Tsawwassen noted that the salmon were in steady decline; and
- The impact on Tsawwassen’s right to culture and way of life due to increased lighting from the Project, including the effects of light pollution on their use of Brunswick Point for hunting waterfowl.

Tsawwassen recommended that the Crown complete, prior to a federal decision on the Project and in collaboration with the Tsawwassen, an assessment of impacts of the Project on Tsawwassen rights. Tsawwassen also requested that the Panel require the Proponent and the Crown to engage further with them before the government makes its decision on the Project. Tsawwassen also requested that the Crown establish and fund a government-to-government oversight body for the Project, inclusive of the Tsawwassen, to assist with regulatory oversight and compliance. Tsawwassen recommended that the Proponent be required to negotiate an agreement regarding the Tsawwassen members’ activities, such as community-based monitoring. Tsawwassen also requested a commitment from the federal and provincial governments to develop measures with Tsawwassen to accommodate any concerns that would not be mitigated by the Proponent.

Tsawwassen noted that they signed a memorandum of agreement with the Port Authority in 2004 that was intended to address Tsawwassen’s Treaty Rights in anticipation of the Project. However, Tsawwassen argued that the Project was significantly different from that described in the 2004 agreement. Tsawwassen did not view implementation of that agreement to be suitable for discharging the duty to consult on the Project. Tsawwassen noted that they expected ongoing consultation by the Crown and the Proponent regarding the impacts of the Project on their Treaty rights and accommodation measures. The Proponent advised the Panel at the public hearing that they were in negotiations with Tsawwassen to develop an addendum to the 2004 agreement.

Musqueam Indian Band

Musqueam noted that the Crown identified them, along with Tsawwassen, as the “priority rights holders” in the vicinity of the Project. They stated that no other group had established or proven rights at the Project site. Musqueam shared with the Panel their 1976 declaration of Aboriginal title to their land and rights to use the land. Musqueam noted that as the priority rights holders, Musqueam and Tsawwassen should have a unique role in environmental follow-up measures and recommended that the Proponent be required to establish a follow-up committee with them to

help to oversee the final design, development and implementation of mitigation and offsetting measures.

Musqueam raised concerns that the existing effects from industrialization are restricting their fishing rights. They noted that fisheries closures continue to shrink the areas where they can fish and that various government agencies were sending mixed messages that caused confusion around where, when, and how Musqueam could harvest. Musqueam expressed frustration that their territory and natural resources are declining, in turn impacting their ability to teach the next generation. Chief Wayne Sparrow stated “how do you teach your children? You teach them by showing them and interacting with them. We’re having that taken away from us and to me, that’s our biggest infringement on our *Sparrow* right.” In reference to the protection of their language, social cohesion, and inter-generational knowledge, Councillor Wendy Grant-John stated “when we talk about protecting the integrity of the *Sparrow* case, it’s not just the fishing. It’s not just the sturgeon. It’s all these other things.”

Councillor Grant-John also spoke of the importance of the Panel and the government working together across department lines, the Panel’s terms of reference, and across the legal interpretation of Musqueam’s rights, to allow the environmental assessment process to adequately incorporate what the Musqueam were saying. Councillor Grant-John stated that the “infringement of our right goes across the government, and we continue to go here and here and here trying to get people to listen”. It was noted that although the Panel did not have an explicit mandate to assess impacts on Aboriginal or Treaty rights, “the rights is fundamentally everything about what you do because that’s what we are presenting to you.”

Métis Nation British Columbia

The Métis Nation British Columbia (Métis Nation) stated that the location of the proposed marine terminal and the container ships travelling to and from the terminal were within lands and water important to the Métis Nation and its members, and where the Métis Nation or its members have asserted rights and interests. The Métis Nation stated that in order for a Métis individual to exercise Aboriginal rights they had to establish that they belonged to an identifiable Métis community with a connection to a historic Métis community. The Métis Nation also noted that Section 35 of the *Constitution Act, 1982*, as well as all existing Canadian law, indicates that treaty rights do not “trump” Métis rights, and there is no hierarchy of rights under Section 35. The Métis quoted a principle from the 2016 Report on Reconciliation with Métis stating that “Métis rights are protected equally along with First Nations (Indian) and Inuit Section 35 rights”, as such a principle is “unassailable and fundamental in nature”.

Semiahmoo First Nation

The Semiahmoo First Nation (Semiahmoo) stated that they held exclusive Aboriginal rights and title to Semiahmoo Bay, Point Roberts, and village sites at SCOUTEN and C’ELLTENEM. Semiahmoo raised concerns that the Project would impact their Aboriginal rights and title. Semiahmoo stated that the heavy rail and truck traffic represented a significant ‘nuisance’ to their Aboriginal rights and title. Semiahmoo also more broadly noted that they had not been

consulted regarding the Tsawwassen First Nation Final Agreement nor did they receive any accommodation for the infringement that the Final Agreement caused on their Aboriginal rights and title.

The First Nations of the Maa-nulth Treaty Society

The First Nations of the Maa-nulth Treaty Society (the Maa-nulth) have Treaty rights within the marine shipping area. A portion of Segment D intersects with the Maa-nulth's Barkley Sound Domestic Fishing Area. The Maa-nulth have the right to harvest all species of fish and aquatic plants other than inter-tidal bivalves, for food, social and ceremonial purposes within their Domestic Fishing Area. The Maa-nulth hold commercial fishing licenses pursuant to a Harvest Agreement. There is overlap between the marine shipping area, shipping lanes and harvesting areas used for commercial and domestic purposes. Harvesting for both commercial and domestic purposes extends beyond the 12 nautical mile limit of Canada's territorial sea.

The Maa-nulth were concerned that Project-related container ships would impact the exercise of their harvesting rights by restricting the times and locations in which those rights could be exercised, disrupting travel ways used by the Maa-nulth citizens to exercise their Aboriginal or Treaty rights, and increasing the likelihood of a collision between a container ship and a vessel owned or operated by the Maa-nulth members.

Douglas Treaty Nations

The Esquimalt Nation and the T'Sou-ke Nations, along with the Scia'new, the Malahat, the Songhees, the Pauquachin, the Tsawout, the Tsartlip, and the Tseycum First Nations all stated that they were signatories of the Douglas Treaty. The Douglas Treaty was signed in 1850 and granted the signatories the right to hunt over "unoccupied lands" and to carry out their fisheries "as formerly".

The W̱SÁNEĆ traditional use study noted that W̱SÁNEĆ Nations understood the Douglas Treaty would ensure the continuation of their lifestyle and cultural systems. Legal counsel Gary Yabsley described the Douglas Treaty as a promise from the government to the signatories that they would be able to sustain themselves in perpetuity. The reserves set aside for the Douglas Treaty groups were often smaller than other Indigenous groups because the Crown considered that those groups derived their wealth from the sea.

Signatories raised concerns that the rights granted to them through the Douglas Treaty had not been upheld to-date, and that the Project would exacerbate that infringement on their rights. A Scia'new First Nation member stated that she felt their rights were being infringed upon because they could not fish in the way they want to. Esquimalt Nation described how their ability to harvest "as formerly" was nearly impossible within their immediate territory and declining regionally. Councillor Mildred Modeste from Esquimalt Nation stated "it's sad because we can't even access the waters in our surrounding area. We have to travel outside to other communities to try and exercise our cultural rights and practices, which breaks my heart." Tsartlip First Nation stated that the rights of the W̱SÁNEĆ Nations to carry on their fisheries as formerly would be

affected by the marine shipping associated with the Project. Chief Rebecca David of the Pauquachin First Nation noted that the right to hunt and fish as formerly was a right that had not been upheld.

Mr. Gary Yabsley noted that the overarching concerns of the community were not necessarily specific to the Project, but were still “inseparable from the Project that the Panel is being asked to consider because its death by a thousand cuts one way or another, and this is just another cut”. Mr. Yabsley noted that the assessment process for the Project was another opportunity for the Nations to share a message about the challenges Indigenous groups face with the Crown and Canadians. Mr. Yabsley further stated that the resources that were guaranteed 150 years ago were gone. Mr. Yabsley stated that the promise in the Douglas Treaty “is inseparable from the reality of an abundance of natural resources. You can’t simultaneously say that you have the right to hunt and fish in a sound economic manner and then destroy the environment in which those resources are produced.”

Scia’new First Nation noted that they felt that the Proponent was dismissive of some of their concerns and did not accept enough responsibility for the marine shipping component of the Project. Scia’new First Nation concluded that the Crown needed to engage with them to correct what they called the “deficient consultation” that had occurred on the Project. Esquimalt Nation shared similar concerns and stated that the Crown would have difficulty discharging their duty to consult if the Proponent continued to deflect its responsibilities.

T’Sou-ke Nation raised several concerns about the impacts of the Project on their Aboriginal title, rights, and Treaty rights. T’Sou-ke Nation stated that the Project would cause serious impacts to, and infringements of, its Aboriginal title, rights and Treaty rights that depend upon the SRKW. T’Sou-ke Nation also raised concern that marine shipping associated with the Project, on its own and in combination with other existing and proposed marine shipping activities, interfered with the exercise of their Aboriginal or Treaty rights as well as their spiritual connection to their Territory and identity as Coast Salish peoples.

Songhees First Nation (Songhees) stated that their Aboriginal or Treaty rights were threatened due to the high level of development within their traditional territory and that the Project exacerbated these concerns because the marine shipping route passed directly through their territory. Songhees identified a number of ways in which the Project may affect their rights including: safety of Songhees members on the water; restricted access to preferred harvesting and resources areas due to disturbances from the ships; and, environmental degradation that would compromise Songhees’ identity as stewards of the land. Songhees noted that the effects and cumulative effects of the Project could make it difficult for them to implement certain aspects of their proposed marine use plan. This could place limitation on Songhees’ ability to exercise their self-governance and other rights. Songhees were in the final stages of negotiating an Agreement in Principle with the government and were concerned about the impacts of the Project on their future Treaty rights.

Cowichan Nation Alliance

The Cowichan Nation Alliance described TI'uqtinus as a permanent village and fishing station located on Lulu Island that was exclusively occupied by the Cowichan Nation Alliance.

TI'uqtinus was where member groups of the Cowichan Nation Alliance engaged in extensive and year-round fishing, hunting, and harvesting. Cowichan Tribes, the Stz'uminus First Nation, the Penelakut Tribe, and the Halalt First Nation stated that they were litigating title claim to the village site.

The Cowichan Nation Alliance stated that they had an “exceptionally strong and demonstrable aboriginal right to fish, harvest, and hunt the waters” at the proposed Project site, specifically in the LAA, a significant portion of the RAA, and in the south arm of the Fraser River. Penelakut Tribe specifically noted that they had an agreement with DFO that recognized the right of the Penelakut Tribe to fish in the LAA. The Halalt First Nation, the Stz'uminus First Nation, and the Cowichan Tribes stated that the Project would have immitigable impacts to their Aboriginal or Treaty rights, and stated that they expected to receive commensurate accommodation to account for the impacts. They noted that the Proponent had not proposed an adequate agreement and they were therefore looking to the Crown to address their required accommodation.

Government Decisions

Indigenous groups raised concern about how the government's efforts to recover the SRKW population could impact their rights. Ditidaht stated that the SRKW recovery measures had the potential to adversely impact their Aboriginal fishing rights. Ditidaht noted that measures such as SRKW-related fishing closures or the establishment of a sanctuary would impact their right to harvest marine resources. Ditidaht noted that the critical habitat set out by DFO encompassed almost all of their marine territory.

The Maa-nulth noted that their fishing rights were impacted by measures put in place by the government to try and help the SRKW. DFO's expansion of the SRKW critical habitat covered “a huge portion” of their southern domestic fishing area. Ms. Sharon Jay of Scia'new First Nation noted that although they were the Salmon people, regulations from DFO were preventing them from fishing salmon in order to save the SRKW.

Lake Cowichan First Nation noted that their traditional activities had been either adversely affected or permanently curtailed due to the development that had been permitted by the government. Lake Cowichan First Nation stated that the Crown had allowed legislation, regulation, and policies to be developed that had directly infringed and adversely impacted the rights and title of Lake Cowichan First Nation.

Governance

Pacheedaht noted that in accordance with Pacheedaht laws, customs, and traditions they have the right to govern the resources in their territory, including the right to regulate access to Swiftsure Bank. Pacheedaht has a protocol to regulate access to Swiftsure Bank, which requires parties that want to fish at Swiftsure to request and fly a protocol flag provided by the Pacheedaht Fisheries

Department. Chief Jeff Jones of Pacheedaht described how, in exchange for access to Swiftsure Bank, members from other nations would bring resources that could not be harvested in Pacheedaht territory, such as oysters and prawns.

Pacheedaht also described how they were working with the Makah Indian Tribe from Washington State, USA, on initiatives to protect their territory, specifically marine safety improvements. Pacheedaht described the Makah's government-to-government relationship with the United States coast guard as a model they would like to see emulated in Canada. Pacheedaht expected the Project to adversely affect their governance rights by materially changing the nature of vessel traffic in their territory without Pacheedaht's consent.

Pacheedaht stated that they have been urging the government to move the outbound shipping lanes away from Swiftsure Bank since in 2005 when the international shipping lanes were rerouted to partially intersect Swiftsure Bank. Pacheedaht argued that this has significantly affected their governance and they need to be involved in any activities looking at vessel management in their territory.

Pacheedaht stressed that many of the mitigation measures needed to address the Project's impacts on their Aboriginal or Treaty rights were beyond the jurisdiction of the Proponent and demanded action by the federal government. Pacheedaht noted that the Project offered an opportunity to advance reconciliation. Pacheedaht recommended that Canada engage in "consent-based and collaborative, bilateral, Nation-to-Nation decision-making with Indigenous groups" in implementing the conditions and recommendations related to the Project.

Councillor Kelly Sport, of Ditidaht, spoke of how important it was for Ditidaht to be an active partner on co-management initiatives and noted that it was key to reconciliation. Councillor Sport stated that reconciliation "has to be shown in actions. It has to be shown in demeanour. It has to be shown in society that we really, we are part of this society and we do know what's best for ourselves." It was further noted that the loss of opportunities to pass on traditional knowledge to the next generation had a nuanced and complicated effect on sacred aspects of their culture and governance.

The Maa-nulth, the Scia'new First Nation, the Esquimalt Nation, and the Pauquachin First Nation stated that the lack of a comprehensive and holistic governance system was allowing the approval of a multitude of industrial and commercial projects, adversely affecting the Salish Sea and their territorial waters. The Indigenous groups reported that the existing governance structure left Indigenous people to endure most of the cumulative impacts resulting from intensive development. The Indigenous groups recommended that the Government of Canada enter into discussions with them and other First Nations in the region to design a process to co-develop a governance system that could help achieve the restoration of balance in the ocean. They noted that a necessary part of that governance system would be a comprehensive, regional cumulative effects management plan that would assess the overall environmental state of and cumulative effects on the Salish Sea ecosystem.

Tsleil-Waututh were concerned that the Project would impact their Aboriginal or Treaty rights, including the current, future and desired right to fish. Tsleil-Waututh stated that they operated under a stewardship policy that outlines a consultation area and defines meaningful consultation and accommodation process for anyone working with the Nation.

T'Sou-ke Nation indicated that the right to self-governance was at the core of their self-determination as a nation. T'Sou-ke Nation stated that the Project could affect their efforts to establish self-governance, including stewardship efforts, economic development initiatives, and ecosystem restoration.

Sharing the Wealth

Scia'new First Nation, Esquimalt Nation, Pauquachin First Nation, and the Maa-nulth stated that they should be entitled to share in the wealth generated by the Project. These Indigenous groups argued that traditionally their wealth had been derived from the ocean and its resources but that the Canadian economy has shifted over time, leaving these Indigenous groups without their traditional means to generate wealth for their members. Mr. Gary Yabsley described how these Indigenous groups traditionally relied on a natural resources-based economy, primarily fishing. Mr. Yabsley stated that the economy of the west coast was "transitioning out of commercial fisheries, sport fisheries, and even food, social and ceremonial fisheries into what amounts to establishing a highway for international trade." The Indigenous groups argued that they needed to be integrated into this "new economic order" and that they should benefit from the use of their traditional waters.

The Maa-nulth indicated that because the Project had the potential to impact their Treaty rights, the Project should not be approved unless an economic benefits package is secured. The Maa-nulth argued that since the Project would require the use of their territorial waters, they should be entitled to share in the wealth generated by the Project. The Maa-nulth noted that they were interested in developing their significant economic potential.

The Maa-nulth, the Esquimalt Nation, and the Scia'new First Nation noted that it was not just the potential diminishment of their ability to harvest from the seas that impacted their rights, but that the use of the sea by others constituted an infringement as well. They noted that a project that expanded the number of ships transiting through their waters was equivalent to projects on land that run a pipeline or highway through Indigenous traditional territories.

United Nations Declaration on the Rights of Indigenous Peoples

Several Indigenous groups reported that the federal government had announced that it was a supporter of the UNDRIP.

Scia'new First Nation, Pauquachin First Nation, Esquimalt Nation, and the Maa-nulth all stated that in order for the government to fully implement UNDRIP and achieve "true reconciliation" the government had to look beyond consultation and accommodation of resource harvesting rights. In the view of the Indigenous groups, reconciliation had to include an economic development component. It was argued that Indigenous groups had to have a strong and viable

economy in order to achieve a nation-to-nation relationship with the federal government. Similarly, the Ditidaht First Nation noted that a co-management process regarding marine decisions in their territory would better demonstrate Canada's commitment to the implementation of UNDRIP.

The Semiahmoo First Nation noted that the government had committed to implementing UNDRIP, but that it had not yet taken meaningful steps. The Semiahmoo First Nation was of the view the UNDRIP applied to the marine shipping lanes but that the Nation had not provided 'free, prior, and informed consent' for marine shipping' as mandated by UNDRIP.

Lyackson stated that reduced access and safety concerns associated with large-vessel traffic constituted an infringement on Lyackson's ability to practice their rights and interests. Lyackson was especially concerned that they had not been consulted on the large vessel anchoring locations off the Gulf islands that they believed infringed on their rights and interests within their marine use and traditional territory. Lyackson was of the view that the Proponent's lack of consultation on the Project contradicted UNDRIP. Lyackson noted that the anchored freighters constituted an eyesore, where the visual sensation of large vessels in the otherwise relatively pristine environment presented a "disturbing reminder" of western world's intrusion on First Nation's rights.

Use of Traditional Knowledge

Some Indigenous groups stressed that the Proponent did not adequately use their shared traditional knowledge within its assessment of the Project.

Tsawwassen stated that the Project would result in the loss of access to at least 117 ha of Tsawwassen traditional territory in the Salish Sea. The proposed new terminal would represent a visual barrier for Tsawwassen members looking out from, or towards, Tsawwassen First Nation Lands. The Tsawwassen expected the Project to have an immediate effect on their ability to transmit knowledge across generations because there were words, including geographical names that could lose or change their meaning if they could no longer be associated with specific reference points that were previously visible to Tsawwassen members. Tsawwassen raised concerns about whether traditional knowledge was adequately considered in the environmental assessment. Tsawwassen noted that environmental assessment was a largely western science-based process, and therefore awareness of the key differences between western science and traditional knowledge was critical. They explained how the difference in worldviews shaped how the assessment was structured and how the effects of the proposed Project on humans were assessed.

For Musqueam, the scale of the Project and its impacts to the Fraser River estuary constituted 'a serious infringement' on their Aboriginal rights and culture. For detailed discussion of the effects of the Project on Musqueam rights and Musqueam current use of lands and resources for traditional purposes, the Musqueam stated that traditional knowledge had to be adequately recognized and used by the Proponent in order to arrive at a meaningful and collaborative process.

Tsleil-Waututh also raised concerns about whether traditional knowledge was adequately considered in the environmental assessment process. Tsleil-Waututh requested that the Panel accept Indigenous science and Indigenous knowledge, equally and at level, with the western knowledge base.

19 Socio-economic Conditions

This section of the report addresses the potential effects of the Project on social conditions per section 5(2)(b)(i) of CEAA 2012. The Panel is also required to take into account the potential economic and social effects of the project, including cumulative effects that may not be included in the definition of environmental effects under CEAA 2012, and means to mitigate those potential adverse effects.

The LAA used in the Proponent's assessment consisted of Metro Vancouver, with a focus on Delta, Tsawwassen community, Tsawwassen First Nation Lands and Musqueam reserve IR4. To provide a regional context, the RAA was defined as the province of British Columbia.

19.1 Population and Labour Market

19.1.1 Proponent's Assessment

The Proponent noted that Metro Vancouver's population was 2,313,000 in 2011. This represented a 9.3 percent increase since 2006, with international immigration driving population growth within the area. The City of Delta, with a population of 100 000, has experienced low but steady population growth of 3.2 percent between 2006 and 2011. Limited growth has been attributed to a short supply of land base in Delta for further residential development and the lack of employment growth in Delta over the same time period.

The Proponent predicted that Metro Vancouver's population would increase by 14.9 percent (or 350,000 persons) between 2011 and 2021 and increase by 22.8 percent from 2011 to 2026. The City of Delta's projected annual population growth rate was relatively low, at 0.5 percent between 2011 and 2026.

The Proponent expected the Project to create 12,700 person-years of direct, indirect, and induced employment during construction, including 4,150 person-years of direct employment from onsite terminal construction activities. The Proponent stated these jobs would generate \$1 billion in labour income, and an estimated \$1.3 billion in revenues for British Columbia's businesses supplying materials and goods and services for construction activities. Of that, \$837 million was expected to accrue to supplier industries in Metro Vancouver.

During operations, onsite terminal activities would generate an estimated 1,550 person-years of direct, indirect, and induced employment each year, including 928 person-years of direct employment. The Project would also generate approximately 11,000 direct jobs annually from off-terminal operations, including trucking and warehousing. It was expected that direct employment would generate \$186 million in labour income annually, as well as \$33 million in revenues for provincial suppliers and services. The Project would be designed as a semi-automated terminal and would create over 900 new terminal jobs, most of which were expected to be unionized longshore jobs.

The Proponent undertook an assessment of potential Project effects on the population and the labour market in Metro Vancouver during the construction and operational phases. This was completed to see if the Project could affect the trend of population growth; labour balance and income; and, training opportunities. The Proponent used the British Columbia PEOPLE MODEL to estimate population growth for Metro Vancouver, the Delta and Tsawwassen community to the year 2036. The model incorporated British Columbia's 2011 Census Data and 2011 National Housing Survey information to generate the assessment results. The Proponent noted that the Project would not alter the overall population growth trend in Metro Vancouver during construction and operations. The Proponent concluded similar levels of international permanent migration into Metro Vancouver with and without the Project during both construction and operations.

For the analysis of employment estimates for Project construction and operations, the Proponent relied on expenditure and employment estimates developed by engineering and shipping industry consultants. The British Columbia Input Output Model (BCIOM) was applied to estimate economic effects of the Project on employment, gross domestic product, economic output (gross revenues), labour income (or household income), and certain taxes.

Potential effects identified during the construction and operational phases of the Project were: change of employment; change of unemployment and participation rates; change in labour income; and, change in training opportunities.

The Proponent stated the Metro Vancouver labour force, as well as in other parts of the Lower Mainland, would have sufficient capacity, under competitive wage and salary conditions, to meet Project-associated labour demands.

The Proponent stated that specialised construction-phase activities might require the use of non-local workers resulting in a small amount of permanent in-migration during construction. These incoming workers would be temporarily working on the Project and would permanently reside in Metro Vancouver based on their success for long-term employment opportunities.

Approximately five percent of the Project's direct construction workforce would be sourced from outside Metro Vancouver. On this basis, there would be a nominal and temporary population boost during construction. Workers filling these positions were not expected to be accompanied by family members and they would likely reside in the Project area for under a year.

The Proponent did not anticipate temporary or permanent in-migration of workers to the study area due to the Project during construction or operations in general. Project-associated direct labour demand during operations was expected to be largely filled (90 percent) from Metro Vancouver's available and qualified labour supply.

The Proponent concluded that the Project would maintain Metro Vancouver's labour market balance by maximising the use of local labour resources and providing training to enhance skills of the local labour pools.

The Proponent reported that the Project would have a positive effect on employment rates in Metro Vancouver during construction and operations. The Proponent also anticipated that with the increase in labour demand, there would be a lower unemployment rate and an increase in participation rate in Metro Vancouver. The Proponent indicated that employment associated with Project operations would lead to a small increase in median incomes in Metro Vancouver. It was noted that training opportunities associated with employment activities during construction and operations were expected to create positive social and economic effects in Metro Vancouver.

The Proponent stated that all residual Project effects on labour market were positive and that no mitigation measures were required, although training opportunities associated with construction and operations activities were expected to create positive effects in Metro Vancouver.

19.1.2 Views of Participants

The BC Ministry of Jobs, Tourism and Skills Training indicated that the Proponent's estimates of labour market were of good quality and statements of potential labour market effect were reasonable. According to the Ministry, using the BCIOM was a credible approach for estimating the amount of labour required for large projects. The Ministry stated, given that the focus of project construction was the creation of land instead of the construction of buildings on existing land, the Project may use a smaller range of construction occupations than other projects might use.

The Ministry of Advanced Education, Skills and Training stated that the labour market appeared more constricted than forecasted by the Proponent, but the difference in unemployment rates from the forecast and the actual rate in 2018 was small.

The Vancouver Regional Construction Association stated that port expansion was economically vital to the Lower Mainland's construction industry. The Association relies heavily on an expanded port capacity to ensure the efficient and timely movement of materials and goods. The Association stated that the Project would create jobs and provide opportunities for construction companies to train apprentices and help grow British Columbia's construction workforce.

The BC Chamber of Commerce mentioned that costs and access to labour are two major factors affecting business in British Columbia. The BC Road Builders and Heavy Construction Association underlined the 'critical shortage' of labourers, heavy equipment operators, electricians and pipefitters for the construction phase, a problem encountered across North America due to the lack of interest of youth into this type of industry.

International Longshore and Warehouse Union Local 502 noted that every indication pointed to the Project being a fully automated terminal with an annual throughput capacity of approximately 2.4 million TEU. The Longshore Union was of the opinion this would result in significant job losses for longshore workers and hundreds of millions of dollars of lost wages and lost inputs for Delta, in particular. This would be in addition to the loss of tens of millions of dollars of in federal, provincial and municipal tax revenues.

19.1.3 Panel's Analysis

The Proponent indicated that it intends to recruit the majority (90 percent) of the labour force from British Columbia, largely the lower mainland. As for out of province recruitment due to a low unemployment rate in British Columbia, the Proponent considered that the British Columbia workforce could accommodate the needs for the Project since the construction requirement would be well under one percent draw on the construction workforce of the province.

The Panel recognizes that the Project could alter the local population through temporary or permanent in-migration of workers and their families if the available and qualified local labour pool does not meet the Project's needs. The Proponent did not provide any data on the amount of the permanent in-migration of workers from British Columbia or out of province that may be required for Project construction and operations. The Panel acknowledges, at this time, that there are shortages of workers in specific trades for construction activities in Metro Vancouver.

As for the possibility of a reduction in labour force with port automation mentioned by the International Longshore and Warehouse Union Local 502, the Port Authority confirmed that the Project would be semi-automated and there would be the creation of new jobs, whether the automation would be full or in part. The Panel is of the view that the Project would indeed bring 900 new family-supporting terminal jobs, most of which are expected to be unionized longshore jobs. The Panel agrees that the Project would bring well paid jobs for the general population.

The Panel recognizes that potential labour shortages in Metro Vancouver have to be kept in mind since the Proponent's conclusions on effects to population and labour market were based on present economic conditions remaining stable. If there is a need for higher permanent in-migration for workers from within or outside the province, the consequence could be a burden on health and emergency services of local areas, such as Delta.

The Panel concludes that the Project would bring beneficial local and regional employment for Metro Vancouver, and in particular for Delta.

19.2 Economic Development

19.2.1 Proponent's Assessment

Economic development was defined by the Proponent as the change that occurs in an important attribute of the economy that is a major driver of a region's economic well-being. Expenditures made by the Project would accrue to local individuals, businesses and communities, thereby contributing to the potential expansion of existing businesses or the creation of opportunities. Local or regional companies could further benefit from the expanded capacity and new skills developed as a result of the Project.

The Proponent identified general economic growth and local and Indigenous contracting opportunities associated with the Project as key issues pertaining to the effects of the Project on economic development. To assess the effects on economic development during construction and operations the Proponent measured: the change in construction aggregate availability and price;

the change in materials, goods, and services contracting revenues; the change in induced output (revenues); and consistency with economic development plans.

Economic development in the LAA was expected to be stimulated through the Project's direct purchase of materials, goods, and services produced by local companies. The Project would also stimulate upstream business contracting and materials, goods, and services supply opportunities due to the Project's purchases from direct suppliers.

The construction of new land for the Project terminal would require the purchase and transport of a substantial amount of aggregate, including sand, rock and gravel. The Proponent stated that the Project was expected to have a negligible effect on sand availability and prices in Metro Vancouver given the local aggregate supply capacity and capabilities. Existing quarries had sufficient capacity to meet Project needs. As a result, the commissioning of a new quarry would not be required to support Project construction and, economic effects to local businesses demanding or supplying aggregate and sand were not anticipated.

It was anticipated that a large portion of the materials, goods, and services purchased by the Project would be sourced from businesses located in Metro Vancouver, and sizable amounts would be sourced from elsewhere in British Columbia, from other provinces, and internationally. Household spending of incomes earned by Project employees and employees of Project contractors and suppliers would support additional employment and business development in the local and British Columbia economies. The estimated revenues of direct supplier industries in Metro Vancouver due to the Project were expected to be over \$500 million during the construction period and an additional \$282 million in revenues for LAA businesses due to expenditures on production inputs to make or provide the materials, goods, and services that are sold directly to the Project. The Proponent stated that forecasted change in material, goods and services, contracting revenues, and induced revenues would be economically beneficial in both phases of the Project.

The Proponent concluded that the Project was consistent with the following economic development plans: Metro Vancouver's Regional Growth Strategy, the economic development objectives of the City of Delta, and the general directions set out in the Tsawwassen Land Use Plan of Tsawwassen. Metro Vancouver's Regional Growth Strategy encouraged the use of port lands for industrial activities but these activities should not spread beyond designated industrial and mixed employment areas. The Proponent stated that the Project was supported by the government of British Columbia under its Pacific Gateway Transportation Strategy.

The Proponent emphasised that, while the City of Delta does not have a formal economic development plan, the City identified the Project as a significant economic driver for Delta business. The Proponent further stated that the City of Delta's Developing Delta document stated that the Project would address the need to create additional capacity to meet growth levels and described direct and induced job benefits of the Project.

The Proponent determined that the Project would have either positive or negligible effects on economic development.

19.2.2 Views of Participants

Several participants, such as the Canadian Chamber of Commerce and the BC Chamber of Commerce, were of the view that the Project would play a critical role in supporting Canadian businesses, locally and regionally. The Greater Vancouver Board of Trade outlined that the Pacific Gateway was estimated to support over \$32 billion in Canadian GDP, nearly \$3 billion in British Columbia alone, and 307,000 jobs in 2016. It also emphasised that port capacity was of national importance.

In an update requested by the Panel, the Ministry of Advanced Education, Skills and Training confirmed that the use of 2008 data by the Proponent was still relevant. The Ministry stated that shares of gross domestic product for relevant industries in British Columbia, such as construction, professional, scientific and technical services, transportation and warehousing sectors and wholesale trade have been relatively stable over time. This relative stability meant that using an updated version of the BCIOM would not be expected to change the economic impacts associated with the Project in a manner that would alter the conclusions of the original analysis of the Proponent.

19.2.3 Panel's Analysis

The Proponent was unable to give the exact number or locations of existing local quarries that would be used to supply the Project since the choice will be the subject of a competitive bidding process. The Panel is of the view that the Port Authority has demonstrated that there is adequate local supply of aggregate and the Project would have a negligible effect on availability and prices in the LAA.

The Panel agrees that the Project would provide beneficial economic opportunities to Metro Vancouver and the direct and induced spending of the Project would benefit local and regional businesses. The Panel is of the view that local and regional businesses have the capacity to supply the goods and services required for the Project.

The Panel agrees with the Proponent that the Project respects the general directions set out in the Tsawwassen First Nation Land Use Plan, but only with respect to its industrial development on the northwestern area of the Nation's Lands. In addition, although the City of Delta does not have a formal economic development plan, the Project would be a significant economic driver for businesses in Delta. The Project would be consistent with the economic development objectives of the City of Delta which are based on the need to create direct and induced job benefits in the medium term. The Panel notes that the Project is also supported by the British Columbia Government as the construction of a new terminal is an action item within its Pacific Gateway Transportation Strategy 2012 to 2020.

Metro Vancouver's Regional Growth Strategy - *Metro Vancouver 2040 Shaping Our Future*, focuses on land use and development policies to guide the future growth of Metro Vancouver. It supports the efficient provision of transportation, regional infrastructure, and community services. The Strategy identifies that port lands should not spread beyond designated industrial

and mixed employment areas and encourages the use of port lands for industrial activities only, thus limiting commercial development on site or adjacent to the port. Regarding the governments' Agreement with Tsawwassen on two water lots in the LAA, only community and recreational activities are permitted. The Panel is of the view that the quality of experience of permitted uses for Tsawwassen would suffer from the proximity of industrial activities and ship movements. The Panel acknowledges that mixed use that allows for commercial development should be considered by Metro Vancouver, the Proponent and interested stakeholders. Mixed use could compliment the development of the Project in order to render the site more attractive to local residents and Tsawwassen by allowing other opportunities for business.

The Panel concludes that the Project would bring positive economic development to Metro Vancouver, and in particular Delta.

19.3 Services, Infrastructure and Project Revenues

19.3.1 Proponent's Assessment

Services and Infrastructure

The Project would use local health, emergency, water and solid waste services and infrastructure. Payments in lieu of taxes and property tax payment to the City of Delta would financially support the provision of these services to the Project.

The Proponent assessed the potential for Project-related changes on the demand for, or the provision of, housing, health care services, emergency (i.e., policing, fire, ambulance), and municipal infrastructure (i.e., water and solid waste systems). A potential effect would occur if a service or infrastructure used by the Project became limited in its supply or capacity.

The Proponent also assessed how local government expenditures could change to meet the demand for and utilisation of services and infrastructure generated by the Project and, if local government revenue streams were insufficient to address these incremental local government expenditures.

The Project demand on health care services may result in utilization of local hospitals 15-27 times per year. The Proponent determined the potential incremental demand on health services was low relative to the total annual number of medical services provided by local hospitals adjacent to the Project. The Proponent presumed that a portion of these hospital visits would require ambulance services. Statistics from existing Roberts Bank terminals showed that one to two calls per month for ambulance services are made. The Proponent estimated that Project could result in 12 to 24 calls for ambulance services annually during project construction and operations, which was relatively low compared to total annual ambulance case loads in Delta.

The Proponent stated that the majority of the calls for police services would be for traffic events due to vehicle movements to and from the Project site during terminal construction and operations. The Delta Police Department receives between 10 to 15 traffic calls per year from the existing Roberts Banks Terminals, with the majority of calls due to backup of trucks bound for

the port facilities on the Roberts Bank causeway. Using the existing range of traffic calls for future police services, the potential incremental demand on the Delta Police Department would be low for the Project.

The Proponent stated that the Infrastructure Developer would be responsible for security within the Project construction area minimising the need for local policing. The Infrastructure Developer would communicate relevant construction plans and activities to the Delta Police Department to aid in police resource planning and response. The Proponent confirmed that policing activities for the port would be within the normal responsibility of a municipal police force and that trade-related security, including inspection of containers, was primarily the responsibility of the Royal Canadian Mounted Police and the Canada Border Services Agency.

Project activities during construction and operations may pose a fire risk. Metro Vancouver is serviced by 19 fire departments with nearly 100 fire halls. The Proponent estimated that the Project could result between 10 and 20 calls to Delta's Fire Department annually during construction and operations. The Proponent determined the potential incremental demand on Fire services due to the Project was low compared to historical total annual reported event services by the city's Fire Department.

The Proponent indicated the supply for potable water for the Project would be delivered from Delta's water system. The Proponent indicated there would be no adverse residual Project-related effects constraining the city's potable water system supply and capacity and was committed to consulting with the City of Delta related to water use.

The Proponent determined that the potential increase for disposal of solid waste during construction and operations was low and within the planned capacity of Metro Vancouver's waste management facilities. The Proponent committed to preparing a Hazardous Materials and Waste Management Plan prior to the start of construction that would include details of expected sources and quantities of construction waste; measures to minimise waste generation; waste storage, handling, and recycling; and disposal procedures and reporting of waste quantities. Materials would be collected and disposed of in accordance with all applicable legislation, guidelines, and standard management practices.

Project Revenues

It is forecast that approximately \$13 million in taxes and fees would be paid to local governments during Project construction, with the majority of the funds going to the City of Delta. During operations, an estimated \$19.7 million in government revenues would be paid annually to provincial and local governments, of which \$6.9 million would be paid to Vancouver municipalities and the Metro Vancouver regional district. An estimated \$4.8 million of this amount would consist of property tax payments, of which more than 95 percent would be directed annually to Delta.

The Proponent stated that proposed mitigation measures would reduce the local government expenditure required to finance services use and demand. The mitigation measures included:

- Health, safety and emergency response plan to reduced risk to employee health and safety and demands on local health and emergency services;
- Land and marine traffic management plan would be developed to manage construction traffic for the Project;
- Construction Phase communication plan would be put in place to ensure timely information distribution for traffic detours and interruptions;
- Waste management plan;
- Onsite policing and security management; and
- Communication strategy with emergency service providers.

The Proponent stated that these plans would be developed in collaboration with the BC Ministry of Transportation and Infrastructure, Tsawwassen, and the City of Delta, Delta Police Department, Delta Fire and BC Ambulance Service. The Proponent determined that no residual adverse Project effects were likely to occur on services and infrastructure or on local government finances.

19.3.2 Views of Participants

The City of Delta acknowledged the significant contribution that the Project would make to the local economy through jobs, taxes, and other economic spin-offs. The City of Delta stated that, as the host community to the Project, it would benefit from annual property taxes estimated at \$4.6 million dollars in additional revenue. The Great Vancouver Board of Trade stated that the benefits of the Project to the community were wide-ranging. The terminal would add approximately \$300 million in government taxes at all levels and \$1.3 million in gross domestic product annually. This additional revenue could be utilized by municipalities and the province to provide healthcare, education and other social programs.

While benefits were recognized by the City of Delta, there was an issue of community safety and Project impact as a focal point for organized crime and drug smuggling. The City of Delta explained that the city was one of the key gateways for the flow of illegal goods into western Canada. In a recent report commissioned by the British Columbia Provincial Government, significant gaps in port policing had been identified. Since Ports Canada Police was disbanded in 1997, policing has largely been delegated to the municipal force and understaffed Canadian Border Security Agency. The City of Delta stressed the need for various policing and enforcement agencies that have jurisdiction at the port, including the Royal Canadian Mounted Police Serious Organized Crime Unit, to work collaboratively to address crime at the port. The City of Delta reported that at the end of 2015 the Port Authority stopped its annual funding of \$400,000 to an integrated police team.

The Delta Police Department, reiterated that the department was responsible for 911 calls at the Port but container inspection was handled by the Royal Canadian Mounted Police and the Canadian Border Services Agency. Currently the inspection facility is working close to maximum capacity and, if there were to be an increase in container volume within the ports, additional inspections would not be possible. Although the city's Police Department could not

report the amount of organized crime that came through the port, it was believed to exist and posed a safety concern to the City of Delta.

Congestion of traffic through the George Massey Tunnel was identified by many business associations as a critical issue for the transportation of goods and the recruitment of labour in the Delta region. The City of Delta requested that any decision about the Project be conditional on the provision of a new crossing of the south arm of the Fraser River to replace or augment the George Massey Tunnel transportation capacity.

Tsawwassen stated that they have closed access to their local roads to transport trucks. It was recommended that the Government of Canada and British Columbia co-develop measures to mitigate traffic concerns before government decisions are made regarding the Project. This would include a traffic impact assessment and traffic management plans that consider the specific concerns of the Tsawwassen.

The City of Delta reported that on average day in 2017, 14 to 20 thousand container trucks used the George Massey Tunnel. The Proponent recognized that there is a problem with road congestion. However, in the Proponent's assessment, and assuming that general traffic would not increase at the George Massey Tunnel by the late 2020s to 2035, container truck traffic would double due to the addition of the Project. Therefore, container traffic use of the George Massey Tunnel would total approximately 2.8 percent of monthly traffic and 4.6 percent of daily traffic on a peak day. While the City of Delta agreed that the percentage of truck traffic through the tunnel may be a low, it had a greater impact because of the size of the trucks.

19.3.3 Panel's analysis

The Panel finds that the Proponent has demonstrated that the estimated incremental usage of local landfills for the disposal of solid waste generated by the Project is within the planned capacity of Metro Vancouver's Integrated Solid Waste and Resource Management Plan. The Panel acknowledges the Proponent's commitment to include measures to minimize, reuse, and recycle waste generation as part of the Waste and Hazardous Material Management Plan. The Panel underlines that all efforts should be made to divert waste from the landfills to help Metro Vancouver meet its target of 80 percent diversion of waste. The Panel also emphasises the importance of preventative solutions in order to reduce the amount of hazardous wastes produced by the Project.

The Panel expects that there would be a need to increase health and emergency services if the Project's labor force decides to permanently reside in Delta or if there is more temporary immigration than predicted. The Panel heard from the City of Delta that ambulance services are presently at their maximum and the Project may have an additional strain on this service.

The Panel is also aware of the concerns regarding the potential for increased crime rates with the Project and the need for adequate police and security services. Based on the revenues and expenditures presented by the City of Delta, the Panel notes that protective services constitute the city's main expenditure and it is apparent that the City of Delta, to some extent, relied on the

Port Authority to fund the integrated police team. The Panel finds that the estimated \$4.6 million in annual property taxes in addition to fees and payments in lieu is a significant beneficial economic effect for Delta. However, the Panel realizes that the effects of the Project on Delta's community safety and security would only be mitigated if actual improvements were made to the city's policing services. For this reason, the Panel is of the view that the Port Authority should resume its annual integrated police team funding.

Finally, throughout the environmental assessment process, the Panel heard from numerous participants about road congestion in the local area and the accrued inconvenience from rail traffic the Project would generate. Although the scope of the environmental assessment referred to marine, road and rail transportation within the areas for which the Proponent has jurisdiction, the Panel is of the view that, if the Project is allowed to proceed, the province, the City of Delta and the Tsawwassen will need to collaboratively address local traffic issues.

The Panel acknowledges the Proponent reporting that traffic projections of container trucks through the George Massey Tunnel were lower than that presented by the City of Delta but also that the nature of the container traffic is different than other vehicles due to their size. The Panel notes that the congestion through the tunnel is not only an issue for container trucks. However, the Project is contingent on the efficient flow of goods and workers to and from the terminal. Based on information provided by the City of Delta, it appears that the earliest a new crossing could be completed is 2030. The Panel is of the view that the proposed improvements to the Highway 99 crossing of the Fraser River should be expedited if the Project is approved.

While the Panel concludes that the Project would have a positive economic benefit, the Panel has made recommendations that would need to be applied to ensure no Project effects on socio-economic conditions in the long-term.

The Panel concludes that with the implementation of the Panel's proposed recommendations, the Project would not result in an adverse effect on the socio-economic conditions, locally or in the region, as a result from changes in services, infrastructure and Project revenues.

Recommendation 47

In order to meet Metro Vancouver Integrated Solid Waste and Resource Management Plan industrial diversion targets the Panel recommends that the Proponent be required to include, in its Hazardous Materials and Waste Management Plan, measures to:

- *Limit non-hazardous waste generation; and*
- *Minimize the amount of hazardous waste that would be produced by the Project.*

Recommendation 48

The Proponent, in consultation with the Delta Police Department, the Royal Canadian Mounted Police and the Canada Border Services Agency be required to:

- *Examine the creation and implementation of a multi-jurisdictional port policing authority to prevent and control crime incidence at Roberts Bank terminals. The task force would eventually transition to the Roberts Bank Terminal 2 port operator security entity; and*
- *Negotiate an agreement with the City of Delta to allocate sufficient funds to implement an integrated police team commensurate with the requirements of the Project.*

Recommendation 49

The Panel recommends that the Proponent, in consultation with the City of Delta, be required to develop a monitoring plan prior to the construction of the Project that would annually evaluate the incremental increase in spending for particular services and infrastructure to determine if the Project is adding a financial burden to Delta. The plan would include:

- *Monitoring throughout construction and for the first 5 years of operations; and*
- *Mechanisms for increasing compensation for the city in the event that revenues are insufficient to meet additional expenditures induced by the Project.*

19.4 Socio-economic Conditions for Indigenous Groups

Section 20.4 - Marine Commercial Use addresses the economic implications of potential displacement of commercial marine fishing and harvesting as a result of the Project footprint and navigational closure area expansions. It also includes effects on commercial licenses held by Indigenous groups and other marine commercial ventures, such as guided sport fishing.

In the following section, the Panel examines the Proponent's assessment of the Project effects on Indigenous groups as part of the overall labour market and economic development related to the Project. In addition, the Panel reviews any effects on existing and future commercial ventures potentially caused by the Project and associated marine shipping.

19.4.1 Proponent's Assessment

The Proponent reported that Indigenous workers represented 2.1 percent of the labour force in the LAA, which includes Metro Vancouver and Delta. The RAA encompassed the province of British Columbia. Labour force participation rates within the Indigenous population exceeded those of the general population in 2011, which likely reflects the comparatively younger age structure of the Indigenous population. Although participation rates for the LAA's Indigenous population are high, so too are unemployment rates. In Metro Vancouver, the Indigenous population experienced an unemployment rate of 12.6 percent, approximately 5.5 percent higher than the region's overall labour force.

Approximately 4,300 Indigenous workers in Metro Vancouver were in the trades, transport, and equipment operations and related occupations, accounting for 16.3 percent of the region's total Indigenous workers. In Delta, 21.1 percent of Indigenous workers were in this occupational group. According to the Proponent, Indigenous participation in trades training increased by 118 percent between 2006 and 2010, suggesting the development of new labour force skills, and potentially, the introduction of new Indigenous workers to the labour force and trades

employment opportunities. In Tsawwassen and Musqueam communities, a large portion of residents are employed as construction labourers.

The Proponent reported that, although incomes in the LAA and the RAA had gradually increased since 2000, median incomes for Indigenous people remained consistently below those of non-Indigenous people over the same period. This finding suggests high levels of income inequality between Indigenous and non-Indigenous members within the LAA and RAA.

The Proponent indicated that the Project would generate indirect employment opportunities in industries supplying goods and services during terminal construction and would generate economic activity through spending of Project-associated employment income. The Proponent also indicated that Project operations would generate direct employment opportunities for Indigenous people in the LAA both within the marine terminal and transportation sector.

The Proponent stated that Project hiring and training processes and practices that directly address systemic challenges facing Indigenous workers in the LAA could support employment and long-term opportunities. The Proponent committed to developing an Indigenous Training, Employment and Procurement Plan for the Project to ensure that economic benefits from the Project flow to Indigenous groups. The Proponent would develop this plan in collaboration with Indigenous groups and through its Indigenous Advisory Committee prior to commencing Project construction. The Proponent would develop a monitoring process that would require contractors to annually report on Indigenous employment and training. The Proponent would review the report to determine the degree of progress and to address any potential obstacles to implementation of the plan.

The Proponent outlined specific measures to support potential employment opportunities for Indigenous people, including the following:

- Continue to abide by the Memorandum of Agreement in place with Tsawwassen to accommodate Tsawwassen for effects from the Project;
- Work with Musqueam to draft Terms of Reference to accommodate effects from the Project;
- Work with the Lake Cowichan First Nation and the Tseycum First Nation to implement commitments within their respective existing Mutual Benefit Agreements;
- Engage with Indigenous groups, including Semiahmoo, Tsleil-Waututh, the Stz'uminus First Nation, the Cowichan Tribes, the Halalt First Nation, Lyackson, the Penelakut Tribe, the Métis Nation, the Hwlitsum First Nation, the Tsawout First Nation, the Pauquachin First Nation, the Tsartlip First Nation, and the Malahat First Nation to develop Mutual Benefit Agreements; and
- Assist all Indigenous groups identified above in accessing potential economic opportunities resulting from the Project, including contracting opportunities and construction employment opportunities. The Proponent would finance training programs for Indigenous groups to prepare for employment opportunities associated with the Project.

The Proponent anticipated positive changes in employment and labour income for the Indigenous population in Metro Vancouver and Delta during construction and operations and positive residual effects on the labour market.

19.4.2 Views of Participants

Indigenous groups expressed concerns that effects from the proposed Project on existing and potential future ventures were not considered in the Proponent's assessment.

Tsawwassen noted a desire to further develop residential areas on their Treaty lands to rent to non-Indigenous persons. Tsawwassen were concerned that they may not be able to attract future residents with existing and potential increases in pollution, as well as increased light and noise from the Project. The Proponent stated that while population growth was anticipated for Tsawwassen First Nation Lands over a similar time period as the construction and operational phases of the Project, this growth was expected to be the result of future economic conditions in general and unrelated to the Project.

Semiahmoo requested prevention and restoration measures to enable a shellfish fishery to be reopened. The Proponent indicated they were interested in initiating discussions with the Semiahmoo regarding potential legacy benefits from the Project, if it proceeds. The Proponent stated that legacy benefits would be over and above the economic benefits resulting from the Project, such as: restoring fisheries, training, funding cultural initiatives, enhancing environmentally sensitive areas, or revitalising aquaculture.

The Penelakut Tribe informed the Proponent that, while government regulations and legislations have made commercial fishing challenging, the Cowichan Nation Alliance planned to be fishing in the Project area in the future. The Malahat First Nation suggested allocation of benefit funding to enable opportunities for boat work, such as boat operator licencing, SCUBA licencing, geoduck aquaculture or workshops on seafood processing.

Tsleil-Waututh noted that there was no socio-economic conditions study conducted for its Nation. In Tsleil-Waututh's view, only limited and dated socio-economic information was provided and the information only applied to Tsleil-Waututh reserve lands.

The T'Sou-ke First Nation indicated they have commercially harvested clams and are concerned that increase shipping will have an adverse effect on this activity.

The Tsawout First Nation, acknowledged that the Proponent predicted a certain amount of "displacement" of harvesters from the area as a result of the construction and operations of the Project. However, Proponent did not go further in describing the effects of displacement on areas outside the Project area, or on other users. If harvesters are displaced from the Project area or the shipping lanes, another Project effect would be increased competition for resources in other areas; however, the Proponent did not assess this effect.

The Pauquachin First Nation were concerned with the Project effects on its economic interests, including on the development of Pauquachin First Nation lands. The Scia'new First Nation was

also concerned that the Project may affect its economic interests, including the potential development of their lands and revenues flowing to Scia'new from existing business. The Esquimalt Nation gave specific examples of off-reserve economic development interests, such as a recreational vehicle park, marina and float-home village, and a property in Rock Bay with commercial/industrial development potential.

The Songhees First Nation raised issues about the effects marine shipping could have on their economic interests on Chatham Island, such as planned cultural tours. Lyackson stated that increased vessel traffic would negatively affect Lyackson's economic development opportunities on Valdes Island. Ditidaht was concerned that marine shipping could affect the wilderness character of their ecotourism business due to visual and auditory disturbances. Their members indicated that an accident, resulting in an oil, fuel, or other cargo contaminant spill, might affect Ditidaht's ability to develop and maintain its ecotourism industry, which is a major source of economic development.

Pacheedaht estimated that increased shipping traffic would have adverse effects on their recreational campground at Gordon River and on their eco-tourism-based business. Pacheedaht reported that there were several sea lion rookeries and caves located in Pacheedaht territory, which were included in their eco-tours routes. Further, Pacheedaht operate Seafoam Seafoods, a seafood processing plant and have several fisheries economic opportunities through a small number of industrial-based licenses managed by Pacheedaht's Fishery Department. The Pacheedaht indicated that the large ships increased their fishing costs because they needed to invest in larger boats or expensive navigational technology for safety purposes.

The Maa-nulth noted that their business and economic development potential rely on the marine environment. The Maa-nulth highlighted that economic development and prosperity within their traditional territory was a key focus of all the Maa-nulth Nations. The Maa-nulth stated that they have commercial salmon fishing licenses that overlap the marine shipping area for the Project and extend offshore along the west coast of Vancouver Island, beyond the 12 nautical mile limit of Canada's territorial sea. The Maa-nulth noted that routine operations of Project-associated ships could affect their ability to commercially harvest. The Maa-nulth indicated that they already had difficulty making a living harvesting commercially because of regulations and a decline in the fisheries and additional ships would only exacerbate those concerns. The Maa-nulth raised concern that an accident or malfunction involving a Project associated container ship could affect their businesses and economic development. The Maa-nulth also described several other marine-based commercial ventures undertaken by, or in partnership with, their Nations, including a cannery in Nanaimo, British Columbia, three shellfish aquaculture businesses, marinas, a recreational fishing business, and ecotourism businesses.

19.4.3 Panel's Analysis

The Panel supports the Proponent's efforts to facilitate access to employment and business opportunities derived from the Project in order for Indigenous groups and individuals to fully profit from the benefits of the Project. The Panel agrees that the Project would bring employment and economic development to Indigenous populations of Metro Vancouver as well as to

members of Tsawwassen, Musqueam, and other Indigenous groups interested in participating in employment and business opportunities offered.

The Panel is of the view that specific training for Indigenous populations would be important since the unemployment rate is higher than for the general population. In this respect, the Proponent committed to engage with the Indigenous Advisory Committee and Indigenous groups to develop Indigenous training.

The Panel concludes that the Project would bring beneficial employment and business opportunities for Indigenous groups and individuals.

However, the Panel notes that while negotiated agreements can benefit an Indigenous community and that some measure of financial or employment measures may be included, these agreements do not allow the Panel to determine if the concerns of the Indigenous groups were or will be addressed or if the potential effects of the Project would be effectively mitigated.

The Panel recommends that the Port Authority commit to facilitating and monitoring employment, training, and procurement from regional Indigenous communities through formal policies and made public through formal announcements.

Recommendation 50

The Panel recommends that the Proponent be required to ensure that all Indigenous groups identified in the Environmental Impact Statement and the Marine Shipping Addendum who express interest in accessing potential employment and business opportunities related to the Project be made fully aware, in a timely fashion, of the opportunities for training, employment, and contracting.

Potential Effects on Commercial Ventures

Notwithstanding the opportunities for employment and contracting that the Project would create, the Panel is of the view that these opportunities should not come at the expense of existing commercial and planned future ventures of Indigenous groups located both in the Project area and the marine shipping area. The Panel notes that while some groups expressed interest in revenue sharing, the majority of Indigenous groups were concerned about the effects of the Project and its associated marine shipping on their ability to protect or develop commercial ventures.

In the case of the Project area, the Panel recognises that there could be an effect on Tsawwassen's proposal to further develop residential areas on their Treaty lands to rent to non-Indigenous persons. The Panel is of the view that the Port Authority should commit to develop a formal reporting mechanism for concerns related to existing or intended commercial ventures in the Project area.

The Maa-nulth clearly emphasized to the Panel that economic prosperity is their key focus and any activity that interferes with their commercial ventures would cause an effect on socio-

economic conditions for the Maa-nulth. The Panel accepts, based on the general information it received on the Maa-nulth's commercial harvesting areas, that marine shipping associated with the Project have the potential to intersect with commercial fishing by the Maa-nulth within Segment D of the marine shipping area. However, the Panel is of the view that not every Project-associated ship movement would result in an interaction with a Maa-nulth vessel undertaking commercial fishing within Segment D. The Panel concludes that the Project is likely to cause a minor residual effect on the Maa-nulth commercial fishing, if this activity occurs in Segment D. The Panel is of the view that this effect is not significant.

To further examine the effects of marine shipping associated with the Project outside of the marine shipping area, but within the within the 12 nautical mile limit of Canada's territorial sea, the Panel considered Figure 5-3 and Figure 5-4 in Section 5 - Marine Shipping. The Panel concludes that, although very few container vessels appear to transit the west coast of Vancouver Island within 12 miles of the shoreline, the Project would cause a minor residual effect on the Maa-nulth commercial fishing if marine shipping associated with the Project intersect with the Maa-nulth commercial fishing activity in waters beyond Buoy J and within the 12 nautical mile limit. Given the expected infrequent interaction between the Maa-nulth commercial fishers with Project-associated ships, the Panel views this effect to be not significant.

The Panel did not have a mandate to examine the effects of Project-associated marine shipping on the Maa-nulth's commercial activities outside of the 12 nautical mile limit.

The Panel acknowledges that the Maa-nulth is currently experiencing adverse effects on their ability to commercially harvest, and that any increase in vessels transiting the area in which they fish commercially would likely exacerbate these effects. The Panel concludes that there would be a cumulative effect on the Maa-nulth's existing commercial ventures due to the Project within the marine shipping area. Similarly, the Project may result in a cumulative effect on the Maa-nulth commercial fishing within the 12 nautical mile limit of Canada's territorial sea, specifically along the west coast of Vancouver Island, in waters beyond Buoy J. The effect along the west side of Vancouver Island is however more infrequent, and of a lower magnitude than the expected effect within Segment D, as fewer vessels transit this coast within 12 miles of the shoreline. The Panel finds it is unable to conclude with respect to the significance of this cumulative effect.

For all other Indigenous groups, the Panel is of the view that 1.5 container ship movements associated with the Project per day would not affect commercial ventures taking place in the marine shipping area or within the 12 nautical mile limit of Canada's territorial sea.

The Panel is of the view that existing and future commercial ventures would not be affected by the Project or marine shipping associated with the Project, except potentially for the Tsawwassen First Nation and the First Nations of the Maa-nulth Treaty Society. In the case of the Maa-nulth, there would be a residual adverse effect and an adverse cumulative effect on commercial fishing in the marine shipping area associated with the Project. The effects would not be significant.

The Panel concludes that marine shipping associated with the Project would result in a non-significant adverse effect and an adverse cumulative effect on the Maa-nulth Nations commercial fishing within the 12 nautical mile limit of Canada's territorial sea. The Panel cannot conclude on the significance of the cumulative effect.

Recommendation 51

The Panel recommends that during the construction phase and the first two years of operations, the Proponent be required to develop a reporting mechanism for concerns from the Tsawwassen First Nation and the Maa-nulth Nations on potential effects of the Project and associated marine shipping activities on their commercial ventures and to evaluate and engage with the groups to find mutually appropriate solutions.

20 Community Resources

In this section, the Panel examines socio-economic effects resulting from changes of the environment caused by the Project on specific environmental components. These include land and marine water uses, agriculture, visual resources, outdoor recreation and marine and commercial use.

20.1 Land and Marine Water Uses

20.1.1 Proponent's Assessment

For its assessment, the Proponent selected four indicators to evaluate land and water uses use in the LAA for the Project. These four indicators were: consistency with land use designations; compatibility with adjacent or proximal land use designation; change in the area of existing land use (including submerged land); and disturbance to other uses.

The Project would be an expansion of existing marine terminal land use at Roberts Bank. Approximately 117 ha of the Project would be constructed on submerged federal Crown land and another 45 ha would be constructed on acquired submerged provincial Crown land, which has been re-designated as "Port Terminal". Land and water use in and adjacent to the Project includes agricultural activities, protected areas, residential uses, industry including port and terminal use, park lands, Tsawwassen First Nation Lands, and Option lands⁷.

The Proponent identified that Project-related changes could affect adjacent and existing land and water use, as well as opportunities for future land uses as defined in applicable land use planning documents and existing by-laws. The Proponent presented summaries of existing and future federal, provincial, local government and Tsawwassen community plans and strategies. The Proponent also noted that, as required by the *Canada Marine Act*, the Port Authority has a Land Use Plan that guides development of port lands and waters over a period of approximately 15-20-years.

The Project includes the need for a 450 m rail tie-in of a lead track from the causeway to the existing BC Rail network. The Port Authority sought a right of way from the BC Railway Company for a narrow strip of the Option land along the causeway, but ended up purchasing the entire property. The Proponent indicated that approximately 0.2 acres of the Option land would be used for the Project. This transaction also included another parcel of land located along Deltaport Way. This land will remain as is until the Proponent requires the land for railway purposes for the Project. The Proponent indicated that further study, consultation, and planning was required to determine the future use of the remainder of this property.

⁷ The Option lands were lands owned by the British Columbia Rail Company and dedicated as railway right-of-way; however, farmers have the option to continue farming-related activities until rail construction has been approved and the land is needed for construction.

The Proponent stated that there were two water lots leased to Tsawwassen First Nation Lands under the *Tsawwassen First Nation Final Agreement (2009)* (Final Agreement of 2009). One lot is located in the inter-causeway area and the other lot is found on the east side of the BC Ferries Tsawwassen Terminal. Both lots were designated for recreational and other community use purposes and excluded uses for business, commercial and industrial purposes and other activities that generate revenues and profits. An additional two water lots, located on each side of the existing causeway, that were federal crown lands could be transferred, assigned or subleased to Tsawwassen. As part of the 2004 *Memorandum of Agreement* between the Port Authority and Tsawwassen, these two lots could be transferred to the Nation if they are not required by the Project. Final conditions of the transfer still have to be negotiated between the Proponent and Tsawwassen. In addition, the Tsawwassen have a right of refusal for 80 years, after the Final Agreement of 2009 came into effect, to purchase approximately 278 ha of provincial land, known as the Brunswick Point Right of Refusal Lands. Tsawwassen may exercise this right if the current lessees choose not to buy the land or decide to sell the land later. The Brunswick Point lands are located within the ALR.

The City of Delta Official Community Plan (OCP) sets out land use policies and directions for land use within the municipality, and provides land use designations to guide development. The OCP contains municipal-wide policies, as well as area plans for the communities of North Delta, Lander, East Lander, Tsawwassen community and Riverside, none of which are within the LAA. The OCP policies are intended to preserve and enhance Delta's waterfront and water-related industries. The upland component of the Project's LAA is designated as Agricultural within the OCP, and contains strategies to assist in supporting the long-term viability of farming in the community. Within the Project's RAA, Delta has 1,475 ha of industrially zoned and designated land, 859 ha of which are occupied. Industrial use within the marine portion of the LAA includes the Roberts Bank terminals and BC Ferries Tsawwassen Terminal. The Proponent stated that the OCP designation of the Roberts Bank terminals was consistent with the Port Authority's Land Use Plan.

The Proponent noted that construction activities related to the expanded tug basin would bring additional vessels to the area and potentially affect the ability of Tsawwassen members to access the community lease lands. The effects would be infrequent and isolated to the construction phase of the Project and partially mitigated by a communication plan. The residual effects were determined to not be significant.

Additional vessels related to project construction could also delay or change the routing of other industrial marine vessel users, including those marine vessels accessing Westshore and Deltaport Terminals. All vessel activities would be closely managed and coordinated by the Infrastructure Developer and marine transportation companies and notification of Project activities would be communicated to the Canadian Coast Guard.

The Roberts Bank WMA is located between the existing Roberts Bank terminals, the BC Ferries Tsawwassen Terminal, and partially on the west side of the proposed Project terminal within the LAA. The Proponent indicated that Project-related construction activities or vessel traffic could

extend into the southeast corner of the WMA and affect marine access to the area for recreational users. The marine recreational use of these portions of the WMA was described by the Proponent as low use. The Proponent considered this potential effect to be ‘minor to moderate’ and a residual effect would not be expected because of the implementation of the Land and Marine Traffic Management Plan.

The Proponent concluded that the WMA were currently compatible with port activities and established vessel activity and were not anticipated to be affected by Project-related vessels during operations.

The Proponent would implement a Construction Communications Plan and a Land and Marine Traffic Management Plan. The Proponent stated that their Communications Plan would include a description of the Port Authority’s Community Feedback Line and a mechanism for two-way dialogue and communication with all land and marine water users. The Communications Plan would include mechanisms to identify and address unanticipated issues regarding Project-related construction activities and interaction with existing users. The Proponent stated that their Land and Marine Traffic Management Plan would include areas of restricted access for marine vessel traffic for safety and minimization of effects on the Roberts Bank Wildlife Management Area, measures to mitigate land and marine construction traffic congestion, control traffic, and mitigate potential traffic hazards. The Proponent concluded that there would be no residual effect on marine-related industrial uses or disturbance to the protected WMA.

The Proponent acknowledged that conflicts currently existed between the Project and adjacent or proximal land use designations, such as agriculture. The Proponent identified approximately 105 ha of ALR land was within a kilometre radius of the Project. The Proponent stated that Project effects on adjacent agricultural lands would be negligible because agricultural lands have co-existed with the existing Roberts Bank terminals since their construction.

The Proponent noted that the Project’s environmental management plans were proposed to mitigate potential effects to environmental components that could be related to agriculture. These plans would help address agricultural concerns expressed by participants, specifically the Delta Farmer’s Institute. The Proponent committed to engage with the Delta Farmer’s Institute in the development and implementation of the Land and Marine Traffic Management Plan to mitigate construction traffic congestion, control traffic, and potential traffic hazards. The Proponent also stated it would provide the Delta Farmer’s Institute an opportunity to review the Waste and Hazardous Materials Management Plan should it express an interest to do so.

The Proponent reported that they were not interested in developing land for industrial uses. Its main focus was to locate and purchase land to develop shore-based marine terminals. The Proponent acknowledged that there was an issue with insufficient industrial land availability in the Greater Vancouver Area, but considered it not specific to the marine terminal container sector. The Proponent noted that it was the industry that acquired land in support of the off-dock businesses and that the shortage of industrial land underlined by City of Delta was related to land acquired by third parties along the supply chain for the purposes of import transload, container stuffing, and empty container storage.

20.1.2 Views of Participants

In response to a Panel information request, the Agricultural Land Commission (ALC) provided details on its roles and responsibilities regarding the ALR. The ALR is land protected for agricultural use under British Columbia's *Agricultural Land Commission Act*. Farming is recognized as the priority use for these lands and related agricultural uses are controlled. Local and regional governments, as well as other provincial agencies, are expected to plan in accordance with the provincial policy of preserving agricultural land. Application must be made to the ALC for exclusion of land from the ALR and permission to utilize the land for non-farm purposes.

The ALC advised the Panel that they had approved an application dated March 12, 2008 from the BC Railway Company to acquire additional right-of-way for railway purposes, 'which could be germane' to the Project. Further, the ALC provided the Panel with a map of the area indicating the right-of-way for railway purposes was still part of the ALR. The potential for negative effects to accrue on ALR properties adjacent to the Project lands included soil disturbance and compaction, weed infestation, cutting of sub-surface drainage and irrigation lines, crop and productivity loss, crop management disruption, farm facility disruption and introduction of pests and diseases. The Commission suggested that the Panel look at mitigation measures for both the construction and post-construction phases of the Project to offset any negative effects.

The City of Delta stated that nearly half of its land base was within the ALR and that farming has contributed significantly to the local economy. Almost 400 ha of agricultural land had been lost to development over the past two decades, which includes road and rail improvements to support port industrial growth. The City of Delta raised concerns about the amount of industrial land that the Port Authority would require for the Project and noted that the industrial land inventory of Metro Vancouver was expected to be exhausted by 2020. The City of Delta noted the difficulty to provide adequate industrial land, and the increasing pressure on their agricultural land to accommodate such requirements from the Proponent and other industries. It was estimated that as much as 600 ha of prime agricultural land in Delta was under pressure from port-related development.

Commercial Real Estate Services Canada, a commercial real estate brokerage company, reported that Vancouver had a very low vacancy and availability rate for industrial land for lease or sale. The vacancy rate as of May 2019 was 1.3 percent, while a healthy market should reflect around four to six percent. The only inventory of vacant land of 6 ha or more in the Delta region was on Tsawwassen First Nation Lands and in Delta's designated industrial area.

Several local residents expressed concerns that agricultural land in Delta and neighbouring areas was under intense pressure from development and being lost to expanding port and other industrial infrastructure projects. One participant noted that there was no new farmland available to replace lost agricultural land. Against Port Expansion noted concerns about industrial development in what was referred to as "primarily agricultural areas". The Delta Naturalists Society stated that the Project would contribute to cumulative impacts on wildlife habitat due to

conversion of farmland. A resident of Tsawwassen community for almost 50 years stated “We moved here because it was a nice place to raise children and it was another small community by the ocean, which is no more. I'm quite devastated about the commercialization of our agricultural land.”

The Delta Farmers Institute stated that Delta was recognized as having the most fertile and productive farmland in Canada. The Farmers Institute reported that local farmers provided a wide range of food products for the residents of the Lower Mainland and were an important contributor to the local economy. The Farmers Institute indicated that several hundred acres in the ALR were lost to the South Fraser Perimeter Road and Deltaport Terminal projects. It noted that the Project would add to that loss in the ALR and may even be “the proverbial straw that breaks the camel’s back.”

The Farmers Institute recommended that the government take a firm stand in defence of the ALR and not allow any further conversion of farmland to non-farm activities without appropriate mitigation measures and a compensation strategy. The Farmers Institute acknowledged that they were not aware of any farmers that were directly affected by the Project.

Tsawwassen members stated they are the closest land owners to the proposed Project. Tsawwassen noted that the Project had the potential to affect their ability to access and enjoy their lands, waters, and traditional practices within their territory, which are central to their culture.

20.1.3 Panel’s Analysis

With the commitments and mitigation measures proposed by the Proponent, the Panel agrees that apart from being a nuisance, the Project would not result in an adverse effect on marine industrial users. The Panel observes that with increased traffic during the construction phase, the level of disturbance to the WMA has the potential to increase with the Project. The Panel accepts the Proponent’s assessment that it is a low use area. The Panel is of the view that if the Marine Traffic Communication Plan includes the requirement to clearly communicate throughout the construction phase and on a regular basis that marine vessels must avoid disturbing the WMA, and in particular the southeast corner, there would be no residual adverse effect from the Project.

Consistency and Compatibility with Adjacent Land and Water Use

The Panel is aware that the Proponent acquired submerged provincial crown lands for the construction of the terminal and the expansion of the causeway, which will be designated ‘industrial’ by the Proponent under its land use plan. The Panel further notes that the Project will be constructed adjacent to an existing Port terminal, also designated as ‘industrial’ under the Port Authority’s land use plan. The City of Delta’s OCP agrees with the designation of the Roberts Bank terminals in its uses, such as making contributions to industrial and shipping industries and expanding the community’s role as a port of trade. The Panel acknowledges that the large industrial land mass associated with the Project is incompatible with adjacent land use designations.

The land use profile for Delta, as presented, in Table 20-1 below, clearly indicates that agricultural land is the dominant feature in the area.

Table 20-1: Land use profile for Delta (Source: Adapted from EIS, Volume 4)

Land Use	Percentage of Delta Land base
Agricultural Land	46 %
Burns Bog	17 %
Single-family residential	11 %
Industry and port terminal use	9 %
Parks, regional parks and open areas	10 %

Contrary to the Proponents' view that the causeway ends in a semi-urban area, the Panel is of the opinion that the semi-urban area in Delta is located east of the BC Ferries Tsawwassen Terminal, outside the LAA of the Project. The industrial character of the port is on water, adjacent to the land area designated as agricultural. The addition of more industrial land, even if in line with the Proponent's land use plan, is increasing the existing conflict with the surrounding land use designation.

The Panel accepts that changes in access to water lots tenured to Tsawwassen under community leases would be negligible during construction. However, the Panel determines that access during operations to future recreational and community activities would be continuously disrupted and could pose a safety risk to Tsawwassen members. However, the Project's 177 ha terminal facility and associated marine shipping activities would affect Tsawwassen's level of use of the area, specifically the use of waterways for traditional purposes. The Proponent stated the foreshore and waters fronting the Tsawwassen community were used regularly by Tsawwassen members for recreational and cultural reasons.

The Panel accepts that the Proponent's proposed Construction Communications Plan and Land and Traffic Management Plan would mitigate Project-related effects on marine-industrial users. However, the Panel is of the view that these plans would not effectively mitigate Project-related effects on Tsawwassen community members and recreational users. The Panel is aware that federal Crown land adjacent to the tug basin will be transferred to Tsawwassen as part of a 2004 Memorandum of Agreement between the Proponent and Tsawwassen members. Because negotiations are on-going, the Panel cannot comment on how much land would actually be transferred to Tsawwassen. However, the Panel is of the view that its future use would be limited in space and in nature due to the location and type of Project-related activities in and adjacent to the tug basin. In Section 16 - Current Use of Lands and Resources for Traditional Purposes, the Panel concludes that the Project would likely significantly affect Tsawwassen current use. The Panel concludes that without additional mitigation measures the Project would constrain the activities of Tsawwassen and potentially other users.

Agricultural Land

The Panel accepts that the Project will remove only 0.2 acres of agricultural land in the LAA of the Project. The Panel is aware that the land acquired by the Proponent was land owned by the

BC Railway Company and was already dedicated as railway right-of-way. The Panel is aware of the necessity of reconciling the use of these lands for Port Authority activities against the community's desire to maintain the land for agricultural purposes. The Panel emphasizes the fact that the small amount of land that the Proponent would require for the Project is part of the ALR. Since the Proponent did not propose an alternative to using the farm land or ways to mitigate further loss of lands in the ALR, the Panel concludes that there would be a residual effect from the Project. Due to the small portion being removed, the effect would not be significant. In combination with past and future projects, the Project would result in a cumulative effect that would be significant due to the ongoing loss to the ALR from industrialization and urbanization in the LAA.

The Panel concludes that there would be a non-significant adverse effect and a significant adverse cumulative effect of the Project on agriculture land use due to the loss of a small portion of land contained within the Agricultural Land Reserve.

Further, the Panel heard that industrial land is limited within Delta and that agricultural land is under considerable pressure from industry, including port related industry. While agricultural uses may have coexisted with existing Roberts Bank terminals since their construction, it is apparent that the availability of agricultural land has diminished over the years. The Panel considers that additional mitigation measures beyond the Port Authority's commitments are needed, concerning the unused land portion acquired for the Project and adjacent farms.

Recommendation 52

The Panel recommends that the Proponent be required to:

- *Maintain as agricultural the portion of land acquired from the BC Railway Company and not required by the Project; and*
- *Implement an agricultural management plan to prevent, monitor and compensate for the loss of farmland and employment and, potential effects on Agricultural Land Reserve properties adjacent to the Project lands.*

20.2 Visual Resources

This section discusses the potential changes to visual resources due to the Project. The Project has the potential to change the visual quality of local and regional viewing opportunities due to the addition of the proposed terminal and widened causeway, as well as affiliated Project infrastructure such as the ship-to-shore gantry cranes.

20.2.1 Proponent's Assessment

The Proponent indicated that visual resources correspond to the natural and cultural aspects of the landscape, visually perceived, that have the potential to negatively or positively affect human views based on their characteristics. For the Proponent, daytime views have recognized scenic values in the vicinity of the Project which would support, for instance, tourism and

recreational activities. Nighttime viewsapes would offer the opportunity for viewing celestial objects or provide a viewing experience in the area contrasting with urban conditions.

The Proponent investigated changes to daytime and nighttime visual resources using viewsapes, which correspond to the viewing extent from a point of reception (POR) towards the Project area.

The Proponent noted that since there are no federal regulations that govern the effects of port and terminal development on daytime visual quality, the Proponent used the British Columbia Visual Resource Management (BCVRM) system, which the Proponent considered to be an established and standardized approach to assessing effects to visual resources. The Proponent stated that this system was recognized as the provincial standard for managing visual quality and was primarily related to forestry development.

Consistent with the approach outlined under the BCVRM system, the Proponent assessed effects on daytime visual resources in terms of changes to the viewing condition between existing and post-development periods as viewed from ten POR. The Proponent took photographs from each POR to record existing views of the Project area. The photographs were then composited with post-development computer simulations of the proposed marine terminal and widened causeway to simulate future views of the Project. The Proponent used basic visual quality classes (VQC) definitions to determine the level and character of the alterations visible on the landscape in pre- and post-development periods (Table 20-2). The Proponent indicated that a change in VQC demonstrated the magnitude of change in the quality of visual resources.

Table 20-2: Classes of visual quality (Source: EIS, Volume 4)

Visual Quality Class	Basic Definition of Visual Quality Class
Preservation	Alterations are very small in scale and not easily distinguished from the pre-development conditions.
Retention	Alterations are difficult to see, small in scale, and indistinct in appearance.
Partial Retention	Alterations are easy to see, small to medium in scale, and noticeable as an element in the landscape.
Modification	Alterations are very easy to see, appear medium to large in scale, and are a prominent element in the landscape.
Maximum Modification	Alterations are very easy to see, large in scale, and are a dominant element in the landscape.

The assessment of nighttime visual resources focused on values associated with the visibility of the night sky and Project-related changes to visual quality. The Proponent used the same 12 nighttime POR as the light assessment, and assigned a classification to each POR following the Commission internationale de l'éclairage (CIE) classification system to describe existing conditions and future conditions with the Project. The methodology used to assess potential changes to light is described in Section 7.3 - Light Pollution.

The LAA for daytime visual resources consisted of an area within 8 km of the Project, where the Proponent indicated that effects were most discernible. For nighttime visual resources, the LAA was within 60 km of the Project area. The RAA was between 8 and 30 km for daytime visual resources, and between 60 and 70 km for nighttime visual resources. See Figure 20-1 for the PORs located within the LAA and the RAA.

The Proponent determined that for five of the ten daytime POR, D-POR 1 to D-POR 5, the effects from the Project would not change the VQC, which were already at ‘maximum modification’ and represented a highly modified level of visible alteration. The Proponent stated that while the prominence of Project features increased at these POR, the existing level of alteration provided the capacity to absorb visible impacts. The Proponent stated that for the remaining five daytime POR, D-POR 6 to D-POR 10, the change in VQC demonstrated a change in the quality of visual resources. These changes were primarily due to increased visible levels of alteration and relative scale of prominent features in the viewscape. The Proponent stated that for the Alaksen National Wildlife Reserve and Garry Point Park, the VQC increased from modification to maximum modification. These locations demonstrated the greatest visual impact from the Project due to an increased prominence of alteration and level of detail discernible from viewing distances between 9 km to 12 km.

In response to the Panel’s Information Request regarding the expectations of viewers for visual quality in the LAA, the Proponent described viewer conditions and expectations for visual quality based on visual impact assessment frameworks. These framework use viewer characterizations as a practical tool to predict the relationship between viewers and the landscape in order to describe the relative expectations or level of concern for visual change. The Proponent presented the viewer type, and described the viewer’s expectation for visual quality at each POR based on number of viewers, duration of viewing events, and whether scenic quality was of primary or secondary importance.

A summary of the effects of the Project on daytime visual resources, as measured by changes in VQC, are presented in Table 20-3. The table also describes the viewer type and expectations for visual quality.

In Section 7.3 - Light Pollution, the Proponent predicted that there would be a change in CIE classification for light trespass at N-POR 11 and for sky glow at N-POR 1 and 2 for mainly cloudy skies. When using the Bortle scale, the Proponent predicted that there would be a change in class at N-POR 7 and N-POR 11.

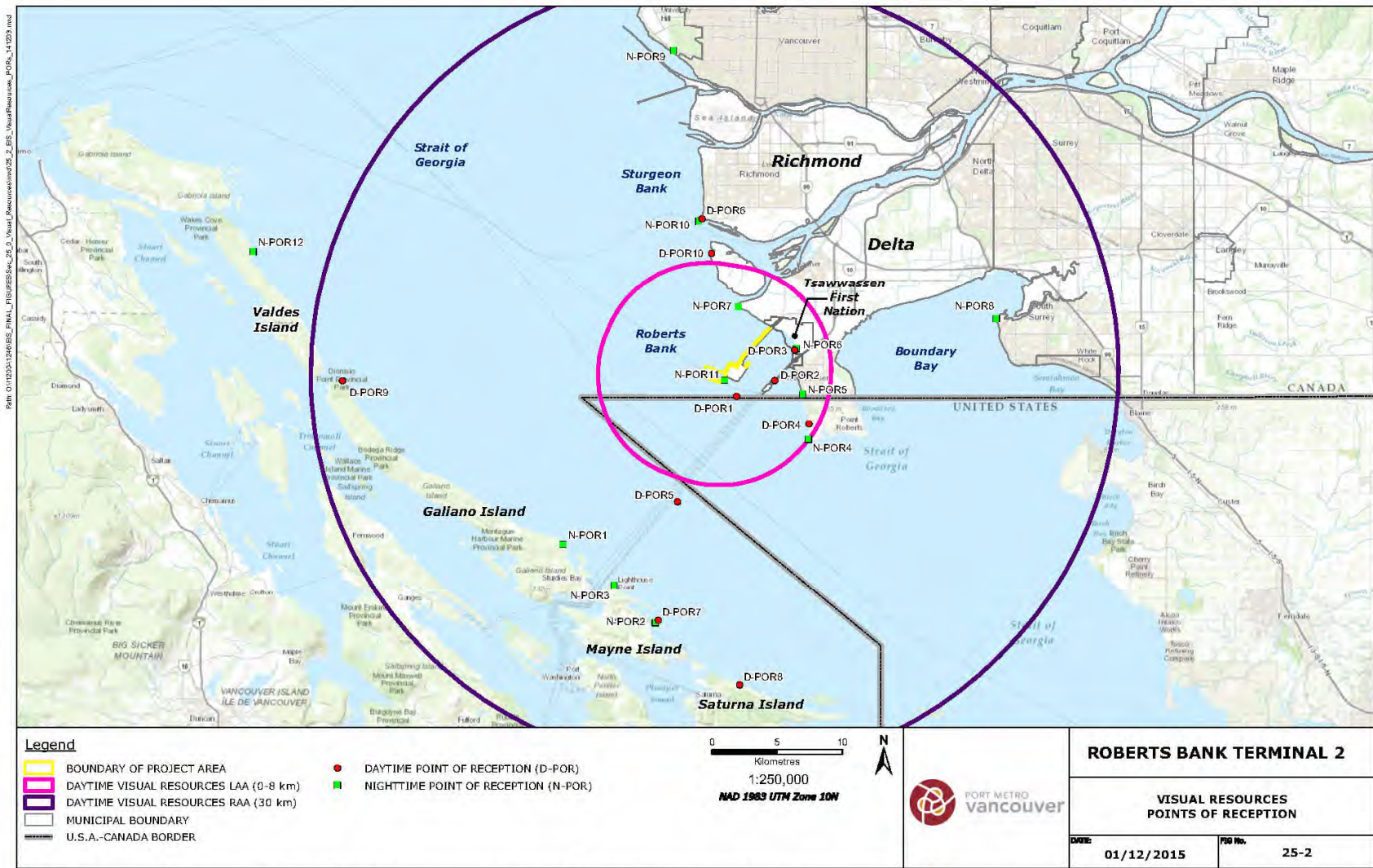


Figure 20-1: Visual Resources Points of Reception (Source: EIS, Volume 4)

Table 20-3: Project-related effects on daytime visual resources and expectations for visual quality (Source: Adapted from EIS, Volume 4 and Project public registry document 1125, IR8-13)

POR #	POR Name	Distance to Existing Terminals (km)	Viewer Type	Expectation for Visual Quality	Existing Visual Quality Class	Potential Visual Quality Class (Post-Development)	Change in Visible Alteration (%)
D-POR 1	B.C. Ferries Duke Point route	2.0	Travel corridor	Moderate	Maximum modification	Maximum modification	+23
D-POR 2	B.C. Ferries causeway	2.6	Travel corridor	Moderate	Maximum modification	Maximum modification	+9
D-POR 3	Tsawwassen First Nation, outer dyke	4.7	Cultural importance	High	Maximum modification	Maximum modification	+14
D-POR 4	Point Roberts, U.S.A. mid-way western shore	6.4	Residential	High	Maximum modification	Maximum modification	+11
D-POR 5	B.C. Ferries Swartz Bay route	12.0	Travel corridor	Moderate	Maximum modification	Maximum modification	+48
D-POR 6	Richmond, Garry Point Park	11.5	Recreation	High	Modification	Maximum modification	+64
D-POR 7	Mayne Island, Bennett Bay Ecological Reserve	19.3	Recreation and tourism	High	Partial retention	Modification	+500
D-POR 8	Saturna Island, Mid-island	24.4	Residential	High	Partial retention	Modification	+150
D-POR 9	Galiano Island, Dionisio Point Provincial Park	31.3	Recreation and tourism	High	Partial retention	Modification	+100
D-POR 10	Alaksen National Wildlife Area	9.3	Recreation and tourism	Moderate	Modification	Maximum modification	+123

The Proponent indicated that it would implement crane colour optimization to reduce contrast of the ship-to-shore gantry cranes and enhance blending with the surrounding landscape and stated that this mitigation was not expected to reduce the changes in classifications of the VQC at any of the daytime POR. The Proponent concluded that after the application of mitigation measures, there would be a residual effect that was low or moderate in magnitude for multiple daytime POR where there was a change in VQC classification. The Proponent defined a significant effect as one that consisted of a low to moderate overall visible change to visual resources that was uncharacteristic within the existing landscape character. The Proponent concluded that the effect would not be significant because the area surrounding the Project is already a predominantly modified landscape as a result of previous activities and projects.

For nighttime visual resources, the Proponent made a commitment to implement a Light Management Plan to minimize excess light and sky glow while still maintaining safe levels of lighting for nighttime construction. The Proponent also committed to implementing a follow-up program on light trespass and sky glow. The Proponent indicated that after the application of mitigation measures, there would be a residual effect that is low in magnitude for N-POR 11. The Proponent stated that the effects would be long-term, continuous and partially reversible however, the effect would not be significant.

The Proponent stated that the area surrounding the Project was already a predominantly modified landscape as a result of alterations from past and present projects and activities. The Proponent stated that daytime and nighttime visual conditions within the LAA were primarily influenced by existing port facilities, including the BC Ferries Tsawwassen Terminal and the Roberts Bank terminals. The Proponent noted that the pre-1958 rural and natural landscape consisted of agricultural lands interspersed with residential and commercial areas and a connecting network of roads and railway corridor. The Proponent noted that the daytime POR used in the assessment did not demonstrate agricultural land features as a dominant visual feature in the viewsapes. The visibility of artificial light was considered to have affected nighttime viewing conditions by creating an environment of low ambient brightness and increased background sky glow, particularly over Metro Vancouver.

The Proponent identified that the George Massey Tunnel Replacement project could interact cumulatively with the Project on visual resources. The Proponent stated that the incremental change introduced by the George Massey Tunnel Replacement project would contribute a negligible increase in the visibility of anthropogenic features and would be in character with the existing urban metropolitan pattern of development within the RAA. Based on this, the Proponent concluded that cumulative effects would not be significant.

20.2.2 Views of Participants

Several participants commented on the existing visual quality of the area, stating that the Project would make an already bright sky worse at night. A participant stated that they avoided using dykes along the shore because it was “so industrial” and noted that during early morning runs before the sun comes up that “the glow hurts your heart.” Another participant stated that they did

not think that industry was ever lovely to look at it, and considered it to be unpleasant. An additional participant considered that the expansion of Deltaport Terminal would mean, among other things, the “loss of beauty in our landscape – for artists, for educational projects for children and youth, and for future generations.”

Musqueam noted that there is only so much that could be done to mitigate the visual effects of the terminal and there would still be a significant residual effect after the Proponent changed the colour of cranes and dimmed lighting.

Tsawwassen stated that a more finely graded scale appropriate to measuring effects on stargazing would be a more meaningful tool for use in the assessment of effects on visual resources.

Tsawwassen recommended that the Proponent use the 9-point Bortle Scale in its assessment.

Tsawwassen noted that any sky glow above 200 percent was rated as G4, the maximum rating, which was indicative of areas of high district brightness. Tsawwassen further noted that a full moon in an area free of artificial illumination has a sky glow value of 3000 percent and highlighted that a full moon belongs in the same category as an urban area, according to the CIE classification system. Tsawwassen noted that this was counter-intuitive in terms of eventual carry-over effects to visual resources where natural sky glow was generally perceived more favourably than artificial sky glow.

A participant stated that there was a lot of subjectivity involved in the Proponent’s statements that the Project would contribute only a minor increase in the visibility of anthropogenic features and artificial lighting, and that the characteristics of the Project features would be consistent with the existing landscape character. It was further noted that there were many members of the community for whom even small changes to visual resources were likely significant.

20.2.3 Panel’s Analysis

Daytime Visual Resources

The Panel notes that the assessment of visual resources underlines the necessity to look at ways to integrate project features with the surrounding landscape. The Panel agrees with the Proponent that colour optimization of the ship-to-shore gantry cranes would not reduce the visual effect at any of the daytime PORs, namely due to the size of the cranes. The Panel agrees with Musqueam that there is only so much that can be done to mitigate the visual effects of the Project. The Panel considers that the cranes would create a presence on the landscape that, although characteristic of the existing port facility, would be uncharacteristic of the surrounding environment.

The Panel notes that although there are no changes in visual quality class for some of the daytime PORs, that there is a percentage change in visible alteration at all POR as per Table 20-3. Based on this, the Panel is of the view that there would be residual effects at all POR.

The Panel agrees with the Proponent that the duration of the effect would be long-term, the frequency would be continuous, and the effects would be partially reversible at all POR. The Panel agrees with the Proponent that effects within 8 km of the Project area would be where

effects to daytime visual resources would be most discernible, and agrees that the extent would be local for some POR, and regional for other POR.

However, the Panel disagrees with the Proponent regarding the magnitude of the effect. The Panel did not rely on the BCVRM system to determine the magnitude of the effect, since the system was designed for use in a natural setting and for forestry applications, and is not optimal for industrial applications such as the Project. The Panel considers that the BCVRM is useful to provide a qualitative classification of the level of alteration, but cannot be relied on to determine the magnitude of adverse residual effects on visual resources due to the presence of project infrastructure.

To determine the magnitude of effect, the Panel took into account the viewer type and the expectation for visual quality. The Panel notes that expectations of visual quality, such as the number of viewers, duration of viewing events, and whether scenic quality was of primary or secondary importance, offer important qualitative information for determining the magnitude of the effect to daytime visual resources. The Panel considers that the following statement of the Proponent to be particularly relevant: “visual impact assessment frameworks employ viewer characterizations as a practical tool to predict the relationship between viewers and the landscape in order to describe the relative expectations or level of concern for visual change.”

The Panel considers that for D-POR 1, 2, and 5, the viewing location is primarily used as a travel corridor and the expectation for visual quality is of secondary importance to the activity or experience pursued (i.e., passenger ferry, or motorist). The magnitude of the effect at these PORs would be low. The Panel considers that although the expectation for visual quality is high at D-POR 6, 7, 9 and 10, the magnitude of the effect would be moderate since the activity being pursued is recreational or touristic, which is a viewing event that is short-term. The Panel considers that at D-POR 3, 4, and 8, where the primary viewing purpose is cultural, or residential, the magnitude of the effect would be high since the duration of the viewing event is long-term. The Panel determines that a significant adverse residual effect at a POR would be one that has an effect of high magnitude, be located within the LAA where effects are most discernible, and experience an effect that is long term in duration, and continuous. The Panel determines that there would be a significant adverse residual effect at D-POR 3, and 4, since they meet the criteria of having an effect that is high in magnitude and are located in the LAA. The effects would not be significant at all other D-PORs.

The Panel concludes that the Project would result in a significant adverse effect on visual resources at daytime points of reception 3 and 4 and surrounding areas.

Nighttime Visual Resources

The Panel agrees with the Proponent’s conclusions that changes in CIE classification are predicted for light trespass at N-POR 11 and for sky glow at N-POR 1 for clear skies, mainly clear skies, and mainly cloudy skies, and at N-POR 2 for mainly cloudy skies. The Panel also notes that the Proponent predicted that there would be changes in Bortle scale class at N-POR 7 and N-POR 11. In Section 7.3 - Light Pollution, the Panel recommends measures to reduce these

effects and proposed that a follow-up program be carried out to verify the accuracy of these predictions.

The Panel is of the view that using the CIE classification system is appropriate to assess the potential changes in the ability to view celestial objects. The Proponent's results already indicate a deterioration of celestial viewing at N-POR above G2 classification. On the other hand, the classification system may not entirely capture the potential for changes in the viewing experience in areas of "high district brightness."

The Panel notes that under existing conditions, many POR were already characterized as G4 or "high district brightness", and therefore no changes in classification were predicted since the G4 classification captures sky glow that is greater than 200 percent above natural dark sky. The Panel is of the view that, based on the comments of Tsawwassen, there could be a perceived change in viewing experience for viewers in residential areas as a result of the Project even if there is no change in CIE classification. The Panel determines that the mitigation measures and follow-up program recommended in Section 7.3 - Light Pollution is required to verify the accuracy of the Proponent's predictions for sky glow and potential changes in viewing experience for nighttime visual resources. The Panel is of the view that N-POR 5 (Tsawwassen community) and N-POR 6 (Tsawwassen First Nation Lands) should be added to the proposed follow-up program.

The Panel acknowledges that after the implementation of the mitigation measures proposed in Section 7.3 - Light Pollution, there would be a residual effect at nighttime PORs where there are predicted changes in classification. The Panel agrees with the Proponent that these effects would be of low magnitude, local, long-term, and continuous, and would not result in a significant adverse effect.

The Panel concludes that the Project would result in a residual adverse effect on visual resources at nighttime points of reception 1, 2, 7, and 11 and surrounding areas. The effect would not be significant.

Recommendation 53

The Panel recommends that the Proponent be required to include in its Light Management Plan a follow-up of:

- *Nighttime point of reception 5 for potential effects on Tsawwassen residents; and*
- *Nighttime point of reception 6 for potential effects on Tsawwassen First Nation Lands and members of the community.*

Cumulative Effects Assessment

The Panel recognizes that both daytime and nighttime visual conditions in the LAA are influenced by existing port facilities, including Deltaport and Westshore Terminals and the BC Ferries Tsawwassen Terminal, when viewed from the sea. When assessing cumulative effects, the Panel considers that adding 25 ship-to-shore cranes and a terminal of 1.3 km by 700 m would

not be consistent with the existing landscape. Participants referred to the industrial character of the Project as an added intrusion to the surrounding environment.

The Panel concluded that the Project would result in a significant adverse effect on daytime visual resources for viewers at D-POR 3 and 4 and surrounding areas. The Panel is of the view that the cumulative effects of the Project would be significant in consideration of the prominence of the existing Roberts Bank terminals and the proposed added structures.

With respect to potential changes in nighttime visual resources, the Panel determined that the Project would not result in significant adverse effects. However, the Panel notes that the light environment at Roberts Bank is degraded under existing conditions, with many areas exceeding the limit of dark sky for most astronomers and the viewing of celestial objects, which corresponds with CIE classification G2 for sky glow and potentially an added deterioration of viewing experience, particularly for residents located in areas surrounding N-POR-5 and 6. Based on this, the Panel concludes that Project, in combination with other past, present, and future reasonably foreseeable projects and activities, would result in a significant adverse cumulative effect on nighttime visual resources.

The Panel concludes that the Project would result in a significant adverse cumulative effect on daytime and nighttime visual resources.

The assessment of visual resources underlines the necessity to look at ways to allow for the harmonious integration of a project with its surroundings. Usually an industrial project could reduce its visual effects by reducing the height of its buildings by design, integrating its location with the surrounding landscape, or adding camouflage landscaping elements. In the case of the Project, to be built on an artificial island, color optimization is the only element considered to partially reduce daytime effects.

The Panel notes that the Proponent is a member of the Association Internationale des Villes Portuaires or the Worldwide Association of Port Cities, and is also responsible for the management of numerous port facilities in the Vancouver area. The Panel is of the view that because there are no federal regulations that govern the effects of port and terminal development on visual quality, or directions as to the choice of locations of new ports or expansions of existing ones, there is an opportunity for the Proponent and other Canadian port authorities to collectively improve the integration of existing and future port infrastructures with the surrounding landscape to minimize visual effects and promote social acceptance. In addition, the Panel is of the view that the Proponent should work with Indigenous groups to develop appropriate visual enhancements.

Recommendation 54

The Panel recommends that Transport Canada in collaboration with Canadian port authorities:

- *Work collaboratively with existing associations, such as the Worldwide Association of Port Cities and Canadian urban planners, to develop a charter, with principles and*

guidelines that could be followed to minimize visual effects of port expansions and promote social acceptance; and

- *Develop and implement with Indigenous groups and other stakeholders, ways to promote port areas as an asset for tourism or the promotion of existing heritage elements.*

20.3 Outdoor Recreation

The Panel's analysis of outdoor recreation was informed by the conclusions of other sections of this report. The elements reviewed are noise and vibration, air quality, water quality with respect to resuspension of sediments, light pollution, visual resources, and changes in availability of marine invertebrates, fish and avifauna.

20.3.1 Proponent's Assessment

Project Area

The Proponent identified four subcomponents for its assessment: 1) recreational boating and wind-sport activities, 2) recreational marine fish and seafood harvesting, 3) recreational hunting, and 4) other land-based outdoor recreation. The Port Authority identified four pathways of interaction between the Project and each subcomponent: area use; area access; resource availability; and quality of environmental setting.

Recreational Boating and Wind-Sport Activities

The Proponent predicted a negligible effect on recreational boating and wind-sport activities. The Proponent noted that there was no overlap with the Project footprint as these activities were identified as mainly taking place on the east side of the BC Ferries Tsawwassen Terminal causeway.

Recreational Marine Fish and Seafood Harvesting

The Proponent provided data showing that over 10 years there were 30,149 total boat days for recreational fish and seafood harvest in DFO's Pacific Fisheries Management Area 29, sub-area 29-D. The area of overlap between the Project's LAA and sub-area 29-D represents approximately 11 percent of the entire sub-area 29-D. Year-to-year trends and species harvested were assumed to be similar between the two areas. The Proponent reported that the existing 502.9 ha navigational closure area for commercial crab harvesters made the Project's LAA a popular location for recreational crab harvesting because of the reduced competition. With the expansion of the navigational closure area during construction and operations, the Port Authority identified a minor effect on recreational marine fish and seafood harvesting due to the displacement of recreational harvesters.

The Proponent stated that most boats used the area along the coast between Point Roberts and the Roberts Bank terminals, and Boundary Bay. The Proponent noted that on a peak day, approximately 50 boats harvested crabs between Point Roberts and west of the Roberts Bank terminals, with approximately 40 harvesting to the east of the BC Ferries Tsawwassen Terminal.

The Proponent did not predict any effect due to a change in availability of crab or salmon levels. To address the potential displacement effect, the Proponent proposed to work with DFO to consult with recreational crab harvesters, and as necessary, implement required and feasible mitigations. The Proponent concluded that there would be no residual effect.

Recreational Hunting

The Proponent identified waterfowl as the main target of recreational hunters. The Proponent noted that in the LAA, land-based recreational hunting took place mainly at Brunswick Point and on farmland east of Canoe Passage. Water-based hunting areas were located in the inter-causeway area and in the waters between the BC Ferries Tsawwassen Terminal causeway and Point Roberts. Land and water-based hunting was also conducted around and on Westham Island. The Proponent predicted that there would be negligible effects on recreational hunting from the Project. The Proponent acknowledged that hunting had become difficult during sunrise and sunset due to light pollution altering the behaviour of the birds since they were more likely to move earlier in the morning and later in the evening. Since hunting was not permitted 30 minutes before sunrise or 30 minutes after sunset, the recreational hunting window was very small. The Proponent noted that the Project was not expected to affect the availability of coastal birds for recreational hunters. The Proponent also stated that the Project footprint did not overlap with any key areas or routes for hunting. In response to a Panel information request, the Proponent indicated that the expansion of the causeway and placement of the terminal would restrict the use of firearms but did not propose measures to mitigate the additional loss to the existing hunting zone. The Proponent predicted that there would be negligible effects on recreational hunting from the Project.

Other Land-Based Outdoor Recreation

This subcomponent included the following activities: walking and running; cycling; birdwatching; and the use of outdoor recreational facilities such as parks. The Proponent stated that Project activities would not result in any change in areas presently used for land-based recreational activities.

In response to a Panel Information Request, the Port Authority conducted a summer and winter use survey of the Brunswick Point Trail and the Tsawwassen Outer Dyke on Tsawwassen First Nation Lands. The results indicated approximately 78 to 100 people use the Brunswick Point Trail on a weekend day depending on the season for a variety of activities including photography, and approximately 56 people used the Tsawwassen Outer Dyke on Tsawwassen First Nation Lands. Since no effects were anticipated on availability of birds, number of bird sightings or bird watching activities in the LAA, the Proponent concluded that there would be no effect on the recreational bird watching activities.

According to the Proponent, there would be no loss in total area or in length of the Brunswick Point or Tsawwassen Sea Dike trails due to the widening of the causeway. Access from one trail to the other was already prohibited to maintain public safety. Individuals who choose to cross the

causeway were doing it at their own risk. The Proponent was open to further discussion with Tsawwassen and the City of Delta on the development of a pedestrian and cyclist overpass.

The Port Authority also identified Tsawwassen Beach adjacent to the Tsawwassen community waterfront and Fred Gingell Park as recreational areas. The Proponent stated that the current Roberts Bank terminals were visible from Fred Gingell Park. The Proponent did not predict any effects on these other land-based outdoor recreation activities.

The Proponent predicted that there would be no effect on the quality of outdoor recreation due to changes in the environmental setting, including noise levels or visual resources since there are already anthropogenic features of an industrial area. The Proponent stated that the Project footprint would not overlap with land-based recreational activities and that Project activities would not bring any change in areas presently used for land-based recreational activities. The Port Authority stated that the Project would not affect Tsawwassen Beach. In addition, the Proponent predicted that there would be no effect from the Project on bird populations, and therefore no effect on the number of bird sightings. The Proponent concluded that there would be no effect from the Project on outdoor recreation.

Marine Shipping Area

The Proponent identified two subcomponents around which the assessment was structured: recreational fishing and seafood harvesting; and recreational boating and other recreational activities such as sailing, kayaking, and shore-based activities. The Proponent acknowledged that there was a long history of development and activity in the marine shipping area that had affected the access, use, and setting for recreational activities. The Proponent reported that recreational activities took place in all four segments of the marine shipping area, including in USA waters. The Proponent identified vessel transit as the only Project-related activity that could interact with outdoor recreation in the marine shipping area.

The Proponent noted that marine shipping associated with the Project would only cause temporary displacement and effects on access to recreational fishing and seafood harvesting. These effects would not create measurable changes due to the existing navigational challenges already present within the marine shipping area. The Proponent also stated that any additional noise or changes in the environmental setting due to marine shipping associated with the Project would be negligible because of the limited frequency of the ships and consequent interactions.

With respect to recreational boating and other marine activities, the Proponent indicated that recreational boating routes are located throughout the Gulf Islands and overlap with the shipping lanes in Haro Strait. The Proponent reiterated the same rationale for negligible effects as for recreational marine and seafood harvesters. In addition, the Proponent noted that kayakers and other non-motorized activities would generally take place closer to shore and would be unlikely to interact with Project-associated ships. The Proponent stated that there would be no change in the recreational environmental setting due to marine shipping associated with the Project.

The Proponent stated that the effects on outdoor recreation would be similar for both Canadian and USA waters, since similar types of marine shipping and recreational activities took place in both of these areas. The Proponent concluded that the potential effects of marine shipping associated with the Project would be negligible.

20.3.2 Views of Participants

Project Area

Several participants noted that the Roberts Bank area was a highly valued bird watching area and identified Brunswick Point as a major attraction. The City of Delta stated that Roberts Bank was recognized internationally for its ecological significance for a wide variety of shorebirds, fish and marine mammals.

One participant raised concern that the Project would contribute to the decline in shorebirds, in turn making the area less attractive to bird watchers. The participant stated that tourism and birding were of great importance in Delta and that the City of Ladner regularly topped the list of bird counts in the province and was of the view that tourism and birding opportunities were not properly addressed by the Proponent.

The Ladner Rod and Gun Club described how the Project area had changed over the years since the original Roberts Bank terminals had been developed. The Rod and Gun Club noted that the existing infrastructure in the area caused increased air and light pollution and habitat loss, which subsequently affected wildlife. The Rod and Gun Club stated that development of the Project would exacerbate these effects.

Tsawwassen reported that areas available to hunt waterfowl in the Fraser River Delta, Roberts Bank, and Boundary Bay had been reduced due to a series of hunting closures and firearms restrictions imposed by municipalities and provincial and federal governments. Tsawwassen noted that if the Project results in more restrictions on firearms use, there would be fewer opportunities for members to harvest waterfowl.

Residents of Delta described how they enjoyed the recreational activities available to them. One participant mentioned that she walked on the dyke to be in nature. Another participant noted that she walked the path on the dike at Brunswick Point daily and raised concern about the environmental degradation taking place.

Marine Shipping Area

A few participants underlined the beauty of the surroundings and their wish to avoid further air and noise pollution from increased shipping. One sailboat owner and a kayaker in the Gulf Islands and San Juan Islands, noted concerns that recreational users always “have to dodge ship after ship, vessel after vessel of all types.”

Parks Canada identified reserves and historic sites within the marine shipping area that could potentially be affected by marine shipping. Parks Canada stated that changes in the number and

size of Project-associated ships, contamination associated with accidents and malfunctions, and changes in resource availability could alter the expected character of the visits experienced at their parks and historic sites in the area.

The Islands Trust identified their main purpose as the protection of “the unique environment and amenities” of the area for the enjoyment of its residents. The Island Trust noted that the Gulf Islands were a recreational area and that the cumulative effects of industrial activities were affecting the character of the islands. They raised concerns regarding cumulative effects on air quality and atmospheric noise produced by anchored ships. The Islands Trust noted that there were limits to what the environment could withstand and was concerned that they were “nearing the breaking point.”

20.3.3 Panel’s Analysis

Project Area

Below, the Panel reviews the Proponent’s assessment of each of the sub-components and then provides a general conclusion on the effects of the Project on outdoor recreation.

Recreational Boating and Wind-Sport Activities

The Panel agrees with the Proponent that there would be no residual effects on recreational boating and wind-sport activities since these activities take place mainly on the east side of the BC Ferries Tsawwassen Terminal causeway.

Recreational Marine Fish and Seafood Harvesting

As reported by the Proponent, there are marine and seafood harvesting activities taking place in sub-area 29-D. Most fishing is done west of the BC Ferries Tsawwassen terminal. However, there would be a displacement of crab harvesters due to an expansion of the navigational closure area by 399.2 ha during construction and 278.5 ha for the life of the Project. Part of the navigational closure area is considered by recreational crab harvesters to be a high productivity harvesting zone. The Panel does not view the Proponent’s commitment to consultation to be an adequate form of mitigation. In the Panel’s view, this does not alleviate the disturbance and inconvenience or compensate the displacement experienced by recreational marine seafood harvesters. The Panel concludes there would be a residual adverse effect on seafood harvesting in terms of a partial loss of a highly productive harvesting zone and a displacement of activities if existing harvest quotas are to be met.

Since there was no specific submission to the Panel and the Proponent did not report the results from its consultation with recreational seafood harvesters, the Panel cannot conclude on the significance of the effect. It can only highlight that the Project area is an active harvesting location based on the information provided in the EIS.

The Proponent stated it is committed to consider additional measures to be implemented with appropriate parties, including recreational harvesters and that consultation with commercial fishermen, DFO and Indigenous groups is ongoing. The Panel agrees with this approach.

Recreational Hunting

The Panel concurs with the Proponent that there would be no measurable changes in availability of waterfowl for hunting. The Panel concludes in Section 15 - Avifauna that there would be a minor effect on diving birds and, because the Project footprint comprises a small fraction of total diving bird habitat in the Salish Sea, the effect would not be significant. The Panel also agrees that the Project footprint would not overlap with key areas used for hunting on Westham Island, Brunswick Point, or Canoe Passage. There could be displacement of activities and interference with navigation for hunters using the inter-causeway area or launching their boats from the northwestern side of the BC Ferries Tsawwassen Terminal causeway, as is permitted for Brant hunters during the hunting season. Hunting seasons are determined by hunting regulations and could coincide with construction activities and movements of ships during operations, including those taking place in and around the tug basin.

The Panel notes that restrictions on firearm use imposed by municipalities, provincial and federal governments would result in an increase of the no-hunting zone areas due to the terminal footprint and the expansion of the causeway. The reduced hunting zone and loss of hunting opportunities would apply to recreational hunters.

Since changes in noise levels are predicted not to be perceptible at hunting locations, the Panel agrees with the Proponent that it would not alter the character of the environmental setting for hunters and the effect would be negligible. For nighttime conditions, light pollution was reported by the Proponent and the Delta Ladner Rod & Gun Club as presently having an effect on duck hunting. The Panel acknowledges the concerns raised about the effect of light on the ability to hunt ducks.

Other Land-Based Outdoor Recreation

As concluded in Section 7.4 - Noise and Vibration, the Project would increase noise levels in the upland area and over marine surfaces adjacent to the proposed terminal. Changes in noise levels would not affect land-based outdoor recreation due to the distance from the source and the activity.

The Panel notes changes in visible alteration for areas where recreational activities occur, such as the Alaksen National Wildlife area and the Garry Point Park in Richmond. In Section 20.2 - Visual Resources, the Panel agrees with the Proponent that effects on daytime visual resources would be most discernible within 8 km of the Project area. The Alaksen National Wildlife area and the Richmond Garry Point Park are located outside this zone, at 9.3 km and 11.5 km respectively. The magnitude of the effect would also be moderate since the activity being pursued is recreational, which is a viewing event that is short-term.

The Brunswick Point Trail and the Tsawwassen Outer Dyke on Tsawwassen First Nation Lands were identified as summer and winter recreational areas with moderate use. The presence of a new terminal would be experienced by the users of the trails and the Panel concludes in Section 20.2 - Visual Resources that there would be a significant adverse daytime effect.

Bird watching is a common activity, particularly during peak bird viewing seasons. The Panel cannot conclude with reasonable confidence that the Project would or would not have a residual adverse effect on the Western sandpiper. However, the Panel is of the view that, due to the great variety of bird species in the LAA, the Project would not restrict birdwatching activities on the trails.

Tsawwassen, in its Neighbourhood Plan of 2016, considered the development of a network of greenways. As stated by Tsawwassen, the Great Blue Heron Way (on the Tsawwassen Outer Dyke) would provide a convenient linkage within the neighbourhood and to other parts of Tsawwassen community and beyond. It would be a legacy host facility, marking cultural and heritage sites. Located at the gateway of the Fraser River, it would connect all First Nations and their neighbours, from the Brunswick trail to Delta and, from the Great Blue Heron trail to the BC Ferries Tsawwassen Terminal and to the Gulf Islands. The Panel is of the view that the Proponent's proposal to develop a pedestrian and cyclist overpass between the Brunswick trail and the Tsawwassen Outer Dyke has merit.

There are aspects of outdoor recreation related to health risk. As indicated in Section 21.1 - Exposure to Atmospheric Pollutants, there are potential exceedances of air quality standards established for health protection. In the LAA, there are recreational activities taking place in parks, such as at the Fred Gingell Park, and beaches on the east side of the BC Ferries Tsawwassen Terminal. The Panel is of the view that a notice should be issued to inform users when exceedances occur.

In Section 21.3 - Exposure to Shellfish Contamination, the Panel concludes there is no potential health risk with respect to water and sediment quality resulting from resuspension of sediments along the above beaches during construction.

The Panel concludes overall that there would be a residual adverse effect from the Project on outdoor recreation due to:

- A loss of a high productivity crabbing area due to the terminal footprint and the expansion of the navigational closure areas;
- A degradation of the quality of experience encountered on the walking trails in the LAA related to visual effects and exceedances of air quality standards in parks and along the coast for people doing land-based outdoor recreational activities; and
- An increase in the size of the no-hunting zones related to restrictions on firearms use.

The effects would be continuous, long-term and of moderate magnitude. Due to the many variables affecting outdoor recreation, such as the level of displacement the Project would cause, the Panel cannot conclude on the significance of effects.

The Panel concludes that the Project would result in a residual adverse effect on outdoor recreation. The Panel is unable to determine the significance of the effect.

Cumulative Effects Assessment

Changes to quality of experience referring to clean air and agreeable visual surroundings would be experienced. In addition, there would be an increase in the size of closure areas for crab harvesters and hunters, during construction and operations, in addition to existing closures or restriction zones. The effects would be significant because of the incremental effect with the addition of the Project.

The Panel concludes that the Project would result in a significant adverse cumulative effect on outdoor recreation.

Recommendation 55

The Panel recommends that Fisheries and Oceans Canada develop a mechanism to engage with recreational seafood harvesters regarding the expansion of the navigational closure areas during the construction and operations of the Project and identify appropriate mitigation measures to facilitate the continuation of recreational seafood harvesting.

Marine Shipping Area

The marine shipping area is host to numerous recreational activities. The Panel's conclusions from other sections of the report, such as on noise and vibration, marine shipping and the ship-wake environment, are used in the following analysis. Visual resources were not examined by the Proponent but there was testimony from participants about its importance.

Recreational Fishing and Seafood Harvesting

According to the Proponent, Project-associated shipping routes in the marine shipping area overlap with, and are adjacent to, areas where recreational fishing and seafood harvesting occurs. This is particularly the case in Segment B (around South Pender Island, Moresby Island, Sidney Island, Discovery Island), Segment C (Race Rocks) and parts of the Strait of Juan de Fuca in Segment D. Boaters are required to observe the Collision Regulations of the *Canada Shipping Act 2001*, which state that vessels of less than 20 metres in length or vessels engaged in fishing are not to impede the passage of a power-driven vessel traveling within a shipping lane. There are 1.5 container ship movements per day associated with the Project. The potential for pass-bys with recreational boats of fishers and harvesters is small. Yet due to the existing regulations of the *Canada Shipping Act 2001*, it would be an additional inconvenience. The Panel is of the view that there would be a minor residual effect but due to the low frequency of ship pass-by, the effect would not be significant.

The Panel did not hear from participants on potential consequences of ship pass-by on fishing gear loss or damage to boats, as it did from Indigenous groups. The Panel can then only infer from the Proponent's statement that there were no statistics available on fishing gear loss or

damage for recreational fishers and seafood harvesters and that gear interactions with large vessels within the LAA were infrequent.

The Panel is of the view that recreational fishing vessels may be subject to wake-waves from container ships and that they could constitute a safety hazard. In addition, in Section 22 - Accidents and Malfunctions, both the Proponent and the Panel agree that a collision involving a container ship and a small vessel may result in significant effects on human health since the severity of the accident could result in human injury or fatality. As discussed in Section 7.4 - Noise and Vibration, noise levels in the marine shipping area are expected to be audible within a four km zone surrounding the shipping lanes. Some of the areas where recreational fishing and seafood harvesting occurs overlap with container ship pass-bys. Due to the low frequency of interactions, the effect would not be significant.

Recreational Boating and Other Marine Recreational Activities

The Proponent stated that shipping routes overlap with, and are adjacent to, areas used for recreational boating, diving and kayaking, although the latter and other paddling activities would take place closer to shore. Users of recreational boating routes and access to diving locations would be interrupted by large vessel activities passing through Haro Strait and the Southern Gulf Islands. The Panel is of the view that non-motorized activities, such as sailing would also interact with marine shipping associated with the Project. A collision involving a container ship and a small vessel could also result in a significant effect.

In terms of the quality of experience, wake-waves could constitute a safety hazard. In terms of noise levels, the Proponent stated that the effects of above-water noise on recreational boating and other marine recreational activities would be similar to those experienced by recreational fishers and seafood harvesters. The Panel disagrees that noise annoyance would be negligible for non-motorized vessels due to short-term noise events of approximately 10 to 25 seconds duration. Noise levels would be approximately between 65 and 68 dBA, at a distance of 50 metres. The Proponent indicated that to be lower than the ambient daytime noise level of 45 dBA, a small vessel would need to be at an 800 m distance. The Panel concludes that there would be an effect on the quality of experience of recreational boaters. The effect would not be significant due the low frequency of Project-associated ship pass-bys.

The Panel agrees that Project effects would not be perceptible for the shore-based recreationists, such as campers and permanent and seasonal residents of the Gulf Islands, since they would not experience increased ambient noise levels from marine shipping associated with the Project due to the distance of the shipping lanes away from land.

The Panel is of the view that the marine shipping associated with the Project would not have an effect on the surrounding air quality that could potentially interfere with recreational activities.

As reported in Section 5 - Marine Shipping Associated with the Project, changes in water quality are not expected from vessel transit associated with the Project.

The Panel concludes that there would be a residual adverse effect from the Project on outdoor recreation in the marine shipping area due to safety risks and loss of quality of experience encountered by users of small vessels and sail-boaters. The effect would be low in magnitude, regional in extent, but intermittent. Due to the short period and the infrequency of the interactions, the effect would not be significant.

The Panel concludes that marine shipping associated with the Project would result in a residual adverse effect on outdoor recreation in the marine shipping area for small vessel boaters. The effect would not be significant.

Cumulative Effects Assessment

In Section 5 - Marine Shipping Associated with the Project, data from 2012 to 2035 indicate that the cumulative increase in ship movements would be of the order of 24 percent for Segment D and 27 percent for Segment B, which included, Victoria, the Southern Gulf Islands (around South Pender Island, Moresby Island, Sidney Island, Discovery Island). The Panel concludes there would be a significant adverse cumulative effect in Segment B.

The Panel concludes that marine shipping associated with the Project would result in an adverse cumulative effect on outdoor recreation in the marine shipping area. The effect would be significant in Segment B.

20.4 Marine Commercial Use

20.4.1 Proponent's Assessment

The Proponent defined marine commercial use as “use of marine waters and resources in order to generate revenue, and includes marine fish and seafood harvesting for commercial purposes, guided sport fishing, and marine-based tourism”. The Proponent noted that the Project had the potential to directly affect marine commercial use by displacing an activity or interfering with or preventing access to a harvesting area and indirectly by reducing the availability of species either for harvest or marine-based tourism.

Marine Fish and Seafood Harvesting

Dungeness crab

The Proponent characterized Roberts Bank as an important crab harvesting area for commercial harvesters. The commercial fishery had no limit of annual harvest volume, either by licence or crab management area, but was subject to regulated fishery opening times. The Proponent stated that the Project was within DFO's Crab Management Area I and that annually over 90 percent of eligible male Dungeness crabs were harvested from Roberts Bank and Boundary Bay. The Proponent also suggested that commercial crab harvesting had been occurring intensively in the vicinity of the existing Roberts Bank terminal and BC Ferries Terminals for years without any noticeable effects on price or revenue.

The Proponent stated that a 714.7 ha commercial navigational closure area was implemented at Roberts Bank in 2009 to ensure large commercial ships could safely approach the terminals. The Port Authority stated that it had the jurisdiction to establish the closure area under the *Canada Marine Act* as well as the Port Authorities Operations Regulations, the latter of which gives them the jurisdiction to regulate the use of floats and prohibit or allow fishing within the area. The Proponent noted that commercial crab harvesters could traverse the closure area but could not harvest there.

The Project would result in an incrementally larger navigational closure area. The Proponent stated that during construction the proposed closure increment for commercial crab harvesters would be 352.3 ha and throughout operations the incremental closure area would be reduced to 231.5 ha. The Proponent stated that the expanded closure area would apply to commercial crab harvesters, but not to Indigenous groups harvesting for food, ceremonial, or social purposes. Figure 20-2 shows the proposed commercial navigational closure area.

The Proponent concluded that the displacement of commercial crab harvesters due to the Project would cause a moderate adverse effect on seafood harvesting. The Proponent stated that the terminal footprint and proposed navigational closure area would overlap a key harvesting area used by commercial crab harvesters that would be lost indefinitely. The Proponent acknowledged that crab harvesters would be forced to re-establish their harvesting activities elsewhere. The Proponent predicted that the effects associated with displacement would include increased competition among commercial harvesters as harvesting areas contracted, as well as a small reduction in harvest and associated revenues. The Proponent noted that due to the annual variability in crab harvest, it could not quantify the potential reduction in harvest levels or revenue that may stem from the expanded navigational closure area.

The Proponent concluded that there would be a negligible effect on the availability of crab because, from a biophysical perspective, the Project was unlikely to have an effect on the ongoing productivity of Dungeness crab.

As mitigation, the Proponent committed to provide commercial crab harvesters and indigenous groups with information on the timing and configuration of the navigational closure area, and committed to consult with those groups to identify and implement any additional feasible mitigation measures. The Proponent stated that it would invite commercial crab harvesters to an annual meeting during construction and the first five years of operations to provide information on the location, status, and progress of construction work and operational activities. The Proponent also committed to undertake an analysis of existing electronic monitoring of trap hauls and government data, and to use that information in their ongoing consultation. The Proponent noted that this mitigation was additional to mitigation proposed to address the potential effects on marine invertebrates.

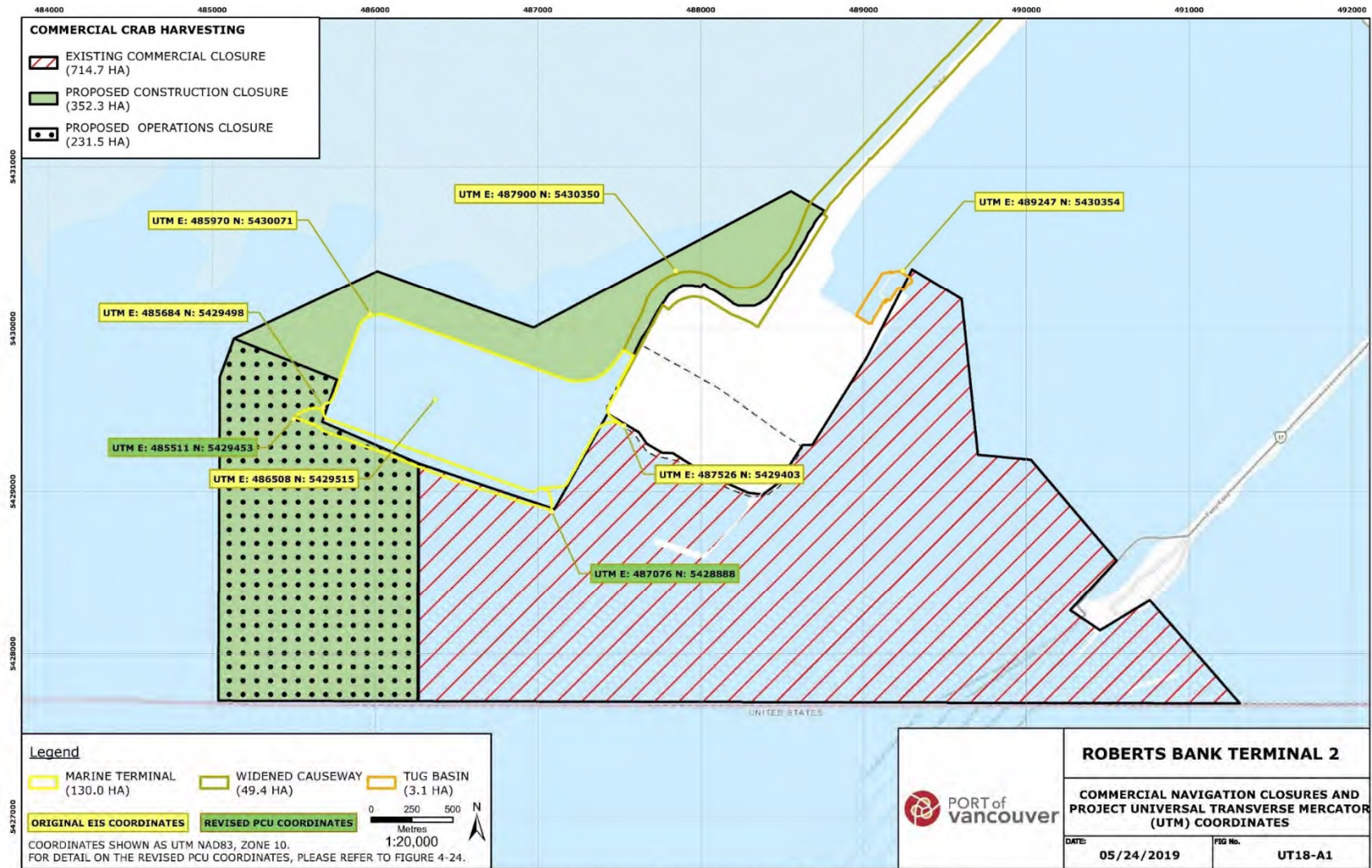


Figure 20-2: Commercial navigational closures (Source: Project public registry document 1872)

The Proponent concluded that the residual effect of displacement of commercial crab harvesting was likely, but not significant. The Proponent's key rationale was that Dungeness crabs could move substantial distances to baited traps outside the navigational closure area and displaced crab harvesters could move to other crab fishing areas. The Proponent also noted that the effects of the closure would be similar to the effects of the 2009 closure, where harvesters were still able to harvest outside the closure area. The Proponent acknowledged that there would be a productivity loss for Dungeness crab, but that it was within the range of natural variability. The Proponent was confident that Fisheries and Oceans Canada's management of the fishery would continue to ensure a viable crab harvesting industry.

The Proponent considered whether the effects from the Project would interact cumulatively with the effects of the Trans Mountain Pipeline Expansion Project, which would be located in Burrard Inlet. The Proponent determined that the residual cumulative effect was likely but not significant because the displaced crab harvesters could move to other crab harvesting areas.

Sockeye Salmon

The Proponent described sockeye salmon as the main fish species harvested in the Project area. The Proponent concluded that the Project would have a negligible effect on marine fish harvesting because there were no commercial harvesting locations identified within the Project footprint and the Project would not have an effect on the productive potential of sockeye salmon.

Tourism

The Proponent identified salmon as the main target for sport fishing in the region around the Project area. The Proponent concluded that the effects from the Project on guided sport fishing would be negligible because there were no guided sport fishing locations identified in the Project area and no access issues related to Project-related vessel traffic.

The Proponent concluded that the effects of the Project on whale watching and eco-tours were negligible because the efficiency and profitability of whale watching and eco-tour operations were not likely to be affected. The Proponent noted that the Project site would not be visible or audible from the key touring and whale watching areas.

20.4.2 Views of Participants

The Area I Crab Fisherman Association (AICFA) expressed concern about the loss of commercial crab fishing grounds due to both the project footprint and the expanded navigational closure area. The AICFA noted that the proposed location of the Project terminal and navigational closure area consistently had the highest concentration of crab fishing activity in the Area I Crab Management Area.

The key concern for the AICFA was the exclusion of commercial crab harvesters from the navigational closure area. The association stated that the implementation of the 2009 navigational closure area at Roberts Bank had a "demonstrable and detrimental" effect on commercial crab harvesting. The AICFA noted that the Proponent did not adequately evaluate

options to mitigate the potential loss of commercial crab fishing grounds, harvests, and revenues from the proposed expanded navigational closure area. They stated that consultation alone was not a tangible mitigation measure to replace lost commercial crab harvest. The AICFA also raised concerns that displacement of crab harvesters from the Project site would affect other crab harvesters due to crowding at the remaining harvesting sites.

The AICFA stated that the commercial crab harvesting season in Area I was only five and a half months long (June 15 to November 30) while Indigenous food, social and ceremonial harvesters were able to harvest year-round. The AICFA noted that implementation of the expanded navigational closure area would further disadvantage commercial crab harvesters. They did not believe the Proponent provided sufficient evidence that Dungeness crab migration behaviour would be adequate to repopulate adjacent commercial crab fishing areas. The AICFA proposed a 'limited access fishing area' that would allow commercial crab harvesting without using floats within the navigation closure area.

Tsawwassen undertook a study to examine crab distribution, movement, and densities in relation to the proposed expanded navigational closure area. The study confirmed that the footprint of the Project would cause the loss of preferred fishing locations. Tsawwassen noted that the navigational closure area would only provide a temporary refuge for male crabs from the commercial fishery as tagged males moved freely between the closure area and the adjacent area open to harvesting. Tsawwassen also noted that commercial fishery landings were approximately seven times greater than the Tsawwassen food, social and ceremonial fishery in the study area. Tsawwassen acknowledged that the proposed expanded navigational closure area could result in a decline in commercial harvest in the area.

Malahat stated that they held a commercial licence to harvest crab in Area I directly at the Project site. They noted that fishing provided a key source of revenue to the Nation. Malahat questioned the Proponent's determination of a negligible effect on change in access and resource availability for seafood harvesting. Malahat noted that when considering the natural variability of crab populations, the Proponent did not adequately consider possible additional anthropogenic pressures on the population such as contaminants and habitat alteration and loss. Malahat stated that they were engaging with the Proponent regarding Malahat's Area I commercial crab licence but that the Proponent had not produced any mitigation measures that adequately addressed the potential effects on their commercial crab harvesting. Malahat was concerned that the Project would displace them from their preferred commercial harvesting location, and raised concerns that the Project could cause their commercial licence to be moved to another crab management area. They noted that Malahat had good relationships with the fishermen to whom they leased their licence and they were concerned that they would potentially have to find new fishermen to crab in a new management area. Forging those new relationships would create uncertainty and risk for Malahat.

Tsleil-Waututh stated that they were not convinced that there would not be economic consequences due to Project-related fishery displacement. They were of the view that the

reduced access to traditional crab fishery areas would likely cause overcrowding in other locations, increasing competition and decreasing accessibility for crab harvesters in the area.

The Proponent confirmed that it was consulting with both the AICFA and Indigenous groups about the navigational closure area. The Proponent stated that it had engaged with the AICFA on potential mitigation measures beyond the Association's proposed limited access fishing area, but noted that the AICFA was not interested in pursuing alternate forms of mitigation. The Proponent's position was that opening up the proposed navigational closure area to commercial harvesting would affect the food, social, and ceremonial fishery. Tsawwassen agreed with that position and stated that they were opposed to the AICFA's proposal.

20.4.3 Panel's Analysis

The Panel agrees that the Project would not have an effect on marine fish harvesting, guided sport fishing, or marine-based tourism because the Panel does not expect the Project to affect the operations or profitability of those activities in the area.

The Panel acknowledges that the Project footprint and navigational closure area overlap with an important commercial crab harvesting area and that commercial crab harvesters would be displaced by the Project. The Panel concludes that neither crab recruitment from the navigational closure area into adjacent commercial crabbing areas nor the displacement of crab harvesters elsewhere in Area I sufficiently mitigates this effect. The Panel concludes that this residual adverse effect would be manifested as a reduction in commercial crab harvest and would be significant.

The Panel concludes that the Project would result in a significant residual adverse effect on marine commercial use related to crab harvesting.

During the public hearing, the Proponent agreed to undertake future consultations with Tsawwassen, Musqueam, and DFO to reconsider the size and configuration of the expanded navigational closure area to optimize FSC crab harvesting within the area. The Panel recognizes that there are direct interactions between FSC and commercial harvesting that are sensitive to the size and location of the expanded navigational closure area. The Panel is of the view that future mitigation of reduced access to commercial crab harvesting areas is linked directly to mitigation of effects on FSC fishers and recommends that the AICFA be engaged in the consultation.

The Panel concludes that the residual adverse effect of the proposed expanded navigational closure area on the commercial crab fishery would combine with the residual adverse effect of the existing navigational closure area to cause an adverse cumulative effect that is likely significant.

The Panel concludes that the Project would result in a residual adverse effect and an adverse cumulative effect on marine commercial use due to the expansion of the existing navigational closure area. The effects would be significant.

Recommendation 56

The Panel recommends that the Proponent, in collaboration with the Area I Crab Fisherman Association, the Indigenous commercial crab fishers that operate within the Local Assessment Area, and Fisheries and Oceans Canada, be required to develop alternate management arrangements that ensure the continued productivity of the commercial crab fishery.

21 Human Health

Section 5 of CEAA 2012 requires the Panel to assess the potential health effects of the Project. The Proponent undertook a Human Health Risk Assessment (HHRA) to quantify the potential health risks of exposure to air emissions, noise and vibration, and contaminants in edible shellfish, as well as a qualitative health impact assessment on food security, stress and annoyance, income and employment and health inequity.

21.1 Exposure to Atmospheric Pollutants

21.1.1 Proponent's Assessment

Project Area

To evaluate potential health effects from exposure to air emissions, the Proponent completed a HHRA using the results of the assessment over the LAA, as conducted in Section 7.2 - Air Quality. The Proponent considered acute and chronic effects from project emissions through inhalation and also conducted a multimedia assessment to determine potential effects of non-volatile chemicals deposition to soil and plants.

The Proponent initially selected 18 discrete receptors as representative reference points to assist in the discussion of the assessment results. At the request of the Panel, the Proponent added 52 receptors representing recreational use areas and sensitive receptors such as schools and medical centers. The Proponent also provided results for the maximum over land and over water predicted concentrations.

As described in Section 7.2 - Air Quality, results showed exceedances of applicable standards for NO₂, particulate matters and ozone for some scenarios under both phases of the Project. For the HHRA, the Proponent presented the results using risk quotients (RQs) which were calculated as the predicted concentration in air contaminant divided by the chemical exposure limit. The Proponent used a RQ threshold of two to account for what it considered a twofold overestimation of the one-hour concentrations predicted by the dispersion modelling. According to the proponent, an RQ below two indicated low risk for public health, whereas RQs greater than two indicated increased potential for adverse health effect. For NO₂, the potential health effect related to acute exposure would be respiratory irritation.

For the construction phase, all results showed RQ values below two with the exception of 1-hour NO₂ over land and over water and annual NO₂ over water using the standards for year 2020. RQ values over two were also expected over water in the vicinity of the Project for 24-hour and annual PM, PM_{2.5}, and PM₁₀ for the average day scenario. For the peak day scenario, the RQ values were also above two for all particulate matters and 1-hour NO₂ over water and for PM, PM₁₀ and 1-hour NO₂.

During operations, all results showed RQ values below two with the exception of 1-hour NO₂ over land and over water, annual NO₂ over water and 24-hour PM_{2.5} over water under the future

with the project operations scenario. Under the 2025 future conditions with the Project scenario, concentrations of 1-hour NO₂ would exceed the 2025 CAAQS objective of 79 µg/m³ for all 70 discrete receptors and almost all of the LAA, as shown in Figure 21-1.

The Proponent stated that RQ values showed that exposure to 1-hour NO₂ concentrations would pose low risks at all upland receptors. RQs above two were calculated at the maximum point of impingement over land and water during operations and the over water during construction. However, the Proponent noted that RQs above two were also predicted at these locations in the future without the Project scenario. The Proponent stated that using the 2025 CAAQS for NO₂ resulted in higher RQ values at these locations, but the contribution of the project operations and construction would not change.

In response to an Information Request to update future conditions to reflect the new CAAQS standards that would come into effect in the year 2020 and 2025 for 1-hour NO₂ and annual NO₂, the Proponent provided several figures and tables of corresponding predicted values for eight scenarios. Represented below is the figure on 98th percentile 1-hour NO₂ concentrations during expected conditions and future conditions with the Project, and a table listing sensitive receptors expected to exceed the CCME 2025 air quality standard of 79 µg/m³ for 1-hour average NO₂.

The Proponent concluded that human health effects from the Project were unlikely to occur because concentrations of particulate matter and NO₂ were over-predicted, and access to marine areas where highest effects were predicted near the terminal would be restricted during construction for safety reasons, making exposure to predicted concentrations highly unlikely. Consequently, the Proponent did not conduct a cumulative effects assessment for exposure to predicted 1-hour NO₂ during operations. The Proponent also determined that health risks as a result of airborne deposition of contaminants to other media such as soil, plants and sediments which are subsequently ingested by wildlife, livestock or humans were also low.

Air emissions from the Project would be managed through monitoring and specific mitigation measures included in the Air Emission Management Plans for construction and operations. No additional measures specific for health effects related to air quality were proposed.

Marine Shipping Area

The Proponent also assessed potential effects on health from air emissions from marine shipping associated with the Project within the Marine Shipping Area. Marine shipping emissions are mainly gaseous chemicals (CO, NO₂, SO₂), particulate matter (PM) and diesel particulate matter (DPM)) that are not considered to be a concern for exposure pathways other than the direct inhalation of air.

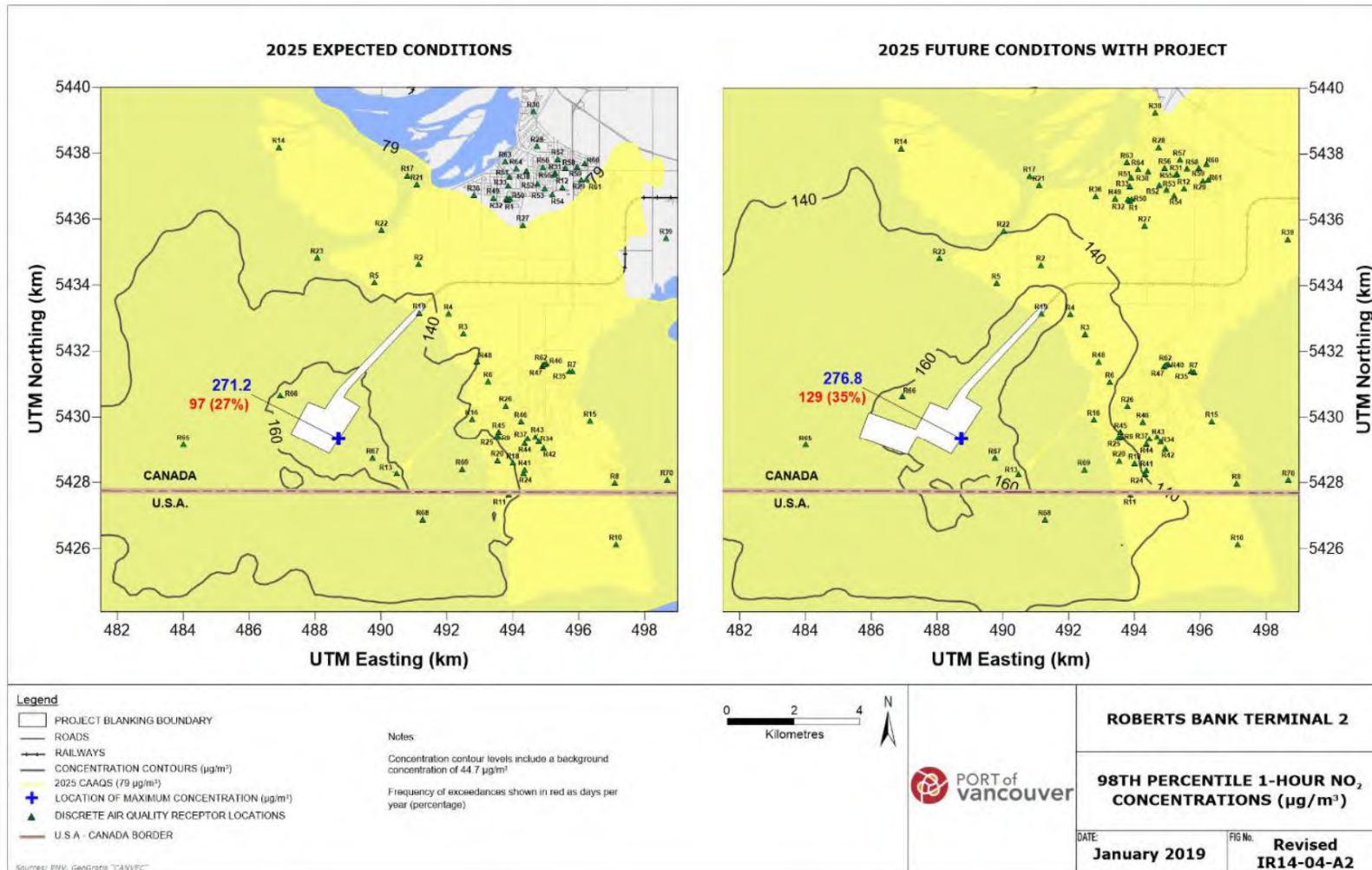


Figure 21-1: 98th percentile 1-hour NO₂ concentrations during expected conditions and future conditions with the Project (Source: Project public registry document 1465, IR14-04)

Note: Contours in the above figure show modelled NO₂ concentrations, and the yellow shading indicates areas in which the 2025 CAAQS objective of 79 µg/m³ would be exceeded. The green triangles represent specific receptors, which are provided in Table 21-1. This Figure does not represent an actual pollutant plume, but rather a statistical map of 98th percentile of modelled ambient NO₂ concentrations at each point in the LAA. The map is based on one year of modelling.

Table 21-1: List of sensitive receptors, all of which are expected to exceed the CCME 2025 air quality standard of 79 µg/m³ for 1-hour average NO₂ during operations (Source: Adapted from Project public registry document 1465, Table 14-04-B4)

Receptor Number	Location Description
R12	Delta Hospital
R20	English Bluff Elementary
R24	Pebble Hill Traditional Elementary /The Rainbow Connection Children's Centre at Pebble Hill
R25	École du Bois-Joli / Prématernelle Lutins Du Bois
R26	Cliff Drive Elementary / Aird's Kidzone Learning Centre/ Tsawwassen Little Friends Preschool
R27	Sacred Heart / Neverland Children's Centre / Lil' Saints Preschool At Sacred Heart
R28	Hawthorne Elementary / Ladner Animal Crackers
R29	Holly Elementary / Holly's Childcare Centre
R30	Neilson Grove Elementary / Bright Eyes Academy Inc.
R31	Delta Continuing Education
R32	Ladner Elementary
R33	Delta Secondary
R34	South Park Elementary
R35	Beach Grove Elementary
R36	Port Guichon Elementary
R37	South Delta Secondary
R38	Delta Christian School
R39	Boundary Bay Montessori House
R40	Southpointe Academy
R41	Rainbow Bridges Enrichment Centre Day Care
R42	Wind and Tide Preschool
R43	Hicks Family Playcare
R44	Sunny Town Learn and Play Childcare Centre
R45	Shooting Stars Early Learning Centre
R46	Wee Bairns
R47	Kids in Paradise
R48	Smuyuq'wa' Lelum Ece Centre
R49	Lynne's Daycare
R50	Happy Castle Child Care
R51	Reach Development Preschool South Delta
R52	Wind and Tide Preschool
R53	Evan's Day Care
R54	Treasure-Chest Family Daycare
R55	Westcoast Wee Watch

Receptor Number	Location Description
R56	Creation Station Day Care
R57	Little Bunnies
R58	Mother Hen's Daycare
R59	The Yellow Door Daycare
R60	Tina's Tiny Tots Daycare
R61	Bright Eyes Academy Inc. at Holly
R62	Renaissance Kids
R63	Delta Medical Center
R64	Denning Health Group

Notes: Sensitive receptors are: hospitals; schools; senior care residences and day care centres. The modelling includes pollution sources from the Project and Operations at Westshore Terminals, Deltaport, and BC Ferries Tsawwassen Terminal. The locations of these sensitive receptors are indicated in Figure 21-1, where they are identified by the Receptor Number.

Using the results of the assessment of air quality, the Proponent determined that effects on human health from air emissions from vessel in transit would be negligible. The Proponent determined that predicted airborne concentrations from both the existing and incremental marine vessel traffic in the marine shipping area are, and would continue to be, lower than the relevant air quality standards. The Proponent also determined that potential adverse effects related to indirect exposure to contaminants in edible marine resources would be negligible. The Proponent considered that low incremental airborne emissions of particulate matter in the marine shipping area would not result in measurable increases in seawater or sediment concentrations of PAHs or other air toxics from ship emissions. This meant that there would be no appreciable incremental contaminant uptake in marine edible resources, and no concern for human consumption.

Given that the Proponent concluded that all effects from vessel in transits would be negligible, no mitigation measures nor follow-up program were proposed for the Project.

21.1.2 Views of Participants

Health Canada considered NO₂, PM_{2.5} and ozone to be non-threshold substances, meaning that health effects may occur at any level of exposure to these substances. Health Canada reported that several health problems could be related to long- and short-term exposure to these contaminants.

Health Canada disagreed with the Proponent that the exceedances in NO₂ are of low consequence to public health. Health Canada stated that available scientific evidence indicates that any increment in concentrations of ambient NO₂ present an increased risk for serious health effects and the public health impacts of exposure to ambient NO₂ are substantial.

Health Canada was concerned about health risks associated with potential, acute exposure of Indigenous harvesters to respiratory irritants (e.g., NO₂), eye irritants (e.g. acrolein and formaldehyde), and particulates (PM_{2.5} and PM₁₀), while they are undertaking traditional activities near the terminal during construction.

Both the BC Ministry of Health and Health Canada raised concerns regarding the exclusion of coal dust and particulate matter in the multi-media assessment. Health Canada stated that the analysis of coal dust constituents would have helped to inform a more complete understanding of the potential risk to human health from exposures to contaminants from multiple environmental media (e.g., air, traditional foods), particularly since the dredging of sediment during Project construction had the potential to resuspend contaminants (from coal dust deposition) into the marine environment. BC Ministry of Health noted that a multi-media HHRA should assess contaminants bound to respirable airborne particulate matter (i.e., attached to coal dust) due to direct exposure via the inhalation pathway.

Health Canada was of the opinion that effects to human health from exposure to 1-hour NO₂ were likely to occur at multiple human receptor locations during the cumulative future conditions scenario, on the basis of very likely exceedances of the upcoming CAAQS for NO₂. Health Canada also disagreed with the Proponent's decision that a cumulative effect assessment for human health was not needed. Health Canada stated that, in addition to potential exposures to elevated fine particulates and other air pollutants by harvesters "over water" near the terminal (especially during construction), the Proponent's results indicated the potential for effects to human health from exposures to NO₂ both over water and on land (on the basis of applicable CAAQS). Health Canada noted that these exposures have the potential to affect many sensitive individuals both on and off the water. Therefore, Health Canada was of the opinion that residual effects of exposure to air emissions on human health were likely to occur.

Health Canada noted that the Proponent did not undertake any ambient air quality measurements and air dispersion modelling for the full length of the shipping route. In their opinion, this supported the requirement for ongoing monitoring of air quality during Project operations along the Strait of Juan de Fuca.

Health Canada stated that the details of how air quality mitigation and adaptive management measures would be implemented should have been presented as part of the Proponent's environmental assessment, rather than as part of the Construction Environmental Management Plan (prior to commencement of construction). This would have allowed for a more complete understanding of the Project's potential residual effects on human health and better inform decision-makers. BC Ministry of Health shared a similar view and stated that critical details needed to determine the effectiveness and appropriateness of the environmental management plans proposed by the Proponent were lacking.

Health Canada stated that to help address key issues and help further identify or reduce potential risks to human health from the Project, they recommended that the Proponent:

- Monitor air quality over the life of the Project as a means of confirming model predictions, with additional monitoring location(s) determined in consultation with local Indigenous and non-Indigenous communities near the proposed terminal and along the marine shipping route (within the 12 nautical mile limit of Canada's territorial sea).
- Assess the potential for Indigenous peoples to be exposed to higher levels of air pollutants over water during the construction and operations of the Project, and

investigate additional mitigation measures to minimize the concentration of air pollutants, such as NO₂ and PM_{2.5} resulting from Project activities, and acknowledge that there are no safe levels of exposure (e.g., to NO₂ and PM_{2.5}).

- Use the most stringent, applicable, air quality criteria (e.g., CAAQS) as an indicator to inform the results of the air quality monitoring program.
- Present details regarding how air quality mitigation, including triggers for implementing adaptive management measures, would be implemented prior to Project construction.

BC Ministry of Health highlighted several deficiencies in the Proponent's assessment. They stated that there was insufficient information to determine whether the Project was likely to cause adverse effects on human health, and a full understanding of these risks was required for proper development of Project management plans and mitigation measures.

Tsawwassen noted the concerns from Health Canada about the Proponent's conclusions on the effects on human health from changes in air quality. Tsawwassen indicated that this uncertainty surrounding the assessment underlined the need for monitoring. Tsawwassen recommended that the Proponent be required to define an adaptive monitoring protocol and process for air issues with details about regular meetings, data sharing, and triggers for action. The process should include full and effective involvement by Tsawwassen and should be completed before a federal decision on the Project so that details can be included in the federal decision statement.

21.1.3 Panel's Analysis

The Panel notes the decision by the Proponent to use the most stringent exposure limits from the list of values recommended by responsible health agencies in the HHRA, provided that the derivation of the value was adequately documented, not outdated, and scientifically defensible. The Panel acknowledges that air quality standards have evolved since the submission of the EIS. In response to these developments, the Proponent updated standards used in the HHRA.

The Panel notes that the Proponent has calculated human risk from exposure to air pollutants as a RQ defined as predicted ambient concentration of air contaminant divided by the chemical exposure limit. The RQ thus assumes exposure equals ambient concentration. The Panel has concluded that this approach introduces an appropriate level of conservatism for risk assessment.

The Panel has carefully considered the Proponent's assessment that the level of conservatism in the overall air quality assessment implies that a RQ between 1.0 and 2.0 predicted for NO₂ and respiratory irritants at the HHRA discrete receptor locations would be of low consequence to public health. HC has advised the Panel that NO₂ should be treated as a non-threshold air pollutant, which means that health effects may occur at any level of exposure, even below an RQ of 1.0. Further, as highlighted in [Section 7.2 - Air Quality](#), ECCC and MV have expressed concerns regarding the Proponent's assertion that the high bias in NO₂ modelled concentrations and therefore high RQ values are due solely to conservatism in modelling.

The Panel rejects the assertion that RQ values between 1.0 and 2.0 predicted for NO₂ and respiratory irritants are of low consequence to public health. The Panel has based its analysis on

the premise that any RQ greater than 1.0 is indicative of an effect on human health due to the relevant pollutant at the given averaging time, although recognizing the advice of Health Canada that NO₂ and respiratory irritants are non-threshold pollutants. The Proponent did not calculate RQ values for exposure to NO₂ using the most recent CAAQS NO₂ standards as exposure limits. In absence of these calculations, the Panel takes the position that modelled ambient NO₂ above the CAAQS standards applicable in 2020 and 2025 for the construction phase imply an RQ greater than 1.0. This approach is taken for both 1-hour and annual average NO₂. The Panel notes that all modelled annual average concentrations are uncertain because the Proponent performed only one year of modelling.

Figure 21-1 shows, in yellow shading, parts of the LAA for which the predicted RQ (by the Panel's analysis explained above) would exceed 1.0, and therefore indicate areas in which exposed populations would experience health effects from 1-hour averaged NO₂. The difference in yellow-shaded area between the left panel (2025 Expected Conditions) and the right panel (2025 Future Conditions) can be interpreted as the additional effect due to the Project. The contours in the two panels show predicted NO₂ concentrations and hence predicted RQ. The Panel notes that it is not possible to infer lesser effects from RQ values less than 1.0 (i.e., concentrations below the 2025 CAAQS objective) and similarly that it is not possible to infer increasing effects from RQ values greater than 1.0 (i.e., concentrations above the 2025 CAAQS objective). For RQ greater than 1.0, the severity of the effect will be largely due to the physical health of exposed individuals rather than due to differences in pollutant concentration. The Panel notes that Figure 21-1 does not represent an actual pollutant plume, but rather a statistical map of the 98th percentile of modelled ambient NO₂ concentrations at each point in the LAA. The map is based on one year of modelling. The Panel notes that Table 21-1 lists 43 sensitive receptors in the LAA at which RQ for exposure to 1-hour averaged NO₂ would be greater than 1.0.

Table 21-2 lists areas and approximate locations which would be subjected to Risk Quotients greater than 1.0, and therefore where populations would be subjected to health effects from the various pollutants and averaging times during construction and from 1-hour average NO₂ during operations.

Table 21-2: Areas and locations in the Local Assessment Area which would be subjected to Risk Quotients greater than 1.0 during construction (Source: Adapted from EIS, Appendix 9.2-A, Appendix E unless otherwise indicated)

Average Construction day	RQ greater than 1.0 in:
1-hour average NO ₂	An area of approximately 200 km ² encompassing almost all of the LAA, including at least 20 sensitive receptors. It is not known how far beyond the LAA boundaries the zone of RQ=1.0 exceedance would extend *(Source: Adapted from Project public registry document 1465, Figure IR14-04-A3)
Annual average NO ₂	An area of approximately 16 km ² encompassing the Roberts Bank port complex and causeway and surrounding waters and extending

	over the BC Ferries Tsawwassen Terminal. *(Adapted from Project public registry document 1465, Figure IR14-04-A3)
24-hour average PM	An area of approximately 2 km ² encompassing part of the Roberts Bank port complex and causeway and surrounding waters
Annual average PM	An area of approximately 1 km ² encompassing part of the Roberts Bank port complex
24-hour average PM ₁₀	An area of approximately 6 km ² encompassing part of the Roberts Bank port complex and causeway and surrounding waters
Annual average PM ₁₀	An area of approximately 3 km ² encompassing part of the Roberts Bank port complex and surrounding waters
24-hour average PM _{2.5}	An area of approximately 2 km ² encompassing part of the Roberts Bank port complex and surrounding waters
Annual average PM _{2.5}	An area of approximately 3 km ² encompassing part of the Roberts Bank port complex and surrounding waters
Peak Construction day	RQ greater than 1.0 in:
1-hour average NO ₂	An area of approximately 3 km ² encompassing part of the Roberts Bank port complex and surrounding waters.
24-hour average PM _{2.5}	An area of approximately 12 km ² encompassing much of the Roberts Bank port complex and causeway and surrounding waters.
24-hour average PM ₁₀	An area of approximately 24 km ² encompassing all of the Roberts Bank port complex and causeway and surrounding waters, the BC Ferries Tsawwassen Terminal and a strip of shoreline on Point Roberts

Note: These approximate areas were determined by the Panel through mathematical inspection and should be considered accurate within 10 percent.

Table 21-3 lists approximate areas and locations which would be subjected to RQs greater than 1.0 due to NO₂, and therefore where populations would be subjected to health effects from the Project during operations

Table 21-3: Areas and locations in the Local Assessment Area which would be subjected to Risk Quotients greater than 1.0 due to NO₂ during Project operations (Source: Adapted from Project public registry document 1465, Figure IR14-04-A2)

Operation, Future Scenario	RQ greater than 1.0 in:
1-hour average NO ₂	The entire extent of the LAA, including at least 40 sensitive receptors. It is not known how far beyond the LAA boundaries the zone of RQ=1.0 exceedance would extend
annual average NO ₂	An area of approximately 6 km ² encompassing the Roberts Bank port complex and causeway and surrounding waters and extending over the BC Ferries Tsawwassen Terminal

The Proponent has not proposed specific measures to mitigate effects on human health due to exposure of air pollution during both phases of the Project. However, the Panel's

recommendations in Section 7.2 - Air Quality would directly address human health effects related to air quality.

The human health effect associated with exposure to annual-average NO₂ and respiratory irritants during construction would be significant because, although exposure would be intermittent, infrequent, localized to the Project area and reversible for some, it would be chronic for others making the effect high in magnitude.

The Panel concludes that the construction phase of the Project would result in a residual adverse effect on human health due to chronic exposure of annual-average NO₂. The effect would be significant.

During operations there is unlikely to be a residual human health effect of annual average NO₂ in future conditions. The exception could be employees of BC Ferries at the BC Ferries Tsawwassen Terminal.

The Panel concludes that there are unlikely to be chronic effects of exposure to annual-average NO₂ to boaters and fishers near the Project because exposure time would be a small fraction of one year.

The human health risk of 1-hour exposures to NO₂ and respiratory irritants would be intermittent; infrequent; wide-spread; potentially fatal to individuals with pre-existing respiratory conditions, chronic for some and reversible for others.

During the operational phase of the Project, the Panel concludes that there would be a significant adverse effect on human health associated with air quality changes based on predicted 1-hour exposures to NO₂. It would affect individuals located in immediate upland areas of approximately 80 km² in western Delta, Tsawwassen First Nation Lands, Tsawwassen community, and Point Roberts who would be exposed where they work, live and play. In particular, there are at least 43 sensitive receptors that would suffer these health effects.

The Panel notes that all modelled annual average concentrations are uncertain because the Proponent performed only one year of modelling, rather than the three years, as requested by the Panel, Metro Vancouver and ECCC.

The Panel concludes that the operational phase of the Project would result in a significant adverse effect on human health based on predicted exposures to 1-hour average NO₂ and respiratory irritants.

Recommendation 57

The Panel recommends that the Proponent during construction and operations be required to comply with the most stringent applicable air quality standards and exposure limits.

Cumulative Effects Assessment

The Panel notes that the air quality modelling for future conditions with the Project and operations at Deltaport and Westshore Terminals and BC Ferries Tsawwassen Terminal effectively incorporates emissions from the Project, Project associated shipping and important pollutant sources in the LAA. While the Panel has criticized the modelling approach for not effectively accounting for all regional pollutant sources, it recognizes that a proper accounting would add to ambient pollution concentrations. The future conditions modelling can thus be taken as depicting a lower possible ambient concentration limit. Based on this approach, the Panel concludes that the Project would result in a cumulative effect on human health due to acute exposure to NO₂ and respiratory irritants.

The cumulative human health risk of 1-hour exposures to NO₂ and respiratory irritants would be intermittent; infrequent; wide-spread; potentially fatal to individuals with pre-existing respiratory conditions, chronic for some and reversible for others. The region over which this effect would be felt is at least 80 km², encompassing western Delta, Tsawwassen First Nation Lands, Tsawwassen community and Point Roberts, and includes 43 sensitive receptors as depicted in Figure 21-1, and listed in Table 21-1.

The Panel concludes that the operational phase of the Project would result in a significant adverse cumulative effect on human health based on predicted exposures to 1-hour average NO₂ and respiratory irritants.

Marine Shipping Area

The Panel agrees with the Proponent's conclusions that emissions from marine shipping associated with the Project would not result in an effect on human health.

The Panel concludes that there would be no air quality effects on human health arising from marine shipping associated with the Project.

21.2 Exposure to Noise and Vibration

This section describes the potential effects on human health from exposure to noise and vibration due to the Project and marine shipping associated with the Project by comparing the outputs of the noise propagation model, as discussed in Section 7.4 - Noise and Vibration, with thresholds used in the evaluation of noise and vibration effects on human health.

21.2.1 Proponent's Assessment

Project Area

To evaluate the potential effects on human health from exposure to noise and vibration, the Proponent carried out a HHRA. The Proponent used the outputs from noise propagation models for construction and operations and compared the results with recognized thresholds for different

indicators that can be used in the evaluation of noise and vibration health effects. These indicators and the corresponding thresholds are presented in Table 21-4.

Table 21-4: Human health indicators and thresholds used in the noise human health risk assessment (Source: Adapted from Project public registry document 412, document 1355, IR12-07 and document 1465, IR14-06)

Indicator	Metric Used	Threshold
Expected percent of community that is highly annoyed	Day-night sound level (Ldn)	6.5% Highly Annoyed
Sleep disturbance from continuous noise	Nighttime sound level (Ln)	Outdoor Ln of 40 dBA ⁸ Outdoor Ln of 45 dBA
Sleep awakenings from continuous noise	Nighttime sound level (Ln)	Outdoor Ln of 55 dBA
Sleep disturbance from impulsive noise events	Maximum sound level (Lmax)	Outdoor Lmax should not exceed 60 dBA 10-15 times per night
Ability to maintain adequate speech comprehension	Daytime sound level (Ld)	Outdoor Ld of 55 dBA Outdoor Ld of 50 dBA for sensitive receptors (such as schools or daycares)
Annoyance associated with low-frequency noise (LFN)	Energy sum of the sound levels in the LFN bands	70 dB
	C-weighted decibels	60-65 dBC for residential locations

The Proponent stated that if the thresholds noted in the table above were exceeded, effects on human health are possible and further analysis or mitigation may be required.

The LAA consisted of an upland portion and a marine portion and relied upon the same seven representative receptor sites used in the Proponent's noise and vibration assessment. The seven receptor sites are presented in Figure 7-3 of [Section 7.4 - Noise and Vibration](#).

The Proponent stated that people were not expected to spend extended periods of time in the marine area while pursuing recreational, fishing, or other activities. The Proponent stated that direct human health effects from upland noise and vibration exposure are only plausible in geographic areas where chronic (long-term) exposures of humans occur, and receptors in the marine study area were not considered further in the HHRA for noise.

⁸ Health Canada assumed that there would be a loss of 15 dBA based on sound transmission through a partially opened window to determine indoor noise levels. For example, an outdoor sound level of 45 dBA would correspond to an indoor sound level of 30 dBA.

The Proponent determined that there would be exceedances of the sleep disturbance threshold of 40 and 45 dBA Ln during both construction and operations at sites 3, 4, and 5. Table 21-5 provides a summary of the noise propagation model outputs in comparison with thresholds.

Table 21-5: Predicted noise levels during construction and operations and compliance with selected thresholds (Source: Adapted from Project public registry document 412, 1210, and 1355)

Site	Ln (dBA)	Do predicted levels exceed Ln of 40 dBA?	Do predicted levels exceed Ln of 45 dBA?	Do predicted levels exceed Ln of 55 dBA?
Construction				
3	52.1	Yes	Yes	No
4	46.1	Yes	Yes	No
5	48.8	Yes	Yes	No
Operations				
3	51.7	Yes	Yes	No
4	46.5	Yes	Yes	No
5	49.6	Yes	Yes	No

The Proponent noted that under expected conditions, most residential areas, including sites 3, 4, and 5 in the LAA, already exceeded the 40 dBA Ln threshold, as shown in Figure 21-2. The Proponent stated that the only exceedance related to the Project during construction and operations occurred at site 4 when comparing predicted levels with the 45 dBA threshold. The Proponent stated that since the increases due to the Project were less than the threshold for perception (i.e., 3 dBA), it was unlikely that individuals would experience noticeable changes in sleep disturbance since humans are more likely to adapt to subtle increases in noise if they are not perceptible.

When asked to provide a map with contour lines indicating the exceedances of the 40 dBA, 45 dBA, and 55 dBA Ln thresholds during Project operations, the Proponent provided the requested maps, but indicated that it was provided for illustrative purposes only. The Proponent stated that there was no physiological reason to adopt a 40 dBA Ln threshold over a 45 dBA Ln threshold, since in their view it did not serve as a more sensitive measure of physiological effects. The Proponent indicated that the sleep disturbance threshold of 45 dBA was most applicable to the assessment of noise-related health effects on sleep disturbance given the geographical context, and existing and planned level of development for the LAA and surrounding communities.

The Proponent indicated that there were no exceedances of the 55 dBA Ln sleep awakenings threshold at sites 3, 4, or 5 during the operations, but noted that there were some areas in the LAA where levels would exceed the 55 dBA threshold. The Proponent stated that during operations, 11 homes within the LAA could experience an increase in the number of noise-related sleep awakenings. The Proponent stated that these effects would largely be limited to residences within proximity of existing roads and rail lines. The Proponent highlighted that most of these homes already experienced noise levels at or above 55 dBA under expected conditions

and noted that three additional homes within Tsawwassen First Nation Lands may experience Ln greater than 55 dBA due to the Project in comparison with the expected conditions scenario.

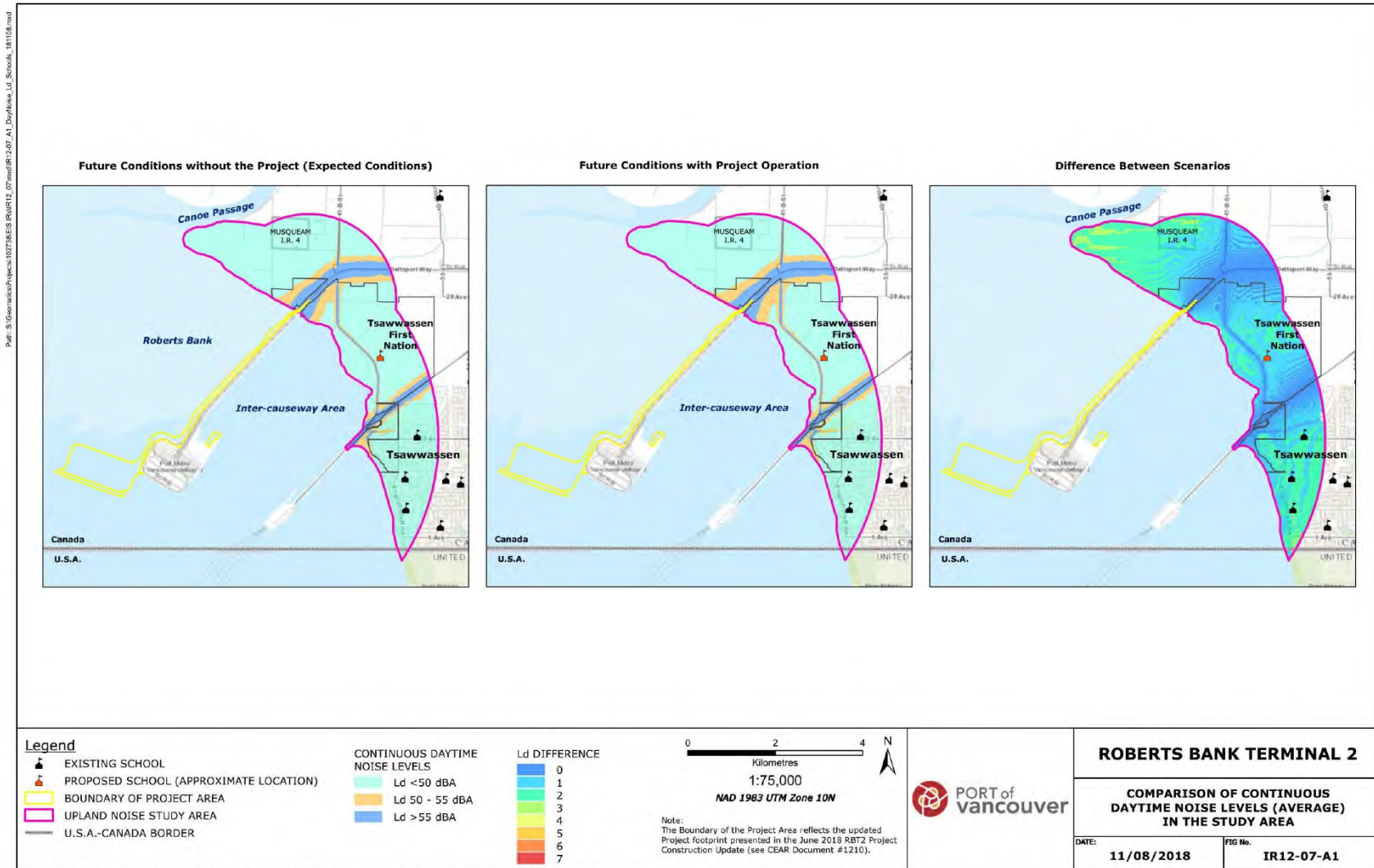


Figure 21-2: Comparison of continuous nighttime noise levels in the assessment area (Source: Project public registry document 1355, IR12-07)

The Proponent indicated that transient and impulsive noise during Project operations was not anticipated to exceed the sleep disturbance guideline of 10 to 15 events per night of 60 dBA L_{max} or greater. Using worst-case downwind meteorological conditions, the Proponent stated that transient noise events were predicted to range from 52.1-58.5 dBA at site 4 and 48.2-59.1 dBA at site 5, and there would be a maximum of 16 impulsive events per hour. The Proponent indicated that while the number of predicted transient and impulsive noise events per night associated with Project operations would exceed the threshold of 10 to 15 events per night, L_{max} noise levels would not exceed the 60 dBA threshold even during worst-case meteorological conditions. The Proponent highlighted that the number of events per night already exceeds the threshold under existing conditions. The Proponent noted that while the high end of the range for L_{max} values would approach the 60 dBA threshold, the average L_{max} values under downwind conditions would be approximately 5 dBA below the threshold. The Proponent concluded that transient and impulsive noise events associated with Project operations even with worst-case meteorological conditions are not predicted to result in a measurable effect on human health.

The Proponent stated that the energy sum of the sound levels in the low-frequency bands was below the rattle criterion of 70 dB at all sites during Project operations, except for site 4 on Tsawwassen First Nation Lands where the sum of sound levels was predicted to be 73.6 dB. The Proponent indicated that increased complaints at site 4 are possible. The Proponent noted that no new exceedances of LFN were predicted as a result of the Project. The predicted LFN levels are summarized in Table 21-6. The Proponent concluded that the Project contribution to LFN was predicted to be so low as to be imperceptible.

Table 21-6: Low-frequency noise levels under expected conditions and future conditions with Project operations in comparison with thresholds (Source: Adapted from Project public registry document 1465, IR14-06)

Site	Expected Conditions				Future Conditions with Project Operations			
	Nighttime LFN (dBC)	Do predicted levels exceed 65 dBC?	Sum of Sound Levels (dB)	Do predicted levels exceed 70 dB?	Nighttime LFN (dBC)	Do predicted levels exceed 65 dBC?	Sum of Sound Levels (dB)	Do predicted levels exceed 70 dB?
4a	65.1	Yes	71.0	Yes	67.7	Yes	73.6	Yes
5	62.5	No	66.0	No	64.1	No	67.6	No
6	51.1	No	54.7	No	52.7	No	56.3	No
7	62.9	No	68.3	No	64.5	No	69.9	No

The Proponent noted that there were no exceedances of the 6.5 percent highly annoyed threshold in the LAA during either construction or operations.

The Proponent stated that L_d during both construction and operations at each receptor location was below the speech comprehension threshold of 55 dBA for residential receptors. When asked by the Panel to consider the potential speech comprehension effects at a proposed new school

presented in Tsawwassen's neighborhood plan, the Proponent stated that daytime noise levels at site 4 on Tsawwassen First Nation Lands would be 49.5 dBA during both construction and operations, which did not exceed the 50 dBA threshold for sensitive receptors.

The mitigation measures to reduce noise during construction and operations are described in Section 7.4 - Noise and Vibration. The Proponent determined that, after the application of mitigation measures, there would be a residual effect on human health due to exposure to noise. The Proponent characterized the residual effect on human health as low to medium in magnitude, low to medium in severity/reversibility, local extent, long-term in duration, and continuous duration during operations. The Proponent stated that a residual effect of the Project on human health would be significant if the noise threshold of 55 dBA for nighttime continuous noise was exceeded, and the integrity of health in the population was compromised. The Proponent determined that the residual effect on human health due to exposure to noise would not be significant.

The Proponent committed to a follow-up program to verify human health noise effects predictions related to nighttime noise, and to verify predictions of negligible health effects from other types of noise. The Proponent indicated that nighttime sound levels, including LFN would be continuously logged by permanent or semi-permanent monitoring stations at key receptors locations during and after construction. If values are higher than predicted, the Proponent would determine the source and cause and would implement additional mitigation measures.

The Proponent considered the potential interactions between residual adverse effects of the Project and the incremental effects of other future projects and activities that are certain and reasonably foreseeable. The Proponent concluded that the same number of homes and individuals would be potentially affected by the inclusion of other projects and activities as in future conditions with the Project scenario, and therefore no additional effects on human health due to exposure to noise would occur. The Proponent noted that while the total future cumulative noise levels may cause adverse effects on a small number of individuals, it considered the total cumulative effect on the overall health of the community to be not significant.

Marine Shipping Area

The Proponent assessed the potential effects on human health in response to potential changes in atmospheric noise from marine shipping associated with the Project. The LAA used for the assessment was the same as was used in the atmospheric noise assessment, and consisted of a 4 km zone surrounding the inbound and outbound shipping routes with Segments A through E.

The Proponent noted that shipping lanes are generally quite far away from locations where humans may be residing, or otherwise spend extended time periods. The Proponent stated that because shipping-related noise is transient, ship-related noise exposure experienced by humans was expected to be low and below the energies that may result in increased rates of feeling highly annoyed in a residential setting or similar area of extended visit or relative solitude. The Proponent concluded that adverse effects on human health related to noise are not expected as a result of marine shipping associated with the Project.

21.2.2 Views of Participants

Several participants indicated that existing noise in the area had already reached unacceptable levels, and that it was affecting their health. Participants noted that their sleep was already disturbed by continuous and impulsive noise, and expressed concern that the Project would increase noise levels that they felt were already too high. Health Canada noted that a change in the character of the sound may be noticeable even if there is little change in actual sound level. Health Canada indicated that statements relating to perception of whether changes in noise are noticeable based solely on decibel levels, such as those made by the Proponent, should be avoided, as these statements have been demonstrated to be incorrect.

Tsawwassen stated that they were particularly concerned about noise impacts during nighttime, given that their members already experience sleep interruptions by train and truck noise. Tsawwassen highlighted that present-day Ln levels are at, or exceed, the World Health Organization guideline for nighttime noise. Tsawwassen recommended that the Proponent identify noise mitigation strategies or partner with other project operators to identify collective mitigation strategies to keep nighttime noise less than 45 dBA.

Health Canada stated that project-related noise may contribute to sleep disturbance, and mitigation measures are warranted. Health Canada highlighted that an annual average outdoor nighttime sound level of 40 dBA at the most exposed building façade is the level intended to protect the public, including the most vulnerable populations, from health effects associated with sleep disturbance. Health Canada indicated that there may be an increased number of residences that would be affected by Project-related noise when using the 40 dBA threshold.

Health Canada noted that the transient and impulsive noise events associated with Project operations were predicted to approach 60 dBA at site 4 (58.5 dBA) and site 5 (59.1 dBA), up to 16 times per hour. They further noted that the Project's 16 impulsive noise events per hour would equate to 144 events per night. Health Canada reported that the average Lmax for discrete noise events should not be used for comparison with the 60 dBA threshold, which was intended for the evaluation of individual noise events. Health Canada stated that mitigation measures should be provided for receptor locations where the 60 dBA Lmax outdoor threshold for individual noise events are exceeded or where the indoor Lmax exceeds 45 dBA.

Health Canada indicated that there was potential for interference with speech comprehension, message communication and the extraction of information at the proposed Tsawwassen First Nation School during both construction and operations. Health Canada noted that the annual average Ld predicted during expected conditions approached the 50 dBA outdoor threshold at site 4, which appeared to be within a few hundred meters of the proposed Tsawwassen First Nation School. Health Canada recommended that the Proponent employ noise mitigation measures during construction and operations to ensure sound levels would not exceed 50 dBA outdoors around schools during periods when students occupy classrooms.

Tsawwassen members identified concerns with both LFN and atmospheric noise inside of their properties and homes and noted that these environmental effects were caused by the operations

of the existing Roberts Bank facility. Health Canada indicated that there was already a very low tolerance towards LFN, and any additional LFN would likely lead to an exaggerated annoyance response and result in Project noise-related complaints. Health Canada outlined that Project-related noise may exacerbate existing community concerns over LFN, and stated that they did not support the Proponent's conclusion that the Project's contribution to LFN was imperceptible.

Health Canada recommended that the Proponent apply specific mitigation measures to prevent any project-related increase in LFN in areas where the Proponent had already been made aware of an existing LFN problem, in addition to areas where calculated changes in LFN exceed 70 dB. Health Canada also recommended the use of 60 dBC as an action level for further monitoring and investigation of LFN.

Health Canada stated that additional monitoring and mitigation were required to address existing community noise concerns. Health Canada indicated that the Proponent should provide a commitment to addressing project impacts on a case-by-case basis through community consultation, including additional noise monitoring. Health Canada recommended that all mitigation measures be considered both at the source and along the path between the source and receptors to prevent noise impacts. Health Canada stated that the Proponent should provide a commitment to undertake noise mitigation measures at specific receptor locations, if all other forms of mitigation prove ineffective.

Health Canada indicated that the methodology used by the Proponent to estimate noise emissions from container ships was reasonable. Health Canada further stated that the available literature suggests that noise issues have historically been related to moored ships.

21.2.3 Panel's Analysis

Project Area

The Panel accepts the Proponent's risk assessment based on a comparison of noise, LFN, impulsive noise and vibration levels with applicable thresholds for the selected indicators of potential adverse effects of noise on human health. The Panel accepts the advice given by Health Canada that conclusions relating to the perceptibility of changes in noise should be avoided. Accordingly, the Panel has assessed the potential effects of the Project in comparison with the internationally-accepted noise thresholds, rather than assessing perceptibility of predicted noise levels increases relative to expected conditions.

The Panel notes that several thresholds would be close to being exceeded during construction and operations of the Project, such as the speech comprehension threshold for sensitive receptors at site 4a, which is located in proximity to the proposed school on Tsawwassen First Nation Lands. The Panel acknowledges that the threshold for sleep disturbance due to impulsive noise during operations would occur much more frequently (10.3 to 16 times per hour) when compared to the threshold (10 to 15 times per night), and the levels at the receptor sites approach the threshold of 60 dBA Lmax. The Panel is of the view that there are potential residual effects associated with speech comprehension and sleep disturbance in the area surrounding site 4 due to

impulsive noise. The Panel recommends that a follow-up program be implemented to confirm predictions and incorporate and implement adaptive management measures as necessary.

The Panel accepts the Proponent's assessment that noise levels would increase as a result of construction and operation of the Project. The Panel is mindful that changes in noise during construction and operations are particularly pronounced at site 4a, which is located on Tsawwassen First Nation Lands. The Panel also acknowledges that Tsawwassen has reported that they already experience sleep disturbance due to continuous and impulsive noise, and annoyance with LFN.

The Panel notes the Proponent's conclusion that noise during operations would result in an additional three homes becoming exposed to nighttime levels exceeding 55 dBA. The Panel agrees with the concerns of Health Canada that there would be an increased number of residences that would be affected by Project-related noise when using the more stringent 40 dBA nighttime sleep disturbance threshold. The Panel is of the view that there would be a greater number of homes in Tsawwassen that would be exposed to exceedances when comparing noise outputs to the 40 dBA threshold, as visible in Figure 21-2.

Furthermore, there are predicted exceedances of LFN at site 4. The Panel is of the view that the mitigation measures proposed by the Proponent are standard and appropriate, but these measures would not completely eliminate the potential effects on human health. The Panel concludes that there would be a residual effect for sleep disturbance from continuous noise during construction and operations, and annoyance with LFN during operations at site 4 and the surrounding area.

The Panel is of the view that the Proponent's significance threshold, which is based on population level effects, does not capture the effect of noise on the health of individuals.

The Panel concludes that residual effects on human health related to changes in continuous nighttime noise levels during Project operations would be localized to several residences closer to key transportation corridors when using the sleep awakenings threshold of 55 dBA. Exceedances of LFN noise during operations are localized to site 4 and the surrounding area. The Panel notes that although the sleep disturbance threshold of 40 dBA is exceeded throughout much of the upland area during expected conditions, the Project would result in additional exceedances, and would result in an effect on human health that is of moderate magnitude.

The Panel concludes that noise from the construction and operations of the Project would result in a residual adverse effect on human health. The effect would not be significant.

Recommendation 58

The Panel recommends that the Proponent be required to design and implement a follow-up program to achieve the following:

- *Carry out continuous monitoring of nighttime sound levels, including low-frequency noise at the Tsawwassen First Nation administration building throughout construction, plus 2 years of operations;*

- *If noise levels during monitoring are higher than predicted, the Proponent is to determine the source and cause of the noise and implement additional mitigation measures, at source or at receptor locations, as required; and*
- *Carry out continuous daytime monitoring at the Tsawwassen First Nation administration building for one year of operations to determine whether receptor-based mitigation measures are required at the proposed school located on Tsawwassen First Nation Lands.*

Cumulative Effects Assessment

The Panel notes that the Proponent's cumulative effects assessment concluded that the same number of homes and individuals would be potentially affected by the inclusion of other projects and activities as in the future conditions with the Project scenario when compared with potential effects in relation to the 55 dBA nighttime threshold. The Proponent concluded that no additional effects on human health related to sleep awakenings associated with noise would occur and that the incremental effect on human health from reasonably foreseeable projects and activities would therefore be negligible.

The Panel does not agree with the Proponent's conclusions, and is concerned that the human health of individuals would be affected by continuous nighttime noise and LFN from the Project. The Panel notes that the Proponent has acknowledged that there are already exceedances of noise thresholds across a large portion of the upland assessment area. Furthermore, the Proponent's noise modelling indicates there would be additional noise from the Project.

The Panel concludes that cumulative health effects due to noise from the Project would be high in magnitude since the Project would be adding to an already severely degraded environment with exceedances of several different human health thresholds across a large portion of the upland LAA, irreversible (for operations), long-term in duration, and continuous. Therefore, the cumulative effects on human health would be significant.

The Panel concludes that the Project would result in a significant adverse cumulative effect on human health due to noise.

Marine Shipping Area

The Panel accepts the assessment approach employed by the Proponent, and the conclusion that marine shipping associated with the Project is not anticipated to measurably affect annual average atmospheric noise levels in the marine LAA. The Panel agrees with the Proponent that noise from marine shipping associated with the Project would not have an effect on human health.

The Panel concludes that noise from marine shipping associated with the Project would not result in a residual adverse effect on human health.

21.3 Exposure to Shellfish Contamination

21.3.1 Proponent's Assessment

The Proponent stated that bivalves were historically an important food source but the intertidal areas at Roberts Bank were located within a permanent sanitary shellfish closure area due to concerns about possible disease transmission caused by pathogenic organisms originating from sanitary, industrial, and other discharges near the shellfish beds. The Proponent noted that Dungeness crabs were not subject to the sanitary closure.

The Proponent stated that it could not identify a Project-related source of contamination and the Project would not result in an increase in contaminant concentrations in the sediments. The Proponent therefore focused on assessing the existing contamination at the site. The Proponent analyzed bivalves and Dungeness crab tissues for contaminants of potential concern (COPCs) that could have originated from historical marine inputs of coal dust, such as PAHs, arsenic, bismuth, cadmium, selenium, and vanadium. Collection efforts for shellfish focused on the Roberts Bank intertidal area, where coal dust deposits had been observed. Overall, the Proponent determined that there would be no contaminant-related health risks for humans consuming edible shellfish at Roberts Bank because the concentrations of contaminants were below toxicological thresholds. The Proponent also concluded that the cancer risks from consuming shellfish at Roberts Bank were acceptably low.

Following the submission of the EIS, the Proponent undertook additional sediment sampling to characterize sediments that could be re-suspended during Project construction. The Proponent calculated the 95 percent upper confidence limit of the mean concentration (UCLM) for each chemical parameter measured in the sediment that could be dredged and utilized as terminal fill during Project construction. The Proponent collected over 700 samples of sediment and noted that the contaminant concentrations at Roberts Bank were less than the applicable CCME Guidelines except for copper, which was naturally elevated in the Project area. In addition, the Proponent highlighted that sedimentation was ongoing at Roberts Bank as a result of natural processes and concluded that any sediments that would be re-suspended during construction would not be contaminated.

The Proponent also sampled contaminants in Dungeness crab hepatopancreas, comparing samples from the proposed terminal, a reference site at Canoe Passage, and the area of the formerly proposed Intermediate Transfer Pit, which was considered to be representative of the Tug Basin. The Proponent concluded that the existing sediment and water quality at the Project site were not contributing to hepatopancreas contaminant loading. The Proponent also conducted a supplemental crab and bivalve study to examine existing contaminant concentrations in crab hepatopancreas as well as arsenic in bivalve and crab leg muscle tissues. The Proponent noted that the potential risks associated with shellfish consumption under the existing conditions at Roberts Bank marginally exceeded applicable health toxicological thresholds for cadmium and inorganic arsenic, which were naturally elevated at Roberts Bank.

The Proponent engaged with Indigenous groups to collect accurate information related to their level of shellfish harvesting and consumption, but noted that the information was sensitive and difficult to obtain. The Proponent stated that the information it received from Indigenous groups was insufficient to determine a representative shellfish consumption rate; therefore, the Proponent selected a consumption rate from publicly available data which indicated a wide range of consumption rates across and within Indigenous groups. Originally, the Proponent used a shellfish consumption rate of 40 g/day for adults in the human health risk assessment, but later updated the human health risk assessment to include a revised consumption rate of 51 g/day. This rate was the approximate mid-point of the range of consumption levels identified through both input from Indigenous groups and a literature review. The updated consumption rate did not change the Proponent's conclusion that there would be no Project-related health effects from consuming shellfish.

The Proponent completed an Aboriginal Dungeness Crab Health follow-up study to address concerns raised by Indigenous groups about crabs with blackened shells and tissue. The study found that the black lesions found on some crab were due to chitinolytic shell disease, a bacterial or fungal infection that was present all along the Pacific Northwest coast. The Proponent concluded that the health risks associated with consuming crab with blackened shells were negligible.

Overall, the Proponent concluded that the Project would result in negligible effects related to shellfish contamination and human health, for both Indigenous and non-Indigenous people. The Proponent based its conclusions on two key assumptions: 1) the source of contamination was historical, therefore any sediment disturbance and re-settlement during construction would not increase levels of contamination, and 2) the samples collected from areas with the highest coal dust contaminant levels were safe for human consumption, so future conditions including Project construction and operations would not alter that. The Proponent was highly confident that the Project would not be a source of contamination and that any re-suspended sediments would not be contaminated.

The Proponent concluded that there was no plausible mechanism for increased contaminant uptake into marine foods and therefore mitigation, follow-up programs or additional monitoring were not required. The Proponent also rejected recommendations from Health Canada and the BC Ministry of Health to implement a traditional foods monitoring program because it noted additional analysis would not change its conclusions and project-specific monitoring would not address regional concerns around shellfish contamination. However, to address the perceived contamination of shellfish, the Proponent proposed to participate in discussions with interested health authorities on a collaborative approach to improving the understanding of shellfish quality at Roberts Bank. The Proponent also stated that other mitigation measures proposed to manage suspended sediments, avoid effects on crab, and consult with Indigenous groups would help reduce the potential for human health-related effects.

21.3.2 Views of Participants

Indigenous groups raised concerns about contamination at Roberts Bank and the surrounding area. Semiahmoo noted that they were concerned about potential contamination from dredging. Chief Harvey Chappell described how their traditional territory, Semiahmoo Bay, was currently contaminated but no one could definitively answer where the contamination was coming from. Tsawwassen raised concerns about the health impacts of consuming traditional foods from the Project area. Tsawwassen noted that its members had observed blackened crabs harvested from the Project area; this was a concern that was also raised by participants at the Proponent's Indigenous Advisory Forum.

Penelakut Tribe submitted a report to the Panel entitled "Risk Assessment of Shellfish Consumption in Coastal Communities in British Columbia." The report described the importance of shellfish in the diets of First Nations on the coast of British Columbia and described a lack of access to safe shellfish for Penelakut Tribe members.

A few Indigenous groups questioned the shellfish consumption rates used by the Proponent. Penelakut Tribe stated that their shellfish consumption rates were 61 g/day. Tsawwassen noted that there were uncertainties regarding the source of shellfish consumption rates and recommended that the Proponent fund a Tsawwassen diet study to confirm assumptions regarding consumption in the HHRA. Tsawwassen noted that this would determine if the Proponent's assessment represented a reliable predictor of health effects from the Project.

Health Canada stated in several submissions that the appropriateness of shellfish consumption rates in the human health risk assessment should be confirmed with Indigenous groups and they recommended that the Proponent be required to consult with Indigenous groups. Health Canada stated that the department did not object to the Proponent's revised consumption level of 51 g/day if that consumption rate was verified by Indigenous groups.

Health Canada also indicated that the Proponent's assessment should have included all COPCs that could pose a risk to human health in order to generate more accurate results. Health Canada pointed out that the release of trace elements from coal dust and their uptake in traditional foods was not considered by the Proponent. Health Canada was of the view that Project-related activities had the potential to re-suspend and increase the availability of COPCs within the Project area.

Health Canada cautioned against the Proponent's position that the existing contaminant concentrations posed a low risk to human health and therefore Project-related activities would not result in contaminant concentrations that could pose an unacceptable human health risk. Health Canada noted that although sediment quality guidelines were often used to screen for potential human health risk, they were specifically designed to protect ecological health and should not be used to extrapolate risks to human health.

The BC Ministry of Health stated that potential contaminants could have been screened out of the Project's assessment because the Proponent used the 95 percent upper confidence level of the

mean concentrations, instead of maximum concentrations. The Ministry stated that had the Proponent used maximum concentrations, several additional contaminants may potentially have been identified as COPCs. The Ministry also noted that contaminants in sediment with bio-accumulative potential were not conservatively included in the human health risk assessment, and therefore the risks from bioaccumulation may have been underestimated. The Ministry stated that there was potential for contaminants to be mobilized during dredging and re-suspended and that this was a potential pathway that was not assessed by the Proponent.

Health Canada stated that they could not directly characterize what the effects of the Project might be on traditional food sources. Health Canada indicated that because the Proponent's assessment was focused on existing conditions only, it excluded the prediction of possible effects from Project-related activities. Overall, Health Canada concluded that the potential risks to human health from exposure to contaminants in traditional foods was uncertain. Similarly, the BC Ministry of Health stated that they could not validate the Proponent's conclusion of no significant effects on human health from the Project. Because Health Canada could not verify the Proponent's conclusions, Tsawwassen requested that the Proponent be required to update their HHRA.

Health Canada recommended that the Proponent develop a monitoring program for traditional marine foods, and use the results of the monitoring program to inform ongoing communications with Indigenous groups and others regarding the potential contamination of marine foods. Tsawwassen supported this recommendation. The BC Ministry of Health also noted that a marine country foods monitoring plan should be developed to monitor contaminant levels. Tsleil-Waututh stated that they would like to see continued sampling and monitoring of shellfish contamination.

21.3.3 Panel's Analysis

In reaching its conclusion on effects on human health from shellfish exposure, the Panel considered the following factors particularly relevant:

- No Project-related source of contamination was identified;
- The Proponent's sampling indicated that the sediments at the Project site did not pose a risk to human health and re-suspension of the sediments would not cause re-mobilization of contaminants;
- In its assessment of surficial geology and marine sediment, the Panel accepted the Proponents conclusion that the Project was not anticipated to cause changes in contaminant concentrations in sediment;
- ECCC agreed with the Proponent's assessment that sediment copper concentrations in excess of CCME Guidelines are representative of ambient background concentrations in the Project area;
- The Proponent noted that the potential risks associated with shellfish consumption under the existing conditions at Roberts Bank exceeded applicable health toxicological

thresholds for cadmium and inorganic arsenic, which were naturally occurring at Roberts Bank; and

- Health Canada and the BC Ministry of Health stated that they were uncertain about the potential risks to human health from exposure to contaminants in traditional foods.

The Panel notes that the Proponent based its conclusion on its interpretation that any contamination in the sediment was historical and the Project would not cause any new contamination. Although a few participants raised uncertainty about the Proponent's methods and conclusions, no participant provided specific evidence that there would be a Project-related source of contamination.

The Proponent's primary means for determining exposure to shellfish contamination was via human health risk assessment. The Panel agrees with this methodology and notes that the results of HHRA depend on the accuracy of the inputs utilized to calculate health risk. The Panel is of the view that the uncertainties regarding the results of the HHRA could have been reduced if the Proponent had been able to provide actual shellfish consumption rates and contaminant concentrations in the shellfish tissue that are consumed. However, since the Panel does not view the Project as a source of contamination, the Panel does not expect that the results of the assessment would have been significantly different had more accurate consumption rates been adopted.

The Panel notes that Indigenous peoples consuming traditional food in the Project area may already be exposed to toxic contaminants that exist naturally at levels above current threshold guidelines. The Panel recognizes that there is an existing DFO sanitary closure for bivalve harvesting and consumption within the intertidal and subtidal zones of the LAA. The Panel considers the sanitary closure unrelated to Port Authority activities and accepts that additional development may further limit access to safe traditional foods.

The Panel agrees with the results of the Proponent's study that concentrations of contaminants in Dungeness crab hepatopancreas are low. Since crab muscle tissue contains much lower concentrations of contaminants than hepatopancreas, the Panel concludes that exposure to crab contamination is negligible.

The Panel concludes that the Project would not result in a residual adverse effect on human health related to shellfish contamination.

21.4 Health Impact Assessment

The Proponent described the Health Impact Assessment as a "process used to identify how a project, policy, or program might influence health." The Proponent noted that the Health Impact Assessment used a qualitative methodology and included an evaluation of indirect effects on health due to Project-related changes in key socio-economic factors. Biophysical, social, economic, cultural, and institutional determinants of health were taken into consideration to assess food security, stress and annoyance, employment and income and health inequity.

21.4.1 Food Security

21.4.1.1 Proponent's Assessment

The Proponent selected food security as a subcomponent because it noted that a potential change in access to traditional food sources could affect food security, resulting in nutrition-related health effects. The Proponent acknowledged the importance of traditional subsistence foods for the health of Indigenous groups. The Proponent selected the Metro Vancouver area as the LAA and British Columbia as the RAA. The Proponent did not include food security as part of its health assessment in the Marine Shipping Addendum.

The Proponent identified three potential pathways for food security: 1) changes in access to harvesting locations; 2) changes in the availability of traditional foods; and 3) changes in the quality of traditional foods. The Proponent relied on the results of its assessments of current use, biophysical environmental components and the HHRA to conclude on food security.

The Proponent relied on various sources of information to collect data on Indigenous traditional food sources. The Proponent noted that it was difficult to provide information on the relative reliance of Indigenous groups on certain types of food and used the study entitled *First Nations Food, Nutrition & Environment* by Chan et al. 2011 (Chan Study) to help characterize that information. The Chan Study provided percentages of on-reserve British Columbia First Nations consuming traditional foods. The Chan Study did not include the Project area but the Proponent used data from the closest zone, Ecozone 6, as a proxy for subsistence food in the LAA. Ecozone 6 includes the First Nations of the Kitsumkalum, the Hagwilget, the Skidegate, the Nuxalk, the Namgis and the Sliammon. Only the Sliammon First Nation on the Sunshine coast, the Skidegate First Nation on Graham Island, and the Namgis First Nation in Alert Bay live on the coast. None of the Indigenous groups included in the Chan Study were the groups covered in the EIS or MSA. The Chan Study indicated a high level of reliance among Indigenous groups on a wide variety of marine resources.

The Proponent noted that there was little quantitative information on traditional food consumption in the LAA and that not all Indigenous groups were willing to share harvesting and consumption information. The Proponent emphasized the difficulties encountered when doing dietary surveys in terms of ownership, control, access and possession rights of such data, and participation rates. The Proponent stated that Indigenous groups' health data was sensitive and considered confidential in most cases. The Proponent argued that health authorities were in the best position to protect Indigenous determinants of health and data for use in such a study.

The Proponent concluded that effects on human health related to food security would be negligible. The Proponent did not predict any effects on traditional foods or on the ability of Indigenous groups to harvest traditional food sources due to the Project. The Proponent acknowledged that Indigenous groups had faced substantial changes over time with respect to the availability and access to traditional foods but noted that those issues were beyond the scope of the Project itself.

The Proponent did not propose any mitigation measures to address food security but made a commitment to develop a follow-up program for current use. The Proponent noted that if concerns regarding food security were expressed, it would work with the relevant groups to address the concerns. The Proponent also expressed a willingness to participate in any regional initiatives that examined food security but noted that those initiatives would be beyond the scope of the Project. The Proponent suggested that those initiatives would be better conducted collaboratively by Indigenous groups, health authorities, and other relevant government agencies.

21.4.1.2 Views of Participants

Many Indigenous groups described how their physical and mental health and well-being was closely linked to their ability to harvest traditional foods and that the shift in their diets away from traditional foods was causing health effects. Some Indigenous groups expressed displeasure with the existing availability of marine resources and considered the reduced availability of traditional foods as a threat to their food security.

A member of Tsawwassen stated “when we started eating the processed food, our health started deteriorating.” Tsawwassen noted that the health of their members was “inextricably” linked to the health of the sea and the health of their relationship with the sea. Tsawwassen stated that the ability to continue to provide traditional food, such as fish and crab for their community, was of great importance.

Musqueam noted that fishing was critical to their food security and broader well-being. Sharing of seafood was also described as “crucial” for the food security of their community as well as an opportunity to build social ties among members. Musqueam also raised concerns about the additional effects of the Project on fish in the Fraser River estuary and the subsequent inability to harvest.

The Pauquachin First Nation stated that food security would be a concern if the Project were to proceed. Chief Rebecca David noted that the food they traditionally harvested was already declining. The Pauquachin First Nation also noted that for W̱SÁNEĆ communities a very small number of harvesters were harvesting most of the food for ceremonies and distribution to community members. Dr. Peter Evans, representing the Pauquachin First Nation, stated that such a system was very fragile and easily disrupted because only a small number of harvesters were supporting food security.

W̱SÁNEĆ Nations noted that community members had to rely on their families and friends to share their harvests or were forced to purchase marine foods. Other Indigenous groups expressed dismay at having to purchase foods that they traditionally harvested themselves. Chief Chappell of the Semiahmoo remarked that they had become so urbanized, members found it easier to purchase food than to harvest it themselves.

Indigenous groups in the marine shipping area also raised concerns about food security. Ditidaht noted that although currently the fish are plentiful at Swiftsure Bank, they were always

concerned about food security. Chief Councillor Joseph stated that it would be “devastating” for their health if they suddenly had to stop harvesting their traditional foods. Pacheedaht stated that any effect or condition that could endanger their ability to harvest traditional foods from Swiftsure Bank was unacceptable. Ms. Roxy Jones of Pacheedaht stated that there would be “zero tolerance” for altering their diets to accommodate to industry. The Songhees First Nation raised concern about increased marine traffic causing pollution and further contamination of their food sources. A member of the Esquimalt Nation noted that the barriers to accessing traditional foods led to their diets being “less healthy”.

Some Indigenous groups underlined that it was misleading to confirm major food sources for Indigenous groups in the LAA as being similar to those groups in Ecozone 6 of the Chan Study that the Proponent relied upon. Further, for many Indigenous groups, the study did not provide detailed data on the types of terrestrial plants, marine vegetation, marine invertebrates, marine birds and marine mammals that were consumed.

21.4.1.3 Panel’s Analysis

The Panel disagrees with the Proponent’s conclusion that the potential adverse effects on food security were negligible because a residual effect on harvesting of traditional food resources was not anticipated. In Section 16 - Current Use of Lands and Resources for Traditional Purposes, the Panel concluded that there would be residual adverse effects on some Indigenous groups in terms of changes to access and availability of traditional resources in the Project area. For marine shipping associated with the Project, the Panel notes the Proponent did not assess food security. The Panel concluded that there would be an effect on access to marine resources but not on their availability.

The Panel disagrees with the Proponent’s use of the Chan Study as an indication of the types and quantity of food consumed by Indigenous people in the LAA. The Panel reviewed the Proponent’s data, including the responses to questions from the Agency on the reliance of each Indigenous groups on country food and compared it to the results of the Chan Study. The Panel’s review of information related to food security indicated that:

- None of the Indigenous groups chosen for the Chan Study’s Ecozone 6 were included in the groups covered in the EIS or MSA;
- The diet varies greatly from one Indigenous group to another and includes both marine and terrestrial resources;
- The priority order of preferred resources for the groups in Ecozone 6 (fish and land mammals) is very different than the order for Indigenous groups of the EIS and MSA (crab, fish, shellfish and other beach food);
- The diet has changed for some Indigenous groups in recent years due to harvesting restrictions, conservation status of the resource, and sanitary closures and restrictions;
- There appears to be avoidance of certain foods because of perceived or real pollution or contamination concerns; and

- Indigenous groups living further from urban centers have a more varied diet of traditional foods.

The Panel is of the view that the diet is much more varied for each Indigenous group than the generalities the Proponent assumed based on the Chan Study. The Panel notes that the predicted Project effects on crab would cause a change in diet and have an effect on food security for groups using the LAA, specifically Tsawwassen. The effect would be small in magnitude, long term, continuous and irreversible. Due to the variety of available marine resources, the effect would not be significant.

In the marine shipping area, access to harvesting sites was the key linkage to food security as the Panel concluded that there is no biophysical effect on the quality or quantity of the resources harvested. Any incremental effect from ship pass-bys in terms of access could have an effect on groups using the shipping lanes or crossing them to reach their preferred harvesting sites, indirectly affecting their diet. Any incremental wave effect in Segment B could have an effect on fishing success or harvesting marine invertebrates in the area.

The Panel concludes that the predicted Project effects on crab would cause a change in the diet and have an adverse effect on food security for Indigenous groups using the Local Assessment Area. However, the Panel cannot conclude if the change would result in an adverse effect on human health.

The Proponent noted substantial changes have occurred over time in the availability of traditional foods. The Panel agrees with this observation. With industrialization, some Indigenous groups have adjusted their diet whether the cause originated from real or perceived pollution issues or conservation restrictions. Some fish species relied on for food have declined, such as Fraser sockeye salmon and eulachon.

The Panel believes it would be important to have a clearer idea of traditional food consumption rates and preferences of Indigenous groups harvesting in the Project area and the marine shipping area and the effects on their health.

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The Panel recommends that the Government of Canada initiate a well-designed and appropriately funded study on food security, to be implemented in collaboration with Indigenous groups and responsible health authorities. The objective of the study would be to examine the effects of food insecurity on the health of Indigenous groups harvesting in the Project area, such as the Tsawwassen First Nation and the Musqueam Indian Band. The study should target preferred traditional marine resources, consumption rates, and effects on consumption of real or perceived contamination.

21.4.2 Stress and Annoyance

The first part of this section examined HHRA in terms of potential standards or guidelines being exceeded and their effect on health. In this section, the Panel evaluates the real and perceived

Project-related changes to air quality, noise, light and shellfish contamination. These changes could result in stress and annoyance, which in turn could affect human health.

21.4.2.1 Proponent's Assessment

In its assessment the Proponent defined stress as “a state of mental tension and worry” and annoyance as “a feeling of displeasure associated with any agent or condition believed to adversely affect an individual or group.”

The Proponent stated construction and operations of the Project could potentially increase stress and annoyance related to noise, light, and perception of food contamination. The Proponent stated that those who hear noises from current operations at Roberts Bank terminals were likely to hear noises more often once the Project was operating. The Proponent also noted that the mere visibility of light from the new terminal could be a source of annoyance. The Proponent stated that if Indigenous groups believed that the Project had the potential to further contaminate food sources it could cause stress and anxiety in some members.

The Proponent proposed a Construction Noise Management Plan and Operation Noise Management Plan to reduce the contribution of Project-related noise to stress and annoyance. The Proponent also stated that light mitigation measures would reduce the contribution of Project-related light to stress and annoyance. The Proponent indicated that consultation, awareness, and education would mitigate perceived contamination of food sources. The proposed activities included consultation with Indigenous groups on the results of shellfish studies and any other future studies to better inform groups regarding the perception of contaminant risks from shellfish ingestion. The Proponent also agreed to participate in discussions with appropriate health agencies on a collaborative basis to improve understanding of shellfish quality at Roberts Bank.

The Proponent concluded that there was no detectable or measurable residual effect on human health due to stress and annoyance.

21.4.2.2 Views of Participants

Tsawwassen stated their members already experience noise as intrusive, especially sleep interruptions, and that even small additions to noise were additions to an already significant adverse effect. An Elder of Tsawwassen spoke in detail of how the noise and “hums” from the Roberts Bank terminals were causing stress to both humans and animals. Tsawwassen also stated “measures such as our Members paying for new windows to reduce noise concerns add impacts to our members, rather than reducing them.”

Health Canada acknowledged that noise could cause annoyance and concluded that Project-related noise could contribute to sleep disturbance. Health Canada also noted that there was potential for annoyance from rattling noise at a few sites in Tsawwassen community.

One participant stated “The rumble of the trains is monstrous and shakes the ground. And this year, alarm sounds were added to the port in late summer, which carry for kilometers--this issue

still has not been resolved despite many complaints by locals.” The participant believed that the Project would lead to more noise pollution for Delta residents.

Another participant expressed concern that the land was being compromised and stated “our air is also suffering from pollution, bringing a wide range of health threats to human beings and other life.” One participant stated “Go for a walk on any terminal...Fumes are emanating from every type of machinery and coal dust is dispersing all over...The rumble of ship and machinery noise is constant...I lived and breathed the fumes and noise.” Another participant noted that the local community was likely to be more sensitive to infrastructure noise and health effects because of the large number of new industrial projects that had happened in the area over the last decade. Another stated “doubling the noise if the terminal is doubled is unconscionable.”

Many residents of Tsawwassen community and Ladner also expressed general concerns about how the light, noise, traffic or pollution would affect the quality of life in the area and the construction of the port would cause additional concerns. One participant noted that the new terminal would negatively affect all Delta residents, who were already dealing with substantial air, noise, and light pollution. Against Port Expansion highlighted that local councils, community and environmental organizations, and residents had repeatedly raised concerns about increased air pollution from truck and train traffic and the subsequent health effects with the Proponent.

21.4.2.3 Panel's Analysis

The Panel acknowledges the concerns communicated by the City of Delta and Tsawwassen with respect to the level of noise people experience due to the existing Roberts Bank terminals. The Panel is of the view that present concerns expressed by participants who reside in the Project area related to air, light and noise pollution indicate a potential for stress and annoyance. The stress and annoyance risk could be exacerbated by the Project. As covered in the HHRA, the Panel concludes that there would be residual adverse effects on human health related to air quality due to chronic exposure of annual-average NO₂ during construction and, exposures to 1-hour average NO₂ and respiratory irritants during operations. As for effects on human health related to atmospheric noise and vibration, the Panel concludes that there would be a residual adverse effect on sleep disturbance from the continuous noise and vibration during construction and operations, as well as annoyance due to low-frequency noise during operations in the vicinity of the Long House on Tsawwassen First Nation Lands.

The Panel agrees with the Proponent that light pollution could potentially increase stress and annoyance. In Section 7.3 - Light Pollution, the Panel concludes that the light environment has been degraded by existing light sources. The immediate vicinity of the existing Roberts Bank terminals would witness an increase in light trespass and a potential deterioration of viewing experience for residents if mitigation measures were not applied.

The Panel concludes that the re-suspension of sediments due to dredging for the creation of the terminal berth pocket and the expansion of the tug basin would not result in shellfish contamination. The Panel is of the view that shellfish contamination, as presently perceived, is unwarranted and unassociated with current Port Authority operations.

The Panel is of the opinion that there are existing elements of stress and annoyance potentially affecting human health. The combined added pollution from the Project on air, noise and light could potentially exacerbate the situation.

The Panel cannot conclude on the Project effects on human health due to stress and annoyance given these aspects of human health are perceived differently by individuals.

21.4.3 Health Inequity

21.4.3.1 Proponent's Assessment

The Proponent noted that inequity exists when there are “avoidable, unnecessary, and unjust differences between groups.” The Proponent stated that although the residents of the Project area generally enjoy good health and well-being, good health was not uniformly distributed. The Proponent identified Tsawwassen and Musqueam as vulnerable groups within the LAA. The Proponent noted that, generally, Indigenous groups had lower levels of health and well-being, which would likely make them less resilient to new stressors. The Proponent recognized that the Indigenous concept of health comprised an array of factors, much broader than measures of mortality and morbidity, and noted that Indigenous health was deeply rooted in the inter-relationships between land, water, culture, and identity. The Proponent also identified lone-parent families and females as potentially more vulnerable due to disparities in income, as well as children ages 12 to 19 in Fraser Health Authority South Area due to demonstrated higher levels of food insecurity.

The Proponent stated that the Project could potentially cause adverse effects on health inequity as a result of unequal distribution of benefits and risks during construction and operations. The Proponent noted that the distribution of both positive and negative health effects from the Project could vary across population groups. The Proponent stated that people who would receive Project benefits would have better health outcomes, while those who were subject to effect of the Project would have poorer health outcomes. The Proponent concluded that health inequity was likely to indirectly increase as a result of the environmental and social changes that would result from the Project. The Proponent also indicated that Indigenous groups, as a more vulnerable population, were more likely to suffer negative effects related to health inequity.

The Proponent used a large spatial boundary for the LAA on human health, which included populations of Vancouver, the Gulf Islands and part of Vancouver Island. The Panel asked the Proponent to provide additional information related to specific profiles and comparisons on vulnerable groups located close to the Project and the LAA, as well as on who would benefit from the Project. In response, the Proponent maintained its general conclusions.

The Proponent highlighted its proposed accommodations related to employment, training, and contracting as mitigation measures to address potential Project-related effects on health inequity because they would provide opportunities for Indigenous groups to realize positive effects of the Project. The Proponent also noted that its planned mitigation measures for all other Project

components, including the Air Quality and Dust Control Management Plan and Light Management Plan, would minimize the Project's contribution to health inequity.

The Proponent characterized the residual effect on health inequity as negligible.

21.4.3.2 Views of Participants

Tsawwassen was concerned that negative effects of the Project were disproportionately felt locally while the benefits would be experienced on a national scale.

The Proponent reported that Musqueam was concerned that employment opportunities did not necessarily equate to improved health benefits resulting from the Project since the ability to fish or gather would be reduced. Further, Musqueam noted that the Proponent had not provided a detailed profile of the vulnerable populations near the Project area and had not clarified who in each vulnerable population would benefit from employment, training, and contracting opportunities or how that would be accomplished.

21.4.3.3 Panel's Analysis

The Panel agrees with the Proponent that there would be an uneven distribution of risks and rewards from the Project, both for the Indigenous and non-Indigenous populations in the LAA. Persons who would profit from economic benefits are not necessarily the ones who have health problems or are prone to suffer from environmental stressors. The Panel further agrees with the Proponent that health inequity was likely to indirectly increase as a result of the environmental and social changes that would result from the Project. However, the Panel disagrees with the Proponent on its characterization of the increase in health inequity as being small. In the Panel's view, health inequity would be moderate since the effect would be felt by sub-groups, not entire populations.

Further, the Proponent considered Tsawwassen and Musqueam as groups that were less resilient to new stressors than other groups because they are disadvantaged in key determinants, such as income, employment, education and health. The Project would impose additional environmental stressors, for sub-groups who are vulnerable economically and physiologically, such as elders, children, asthmatics and others that may have compromised lung function. The Panel notes that there was no social study done by the Proponent to support the concept of resilience to clarify which sub-groups were less resilient or to establish the link between the level of health and additional environmental stressors and added income from the Project.

The Proponent did not convincingly demonstrate the link between the unequal distribution of the Project's benefits and health risks during construction and operations. While the Proponent argues that members of Tsawwassen and Musqueam would benefit from training, employment and business opportunities, the Panel is not convinced that health inequity would be reduced among all vulnerable groups defined by the Proponent. A comparison between the general populations and sub-groups at risk was also not provided. Therefore, the Panel cannot conclude definitively on the effects on human health related to health inequity or to what extent health inequity could be reduced or aggravated by the Project for specific vulnerable groups.

The Panel cannot conclude definitively on the effects of the Project on human health related to health inequity or to what extent health inequity could be improved or aggravated by the Project for specific vulnerable groups.

22 Accidents and Malfunctions

In this section, the Panel examines the environmental effects of accidents or malfunctions that may occur during the lifetime of the Project, as well as accidents or malfunctions that may occur in connection with marine shipping associated with the Project. The information is presented in two distinct sections related to land-based and marine-based activities, respectively.

22.1 Land-Based Accidents and Malfunctions

22.1.1 Proponent's Assessment

The Proponent identified the types of accidents or malfunctions that might occur in connection with the Project, determined the potential environmental effects of a range of potential accidents and malfunctions, and described the measures to reduce the risk and minimize the potential effects. The Proponent identified six types of land-based accidents or malfunctions: motor vehicle accidents, train derailments, train-related collision, fire or explosion, land spill, and container handling accidents at the terminal.

The Proponent assessed the risk associated with an accident or malfunction as a function of the event's probability of occurrence and the anticipated consequences of the event. In order to evaluate the level of risk associated with an accident or malfunction, the Proponent assigned probability categories to each type of accident or malfunction. Probability was assigned a rating of high, moderate, low, very low, or extremely low, corresponding to the expected return period of a specified event once in 1, 10, 20, 50 and 100 or more years. The Proponent also provided severity ratings for the consequences associated with each event.

The Proponent developed plausible worst-case scenarios to represent the most severe environmental consequences for events with a moderate to high-risk level. The Proponent identified all interactions between a particular worst-case scenario and an environmental component and evaluated measurable residual adverse effects. The Proponent identified that there were two plausible worst-case scenarios for land-based accidents or malfunctions that required further assessment: a motor vehicle accident and a train derailment.

The Proponent's risk mitigation framework described the prevention and response measures in place based on existing regulatory requirements, existing and proposed practices and procedures within the Proponent's jurisdiction, as well as Project-specific design, management, and emergency response plans.

The Proponent stated that contingency planning for land-based accidents and malfunctions during construction and operations of the Project would include the use of regulatory and administrative controls, enhanced worker training and specialized emergency response teams. The Proponent's proposed mitigation measures for potential effects from land-based accidents were contained in the following plans: Environmental Management, Spill Preparedness and Response; Hazardous Materials Management; Emergency Management and Response; and, Land and Marine Traffic Management. The Proponent made a commitment to develop these plans in

consultation with affected parties. Land-based accidents and malfunctions identified by the Proponent are as follows:

Motor Vehicle Accident

The Proponent explained that a motor vehicle accident scenario resulting from the Project would involve employee and service vehicles, as well as container trucks traveling to and from the Project terminal. The consequences of such an accident included human injury, spill of deleterious materials (e.g., gasoline, diesel fuel, antifreeze, transmission fluid, lubricants), and property damage of yard equipment. The Proponent stated that such an event had a high probability of occurrence during construction and operations, based on the occurrence of past serious accidents in the area.

The Proponent described the first plausible worst-case scenario for a motor vehicle as a tanker truck accident during the construction phase, resulting in a release of up to 20 m³ of diesel fuel. The Proponent estimated that the probability of occurrence for this scenario was very low (once over a 50-year period) based on existing regulations for the transportation of dangerous goods, tanker driver qualifications, construction yard speed limit, and the nature of the roadway. The Proponent concluded that the accident would not result in residual effects, after taking into account its Emergency Management and Response Plan and noted that the demand for emergency services would be within the capacity of municipal and provincial agencies.

Train Derailments

The Proponent indicated that a train derailment related to the Project could occur within the T-yard on the widened causeway and at an intermodal yard located on the marine terminal. The Proponent stated that the main factors involved in train derailments were the type of track, train speed, and human error. The Proponent estimated that the probability of such a minor accident was high (i.e., once over a 1-year period). However, the probability of an incident resulting in a major injury or a spill was low (i.e., once over a 20-year period) due to the slow speeds at which the trains travel.

The Proponent described the second plausible worst-case accident scenario as a low energy train derailment on the widened causeway during construction or operations that would result in the release of up to 15 m³ of diesel fuel, as well as smaller amounts of cooling water and lubricating oil. The Proponent estimated that the probability of the occurrence was very low (i.e., once over a 50-year period) due to the level grade of the tracks and the slow speed maintained by rail traffic along the widened causeway. The Proponent concluded that the accident would not result in residual effects after considering spill response measures that would be taken by municipal and provincial agencies and locomotive owners.

Train-related Collisions

The Proponent discussed potential train-related collisions during construction and operations, with either a motor vehicle or another train. The Proponent stated that measures included in the Land and Marine Traffic Management Plan would minimize the probability and consequences

associated with a collision. Should an accident occur, the Proponent noted that adverse environmental effects would be prevented through spill containment and cleanup. The probability of a train collision with a motor vehicle collision was considered to be low and moderate for a train on train collision.

Fire and Explosion

The Proponent discussed the potential for fire and explosion during construction and operations and determined the probability of such an occurrence would be very low. Such an event could be caused by equipment malfunction, leaking or damaged chemical containers and inappropriate handling and stowage of containers. Consequences of such an event could include human injury or mortality, discharge of deleterious materials, disruption of activities and property damage. The Proponent stated that the terminal design included fire water supply, oil water separators and shutoff valves to prevent discharge to the marine environment. Evacuation and response measures would be described in the construction and operation Health and Safety and Emergency Response Plans.

Land Spill

The Proponent discussed the potential for a land spill during construction and operations and deemed the probability of such an occurrence to be moderate to high. The Proponent explained that land spills of various deleterious substances such as fuel, oils, solvents and concrete could occur during refueling, servicing, maintenance and construction activities. The Proponent considered the codes, rules and legislation applicable to prevent the occurrence of spills and to minimize environmental consequences. The Proponent stated the construction and operation Spill Preparedness and Response Plan would describe spill prevention and containment measures, including the equipment and materials to be maintained on site.

Container Handling Incident

The Proponent discussed the potential for a container handling incident resulting in a spill during operations. The Proponent stated that, based on global container-related losses, the probability of such occurrences was extremely low. The Proponent specified that only 0.7 percent of the total container throughput at the proposed terminal would contain dangerous goods and estimated that the chance of rupture of a dropped container to be 1 in 100. The Proponent noted that hazardous substances that could be handled at the terminal would include flammable, corrosive, toxic, explosive and radioactive substances and materials. The Proponent determined that discharge into the marine environment could adversely affect water and sediment quality as well as marine vegetation, fish, and mammals that came into contact with the spill. The nature and extent of the adverse effects would depend on factors such as weather, the properties of the discharge materials and how readily it could be contained and remediated.

The Proponent mentioned that the terminal operator would be expected to implement the Waste and Hazardous Materials Management Plan and the Spill Preparedness and Response Plan to

remove damaged containers and control the spill. The Proponent committed to develop these plans in consultation with affected parties.

In response to a Panel Information Request, the Proponent provided additional information on the risk assessment methodology used to assess land-based accidents and malfunctions, as shown in Table 22-1.

Table 22-1: Risk assessment results for land-based accidents or malfunctions (Source: Adapted from Project public registry document 1333)

Type of event	Probability Level	Severity of Consequence	Risk Level
Motor vehicle accident	High	Moderate	High
Train derailments	High	Minor	Moderate
	Low	Moderate	Moderate
Train collision	Low	Minor	Low
	Moderate	Minor	Moderate
Fire and Explosion	Very low	Moderate	Moderate
Land spill	Moderate to high	Moderate	Moderate to high
Container handling incident	Extremely low	Minor	Low

22.1.2 Views of Participants

The City of Delta commented that Delta Fire & Emergency Services are well trained and equipped to deal with hazardous materials and dangerous goods incidents on land. They requested that appropriate municipal departments be involved in the development and approval of the Proponent's Environmental Management Plans to ensure that potential impacts and disruptions to the local community were identified, avoided or minimized.

The City of Vancouver recommended that the Panel ensure that the Proponent implement a robust spill preparedness and response program to account for the potential of land and marine-based spills for all hazardous and noxious substances transported through the Project terminal.

The BC Ministry of Environment and Climate Change Strategy stated that in the event of a spill that may affect provincial resources, the *Environmental Management Act* and its regulations would apply. Provincial regulations pertaining to the Project in the event of a spill are the Spill Preparedness, Response and Recovery Regulation and the Spill Reporting Regulation. The Ministry indicated that it would have responsibility for land-based spill response above the high tide line, and noted that it expected higher tanker traffic, possibly resulting in more fuel spills reaching the shore. The Ministry recommended that the Proponent's Spill Preparedness and Response Plan align with its provincial legislative requirements.

22.1.3 Panel's Analysis

The Panel agrees with the methodology used by the Proponent to evaluate risk based on probability of occurrence and severity of the consequence. However, the Panel disagrees with the severity rating that the Proponent has assigned to the consequence of certain events. For example, if the consequence is mortality, the severity of the consequence should have been qualified as high. Further, for the scenario of discharge of hazardous substance from a damaged container, the Proponent noted that environmental components could be affected by a spill but did not quantify the potential magnitude of the effect. The Panel is of the view that consequences have the potential to be severe if the spill reaches the marine environment, particularly for any vulnerable species present during the accident, such as juvenile salmon and migrating shorebirds and harvesters of marine resources.

The Panel is of the view that the Proponent should be in a position to manage the risk related to all types of accidents and malfunctions regardless of the probability of occurrence. If such an event were to occur, the Proponent should be prepared to have all applicable emergency response measures in place.

The Panel disagrees with the Proponent's assumption that existing or proposed mitigation measures would be effective to prevent an accident or malfunction or mitigate its consequences such that there is no potential for residual adverse effects. In order to ensure effectiveness, mitigation measures would have to be adequately tailored to the magnitude and extent of the effect, require coordination between public and private emergency response authorities and involve no possibility of human error.

The Panel concludes that additional measures are required to adequately address effects that may occur as a result of land-based accidents or malfunctions.

Recommendation 60

The Panel recommends that the Proponent be required, in collaboration with the City of Delta and the BC Ministry of Environment and Climate Change Strategy, to include in its Environmental Management Plans the following:

- *Regular, coordinated training and exercises involving the organizations responsible for spill prevention and control of hazardous and noxious substances that may be released during land-based construction and operations;*
- *A description of the roles and responsibilities of each organization involved in a coordinated accident response, including the identification and solutions to any limitation towards effective and coordinated emergency response; and*
- *A review of necessary additional expenditures induced for the City of Delta for health and emergency response services and equipment.*

Recommendation 61

The Panel recommends that the Proponent be required, in collaboration with the appropriate provincial and federal organisations, the City of Delta and the Tsawwassen First Nation, to include in its Environmental Management Plans:

- *Preventative measures to minimize or avoid accidents or malfunctions that could arise from carrying out land-based construction and operations activities that may pose a risk during sensitive time periods for vulnerable species in the vicinity of the Project, such as juvenile salmon and migratory birds;*
- *Detailed response protocols to account for all types of substances that may be spilled at the terminal, and for different environmental conditions at Roberts Bank;*
- *Measures for the long-term monitoring of effects due to spills of oils, lubricants and other hazardous and noxious substances;*
- *Measures for the remediation of the effects of these spills; and*
- *A review of necessary additional expenditures induced for the City of Delta for emergency response services and equipment with a mechanism for cost recovery.*

22.2 Marine-based Accidents and Malfunctions

22.2.1 Proponent's Assessment

The Proponent's methodology was similar for land-based and marine-based accidents and malfunctions, except that the Proponent used marine vessel incidence predictions to inform the probability of marine-based events during operations. The Proponent also presented a qualitative evaluation of the physical fate and transport of potential spill incidents.

The Proponent developed plausible worst-case scenarios to represent the most severe environmental consequences for events with a moderate to high-risk level. The Proponent identified all interactions between a particular worst-case scenario and an environmental component and evaluated any measurable residual adverse effects. For marine-based accidents in the Project area, the Proponent identified container vessel allision and fuel spill at the terminal berth face as plausible worst-case scenarios requiring further assessment. The plausible worst-case scenario in the marine shipping area requiring further assessment was a vessel grounding and fuel spill.

Marine-Based Accidents in the Project Area

Within the Project area, the Proponent assessed the following accident and malfunction scenarios: vessel grounding, vessel foundering, vessel allision, vessel collision, vessel fire or explosion, marine spill, and break in the discharge at sea pipeline or non-compliant discharges.

Vessel Grounding

The Proponent determined that the probability of grounding was low for a construction-related vessel and extremely low in the case of a container ship during operations. After taking

assistance measures into consideration, the Proponent stated that potential effects would include localized disturbance to marine vegetation and marine invertebrates, which would quickly re-establish.

Vessel Foundering

The Proponent discussed the potential for vessel foundering, which entails cap-sizing or sinking. The Proponent determined that the probability of foundering during construction (e.g., a loaded barge), was moderate. The probability of foundering for a container vessel during operations was deemed extremely low. After taking assistance and response measures into account, the Proponent noted that the potential effects would include substrate disturbance, localised effects on marine vegetation and invertebrates and acute or chronic effects from spilled substances to exposed invertebrates, fish, marine mammals or coastal birds.

Vessel Allision

The Proponent described the worst-case accident scenario for vessel allision as a container ship experiencing equipment failure in its approach to the Project terminal. The container ship would have the potential to collide with the terminal berth face, leading to a haul breach and a discharge of up to 2,500 m³ of heavy fuel oil in to the surrounding waters. The Proponent concluded that residual adverse effects would be expected for most environmental components and that the nature of the effects would depend on the effectiveness of spill response and cleanup efforts. The Proponent determined that the residual adverse effects of this scenario could be significant for the SRKW, human health, and current use. The Proponent determined that the probability of this scenario as extremely low, and therefore the effects would be unlikely.

The Proponent assessed that the probability of an allision involving a construction-related vessel would be low due to the use of qualified marine transportation companies, the physical setting of the Project in open waters and the coordination of works and operations by either the infrastructure developer or terminal operator.

Vessel Collision

The Proponent estimated that the probability of a collision between a construction-related vessel and another vessel was very low due to the relative low number of vessels engaged in the work at any one time. If a collision resulted in a spill, effects could occur to exposed marine organisms. The Proponent proposed measures to inform non-Project related vessels about the boundaries and timing of construction activities, the location of navigational markers and the characteristics of vessels mobilised at or near the site. During operations, the probability of a collision between a container ship and a deep-sea vessel was considered to be extremely low and the probability of a collision between a container ship and a ferry or a fishing vessel was very low.

Vessel Fire or Explosion

The Proponent assessed several scenarios that could result in fire or explosion during construction and operations, and associated spills, and rated the probability of occurrence as very

low or extremely low. The Proponent noted that air and marine pollution may result from a marine-based fire or explosion, which could subsequently affect nearby aquatic organisms and their habitat. The Proponent stated that effects on the environment and on a vessel and its crew would largely depend on the effectiveness of the emergency response.

The Proponent explained that several measures were in place to prevent the occurrence of fire or explosion during construction and operations of the Project and for the mitigation of related effects. These measures included: the provision of equipment and systems for fire detection; containment and suppression; emergency response support from local and federal entities, such as the Delta Fire and Emergency Services, the Canadian Coast Guard, and the Western Canada Marine Response Corporation (WCMRC); and fire fighting assistance from other vessels at the terminal, from tugs, and from the City of Vancouver fireboats.

Marine Fuel Spill

The Proponent assessed effects related to a spill of deleterious substances from construction-related vessels or equipment located on the containment dykes. The Proponent rated the probability for such spills, which would involve fuel, oil or lubricants, as moderate to high. The Proponent noted that exposure of any marine organisms to the spill could result in adverse effects. The nature of the effects would depend on the substances and the characteristics of the organisms exposed, with greater risk to sessile organism and fish spawn. The Proponent mentioned that all activities involving fuels and lubricants would be undertaken in accordance with the Spill Prevention and Response Plan as part of its construction Environmental Management Plan.

Break in Supernatant Discharge Pipelines or Non-compliant Discharge

The Proponent assessed the scenario of a break in the supernatant discharge pipelines resulting in a non-compliant discharge of dredgeate materials, which would result in an adverse effect on marine water quality, marine invertebrates and marine fish. The Proponent explained that a potential break in the supernatant discharge pipelines were mitigated by avoiding proximity of the pipelines with existing terminal operations. Potential effects would further be mitigated by applying immediate corrective measures in the event of a break, which would be detected by monitoring along the pipeline. The Proponent concluded that potential effects would not be significant, since the event would be short-term.

The Proponent noted that an accidental release from the dredge of Fraser River sand used to fill in the terminal during construction would not differ sufficiently from the natural conditions created by the discharge of Fraser River sediment in the Fraser estuary to adversely affect environmental components.

Marine-Based Accidents in the Marine Shipping Area

The Proponent identified five types of credible marine based accidents and malfunctions in the marine shipping area: loss overboard of containers; collision or grounding of vessels in-transit; fire and explosions; and foundering. The Proponent developed plausible worst-case scenarios to

represent the most severe environmental consequences for events with a moderate to high-risk level. The Proponent identified all interactions between a particular worst case scenario and an environmental component and evaluated any measurable residual adverse effects. For marine-based accidents in the marine shipping area, the Proponent identified container vessel collision with a small vessel and a vessel grounding resulting in a heavy fuel oil spill as plausible worst-case scenarios requiring further assessment.

Grounding and Oil Spill

The Proponent's plausible worst-case accident scenario involved a vessel grounding, which leads to a spill of 7,500 m³ of heavy fuel oil in the marine shipping area. The spill was hypothetically located at the South end of Pender Island and would have occurred in the month of May. The Proponent considered this location and time of year to represent the worst conditions for transport of the spill away from Boundary Passage into Haro Strait, as illustrated in Figure 5-1 of Section 5 - Marine Shipping Associated with the Project. The Proponent indicated that the probability of a container ship grounding itself in the marine shipping area and resulting in an oil spill would be extremely low.

The Proponent considered that the spill would disperse from Segment B into Segments A and E to the north and into Segments C, D, and G to the south. The Proponent's assessment relied on qualitative and semi-quantitative approaches, as well as on quantitative risk assessments completed for TMX, which predicted the general transport and behaviour of hypothetical spill events in higher incident risk areas. The Proponent also used information available following the experiences of several agencies with oil spills, such as the Exxon Valdez, Deepwater Horizon and other spills. For the purpose of a plausible worst-case scenario, the Proponent assumed no interventions would be undertaken. However, the Proponent noted that spill recovery activities would be initiated within 72 hours of the incident, as illustrated in Figure 22-1.

The Proponent considered that the event leading to the oil spill, the spill itself, and spill response may adversely affect air, water, noise, light and underwater noise, which could further affect other environmental components. The Proponent concluded that residual adverse effects on marine fish and fish habitat would not be significant, given that population-level effects were anticipated to be reversible in the long-term. The Proponent determined that the long-term integrity of marine bird populations would not be compromised and concluded that residual adverse effects on marine birds would not be significant. For marine mammals exposed to a heavy fuel oil spill, the Proponent anticipated that population-level effects would not be significant except for SRKW, due to the potential to affect the survival and recovery of the at-risk population. The Proponent noted that there was uncertainty in its prediction of effects for fish and fish habitat, marine birds, and marine mammals due to natural variability in population abundance and distribution, lack of long-term monitoring information, as well as with the timing and behaviour of the spill.

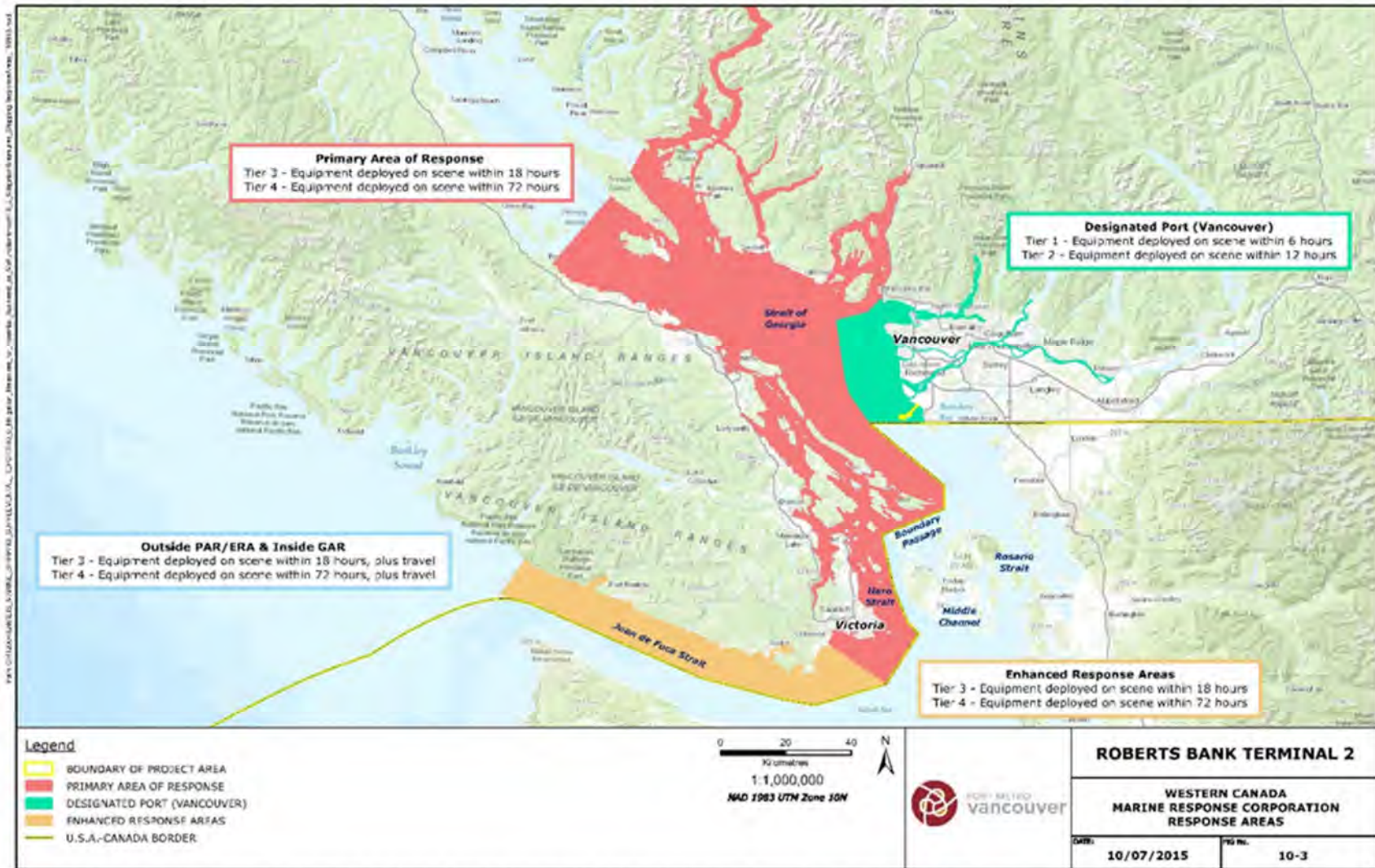


Figure 22-1: Spill response times in the marine shipping area (Source: MSA)

The Proponent determined that residual adverse effects from an oil spill worst-case scenario on human health would be negligible based on the implementation of mitigation measures, such as contamination closures and spill response measures. Any residual adverse effect would only be felt in the short-term and at the individual level, such that population-level effects would be undetectable. The Proponent assessed potential effects from a spill on marine commercial use and concluded that effects would be significant for marine-based tourism and guided sports fishing because the use of alternate areas with similar ecosystem features would be limited. For commercial fishing and seafood harvesting, and marine transportation, the Proponent anticipated that residual adverse effects would not be significant, after the application of mitigation measures such as compensation for oil spill damage and the possibility to use alternative areas and routes. The Proponent concluded that effects on outdoor recreation would be significant based on the resulting change in the environmental setting and long-term perception of environmental degradation. Due to their sensitivity to change, the Proponent determined the residual adverse effect on archeological and heritage resources from the spill itself, as well as related response activities, would be significant.

The Proponent assessed effects from an oil spill on current use of lands and resources for traditional purposes and explained that an oil spill had the potential to affect access to preferred locations, availability and quality of preferred resources, and quality of experience. More specifically, a spill may result in access restrictions and displacement to other areas or avoidance of current use activities, which may compromise support of traditional diets, economies, social and spiritual life, governance, and cultural transmission. The Proponent considered that applicable mitigation measures included the marine vessel traffic management framework, response measures, and compensation and insurance provisions but that depending on the affected group, none of those would adequately compensate for potential cultural losses. The Proponent considered that the residual adverse effect was significant since it could restrict use of a preferred location to a degree that the means and objectives of current use activities would no longer be achievable.

The Proponent concluded that all significant adverse effects identified as a result of the plausible worst-case scenario for a heavy fuel oil resulting from a Project-associated vessel grounding would be unlikely, due to the low probability of such an event.

In response to concerns pertaining to effects on marine birds from a different oil spill scenario and the timing of the spill, the Proponent explained that a spill of heavy fuel oil would have more serious effects relative to a light fuel oil spill, regardless of the season. The Proponent stated that, the scenario it assessed adequately represented the plausible worst-case environmental attributes, conditions, and response times accounting for species presence, abundance, and seasonal use of the area by marine birds. The Proponent added that modelling predictions would not inform response and recovery strategies given that effective response was dependent upon oil type and the environmental conditions where the spill occurred.

The Proponent noted that the volume of oil spilled due to a collision with a crude oil tanker would differ from the scenario of a spill following grounding of a container ship alone but that the assessment of effects would not differ based on the volume of the heavy oil spill.

Collision in Transit

The Proponent assessed several accident scenarios for collisions of ships associated with the Project in the marine shipping area. It was determined that a collision would most likely take place in Segment B, near East Point on Saturna Island at the entrance to Boundary Passage and near Turn Point on Stuart Island at the entrance of Haro Strait.

The Proponent described the plausible worst-case accident scenario for vessel collisions in-transit as a collision between a container ship and a small fishing or recreational vessel. The probability of this occurrence was determined to be extremely low by the Proponent. It was noted that container ships do not have the discretion to transit outside of the shipping lanes to avoid fishing vessels, unless there was an imminent or immediate risk of a collision. The Proponent stated the collision could result in damage to, or loss of, the vessel and gear and in human injury and fatality. The Proponent noted measures to prevent such collisions were part of existing systems to manage vessel traffic, such as use of ship's radar and loudhailers and the Canada Coast Guard's Marine Communications and Traffic Services. To mitigate the potential effects in accident situations, vessels associated with the Project would carry third-party insurance coverage and the affected parties would be compensated. The Proponent indicated that parallel measures exist in USA waters. The Proponent concluded that potential effects on human health and current use would be significant, although unlikely.

In order to further mitigate the probability of a collision between a container ship and a small vessel, the Proponent made a commitment to collaborate with the appropriate regulatory authorities and Indigenous groups to provide real-time information regarding shipping associated with the Project throughout the marine shipping area. The Proponent further stated it would identify mitigation measures that may reduce the impact of international shipping lanes on fishing activities by Indigenous groups.

The Proponent examined the accident scenario of a container ship collision with a ferry and stated that the highest potential for such an incident would be in Segment A where vessels associated with the Project transit adjacent to the approach of the BC Ferries Tsawwassen terminal. The Proponent concluded that the residual effect on human health could be significant, although unlikely.

The Proponent further examined the event of a collision involving a container ship and a liquefied natural gas carrier. The Proponent explained that liquid natural gas, although flammable, was not explosive under most circumstances. Rather, a pool of spilled liquid natural gas, if ignited, could result in a flash fire which would burn back to the source and be relatively limited in extent. The Proponent mentioned that in such an event, the crew would be at risk but not the public. The Proponent noted that the more important effects would occur within 250 m of the liquid natural gas spill and in the vicinity of a potential flash fire. The Proponent explained

that additional mitigation measures exist for liquid natural gas carriers, such as the use of a safety awareness zone, the escort of three tug boats for assistance, and specific fire fighting and control measures in case of a spill.

The Proponent noted that the volume of oil spilled due to a collision with a crude oil tanker would differ from a spill following grounding of a container ship alone but that the assessment of effects would not differ based on the volume of the heavy oil spill.

Loss Overboard of Containers

The Proponent stated that spills resulting from the loss of containers overboard were not plausible events. The Proponent explained that, based on historical data, the maximum loss of containers overboard due to a vessel collision or grounding event was 25 percent of the vessel's volume. For the release of hazardous and noxious substances to occur, the containers would have to be structurally compromised. Due to the very low probability of the occurrence of this series of events, the Proponent gave no further consideration to this scenario.

Fire and Explosions

The Proponent assessed the probability of fires and explosions onboard ships in the marine shipping area to be extremely low. Given that prevention and response measures for fires and explosions would mitigate any consequences, the Proponent concluded there was a low risk for this type of event and did not consider it further.

Foundering

The Proponent stated that foundering was not considered a plausible accident or malfunction arising from shipping associated with the Project and did not assess the potential effects further.

Mitigation Measures

The Proponent considered that the regulatory framework currently in effect as appropriate mitigation to prevent the occurrence of marine-based accidents and malfunctions. For example, with regards to spill response, shipping companies must adhere to international requirements set by the IMO. The IMO is responsible for the safety and security of shipping and the prevention of pollution by ships. By regulation, all ships entering Canadian waters must have an agreement in place with the WCMRC to ensure the provision of spill response in the event of an incident.

In addition to the regulatory framework that governs the marine shipping industry, the Proponent proposed measures to minimize the potential for accidents or malfunctions and mitigate resulting consequences. For example, the terminal configuration was designed to reduce potential accidents during berthing, ship-to-shore container handling, and departure. In addition, the expansion of the tug basin was designed to accommodate additional escort tugs for improved marine safety. As part of the Project-specific Construction and Operation Environmental Management Plans, the Proponent would include Environmental Training Plans, Health and Safety and Emergency Response Plans, and Spill Preparedness and Response Plans.

In the event of an accident or malfunction within its jurisdiction, the Proponent's 24-hour Operation Centre would allow the Port Authority to provide operational assistance to enable a collaborative, effective, and unified response. The Proponent explained that the party responsible for the incident would be expected to collaborate with either the infrastructure developer during construction, or the terminal operator during operations, to implement additional requirements from regulatory authorities pertaining to assessing, monitoring, and mitigating environmental effects.

The Proponent referred to the Port Information Guide as the key document it uses to promote safe and efficient navigation within its jurisdiction, including at the Roberts Bank terminals. The guide would apply to all vessels in the port, and to all persons responsible for the planning, operation, conduct, and navigation of these vessels.

The Proponent made additional commitments in response to concerns expressed by participants. For example, as part of the Project's construction and operation Spill Preparedness and Response Plans, the Proponent committed to working with WCMRC and Indigenous groups. This collaboration would serve to implement plans in consideration of identified archaeological sites and areas of importance from information provided by appropriate agencies and Indigenous groups. The Proponent also committed to incorporate wildlife information, requested by Environment and Climate Change Canada, in the Spill Preparedness and Response Plans, such as species, populations, and spatial and temporal distribution, in addition to measures and strategies required to report, respond, and monitor spill emergencies.

The Proponent committed to collaborate and assist agencies leading initiatives in the marine shipping area, when requested, and to actively participate as a key stakeholder in the OPP Working Group or other federal initiatives, several related to spill response.

Transboundary Effects Assessment

The Proponent expected effects from marine-based accidents or malfunctions would be similar in U.S. and Canadian waters for all components, other than effects on current use of land and resources for traditional purposes. In this case, the Proponent was of the opinion that in accordance with the requirements of CEAA, 2012, only effects occurring in Canada had to be addressed.

22.2.2 Views of Participants

Transport Canada noted that spill response is a matter of federal jurisdiction, and that more than 100 regulations, 30 acts and international agreements and commitments made up Canada's marine safety regime. Transport Canada noted it administers the regime with the Canadian Coast Guard as the on-water operator, and scientific support provided by ECCC, DFO, and NRCan. The regime is built on the polluter-pay principle and requires ship-owners to have spill response plans and agreements in place with a certified Response Organization in their Geographic Area of Response, which, in the case of the Project, is the WCMRC.

Transport Canada and its federal partners in the OPP reported on several OPP initiatives relevant to marine safety and environmental response for the Project and marine shipping activities associated with it, including:

- *Regional Response Planning* – investing in preparedness and response capacity, such as in the development of Geographically Specific Response Plans by the Canadian Coast Guard with Indigenous groups in the South Coast of British Columbia;
- *24/7 Emergency Response Capacity* – improving interoperability and coordination between departments as part of the 24/7 emergency response capacity provided by the National Command Centre and three Regional Operation Centres, including one in Victoria;
- *Incident Command System* – ensuring a seamless integration of different agencies and organizations across jurisdictions, such as the province of British Columbia and Indigenous communities, through the provision of training, digital tools, and resource mobilization;
- *On-scene response capacity* – improving response between various levels of government and Indigenous communities by investing in primary response teams, increasing training and exercising, and equipment modernization. For example, the Canadian Coast Guard plans to establish a station in Port Renfrew primarily focused on safety of life at sea and search and rescue;
- *National framework to respond to hazardous and noxious substances* – developing a national preparedness and response program for releases of hazardous and noxious substances from ships;
- *Requirements for the oil spill response organizations* – reflecting on how environmental response planning in Canada has evolved since the current requirements were developed for organisations such as the WCMRC;
- *Legislative amendments to key legislation* – amendments to the *Canada Shipping Act, 2001* and the *Marine Liability Act* to, for example, reduce delays in environmental response and removing the Canada Ship-source Oil Pollution Fund’s limit per incident to provide unlimited compensation for eligible costs;
- *Partnerships with Indigenous communities in marine safety* – establishing new relationships and advance partnerships with Indigenous coastal communities in OPP initiatives. Transport Canada highlighted engagement efforts with the Pacheedaht First Nation and the T’Sou-ke Nation as partners on the Enhanced Maritime Situational Awareness pilot initiative;
- *Indigenous and community capacity in the design and delivery of the marine safety and environmental protection measures* – including, for example, establishing the Coastal Nations Coast Guard Auxiliary, and providing training in marine search and rescue, environmental response, and incident management. Training sessions has occurred in British Columbia, including one in Sooke, with as many as 35 different First Nations attending; and
- *Investing in oil spill research and spill response method* – including near-shore modelling and research in the fate and behaviour of oil to develop evidence-based response plans.

Transport Canada noted that Canada currently had a state-of-the-art marine safety regime. Transport Canada considered the improvements outlined under the OPP as additional means to protect Canada's coasts, and to respond to marine safety concerns raised through previous consultations.

The Canadian Coast Guard reported that they carry out their mandate as part of Canada's Marine Safety and Security System with many partners. The Canadian Coast Guard referred to exercises conducted as part of the Greater Vancouver Integrated Response Plan as an example of how municipalities, First Nations, federal and provincial partners are working together to manage spill response. The Canadian Coast Guard noted that they also collaborate with the US Coast Guard on management of vessel traffic and on planning, preparedness and response to spills of harmful substances in contiguous waters, according to joint agreements such as the Vessel Traffic Services Agreement and the Canada-United States Marine Pollution Joint Contingency Plan.

Several Indigenous groups were also concerned with emergency response capacity and commented that the Proponent should have done assessments specific to their activities and territories and that the Proponent and the Government of Canada should have tailored mitigation measures to them. Tsawwassen recommended that the Proponent and the Government of Canada collaborate with them to collect Shoreline Cleanup Assessment Techniques data and to develop Geographic Response Plans specific to the Fraser River estuary. Tsawwassen also recommended that the Proponent and the Government of Canada establish an emergency response program and facility on Tsawwassen First Nation Lands, should the Project be approved.

Ditidaht raised concerns about the lack of adequate spill response planning within their traditional territory and noted that general response plans did not consider unique aspects, such as Nitinat Lake, which is a tidal inlet. The Maa-nulth commented that the Proponent should implement specific mitigation measures, such as emergency preparedness plans and spill response strategies, training and equipment caches for the Maa-nulth communities. The Cowichan Nation Alliance had outstanding concerns related to the adequacy of marine safety measures for container vessel rescue, spill response, and shoreline cleanup. The Songhees First Nation requested training and capacity funding for their members involved in an emergency response. The Songhees First Nation recommended that Transport Canada work with them to establish a response protocol at Tl'ches.

Several participants raised concerns regarding the marine safety and spill response regime in British Columbia. Participants indicated that steps should be taken to improve the marine safety system in order to eliminate the risk of high consequence events and decrease the dependency on third party marine emergency response for marine-based activities. Participants recommended that a world class spill response program should be established in British Columbia before the Project becomes operational. Other participants requested that the Panel recommend a project specific mitigation measure to avoid potential accidents and oil spills by requiring the Proponent

to have appropriately positioned emergency response towing vessels along the Project's vessel traffic route.

A number of Indigenous groups recommended that additional spill response bases be established for the Project and should not be contingent on the TMX project. Pacheedaht requested that a marine emergency response centre be established at Port Renfrew in Pacheedaht Territory. The marine emergency response centre would be collaboratively managed by Pacheedaht and the Canadian Coast Guard. The Maa-nulth were concerned that the spill response base proposed in connection to the TMX project in Port Alberni would be too far from where a significant spill could occur in their territory. The Songhees First Nation recommended the establishment of a marine emergency response base at Oak Bay to allow for quick response within their territory.

A number of Indigenous groups commented on the Ship-source Oil Pollution Fund, indicating that the fund did not compensate for non-economic losses, such as cultural degradation and impacts to governance. Indigenous community members noted the fund would not address issues related to the lack of access to harvesting sites, the destruction of important cultural and archeological sites, and the loss of opportunities for the transfer of traditional knowledge to youth. Indigenous groups further explained that it would only take one accident event to cause years worth of economic and environmental damages. In addition, Indigenous groups raised concerns about the financial strain it would place on their communities when participating in spill response activities and the type of compensation that would be available to them for damages sustained to non-commercial fisheries as a result of an accident.

Several Indigenous groups raised concerns about the potential effects that may result from a collision between a container ship associated with the Project and a small vessel in the marine shipping area. The Maa-nulth noted that the Proponent's reliance on a plausible worst-case scenario was not adequate and requested additional hypothetical fuel spill scenarios be studied in different locations, for each season and involving various types of accidents. Pacheedaht emphasized that they relied on marine resources and that the potential risks from a fuel spill would be high to their community members. Pacheedaht also commented on the potential risk to the safety of their fishermen in the event of a collision with a container ship at Swiftsure Bank. The Cowichan Nation Alliance noted that the occurrence of a fuel spill was inevitable when considering the current traffic in the marine shipping area. The Cowichan Nation Alliance stated that a fuel spill in the Salish Sea had the potential to be catastrophic to their way of life and Aboriginal Rights. The Esquimalt Nation described how a past fuel spill in marine shipping area had adversely affected their territory by blocking access to their beach, interfering with their traditional activities, and resulting in a public health advisory from their Nation's health authority.

The Pauquachin First Nation described the risk of a potential fuel spill in the Salish Sea as a constant stress to its members and noted that the Proponent's conclusion did not reduce that stress. Musqueam and the Lyackson stated that the increase in shipping and associated risk of fuel spills may affect intertidal resources, such as Dungeness crabs and other harvested marine invertebrates. Lyackson stated that many of these intertidal resources were no longer available to

them and the increased risk of a fuel spill would make existing conditions worse. Views from USA Indigenous groups were similar to those from Canadian Indigenous groups, and are documented in more detail in Section 23 - Indigenous Groups of the Northwest Pacific Coast of the USA.

With regards to the Proponent's assessment of effects from a fuel spill on marine birds, ECCC commented that spill probability modelling was required to support the assessment of an accident scenario involving a collision between a container ship and tanker to account for the large volume of crude oil carried in a tanker vessel. ECCC recommended that the Proponent develop a Wildlife Emergency Response Plan to include tailored spill prevention and response measures and strategies to mitigate the potential effects from fuel spills on marine birds and species at risk.

In terms of potential effects from a fuel spill on marine mammals, several Indigenous groups and participants noted that a fuel spill could have devastating long-term effects on the SRKW population. These types of accidents would present an acute risk to SRKW individuals; potentially leading to a population-level effect depending on the individuals affected; and, presenting a long-term effect on the SRKW critical habitat. The US Washington State Department of Ecology indicated that protection of SRKW from a potential oil spill was crucial.

In order to mitigate potential effects from a fuel spill on archaeological resources, Parks Canada recommended that the Proponent should identify all archaeological sites and areas of archaeological importance to its response crews as part of its spill response plans and protocols.

22.2.3 Panel Analysis

The Panel finds that the Proponent adequately identified the types of marine-based accidents and malfunctions that may occur in relation to the Project and the marine shipping area. The Panel agrees with the Proponent's approach to evaluating the probability of occurrence of the types of marine-based accidents and malfunctions that were assessed. However, the Panel is of the view that the Proponent may have underestimated the severity of certain effects, such as those resulting in injury or fatality and on sensitive receptors, such as vulnerable marine species.

Effects from a Collision

The Panel agrees with the Proponent that a collision involving a container ship and a small vessel may result in an effect on human health and current use that would be significant. The Panel notes that no amount of compensation would be sufficient to mitigate the severity and accidents resulting in human injury or fatality. The Panel is of the view that improvements to mitigation measures focused on prevention, such as those related to the management and communication of vessel traffic activities to all users proposed under the OPP, are critical elements for the safety of users that could interact with Project-associated vessels in the marine shipping area.

Effects of an Oil Spill

Some participants indicated that it is unrealistic to discount that human error and non-compliance to regulatory controls do not occur and that these have the potential to cause accidents.

Accordingly, the Panel disagrees with the Proponent's conclusion that laws and regulations would be observed during all Project phases and there would be no consideration given to human error and non-compliance in terms of accidents and malfunctions

The Panel reviewed the Proponent's assessment of effects provided in the accident scenario of a fuel spill in Segment B following the grounding of a container ship. The Panel agrees with the Proponent's assessment of marine water quality effects. The Panel notes that the Proponent concluded that the effects on marine fish and fish habitat would not be significant, given that population-level effects were anticipated to be reversible in the long-term. The Panel recognizes that the Proponent acknowledged effects from a spill may depend on specific conditions and environmental components affected by the spill. The Panel finds that although certain species of invertebrates or fish would be more susceptible to oil exposure, life history characteristics for marine invertebrates and fish species in the marine shipping area would allow populations to recover from a single spill event. The Panel agrees with the Proponent on the characterization of marine fish vulnerability to toxic constituents of heavy oil.

In terms of intertidal shoreline habitat and its importance for marine birds, the Panel disagrees with the Proponent that a duration of months to years for habitat recovery would not lead to significant effects. The Panel notes that the Proponent recognized that there was a high level of uncertainty due to natural variability and that effects could be more severe in the case of highly utilized sheltered habitats by birds. The Panel is of the view that the potential effects on marine birds could be significant. This is especially true for shorebirds, where the severity of the effect would depend strongly on the timing of the spill in relation to seasonal migration.

The Panel agrees with the Proponent that an oil spill would lead to significant effects on the access and availability to preferred areas required for: outdoor recreation; marine-based tourism; and, guided sports fishing sectors. The Panel disagrees with the Proponent's assessment that the compensation regime in place for effects of an oil spill on marine transportation, commercial fishing and seafood harvesting would mitigate the potential for significant effects. As indicated by several Indigenous groups, the ship-source oil pollution fund does not address all damages that may result from an oil spill. The Panel is of the view that currently non-eligible expenses, as identified by Indigenous groups, should be addressed.

The Panel accepts the Proponent's conclusion that the potential residual effects on archaeological and cultural sites from shoreline oiling as a result from a fuel spill would be significant.

The Panel is satisfied with the Proponent's determination that effects from an oil spill on outdoor recreation would be significant since recreational boating, fishing and seafood harvesting would be affected both by the oil spill and the long-term perception of environmental degradation. The Panel disagrees with the Proponent that this effect would be reversible in the long-term.

The Panel expects there would be effects from a heavy fuel oil spill from a container ship on the current use of land and resources for traditional purposes and cultural heritage, in terms of access, availability of resources and quality of the experience. The Panel agrees with the Proponent that such effects would be significant and long lasting, taking into consideration the restrictions that an oil spill would impose on the ability to perform traditional activities.

The Panel agrees that exposure to a heavy fuel oil spill would not result in human health effects. This is because harmful exposure is prevented by established concentration limits for petroleum hydrocarbons for persons doing cleanup activities and planned contamination closures related to harvesting of marine resources are established.

Given that the quality of traditional food resources would be significantly affected by a fuel spill, the Panel accepts that potential changes to food security would result in a significant adverse effect on human health for Indigenous groups, related to an avoidance of subsistence food sources with associated nutritional implications.

Mitigation Measures

The Panel notes that the Canadian Coast Guard referenced the Greater Vancouver Integrated Response Plan as an example of successful coordinated response planning. Although that specific response plan is successful, the Panel finds that there is no equivalent coordinated response plan applicable to the Project area.

Based on the experience shared by Indigenous groups, it is the Panel's view that successful implementation and a long-term commitment to all proposed initiatives under the OPP is essential to ensure appropriate prevention of, and response to, fuel spills in the marine shipping area. The Panel is satisfied that Transport Canada and its federal partners demonstrated that the OPP initiatives were designed to fill the information gaps raised by Indigenous groups, the province of British Columbia, and the City of Delta.

The Panel heard from Indigenous groups and participants that it is necessary to establish additional spill response bases in the marine shipping area and they should not be contingent on the approval of the TMX project. The Panel accepts that the proposed mitigation measures of a new spill response base at Port Alberni and the reduction of incident response times would be required to address potential effects related to marine-based accidents and malfunctions related to the Project and shipping activities in the marine shipping area.

The Panel supports Parks Canada's advice that archaeological sites and areas of archaeological importance should be identified as part of the Proponent's spill response procedures.

The Panel agrees that a marine emergency response centre is required at Port Renfrew as recommended by Pacheedaht. Although there is a respondent out of the Seattle Traffic center for the area where Pacheedaht harvest, as seen in Figure 5-5, there is a need to provide further Canadian marine response capacity, in addition to oil spill response, in this remote part of the West Coast of Vancouver Island.

The Panel considers that the improvements made to the Ship-source Oil Pollution Fund do not adequately address the types of damages that may be incurred by Indigenous groups and coastal communities such as: lack of access to harvesting sites; the destruction of important cultural and archeological sites; loss of business opportunities; and lost opportunities to pass on traditional knowledge to youth.

Transboundary Effects Assessment

The Panel addresses potential transboundary effects related to oil spill specifically related to Indigenous groups of the Pacific Northwest of the U.S.A in Section 23 - Indigenous Groups of the Northwest Pacific Coast of the USA.

The Panel concludes that further mitigation measures, as recommended below, are needed to prevent the occurrence of accidents or malfunctions and to address the potential effects that may result from an oil spill. The Panel concludes that in the case of an oil spill, there would be residual effects on some of the biophysical and human environmental components.

The Panel concludes that if a worst-case oil spill event were to occur, it would result in a residual adverse effect, which could be significant for vulnerable species such as the Southern Resident Killer Whale and marine birds, marine commercial and recreational activities, current use, cultural heritage and health of Indigenous groups.

Recommendation 62

The Panel recommends that the Proponent be required to, in collaboration with Transport Canada, the Canadian Coast Guard, the Western Canada Marine Response Corporation, and the City of Delta, develop an integrated response plan, similar to the Greater Vancouver Integrated Response Plan, to ensure effective and coordinated response to marine shipping accidents that may occur within the Proponent's jurisdiction.

Recommendation 63

The Panel recommends that the Proponent be required, in its Construction and Operation Spill Preparedness and Response Plans, in collaboration with the British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development, Environmental and Climate Change Canada, and Parks Canada, to:

- *Identify specific measures to protect archaeological sites and areas of importance, based on information provided by appropriate agencies and Indigenous groups; and*
- *Incorporate marine and terrestrial wildlife oil spill vulnerability information, on species, populations, and their spatial and temporal distributions, in addition to measures and strategies required to report, respond to, and monitor spill emergencies.*

Recommendation 64

The Panel recommends that the Proponent be required to publicly report, on an annual basis, their participation and contribution to the Oceans Protection Plan Working Group and other federal initiatives relevant to marine shipping associated with the Project for the first five years of operations.

Recommendation 65

The Panel recommends that Transport Canada and its federal partners, in partnership with the Western Canada Marine Response Corporation:

- *Revise mandatory response times in the marine shipping area to reflect improved capacities since the response times were mandated by the Canada Shipping Act, 2001, and further, to improve response times based on the results from consultation with relevant parties as part of Oceans Protection Plan initiatives;*
- *Renew collaborative activities with the British Columbia Ministry of Environment and Climate Change Strategy to improve coordination and alignment of legislation, policy and programs related to spill response and environmental management of oil spills among different levels of government; and*
- *Continue to support and invest in oil spill research and modelling initiatives, such as near-shore modelling, to support the advancement of evidence-based Geographic Response Strategies.*

Recommendation 66

The Panel recommends that Transport Canada and the Canadian Coast Guard:

- *Evaluate measures to improve and broaden the Ship-source Oil Pollution Fund for justifiable costs and damages that are not currently included, especially to compensate for effects on cultural heritage of Indigenous group; and*
- *Examine measures to improve oil spill response and to co-develop proposals, such as a marine emergency response centre at Port Renfrew.*

Recommendation 67

The Panel recommends that the Government of Canada, in collaboration with the British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development, communicate the locations of known physical and cultural heritage sites to oil spill response authorities in order to enhance the protection of these sites in the event of an oil spill. The locations should be shared under a confidentiality agreement to be signed before Project operations begin.

23 Indigenous Groups of the Northwest Pacific Coast of the USA

This section examines the potential effects of the Project on Indigenous groups located in the USA. The Canada/USA border is approximately 11 km south of the Project. As described in Section 5 - Marine Shipping Associated with the Project, the designated marine shipping lanes run through the Strait of Juan de Fuca, the Strait of Georgia, and Puget Sound, referred to collectively as the Salish Sea. Inbound and outbound shipping lanes are on the south and north sides of the Canada-USA border, respectively. The international shipping lanes are established shipping lanes managed jointly by Canada and the USA.

Four Indigenous groups from the USA identified themselves as potentially affected by the Project: the Suquamish Tribe, the Swinomish Indian Tribal Community, the Tulalip Tribes, and the Lummi Nation. During the environmental assessment, the Panel provided these groups with opportunities to present their views on the potential environmental effects of the Project. The Panel also provided the Proponent with an opportunity to address and comment on these concerns during the public hearing and during closing remarks.

23.1 Proponent's Assessment

The Proponent assessed the potential effects of marine vessel traffic associated with the Project in USA waters, as well as effects of marine vessel traffic in Canadian waters that extended into USA waters. In its assessment, the Proponent expected that effects would be similar in the USA and Canada, given the similar marine shipping activities in the Salish Sea off the coasts of Washington State and British Columbia.

The Proponent also assessed potential effects of marine shipping associated with the Project on current use of lands and resources for traditional purposes for those effects that occur in Canada, in accordance with the requirements of the *Canadian Environmental Assessment Act, 2012* (CEAA 2012). The Proponent's assessment did not consider specific effects on the Suquamish Tribe, the Swinomish Indian Tribal Community, the Tulalip Tribes, or the Lummi Nation. Where available, information related to Indigenous groups in the USA was considered by the Proponent in the assessment of transboundary effects such as for oil spills.

23.2 Views of Participants

The Suquamish Tribe, Swinomish Indian Tribal Community, the Tulalip Tribes, and the Lummi Nation identified themselves as signatories to the 1855 Treaty of Point Elliot with the United States government. The Treaty guarantees those groups the right to fish in their "usual and accustomed" fishing grounds, which the groups described as encompassing the Salish Sea including Haro and Rosario Straits, and overlapping the shipping lanes. The groups highlighted that their treaty-reserved rights predate both the establishment of the USA/Canada border and the establishment of international shipping lanes. The Indigenous groups stated that they had a right to fish in the international shipping lanes. They also stated that although they were physically located in the USA, the natural resources and practices they used were interwoven with the Canadian portion of the Salish Sea.

The Suquamish Tribe, Swinomish Indian Tribal Community, and the Tulalip Tribes submitted evidence jointly as the “U.S. Tribes”. The U.S. Tribes raised concerns that the Project would affect their ability to preserve their traditional way of life, including fishing for commercial, subsistence and ceremonial purposes, and continuing their cultural customs. The U.S. Tribes stated that a large portion of their fishery occupied the area affected by the international shipping lanes. The U.S. Tribes indicated that their large gillnets could not be easily maneuvered due to the volume of the loaded net. They also explained that a gillnet set could take 10 to 20 hours depending on the circumstances. The U.S. Tribes stated that the interference caused by inbound and outbound ships resulted in economic hardship to tribal fishers due to loss of gear and fish, and created serious safety and health hazards on the water. Mr. Glen Gobin from the Tulalip Tribes stated that when a 1,800-foot gill net had to be retrieved in order to get out of the way of a passing container ship, it displaced members from fishing opportunities and reduced access to fishing areas. The U.S. Tribes stated that a 2014 study of the impacts of increased marine vessel traffic suggested that each tribal fisherman lost between 40 and 50 crab pots each year. They were concerned that additional vessel traffic from the Project would add to the existing economic damage to tribal fishing.

The U.S. Tribes described the safety concerns that members faced while fishing in the Salish Sea due to commercial vessel traffic. Elder David Sigo of the Suquamish Tribal Council recounted a situation where he was too close to a large container ship. Elder Sigo stated, “I was trying to figure out how I was going to get away from it, and I was digging around, looking for a knife or something to cut the net or something... and I just happened to find a knife at the last moment and cut the net. I was so scared for my family, for all the people out there that are fishing”. Members of U.S. Tribes stated that additional ships from the Project would exacerbate these concerns.

The U.S. Tribes stated that their commercial fishing practices were economically significant to their members. They described fishing as a substantial cornerstone of tribes’ economies and noted that there was a direct link between increased vessel traffic and harm to their traditional practices. The U.S. Tribes noted that they harvested Fraser River sockeye, which was an important source of cultural, spiritual, and subsistence food for them. Mr. Glen Gobin reported that since Chinook salmon numbers have declined so much in recent years, he now could only catch it incidentally when fishing for Sockeye salmon.

In addition to salmon, the U.S. Tribes stated they fish and harvest many other marine species, including herring, cod, sturgeon, crabs, clams, red and green sea urchins, and sea cucumbers. The U.S. Tribes noted that members would like to eat more fish and shellfish, but were unable to do so for various reasons, including lack of access, declining resources, and fear of pollution.

The U.S. Tribes indicated that the increased vessel traffic due to the Project would increase the risk of oil spills. They noted that a spill would affect their tribal fisheries and potentially cause “catastrophic damage to the Salish Sea and the marine species that the U.S. Tribes depend on for cultural and economic subsistence.” The U.S. Tribes raised concerns about the effects of a spill on the SRKW. Chairman Leonard Forsman of the Suquamish Tribe noted that a spill in 2003

released 5000 gallons of oil into the Doe Kag Wats marsh, an important place for them culturally and spiritually. They stated that there was still oil on the beach today.

The U.S. Tribes expressed concerns about the effects of the Project on the SRKW, specially, the effects of underwater noise and the risk of vessel collisions. The U.S. Tribes explained that the SRKW were inextricably linked with their cultural identity and referred to the SRKW as their relatives. Ms. Debra Lekanoff of the Tulalip Tribes stated, “They are part of the names and the cultures and the songs and the history here. Without them...we become a shell of who we are”. Another member of the Tulalip Tribes stated the SRKW were a visible, vibrant, and integral part of a healthy Salish Sea and equally integral to the culture and spiritual practices of the Tribes who have shared these waters with the SRKW since time immemorial. The Suquamish Tribe explained that SRKW were part of the very fabric of the Suquamish people’s culture and an irreplaceable part of tribal canoe journeys.

The U.S. Tribes noted that the Proponent failed to adequately assess the cumulative effects that the Project would have on the Salish Sea. They stated the Project, in addition to other proposed projects on the Salish Sea, would exacerbate the existing effects. Mr. Glen Gobin stated: “we can look around us and we can see the impacts that are taking place daily. What’s happening to our environment? What’s at risk for our people? Our way of life? The way we practice for thousands of years”. The U.S. Tribes also noted that any effects felt on the Canadian side of the border would be felt equally in the American portion of the Salish Sea.

The U.S. Tribes stated that, because the Project would cause significant harms and risks to their ability to preserve their ways of life, the Proponent should have fully assessed harms from increased vessel traffic through Treaty-reserved and protected fishing areas, marine pollution and noise impacts on salmon and endangered SRKW, and cumulative effects. The U.S. Tribes indicated that the environmental harm caused by a potential spill would reach outside Canada’s jurisdiction and that Canada has an international responsibility to prevent activities within its jurisdiction from damaging the environment outside its borders.

The U.S. Tribes concluded that the harm arising from the Project to their way of life could not be mitigated. They stated that the loss of fishing and the loss of the SRKW was a direct loss to their “tribal ways of life”.

The Lummi Nation identified the Salish Sea, referred to as the *Xw’ullemy*, as culturally significant to their people. The Lummi Nation stated that the Salish Sea had sustained the Nation’s existence and that the natural heritage of the Salish Sea was inseparable from the Nation’s inherent rights, traditional knowledge, and communal well-being. The Lummi Nation pointed out that many of the bird and mammal species common to the Salish Sea were listed as either threatened or endangered, including the SRKW. The Lummi Nation identified the SRKW as their “relatives” and raised concern about the effects of vessel traffic on their population. The Lummi Nation stated that vessel noise was known to have negative effects on marine resources, including the SRKW.

The Lummi Nation was of the view that the Salish Sea was eligible to be listed as a National Historic Landmark and for inclusion on the World Heritage List for its association with the culture, traditions, and history of the Lummi people. The Lummi noted that environmental components that contributed to its cultural, biological, and spiritual significance such as fishing sites and marine resources, could be impacted by the Project.

The Lummi Nation referred to themselves as the “salmon people” and described the importance of fishing to their culture and way of life. The Lummi Nation stated that the Proponent’s assessment of Project effects on Chinook salmon was inadequate and that it was clear that the Project could result in negative impacts on juvenile Chinook. In their view, effects to Chinook salmon had a direct impact on the Lummi Nation’s fishers in their traditional territory. The Lummi Nation indicated that the Fraser River was the predominant source of salmon into the Salish Sea and degradation of the near-shore ecosystem at Roberts Bank had already occurred due to the existing port structures and the Project would further degrade the habitat.

The Lummi Nation explained that the Project could affect critical areas in San Juan County, including the San Juan Islands National Wildlife Refuge. Other concerns expressed by the Lummi Nation included: potential interference of their fishing grounds from increased Project vessel traffic; loss of fishing gear; and, safety concerns from the occurrence of vessel collisions and accidents. The Lummi Nation stated that reef net fishing was an important traditional method of fishing that the Lummi Nation was trying to restore for its members. The Lummi Nation also noted that the Salish Sea contained hundreds of Lummi archeological sites registered with Washington State Historic Preservation Office.

The Lummi Nation stated that their holistic worldview was not reflected in the environmental assessment process. In their view, the environmental assessment process marginalized or ignored indigenous ancestral beliefs and core values. Further, the Lummi Nation noted that the Proponent failed to use a culturally appropriate environmental baseline in its assessment of the Project. The Lummi Nation was of the view that the Proponent should have used a pre-industrial baseline and identified a trajectory of change over time for specific value components integral to the inherent rights of the Lummi Nation because an ever-shifting baseline leads to an ever-diminishing resource baseline.

23.3 Panel’s Analysis

In addition to the potential transboundary effects due to marine shipping associated with the Project that were identified by the Proponent, the Panel understands that the concerns brought forward by the U.S. Tribes and the Lummi Nation extend to fish and seafood harvesting for commercial, subsistence, and ceremonial purposes and physical and cultural heritage. A detailed discussion of the environmental effects due to marine shipping associated with the Project and the Panel’s conclusions on the potential for those effects to occur across the Canada/USA border are in the relevant sections of this report.

The Panel is aware of the statutory requirement of section 5(1)(c) CEAA 2012⁹, which states, with respect to aboriginal peoples, an effect occurring in Canada of any change that may be caused to the environment on, among other things, current use of lands and resources for traditional purposes. In general, the Panel accepts the Proponent's approach to assessing transboundary effects, principally that effects occurring in Canada would be similar to those occurring the USA. However, the Panel notes that many of the concerns expressed by the U.S. Tribes and the Lummi Nation relate to the use of lands and resources in the marine shipping area, and how this use is explicitly tied to culture, traditions, and identity. The Panel is of the opinion that this should be considered a potential transboundary effect of the Project.

Marine Commercial Fishing and Seafood Harvesting

The Panel heard from the U.S. Tribes and the Lummi Nation that fishing activities are substantial cornerstones of their economies and central to their culture and way of life. The Panel was told that these groups have Treaty-protected fishing rights to fishing areas and resources, which rely substantially on the Fraser River Sockeye run. The Swinomish Tribe stated they are the second-largest fishing fleet in the Puget Sound; however, other areas they use that would be directly affected by shipping traffic include the Strait of Juan de Fuca, Haro Strait, and Boundary Pass.

Although the Panel does not have the mandate to determine the validity of Aboriginal and Treaty rights or to assess impacts of the Project on those rights, the Panel accepts that fishing areas and resources in the Salish Sea require a healthy ecosystem on both sides of the Canada-USA border. The Panel concludes that marine resources would not be affected by marine shipping associated with the Project. The Panel concludes that juvenile coho and sockeye salmon are not susceptible to Project effects due their distribution within the deeper and faster-flowing zones of the Fraser River during downstream migration. Therefore, the Panel notes that the Project would not affect the availability of these salmon species in the Salish Sea. However, the Panel has concluded that the Project would result in a significant adverse residual effect on two ocean-type juvenile Chinook salmon population in the Project area. Because juvenile Chinook salmon migrate to the open ocean, the Panel concludes that this also constitutes a transboundary effect on marine fish. However, the degree to which the Project effect on juvenile Chinook salmon stocks would affect adult stocks or decreases the availability of the resource for the U.S. Tribes and the Lummi Nation in the long term is unknown.

⁹ Section 5(1)(c) of the *Canadian Environmental Assessment Act, 2012*: with respect to Aboriginal peoples, an effect occurring in Canada of any change that may be caused to the environment on: health and socio-economic conditions; physical and cultural heritage; the current use of lands and resources for traditional purposes; and, any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

Use of Lands and Resources

The Panel understands that the U.S. Tribes and the Lummi Nation members harvest fish and seafood within and adjacent to shipping lanes, and agrees with the groups that the ability to access these areas should not be hindered. The Proponent stated that shipping activities would temporarily displace current use activities taking place at the same time, in, or near, the shipping lanes but that there was not likely to be overlap with every ship movement associated with the Project. The Panel accepts the Proponent's position, but notes that the need to schedule current use activities around ship movements or the requirement to shorten the window of opportunity to harvest interferes with access for the U.S. Tribes and the Lummi Nation. The Panel recognizes that additional ships would cause a noticeable change to a harvesters' experience when they interact with a passing ship, but the added number of ships from the Project is not enough to affect the experience of each harvester.

The U.S. Tribes and the Lummi Nation outlined that ship wake effects from container ships on small vessels used for commercial and traditional harvesting was occurring in the marine shipping area. The groups stated that any additional vessel traffic from the Project would exacerbate these effects. When assessing the magnitude and likelihood of ship wake effects, the Panel took into consideration the timing of the interaction between a small vessel and a container ship and the location of the vessel interaction.

Interactions between small vessels and large ships within the shipping lanes can cause loss or damage to fishing gear. Such interactions, while infrequent, could interfere with the ability of the U.S. Tribes and the Lummi Nation to access preferred fishing areas and resources. The Panel considers that ship pass-bys pose a potential safety concern for small vessels. Due to the small number of ship movements associated with the Project, the Panel concludes that there is no residual adverse transboundary effect from marine shipping activities associated with the Project. However, given the reliance on fishing, the number of members who harvest for subsistence, economic, and ceremonial purposes, and the potential for economic damage, the Panel is of the view that the total ship movements in the international shipping lanes could affect the use of marine resources by the U.S. Tribes and the Lummi Nation.

Air Quality

The effects of marine shipping associated with the Project on air quality is discussed in [Section 7.2 - Air Quality](#). The Panel concludes that marine shipping associated with the Project is unlikely to materially affect air quality because it would emit a very small fraction of total pollutants in the marine shipping area. The Panel finds no evidence that existing marine shipping results in any exceedances of applicable air quality standards. The Panel concludes in [Section 21.1 - Exposure to Atmospheric Pollutants](#), that the Project would result in emissions of air pollutants during construction and operations resulting in exceedances of applicable air quality standards and guidelines for NO₂ and respiratory irritants. The LAA for the air quality assessment transects the Canada-USA border. Therefore, the Panel concludes there would be a transboundary effect on air quality due to the Project that would extend to Point Roberts.

Physical and Cultural Heritage

In Section 8.5 - Wave Environment, the Panel concludes that there would be no residual effect from marine shipping associated with the Project on coastal erosion that would affect archaeological sites. This conclusion applies to transboundary effects to archaeological sites as well.

In Section 22 - Accidents and Malfunctions, the Panel describes the responsibility and importance of governments to improve their preparedness and response plans to fuel oil spills. The identification and mapping of physical and cultural heritage sites would be a key element to ensure the protection of these sites.

The U.S. Tribes and the Lummi Nation described the importance of the SRKW as an iconic species at the heart of their spiritual and cultural identities. In Section 14 - Marine Mammals, the Panel concludes that the Project would have a significant adverse residual effect and a significant cumulative effect on SRKW. The Panel acknowledges that if the population of SRKW were to decline any further, there could be serious population consequences, and the survival of SRKW could be significantly compromised. The Panel recognizes that there is no defined threshold for the population size of SRKW necessary for the continuity of a culture or its related transmission of knowledge for the U.S. Tribes and Lummi Nation. In the absence of a defined threshold, the Panel acknowledges that there would be a residual effect, but is unable to conclude on the significance of that effect.

Accidents and Malfunctions

In addition to the effects of increased vessel traffic, the Panel notes that the U.S. Tribes and the Lummi Nation expressed concerns about accidents and malfunctions. The Proponent presented various accident scenarios that could occur in the marine shipping area, however, only two have the potential for transboundary effects: a powered container ship grounding on hard substrate resulting in a fuel oil spill and a collision of a container ship with a small vessel. The Panel summarizes the effects below, and describes how these scenarios could affect the U.S. Tribes and the Lummi Nation.

Collision

The Proponent assumed that a collision between a Project-associated container ship and a small vessel would result in damage to or loss of vessel and gear, and human injury or fatality. In the Panel's view, such a collision also interferes with the U.S. Tribes group's ability to access and use preferred resources. The Proponent stated that the mitigation measures to reduce the occurrence of a vessel collision includes the use of ship radar; loudhailers; and the Coast Guard Marine Communications and Traffic Services. To mitigate the economic consequences of a collision, the Proponent indicated that vessels associated with the Project would have third-party insurance coverage and provisions for monetary compensation. The Proponent mentioned that parallel measures exist in U.S. waters. The Proponent concluded that the Project would not result in an increase in the probability of a collision and that the residual adverse effects on human

health and current use by Indigenous groups would be significant but unlikely. The Panel agrees with this conclusion and notes that the conclusion applies on both sides of the border.

Fuel Oil Spill

The Proponent concluded that even with mitigation measures, a heavy fuel oil spill would result in a measurable residual effect on current use by Indigenous groups living in Canada. The Panel considers that a heavy fuel oil spill from a Project-associated container ship, originating from either side of the border, would affect the U.S. Tribes and the Lummi Nation from changes in access to preferred lands and resources and the availability and quality of preferred resources, depending on the location of the fuel oil spill. The Panel expects that in the event of a spill, the quality of the experience for current use and cultural activities would also be affected and long lasting. The Panel concludes that the residual effect would be significant. Although accidents are unlikely to occur, the Panel underlines the importance of additional actions to improve preparedness and response plans proposed by governments.

The Proponent also assessed the effects on human health due to the exposure to contaminants from a fuel spill and the exposure to contaminants in edible marine resources. The Panel agrees with the Proponent's assessment that the resulting contamination of marine resources would be a significant effect for Indigenous groups because it would affect the quality of preferred resources. The Panel understands the anxiety expressed by the U.S. Indigenous groups and, in particular, the Suquamish Tribe with respect to fuel oil spills since they had to live through a spill at Point Wells and its consequences in 2003. The Panel notes there is a Joint Contingency Plan between Canada and the USA which includes cross-border mutual aid drills with partners, including U.S. Oil Spill Response Organizations in Washington and Alaska and the WCMRC. The WCMRC also has a number of mutual aid agreements in place with Canadian and USA departments that provide assistance and equipment in the event of a large oil spill. The Panel understands that the Proponent and Transport Canada consider the responsibility to avoid accidents to lie with the vessel operators who are to observe the laws and regulations on safety at sea. Similar marine safety regulations exist in the USA to mitigate against vessel collisions.

In Section 22 - Accidents and Malfunctions, the Panel discussed aspects of response and preparedness programs and protocols for fuel oil spills that need to be maintained or improved by the Canadian government, including equipment and communication systems for safe navigation. These features of response and preparedness fall under the responsibility of the federal government and not the Proponent, although the Proponent has committed to take part in joint actions. The improvements would benefit all users of the Salish Sea on both sides of the Canada-USA border.

The Panel recognizes that resulting cumulative effects in the Salish Sea due to increase vessel traffic need to be addressed. There are additional cumulative effects on many environmental components resulting from the Project and its associated marine shipping. In Section 25 - Cumulative Effects Assessment, the Panel has recommended the initiation of a regional environmental assessment, including cumulative effects, for the Fraser River estuary and for the

Salish Sea. In these actions, the Panel would encourage the engagement and collaborative efforts of the USA.

The Panel concludes that the Project and marine shipping associated with the Project would result in a residual adverse transboundary effect and an adverse cumulative transboundary effect on the cultural practices of the USA Indigenous groups related to the Southern Resident Killer Whale. The Panel is unable to determine the significance of these effects.

24 Purpose, Cost and Benefits

24.1 Purpose of the Project

Section 19(f) of CEAA 2012 requires the consideration of the purpose of the Project. The purpose is the rationale or reasons for which the Project would be carried out from the Proponent's perspective and defines the opportunities and problems that the Project is intended to address.

24.1.1 Proponent's Assessment

The Proponent proposes to build the Project to meet the forecast increase in demand for containerized trade on the west coast of Canada. The Project would continue to maximize the potential economic and competitive benefits of the Port of Vancouver, which is Canada's largest port and the fifth largest container port in North America in terms of volume. In 2014, 3.5 million TEU moved through Canada's west coast ports, to which 2.9 million TEU were handled by infrastructure within the Proponent's jurisdiction. By 2017 that number increased to 3.25 million TEU, representing 51 percent of Canada's offshore container trade. The Proponent stated that independent forecasts show that the west coast of Canada would run out of marine terminal capacity to handle containers as early as the mid-2020s. The Proponent asserted that building a new terminal at Roberts Bank was the most desirable option to provide much needed container capacity on Canada's west coast.

Overall container volumes have grown at a significant pace within Canada. According to the Proponent, between 1995 and 2000, the average annual growth of containers through west coast ports was approximately 142,000 TEU; since 2012, annual growth grew to 180,000 TEU. The Proponent's forecast predicted sustained growth in container traffic through the west coast of Canada to 2040 and beyond and is presented in Figure 24-1.

The Proponent stated that recent improvements had been made to west coast container terminals, including at the Port of Vancouver's Deltaport and Centerm Terminals and Prince Rupert's Fairview Terminal. When the Proponent's terminals and the Fairview Terminal in Prince Rupert reach capacity, shippers would likely be forced to use ports on the west coast of the United States of America and pay increased transportation costs. The Proponent indicated that rerouting containers away from the Port of Vancouver could cause a loss in revenue as much as \$230 million per year by 2040. These shipping costs would be passed on to Canadian consumers and affect Canada's trade competitiveness.

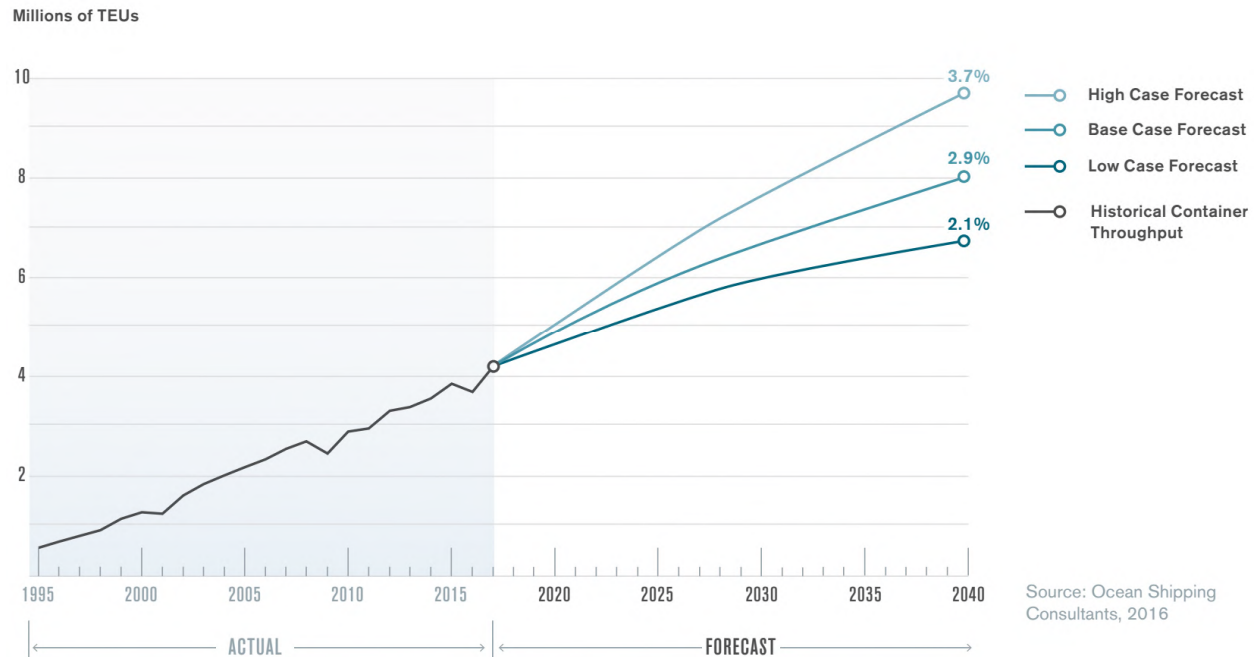


Figure 24-1: Historical container traffic, and forecast container traffic for the west coast of Canada (Source: Project public registry document 1341)

The Proponent forecast that all of the container terminals on Canada’s west coast, including the Project, would be needed to accommodate Canada’s growing trade markets. The Proponent stated that a terminal functioning at over 85 percent of its design capacity is inefficient and unsustainable. It also overloads all elements of the supply chain, including labour supply, rail, trucking and the terminal itself. The Proponent concluded that without the Project, the 85 percent practical capacity of terminals would be surpassed by 2020 resulting in a disruption of the supply chain. The Proponent referred to the Ocean Shipping Consultants Forecast Study 2016 (OSC 2016) which stated “Common user terminals like those operated in the Port of Vancouver will see difficulties at other stages of the transport chain begin to emerge when demand reaches much in excess of around 80 percent of design capacity. For example, vessels may be queuing for berths or there can be landside congestion.”

The Proponent stated that the Project would play a vital strategic role in Canada’s trade network by strengthening Canada’s trade links with the Asian market and would ensure that Canada does not run out of capacity to take advantage of growing trade with Asia. The Proponent emphasized that it was important that the Vancouver Gateway as a whole remain competitive and able, from a cost and reliability perspective, to serve Canada’s trade. Two issues were identified as being essential to the Port of Vancouver’s continued ability to provide Canadian exporters and importers with efficient access to international markets; increased container capacity and greater terminal competition. The Proponent was of the opinion that it would be better to have more than one terminal operator at Roberts Bank and a number of different operators in the Port of Vancouver. This would support a healthy and competitive container-handling market and prevent control of a significant majority of the large-ship container terminal capacity at the Port of Vancouver by one terminal operator. During the public hearing, the Proponent reiterated that

once Fraser Surrey Docks was purchased, only two terminal operators (DP World and Global Container Terminals) would handle 100 percent of the container capacity on the west coast of Canada¹⁰. The Proponent stated that competition drives affordable prices for consumers and if competition were to be reduced, prices would almost inevitably rise, and that would be to the detriment of consumers. The Proponent also reported that if the Project was not built, increasing import demand for container cargo by Canadians would go through USA ports, resulting in higher costs.

In response to the Panel's request to provide further information and studies to support the purpose of the Project, the Proponent provided the following for its assessment:

- The Ocean Shipping Consultants Forecast Study 2016, which provided a subjective review of the relative competitive position of the Project versus other locations in the Pacific Northwest and other parts of North America;
- The Ocean Shipping Consultants Report 2017, which is a study on the potential consequences of not developing the Project; and
- The Mercator Report 2018, which assessed infrastructure of container terminals in the Pacific Northwest.

Based on these reports the Proponent concluded that the Port of Vancouver was competitive for the following reasons:

- It offered lower overall shipping costs to central and eastern Canada and the American Midwest;
- It was located closer to Asia than most USA ports;
- It had an exceptional and cost-competitive rail network available;
- It offered the availability of Canadian exports to fill empty containers such that shipping lines can earn revenue from both legs of the containers' ocean voyages;
- It offered the ability to transload goods into 53-foot containers for significant rail savings for shippers; and
- It had extensive off-dock facilities that are close to marine terminals and collectively offer a sophisticated regional hub for goods movement to facilitate all of these value-enhancing opportunities.

The Proponent stated that the future of Canada's economic prosperity depended on being able to get goods and resources to and from other markets efficiently and reliably. Accordingly, the Port Authority had to plan how to efficiently move goods to ensure Canada is able to capitalize on the substantial potential of world trade in the future. With respect to competitive advantage, the Proponent explained that the Project itself would not hold any particular advantage over other container terminals. However, the forecast showed that all the container terminals on Canada's

¹⁰ DP World PLC completed its acquisition of B.C. Surrey Fraser Dock during the Roberts Bank Terminal 2 Project Public Hearing in May, 2019.

west coast, including Roberts Bank Terminal 2, would be needed to accommodate Canada's growing trade. The Proponent concluded that developing the Project would ensure that efficient operations were maintained at the Port of Vancouver and that there was sufficient container capacity available to satisfy future requirements of port customers.

24.1.2 Views of Participants

The Shipping Federation of Canada agreed with the container traffic forecasts commissioned by the Proponent, which indicated containerized cargo volumes through Canada's west coast would increase by 2.1 to 3.7 percent between now and 2040. The Shipping Federation of Canada stated that these percentages support the long-term trends in global markets and trade agreements, such as the Trans-Pacific Partnership economic trade agreement, which provides Canada with access to key Asian markets.

Global Container Terminals (GCT) stated that although they agree with the Proponent that container volumes had grown and would continue to grow, growth would be moderate and capacity expansion should be built incrementally. The Black Quay Consulting Report commissioned by GCT showed an overall growth in container volumes through the west coast at, or just below, the base case scenario of 2.9 percent. The report also showed that when there was economic downturn the volumes decreased below the low case scenario of 2.1 percent. Overall, the report showed that the next significant step in capacity needed on the west coast would be in 2031. GCT also submitted the CPCS final report "Assessment of Policy Opinions to Satisfy Canadian West Coast Container Port Capacity Needs", which projected that container traffic would increase to 5.8 million TEUs by 2025 and to over 9 million TEUs by 2050.

Some participants argued that increased container capacity was not needed for the foreseeable future while others suggested that the Proponent should use a higher level than the 85 percent practical capacity for terminals in order to eliminate the need for the Project. GCT challenged the Proponent's statements that Roberts Bank Terminal 2 was the only project that could be built in time to meet capacity demands by the late 2020s, or that it was the only project that could ensure Canada would be able to meet the growing trade demands. GCT stated that planned terminal expansions in the Port of Vancouver and in Prince Rupert would provide sufficient capacity by early 2030 should the container growth rate maintain the base case rate. Further, to maintain practical capacity of 85 percent of existing terminals, new capacity on the west coast would only be needed in the early 2030s. GCT suggested that an incremental expansion of Deltaport Terminal (Deltaport Fourth Berth) would have the ability to deliver timely incremental capacity at a lower cost to meet growing trade demands. GCT stated that overcapacity or poor capacity utilization had the potential to result in terminal closures such as with terminal 5 in the Port of Seattle. GCT argued that a smart, phased approach that expands existing terminal footprints over time could provide the right amount of port capacity at the right time.

Transport Canada forecast that growth in total trade would continue to increase 25 to 30 percent over the next decade in Canada. Transport Canada stated that economic growth, shifts in the manufacturing sector, the way that over-seas products are moved, technology, and competitiveness all influence the demand for containerization. Transport Canada expected that

the demand for containers would grow in the three to four percent range over the next decade, which meant that new capacity would be required in order to support this growth.

Transport Canada stated that Canada's Export Diversification Strategy seeks to capitalize on trade between North America, Asia and other emerging countries to increase Canada's overseas exports by 5 percent by 2025. Transport Canada indicated that transportation infrastructure plays a key role in economic opportunities and competitiveness for Canada, and that investing in trade corridors and infrastructure to support trade were key components of the strategy.

During the review of the EIS, the Panel asked Transport Canada to comment on the Proponents' projected port capacity and forecast container volumes. Transport Canada responded that Transport Canada's Economic Analysis team are mandated to study and analyze economic, social and technological factors that are relevant to the understanding of Canada's transportation system. Transport Canada stated that, while the Economic Analysis team could not validate the forecasts and capacity needs of the west coast ports, they reviewed the Proponent's information and regarded it to be broadly reasonable based on the most recent publicly available data.

Participants argued against the Proponent's claim that having more than one operator was important for competitive purposes and felt that having another terminal operator would put all at risk to lose money. They indicated there was no ground for the Proponent needing the Project for competitive purposes and that it would not serve the public interest. By contrast, the Shipping Federation of Canada stated that a new operator for the Project was crucial because currently one operator handles over 70 percent of existing trade volumes. A third terminal operator would create new incentives, not only for more competitive pricing, but also for optimizing terminal operations, increasing efficiency and driving innovation. GCT recommended the Panel compel the Proponent to provide information and rationale for not engaging the existing terminal operators consistent with standard historic and current practice of working with existing terminal operators to develop capacity.

The Chamber of Shipping, which represents approximately 75 percent of the vessels operating in British Columbia, generally supported the Project. The Chamber of Shipping stated that there was a demand for additional container capacity that could be met by the Project, as long as any project did not expose current and future Gateway users and customers to unnecessary financial risk. The Chamber of Shipping stated they were supportive of additional competitiveness in the terminals in the Lower Mainland highlighting it was an important element of an efficient and productive supply chain for Canada to trade globally.

GCT stated that there was no established correlation between port performance and the number of terminal operators, arguing that competition between operators within a port was less relevant when compared to competition between various ports.

Transport Canada pointed to the World Economic Forum that defines competitiveness as "a complex phenomenon that includes a set of institution, policies and factors that is affecting the level of productivity of an economy which, in turn, set the level of the prosperity that the economy can achieve over the medium to long term." Transport Canada stated that one of those

factors is transportation, measured as transportation time, and logistics, which includes labour, energy costs, capital costs and taxes and fees. Reducing transportation time would reduce overall costs of transportation and cost for the economy. Transport Canada stated that, based on information from 2012, the Port of Vancouver is competitive compared to the west coast port complexes in the USA.

Some participants argued that USA bound containers should not be included in the Proponent's forecast. GCT stated that in 2018, nearly 35 percent of all BC container import cargo was destined for the USA and, therefore, discretionary in nature. One participant indicated that from 2015 to 2019, 23 percent of the total shipments to the Port of Vancouver were containers bound for the USA. They concluded that the Proponent would not have had growth, or would have had negative growth, over the last four years without the shipments of USA bound containers.

24.1.3 Panel's Analysis

The Proponent considers the purpose of the Project is to offer trade opportunities to Canadians. The Panel notes that Article 4(a) of the *Canada Marine Act* (S.C. 1998, c. 10) states that one of the purposes of the Act is to "implement marine policies that provide Canada with the marine infrastructure that it needs and that offer effective support for the achievement of national, regional, and local social and economic objectives, and will promote and safeguard Canada's competitiveness and trade objectives." Article 4(a.1) is "to promote the success of ports for the purpose of contributing to the competitiveness, growth and prosperity of the Canadian economy." The Panel considers that the purpose of the Project, as described by the Proponent, is in line with the regulatory requirements under the Act.

Further, the Panel notes that the Proponent's container traffic forecast was generally accepted by participants, namely the Chamber of Shipping, the Shipping Federation of Canada, and Transport Canada. The Panel recognizes Transport Canada's mandate with respect to Canada's transportation system and accepts their conclusion that the Proponent's container traffic forecast for ports on the west coast provides a sound basis for long term planning and is reasonable. The Panel agrees that increases in capacity and efficiency, some of which are already underway at ports on the west coast, will only meet short-term container demand.

The Panel notes that GCT also reported that, under a base-case trade growth scenario, there is sufficient west coast container capacity until the early or mid-2030's. The Panel believes this is consistent with the purpose of the Project. The Proponent stated that the proposed terminal was expected to reach capacity over the 2030s and that given the environmental impacts from construction, it did not make sense to build part of the Project now and another part later. The Panel accepts the Proponent's argument that although the proposed terminal may not need 2.4 million TEU on opening day (2030), it would over the life of the Project.

The Panel notes that GCT further claimed that under a low trade growth scenario, neither the Project nor an expansion of Deltaport Terminal would be required until after 2050. However, the Panel notes the GCT suggestion that for planning purposes, a low growth scenario is not advisable and they themselves are guided by the base-case as an industry standard for project

planning. The Panel also notes that the CPCS final report commissioned by GCT found that both an expansion of Deltaport Terminal and the Project could provide capacity to accommodate forecast demand beyond 2025 as “they are in effect competing projects.” The Panel considers that GCT was not arguing if the Project could serve the growing demand for container capacity, which is the purpose of the Project, but rather that it would prefer additional container capacity be delivered by its own Project, the Deltaport Fourth Berth.

The Panel recognizes the debate between some participants regarding the number of terminal operators needed for competitive purposes. The Proponent stated that the Project was essential to promote competition within the Port of Vancouver and that one of the Port Authority’s objectives was to introduce a new terminal operator at Roberts Bank. This is consistent with the Port Authority’s mandate to ensure the gateway provides service to customers at a reasonable cost. While the Proponent stressed that the Port Authority was the landlord and it would never be a competitor to existing terminal operators, GCT encouraged the activation of a national review of port competitiveness to ensure that the Proponent’s methodologies and preference for terminal operators were serving Canada’s national interest. The Panel is of the view that the choice of the entity that will operate the terminal is a business decision and does not factor into the Panel’s conclusion on the purpose of the Project or the potential environmental effects of the Project.

Some participants noted that if USA bound containers were excluded from the Proponent’s container traffic forecast, the Project could not be justified. The Proponent indicated that, based on cargo tonnage data collected, the percentage of containers destined for the USA have grown from 7 to 24 percent between 2000 and 2015 and export containers originating from the USA have fluctuated from 1 to 6 percent of total exports. The OSC 2016 study forecast that containers carrying cargo to and from the USA would remain steady at 23 percent of imports and 4 percent of exports between 2020 and 2030.

The Panel understands that neither port authorities nor terminal operators can refuse to handle containers based solely on the fact that those containers originate from or are destined for the USA. The Proponent highlighted that terminals in Vancouver are common-user ports and only the federal government has the power and authority to control trade generally, through various acts and regulations, including the ban of trade with certain countries. The Panel accepts that containers originating from or destined to the USA cannot be excluded from the Proponent’s container traffic forecast.

The Panel concludes that the Proponent has adequately demonstrated the purpose of the Project.

24.2 Cost of the Project

24.2.1 Proponent’s Assessment

The Proponent estimated that the Project would cost approximately \$3 billion dollars. The Proponent stated that Canadian port authorities operate autonomously on a not-for-profit commercial basis. The port authority must be financially self-sufficient, receiving no federal

subsidies, loans or backing of commercial loans. The Canadian port authorities generate revenues from the services they provide, and by leasing land to terminal operators. The Proponent emphasized that construction of the Project was subject to environmental permits and approvals, market conditions, and the procurement of an infrastructure developer and an operator, who would be responsible for designing, building, financing, maintaining and operating the terminal and related infrastructure. The Project would be funded by the Proponent and through private funding. Federal grants or tax dollars would not be provided. The Proponent outlined the proposed investment structure of the Project (Table 24-1), stating that the Project would ultimately be paid for by users in the form of user fees collected by the operator and in turn paid to the port authority. The Proponent's initial capital expenditure would rely on its cash balance or borrowing from a lending institution. The Port emphasized that their revenues come from tenant rents and Port user fees.

Table 24-1: Potential commercial structures for the Project (Source: Project public registry document 1835)

Commercial Structure	VFPA	Infrastructure Developer	Terminal Operator	Total
*Design-Build-Finance-Maintain Separate Terminal Operator	10-30%	45-65%	15-35%	100%
Build/Operate /Transfer	10-30%	70-90%		100%
Design-Build Engineering, Procurement & Construction	45-65%	-	35-55%	100%

*Assumed approach under the Proponent's current procurement process

24.2.2 Views of Participants

Some participants considered that the money spent on the port infrastructure could be better spent elsewhere. Other members of the public indicated that the Project posed too big a financial risk to Canadian taxpayers and an environmental risk to the Fraser River estuary. A couple of participants noted that the total cost of developing the Project amounted to approximately \$1,000 per container (TEU) which would make the Project economically unviable in terms of the fees the Proponent would need to charge the terminal operator.

The Chamber of Shipping expressed concerns about the potential financial exposure, should the Proponent be unsuccessful in finding an operator to take over the facility once it is built. It suggested that the Proponent develop an exit strategy to address such a scenario.

GCT pointed out that the Proponent's financial structures require a large federal subsidy or tax payer support to make the commercial structure viable. Although the Proponent presented numerous alternative commercial structures, in GCT's opinion, there was no evidence the Project was commercially viable. GCT noted that capital investment from an infrastructure developer must be supported by either implicit or explicit federal guarantees or other forms of tax payer support. To support their argument, GCT pointed to the Proponent's financial structure that

identified 10-30 percent Proponent capital and 45-65 percent infrastructure developer capital. GCT stated that this equated to 55-95 percent of the capital allocation depended on either direct or indirect tax payer/federal guarantee or subsidy. GCT highlighted that the expected cost of the Project would likely make it the most expensive new container capacity ever built in Canada.

GCT underlined that the development of container handling capacity needs to be cost-effective in order to preserve the existing cost advantage that Canadian terminal and railway operators are able to offer when compared to other continental ports. The Chamber of Shipping was of the opinion that the overall competitiveness of terminals was directly linked to the costs that it incurs. The Chamber of Shipping stated that there needs to be assurance that the Project, should it be approved, find a suitable tenant to operate and keep the port's revenue neutral or at least at a low cost to users and customers.

24.2.3 Panel's Analysis

The Panel understands that the letters patent specify how the Port Authority spends money and re-invests corporate profits, such as ancillary infrastructure for the Pacific Gateway. This includes funds from the federal and provincial governments and private businesses. For instance, the Port Authority invested in the Deltaport Road and Rail Improvement Project. The Panel acknowledges that these are infrastructure projects that benefits all users and not just those destined to the Deltaport Terminal or the proposed Roberts Bank Terminal 2. The Panel accepts that tax dollars is used in these types of infrastructure projects

Further, the Port Authority is a not-for profit entity, that pays a 'gross revenue charge' to Transport Canada every year, as a percentage of the Port Authority's revenue. This implies that a higher revenue would eventually go to Transport Canada if the Project were to be built.

The Proponent stated that it had the financial capacity required to support a borrowing limit increase in excess of what would be required for the Project. The letters patent specify the conditions for amounts and limits of permissible loans. The Proponent stated that a borrowing limit decision would be made by the federal government only after a positive environmental assessment decision was made.

The Panel is aware that many participants were concerned that the cost of building the Project was out of proportion to its usefulness, especially given there was no assurance that the Project would have an operator or that the Proponent could keep costs low for competitive purposes. The Panel considers that maintaining existing cost advantages presently offered to users is an important factor in the overall competitiveness of the terminal. Following the review of the financial structures proposed by the Proponent, the Panel, if the Project proceeds, favors an alternative structure that poses less risk and requires minimal investment by the Proponent.

During the public hearing, the Panel discussed the concept of a bank guarantee to be posted by the Proponent for decommissioning the terminal in the event the Proponent's prediction of economic success is incorrect. The Panel accepts that the land value of the terminal may be enough to ensure that the Proponent could financially support decommissioning if required.

Further, the Panel is of the opinion that any business case under consideration should include an assurance that a terminal operator would be in place prior to any investment by the Proponent.

24.3 Benefits of the Project

The Proponent was required by the Environmental Impact Statement Guidelines to describe the predicted environmental, economic and social benefits of the Project. The Government of Canada, in assessing the justifiability of the significant adverse environmental effects, will consider this information.

Under subsections 47(1) and 52(1) of CEAA 2012, the Minister of the Environment must decide if a project is likely to cause significant adverse environmental effects, after taking into account the Panel's report and the implementation of any mitigation measures that the Minister considers appropriate. If the Minister decides that a project is likely to cause significant adverse environmental effects, the Minister must refer to the Governor in Council the matter of whether those effects are justified in the circumstances.

Pursuant to the Panel's Terms of Reference (article 3.4 and 4.29), if the Panel concludes, after taking into consideration the implementation of any mitigation measures, that the Project is likely to cause significant adverse environmental effects, the Panel may receive and take into account information with respect to whether any significant adverse environmental effects may be justified in the circumstances. The Panel reports here what it heard on these matters and make a recommendation.

24.3.1 Proponent's Assessment

Within the EIS, the Proponent stated that container terminals are crucial gateways benefiting all Canadians. They handle imported goods heading for destinations across the country and exported goods intended for markets around the world. The proposed Project would facilitate the exchange of goods that would lead to the economic growth of Canadian businesses and ensure the expansion of Canada's trade industry. The Project would also be a significant economic driver for the region.

According to the Proponent, Project construction activities would create an estimated 12,700 person-years of direct, indirect, and induced employment for British Columbians, including 4,150 person-years of direct employment from on-terminal construction activities. These jobs would generate \$1 billion in labour income, and an estimated \$1.3 billion in revenues for British Columbia businesses supplying materials and goods and services for construction activities. Out of the \$1.3 billion in estimated revenues, \$837 million would be paid to supplier industries in Metro Vancouver. The Proponent estimated that Project construction would generate approximately \$174 million in provincial and local government fees, as well as \$127 million in federal tax revenue. Of the estimated \$20 million in taxes and fees paid to municipalities and regional governments, approximately \$13 million would go to local governments within Metro Vancouver, with the majority of that revenue going to the City of Delta.

During operations, the Proponent stated that on-terminal activities related to the Project would create an estimated 1,550 person-years of direct, indirect, and induced employment each year. This would include 928 person-years of direct employment and that the majority of jobs would be unionized and located within Metro Vancouver. The Proponent indicated the Project would generate \$186 million in labour income annually, as well as \$33 million in revenues for BC suppliers and services. The Project would also create approximately 11,000 direct jobs annually from off-terminal operations, including trucking and warehousing. The Proponent noted that an estimated \$19.7 million in government revenues would be paid annually to provincial and local governments during operations, of which \$6.9 million would be paid to municipalities and the regional district. The Proponent highlighted that an estimated \$4.8 million of this amount would be comprised of property tax payments, of which more than 95 percent would be paid annually to the City of Delta. Further, the Proponent stated that the terminal operator, infrastructure developer, and suppliers would pay \$42 million in taxes annually to the three levels of government.

The Proponent, in collaboration with Indigenous groups, would facilitate access to Project benefits, including training, employment and contracting opportunities for the groups. The Proponent stated it is committed to supporting local communities, in addition to having already initiated discussions for a community investment fund, and making a legacy-benefits fund available to Indigenous groups.

Overall, the Project was described by the Proponent as reducing or avoiding environmental and social effects while enhancing economic benefits to Canadians. The Proponent stated that it has advanced the understanding of environmental and socio-economic aspects within the Project area and the marine shipping area. In particular, the Proponent noted that it had made several important scientific advances and innovations in data collection, modelling, and analysis that would benefit Canadians.

24.3.2 Participant Views

Some participants considered that the Project would offer enormous benefits to Canadians. The Canadian Chamber of Commerce, representing over 200,000 members in all sectors of the economy and in all regions of Canada, supported the Project and the important socio-economic benefits it would provide for all Canadians. The Canadian Chamber of Commerce emphasized that ensuring Canada could accommodate container demand in the coming decades would benefit Canadian consumers, create thousands of new direct and indirect jobs and generate new tax revenue for governments. The Canadian Chamber of Commerce stated that because of the Project's significant economic benefits, the environmental impacts were justified. The Shipping Federation of Canada believed the construction of the Project was an essential and necessary step in providing efficiency to the intermodal network overall, which would benefit a wide range of network users.

The BC Chamber of Commerce, a business organization representing 36,000 members from various sectors of the economy, consider that the Port of Vancouver is a significant part of the economic engine that supports both the Province and Canada's prosperity by connecting British

Columbia businesses and consumers from across the country with over 170 trading nations worldwide. The Canada China Business Council stated that if infrastructure barriers such as port capacity stand in the way, Canadian products would ship via other ports such as those in the USA. They indicated that Canada would benefit from the added value provided by an all-Canadian logistics solution. They stated that the economic benefits of the Project are clear and they are in Canada's favor.

A number of participants raised concerns at the degree to which the adverse environmental effects of the Project outweigh the economic benefits generated by Project. It was noted by some members of the public that the Proponent should have assessed the value of environmental services or the environmental capital of the Project (i.e., quantify the environmental loss in terms of dollars due to the Project), and questioned the lack of consideration the Proponent had given to the true economic cost of environmental losses. One participant stated that the value of the environment has to receive long-term consideration when assessing the short-term economic needs of the Proponent and benefits of the Project. It was noted that a piecemeal examination of project impacts does not serve future generations or nature and there is a need to take a holistic approach to examine trade and cargo transportation in an environmentally sustainable manner. One participant indicated that "it is not in the national interest to assume that commercial interests are synonymous with national or public interests", further noting that the Project was unsustainable because of its cumulative impacts on the Salish Sea.

Many participants argued that there was no need for the Project based on the view that the Proponents' container traffic forecasts were incorrect or that capacity could be filled at other ports on the west coast, for example, Fairview Terminal in Prince Rupert. One participant stated that even though the environmental effects of the Project were well recognized and documented, those effects would be ignored and overridden by assumptions of what was in the "public interest."

GCT was of the view that based on the current information on the record, the Project would result in significant adverse environmental effects that could not be mitigated and were not justified in the circumstances. In GCT's opinion, the information deficiencies included a lack of supporting analysis to justify the purpose of the Project, ongoing uncertainty of the environmental effects of the Project, such as on biofilm, an inadequate assessment of alternative means, and an unknown terminal operator for the Project.

BSC stated that when considering whether the significant adverse environmental effects could be justified, the choice is not between expanding Canada's trade capacity and the local environment. BSC noted that if the Fraser Estuary Management Plan process was still in place, it would have identified alternatives to the Project earlier and would have permitted the community to consider the trade-offs between identified options and how to better expand Canada's trade capacity.

24.3.3 Panel's Analysis

The Panel recognizes the importance of ensuring Canada has sufficient capacity to take advantage of growing trade with Asia and accepts that the Project can play a 'vital strategic role' in Canada's trade network by strengthening Canada's trade links with the Asian market. The Proponent underlined that it is important to all ports that the Vancouver gateway as a whole remain competitive and able, from a cost and reliability perspective, to serve Canada's trading activity.

While the Project could benefit Canadian trade by offering better prices, business opportunities, and maintaining a competitive market, the Panel is aware that a number of participants raised concerns about the degree to which the environmental effects of the Project outweigh the economic benefits of the Project. While maintaining national economic and financial stability is a public good, it should not be achieved by the transfer of all costs, disadvantages and externalities to local communities. Considering the fact that the Salish Sea and the coast are assets of particular interest to those living in the area and to Canadians at large, the concept of what is in the public's interest requires the government to give equal weight to both sides of the argument.

The Panel is of the view that the evaluation of externalities of a Project should be required at the onset of an environmental assessment process. This would permit the identification of required alternatives at the onset if trade-offs between different options are unacceptable to communities.

In addition, programs or structures coordinating environmental management review for a region should be established. The Panel heard from participants that there is a need to reinstate the Fraser River Estuary Management Program (FREMP), which was terminated in 2013 by the federal government. FREMP was an intergovernmental program that coordinated environmental management review and interagency communications for projects and shoreline developments in the Fraser River estuary. The Program aimed to improve environmental quality in the estuary while providing economic-development opportunities and sustaining the quality of life in and around the estuary. The Panel is also aware that in November 2016 the federal government announced a re-start of FREMP, however there appears to have been little progress made since that announcement.

Recommendation 68

The Panel recommends that the Government of Canada develop and implement intergovernmental management programs for the improvement and long-term environmental management of the Fraser River estuary and the Salish Sea. The programs should include: a governance body made up of public and private sector stakeholders and representatives of Indigenous groups to oversee the programs, funding commitments, monitoring requirements, a decision-making framework around possible future resource development and management, environmental conservation programs, community sustainable and subsistence activities and a public reporting system. The Intergovernmental Management Programs should be developed to align with the result of a regional environmental assessment (See Recommendation 70)

25 Cumulative Effects Assessment

CEAA 2012 requires that the environmental assessment take into account any cumulative effects that are likely to result from the designated project in combination with other physical activities that have been or will be carried out.

In addition to CEAA 2012, section 12 of the EIS Guidelines for the Project required the Proponent to describe the analysis of the total cumulative effect on a VC over the life of the project, including the incremental contribution of all current and proposed physical activities, in addition to that of the Project. The EIS Guidelines required the Proponent to include different forms of effects (e.g., synergistic, additive, induced, spatial or temporal) and to identify impact pathways and trends.

The EIS Guidelines defined cumulative effects as follows:

“Cumulative effects are defined as changes to the environment due to the project combined with the existence of other works or other past, present and reasonably foreseeable physical activities. Cumulative effects may result if:

- *Implementation of the project being studied may cause direct residual adverse effects on the environmental components, taking into account the application of technically and economically feasible mitigation measures; and*
- *The same environmental components may be affected by other past, present or reasonably foreseeable physical activities.*

The Panel’s analysis and conclusions on potential cumulative effects on each environmental component are in the relevant sections of this report. This section focuses on the overall approach to cumulative effects assessment.

25.1 Proponent’s Assessment

The Proponent explained that it was only when there were residual effects of the Project, which already accounted for past projects and activities, that the assessment considered Project effects in combination with the additional or incremental effects of other projects and activities that will be carried out, if any were present. According to the Proponent, this approach identified the additional, incremental, future cumulative effects. In addition, the Proponent specified that cumulative effects from future activities would be considered only in cases where there was sufficient information available to assess the effects of other future activities.

During the pre-panel phase of the environmental assessment, the Agency requested that the Proponent provide an analysis of the total cumulative effects of the Project, including how the VC had been affected by past projects and activities, how the VC would be further affected by the residual effects of the Project, and how other certain and reasonably foreseeable projects and activities may also affect the VC. In response, the Proponent provided a more detailed assessment pertaining to effects of past activities and demonstrated how it had considered past projects for all those VCs predicted to have a residual effect. For VCs where no residual effects

were predicted, no further details were provided on how the existing condition of the VC had been influenced or changed by past projects or activities.

The Proponent also stated that the availability of good quantitative and historic data, especially in the marine environment, was a challenge when conducting cumulative effects assessment. The Proponent offered to participate in a regional baseline study or a regional cumulative effects study with the Government of Canada or the Government of British Columbia.

Table 25-1: Environmental components that may be affected by residual adverse effects of the Project as identified by the Proponent (Source: Adapted from Project public registry document 388 and 412)

Environmental Component	Residual Effect (after mitigation)	Total Cumulative Effects Analysis Conclusion
Marine Invertebrates	Productivity loss for bivalve shellfish, Dungeness crab and orange sea pen during construction and operations.	Residual (cumulative) effect of the Project in combination with the effects of other projects and activities that have been carried out was considered not significant.
Marine Fish	Productivity loss for forage fish and flatfish during construction and operations.	Since a Project-related effect (i.e., productivity loss) resulting from changes in the acoustic environment is unlikely, a cumulative effect with the effects from other past, present, and future projects and activities was also unlikely.
Marine Mammals	Change in acoustic environment resulting in behavioural effects or acoustic masking for Southern Resident Killer Whale, North Pacific Humpback Whale, and Steller Sea Lion during operations.	Cumulative effects to SRKW from the Project in combination with other projects and activities that have been and will be carried out were anticipated to remain significant. For other toothed whales, baleen whales, and seals and sea lions, the residual cumulative effect of the Project in combination with the effects of other projects and activities that have been and will be carried out was considered not significant.
Coastal Birds	Productivity loss for diving birds during construction and operations.	The total cumulative effect of the Project in combination with the effects of other projects and activities that have been carried out was considered not significant.
Marine Commercial Use	Changes in area, harvest and revenue for seafood harvesting during construction and operations.	The total cumulative effect of the Project on marine commercial use (seafood harvesting) in combination with the effects of other projects and activities that have been and will be carried out was considered not significant.

Environmental Component	Residual Effect (after mitigation)	Total Cumulative Effects Analysis Conclusion
Visual Resources	Daytime and nighttime viewing opportunities of visual resources.	The total cumulative effect of the Project residual effects of the Project in combination with the effects of other projects and activities that have been and will be carried out was considered not significant.
Human Health	Air emissions	Because the residual effect of the Project on human health related to exposure to air emissions is unlikely to occur, it would not be likely to result in a cumulative effect, and was not considered further.
	Noise	While the total future cumulative noise levels may cause adverse effects to a small number of individuals, the total cumulative effect on the overall health of the community was considered not significant.
Land and Water Use	Disturbance to community lease lands during construction.	The residual (cumulative) effect of the Project in combination with the effects of other projects and activities that have been carried out was considered not significant.
Archaeological and Heritage Resources	Crushing or biological degradation of potential fish trap stakes during construction.	The residual (cumulative) effect of the Project in combination with the effects of other projects and activities that have been carried out was considered not significant.
	Reduced access for future archaeological study or preservation of potential fish trap stakes	
	Exposure of potential fish trap stakes during construction.	

25.2 Views of Participants

Many participants expressed concerns regarding the Proponent's approach to cumulative effect assessment and the lack of a cumulative effects assessment for several VCs. The environmental effects due to past projects and activities at Roberts Bank since 1960 were described by many participants and it was generally believed that the Proponent had not considered those effects fully in its assessment.

Some participants reported that the environmental effects of extensive development in the Lower Fraser River estuary extended over the past 150 years. FLNRORD reported that the ecosystems of the Fraser River estuary had been subject to the cumulative effects of development throughout the estuary since 1827. Such ecological degradation included diking, urbanization, agriculture, industrial development, river dredging, and construction of river training infrastructure.

FLNRORD anticipated that impacts from the Project would degrade the ecological integrity of the area and contribute further to the cumulative negative effects of development throughout the Fraser River estuary.

The Boundary Bay Conservation Committee stated that the ecological treasures of the Roberts Bank ecosystem were already under stress from past port developments. The Boundary Bay Conservation Committee was of the view that doubling the port on Roberts Bank would exacerbate cumulative effects of previous developments and could precipitate collapse of this vital ecosystem resulting in an environmental catastrophe with global consequences.

Based on information provided by Indigenous groups, the Agency submitted that the Proponent's approach to cumulative effects did not capture baseline information reflective of the changes experienced by Indigenous harvesters and their ability to exercise their Aboriginal or treaty rights. The Agency reported that many locations used by the Tsawout First Nation harvesters had already exceeded their threshold, therefore affecting their ability to exercise those rights or to understand what the future impacts might be.

One participant stated that a flaw in cumulative effects assessments, as defined in legislation and practice, was when significant changes had already taken place and acknowledged but there were no additional requirements to demonstrate that the change would not affect the species from continuing to be self-sustaining and that a tipping point of viability had not been crossed. The participant stated that given the number of listed species involved in the Project there was a need for the Proponent to consider synergistic effects.

Comox Valley Nature stated that the degraded existing conditions of the Salish Sea at Roberts Bank should not constitute the baseline to assess cumulative effects. The question should not be what impact the Project would have on the current state of the ecological environment, but what the Project impact represents within a trajectory of progressive degradation over the past two centuries. Bird Studies Canada recommended that any cumulative effects assessment in the Fraser River estuary must establish a historical baseline that predates recent industrial expansion across the estuary.

The Agency reported that many Indigenous groups had concerns with the temporal scope of the cumulative effects assessment and how it influenced the baseline information. The Agency explained that the baseline for the cumulative effects assessment started at present time and consequently did not underline how existing projects have already changed the environment. The Agency also reported that the Proponent did not clearly explain how historical impacts on VCs, including on traditional use, rights, title and culture were considered and how those changes may further affect the group's ability to exercise its rights, title and culture.

Tsawwassen stated that in assessing cumulative effects related to the Project, the Nation supported the use of a pre-1960 baseline to reflect conditions prior to the construction of the BC Ferries Tsawwassen Terminal and the Deltaport Terminal, which permanently altered the foreshore of their territorial lands. Tsawwassen also expressed concern that the cumulative

effects assessment was not useful because it restricted the scope of the environmental assessment to only cumulative future effects, without taking into account the effect of past or on-going projects or activities. Consequently, the assessment undertaken by the Proponent represented an incremental assessment rather than a cumulative assessment and lacked the historical context and current barriers limiting the exercise of rights and culture.

Tsawwassen recommended that the Government of Canada, the Government of British Columbia, Metro Vancouver and the Port Authority fund and undertake a regional cumulative effects assessment for the entire Fraser River Lowland. The purpose of the regional assessment would be to guide management decisions to ensure the sustainability of components of crucial importance to the Nation and not solely describe the present environmental condition. The terms of reference for this assessment should be co-developed with Tsawwassen members and other Indigenous groups and include a commitment to work on reversing effects that exceed ecological thresholds. The terms of reference should be completed before a federal decision on the Project.

The Hwlitsum First Nation stated that they hoped that sharing their traditional knowledge pointed out the need to look at any proposed project through the lens of cumulative impact. The Hwlitsum First Nation noted that a project's reference point for determining cumulative impacts should be a point before industrialization rather than an individual project's potential impact.

Bird Studies Canada stated that the cumulative effects assessment repeatedly relied on vague mitigation commitments to rule out potential residual effects, thereby limiting the number of impacts subject to cumulative effects assessments to a mere handful. To address this shortcoming, Bird Studies Canada stated that the Panel could have asked for a set of different cumulative effects scenarios with different mitigation measure success rates. Bird Studies Canada mentioned that scenarios could have been developed for 100, 50 and 0 percent effectiveness of the mitigation measures instead of assuming that the mitigation measures would be fully effective.

Many Indigenous groups disagreed that a cumulative effects assessment was not required for current use of lands and resources for traditional purposes because the Proponent concluded no measurable residual adverse Project-related effect after the application of mitigation measures. Ditidaht First Nation stated this approach was outdated and completely inadequate in the context of Section 35 of the *Constitution Act, 1982*, as it improperly imported a "significance" test into the assessment of impacts to rights. If a cumulative effects assessment is only ever taken after the Proponent evaluates the significance of a residual effect, after the application of a mitigation measure, then a barrier is established to properly assess a project's potential adverse effects within its greater context.

Pacheedaht underlined that despite the emphasis placed on cumulative effects in their evidence and despite the importance of understanding cumulative impacts in order to conclude on the effects of the Project on Indigenous peoples, the Proponent failed to undertake a cumulative effects assessment in its Marine Shipping Addendum due to the conclusion of no residual effect.

Many participants called for a management framework that would oversee development in the Salish Sea and conduct studies to address cumulative effects. As reported by the Agency, many Indigenous groups called for a single entity or foundation charged with protecting the Salish Sea on both sides of the border, which includes environmental non-profits, academics, and First Nations. Many participants requested a regional cumulative effects assessment and management plan that would assess the overall environmental state of the Salish Sea and the ecosystem of the Lower Fraser River estuary.

Bird Studies Canada stated that a community-supported plan was needed before further development in the estuary was permitted to take place. Bird Studies Canada, in collaboration with BC Nature, stated that they initiated a petition with 1800 plus signatures to not approve any new industrial projects until a Fraser Estuary Restoration and Management Plan was in place that secured the health of the Fraser River delta. Bird Studies Canada requested that the Panel recommend a Fraser Estuary Restoration and Management Plan that would link to the Salish Sea Cumulative Effects Management Plan required under the TMX conditions.

A local resident mentioned that conducting a cumulative effect assessment only when there were residual effects was a ‘fallacy’ and proponents should be looking at effects to the ecosystem and integrate better science into their assessment. The resident stated that governments could also play a larger role in establishing baselines and ensuring that sound science was used in decision-making. The resident also called for a moratorium on any further development on the Fraser River estuary that would alter the migration of salmon, and a full environmental and hydrological study of the Fraser River watershed and estuary.

Many participants referred to the former Fraser River Estuary Management Program (FREMP) as an example of such a framework. FLNRORD stated that there was a need to reinstate the FREMP, which was closed in 2013 by the Federal government. The FLNRORD explained that the FREMP was an intergovernmental program that coordinated environmental management, review and interagency communications for projects and shoreline developments in the Fraser River estuary. The Program also created a management plan for the estuary in 1993 that aimed to improve environmental quality in the estuary while providing economic-development opportunities and sustaining the quality of life in and around the estuary. Former project coordination responsibilities of FREMP became the responsibility of Vancouver Fraser Port Authority, the primary driver for many development projects in the estuary. FLNRORD noted that in November 2016 the federal government announced a re-start of FREMP but it appeared to have made little progress since that announcement. FLNRORD requested that the Panel recommend the federal government establish a new FREMP with stable funding and a co-governance framework that involves First Nations. FLNRORD stated that since no single entity was responsible for the ecological integrity of the Fraser River, restarting FREMP was a key step toward shared stewardship of the estuary.

25.3 Panel’s Analysis

Based on the numerous submissions provided to the Panel throughout the review, it is evident that the marine ecosystem of the Fraser River estuary is increasingly being threatened by the

cumulative effects of development and human activities. The Panel recognizes the importance of addressing the cumulative effects of successive actions in the context of a project environmental assessment, however the approach taken to evaluate such effects requires a holistic evaluation of the combined effects of developments, human activities and natural processes on the environment. This would allow for a consideration of incremental effects on an environmental component over time from multiple projects and activities at a regional scale and to what degree an environmental component approaches or exceeds a defined threshold and undergoes a tipping point towards degradation. The Panel agrees with participants and considers that a proper cumulative effects assessment for the Project is crucial given the series of developments in the area that have occurred over the past decades.

Inclusion of Past Effects

The Panel appreciates that a cumulative effects assessment must take into account the effects of past, existing, and future projects and activities in combination with the residual effects of the Project even if project effects are minor and not significant. In its request for additional information the Agency explained that, regardless of whether effects from future projects and activities were expected to occur or not, the total cumulative effects of the Project needed to take into account the effects from past and existing projects and activities if they might interact with residual effects from the Project. Further, during the sufficiency review of the EIS, the Panel asked the Proponent to reconsider its assessment for several environmental components to evaluate the potential for residual effects and cumulative effects.

In response, the Proponent further explained that they avoided the issues of a shifting baseline by evaluating the significance of the Project's effects in terms of the integrity of the environmental component without reference to any temporal baseline. The Proponent stated that viability thresholds are commonly used because it indicates when an environmental component would be unacceptably compromised. If the threshold was exceeded in the future condition, the Project effect, combined with the effects of past and present project, was significant. Although the Panel can acknowledge that the Proponent provided additional details regarding past and existing effects for those environmental components for which residual effects were already identified in the Proponent's assessment, the Proponent did not describe past projects and activities contributing to the current state of those environmental components for which there were no residual effects predicted.

The Panel agrees with the Agency that using the existing conditions of an environmental component to reflect past effects results in a shift in baseline that could mask residual and potentially significant effects that have historically occurred or could occur in combination with effects of the Project. The Panel agrees with the Agency's approach and considers that effects from past and existing projects on an environmental component must be described and considered on their own and not as reflection of the current condition of the environmental component. The Panel is of the view that if the Proponent had re-evaluated all environmental components as requested, the Proponent would have identified more residual effects and appropriate mitigation measures could have been applied.

Further, the use of a temporal baseline to characterize residual effects would have allowed the Panel to assess measurable changes compared to the baseline conditions or other applicable standards, guidelines or objectives. The Panel notes that cumulative effects for Indigenous communities may have a regional or historic context and may extend to aspects of cultural heritage, socio-economics, health and other matters tied to their history and connection to the landscape.

Residual Effects

The Panel recognizes that the Proponent conducted a cumulative effects assessment when a residual effect was predicted, however, in many cases the Proponent concluded the residual effect was negligible, not detectable, or so small as to not be measurable. In other instances, the Proponent stated that the mitigation measure would partially mitigate the effect and still concluded that there was no residual effect. In both instances the Proponent concluded that a cumulative effects assessment was not required. The Panel is of the view that the Proponent often determined there was no residual effect despite uncertainty regarding the effectiveness of mitigation, which is neither conservative nor does it conform to its approach to assess the Project effects in a precautionary manner. For a residual effect to be reduced to zero, the mitigation measures would have to be fully effective so that no effect remains.

The Panel heard from the Proponent that undetectable and unmeasurable are synonymous terms that were used to describe residual effects that are of very low consequence; ones that the Proponent was unable to clearly characterize the magnitude, frequency, duration, and extent of the residual effect. The Panel does not accept that a residual effect, no matter how small, should be excluded from a cumulative effect assessment, nor does the Panel accept that a residual effect needs to be characterized in order for a cumulative effects assessment to be carried out. The EIS Guidelines required that residual effects, even if very small or insignificant, be described. This was particularly important in consideration of the cumulative effects assessment where small residual effects could combine with the effects of other projects and activities that have been or will be carried out.

Current and Needed Initiatives

Although cumulative effects assessments have long been recognized as an essential part of environmental assessments, discussion remains on the best methods to be used. The dynamic nature of the marine environment, the complexity of biological processes that occur at the Project site, the availability of good quantitative data, and the past damage to the ecosystem adds challenges to a comprehensive cumulative effects assessment. Based on input from participants throughout the review, the Panel recognizes that improvements to guidelines and best practices to facilitate cumulative effects assessments is needed. The Panel further agrees that the requirement for a regional assessment is overdue and needs to be given serious consideration by governments, as well as how the outcome of such an assessment will be tied to management objectives.

The Panel understands that through the Cumulative Effects of Marine Shipping initiative of the OPP, Transport Canada is to develop a national cumulative effects assessment framework for marine shipping and regionally-specific tools and mitigation measures that can be applied to existing vessel movements, as well as future project developments, and system-wide initiatives that can be applied nationally. To facilitate the assessment, data will be collected at six pilot areas across Canada, including the South Coast of British Columbia.

The Panel heard during the public hearing that engagement has been initiated with local communities, stakeholders, and Indigenous groups, and will continue throughout to determine key concerns and help collect baseline environmental information to inform assessments of the cumulative effects of marine shipping.

Quality and Extent of Baseline Data

The Panel heard from the Proponent that good quantitative data to prepare its cumulative effects assessment was often limited or not available, particularly in marine environments. The Agency recognized the problem of completing a comprehensive assessment in the absence of good quantitative data. The Agency's *Cumulative effects assessment practitioners guide 1999*, used by the Proponent, offered solutions in determining effects when there was uncertainty due to lack of information or knowledge. The guide recommended that the 'rules-of-thumb' be considered such as: making conservative conclusions or using the precautionary principle; providing a record or audit trail of all assumptions, data gaps, and confidence in data quality and analysis to justify conclusions. Other proposals are identical to solutions generally proposed when assessing residual effects in the case of uncertainties, such as proposing follow-up programs to ensure the effectiveness of mitigation measures and to verify the accuracy of the environmental assessment.

Therefore, the absence of good quantitative data cannot be used to justify the avoidance of doing a cumulative effects assessment. However, the Panel is of the view that governments have an important responsibility to establish baselines such as that proposed in the OPP initiative for future uses by consultants, governments and the public. The Panel considers that it is up to these initiatives to establish temporal and spatial boundaries and thresholds, as well as to offer tools on how to do regional cumulative effects assessments.

The quality of data can be further improved with the use of traditional and community knowledge. Numerous participants, Indigenous and non-Indigenous, provided information about cumulative effects to the Proponent and the Panel during this environmental assessment, reliable data that could improve evaluation of effects. In building baseline data banks, governments should consider using traditional and community knowledge.

The Panel is of the opinion that an evaluation of the baseline conditions and context needs to be carried out early in the environmental assessment process, by both proponents and governments. This preliminary work needs to include whether the present ability of the community to exercise rights has been diminished due to factors such as cumulative adverse effects and historical or current interferences with traditional practices. The study of contextual factors and baseline conditions should be undertaken in partnership with the Indigenous group whenever possible.

Community-defined thresholds and measures for key indicators, where they exist, should be part of the assessment. Further, the Cumulative Effects of Marine Shipping initiative under the OPP is limited to shipping activities. A regional environmental assessment is needed and should favour a broader ecosystem approach.

Recommendation 69

The Panel recommends that the Cumulative Effects of Marine Shipping initiative of the Oceans Protection Plan be pursued with appropriate budgets.

Recommendation 70

The Panel recommends the Government of Canada undertake two regional environmental assessments for the Fraser River estuary and the Salish Sea to establish an environmental baseline, identify environmental and cumulative effects of the areas, and mitigation and follow-up requirements. The regional assessment should be used to develop and implement Intergovernmental Management Programs of the Fraser River estuary and the Salish Sea (See Recommendation 68).

26 Environmental Management Plans, Follow-up and Monitoring

26.1 Proponent's Assessment

The Proponent proposed a Construction Environmental Management Plan (EMP) and an Operation EMP, each with several stand-alone sub-plans, for the Project. The EMPs would ensure that proper measures and controls were in place to prevent or reduce adverse environmental effects and to provide clearly defined action plans and emergency response procedures to protect human and environmental health and safety. During the development of Project EMPs, regulatory requirements and standards would be addressed and consultation with relevant regulatory agencies, non-governmental organizations, and Indigenous groups, potentially affected by the Project, would be undertaken.

The Proponent would select an Infrastructure Developer and Terminal Operator for the Project that would lead the development of the EMPs and they would be finalized near the start of the construction and operation phases of the Project. The EMPs and the sub-plans would be updated throughout construction and operations by the Environmental Monitor to reflect evolving site conditions and any applicable findings. Mitigation measures would be implemented as outlined in the EMPs. The Proponent emphasized that they hold the ultimate responsibility for the various components of follow-up programs and adaptive management plans, if required.

All EMPs for the Project would include, at a minimum, the following information:

- Identification of objectives to be achieved;
- Environmental mitigation measures, standard management practices, and other requirements to support the plan's objectives; and
- Roles and responsibilities of all parties involved in the development and implementation of the EMP and its sub-plans.

Environmental compliance monitoring and reporting for the Project would verify compliance with the terms and conditions of Project approval and existing legislation, industry standards, regulatory requirements, and other included sub-plans of the EMPs. The Proponent stated that Compliance Monitoring Plans comprise contingencies measures to be employed should monitoring indicate mitigation measures are not effective in relation to prescribed management practices or established standards.

Once developed, the Proponent's Compliance Monitoring Plans would describe monitoring parameters and requirements for all plans under the EMPs. The Proponent proposed a list of agencies it would consult to revise the construction and operations plans and committed that the City of Delta would be added and that all of their EMPs and sub-plans would be made publicly available on the Project's website. Prior to the start of construction, the Proponent proposed to work collaboratively with Indigenous groups and to engage the Indigenous Advisory Committee as a communication mechanism to support dialogue and issue resolution between the Port Authority and Indigenous groups during construction and operations.

A follow-up program would be developed to verify the accuracy of effects predictions and to determine the effectiveness of mitigation measures. The Proponent provided the elements of their follow-up program, including the intended objective and approach for each environmental component. Their follow-up program consists of 24 elements that would be further developed and refined following engagement and consultation with Indigenous groups and regulators, a Follow-up Advisory Committee and other collaborators, as required.

The Proponent would develop the Project's follow-up program using an adaptive management approach. The Proponent described adaptive management as an iterative process used to address scientific and perceived uncertainty, in which field results are used to modify management action. The Proponent would select monitoring targets for each follow-up program element to allow the identification of adverse Project effects through monitoring. By comparing monitoring results for each monitoring target against the corresponding action threshold values, the Proponent would be warned of potential adverse effects. If the follow-up program results indicated adverse effects, and if the cause for the detected adverse effects was Project-related, corrective management action would be initiated.

In addition, the Proponent would hold an offsetting workshop on approaches to building offsetting habitats. The purpose of the workshop would be to share information and gather input from Indigenous groups on habitat construction and monitoring parameters, and to identify opportunities for collaboration.

During the environmental assessment, the Panel requested that the Proponent provide a compilation of the mitigation measures and commitments for each environmental component affected by the Project and marine shipping associated with the Project. The Panel also requested that the compilation be updated to incorporate all commitments made during the public hearing. The compilation of proposed mitigation measures and Project commitments is in Appendix G.

The Proponent further submitted awareness and education programs as a means to eliminate, reduce or control adverse environmental effects of the Project. During operations, the Proponent proposed an Environmental Training Plan to keep Project personnel and sub-contractors informed about key environmental considerations relevant to Project operations. The Proponent was of the view that environmental awareness and education could prevent activities that pose environmental risks.

The Proponent stated that they would be prepared to participate in the OPP and other federal government initiatives, and to coordinate the Port Authority's own consultation with Indigenous groups on marine shipping associated with the Project. In recognition of the importance of salmon and SRKW, the Proponent committed to working collaboratively with Indigenous groups, regulators, agencies and stakeholders to explore additional opportunities to contribute to salmon and SRKW initiatives. Moreover, the Proponent would continue to engage in regional programs to address the recovery of SRKW.

26.2 Views of Participants

In general, participants expressed concern that the details of the EMPs and monitoring and follow-up programs were not explicit enough and should not wait until the permitting stage of the Project. Some participants argued that most of the mitigation measures were no more than proposals or promises to be worked out between the Proponent and federal departments after the Project was in place.

Tsawwassen stated that proposed mitigation measures did not have enough detail and relevance to Project effects on Tsawwassen to be considered effective mitigation. Tsawwassen pointed out that the Proponent's Updated Project Commitments stated that "critical mitigation plans have not yet been developed". Tsawwassen further submitted that some proposed mitigation measures would only partially mitigate impacts on Tsawwassen and that some proposed mitigation measures have impacts of their own. Tsawwassen stated that given the incomplete nature of many of the mitigation measures the Project would likely cause significant adverse environmental effects and further efforts would be required to evaluate and mitigate the Project's potential environmental effects.

Musqueam suggested that the Proponent be required to establish a Follow-up Advisory Committee and an Offsetting Planning Committee co-governed by the Proponent, the Crown, Musqueam and Tsawwassen. Musqueam would sit on the committee as a co-decision-making authority and help oversee the final design, development, and implementation of mitigation and offsetting measures, monitoring, and related follow-up plans.

Musqueam further suggested that the Proponent be required to undertake additional studies to address uncertainty and information gaps prior to construction and finalization of requirements for mitigation, offsetting, and follow-up plans. Musqueam recommended that the Proponent fund, conduct, and complete in partnership with Musqueam and Tsawwassen, additional studies to characterize effects of project interactions on eulachon, white sturgeon and juvenile salmon. The results of these studies would be used to inform the design, the development and the implementation of additional mitigation, offsetting, monitoring and follow-up plans, as may be required.

Musqueam further submitted that, in order to understand the seriousness of the effects of large vessel traffic in the Salish Sea on Musqueam rights, the Proponent must develop a Marine Shipping follow-up program with Musqueam and Tsawwassen prior to construction.

26.3 Panel's Analysis

The Panel recognizes that the Proponent has made numerous commitments to develop and implement a range of management, offsetting and mitigation plans, which are to include input and approvals from qualified professionals and federal and provincial authorities and, where appropriate, Indigenous groups. The Panel understands that many of the draft plans would be provided for review prior to the start of relevant Project phases, which in many cases would be after the Project is built.

The purpose of a follow-up and effects monitoring program is to verify the accuracy of the conclusions of the environmental assessment and to determine the effectiveness of the measures implemented to mitigate the adverse environmental effects of the Project. However, a commitment to implement EMPs does not eliminate the need to first identify and describe the mitigation measures that could be implemented and modified as required, in order to eliminate, reduce, or control potential effects. Monitoring and follow-up without some assurance that mitigation measures are readily available to fully mitigate effects that arise from the Project leads to uncertainty in the Proponent's ability to mitigate in an effective and timely manner. In almost all cases, the Proponent's EMPs and sub-plans do not provide the necessary details on the technical and economic feasibility of measures that are available in the event of an adverse environmental effect. Further, the Panel is of the view that, in many instances, the mitigation measures proposed by the Proponent would not be as effective as the Proponent predicted. The Panel recognizes that adaptive management would be essential if proposed mitigation fails.

The Panel approves of the Proponent's revised list of agencies it would consult to develop construction and operations plans and suggest that the Indigenous Advisory Committee includes both Indigenous groups with activities taking place in the Project area and the marine shipping area.

The Panel agrees that the commitments and mitigation measures proposed by the Proponent in Appendix G are necessary if the Project were to proceed. The Panel has recommended additional mitigation measures, as well as expanded on many of the Proponent's commitments throughout the report.

Recommendation 71

In addition to the engagement of the Indigenous Advisory Committee in the Project area, the Panel recommends that the Proponent be required to develop and implement an Indigenous Advisory Committee that consists of those Indigenous groups undertaking activities in the marine shipping area and are potentially affected by marine shipping associated with the Project.

Appendix A: Panel Member Biographies

Mrs. Jocelyne Beaudet - Panel Chair

Jocelyne Beaudet is a communications consultant. She has over forty years of experience in various fields related to the environment, socio-economic conditions and public participation. She holds two Bachelor's degrees, one in Science and one in Physical Anthropology from the Université de Montréal, a Master's degree in cultural anthropology from McGill University and pursued a Ph.D. program in urban geography at McGill University. She now resides in Lunenburg, Nova Scotia.

Mrs. Beaudet has developed communications plans and public consultation strategies for numerous environmental initiatives. As a consultant, she has advised the Office of the Auditor General of Canada on issues related to the Canadian North, organized strategies on climate change and air pollution, and advised the Task Force on Sustainable Transportation for the National Round Table on the Environment and the Economy. While working for Tecsum Inc., over a period of seven years, she developed communications and public consultation plans for transportation and mining projects in Quebec and Africa, and collaborated in the preparation of environmental impact assessments.

Mrs. Beaudet's international experience includes three years as head of Environmental Planning in the Sultanate of Oman and head of Conservation and Protection of the Environment for the Ministry of Environment, the first ministry of its kind in the Arab world.

Mrs. Beaudet has extensive experience undertaking public consultation as a panel member for federal, provincial and municipal environmental agencies. She served as a member of the Joint Review Panel for the Site C Clean Energy Project, the Darlington New Nuclear Power Plant Project, the Eastmain 1-A/Rupert Hydroelectric Project, and as the Provincial Executive Co-Secretary of the Joint Review Panel for the Lachine Canal Decontamination Project. She has served as a chair on six mandates and as a member on panels for the Bureau d'audiences publiques sur l'environnement du Québec. With the Bureau, she was involved in proposed projects on windmill farms, river diversions and hydro power stations, roads, and industrial installations. Most of her federal and provincial mandates addressed Indigenous interests and issues.

For the Office de consultation publique de Montréal, she served both as a chair for three mandates and as a member for two on panels with proposed projects requiring changes to the City's urban plans and on proposed policies related to cultural heritage and family action plans. Mrs. Beaudet was also a member of the committee reviewing one of Hydro-Quebec's proposals following the ice storm of 1998.

Mrs. Beaudet was extensively involved in charity work related to community poverty issues, homeless women in Montreal, and education of the young at the graduate level.

Dr. David Levy - Panel Member

Dr. David Levy is a Fisheries Scientist who has worked with BC First Nations, the Governments of Canada and BC, the Pacific Salmon Commission, non-governmental organizations as well as the private sector. He holds a B.Sc. degree in Marine Biology from McGill University and a Ph.D. in Zoology from the University of BC. Since 1990 he has operated Levy Research Services Ltd. to provide independent advice in fisheries and aquatic environmental assessment. Prior to 1990, he worked with Westwater Research Centre, UBC and undertook fisheries studies in the Fraser River Estuary and Babine Lake. He has also worked internationally on environmental assessment and training projects in Latin America and SE Asia.

Dr. Levy served as an Expert Witness during *Exxon Valdez* litigation and was Science Director for the Cohen Commission of Inquiry into the Decline of Sockeye Salmon in the Fraser River. Dr. Levy has undertaken numerous salmon research projects in the Fraser River including an assessment of climate change effects on Fraser salmon. He is presently the Independent Member of the Nechako Fisheries Conservation Program, coordinating salmon conservation initiatives between Rio Tinto and the Governments of Canada and British Columbia.

Dr. Levy provides advice to BC First Nations in relation to salmon co-management, fisheries assessments in Traditional Territories and analysis of development activities that affect aquatic resources. He has undertaken projects for the First Nations Fisheries Council of BC, Upper Fraser Fisheries Conservation Alliance, A-Tlegay Fisheries Society, Cooks Ferry Indian Band and many other Fraser River First Nations. Over the past 15 years, he has worked closely with the St'át'imc Nation and BC Hydro in support of Water Use Planning in the Bridge-Seton Hydroelectric System.

Dr. Douw Steyn — Panel Member

Dr. Douw Steyn is a Professor Emeritus in the Department of Earth, Ocean and Atmospheric Sciences at The University of British Columbia and long-time resident of Vancouver. His academic expertise is in boundary layer, mesoscale, and air pollution meteorology. Dr. Steyn has a PhD in Atmospheric Science from The University of British Columbia, and a Master of Science and Bachelor of Science from the University of Cape Town. Dr. Steyn has taught in a wide range of academic programs, including the Atmospheric Science, Environmental Science and Physical Geography Programs, and has wide knowledge of ecosystem structure and function and specific knowledge of the Fraser River Estuary.

Dr. Steyn has been a faculty member at The University of British Columbia since 1982. Dr. Steyn's responsibilities have included the Chair of Atmospheric Science, Director of Science One Program, Chair of Environmental Science Program, Associate Dean of the Faculty of Graduate Studies and Interim Principal in the College for Interdisciplinary Studies. Dr. Steyn served for many years as Chair of the NATO International Technical Meeting on Air Pollution Modelling and its Application. Dr. Steyn has served as editor of a number of international academic journals in his field of expertise. Dr. Steyn has conducted research field studies in Canada, Switzerland, South Africa, Costa Rica and Austria. He has worked actively in a number of public

contexts to improve or to prevent further deterioration of regional air quality in the lower Fraser Valley.

Dr. Steyn has an extensive list of academic awards and distinctions, professional consultancies and activities, and publications. He has conducted research, analysis and reviews in relation to air quality for a host of citizen and environmental organizations and for all levels of government. He has frequently appeared as an expert witness in provincial and federal courts.

Appendix B: Roberts Bank Terminal 2 Project Amended Review Panel Terms of Reference

Amended April 2019
Original April 2015

Roberts Bank Terminal 2 Project Amended Review Panel Terms of Reference

The federal Minister of the Environment, (the Minister) has statutory responsibilities pursuant to the *Canadian Environmental Assessment Act, 2012* (CEAA 2012) and, after considering whether the designated project may cause significant adverse environmental effects and public concerns related to such possible significant environmental effects, has referred the environmental assessment of the proposed Roberts Bank Terminal 2 Project to a Review Panel in accordance with section 38 of CEAA 2012.

Environmental assessment is a planning tool used to ensure that projects are considered in a careful and precautionary manner in order to avoid or mitigate possible adverse environmental effects. One of the purposes of CEAA 2012 is to ensure opportunities for meaningful public participation during an environmental assessment. Meaningful participation is best achieved when all parties have a clear understanding of the proposed project, timely access to information regarding the assessment, and an opportunity to have their views heard and considered.

The [Updated Guidelines for the Preparation of an Environmental Impact Statement for the Roberts Bank Terminal 2 Project](#) (EIS Guidelines) identify for the proponent the minimum information requirements for the preparation of its Environmental Impact Statement (EIS). The document specifies the nature, scope and extent of the information required including a description of the project, existing environment, predicted environmental effects and proposed measures to mitigate any adverse environmental effects. The EIS Guidelines were released to the proponent and made publicly available on January 7, 2014 and were updated in February 2015.

Pursuant to subsection 42(1) of CEAA 2012, the Minister must establish the Review Panel Terms of Reference. These Terms of Reference establish the composition and mandate of the Review Panel and also set out the framework of the process that the Review Panel will follow.

1. Description of the Project

- 1.1. On September 12, 2013, the Canadian Environmental Assessment Agency (the Agency) received the [Roberts Bank Terminal 2 Project Description](#) from Port Metro Vancouver (the proponent). The proponent proposes to construct and operate the Roberts Bank Terminal 2 Project (the project), a new three-berth marine container terminal located at Roberts Bank in Delta, British Columbia, approximately 35 kilometres south of Vancouver. Located next to the existing Deltaport and Westshore

Terminals, the project would provide an additional 2.4 million twenty-foot equivalent units of container capacity per year at Roberts Bank.

- 1.2. The description of the project for the purpose of the environmental assessment is the construction, operation and where relevant, decommissioning of project components and physical activities, including mitigation measures that are proposed to mitigate the predicted environmental effects of the project. Marine shipping activities within the 12 nautical mile limit of Canada's territorial sea are incidental to the marine container terminal and therefore part of the description of the project for the purposes of the environmental assessment. The requirements for a detailed description of the project are provided in the EIS Guidelines and the description will be included in the proponent's EIS.

2. Factors to be Considered

- 2.1. The environmental assessment by the Review Panel must take into account the following factors listed in subsections 19(1) and 19(3) of CEAA 2012:
 - a. the environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project and any cumulative environmental effects that are likely to result from the project in combination with other physical activities that have been or will be carried out;
 - b. the significance of the effects referred to in section 2.1(a);
 - c. comments from the public that are received in accordance with CEAA 2012;
 - d. mitigation measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project;
 - e. the requirements of the follow-up program in respect of the project;
 - f. the purpose of the project;
 - g. alternative means of carrying out the project that are technically and economically feasible and the environmental effects of any such alternative means;
 - h. any change to the project that may be caused by the environment; and
 - i. community knowledge and Aboriginal traditional knowledge.
- 2.2. The term "environmental effect" is described in section 5 of CEAA 2012.
- 2.3. As required by the Minister pursuant to paragraph 19(1)(j) of CEAA 2012, the environmental assessment must also take into account the following matter that is relevant to the environmental assessment:
 - a. the potential economic, social, heritage and health effects of the project, including cumulative effects, that may not be encompassed by the definition of environmental effects under CEAA 2012, and practicable means to mitigate such potential adverse effects.
- 2.4. For greater certainty, the potential economic, social, heritage and health effects of the project, including cumulative effects, that are not encompassed by the definition of environmental effects under CEAA 2012 are not environmental effects of the project for the purposes of the Minister's decision on whether the project is likely to cause significant adverse environmental effects and will not be subject to conditions to the proponent in any decision statement issued by the Minister under CEAA 2012.

- 2.5. The scope of the factors to be considered in the environmental assessment are outlined in the EIS Guidelines.

3. Mandate of the Review Panel

- 3.1. The Review Panel shall conduct an assessment of the environmental effects of the project in a manner consistent with the requirements of CEAA 2012 and these Terms of Reference.
- 3.2. In accordance with section 43 of CEAA 2012, the Review Panel must:
 - a. conduct an environmental assessment of the project;
 - b. ensure that the information that it uses when conducting the environmental assessment is made available to the public;
 - c. hold hearings in a manner that offers any interested party an opportunity to participate in the environmental assessment;
 - d. prepare a report with respect to the environmental assessment that sets out:
 - i. the rationale, conclusions and recommendations of the Review Panel, including any mitigation measures and follow-up program; and
 - ii. a summary of any comments received from the public, including interested parties;
 - e. submit the report with respect to the environmental assessment to the Minister; and
 - f. on the request of the Minister, clarify any of the conclusions and recommendations set out in its report with respect to the environmental assessment.
- 3.3. The Review Panel shall have all the powers and duties of a panel described in section 45 of CEAA 2012.
- 3.4. The Review Panel may receive and take into account information with respect to whether any significant adverse environmental effects may be justified in the circumstances.
- 3.5. In accordance with sections 47 and 52 of CEAA 2012, if the Minister decides that the project is likely to cause significant adverse environmental effects, the Minister will refer the matter to the Governor in Council (Cabinet) who must decide whether those environmental effects are justified in the circumstances.

Potential or Established Aboriginal or Treaty Rights and Interests

- 3.6. For legal and policy reasons, the Crown consults with and, where appropriate, accommodates Aboriginal groups regarding the potential adverse impacts of its decisions on potential or established Aboriginal or Treaty rights. Aboriginal consultation is integrated with the review panel and regulatory process to the extent possible.
- 3.7. Through these Terms of Reference, the Review Panel is given the mandate to collect information on behalf of the Crown as outlined in sections 3.9 to 3.11. The federal government maintains the duty to consult throughout the environmental assessment

process and will be responsible for the items detailed in section 3.8, where necessary.

- 3.8. The Review Panel will not make any conclusions or recommendations as to:
- a. the validity of potential or established Aboriginal or Treaty rights asserted by an Aboriginal group or the strength of such claims;
 - b. the scope of the Crown's duty to consult an Aboriginal group;
 - c. whether the Crown has met its respective duty to consult or accommodate in respect of rights recognized and affirmed by section 35 of the Constitution Act, 1982;
 - d. whether the project would be an infringement of potential or established Aboriginal or Treaty rights; and
 - e. any matter of Treaty interpretation (historic or modern).
- 3.9. The Review Panel shall accept as part of the environmental assessment:
- a. information presented by Aboriginal persons or groups regarding the location, extent and exercise of potential or established Aboriginal or Treaty rights that may be affected by the project;
 - b. information presented by participants in the review panel process that relates to any potential adverse impacts of the project on potential or established Aboriginal or Treaty rights and related interests including, where appropriate, identification of the specific treaty provision at issue and potential or established Aboriginal title claims. Information received by the Review Panel may also be relevant to its assessment of the environmental effects of the project, including those environmental effects that might adversely impact potential or established Aboriginal or Treaty rights. Relevant information could include but is not limited to:
 - i. impacts on uses of lands and resources by Aboriginal groups;
 - ii. impacts on hunting, marine, riverine and terrestrial harvesting including fishing, gathering and other traditional uses of land (e.g. use of sacred sites) in addition to related effects on lifestyle, culture, health, socio-economic conditions and quality of life of Aboriginal people;
 - iii. alterations to access into areas used by Aboriginal people for traditional uses; and
 - iv. the ability of future generations to pursue traditional activities or lifestyle;
 - c. information about the potential seriousness of potential impacts of the project on the exercise of potential or established Aboriginal or Treaty rights, and information on approaches to assessing the seriousness of the impacts; and
 - d. information presented by participants in the review panel process concerning measures proposed to mitigate and/or avoid any identified adverse impacts on potential or established Aboriginal or Treaty rights and interests.
- 3.10. The Review Panel will provide a summary of the information received in the Review Panel Report.
- 3.11. The Review Panel may use the information received through the review panel process to make recommendations which, if implemented, would avoid or mitigate the environmental effects of the project; including those environmental effects that might adversely impact potential or established Aboriginal or Treaty rights.

4. The Environmental Assessment Process

The Review Panel

- 4.1. Pursuant to section 42 of CEEA 2012, the Minister will appoint as Members of the Review Panel persons who are unbiased and free from any conflict of interest relative to the designated Project and who have knowledge or experience relevant to its anticipated environmental effects.
- 4.2. The Review Panel will consist of at least three Members, including one Chairperson. In the event that a Review Panel Member resigns or is unable to continue to work, the remaining Members shall constitute the Panel unless the Minister determines otherwise. In such circumstances, the Minister may choose to replace the Review Panel Member.
- 4.3. By way of letter from the Chairperson, the Review Panel may request clarification of its Terms of Reference from the President of the Canadian Environmental Assessment Agency (the Agency). Upon receiving such a request, the President is authorized to act on behalf of the Minister to provide the clarification. The President shall use best efforts to provide a response to the Review Panel within 14 calendar days. The Review Panel shall continue with the environmental assessment to the extent possible while waiting for a response in order to comply with the timelines of these Terms of Reference. The Review Panel shall issue a notice to Aboriginal groups, government bodies, the public and other interested parties regarding any clarifications to its Terms of Reference and shall make those clarifications available on the public registry.
- 4.4. By way of letter from the Chairperson, the Review Panel may request an amendment to its Terms of Reference from the Minister. The Minister may delegate authority to the President of the Agency to act on the Minister's behalf in the consideration of and response to a request from the Review Panel for an amendment to the Terms of Reference. The Review Panel shall continue with the environmental assessment to the extent possible while waiting for a response in order to comply with the timelines of these Terms of Reference. The Minister or the President of the Agency, as the case may be, shall use best efforts to provide a response to the request for an amendment to the Terms of Reference within 14 calendar days. The Review Panel shall issue a notice to Aboriginal groups, government bodies, the public and other interested parties regarding any amendments to its Terms of Reference and shall make those amendments available on the public registry.

The Panel Secretariat

- 4.5. The Panel Secretariat will provide administrative, technical, and procedural support as requested by the Review Panel and shall be comprised of staff from the Agency. The Secretariat will report to the Review Panel and will be structured to allow the Panel to conduct its environmental assessment in an efficient and cost-effective manner. Members of the Secretariat shall be free from any real or perceived conflict

of interest, and shall be guided in their work and professional conduct by the *Values and Ethics Code for the Public Service*.

Completeness Review of Environmental Impact Statement (EIS) by the Agency:

- 4.6. The proponent will prepare its EIS in accordance with the EIS Guidelines and submit it to the Agency.
- 4.7. Prior to the establishment of the Review Panel, the Agency will make the EIS available for a review and comment period to receive input on the completeness of the EIS as evaluated against the requirements of the EIS Guidelines and applicable legislation. The Agency will determine if the required information is present and if there is enough information for the Review Panel to commence its sufficiency review of the EIS.
- 4.8. If the Agency determines that the EIS is not complete, it shall request additional information from the proponent. Upon receipt of the additional information, the Agency shall determine if an additional review and comment period is required, and if so, will conduct the additional review and comment period.
- 4.9. The procedures above will apply until such time as the Agency determines that there is enough information for the Review Panel to commence its sufficiency review of the EIS.
- 4.10. When the Agency determines that there is enough information for the Review Panel to commence its sufficiency review of the EIS, the Review Panel will be appointed by the Minister in accordance with the timeline set out in section 4.12.
- 4.11. The Agency review of the EIS for completeness does not affect or predetermine the result of the Review Panel assessment of the sufficiency of the EIS.

The Review Panel Process

- 4.12. The timeline for the establishment of the Review Panel is 150 days (5 months) from the date of the referral of the environmental assessment to Review Panel. This 150-day period does not include time taken by the proponent to submit its EIS or any additional information that is required by the Agency.
- 4.13. The Review Panel shall undertake its mandate in three stages:
 - Stage 1- Sufficiency review of the EIS
 - Stage 2- Conduct a public hearing
 - Stage 3- Prepare and submit a report to the Minister
- 4.14. The Review Panel shall fulfill its mandate and submit its report to the Minister within 430 days (14 months) of the date of establishment of the Review Panel. The 430 days does not include the time period(s) between when the Review Panel may request information from the proponent and receipt of the requested information by the Panel.

Stage 1 - Sufficiency Review of the EIS by the Review Panel

- 4.15. The EIS will be provided by the Agency to the Review Panel upon appointment of the Members. The Review Panel will initiate a comment period of not less than 60 days to allow Aboriginal groups, government bodies, the public, and other interested parties to submit comments to the Review Panel on the sufficiency and technical merit of the EIS.
- 4.16. If the Review Panel determines that the EIS is not sufficient to proceed to a public hearing, it shall request additional information to be provided by the proponent
- 4.17. The Review Panel will allow for the review of and comment on additional information it receives.
- 4.18. The process described above will apply, with any necessary adjustments, until such time as the Review Panel determines it has sufficient information to proceed to a public hearing.
- 4.19. The Review Panel may request specialist or expert information or knowledge with respect to the project from federal or provincial authorities in possession of such information or knowledge.
- 4.20. The Review Panel may retain the services of independent non-government experts to provide advice on certain subjects with respect to the environmental assessment of the project.
- 4.21. The Review Panel shall notify Aboriginal groups, government bodies, the public and other interested parties of the names of experts retained by the Panel, and any documents obtained or created by the experts that are submitted. This shall exclude any information subject to solicitor-client privilege.
- 4.22. The Review Panel may require any expert to appear at the public hearing to address the document(s) they have created or obtained and that were submitted to the Panel and made public in accordance with the preceding paragraphs.

Stage 2 – Public Hearing

- 4.23. Once the Review Panel determines that the EIS contains sufficient information to proceed to a public hearing, it will schedule and announce the public hearing. The Review Panel shall provide a minimum of 45-day notice of the start of the public hearing.
- 4.24. The Review Panel shall issue procedures for the conduct of the public hearing. These procedures will allow for the hearing to be open to Aboriginal groups, government bodies, the public and other interested parties, subject to subsection 45(3) of CEAA 2012, and be conducted in a manner that offers all interested parties an opportunity to participate in the hearing process.
- 4.25. The Review Panel shall, where practicable, hold the public hearing in the area(s) in closest proximity to the project, including Aboriginal communities, to provide convenient access for potentially affected Aboriginal groups and local communities.

- 4.26. The Review Panel shall take into account the timing of traditional activities in Aboriginal and local communities when setting the time and location of the public hearing.

Stage 3 – Review Panel Report

- 4.27. Following the completion of the public hearing, when the Review Panel determines that it has all of the information that it requires, the Panel will close the record for the environmental assessment and shall prepare and submit a report to the Minister.
- 4.28. The report shall include:
- a. the rationale, conclusions and recommendations of the Review Panel on the environmental assessment of the project including any mitigation measures and follow up programs;
 - b. a summary of the report;
 - c. a summary of any comments received including those from Aboriginal groups, government bodies, the public and other interested parties;
 - d. an identification of those conclusions that relate to the environmental effects of the project defined in section 5 of CEAA 2012;
 - e. an identification of recommended mitigation measures and follow up programs that relate to the environmental effects of the project defined in section 5 of CEAA 2012, including, as appropriate, any commitments identified by the proponent in the EIS or during the review panel process; and
 - f. a summary of the information received by participants as set out in section 3.10 above.
- 4.29. If, taking into account the implementation of any mitigation measures, the Review Panel concludes that the project is likely to cause significant adverse environmental effects, the Panel may include in its report information that it has received with respect to whether those significant adverse environmental effects are justified in the circumstances.
- 4.30. The report shall reflect the views of each member of the Review Panel.
- 4.31. The Review Panel must consider any requests made by Aboriginal groups to have the report summary translated into their Aboriginal language(s). If the Review Panel agrees with such a request, it must recommend to the Agency that such translations be provided by the Agency in a timely manner.
- 4.32. The Review Panel will submit its report to the Minister at the earliest possible date and within the overall time limit established by the Minister for the three stages of the Panel's mandate.
- 4.33. Upon receiving the report submitted by the Review Panel, the Minister will advise Aboriginal groups, government bodies, the public and other interested parties that the report is available.
- 4.34. In accordance with subsection 43 (1)(f) of CEAA 2012, the Review Panel may be required to clarify any of the conclusions and recommendations set out in its report with respect to the environmental assessment.

5. Government of the Province of British Columbia

- 5.1. The Roberts Bank Terminal 2 Project constitutes a reviewable project pursuant to Part 8 of British Columbia's *Reviewable Projects Regulation*. The order pursuant to section 14 of the British Columbia *Environmental Assessment Act*, issued on December 19, 2014 by the provincial Minister of Environment, describes the provincial environmental assessment of the proposed Project.
- 5.2. The factors to be considered in the provincial environmental assessment include the factors described in Part 2 of these Terms of Reference.
- 5.3. Subject to subsections 45(3), (4) and (5) of CEEA 2012, all information received by the Review Panel will be available to British Columbia. To the extent possible, British Columbia intends to rely on the information produced in the federal review panel process for the provincial environmental assessment. British Columbia intends to actively participate in the review panel process.

6. Record of the Environmental Assessment

- 6.1. From the appointment of the Review Panel to the submission of the Review Panel Report, a public registry will be maintained by the Panel Secretariat in a manner that provides for convenient public access, and that complies with sections 79 to 81 of CEEA 2012.
- 6.2. Subject to subsections 45(3), (4) and (5) and 79(3) of CEEA 2012, the public registry will include all records produced, collected or submitted relating to the

Appendix C: List of Appearances at the Public Hearing

A

Adams, Ruth
Tsawwassen First Nation

Ahlm, Louise
Tsawwassen First Nation

Alcorn, Alan
Moffat and Nichol Consultants

Anderson, Gillian
BC Great Blue Heron Society

Armstrong, Brad
Vancouver Fraser Port Authority

Asher, Rodney

B

Bains, Tyler
Commercial Real Estate Services
Canada

Baird, Ken
Tsawwassen First Nation

Baird, Laura
Tsawwassen First Nation

Baird, Mike
Tsawwassen First Nation

Baird, Patricia

Balke, Eric
British Columbia Ministry of Forests,
Lands, Natural Resource Operations
and Rural Development

Bates, Jack
Delta Farmers Institute

Baxter, Dan
BC Chamber of Commerce

Baxter, Sean
Vancouver Fraser Port Authority

Beckman, Leslie
Tsawwassen First Nation

Belless, Armene

Beninger, Peter
BC Nature

Bishop, Erin
Vancouver Fraser Port Authority

Bisset, Ben
Tsawwassen First Nation

Bocking, Robert
LGL Limited

Bodman, Cynthia

Boisvert, Jason
Canadian Environmental Assessment
Agency

Bourque, Sandra
VAPOR

Boyd, Sean
Environment and Climate Change
Canada

Bright, Doug
Hemmera

Broad, Michael
Shipping Federation of Canada

Brouwer, Robert

Brown, Carrie
Vancouver Fraser Port Authority

Brown, Keith
T'Sou-ke Nation

Brown, Stephen
Vancouver Fraser Port Authority

Buffum, Stephanie
Friends of the San Juans

Bundy, Alida
Fisheries and Oceans Canada

Burns, Christopher
LGL Limited

Buzzoni, Guy
Global Container Terminals Inc.

C

Casey, James
Bird Studies Canada

Cassidy, John
Natural Resources Canada

Cassidy, Laura
Tsawwassen First Nation

Challenger, Wendell
LGL Limited

Chappell, Harley
Semiahmoo First Nation

Charles, Gordon
Scia'new (Beecher Bay) First Nation

Chipps, Russell
Scia'new (Beecher Bay) First Nation

Cho, Michael
Vancouver Fraser Port Authority

Clark, Colleen
Greater Langley Chamber of
Commerce

Clarke, John
Natural Resources Canada

Clements, James
Canadian Pacific Railway Ltd.

Colero, Lawrence

Cootes, Charlie
First Nations of the Maa-nulth Treaty
Society

Cumming, Katherine
Parks Canada

Curtis, Dan
Fisheries and Oceans Canada

D

David, Rebecca
Pauquachin First Nation

Dekovic, Marko
Global Container Terminals Inc.

Demarchi, Mike
LGL Limited

den Dikken, Anita

Doran, Tom
International Longshore & Warehouse
Union Local 502

Dornhelm, Richard
Vancouver Fraser Port Authority

Doucette, Paula
Transport Canada

Douglas, Keith
Resource Works

Drever, Mark
Environment and Climate Change
Canada

Drew, Teresa
RWDI

Dubord, Neil
Delta Police Department

Duke, Laura
Vancouver Fraser Port Authority

E

Edgar, Aaron
Ditidaht First Nation

Ehrlichman, Tom
Swinomish Tribe

Elnor, Bob
Environment and Climate Change
Canada

Emsley, Roger
Against Port Expansion

Engelsjord, Mike
Fisheries and Oceans Canada

Evans, Peter
Pauquachin First Nation

F

Faszer, Andrew
Golder Associates

Flanagan, Jason
Transport Canada

Flindt, Kyle
Tsawwassen First Nation

Forsman, Leonard
Suquamish Tribe

G

George, Michelle
Tsleil-Waututh Nation

George, William
Lummi Nation

Gobin, Glen
Tulalip Tribes

Gobin, Teri
Tulalip Tribes

Grant, Wade
Musqueam Indian Band

Grant-John, Wendy
Musqueam Indian Band

Greer, Ryan
Canadian Chamber of Commerce

Grosman, Doron
Global Container Terminals Inc.

Guerin, Morgan
Musqueam Indian Band

H

Haines, Darren
First Nations of the Maa-nulth Treaty Society, Pauquachin First Nation, Scia'new (Beecher Bay) First Nation

Haley, Ron
Hemmera

Hammond, Blair
Environment and Climate Change Canada

Hanson, George
Vancouver Island Economic Alliance

Harlos, Erin
Vancouver Fraser Port Authority

Harris, Ray
Stz'uminus First Nation

Harrison, Darryl
Golder Associates

Harvie, George
City of Delta

Hatziantoniou, Yota
Health Canada

Henderson, Michael
Greater Vancouver Gateway Council

Heryet, Trevor
Transport Canada

Hill, Philip
Natural Resources Canada

Hindmarch, Sofi
Bird Studies Canada

Hornbrook, Jim
Hwlitsum First Nation

Howe, Kyle
Metro Vancouver

Hrebenyk, Bohdan
Hemmera

Huberman, Anita
Surrey Board of Trade

J

Jackson, Corey
Fisheries and Oceans Canada

James, Josh
Penelakut Tribe

James, Owen
Boundary Bay Conservation Committee

James, Thomas
Natural Resources Canada

James, William
Lummi Nation

Jardine, Catherine
Bird Studies Canada

Jay, Sharon
Scia'new (Beecher Bay) First Nation

Jennejohn, Derek
Metro Vancouver

Jilesen, Monique
Global Container Terminals Inc.

Johnson, Larry
First Nations of the Maa-nulth Treaty Society

Jones, David
Fraser Voices

Jones, Helen
Pacheedaht First Nation

Jones, Jeff
Pacheedaht First Nation

Jones, Roxy
Pacheedaht First Nation

Jones, Susan
Boundary Bay Conservation Committee

Jones, Teresa

Jones, Trevor

Joseph, Robert
Ditidaht First Nation

Jourdenais, Marc
Canadian Coast Guard

K

Kaminski, Greg
Health Canada

Karaloff, Kevin
Vancouver Fraser Port Authority

Karpouzi, Vasiliki
Hemmera

Kenny, Caitlin
Halalt First Nation

Kiselbach, Jason
Commercial Real Estate Services
Canada

Kolvyn, Moneca

Kryzanowski, Kelli
British Columbia Ministry of
Environment and Climate Change
Strategy

Kyle, Roseanne
Pacheedaht First Nation

L

Lachmuth, Cara
British Columbia Ministry of Health

Lacroix, Deb
Ecofish Research

Lakhani, Snehal
Environment and Climate Change
Canada

Lambert, Tim
British Columbia Ministry of Health

Langer, Otto
VAPOR

La Rusic, Adam
Environment and Climate Change
Canada

Larkin, Kelly
Transport Canada

Lauria, Mary Lou
Worley Parsons

Lawrence, Nigel
Suquamish Tribe

Lekanoff, Debra
Swinomish Tribe

Leonard, James
Mercator International

Lewis-Manning, Robert
Chamber of Shipping

Litwin, Val
BC Chamber of Commerce

Luckham, Peter
Islands Trust Council

Luschiim, Charlie
Cowichan Tribes

Lyrette, Ninon
Health Canada

M

MacDuffee, Misty
Raincoast Conservation Foundation

MacGillivray, Alex
Jasco Applied Sciences

Magnan, Al
Fisheries and Oceans Canada

Marmorek, David
ESSA Technologies

Massey, Douglas George

McCandless, Robert

McCann, Timothy
Canadian Coast Guard

McCrystal, Zoe
Hwilitsum First Nation

McDonald, Mark
Delta Ladner Rod and Gun Club

McDougall, Rick
Vancouver Fraser Port Authority

McEwan, Tim
Independent Contractors and Business
Association of British Columbia

McGill, Sean
City of Delta

McKenna, Kevin
Pacheedaht First Nation

McNulty, Sean
Vancouver Fraser Port Authority

Meier, Sonya
Hemmera

Michaud, David
Health Canada

Miller, Peter
Pacheedaht First Nation

Millette, Bernice
Scia'new (Beecher Bay) First Nation

Modeste, Mildred
Esquimalt Nation

Moore, Colin
HEC

Moore, James
Canada China Business Council

Morash, Marcia
Parks Canada

Morin, Jesse
Tsleil-Waututh Nation

Morris, Raynell
Lummi Nation

Moseley, Scott
Canadian Coast Guard

Murdoch, Philip
Canadian Coast Guard

Murray, Anne
Delta Naturalists Society

Mussatto, Darrell

N

Neale, Tina
British Columbia Ministry of
Environment and Climate Change
Strategy

Neary, Kevin
Pacheedaht First Nation

Neilson, John
Comox Valley Nature

Northrup, Scott
Hemmera

O

Ogston, Lindsey
Tsleil-Waututh Nation

O'Hara, Pamela
Vancouver Fraser Port Authority

Olivier, Sarah
Canadian Environmental Assessment
Agency

Osicki, Aaron
Parks Canada

P

Palmer, Charlie
Hemmera

Paulsen, Don

Peacock, Ken
Business Council of British Columbia

Pearson, Kristine
Pacheedaht First Nation

Pelletier, Luc
Health Canada

Pelton, Jeff
Transport Canada

Perry, Ian
Fisheries and Oceans Canada

Pitcairn, Matt
Richmond Chamber of Commerce

Planes, Gordon
T'Sou-ke Nation

Pratt, Lovel
Friends of the San Juans

Q

Quigley, Jason
Vancouver Fraser Port Authority

R

Ray, Derek
Northwest Hydraulic Consultants

Reader, Brian
Parks Canada

Rear, Scott
Canadian Coast Guard

Richardson, Tessa
Fisheries and Oceans Canada

Roberge, Chantal
Health Canada

Robinson, Andrew
Environment and Climate Change
Canada

Robinson, Orla
Vancouver Fraser Port Authority

Ronback, James

Rourke, James
Hemmera

Ruffo, Gord
Vancouver Fraser Port Authority

Russo, Kurt
Lummi Nation

S

Sanders, Michelle
Transport Canada

Sauder, Ruth
Scia'new (Beecher Bay) First Nation

Scott, David
Raincoast Conservation Foundation

Scott, Kelly
B.C. Road Builders and Heavy
Construction Association

Scott, Roxanne
Golder Associates

Seymour, William
Cowichan Tribes

Shandro, Janis
Arrowsmith Gold

Shearer, Garry
Delta Chamber of Commerce

Sigo, David
Suquamish Tribe

Sigo, Robin Little Wing
Suquamish Tribe

Silver, Dalton
Sumas First Nation

Singh, Sharon
Global Container Terminals Inc.

Skabar, Kip
Stantec Consulting

Smith, Trefor
Musqueam Indian Band

Solomon, Lawrence
Lummi Nation

Solomon, Richard
Lummi Nation

Sparkes, Marilyn-Louise

Sparrow, Wayne
Musqueam Indian Band

Splokton, Terry
Tsawwassen First Nation

Sport, Kelly
Ditidaht First Nation

Stark, Steven
Tsawwassen First Nation

Steele, Jessica
Tsleil-Waututh Nation

Stewart, Cliff
Vancouver Fraser Port Authority

T

Taitt, Mary
Boundary Bay Conservation
Committee

Tate, Darryl
Ditidaht First Nation

Taylor, Addie
Scia'new (Beecher Bay) First Nation

Thibault, Harvey

Thomas, Richard (Pahalicktun)
Lyackson First Nation

Thomas, Robert
Esquimalt Nation

Thomas, Shannon
Lyackson First Nation

Thompson, Jack
Ditidaht First Nation

Thomson-Leach, Erin
Ditidaht First Nation

Thornton, Sheila
Fisheries and Oceans Canada

Toews, Scott
Hemmera

Tollit, Dominic
SMRU Consulting

Tretheway, Mike
InterVISTAS

Trounce, Krista
Vancouver Fraser Port Authority

U

Underwood, Lorne
Tsawout First Nation
Uthayakuma, Uthaya
Vancouver Fraser Port Authority

V

Vagle, Svein
Fisheries and Oceans Canada
van der Velden, Peter
van Hemmen, David
Greater Vancouver Board of Trade
Veirs, Scott
Ecojustice
Venton, Margot
Ecojustice

W

Walker, Melanie
Tsleil-Waututh Nation
Wells, Katelyn
Environment and Climate Change
Canada
Williams, Merle
Tsawwassen First Nation
Williams, Victoria
Tsawwassen First Nation
Wilson, Duncan
Vancouver Fraser Port Authority
Wilson, John
Transport Canada
Winterbottom, Marina
Hemmera
Wong, Nicholas
Wood, Jason
SMRU Consulting
World, Susan
Wright, Nicole
Ecofish Research

Y

Yabsley, Gary
Esquimalt Nation, First Nations of the
Maa-nulth Treaty Society, Pauquachin
First Nation
Yacysheh, Tom
British Columbia Ministry of Forests,
Lands, Natural Resource Operations
and Rural Development
Ydenberg, Ron
Simon Fraser University
Yurk, Harald
Fisheries and Oceans Canada

Appendix D: Current Use Criteria Tables

Table 1: Criteria table for assessing, with respect to Indigenous peoples, an effect occurring in Canada of any change that may be caused to the environment on the current use of lands and resources for traditional purposes.

Magnitude	Spatial Extent	Duration	Frequency	Reversibility	Ecological and cultural context
<p>Definition: Magnitude refers to the amount of change in a measurable parameter relative to existing conditions or other standards, guidelines or objectives.</p> <p>For current use this will include changes to key indicators (e.g. resources, access, and experience).</p>	<p>Definition: Spatial area over which the effect on the current use of lands and resources for traditional purposes is predicted to occur.</p>	<p>Definition: Length of time that an effect is experienced, from the community perspective.</p> <p>Effects that occur at only certain times of year may be experienced as ongoing, if they take place on a weekly, monthly or annual basis. They can also be permanent or short, medium or long term.</p>	<p>Definition: How often disruptions to the practice of current use of lands and resources may occur, on a continuous basis or during relevant seasons.</p>	<p>Definition: A reversible environmental effect is one where the VC is expected to recover from the environmental effects caused by the project. For current use, this would correspond to a return to existing conditions of both the resource and customs and traditions associated with the resource.</p> <p>*Note: Reversibility does not include the potential to move the practice of current use of lands and resources to another jurisdiction or area.</p>	<p>Definition: Effects to ecosystems that support a community’s culture and cultural health, its practices, customs and traditions.</p> <p>Prospect of disruption to preferred ways of continuing customs, traditions and practices. Culture may be linked to culturally important landscapes, species and determinants of community health identified by the affected community.</p> <p>Consideration of the interruption of the intergenerational transfer of knowledge to future generations.</p>
<p>Low: a slight, but detectable effect resulting in a small</p>	<p>Small: The potential effect on current use of lands and resources</p>	<p>Temporary (equal or less than 6 years): The potential effect</p>	<p>Sporadic: The effect would be confined to occasional periods, limited to the life of the Project.</p>	<p>Reversible: The effect may be reversed in the short term (<i>i.e.</i> a few years).</p>	<p>Little indication that there would be any potential effect on traditional resources or the ecosystem used by</p>

Magnitude	Spatial Extent	Duration	Frequency	Reversibility	Ecological and cultural context
change to current use of lands and resources for traditional purposes and associated indicators.	for traditional purposes could occur over a small portion of the area presently used.	on current use of lands and resources for traditional purposes equals or lasts less than 6 years (i.e., approximate duration of construction phase).			<p>the affected group. Small reduction in value of culturally important harvesting locations or ability of group to obtain quality and quantity of resources. The effect allows intergenerational transfer of knowledge and practice current use of lands and resources for traditional purposes to continue into the future.</p> <p>Population sub-groups (such as elders, children, youth, women, specific families and/or households) are likely to experience effects from the Project but are likely to maintain the ability to practice current use of lands and resources for traditional purposes.</p>
Moderate: a detectable effect to current use of lands and resources for traditional purposes and associated indicators.	Moderate: The potential effect on current use of lands and resources for traditional purposes could occur over a moderate portion of	Long Term: The potential effect on current use of lands and resources for traditional purposes will be ongoing but will not last beyond one generation.	Intermittent: The effect is likely to be intermittent or occur on a repeated basis throughout the operation and after the end of the Project	Partly Reversible: The potential effect on current use of lands and resources for traditional purposes is likely to be reversed within one generation.	<p>A potential effect on current use is unlikely to extend to preferred areas, preferred or scarce resources or to ecosystems of high value to the affected community.</p> <p>The effect may impede or alter access to practice harvesting activities but without limiting</p>

Magnitude	Spatial Extent	Duration	Frequency	Reversibility	Ecological and cultural context
	the area presently used.				<p>connection to an area or sense of place. There may be some loss of habitat or availability of culturally important resources. The disturbance may be of a physical or sensory nature (noise, visual quality, etc.).</p> <p>Transfer of knowledge between generations may be interrupted for a moderate period of time by the Project, however practices may be resumed broadly within one generation.</p> <p>Population sub-groups are likely to experience an increased effect on the ability to practice current use of lands and resources for traditional purposes. One or more population sub-groups may be disproportionately affected by the Project.</p>
<p>High: A detectable effect that is expected to substantially alter current use of lands</p>	<p>Extensive: The potential effect on current use of lands and resources for traditional purposes</p>	<p>Permanent: The potential effect on current use of lands and resources for traditional purposes</p>	<p>Continuous: The effect to current use of lands for traditional purposes would occur constantly during, and potentially beyond, the economic life of the</p>	<p>Irreversible: The potential effect on current use of lands and resources for traditional purposes is unlikely to be reversed,</p>	<p>The potential effect on current use of lands and resources for traditional purposes is likely to cause an interference with the preferred manner of practice or a</p>

Magnitude	Spatial Extent	Duration	Frequency	Reversibility	Ecological and cultural context
<p>and resources and associated indicators.</p>	<p>could occur over an extensive portion or the entire area presently used.</p>	<p>will last beyond one generation or be permanent.</p>	<p>Project. “Constantly” can mean either that a project activity interacts with the current use of lands and resources for traditional purposes on an uninterrupted basis or on a sporadic but repeated basis that may coincide with traditional activities that take place at certain intervals or seasons.</p>	<p>either in whole or in part, because the effect is likely to persist beyond one generation.</p>	<p>preferred area, including limited use of, or access to, preferred quality and quantity of resources. Multiple effects could occur to one area of high importance. The Project may cause effects on a species that is culturally important, that has limited availability or high sensitivity to change or that is also a federally or provincially listed species at risk.</p> <p>Access to practice harvesting or other cultural activities would likely be disrupted, limited or eliminated.</p> <p>Disturbance may be of a spiritual, cultural, social, physical or sensory nature (noise, visual quality, etc.).</p> <p>Intergenerational transfer of knowledge would be interrupted for an extended time period and may not be reversed either in whole or part.</p> <p>One or more population sub-groups will be disproportionately affected by the Project. Mitigation measures are unlikely to preserve the ability</p>

Magnitude	Spatial Extent	Duration	Frequency	Reversibility	Ecological and cultural context
					of these groups, or the community as a whole, to continue to practice the current use of lands and resources for traditional purposes in a preferred manner.

Table 2: Criteria for determining the likelihood of any predicted residual adverse effect or cumulative effect that is deemed to be significant.

Likelihood
<p>Definition: Prospect of an effect on current use of lands occurring that is based on information from technical and community-based experts, including those most likely to be affected. The full lifecycle of a project’s effects, including its various stages and lifespan, would be considered in determining the likelihood of occurrence of an effect. Likelihood refers to more than just the probability of environmental effects, and also includes the consequences, such as the prospect of diminishment of sense of place, confidence in the quality and quantity of resources, and experience.</p>
<p>Low. A potential effect on current use of lands and resources for traditional purposes is unlikely but could occur.</p>
<p>Moderate. A potential effect on current use of lands and resources for traditional purposes is likely but may not occur.</p>
<p>High. A potential effect on current use of lands and resources for traditional purposes is highly likely or certain to occur.</p>

Table 3: Criteria table for assessing cumulative effects, with respect to Indigenous peoples, of any change that may be caused to the environment on the current use of lands and resources for traditional purposes.

Magnitude	Spatial Extent	Duration	Frequency	Reversibility	Ecological and cultural context
<p>Definition: Magnitude refers to the amount of change in a measurable parameter relative to baseline conditions or other standards, guidelines or objectives resulting from the effects of past, existing and future projects or activities.</p> <p>Cumulative effects may have a regional or historic context and may extend to aspects of current use of lands and resources related to socio-economics, health and other matter tied to an Indigenous community’s history and connection to the landscape.</p> <p>For current use this will include changes to key indicators (e.g. resources, access, and experience).</p>	<p>Definition: Spatial area over which the effect of the Project, in combination with other past, present, and future physical activities on the current use of lands and resources for traditional purposes is predicted to occur.</p>	<p>Definition: Length of time that an effect is experienced as a result of the Project in combination with other past, present, and future physical activities.</p>	<p>Definition: How often disruptions to the practice of current use of lands and resources may occur as a result of the Project in combination with other past, present, and future physical activities.</p> <p>This is considered from the community perspective. For example, effects that occur at only certain times of year may be experienced as ongoing if they take place on a weekly, monthly or annual basis.</p>	<p>Definition: A reversible environmental effect is one where the VC is expected to recover from the environmental effects caused by the project in combination with other past, present, and future physical activities. For current use, this would correspond to a return to existing conditions of both the resource and landscape and the practices, customs and traditions with the landscape or resource, within the temporal boundaries defined by the Panel.</p> <p>*Note: Reversibility does not include the potential to move the practice of current use of lands and resources to another jurisdiction or area.</p>	<p>Definition: Effects to ecosystem that supports a community’s culture and cultural health, well-being, including its harvesting practices, customs and traditions.</p> <p>Prospect of disruption to preferred ways of continuing customs, traditions and practices. Culture may be linked to preferred landscapes, species and determinants of community health identified by the affected community.</p> <p>Consideration to be given to the interruption of the intergenerational transfer of knowledge to future generations.</p>

Magnitude	Spatial Extent	Duration	Frequency	Reversibility	Ecological and cultural context
<p>Low: There is little development in the community’s territory that has created restraints on the potential effect on current use of lands and resources for traditional purposes and the Project or activity would be in an area with few existing impacts.</p> <p>The Project may contribute to further cumulative effects.</p>	<p>Small: The potential cumulative effect on current use of lands and resources for traditional purposes could occur over a small portion of the area presently used.</p>	<p>Temporary: The potential cumulative effect on current use of lands and resources for traditional purposes lasts 6 years or less (i.e., approximate duration of construction phase).</p>	<p>Sporadic: The potential cumulative effect would be confined to occasional periods during the life of the Project.</p>	<p>Reversible: The cumulative effect may be reversed in the short term.</p>	<p>Little indication that there would be any potential cumulative effect on traditional resources or ecosystems that support cultural practices of the affected group. Little to no reduction in value of culturally important harvesting locations or ability of group to obtain quality and quantity of resources.</p> <p>Any cumulative effect allows the intergenerational transfer of knowledge and practice current use of lands and resources for traditional purposes to continue into the future.</p>
<p>Moderate: There are other land uses, including proposed or existing projects, in the community’s territory that affect current use of lands and resources for traditional purposes.</p> <p>The Project could contribute to further cumulative effects.</p>	<p>Moderate: The potential cumulative effect on current use of lands and resources for traditional purposes could occur over a moderate portion of</p>	<p>Long Term: The potential cumulative effect on current use of lands and resources for traditional purposes will be ongoing but not last beyond one generation.</p>	<p>Intermittent: The cumulative effect is likely to be intermittent or occur on a repeated basis throughout the operation and decommissioning of the Project.</p>	<p>Partly Reversible: The potential cumulative effect on current use of lands and resources for traditional purposes is likely to be reversed within one generation.</p>	<p>The potential cumulative effect on current use of lands and resources for traditional purposes is unlikely to extend to preferred areas, preferred or scarce resources or to ecosystem or cultural practices of high value to the affected community. The cumulative effect may impede or alter access to practice harvesting activities but without limiting connection to an</p>

Magnitude	Spatial Extent	Duration	Frequency	Reversibility	Ecological and cultural context
	<p>the area presently used.</p>				<p>area or sense of place. There may be some loss of habitat or availability of culturally important species. The disturbance may be of a spiritual, cultural, physical or sensory nature (noise, visual quality, etc.).</p> <p>Transfer of knowledge between generations may be interrupted for a moderate period of time as a result of the cumulative effect, however practices may be resumed broadly within one generation.</p>
<p>High: There are multiple other land uses, including proposed or existing projects, which affect the community’s current use of lands and resources for traditional purposes. The Project may interact with the current use of lands and resources for traditional purposes in an area highly valued given the cumulative context. The traditional activities which may be affected by the Project are not</p>	<p>Extensive: The potential cumulative effect on current use of lands and resources for traditional purposes could occur over an extensive portion of the area presently used, or the entire area.</p>	<p>Permanent: The potential cumulative effect on current use of lands and resources for traditional purposes will last beyond one generation or be permanent.</p>	<p>Continuous: The potential cumulative effect would occur constantly during, and potentially beyond, the economic life of the Project. “Continuous” can mean either that a project activity interacts with the current use of lands and resources for traditional purposes on an uninterrupted basis or on a sporadic but</p>	<p>Irreversible: The potential cumulative effect on current use of lands and resources for traditional purposes is unlikely to be reversed, either in whole or in part, because the cumulative effect is likely to persist beyond one generation.</p>	<p>The potential cumulative effect on current use of lands and resources for traditional purposes is likely to cause an interference with the preferred manner of practice or a preferred area, including limited use of, or access to, preferred quality and quantity of resources and/or limitations on scarce, or high, community valued areas. Multiple cumulative effects could occur to one area of high importance.</p>

Magnitude	Spatial Extent	Duration	Frequency	Reversibility	Ecological and cultural context
<p>currently practiced in the preferred manner because of conservation issues, lack of access, or government policy/programs.</p> <p>The Project will contribute to further cumulative effects.</p>			<p>repeated basis that may coincide with traditional activities that take place at certain intervals or seasons.</p>		<p>Access to harvesting and other cultural activities would likely be disrupted or limited as a result of the cumulative effects of past, existing and future projects or activities or would require displacement of practice to another area.</p> <p>Disturbance as a result of the cumulative effect may be of a spiritual, cultural, social, physical or sensory nature (noise, visual quality, etc.).</p> <p>Intergenerational transfer of knowledge would be interrupted for an extended time period as a result of the cumulative effect and may not be reversed either in whole or part.</p>

Appendix E: Indigenous Summaries

This Appendix provides an overview of background information contained on the public registry for the Indigenous groups assessed during the environmental assessment.

Tsawwassen First Nation

Traditional Territory

Tsawwassen is a hun'qum'i'num word that means "Land Facing the Sea". The Tsawwassen First Nation's home and Treaty lands are situated near Roberts Bank on the shore of the Salish Sea. The Tsawwassen First Nation community is located adjacent to Roberts Bank, spanning the shoreline from southwest of the BC Ferries Tsawwassen Terminal to north of the Roberts Bank causeway in Tsawwassen community, British Columbia. There is a population of 190 members living on Tsawwassen First Nation Lands.

Historically, Tsawwassen First Nation's traditional territory encompassed lands and waters throughout the Fraser River delta, extending south to the Point Roberts peninsula, southwest and west to the Gulf Islands, and northeast to the Pitt River and Pitt Lake area. The Tsawwassen First Nation have lived in their territory sustaining themselves and their way of life for thousands of years. The Tsawwassen First Nation stated that there has always been a fundamental connection between their members and the lands, waters, and resources of their territory.

Rights

The Tsawwassen First Nation exercise treaty rights in the proposed Project area, established through the Tsawwassen First Nation Final Agreement, signed in 2009. The Tsawwassen First Nation Final Agreement establishes the Tsawwassen First Nation Lands, which is a land base of 662 ha that is owned by and under the jurisdiction of the Nation. In addition, Tsawwassen First Nation has jurisdiction to enact laws in a number of areas, including land management, over Tsawwassen First Nation Lands. Other Tsawwassen First Nation Lands consist of an additional 62 ha (referred to as the Boundary Bay and Fraser River parcels) that remain under the jurisdiction of the Corporation of Delta.

The Tsawwassen First Nation Final Agreement also establishes harvesting areas:

- Tsawwassen Fishing Area (fully overlaps the LAAs for applicable marine resources);
- Tsawwassen Intertidal Bivalve Fishing Area (lies within the marine shipping area); and
- Tsawwassen Wildlife and Migratory Bird Harvesting Area (southern portion overlaps the marine shipping area).

The Tsawwassen First Nation has rights to fish, harvest and gather renewable resources in defined areas. They also have the right to practice the Tsawwassen First Nation's culture. Allocated species include salmon (sockeye, chum, pink, chinook and coho), and non-allocated species include crab and other fish or aquatic plants. The Tsawwassen First Nation is charting a

new path for the Nation based on self-determination, community health and well-being and prosperity.

The Tsawwassen First Nation does not distinguish between historical and contemporary uses of lands and resources for traditional purposes and that they understand current use to be a contemporary expression of activities that have been carried out for thousands of years.

Musqueam First Nation

Traditional Territory

The Musqueam First Nation have approximately 1,383 members and three reserves located within the greater Vancouver area, British Columbia. Their main community is located in south Vancouver, approximately 23 kilometres from the Project area.

Musqueam Indian Band's identity is closely linked to the Fraser River. The name, Musqueam, or *məθkʷəy*, translates to "People of the River Grass", signifying the grasses that grow throughout the Fraser River delta and tidal flats. Traditionally, the distribution and sharing of food and goods was an important part of Musqueam resource use, allowing access to an even wider range of foods and materials. The Musqueam First Nation defined their traditional territory as the "lands, lakes and streams defined and included by a line commencing at Harvey Creek in Howe Sound and proceeding Eastward to the height of land and continuing on the height of land around the entire watershed draining into English Bay, Burrard Inlet and Indian Arm; South along the height of land between Coquitlam River and Brunette River to the Fraser River, across to the South or left bank of the Fraser River and proceeding downstream taking in the left bank of the main stream and the South Arm to the sea, including all those intervening lands, islands and waters back along the sea shore to Harvey Creek, and the sea, its reefs, flats, tidal lands and islands adjacent to the above described land and out to the center of Georgia Strait..."

The Musqueam First Nation are part of the Coast Salish linguistic group and speak the downriver dialect of Halkomelem.

Rights

The Musqueam First Nation have an established right to fish for food, social, and ceremonial purposes in Canoe Passage as per the *R. vs. Sparrow* Supreme Court decision in 1990. The Musqueam First Nation also assert an Aboriginal right to fish for food, social, and ceremonial purposes over a broader area. A Comprehensive Fisheries Agreement between the Musqueam First Nation and the federal government, in place since 2001, acknowledges Musqueam marine harvesting throughout a wide area, including Roberts Bank and portions of the Salish Sea. The Musqueam First Nation are currently involved in Treaty negotiations. No Agreement-in-Principle has been agreed-to yet.

At the time of contact, the Musqueam First Nation had rights over salmon harvesting and other resource-harvesting areas in the Lower Fraser River and certain protocols existed that regulated access to these areas based on kinship and inter-village ties. Protocols that determine access

rights continue today and other First Nations seeking access to waterways and resources in Musqueam's territory must apply through the Musqueam Fisheries Department.

Musqueam identified the following asserted rights and related interests in relation to the Project area:

- Harvesting marine resources (fish, invertebrates, mammals);
- Harvesting aquatic and terrestrial plants and berries;
- Hunting (wildlife and birds);
- Use of harvesting areas;
- Use of trails and travelways;
- Use of sacred areas; and
- Cultural transmission.

Semiahmoo First Nation

Traditional Territory

The Semiahmoo First Nation community is located southeast of White Rock, British Columbia approximately 29.5 kilometres from the Project area. As of June 2014, the registered population of the Semiahmoo First Nation was 89 members. The Semiahmoo First Nation has one reserve (Semiahmoo) comprising 129.1 ha of land southeast of White Rock.

The Semiahmoo First Nation's asserted traditional territory extends to the north shore of the Lower Fraser River, the southern Gulf Islands and northern San Juan Islands, as well as the northwestern portion of Washington State, USA. The Semiahmoo First Nation identified traditional village sites at Point Roberts and Cannery Point and deep connections to Semiahmoo Bay, Boundary Bay, and the Salish Sea.

The Semiahmoo First Nation described their historic reef net as "an integral piece of not only our communities but our interconnectedness to other First Nations." The Semiahmoo First Nation do not presently use reef nets but stated that they were interested in teaching their youth and elders how to fish with reef nets to help understand who they are.

The Semiahmoo are part of the Coast Salish linguistic group and speak the dialect SENĆOŦEN.

Rights

The Semiahmoo First Nation stated that they hold Aboriginal rights and title throughout their traditional territory, including the following asserted rights and related interests in relation to the Project area:

- Hunting;
- Fishing;
- Cultural and spiritual practices; and
- Access rights to the Salmon River and Kanaka Creek.

The Semiahmoo First Nation stated that they have exclusive Aboriginal rights and title to Semiahmoo Bay and Point Roberts. Semiahmoo were the traditional keepers, caretakers or protectors of the reef net sites at Point Roberts. The Semiahmoo First Nation is not involved in treaty negotiations.

Tsleil-Waututh Nation

Traditional Territory

The Tsleil-Waututh Nation's asserted traditional territory extends approximately from the vicinity of Mount Garibaldi in the north, south to the 49th parallel and beyond, west towards Gibsons, and east toward Coquitlam Lake, British Columbia.

The Tsleil-Waututh Nation has three reserves comprising 110.7 ha of land: one on the north shore of Burrard Inlet, and two located near the head of Indian Arm. The registered population of the Tsleil-Waututh Nation is approximately 560 members.

The Tsleil-Waututh people are Coast Salish and speak a dialect of Halkomelem called Hun'qumyi'num.

Rights

The Tsleil-Waututh Nation have asserted rights to harvest marine and aquatic resources (including invertebrates, fish, mammals, and plants), as well as terrestrial plants and berries. The Tsleil-Waututh Nation also have asserted rights to hunt wildlife and birds, and to use trails, travelways and sacred areas.

The Tsleil-Waututh Nation is involved in treaty negotiations and are negotiating an Agreement-in-Principle. The Tsleil-Waututh Nation requested that the Statement of Intent for treaty negotiations not be referred to with respect to the Project, as it was not relevant.

Stz'uminus First Nation

Traditional Territory

The Stz'uminus First Nation has four reserves on Vancouver Island, near Chemainus and Ladysmith. Their traditional territory extends north in the Strait of Georgia, across to the mainland, up the Fraser River, and south along the southern coast of Vancouver Island, British Columbia. The population of the Stz'uminus First Nation is approximately 1,350 members.

The Stz'uminus First Nation are part of the Coast Salish, Hul'qumi'num-speaking linguistic group and are represented by the Cowichan Nation Alliance on matters outside of treaty negotiations. The members of the Cowichan Nation Alliance are the Cowichan Tribes, the Halalt First Nation, the Penelakut Tribe, and the Stz'uminus First Nation.

Rights

The Stz'uminus First Nation identified the following asserted rights within their traditional territory and in relation to the Project area and the marine shipping area:

- Harvesting marine resources (fish, invertebrates, mammals, and vegetation);
- Harvesting coastal birds and ducks;
- Use of marine travelways for food, social and ceremonial purposes; and
- Traditional lands and waters in area of Tl'uqtinus (traditional village site on the south shore of Lulu Island along the Fraser River).

The Cowichan Nation Alliance made a declaration of Aboriginal Title to the Tl'uqtinus Lands on Lulu Island and of Aboriginal fishing rights to the South Arm of the Fraser River.

Cowichan Tribes*Traditional Territory*

Cowichan Tribes is the largest Indian Act Band in British Columbia with over 5,000 registered members. The Cowichan Tribes have nine reserves on southeast Vancouver Island, British Columbia. Their traditional territory includes the surrounding region around Cowichan and Shawnigan Lakes, extends north in the Strait of Georgia, across to the mainland, and up the Fraser River, and south along the southern coast of Vancouver Island and the southern Gulf Islands.

The Cowichan Tribes are part of the Coast Salish, Hul'qumi'num-speaking linguistic group and are represented by the Cowichan Nation Alliance on matters outside of treaty negotiations. The members of the Cowichan Nation Alliance are Cowichan Tribes, the Halalt First Nation, the Penelakut Tribe, and the Stz'uminus First Nation.

Rights

The Cowichan Tribes identified the following asserted rights within their traditional territory, and in relation to the Project area and the marine shipping area:

- Harvesting marine resources (fish, invertebrates, mammals, and vegetation);
- Harvesting coastal;
- Use of marine travelways for food, social, and ceremonial purposes; and
- Traditional lands and waters in area of Tl'uqtinus (traditional village site on the south shore of Lulu Island along the Fraser River).

The Cowichan Nation Alliance made a declaration of Aboriginal Title to the Tl'uqtinus Lands on Lulu Island and of Aboriginal fishing rights to the South Arm of the Fraser River.

The Cowichan Tribes are represented by the Hul'qumi'num Treaty Group in treaty negotiations.

Halalt First Nation

Traditional Territory

The Halalt First Nation has two reserves on Vancouver Island and their main community is near Crofton, British Columbia. Their traditional territory extends north in the Strait of Georgia, across to the mainland, and up the Fraser River, and south along the southern coast of Vancouver Island. Their members traditionally used Bonsall Creek, the Chemainus River, and the Salish Sea including the Strait of Georgia. The registered population of the Halalt First Nation is approximately 211 members.

The Halalt First Nation are part of the Coast Salish, Hul'qumi'num-speaking linguistic group and are represented by the Cowichan Nation Alliance on matters outside of treaty negotiations. The members of the Cowichan Nation Alliance are Cowichan Tribes, the Halalt First Nation, the Penelakut Tribe, and the Stz'uminus First Nation.

Rights

The Halalt First Nation stated that they have Aboriginal rights immediately at and surrounding the Project site. The Halalt First Nation identified the following asserted rights within their traditional territory and in relation to the Project area and the marine shipping area:

- Harvesting marine resources (fish, invertebrates, mammals, and vegetation);
- Harvesting coastal birds and ducks;
- Use of marine travelways for food, social and ceremonial purposes; and,
- Traditional lands and waters in area of Tl'uqtinus (traditional village site on the south shore of Lulu Island along the Fraser River).

The Cowichan Nation Alliance made a declaration of Aboriginal Title to the Tl'uqtinus Lands on Lulu Island and of Aboriginal fishing rights to the South Arm of the Fraser River. The Halalt First Nation is also in the process of a specific claims process for the Shoal Islands next to Willy's Islands.

The Halalt First Nation are represented by the Hul'qumi'num Treaty Group in treaty negotiations.

Lake Cowichan First Nation

Traditional Territory

The main Lake Cowichan First Nation is located adjacent to Cowichan Lake, British Columbia, approximately 70 kilometres west of the Project area. Their traditional territory extends north in the Strait of Georgia, across to the mainland, and up the Fraser River, and south along the southern coast of Vancouver Island. Their traditional territory centers on Cowichan Lake, taking in the surrounding lands, streams and other waters; they continue to use the area to the present day. The registered population of Lake Cowichan is fewer than 20 members.

Lake Cowichan First Nation is part of the Coast Salish linguistic group and speak the dialect Hul'q'umi'num.

Rights

The Lake Cowichan First Nation identified the following asserted rights within their traditional territory and in relation to the Project area and the marine shipping area:

- harvesting marine resources (fish, invertebrates, mammals, and vegetation); and
- Hunting ducks.

The Lake Cowichan First Nation is represented by the Hul'qumi'num Treaty Group in treaty negotiations.

Lake Cowichan requested that the Port Authority consult with them separately from the Cowichan Nation Alliance on the Project.

Lyackson First Nation

Traditional Territory

The Lyackson First Nation has three reserves located on Valdes Island, British Columbia. Their administrative office is located in Chemainus. The registered population of Lyackson First Nation is approximately 200 members.

The Lyackson First Nation claim traditional village sites on Valdes Island, Cowichan Bay, and the Cowichan River, as well as a shared village site on the South Arm of the Fraser River. Their traditional territory extends north in the Strait of Georgia, across to the mainland, and up the Fraser River, and south along the southern coast of Vancouver Island. The Lyackson First Nation note that their vision for the future includes a reinvigoration of the crossing from Lyackson to Roberts Bank as a tribal journey.

The Lyackson First Nation have described 'Le'eyqsun' (Valdes Island) as their homeland and asserted ancestral territory (30 kilometres west of Roberts Bank). Their creation story for Le'eyqsun begins when the Lyackson Mustimuhw asked a mystical creature to cut down a great Douglas Fir tree for them to live on. As the tree was being cut, the Lyackson Mustimuhw sang and drummed. As the tree fell, the tip broke off and became Le'eyqsun Island and the trunk became Galiano Island. Based on Hul'qumi'num cultural beliefs and practices, deceased ancestors should not be disturbed by noise or light after 3:00 pm.

The Lyackson First Nation are part of the Coast Salish linguistic group and speak the dialect Hul'q'umi'num.

Rights

The Lyackson First Nation have asserted Aboriginal rights to harvest marine resources, hunt wildlife and birds, use travelways to preferred harvesting locations, and use cultural or sacred

areas and traditions/practices. The Lyackson First Nation have asserted title to lands at Valdes Island and the surrounding waters, as well as throughout their traditional territory, including Roberts Bank and areas on the south arm of the Fraser River. The Lyackson First Nation have filed a claim to the southern part of Le'eyqsun.

Lyackson is represented by the Hul'qumi'num Treaty Group in treaty negotiations.

Penelakut Tribe

Traditional Territory

The Penelakut Tribe's main present day community is located on Penelakut Island, British Columbia, approximately 35.5 kilometres west of the Project. The Penelakut Tribe have four reserves: two on Penelakut Island, one on Galiano Island, and one on the mainland at the mouth of Bonsail creek in Stuart Channel. Their traditional territory extends north in the Strait of Georgia, across to the mainland, and up the Fraser River, and south along the southern coast of Vancouver Island. The registered population of the Penelakut is 944 members.

The Penelakut Tribe are part of the Coast Salish linguistic group and speak the dialect Hul'q'umi'num. They are represented by the Cowichan Nation Alliance on matters outside treaty negotiations. The members of the Cowichan Nation Alliance are Cowichan Tribes, the Halalt First Nation, the Penelakut Tribe, and the Stz'uminus First Nation.

Rights

The Penelakut Tribe identified the following asserted rights within their traditional territory and in relation to the Project area and the marine shipping area:

- Harvesting marine resources (fish, invertebrates, mammals, and vegetation);
- Harvesting coastal birds and ducks;
- Use of marine travelways for FSC purposes; and
- Traditional lands and waters in area of Tl'uqtinus (on the south arm of the Fraser River).

The Penelakut Tribe assert Aboriginal title throughout their traditional territory, including in the Project area. Specifically, they assert Aboriginal fishing rights in the Fraser River and Canoe Passage areas.

The Cowichan Nation Alliance made a declaration of Aboriginal Title to the Tl'uqtinus Lands on Lulu Island and of Aboriginal fishing rights to the South Arm of the Fraser River.

The Penelakut Tribe are represented by the Hul'qumi'num Treaty Group in treaty negotiations.

Métis Nation British Columbia

Traditional Territory

The Métis Nation of British Columbia (Métis Nation) are governed by provincially based organizations called Nations. These groups govern and represent the interests of geographically dispersed peoples because as a collective, the Métis were not forced onto reserves. The Métis Nation represents over 16,500 citizens in 37 Métis chartered communities across the Province.

The Proponent identified six Métis charter communities in the Lower Mainland and an additional six based on Vancouver Island:

- Chilliwack Métis Association
- Fraser Valley Métis Association
- Golden Ears Métis Society
- Waceya Métis Society
- North Fraser Métis Association
- Nova Métis Heritage Association
- Cowichan Valley Métis Association
- Mid-Island Métis Nation Association
- North Island Métis Association
- Alberni Clayoquot Métis Association
- MIKI'SIW Métis Association
- Métis Nation of Greater Victoria Association.

The Métis Nation identified mobility as a distinctive feature of the Métis and noted that it continued to be important for members who “rely on the kinship networks of their forebears to travel for the purposes of harvesting or cultural and social events.” The Métis Nation noted that their members travel great distances to harvest or engage in other cultural activities and that their use of lands and resources is not generally constrained to specific geographical areas such as traditional territory. Their ideas of territory are “expansive and generally not exclusive”.

Rights

The Métis Nation noted that verification of membership in the contemporary Métis community was important because their Aboriginal rights are collective. They exercise their rights in the entire shipping area, the lower mainland, the Gulf Islands, and Vancouver Island. The Métis Nation identified the following asserted rights within their traditional territory and in relation to the Project area and the marine shipping area:

- Harvesting aquatic species (marine invertebrates, marine fish);
- Harvesting wildlife (including birds);
- Harvesting plant, wood, and earth resources; and
- Use of cultural sites.

Stó:lō Tribal Council

Traditional Territory

The Stó:lō Tribal Council is located in Agassiz, British Columbia, approximately 104 kilometres from the Project area. The Council represents eight member First Nations:

- Seabird Island First Nation
- Scowlitz First Nation
- Soowahlie Band
- Kwaw'Kwaw'Apilt First Nation
- Kwantlen First Nation
- Shxw'ow'hamel First Nation
- Chawathil First Nation
- Cheam Indian Band

The combined population of the communities is approximately 2,900 members.

The Stó:lō Tribal Council's member band's collective asserted traditional territory encompasses much of the land along the Lower Fraser River, north to Garibaldi Provincial Park, south to the USA border, and east to Manning Provincial Park.

Rights

Neither the Proponent nor the Stó:lō Tribal Council provided information to the Panel regarding the Stó:lō's asserted Aboriginal rights in the Project area. The Stó:lō Tribal Council is not involved in treaty negotiations.

Stó:lō Nation

Traditional Territory

The Stó:lō Nation is located in Chilliwack, British Columbia, approximately 132 kilometres from the Project area. The Stó:lō Nation represents 11 First Nations:

- Aitchelitz First Nation
- Leq'a:mel First Nation
- Matsqui First Nation
- Popkum First Nation
- Skawahlook First Nation
- Skowkale First Nation
- Shxwhà:y Village
- Squiala First Nation
- Sumas First Nation
- Tzeachten First Nation
- Yakwekwioose Band

Rights

Neither the Proponent nor the Stó:lō Nation provided information to the Panel regarding the Stó:lō's Nation's asserted Aboriginal rights in the Project area. The Stó:lō Nation is involved in treaty negotiations and they are negotiating an Agreement-in-Principle on behalf of their members.

Hwlitsum First Nation

Traditional Territory

The Hwlitsum First Nation's office is located in Delta, British Columbia, approximately two kilometres from the Project area. The Hwlitsum represent over 400 Hul'qumi'num people on the lower mainland, Gulf Islands, and eastern Vancouver Island. The Hwlitsum First Nation does not have any reserve lands. Their office and wharf are located on fee simple land owned by Hwlitsum members.

The Hwlitsum First Nation's traditional territory includes a large portion of the Lower Mainland, the Gulf Islands, and a portion of Vancouver Island. Canoe Passage is the spiritual center of the Hwlitsum First Nation. The Hwlitsum First Nation note that they are the successor to the Lamalchi First Nation, a distinct Aboriginal group before contact.

Rights

The Hwlitsum First Nation identified the following asserted rights within their traditional territory and in relation to the Project area and the marine shipping area:

- Harvesting marine resources (fish, invertebrates, mammals, and vegetation);
- Hunting;
- Harvesting terrestrial plants and trees;
- Ability to practice cultural and spiritual activities; and
- Use of cultural and sacred areas.

The Hwlitsum First Nation is not a band registered under the Indian Act and is currently involved in Treaty negotiations with the BC government.

The Hwlitsum First Nation was not an Indigenous group identified by the Agency in the EIS Guidelines; however, the Proponent did include them in the EIS.

WSÁNEĆ Nations

The Tsawout First Nation, the Pauquachin First Nation, the Tsartlip First Nation, the Tseycum First Nation and the Malahat First Nation are all part of the WSÁNEĆ Nations.

The WSÁNEĆ Nations stated that “harvesting, sharing and/or receiving traditional marine resources all lie at the heart of what it means to be WSÁNEĆ.”

The WSÁNEĆ Nations identified reef net fishing as a particularly important traditional practice. The Tsartlip First Nation described the reef-net fishery as a “gift from the supernatural” given to the WSÁNEĆ by the Salmon People in exchange for a beautiful WSÁNEĆ princess. The WSÁNEĆ Nations traditionally had a large and important reef net fishery at Point Roberts, as well as reef net sites on the eastern side of the shipping lanes. Reef net harvesting was a traditional practice of the Pauquachin First Nation and noted that they were interested in reviving this practice.

Tsawout First Nation

Traditional Territory

The Tsawout First Nation has six reserves located on Vancouver Island and the Gulf Islands, British Columbia, with the largest located in East Saanich. The registered population of the Tsawout First Nation is approximately 900 members.

The Tsawout's Traditional Territory encompasses the southern Gulf Islands and Vancouver Island and across the Salish Sea to the Point Roberts and Boundary Bay area. The Tsawout First Nation speak SENĆOŦEN, part of the Northern Straits Salish language family.

Rights

The Tsawout First Nation are a signatory to the Douglas Treaty and have established Douglas Treaty rights to hunt over unoccupied lands and to carry on their fisheries "as formerly". The Tsawout First Nation also assert that they hold and exercise Aboriginal rights and title throughout their territory. The marine shipping associated with the Project transits through their territorial waters where the Tsawout First Nation consider that their Douglas Treaty and Aboriginal rights apply.

Pauquachin First Nation

Traditional Territory

The Pauquachin First Nation is located on Vancouver Island, British Columbia, with its main reserve located on Cole Bay on the west side of Saanich Inlet. The Pauquachin First Nation has approximately 400 members.

The Pauquachin First Nation speak SENĆOŦEN, part of the Northern Straits Salish language family. The Pauquachin First Nation is part of the W̱SÁNEĆ Nations. The W̱SÁNEĆ traditional territory encompasses the Saanich Peninsula, through the San Juan and southern Gulf Islands, to Point Roberts and Boundary Bay. Traditionally the W̱SÁNEĆ travelled seasonally from the islands to the mainland.

Rights

The Pauquachin First Nation identified the following asserted rights within their traditional territory and in relation to the Project area and the marine shipping area:

- The right to renewable and non-renewable resources within their territory; and
- The right to continue their cultural practices and to protect areas critical to the survival of their culture, including heritage sites and spiritual places.

The Pauquachin First Nation stated that they have Douglas Treaty rights, however the Government of Canada is of the view that they have asserted, rather than established, Douglas Treaty rights.

Tsartlip First Nation

Traditional Territory

The Tsartlip First Nation has four reserves located on southeast Vancouver Island and Mayne Island, British Columbia, with the main reserve located in Brentwood Bay (south Saanich). The registered population of the Tsartlip First Nation is approximately 985 members.

The Tsartlip First Nation assert that their territory runs from southern Vancouver Island through the Strait of Georgia and Gulf Islands to the Fraser River and that area encompasses their fishing stations, hunting, trapping, and gathering areas, winter and summer villages and spiritual and cultural sites. They noted that their winter homes were on southern Vancouver Island and the Gulf Islands, while their summer homes were on the mainland.

The Tsartlip First Nation speak SENĆOŦEN, part of the Northern Straits Salish language family and are part of the W̱SÁNEĆ Nations.

Rights

The Tsartlip First Nation are a signatory to the Douglas Treaty and have established Douglas Treaty rights to hunt over unoccupied lands and to carry on their fisheries “as formerly”. The Tsartlip First Nation stated that they had specifically asked for the inclusion of their fishing right in their Douglas Treaty because it was so important to who they were as a people. The Tsartlip First Nation also assert Aboriginal rights and title.

The Tsartlip First Nation also assert that they hold and exercise Aboriginal rights and title throughout their territory.

Tseycum First Nation

Traditional Territory

The Tseycum First Nation has five reserves on Vancouver Island and the Gulf Islands. The largest reserve by size is located on Saturna Island, while the largest by population is on the Saanich Peninsula. The Tseycum First Nation has approximately 200 members.

The Tseycum First Nation speak SENĆOŦEN, part of the Northern Straits Salish language family. The Tseycum First Nation is part of the W̱SÁNEĆ Nations. The W̱SÁNEĆ traditional territory encompasses the Saanich Peninsula, through the San Juan and southern Gulf Islands, to Point Roberts and Boundary Bay. Traditionally the W̱SÁNEĆ travelled seasonally from the islands to the mainland.

Rights

The Tseycum First Nation are a signatory to the Douglas Treaty and have established Douglas Treaty rights to hunt over unoccupied lands and to carry on their fisheries “as formerly.”

The Tseycum First Nation assert that they hold and exercise Aboriginal rights and title throughout their territory. The Tseycum First Nation indicated that the marine shipping lanes traverse waters through the heart of their marine territory and close to their reserves.

Malahat First Nation

Traditional Territory

The Malahat First Nation were known as the “saltwater people.” The Malahat First Nation has two reserves on the west shore and south shore of Saanich Inlet. The registered population of the Malahat First Nation is approximately 320 members.

Malahat’s traditional territory encompasses the Saanich Inlet, North and South Pender Islands, and extends west into the Seymour range of mountains.

The Malahat First Nation speak SENĆOŦEN, part of the Northern Straits Salish language family and are part of the W̱SÁNEĆ Nations.

Rights

The Government of Canada takes the view that the Malahat First Nation have asserted, rather than established, Douglas Treaty rights, including an asserted right to fish for food, social, ceremonial and commercial purposes. The Malahat First Nation assert Aboriginal and Treaty rights to traditional use of all the area represented in their Statement of Intent.

The Malahat First Nation is associated with the Te’Mexw Treaty Association along with the Scia’new, Songhees, T’Sou-ke, and Nanoose First Nations. This group reached an Agreement-in-Principle under the BC Treaty Commission process.

Scia’new First Nation (Beecher Bay Indian Band)

Traditional Territory

The Scia’new First Nation has eight reserves in the area around Sooke, British Columbia. The registered population of the Scia’new First Nation is approximately 250 members.

The Scia’new First Nation’s traditional territory extends north of present-day Sooke and south across the Strait of Juan de Fuca to the north shore of the Olympic Peninsula in Washington State, USA.

The Scia’new First Nation traditionally spoke four different languages and shared words with dialects from the Northern Straits Salish language family. Today the main Aboriginal language spoken by the Scia’new First Nation is Hul’q’umi’num’.

Rights

The Scia’new First Nation is a signatory to the Douglas Treaty and has established Douglas Treaty rights to hunt over unoccupied lands and to carry on their fisheries “as formerly”. The Scia’new First Nation also asserts Aboriginal rights and title within their traditional territory, including the area traversed by the marine shipping lanes.

The Scia'new First Nation is associated with the Te'Mexw Treaty Association along with the T'Sou-ke, Songhees, Malahat, and Nanoose First Nations. The Scia'new First Nation reached an Agreement-in-Principle under the BC Treaty Commission process.

Esquimalt First Nation

Traditional Territory

The Esquimalt Nation has a single reserve located on the eastern shore of Esquimalt Harbour, in Esquimalt, British Columbia. The registered population of Esquimalt is approximately 300 members.

Robert Thomas, Lead Councillor for the Esquimalt Nation described how the Esquimalt lived in a “finely-balanced” relationship with tides and the seasons that sustained them. Mr. Thomas noted that the Esquimalt Nation “repaid the land through commitment and stewardship and through our ceremonies. I understand this obligation as a sacred trust.” The Esquimalt’s traditional territory includes the southern coast of Vancouver Island, Haro Strait, and the southern tip of Saanich Inlet.

The Esquimalt Nation speak Lekwungen, part of the Northern Straits Salish language family.

Rights

The Esquimalt Nation is a signatory to the Douglas Treaty and has established Douglas Treaty rights to hunt over unoccupied lands and to carry on their fisheries “as formerly”. The Esquimalt First Nation also asserts Aboriginal rights and title based on historic use and occupation. The Esquimalt Nation has characterized their rights as including, but not limited to, rights to land, water and seabed within their territory, rights to both renewable and non-renewable resources and a right of self-government.

Songhees First Nation

Traditional Territory

The Songhees First Nation has four reserves on or adjacent to southeast Vancouver Island, British Columbia. The registered population of the Songhees First Nation is approximately 660.

The Songhees First Nation’s traditional territory encompasses the southeastern tip of Vancouver Island extending north to the bottom of the Saanich peninsula, south to the border, and west into the American waters of Haro Strait. An area of great importance to the Songhees is Tl’ches, an archipelago in the Strait of Juan de Fuca which encompasses Chatham and Discovery Islands.

The Songhees First Nation speaks Lekwungen, considered part of the Northern Straits Salish language family.

Rights

The Songhees First Nation is a signatory to the Douglas Treaty and has established Douglas Treaty rights to hunt over unoccupied lands and to carry on their fisheries “as formerly”.

The Songhees First Nation is associated with the Te’Mexw Treaty Association along with the T’Sou-ke, Scia’new, Malahat, and Nanoose First Nations. The Songhees First Nation reached an Agreement-in-Principle under the BC Treaty Commission process.

T’Sou-ke First Nation*Traditional Territory*

The T’Sou-ke First Nation has two reserves located around the Sooke Basin on the southern end of Vancouver Island, British Columbia. The registered population of the T’Sou-ke First Nation is around 250 members.

The T’Sou-ke First Nation described their territory as based around water. Chief Gordon Planes stated “wherever that water flows, you’ll see where our territory lies.” The T’Sou-ke’s traditional territory surrounds the present-day town of Sooke, extending north to the San Juan River and south across the Strait of Juan de Fuca to the northern part of the Olympic peninsula in Washington State, USA. The T’Sou-ke First Nation consider Sooke Lake (north of the town of Sooke) as the heart of their traditional territory.

The T’Sou-ke speak SENĆOŦEN, of the Northern Straits Salish language family.

Rights

The T’Sou-ke First Nation are a signatory to the Douglas Treaty and have established Douglas Treaty rights to hunt over unoccupied lands and to carry on their fisheries “as formerly”. In addition, the T’Sou-ke First Nation asserts Aboriginal rights and title to land, air, water, and foreshore across their traditional territory.

The T’Sou-ke First Nation is associated with the Te’Mexw Treaty Association along with Scia’new, Songhees, Malahat, and Nanoose First Nations and has reached an Agreement-in-Principle under the BC Treaty Commission process.

Pacheedaht First Nation*Traditional Territory*

The Pacheedaht First Nation means “people of the seafoam”. Pacheedaht's traditional territory is located on the west coast of Vancouver Island, British Columbia, and its four reserves and main community are located near Port Renfrew and Port San Juan. The population of the Pacheedaht First Nation is approximately 300 members.

Pacheedaht described themselves as ocean people and noted that they traditionally oriented their villages towards water and water resources. Pacheedaht’s traditional territory encompasses

approximately 129 kilometres of marine coastline along the Strait of Juan de Fuca, between Sherringham Point on the east and Bonilla Point on the West. Pacheedaht traditionally used the lands and marine areas, stretching 50 kilometres to the south and 25 kilometres north of their main community, to conduct fishing and other activities. Pacheedaht's preferred harvesting area is Swiftsure Bank, at the entrance to the Strait of Juan de Fuca.

Pacheedaht are part of the Nuu-chah-nulth people, which also includes the Ditidaht First Nation; they are also closely related to the Makah Tribe in Washington State, USA. Pacheedaht Nation speak the Ditidaht language, which is part of the Wakashan language family.

Rights

Pacheedaht has asserted Aboriginal fishing and harvesting rights throughout their traditional territory, including at Swiftsure Bank. Pacheedaht asserts Aboriginal rights and interests, including title and self-governance rights, to its traditional territory. Members of the Pacheedaht First Nation have historically, and continue to, extensively use and occupy the lands, resources and waters in their traditional territory, including the proposed container ship route, for exercising their Aboriginal rights.

Ditidaht First Nation

Traditional Territory

The Ditidaht First Nation has 17 reserves located on Southwest Vancouver Island, British Columbia, with their main community located on the northeast shore of Nitinat Lake. The registered population of the Ditidaht First Nation is approximately 775 members.

Ditidaht's traditional territory includes the land and waters stretching along the southwest coast of Vancouver Island between Bonilla Point on the east and Pachena Point on the west; extends inland to include Nitinat Lake, the Nitinat River, and their drainage systems; and is traditionally considered to extend offshore as far as the Vancouver Island mountains are visible from a canoe. The Ditidaht First Nation marine territory includes Swiftsure Bank.

Ditidaht members speak the Ditidaht language, which is part of the Wakashan language family. The Ditidaht First Nation shares close cultural, kinship, and linguistic ties with the Pacheedaht First Nation.

Rights

Ditidaht identified the following asserted rights within their traditional territory and in relation to the marine shipping area:

- Harvesting marine resources (fish, invertebrates, mammals, and vegetation);
- Harvesting terrestrial resources;
- Use of trails, travelways, and sacred areas for food, social and ceremonial purposes; and
- Access to traditional harvesting grounds and transmission of traditional knowledge.

Ditidaht report that they have Aboriginal rights to fish in their traditional territories and sell caught fish in the commercial market place per the decision in *Ahousaht Nation et. al v. Canada*. Ditidaht also note that they share Aboriginal rights and interests at Swiftsure Bank with the Pacheedaht First Nation and the Makah Nation in the USA.

The First Nations of Maa-nulth Treaty Society

Traditional Territory

Maa-nulth Nations are comprised of five First Nations on the west coast of Vancouver Island, British Columbia. There are approximately 2,372 registered members of the Maa-nulth Nations.

The Maa-nulth Nations described how the ocean was key to their culture and their way of life. They noted that their traditional villages always faced the sea and described the ocean as their “front door” and their “breadbasket.”

The Maa-nulth Nations represented the following First Nations in the environmental assessment:

- The Huu-ay-aht First Nations;
- The Ka:’yu:’k’t’h’/Che:k’tles7et’h’ First Nations;
- The Toquaht Nation;
- The Uchuklesaht Tribe; and
- The Yuułu?ił?ath First Nation, also known as the Ucluelet First Nation.

Rights

Maa-nulth Nations have treaty rights under the Maa-nulth First Nations Final Agreement, which came into force in 2011. The rights specified under the Agreement include:

- The right to harvest fish, aquatic plants, and inter-tidal bivalves for food, social and ceremonial purposes;
- The right to harvest wildlife for food, social and ceremonial purposes;
- The right to harvest migratory birds for food, social and ceremonial purposes;
- The right to gather plants;
- The right to harvest renewable resources; and
- The right to practice Maa-nulth First Nation culture.

The Agreement defines the areas where these rights can be exercised. The areas defined in the Treaty are centered around Kyuoquot Sound and Barkley Sound, on the west side of Vancouver Island, British Columbia. A portion of Segment D of the marine shipping area intersects with the Maa-nulth’s Barkley Sound Domestic Fishing Area.

Appendix F: Cultural Heritage Criteria Tables

Table 1: Criteria table for assessing, with respect to Indigenous peoples, an effect occurring in Canada of any change that may be caused on cultural heritage

Magnitude	Spatial Extent	Duration	Frequency	Reversibility	Ecological and cultural context
<p>Definition: Magnitude refers to the amount of change in a measurable parameter relative to existing conditions or other standards, guidelines or objectives.</p> <p>For cultural heritage this will include changes to components that support a community’s culture and cultural health, including its practices, customs and traditions and disruption or loss to preferred ways of continuing customs, traditions and practices.</p> <p>Culture may be linked to culturally important landscapes or sites, and/or determinants of community’s health identified by the affected community.</p>	<p>Definition: Spatial area over which the effect on the cultural resource is predicted to occur.</p>	<p>Definition: Length of time that an effect is experienced, from the community perspective.</p> <p>Effects that occur at only certain times of year may be experienced as ongoing, if they take place on a weekly, monthly or annual basis. They can also be permanent or short, medium or long term.</p>	<p>Definition: How often disruptions to the practices associated with cultural heritage may occur, and whether this is on a continuous basis or during specific seasons.</p>	<p>Definition: A reversible environmental effect is one where the VC is expected to recover from the environmental effects caused by the project.</p> <p>For cultural heritage, this would correspond to a return to existing conditions of the culturally important landscape or site and the associated customs and traditions.</p> <p>*Note: Reversibility does not include the potential to move cultural practices to another jurisdiction or area.</p>	<p>Definition: Effects to a tangible or intangible cultural landscape that support a community’s culture and cultural health including cultural practices, customs and traditions.</p> <p>Prospect of disruption to preferred ways of continuing customs, traditions and practices. Cultural heritage may be linked to culturally important landscapes, species and determinants of community health identified by the affected community.</p>

Magnitude	Spatial Extent	Duration	Frequency	Reversibility	Ecological and cultural context
<p>Low. A slight noticeable effect resulting in a small change on a cultural resource(s) (custom, belief, artifact) that is expected to cause an interference with the manner of practice, or access to a cultural resource(s).</p> <p>Small reduction to important cultural heritage locations or conduct of cultural activities at these locations.</p>	<p>Small. The potential effect on cultural heritage could occur over a small portion of the area presently used.</p>	<p>Temporary (equal or less than 6 years). The potential effect on cultural heritage equals or lasts less than 6 years (i.e., approximate duration of construction phase). The effect is unlikely to persist beyond one generation.</p>	<p>Sporadic. The effect would be confined to occasional periods, limited to the life of the Project.</p>	<p>Short-term. The potential effect will be reversed in the short-term (i.e., a few years).</p>	<p>Small indication that there would be any potential effect on tangible and intangible cultural landscapes, cultural practices, customs and traditions.</p> <p>The effect allows intergenerational transfer of knowledge and cultural heritage to continue into the future.</p> <p>Interference or disturbance to a practice of a cultural activity for a few members of the community.</p>
<p>Moderate. The noticeable change to cultural resource(s) (customs, beliefs, or artifacts) that is expected to cause an interference with a manner of practice, or access to a cultural resource(s).</p>	<p>Moderate. The potential effect to cultural heritage could occur over a moderate portion of the area presently used.</p>	<p>Long Term. The potential effect on cultural heritage will be ongoing but not last beyond one generation.</p>	<p>Intermittent. The effect is likely to be intermittent or occur on a repeated basis throughout the operation and after the end of the Project</p>	<p>Medium-term. The potential effect on cultural heritage is likely to be reversed within one generation.</p>	<p>A potential effect on cultural heritage is unlikely to extend to preferred or sacred areas or practices or to cultural landscapes of high value to the affected community.</p>

Magnitude	Spatial Extent	Duration	Frequency	Reversibility	Ecological and cultural context
<p>Project effects will create limitations on some valued areas and their access where spiritual activities take place.</p>					<p>The effect may impede or alter access to cultural activities, but without limiting connection to an area or sense of place.</p> <p>There may be some loss of or loss of connection to cultural landscapes. The disturbance may be of a cultural, spiritual, social, physical, or sensory nature (noise, visual quality, etc.).</p> <p>Transfer of knowledge between generations may be interrupted for a moderate period of time by the Project, however practices may be resumed broadly within one generation.</p> <p>Interference or disturbance to a practice of a cultural activity for a particular section of a community.</p>

Magnitude	Spatial Extent	Duration	Frequency	Reversibility	Ecological and cultural context
<p>High. An effect on that is expected to substantially alter cultural heritage parameter(s). The effect will interfere with the preferred manner of practice, or access to a cultural resource(s).</p>	<p>Extensive. The potential effect could occur over an extensive portion of the entire area used for the practice of the cultural resource(s).</p>	<p>Permanent. The potential effect on cultural heritage will last beyond one generation or be permanent.</p>	<p>Continuous. The effect to cultural heritage would occur constantly during, and potentially beyond, the economic life of the Project. “Constantly” can mean either that a project activity interacts with cultural practices on an uninterrupted basis or on a sporadic but repeated basis that may coincide with traditional activities that take place at certain intervals or seasons.</p>	<p>Long term. The potential effect to cultural heritage is not to be reversed, either in whole or part, because the effect is likely to persist beyond one generation.</p>	<p>The potential effect on cultural heritage is likely to extend to preferred or sacred areas or practices or to cultural landscapes of high value to the affected community and to cause an interference with the preferred manner of practice or a preferred or scared area including limited use of, or access to, cultural landscapes or sites.</p> <p>Multiple effects could occur to one area of high importance. The Project may cause effects on a species that is culturally important, that has limited availability or high sensitivity to change or that is also a federally or provincially listed species at risk. Access to practice of cultural activities would</p>

Magnitude	Spatial Extent	Duration	Frequency	Reversibility	Ecological and cultural context
					<p>likely be disrupted, limited or eliminated.</p> <p>Disturbance may be of a spiritual, cultural, social, physical or sensory nature (noise, visual quality, etc.).</p> <p>Intergenerational transfer of knowledge could be interrupted for an extended time period and may not be reversed either in whole or part.</p> <p>Interference or disturbance to a practice of a cultural activity for the community as a whole, or for individuals that are the stewards of the knowledge for the community.</p>

Table 2: Criteria for determining the likelihood of any predicted residual adverse effect or cumulative effect that is deemed to be significant

Likelihood
<p>Definition: Prospect of an effect on cultural heritage occurring that is based on information from community-based experts, including those most likely to be affected.</p> <p>The full life-cycle of a project’s effects, including its various stages and lifespan is considered in determining the likelihood of occurrence of an effect.</p> <p>Likelihood refers to more than just the probability of environmental effects. It includes consequences, such as, the prospect of losing elements of cultural heritage.</p>
<p>Low. A potential effect on cultural heritage is unlikely but could occur.</p>
<p>Moderate. A potential effect on cultural heritage is likely but may not occur.</p>
<p>High. A potential effect on cultural heritage is highly likely or certain to occur.</p>

Table 3: Criteria table for assessing cumulative effects, with respect to Indigenous peoples, of any change that may be caused to the environment on cultural heritage.

Magnitude	Spatial Extent	Duration	Frequency	Reversibility	Ecological and cultural context
<p>Definition: Magnitude refers to the amount of change in a measurable parameter relative to baseline conditions or other standards, guidelines or objectives.</p> <p>Effects of past, existing and future projects or activities. Cumulative effects may have a regional or historic context and may extend to aspects of cultural heritage related to socio-economics, health and other matters tied to an Indigenous community’s history and connection to the landscape.</p> <p>For cultural heritage this will include changes to customs, beliefs, artifact, sites.</p>	<p>Definition: Spatial area over which the effect of the Project, in combination with other past, present, and future physical activities on cultural heritage is predicted to occur.</p>	<p>Definition: Length of time that an effect is experienced as a result of the Project in combination with other past, present, and future physical activities.</p>	<p>Definition: How often disruptions to cultural heritage may occur as a result of the Project in combination with other past, present, and future physical activities.</p> <p>This is considered from the community perspective. For example, effects that occur at only certain times of year may be experienced as ongoing if they take place on a weekly, monthly or annual basis.</p>	<p>Definition: A reversible environmental effect is one where the environmental component is expected to recover from the environmental effects caused by the project.</p> <p>For cultural heritage, this would correspond to a return to existing conditions of the culturally important landscape or site and the associated customs and traditions.</p> <p>*Note: Reversibility does not include the potential to move cultural practices to another jurisdiction or area.</p>	<p>Definition: Effects to a tangible or intangible cultural landscape that support a community’s cultural heritage including cultural practices, customs and traditions.</p> <p>Prospect of disruption to preferred ways of continuing customs, traditions and practices.</p> <p>Cultural heritage may be linked to culturally important landscapes, species and determinants of community health identified by the affected community.</p>

Magnitude	Spatial Extent	Duration	Frequency	Reversibility	Ecological and cultural context
<p>Low: The effects resulting from past, existing or proposed projects would impact few area(s) where the practice of cultural heritage takes place and the Project or activity would be in an area with few existing impacts.</p> <p>Small reduction of important cultural heritage locations or conduct of cultural activities at these locations.</p> <p>The Project may contribute to further cumulative effects.</p>	<p>Small: The potential cumulative effect on cultural heritage could occur over a small portion of the area presently used.</p>	<p>Temporary: The potential cumulative effect on cultural heritage purposes lasts 6 years or less (i.e., approximate duration of construction phase).</p>	<p>Sporadic: The cumulative effect would be confined to occasional periods during the life of the Project.</p>	<p>Reversible: The cumulative effect may be reversed in the short term.</p>	<p>Small indication that there would be any potential cumulative effect on cultural heritage, including tangible and intangible cultural landscapes, cultural practices, customs and traditions.</p> <p>The cumulative effect allows intergenerational transfer of knowledge to continue into the future.</p>
<p>Moderate: There are other land uses, including proposed or existing projects, in the community’s territory that affect cultural heritage.</p>	<p>Moderate: The potential cumulative effect on cultural heritage could occur over a moderate</p>	<p>Long Term: The potential cumulative effect on cultural heritage will be ongoing but not last beyond one generation.</p>	<p>Intermittent: The potential cumulative effect is likely to be intermittent or occur on a repeated basis throughout the operation</p>	<p>Partly Reversible: The potential cumulative effect on cultural heritage is likely to be reversed within one generation.</p>	<p>The potential cumulative effect on cultural heritage is unlikely to extend to preferred or sacred areas or practices or to cultural landscapes of high value to the affected community.</p>

Magnitude	Spatial Extent	Duration	Frequency	Reversibility	Ecological and cultural context
<p>The Project could contribute to further cumulative effects.</p>	<p>portion of the area presently used.</p>		<p>and decommissioning of the Project.</p>		<p>The cumulative effect may impede or alter access to cultural activities, but without limiting connection to an area or sense of place.</p> <p>There may be some loss of or loss of connection to cultural landscapes. The disturbance may be of a spiritual, cultural, social, physical, spiritual or sensory nature (noise, visual quality, etc.).</p> <p>Transfer of knowledge between generations may be interrupted for a moderate period of time as a result of the cumulative effect, however practices may be resumed broadly within one generation.</p>
<p>High: There are multiple other land uses, including proposed or existing projects, which affect the community’s cultural heritage, including cultural landscape. The Project may interact with the</p>	<p>Extensive: The potential cumulative effect on cultural heritage for traditional purposes could occur over an extensive portion of</p>	<p>Permanent: The potential cumulative effect on cultural heritage for traditional purposes will last beyond one generation or be permanent.</p>	<p>Continuous: The potential cumulative effect would occur constantly during, and potentially beyond, the economic life of the Project. “Continuous”</p>	<p>Irreversible: The potential cumulative effect on cultural heritage is unlikely to be reversed, either in whole or in part, because the cumulative</p>	<p>The potential cumulative effect on cultural heritage is likely to extend to preferred or sacred areas or practices or to cultural landscapes of high value to the affected community and to cause an interference with the preferred</p>

Magnitude	Spatial Extent	Duration	Frequency	Reversibility	Ecological and cultural context
<p>cultural heritage in an area highly valued given the cumulative context. The customs, traditions, and practices which may be affected by the Project are not currently practiced in the preferred manner because of conservation issues, lack of access, or government policy/programs.</p> <p>The Project will contribute to further cumulative effects.</p>	<p>the area presently used, or the entire area.</p>		<p>can mean either that a project activity interacts with the cultural heritage on an uninterrupted basis or on a sporadic but repeated basis that may coincide with cultural practices that take place at certain intervals or seasons.</p>	<p>effect is likely to persist beyond one generation.</p>	<p>manner of practice or a preferred or scared area.</p> <p>Multiple cumulative effects could occur to one area of high importance.</p> <p>The Project may contribute to a cumulative effect on a species that is culturally important, that has limited availability or high sensitivity to change or that is also a federally or provincially listed species at risk.</p> <p>Access to practice of cultural activities would likely be disrupted or limited as a result of the cumulative effects of past, existing and future projects or activities.</p> <p>Disturbance as a result of the cumulative effect may be of a spiritual, cultural, social, physical or sensory nature (noise, visual quality, etc.).</p>

Magnitude	Spatial Extent	Duration	Frequency	Reversibility	Ecological and cultural context
					<p>Intergenerational transfer of knowledge could be interrupted for an extended time period as a result of the cumulative effect and may not be reversed either in whole or in part.</p>

Appendix G: Vancouver Fraser Port Authority Commitments, Proposed Mitigation, and Follow-up Programs

Table A1 Compilation of Proposed Mitigation Measures and Other Project Commitments – RBT2 Project

Check marks are added to identify the applicability of different mitigation measures to intermediate components, valued components, and current use of lands and resources for traditional purposes (Current Use). No check marks were applied to Project commitments.

Number	Phase			Applicable Mitigation Measures and Other Project Commitments	Applicable Environmental Management Plan (EMP) or Other Plan(s)	Intermediate Components										Valued Components										Current Use		
	Design	Construction	Operation			Air Quality	Noise and Vibration	Light	Coastal Geomorphology	Surficial Geology and Marine Sediment	Marine Water Quality	Underwater Noise	Marine Vegetation	Marine Invertebrates	Marine Fish	Marine Mammals	Coastal Birds	Ongoing Productivity of CRA Fisheries	Labour Market	Economic Development	Services and Infrastructure	Marine Commercial Use	Outdoor Recreation	Visual Resources	Land and Water Use		Human Health	Archaeological and Heritage Resources
PROJECT DESIGN AND GENERAL COMMITMENTS																												
1				The VFPA will ensure that the design, construction, and operation of the Project is carried out in an environmentally responsible manner and will employ standard management practices and comply with all applicable legislation. The VFPA will instruct, advise, and require (via contractual arrangements and as part of Project permitting) the selected infrastructure developer and terminal operator to abide by all relevant commitments in this table.	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	✓	✓	✓	The VFPA will engage with Indigenous groups, the local community, and stakeholders during final design, construction, and operation of the Project. This will include detailed design consultation on topics such as construction and final design elements. The VFPA is committed to continuing to engage with the Delta community through the Port Community Liaison Committee (PCLC), community office, community feedback line, and continued liaison with the City of Delta.	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	✓			The VFPA will ensure the Project is designed within the footprint defined in the Project Construction Update (CEAR Document #1210).	Element to be included in final design, for implementation by infrastructure developer		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓
4	✓			The VFPA will ensure the Project is designed such that the causeway widening has a reduced footprint, as shown in the Project Construction Update (CEAR Document #1210).	Element to be included in final design, for implementation by infrastructure developer									✓	✓	✓						✓				✓	✓	
5	✓	✓		The VFPA will ensure the Project is designed and constructed to reduce the effects of channel formation from dyke construction to the satisfaction of a qualified professional(s).	Element to be included in final design, for implementation by infrastructure developer				✓	✓	✓	✓	✓	✓	✓	✓										✓	✓	
6	✓			The VFPA will ensure the terminal is designed with a rounded northwest terminal corner as determined by a qualified professional(s) to reduce the potential for seabed scour and associated sediment deposition post-Project construction.	Element to be included in final design, for implementation by infrastructure developer				✓	✓	✓	✓	✓	✓	✓	✓										✓	✓	

Number	Phase			Applicable Mitigation Measures and Other Project Commitments	Applicable Environmental Management Plan (EMP) or Other Plan(s)	Intermediate Components										Valued Components										Current Use	
	Design	Construction	Operation			Air Quality	Noise and Vibration	Light	Coastal Geomorphology	Surficial Geology and Marine Sediment	Marine Water Quality	Underwater Noise	Marine Vegetation	Marine Invertebrates	Marine Fish	Marine Mammals	Coastal Birds	Ongoing Productivity of CRA Fisheries	Labour Market	Economic Development	Services and Infrastructure	Marine Commercial Use	Outdoor Recreation	Visual Resources	Land and Water Use		Human Health
7	✓			The VFPA will ensure the design of the Project is such that portions of the terminal’s north face and northern side of causeway will be constructed to include rocky shoreline. The design of this rocky shoreline will include input from a qualified professional(s) to create habitat opportunities within this shoreline structure.	Element to be included in final design, for implementation by infrastructure developer							✓	✓	✓		✓											✓
8	✓			The VFPA will ensure that the caisson face is designed to include fish refuge habitat.	Element to be included in final design, for implementation by infrastructure developer							✓	✓	✓		✓											✓
9		✓		The VFPA will ensure that all hollow steel piles will be capped following installation.	Element to be included in final design, for implementation by infrastructure developer Marine Species Management Plan and Construction Terrestrial Vegetation and Wildlife Management Plan										✓											✓	
10	✓	✓		The VFPA will ensure the Project is constructed without the use of the intermediate transfer pit in the marine environment.	N/A	✓	✓			✓	✓	✓	✓	✓	✓	✓				✓	✓		✓	✓		✓	
11	✓	✓		The VFPA will ensure vibro-replacement techniques are not used in the marine environment.	N/A		✓			✓	✓	✓		✓	✓	✓										✓	
12	✓	✓		The VFPA will ensure that material dredged from the tug basin is placed within the Project footprint as fill for the Project land development.	N/A					✓	✓		✓	✓	✓	✓				✓	✓					✓	
13	✓	✓		The VFPA will ensure the Project is designed to reduce the combined number of dredge equipment and tug/barge movements to the satisfaction of a qualified professional(s).	N/A	✓	✓				✓		✓	✓	✓	✓				✓	✓		✓			✓	
ENVIRONMENTAL MANAGEMENT PLANS																											
14		✓		Prior to the start of construction, the VFPA will develop a Construction Environmental Management Plan (CEMP) to the satisfaction of a qualified professional(s). The CEMP will be implemented during construction. The CEMP will include at a minimum the following sub-plans, developed in consultation with the parties identified below.	CEMP	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓

Number	Phase			Applicable Mitigation Measures and Other Project Commitments	Applicable Environmental Management Plan (EMP) or Other Plan(s)	Intermediate Components										Valued Components										Current Use			
	Design	Construction	Operation			Air Quality	Noise and Vibration	Light	Coastal Geomorphology	Surficial Geology and Marine Sediment	Marine Water Quality	Underwater Noise	Marine Vegetation	Marine Invertebrates	Marine Fish	Marine Mammals	Coastal Birds	Ongoing Productivity of CRA Fisheries	Labour Market	Economic Development	Services and Infrastructure	Marine Commercial Use	Outdoor Recreation	Visual Resources	Land and Water Use		Human Health	Archaeological and Heritage Resources	
				<ul style="list-style-type: none"> • Construction Compliance Management Plan (Canadian Environmental Assessment Agency (CEA Agency), City of Delta¹¹, Environment and Climate Change Canada (ECCC), Fisheries and Oceans Canada (DFO), Indigenous groups) • Air Emission Management Plan¹² (B.C. Ministry of Environment and Climate Change Strategy (ECCS), CEA Agency, City of Delta, ECCC, Health Canada, Metro Vancouver, Indigenous groups) • Archaeological Monitoring and Management Plan (B.C. Archaeology Branch, CEA Agency, Parks Canada, Indigenous groups) • Communications Plan (CEA Agency, City of Delta, DFO, Transport Canada, Indigenous groups) • Dredging and Sediment Discharge Plan (CEA Agency, ECCC, DFO, Indigenous groups) • Environmental Training Plan (CEA Agency, Indigenous groups) • Health and Safety and Emergency Response Plan (B.C. Ambulance Service, CEA Agency, City of Delta, Coast Guard, Delta Fire and Emergency Services, Delta Police Department, ECCC, WorkSafeBC, Indigenous groups) • Indigenous Monitors Plan (CEA Agency, Indigenous groups) • Land and Marine Traffic Management Plan (B.C. Ambulance Service, B.C. Ministry of Transportation and Infrastructure, CEA Agency, City of Delta, Coast Guard, Delta Farmers Institute, Delta Fire and Emergency Services, Delta Police Department, DFO, Transport Canada, WorkSafeBC, Indigenous groups) • Light Management Plan (CEA Agency, City of Delta, ECCC, DFO, Indigenous groups) • Marine Mammal Management Plan (CEA Agency, DFO, Indigenous groups) • Marine Species Management Plan (CEA Agency, DFO, Indigenous groups) • Marine and Terrestrial Invasive Species Management Plan (CEA Agency, DFO, Indigenous groups) • Noise and Vibration Management Plan (B.C. Ministry of Health, CEA Agency, City of Delta, ECCC, Health Canada, Indigenous groups) • Sediment and Erosion Control Plan (CEA Agency, ECCC, DFO, Indigenous groups) 																									

¹¹ The VFPA will ask the City of Delta to identify which additional CEMPs that may be of interest for their review and consultation.

¹² This plan was previously referred to as Air Quality and Dust Control Plan, for the construction phase.

Number	Phase			Applicable Mitigation Measures and Other Project Commitments	Applicable Environmental Management Plan (EMP) or Other Plan(s)	Intermediate Components										Valued Components										Current Use	
	Design	Construction	Operation			Air Quality	Noise and Vibration	Light	Coastal Geomorphology	Surficial Geology and Marine Sediment	Marine Water Quality	Underwater Noise	Marine Vegetation	Marine Invertebrates	Marine Fish	Marine Mammals	Coastal Birds	Ongoing Productivity of CRA Fisheries	Labour Market	Economic Development	Services and Infrastructure	Marine Commercial Use	Outdoor Recreation	Visual Resources	Land and Water Use		Human Health
				<ul style="list-style-type: none"> Spill Preparedness and Response Plan (B.C. Ambulance Service, CEA Agency, City of Delta, Coast Guard, Delta Fire and Emergency Services, Delta Police Department, ECCC, DFO, Transport Canada, WorkSafeBC, Indigenous groups) Terrestrial Vegetation and Wildlife Management Plan (B.C. Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD), CEA Agency, ECCC, Indigenous groups) Underwater Noise Management Plan (CEA Agency, DFO, Indigenous groups) Waste and Hazardous Materials Management Plan (CEA Agency, ECCC, Metro Vancouver, Indigenous groups) Water Quality Management Plan (CEA Agency, ECCC, DFO, Indigenous groups) Wetland Management Plan (CEA Agency, ECCC, DFO, Indigenous groups) <p>The VFPA will provide the draft sub-plans to the parties for review a minimum of 90 days prior to start of construction. The CEMP and its associated sub-plans will also be made publicly available on the RBT2 website.</p>																							
15	✓			<p>Prior to the start of construction and throughout construction, the VFPA will retain a qualified professional(s), the Independent Environmental Monitor, as a neutral observer to inspect, document, and report on environmental compliance and effectiveness.</p>	Construction Compliance Management Plan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
16		✓		<p>Prior to the start of operation, the VFPA will develop an Operation Environmental Management Plan (OEMP) to the satisfaction of a qualified professional(s). The OEMP will be implemented during operation. The OEMP will include at a minimum the following sub-plans, developed in consultation with the parties identified below.</p> <ul style="list-style-type: none"> Operation Compliance Management Plan (CEA Agency, City of Delta⁴, ECCC, DFO, Indigenous groups) Air Emission Management Plan (B.C. Ministry of ECCS, CEA Agency, City of Delta, ECCC, Health Canada, Metro Vancouver, Indigenous groups) Archaeological Monitoring and Management Plan (B.C. Archaeology Branch, CEA Agency, Parks Canada, Indigenous groups) Communications Plan (B.C. Environmental Assessment Office, CEA Agency, City of Delta, DFO, Transport Canada, Indigenous groups) Environmental Training Plan (CEA Agency, Indigenous groups) Health and Safety and Emergency Response Plan (B.C. Ambulance Service, CEA Agency, City of Delta, Coast Guard, Delta Fire and Emergency Services, Delta Police Department, ECCC, WorkSafeBC, Indigenous groups) 	OEMP	✓	✓	✓		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	

Number	Phase			Applicable Mitigation Measures and Other Project Commitments	Applicable Environmental Management Plan (EMP) or Other Plan(s)	Intermediate Components										Valued Components										Current Use	
	Design	Construction	Operation			Air Quality	Noise and Vibration	Light	Coastal Geomorphology	Surficial Geology and Marine Sediment	Marine Water Quality	Underwater Noise	Marine Vegetation	Marine Invertebrates	Marine Fish	Marine Mammals	Coastal Birds	Ongoing Productivity of CRA Fisheries	Labour Market	Economic Development	Services and Infrastructure	Marine Commercial Use	Outdoor Recreation	Visual Resources	Land and Water Use		Human Health
				<ul style="list-style-type: none"> Light Management Plan (CEA Agency, City of Delta, ECCC, DFO, Indigenous groups) Noise and Vibration Management Plan (B.C. Ministry of Health, CEA Agency, City of Delta, ECCC, Health Canada, Indigenous groups) Spill Preparedness and Response Plan (B.C. Ambulance Service, CEA Agency, City of Delta, Coast Guard, Delta Fire and Emergency Services, Delta Police Department, ECCC, DFO, Transport Canada, WorkSafeBC, Indigenous groups) Terrestrial Vegetation and Wildlife Management Plan (B.C. Ministry of FLNRORD, CEA Agency, ECCC, Indigenous groups) Waste and Hazardous Materials Management Plan (CEA Agency, ECCC, Metro Vancouver, Indigenous groups) Water Quality Management Plan (CEA Agency, ECCC, DFO, Indigenous groups) <p>The VFPA will provide the draft sub-plans to the parties for review a minimum of 90 days prior to start of operation. The OEMP and its associated sub-plans will also be made publicly available on the RBT2 website.</p>																							
17			✓	The VFPA will ensure the terminal operator appoints a qualified individual(s), deemed satisfactory by the VFPA, to oversee the execution of the OEMP and report on its implementation in a manner and at a frequency to be determined in the Operation Compliance Management Plan.	Operation Compliance Management Plan	✓	✓	✓		✓	✓			✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Sub-plans to the Construction and Operation Environmental Management Plans																											
18		✓	✓	<p>Prior to the start of construction and operation, the VFPA will develop <u>Compliance Management Plans</u> (Construction Compliance Management Plan and Operation Compliance Management Plan) to the satisfaction of a qualified professional(s). The plans will be implemented during the relevant phase. These plans must include at a minimum the following:</p> <ul style="list-style-type: none"> Roles and responsibilities for implementation and monitoring; Regulatory compliance requirements; A description of the compliance management system, including processes and data management; Measurable compliance limits in the relevant sub-plan; Sampling and monitoring methodologies and frequencies needed to assess compliance of the relevant sub-plan; Reporting requirements; Protocols for documenting, communicating, and correcting instances of non-compliance with the Project's regulatory requirements, EMPs/sub-plans, and environmental protection plans (EPPs) (and similar documents); 	Compliance Management Plans	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓

Number	Phase			Applicable Mitigation Measures and Other Project Commitments	Applicable Environmental Management Plan (EMP) or Other Plan(s)	Intermediate Components										Valued Components							Current Use				
	Design	Construction	Operation			Air Quality	Noise and Vibration	Light	Coastal Geomorphology	Surficial Geology and Marine Sediment	Marine Water Quality	Underwater Noise	Marine Vegetation	Marine Invertebrates	Marine Fish	Marine Mammals	Coastal Birds	Ongoing Productivity of CRA Fisheries	Labour Market	Economic Development	Services and Infrastructure	Marine Commercial Use		Outdoor Recreation	Visual Resources	Land and Water Use	Human Health
				<p>The plans will be developed in consultation with the following parties: B.C. Ministry of ECCS, CEA Agency, City of Delta, ECCC, Health Canada, Metro Vancouver, and Indigenous groups.</p> <p>The VFPA will provide the draft plans to the parties for review a minimum of 90 days prior to the start of the relevant phase.</p>																							
20	✓	✓		<p>Prior to the start of construction and operation, the VFPA will develop <u>Archaeological Monitoring and Management Plans</u> to the satisfaction of a qualified professional(s). The plans will be implemented during the relevant phase. The plans must include at a minimum the following:</p> <ul style="list-style-type: none"> • Roles and responsibilities for implementation and monitoring; • A description of how archaeological values will be identified; • A description of potential effects to archaeological values and mitigation to address those effects; • A chance find procedure in the event that archaeological resources are exposed during construction; and • Archaeological awareness training, a summary of relevant components of the construction phase Environmental Training Plan, setting out training objectives and mechanisms to be used to keep Project personnel (including subcontractors) informed about heritage or cultural characteristics or requirements (e.g., chance find procedure). <p>The plans will be developed in consultation with the following parties: B.C. Archaeology Branch, CEA Agency, Parks Canada, and Indigenous groups.</p> <p>The VFPA will provide the draft plans to the parties for review a minimum of 90 days prior to start of the relevant phase.</p>	<p>Archaeological Monitoring and Management Plans</p> <p>Compliance Management Plans</p>																				✓	✓	
21	✓	✓		<p>Prior to the start of construction and operation, the VFPA will develop <u>Communications Plans</u> to the satisfaction of a qualified individual(s). The plan will be implemented during the relevant phase. The plans must include at a minimum the following:</p> <ul style="list-style-type: none"> • Roles and responsibilities for implementation and monitoring; • Mechanisms to update and make available information public; • Implement a mechanism for two-way dialogue and communications; • A description of the VFPA Community Feedback Line; • Measures to provide updates regarding Project activities in a manner and frequency that ensures Indigenous groups, public, and stakeholders are informed of the nature, location, status, and progress of Project activities that may affect these parties; and • Mechanisms to identify and address unanticipated issues regarding the Project-related construction activities and interaction with existing users. 	<p>Communications Plans</p> <p>Compliance Management Plans</p>												✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	

Number	Phase			Applicable Mitigation Measures and Other Project Commitments	Applicable Environmental Management Plan (EMP) or Other Plan(s)	Intermediate Components										Valued Components										Current Use		
	Design	Construction	Operation			Air Quality	Noise and Vibration	Light	Coastal Geomorphology	Surficial Geology and Marine Sediment	Marine Water Quality	Underwater Noise	Marine Vegetation	Marine Invertebrates	Marine Fish	Marine Mammals	Coastal Birds	Ongoing Productivity of CRA Fisheries	Labour Market	Economic Development	Services and Infrastructure	Marine Commercial Use	Outdoor Recreation	Visual Resources	Land and Water Use		Human Health	Archaeological and Heritage Resources
				<p>The plans will be developed in consultation with the following parties: CEA Agency, City of Delta, DFO, Transport Canada, and Indigenous groups.</p> <p>The VFPA will provide the draft plans to the parties for review a minimum of 90 days prior to the start of the relevant phase.</p>																								
22	✓	✓	✓	<p>Prior to the start of construction and operation, the VFPA will develop <u>Environmental Training Plans</u> to the satisfaction of a qualified professional(s). The plans will be implemented during the relevant phase. The plans must include at a minimum the following:</p> <ul style="list-style-type: none"> • Roles and responsibilities for implementation, monitoring, and application; • Mechanisms to ensure that all personnel receive environmental awareness training; and • Address, among other topics, the Project requirements in relation to protecting water quality, fish and fish habitat, marine mammals, marine invertebrates, coastal birds, spill preparedness, noise, archaeological resources, and human health. <p>The training will include general training for all on-site personnel and role-specific training as determined by the infrastructure developer's and terminal operator's Environmental Managers.</p> <p>The plans will be developed in consultation with the following parties: CEA Agency and Indigenous groups.</p> <p>The VFPA will provide the draft plans to the parties for review a minimum of 90 days prior to the start of the relevant phase.</p>	<p>Environmental Training Plans Compliance Management Plans</p>	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓				✓	✓		✓	✓	✓	✓	✓
23	✓	✓	✓	<p>Prior to the start of construction and operation, the VFPA will develop <u>Health and Safety and Emergency Response Plans</u> to the satisfaction of a qualified individual(s). The plans will be implemented during the relevant phase. The plans must include at a minimum the following:</p> <ul style="list-style-type: none"> • Roles and responsibilities in relation to health, safety, emergency, and security management; • Measures to prevent, prepare for, respond to, and recover from an emergency; • Procedures in the event of an emergency for communication with emergency service providers such as B.C. Ambulance Service, Coast Guard, City of Delta, Delta Fire and Emergency Services, and Delta Police Department; • Measures to ensure the emergency service providers have current information regarding the nature, location, status, and progress of construction work; and • Measures to ensure the emergency service providers have current information regarding operational plans, activities, timelines, service requirements, and management of emergency services utilisation. 	<p>Health and Safety and Emergency Response Plans Communications Plans</p>														✓						✓		✓	

Number	Phase			Applicable Mitigation Measures and Other Project Commitments	Applicable Environmental Management Plan (EMP) or Other Plan(s)	Intermediate Components										Valued Components										Current Use	
	Design	Construction	Operation			Air Quality	Noise and Vibration	Light	Coastal Geomorphology	Surficial Geology and Marine Sediment	Marine Water Quality	Underwater Noise	Marine Vegetation	Marine Invertebrates	Marine Fish	Marine Mammals	Coastal Birds	Ongoing Productivity of CRA Fisheries	Labour Market	Economic Development	Services and Infrastructure	Marine Commercial Use	Outdoor Recreation	Visual Resources	Land and Water Use		Human Health
				<p>accordance with the Marine Spills Contingency Plan – National Chapter administered by the Coast Guard. All spill response will be coordinated and directed by personnel with documented spill response training;</p> <ul style="list-style-type: none"> • Incorporation of wildlife information (such as species, populations, and spatial and temporal distribution) and measures and strategies required to report, respond to, and monitor spill emergencies; • A description of how the VFPA will work in confidence with Western Canada Marine Response Corporation as required, and Indigenous groups, as identified and appropriate based on interest, to implement the plan in consideration of identified archeological sites and areas of archeological importance from information provided by appropriate agencies and Indigenous groups; and • A protocol for documenting, communicating, and correcting instances of non-compliance with the plans. <p>The plans will be developed in consultation with the following parties: B.C. Ambulance Service, CEA Agency, City of Delta, Coast Guard, Delta Fire and Emergency Services, Delta Police Department, ECCC, DFO, Transport Canada, WorkSafeBC, and Indigenous groups.</p> <p>The VFPA will provide the draft plans to the parties for review a minimum of 90 days prior to the relevant phase.</p>																							
27	✓	✓		<p>Prior to the start of construction and operation, the VFPA will develop <u>Terrestrial Vegetation and Wildlife Management Plans</u> to the satisfaction of a qualified professional(s). The plans will be implemented during the relevant phase. The plans must include at a minimum the following:</p> <ul style="list-style-type: none"> • Roles and responsibilities for implementation and monitoring; • A description of how terrestrial vegetation and wildlife values will be identified; and • A description of potential effects to terrestrial species and mitigation to address those effects, including but not limited to barn owls. <p>The plan will be developed in consultation with the following parties: B.C. Ministry of FLNRORD, CEA Agency, ECCC, and Indigenous groups.</p> <p>The VFPA will provide the draft plan to the parties for review a minimum of 90 days prior to start of the relevant phase.</p>	<p>Terrestrial Vegetation and Wildlife Management Plans</p> <p>Compliance Management Plans</p>																						✓
28	✓	✓		<p>Prior to the start of construction and operation, the VFPA will develop <u>Waste and Hazardous Materials Management Plans</u> to the satisfaction of a qualified professional(s). The plans will be implemented during the relevant phase. The plans must include at a minimum the following:</p> <ul style="list-style-type: none"> • Roles and responsibilities for implementation and monitoring; • Waste management measures to avoid human-wildlife conflicts; 	<p>Waste and Hazardous Materials Management Plans</p> <p>Spill Preparedness and Response Management Plans</p>	✓																				✓	

Number	Phase			Applicable Mitigation Measures and Other Project Commitments	Applicable Environmental Management Plan (EMP) or Other Plan(s)	Intermediate Components										Valued Components										Current Use	
	Design	Construction	Operation			Air Quality	Noise and Vibration	Light	Coastal Geomorphology	Surficial Geology and Marine Sediment	Marine Water Quality	Underwater Noise	Marine Vegetation	Marine Invertebrates	Marine Fish	Marine Mammals	Coastal Birds	Ongoing Productivity of CRA Fisheries	Labour Market	Economic Development	Services and Infrastructure	Marine Commercial Use	Outdoor Recreation	Visual Resources	Land and Water Use		Human Health
				<ul style="list-style-type: none"> The requirement to maintain inventories of types and quantities of all hazardous materials stored on site and hazardous waste materials generated, stored, or removed from site; The requirement to store and handle all hazardous materials and wastes in accordance with Federal Hazardous Products Act, Workplan Hazardous Materials Information System (WHMIS), B.C. Environmental Management Act, and Federal Transportation of Dangerous Goods Act; and Measures to minimize waste generation throughout construction and operation. <p>The plans will be developed in consultation with the following parties: CEA Agency, ECCC, Metro Vancouver, and Indigenous groups.</p> <p>The VFPA will provide the plans to the parties for review a minimum of 90 days prior to the relevant phase.</p>	Compliance Management Plans																						
29	✓	✓		<p>Prior to the start of construction and operations, the VFPA will develop <u>Water Quality Management Plans</u> to the satisfaction of a qualified professional(s). The plans will be implemented during relevant phase. The plans must include at a minimum the following:</p> <ul style="list-style-type: none"> Roles and responsibilities for implementation and monitoring; A description of the minimum sampling frequency and monitoring methodologies that will be used to evaluate compliance; Site-specific thresholds for water quality; and The means by which effectiveness of water quality mitigation will be assessed during constructions. <p>The plans will be developed in consultation with the following parties: CEA Agency, ECCC, DFO, and Indigenous groups.</p> <p>The VFPA will provide the plans to the parties for review a minimum of 90 days prior to the relevant phase.</p>	Water Quality Management Plans Dredging and Sediment Discharge Plan Sediment and Erosion Control Plan Construction Compliance Management Plan																						✓
Sub-plans to the Construction Environmental Management Plan																											
30	✓			<p>Prior to the start of construction, the VFPA will develop a <u>Dredging and Sediment Discharge Plan</u> to the satisfaction of a qualified professional(s). The plan will be implemented during construction. The plan must include at a minimum the following:</p> <ul style="list-style-type: none"> Roles and responsibilities for implementation and monitoring; Measures to reduce the combined number of dredge equipment and tug/barge movements; A description of how material dredged will be handled and managed; Measures to ensure that material dredged from the tug basin is placed within the terminal footprint as fill for the Project land development; 	Dredging and Sediment Discharge Plan Construction Water Quality Management Plan Construction Compliance Management Plan																						✓

Number	Phase			Applicable Mitigation Measures and Other Project Commitments	Applicable Environmental Management Plan (EMP) or Other Plan(s)	Intermediate Components										Valued Components										Current Use	
	Design	Construction	Operation			Air Quality	Noise and Vibration	Light	Coastal Geomorphology	Surficial Geology and Marine Sediment	Marine Water Quality	Underwater Noise	Marine Vegetation	Marine Invertebrates	Marine Fish	Marine Mammals	Coastal Birds	Ongoing Productivity of CRA Fisheries	Labour Market	Economic Development	Services and Infrastructure	Marine Commercial Use	Outdoor Recreation	Visual Resources	Land and Water Use		Human Health
				<ul style="list-style-type: none"> Site-specific water quality objectives and thresholds based on turbidity or total suspended solids models; Criteria for the location of real-time monitoring of turbidity; Measures related to the protection of marine species and relevant EMPs (i.e., sub-plans); and Criteria, protocol, and procedures to stop construction activities to address non-compliances. <p>The plan will be developed in consultation with the following parties: CEA Agency, ECCC, DFO, and Indigenous groups.</p> <p>The VFPA will provide the draft plan to the parties for review a minimum of 90 days prior to the start of construction.</p>																							
31		✓		<p>Prior to the start of construction, the VFPA will collaborate with Indigenous groups to develop an <u>Indigenous Monitors Plan</u>. The plan will provide an overview of the approach to effectively incorporate Indigenous monitors into the construction monitoring framework for biophysical components (e.g., purpose/objectives, roles/responsibilities, funding, and training) and for engaging with each Indigenous group regarding the development of group-specific Terms of Engagement. The Terms of Engagement will outline the role of each group's monitor(s), including at a minimum training, communication, and inspection frequency and focus.</p>	Indigenous Monitors Plan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓
32		✓		<p>Prior to the start of construction, the VFPA will develop a <u>Land and Marine Traffic Management Plan</u> to the satisfaction of a qualified individual(s). The plan will be implemented during construction. The plan must include at a minimum the following:</p> <ul style="list-style-type: none"> Roles and responsibilities for implementation and monitoring; Communication protocols and procedures; Areas of restricted access for marine vessel traffic for safety purposes, as well as to minimize effects to the Roberts Bank wildlife management area (WMA), and exposure to air emissions near the terminal. If marine vessel traffic access is required in the restricted access areas, a qualified professional(s) must develop additional mitigation, if there are potential effects to the WMA; and Measures to mitigate land and marine construction traffic congestion, control traffic, and mitigate potential traffic hazards. <p>The plan will be developed in consultation with the following parties: B.C. Ambulance Service, B.C. Ministry of FLNRORD, B.C. Ministry of Transportation and Infrastructure, CEA Agency, City of Delta, Coast Guard, Delta Fire and Emergency Services, Delta Police Department, DFO, Transport Canada, WorkSafeBC, and Indigenous groups.</p> <p>The VFPA will provide the draft plan to the parties for review a minimum of 90 days prior to the start of construction.</p>	Land and Marine Traffic Management Plan Construction Communications Plan Construction Environmental Training Plan Construction Compliance Management Plan	✓	✓												✓	✓	✓		✓	✓		✓	

Number	Phase			Applicable Mitigation Measures and Other Project Commitments	Applicable Environmental Management Plan (EMP) or Other Plan(s)	Intermediate Components										Valued Components										Current Use	
	Design	Construction	Operation			Air Quality	Noise and Vibration	Light	Coastal Geomorphology	Surficial Geology and Marine Sediment	Marine Water Quality	Underwater Noise	Marine Vegetation	Marine Invertebrates	Marine Fish	Marine Mammals	Coastal Birds	Ongoing Productivity of CRA Fisheries	Labour Market	Economic Development	Services and Infrastructure	Marine Commercial Use	Outdoor Recreation	Visual Resources	Land and Water Use		Human Health
				<ul style="list-style-type: none"> Timing of impact pile driving, including daytime-only impact piling to ensure detection of all marine mammals within the prescribed buffer zone, and seasonal timing of impact pile driving activities to avoid periods of marine mammal occurrence (other than harbour seals and sea lions), if deemed technically feasible; and The use of hydrophone monitoring of the buffer zone in periods of darkness or poor visibility, and the use of additional technologies to detect marine mammals in darkness and in poor conditions, such as infrared automated detection systems, if deemed technically feasible by the onset of construction. <p>The plan will be developed in consultation with the following parties: CEA Agency, DFO, and Indigenous groups.</p> <p>The VFPA will provide the draft plan to the parties for review a minimum of 90 days prior to the start of construction.</p>																							
34	✓			<p>Prior to the start of construction, the VFPA will develop a <u>Marine Species Management Plan</u> to the satisfaction of a qualified professional(s). The plan will be implemented during construction. The plan will consider all marine species with the exception of marine mammals. The plan must include at a minimum the following:</p> <ul style="list-style-type: none"> Roles and responsibilities for implementation and monitoring; A description of how marine species values will be identified; A description of potential effects to marine species and identification of sensitive life phases; Mitigation to be developed and implemented, including fisheries-sensitive windows, to avoid and reduce potential effects to marine species, including monitoring for spawning activity; Standard processes and procedures, including timing, to salvage and relocate marine species; and A description of the process and procedures for the Orange Sea Pen Transplant Program. <p>The plan will be developed in consultation with the following parties: CEA Agency, DFO, and Indigenous groups.</p> <p>The VFPA will provide the draft plan to the parties for review a minimum of 90 days prior to the start of construction.</p>	<p>Marine Species Management Plan</p> <p>Construction Environmental Training Plan</p> <p>Construction Compliance Management Plan</p>																					✓	
35	✓			<p>Prior to the start of construction, the VFPA will develop a <u>Marine and Terrestrial Invasive Species Management Plan</u> to the satisfaction of a qualified professional(s). The plan will be implemented during construction. The plan must include at a minimum the following:</p> <ul style="list-style-type: none"> Roles and responsibilities for implementation and monitoring; List of invasive species and associated regulatory requirements; A description of how invasive species encountered during construction activities will be managed; and 	<p>Marine and Terrestrial Invasive Species Management Plan</p> <p>Construction Environmental Training Plan</p> <p>Construction Compliance Management Plan</p>																					✓	

Number	Phase			Applicable Mitigation Measures and Other Project Commitments	Applicable Environmental Management Plan (EMP) or Other Plan(s)	Intermediate Components										Valued Components										Current Use	
	Design	Construction	Operation			Air Quality	Noise and Vibration	Light	Coastal Geomorphology	Surficial Geology and Marine Sediment	Marine Water Quality	Underwater Noise	Marine Vegetation	Marine Invertebrates	Marine Fish	Marine Mammals	Coastal Birds	Ongoing Productivity of CRA Fisheries	Labour Market	Economic Development	Services and Infrastructure	Marine Commercial Use	Outdoor Recreation	Visual Resources	Land and Water Use		Human Health
				<ul style="list-style-type: none"> A description of how measures will be implemented and monitored. The plan will be developed in consultation with the following parties: CEA Agency, DFO, and Indigenous groups. The VFPA will provide the draft plan to the parties for review a minimum of 90 days prior to the start of construction. 																							
36		✓		<p>Prior to the start of terrestrial ground disturbance, the VFPA will develop a <u>Sediment and Erosion Control Plan</u> to the satisfaction of a qualified professional(s). The plan will be developed prior to and implemented during construction. The plan must include at a minimum the following:</p> <ul style="list-style-type: none"> Roles and responsibilities for the installation, maintenance, and effectiveness monitoring of sediment and erosion control measures; Installation and regular inspection of land-based erosion-control measures; and A protocol for documenting, communicating, and correcting instances of non-compliance. <p>The plan will be developed in consultation with the following parties: CEA Agency, ECCC, DFO, and Indigenous groups.</p> <p>The VFPA will provide the draft plan to the parties for review a minimum of 90 days prior to start of construction.</p>	<p>Sediment and Erosion Control Plan</p> <p>Construction Water Quality Management Plan</p> <p>Construction Compliance Management Plan</p>																						✓
37		✓		<p>Prior to the start of construction activities with the potential to impact marine mammals and marine fish, the VFPA will develop an <u>Underwater Noise Management Plan</u> to the satisfaction of a qualified professional(s) and in consultation with DFO. The plan will be implemented during construction. With regard to marine mammals and marine fish, the plan will describe at a minimum the following:</p> <ul style="list-style-type: none"> Roles and responsibilities for implementation and monitoring; The monitoring parameters and methods to ensure sound levels remain below prescribed thresholds for marine fish and marine mammals; Apply gradual start-up or ramping of construction activities, such as pile driving, to allow marine species to habituate or temporarily leave the area; Requirement for the deployment of hydrophones; and Procedures in cases of sound exceedances, and mitigation measures that will prevent injury to marine fish and hearing injury and behavioural changes to marine mammals during impact pile driving, including but not limited to sound reduction or dampening methods or technologies. <p>The plan will be developed in consultation with the following parties: CEA Agency, DFO, and Indigenous groups.</p> <p>The VFPA will provide the draft plan to the parties for review a minimum of 90 days prior to start of construction.</p>	<p>Underwater Noise Management Plan</p> <p>Marine Mammal Management Plan</p> <p>Marine Species Management Plan</p> <p>Construction Compliance Management Plan</p>																						✓

Number	Phase			Applicable Mitigation Measures and Other Project Commitments	Applicable Environmental Management Plan (EMP) or Other Plan(s)	Intermediate Components										Valued Components										Current Use		
	Design	Construction	Operation			Air Quality	Noise and Vibration	Light	Coastal Geomorphology	Surficial Geology and Marine Sediment	Marine Water Quality	Underwater Noise	Marine Vegetation	Marine Invertebrates	Marine Fish	Marine Mammals	Coastal Birds	Ongoing Productivity of CRA Fisheries	Labour Market	Economic Development	Services and Infrastructure	Marine Commercial Use	Outdoor Recreation	Visual Resources	Land and Water Use		Human Health	Archaeological and Heritage Resources
38		✓		<p>The Noise and Vibration Management Plan and Underwater Noise Management Plan will be implemented during construction to mitigate noise-related effects to human health, marine mammals, marine fish, and coastal birds from pile driving.</p> <p>The VFPA commits to use of use of vibratory hammer during piling instead of impact pile driving during daylight hours, unless otherwise agreed to by a qualified professional(s). Piling will include the use of noise suppression methods, if feasible.</p>	<p>Construction Noise and Vibration Management Plan</p> <p>Marine Mammals Management Plan</p> <p>Marine Species Management Plan</p> <p>Underwater Noise Management Plan</p> <p>Construction Compliance Management Plan</p>		✓																					✓
39		✓		<p>Prior to the start of construction, the VFPA will develop a <u>Wetland Management Plan</u> to the satisfaction of a qualified professional(s). The plan will be implemented during construction. The plan must include at a minimum the following:</p> <ul style="list-style-type: none"> • Roles and responsibilities for implementation and monitoring; • A description of how wetland values will be identified; and • A description of potential effects to wetland function for identified wetlands in the Wetland Functions Assessment (IR11-21 of CEAR Document #934) and mitigation to address those effects. <p>The plan will be developed in consultation with the following parties: CEA Agency, ECCC, DFO, and Indigenous groups.</p> <p>The VFPA will provide the draft plan to the parties for review a minimum of 90 days prior to start of construction.</p>	<p>Wetland Management Plan</p> <p>Dredging and Sediment Discharge Plan</p> <p>Construction Environmental Training Plan</p> <p>Marine and Terrestrial Invasive Species Management Plan</p> <p>Marine Species Management Plan</p> <p>Construction Compliance Management Plan</p>																							✓
INDIVIDUAL PROJECT MEASURES, COMMITMENTS, AND PLANS																												
40		✓	✓	<p>Prior to the start of construction, the VFPA will develop a final <u>Offsetting Plan</u>. The plan will be included in the application to DFO for an Authorization under Paragraph 35(2)(b) of the <i>Fisheries Act</i>. The plan will be implemented prior to and during construction and operation. The plan will identify the following:</p> <p>a) The means by which the ongoing productivity of the Roberts Bank ecosystem, and each of the marine biophysical valued components identified in the EIS, is maintained; and</p> <p>b) The means by which no-net-loss of wetland function will be achieved for the wetland types identified in the Wetland Functions Assessment (IR11-21 of CEAR Document #934), meeting the intent of the Federal Policy on Wetland Conservation on Federal lands (Government of Canada 1991 or as amended or replaced from time to time).</p> <p>The plan at a minimum will include the following:</p>	Offsetting Plan																							✓

Number	Phase			Applicable Mitigation Measures and Other Project Commitments	Applicable Environmental Management Plan (EMP) or Other Plan(s)	Intermediate Components										Valued Components										Current Use	
	Design	Construction	Operation			Air Quality	Noise and Vibration	Light	Coastal Geomorphology	Surficial Geology and Marine Sediment	Marine Water Quality	Underwater Noise	Marine Vegetation	Marine Invertebrates	Marine Fish	Marine Mammals	Coastal Birds	Ongoing Productivity of CRA Fisheries	Labour Market	Economic Development	Services and Infrastructure	Marine Commercial Use	Outdoor Recreation	Visual Resources	Land and Water Use		Human Health
				<ul style="list-style-type: none"> • A description of anticipated residual productivity losses to marine biophysical valued components as a result of the Project; • A description of anticipated residual losses to wetland function as a result of the Project; • A description of the offsetting measures to be implemented, including the amount and type of offsets required, the selection of offsetting sites, including consideration of Indigenous priorities, and a schedule/timeline for implementation of offsetting measures; • A description of how the design of offsetting habitat has considered concerns regarding potential eutrophication/anoxia and changes in water drainage; • A description of how the offsetting will be monitored for effectiveness, as well as for invasive species; • A description of the triggers for implementing adaptive measures; • A description of the contingency measures that will be put into place if the offsetting measures are not successful; and • The content and schedule of reporting to agencies and Indigenous groups. <p>The VFPA commits, in preparing the final Offsetting Plan, to include more than one approach to assessing the benefits of offsetting, which could include, for example, estimating the production per functional group per habitat type.</p> <p>The plan will be developed in consultation with regulators, and Indigenous groups.</p>																							
41	✓	✓		<p>The VFPA will enhance its proposed offsetting as requested by Indigenous groups. This enhanced offsetting will form part of the final Offsetting Plan referred to in item 27, above.</p> <p>The enhanced proposed offsetting will be focused on priority species, such as Chinook salmon, and priority habitats, and may include the following:</p> <ul style="list-style-type: none"> • Additional onsite habitat types and areas (for example increased eelgrass areas); • Additional onsite habitat features (for example use of oyster shells to increase juvenile crab productivity); and • Identification and development of offsite opportunities, including considering potential opportunities to address limiting factors to priority species such as Chinook salmon. <p>The VFPA will continue to consult and collaborate with Indigenous groups and engage with regulators to develop the final Offsetting Plan.</p>	Offsetting Plan																						✓

Number	Phase			Applicable Mitigation Measures and Other Project Commitments	Applicable Environmental Management Plan (EMP) or Other Plan(s)	Intermediate Components										Valued Components										Current Use		
	Design	Construction	Operation			Air Quality	Noise and Vibration	Light	Coastal Geomorphology	Surficial Geology and Marine Sediment	Marine Water Quality	Underwater Noise	Marine Vegetation	Marine Invertebrates	Marine Fish	Marine Mammals	Coastal Birds	Ongoing Productivity of CRA Fisheries	Labour Market	Economic Development	Services and Infrastructure	Marine Commercial Use	Outdoor Recreation	Visual Resources	Land and Water Use		Human Health	Archaeological and Heritage Resources
				During the month of April, and prior to and during dredging in the dredge basin, the VFPA will deploy hydroacoustic technologies (e.g., split-beam echosounder) to detect in real time and guide dredging activities away from schools of migrating eulachon.																								
46		✓		The VFPA will ensure that all quarry material (once a quarry source is identified) will be characterised to demonstrate that Project construction activities, including supernatant discharge, will not result in marine pollution, as defined in the London Protocol and Convention and summarised by ECC in CEAR Document #1091, and will meet the pollution prevention provisions as determined by DFO as part of the Fisheries Act Authorization.	Dredging and Sediment Discharge Plan Construction Compliance Management Plan																							✓
47		✓		The VFPA will employ specific dredging practices to handle the upper 0.5 m of sediments from the existing tug basin and tug basin expansion area to avoid discharge of fines in supernatant and reduce the potential for increasing polychlorinated biphenyl concentrations in the receiving environment to the satisfaction of a qualified professional(s).	Dredging and Sediment Discharge Plan Construction Compliance Management Plan																							✓
48		✓	✓	Throughout construction and operation, the VFPA will do the following: <ul style="list-style-type: none"> Ensure monitoring and control of English cordgrass to the satisfaction of a qualified professional(s) at RBT2 onsite habitat enhancement areas; Ensure existing cordgrass within the footprint of the causeway widening will be managed to the satisfaction of a qualified professional(s) in coordination with the Province's English Cordgrass Management Program to ensure appropriate disposal of cordgrass within the Project footprint; and Coordinate with the Province's English Cordgrass Management Program prior to and during construction to limit seed dispersal to the satisfaction of a qualified professional(s). 	Marine and Terrestrial Invasive Species Management Plan Compliance Management Plan																							✓
49		✓		Throughout construction, the VFPA will ensure that in water works below -5 m chart datum (CD) are scheduled outside of the fisheries-sensitive windows for Dungeness crabs (October 15 to March 31) unless agreed to by DFO and mitigation is developed and implemented to the satisfaction of a qualified professional(s).	Marine Species Management Plan Construction Compliance Management Plan																							✓
50		✓		The VFPA will ensure that monitoring is conducted for the potential presence of spawning herring during construction activities outside the juvenile salmon timing window, in mid- to late February, in areas that spatially overlap with herring spawning habitats (e.g., native eelgrass).	Marine Species Management Plan Construction Compliance Management Plan																							
51		✓		During construction, the VFPA is committed to minimizing handling of crab, and to working with Indigenous groups, in implementation of crab salvage mitigation, as part of the Marine Species Management Plan.	Marine Species Management Plan Construction Compliance Management Plan																							✓

Number	Phase			Applicable Mitigation Measures and Other Project Commitments	Applicable Environmental Management Plan (EMP) or Other Plan(s)	Intermediate Components										Valued Components										Current Use	
	Design	Construction	Operation			Air Quality	Noise and Vibration	Light	Coastal Geomorphology	Surficial Geology and Marine Sediment	Marine Water Quality	Underwater Noise	Marine Vegetation	Marine Invertebrates	Marine Fish	Marine Mammals	Coastal Birds	Ongoing Productivity of CRA Fisheries	Labour Market	Economic Development	Services and Infrastructure	Marine Commercial Use	Outdoor Recreation	Visual Resources	Land and Water Use		Human Health
52	✓	✓		The VFPA will commit to funding programs or studies, up to \$500,000, that build on recent and ongoing work related to eulachon and sturgeon in the lower Fraser River, following Project approval. Such programs or studies will be conducted in partnership with Tsawwassen First Nation and Musqueam First Nation.	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
53		✓		Throughout construction, the VFPA will ensure that in water works above -5 m CD will be scheduled outside of the fisheries-sensitive windows for juvenile salmon (March 1 to August 15), unless agreed to by DFO and mitigation is developed and implemented to the satisfaction of a qualified professional(s).	Marine Species Management Plan Construction Compliance Management Plan								✓	✓		✓	✓										✓
54		✓	✓	The VFPA will continue to explore and evaluate opportunities to contribute to, support, and/or participate in current or future regional and/or multi-stakeholder initiatives (e.g., the VFPA's Habitat Enhancement Program) that will inform effective management of adult salmon populations and enhance their productivity.	N/A									✓		✓											✓
55		✓	✓	The VFPA will continue to explore and evaluate additional opportunities to contribute to, support, and/or participate in regional and/or multi-stakeholder initiatives that will inform effective management and recovery of SRKW. This includes ongoing consultation and opportunities with Indigenous groups, regulators, agencies, and stakeholders. The VFPA will continue to engage in regional programs to address the current condition of SRKW and will support/collaborate with the Government of Canada to meet recovery objectives in its federal Action Plan for SRKW.	N/A						✓			✓													✓
56			✓	Prior to the start of operation, the VFPA will distribute the marine mammal awareness pamphlets 'Marine Mammals of the Roberts Bank Area' and 'Mariner's Guide to Whales, Dolphins, Porpoises of Western Canada' to marine pilots working within VFPA jurisdiction.	Marine Mammal Management Plan Construction Compliance Management Plan										✓												✓
57		✓		Prior to the start of construction, the VFPA will ensure that a no-idling policy is developed to be implemented during construction. The policy will include exceptions for safety, weather, and construction requirements.	Air Emission Management Plans Noise and Vibration Management Plans	✓	✓									✓				✓	✓			✓			✓
58		✓		During construction, the VFPA will ensure that all equipment and vehicles will be maintained, inspected, and operated according to manufacturer specification to ensure peak performance while minimizing noise and air emissions. Noise suppression systems will be used and maintained for all equipment where such systems are available and practical as determined by a qualified professional(s).	Terrestrial Vegetation and Wildlife Management Plans Compliance Management Plans	✓	✓								✓						✓			✓			✓

Number	Phase			Applicable Mitigation Measures and Other Project Commitments	Applicable Environmental Management Plan (EMP) or Other Plan(s)	Intermediate Components										Valued Components										Current Use	
	Design	Construction	Operation			Air Quality	Noise and Vibration	Light	Coastal Geomorphology	Surficial Geology and Marine Sediment	Marine Water Quality	Underwater Noise	Marine Vegetation	Marine Invertebrates	Marine Fish	Marine Mammals	Coastal Birds	Ongoing Productivity of CRA Fisheries	Labour Market	Economic Development	Services and Infrastructure	Marine Commercial Use	Outdoor Recreation	Visual Resources	Land and Water Use		Human Health
				the VFPA to inform annual consultation with AICFA during construction and first 5 years of operation; and <ul style="list-style-type: none"> Where identified with DFO, commercial crab harvesters, and Indigenous groups, the VFPA will consider additional measures and implement with appropriate parties. 																							
63	✓	✓		The VFPA will consult with recreational crab harvesters through the Lower Fraser Sport Fishing Advisory Committee and DFO concerning the proposed navigational closure expansion, including the following objectives: <ul style="list-style-type: none"> Provide recreational crab harvesters with information about the nature, location, status, and progress of the proposed expansion of the navigational closure area, construction work, and operational activities to allow harvesters to adapt their activities; and Where identified with DFO, recreational harvesters, and Indigenous groups, the VFPA will consider additional measures and implement with appropriate parties. 	N/A																✓						✓
64	✓	✓		The VFPA will ensure the cranes' colour is optimised to reduce contrast and enhance blending with the landscape, which may involve recommendations by a qualified professional(s).	N/A																	✓					✓
65		✓		Prior to the start of construction, the VFPA will consult with industrial users to develop mitigation to be implemented during construction to minimize interference to industrial users.	Land and Marine Traffic Management Plan																		✓				
66		✓		During Project construction, access to marine areas near construction activities will be restricted for the safety of all non-construction related marine users. The restricted area will include the waters between the Project footprint and Westshore Terminals, and will be defined in the Land and Marine Traffic Management Plan. The restriction will be developed in consultation with Indigenous groups and be communicated in accordance with the Construction Communications Plan.	Land and Marine Traffic Management Plan Construction Communications Plan														✓	✓				✓		✓	
67		✓	✓	For the purpose of addressing perception of shellfish contamination, the VFPA will participate in discussions with interested health authorities (Health Canada, DFO, First Nation health authorities, Indigenous groups) on a collaborative approach to improving the understanding of shellfish quality at Roberts Bank.	N/A																			✓		✓	
68		✓		Prior to the start of construction, the VFPA will ensure a test trench, or series of trenches, is excavated across the eastern end of the causeway expansion area within the area of moderate archaeological potential (Figure 8 of EIS Appendix 28-A). The excavation will be completed under the direction of a professional archaeologist, with assistance of Indigenous monitors. If fish trap stakes are encountered during the test excavations, the excavation will be expanded along the orientation of the feature toward the existing causeway. If fish trap stakes are	Construction Archaeological Monitoring and Management Plan																				✓	✓	

Number	Phase			Applicable Mitigation Measures and Other Project Commitments	Applicable Environmental Management Plan (EMP) or Other Plan(s)	Intermediate Components											Valued Components								Current Use		
	Design	Construction	Operation			Air Quality	Noise and Vibration	Light	Coastal Geomorphology	Surficial Geology and Marine Sediment	Marine Water Quality	Underwater Noise	Marine Vegetation	Marine Invertebrates	Marine Fish	Marine Mammals	Coastal Birds	Ongoing Productivity of CRA Fisheries	Labour Market	Economic Development	Services and Infrastructure	Marine Commercial Use	Outdoor Recreation	Visual Resources		Land and Water Use	Human Health
				encountered, the location of stakes will be mapped and samples will be taken as they become visible, including measures to conserve organic materials to preserve the stake samples. The samples will be sent to a lab for radiocarbon dating to determine the relative age of the artifacts.																							
69			✓	For a period of four years after completion of the terminal containment dykes, a professional archaeologist will annually monitor (visually inspect) for possible tidal erosion of the area of moderate archaeological potential (Figure 8 of EIS Appendix 28-A) and the potential exposure of buried fish trap stakes. The work will be undertaken with the assistance of Indigenous monitors. If fish trap stakes are encountered, the chance find procedure will be implemented, the location of stakes will be mapped and samples will be taken as they become visible, including measures to conserve organic materials to preserve the stake samples. The samples will be sent to a lab for radiocarbon dating to determine the relative age of the artifacts.	Operation Archaeological Management and Monitoring Plans																				✓	✓	
70		✓	✓	Throughout construction and operation, the VFPA will continue to abide by the Memorandum of Agreement in place with Tsawwassen First Nation to accommodate for effects of the Project.	N/A																					✓	
71		✓	✓	The VFPA will continue to negotiate in good faith with Musqueam First Nation on the development of a Memorandum of Agreement for the Project.	N/A																					✓	
72		✓	✓	The VFPA will continue to negotiate in good faith with identified Indigenous groups towards mutual benefit agreements that are still in development and will abide by mutual benefit agreements that are in place.	N/A																					✓	
73		✓	✓	The VFPA commits to specific consultation with Tsawwassen First Nation, Musqueam First Nation, other Indigenous groups (as appropriate), and DFO on the terms of licencing to use the navigational closure areas for domestic or food, social, and ceremonial (FSC) crab harvesting purposes. Consultation with domestic and FSC crab harvesters will include the timing of implementation and spatial area (including configuration) of the expanded navigational closure.	N/A																					✓	
74		✓	✓	The VFPA will continue to support access for Indigenous crabbing for domestic or FSC purposes within the area closed to commercial and recreational crabbing.	N/A																					✓	
75		✓	✓	Prior to the start of construction and operation, the VFPA will develop communication protocols for the relevant phase in collaboration with Indigenous groups to ensure Indigenous groups have current information about planned and unplanned construction and operation activities and procedures for maintenance of safety that may impact Indigenous groups' Current Use access or quality of experience, and to identify additional measures, where necessary.	N/A																					✓	

Number	Phase			Applicable Mitigation Measures and Other Project Commitments	Applicable Environmental Management Plan (EMP) or Other Plan(s)	Intermediate Components										Valued Components							Current Use				
	Design	Construction	Operation			Air Quality	Noise and Vibration	Light	Coastal Geomorphology	Surficial Geology and Marine Sediment	Marine Water Quality	Underwater Noise	Marine Vegetation	Marine Invertebrates	Marine Fish	Marine Mammals	Coastal Birds	Ongoing Productivity of CRA Fisheries	Labour Market	Economic Development	Services and Infrastructure	Marine Commercial Use		Outdoor Recreation	Visual Resources	Land and Water Use	Human Health
				<ul style="list-style-type: none"> • <u>Roberts Bank Ecosystem Model</u> Evaluation of <u>Rockfish and Lingcod</u> Forecasts and Associated Effects Verification (informed by element described in Table C11); • <u>Roberts Bank Ecosystem Model</u> Evaluation of <u>Blue Heron</u> Forecasts and Associated Effects Verification (Table C4); • <u>Eelgrass Habitat Offset</u> Effectiveness (Table C5); • <u>Intertidal Marsh Habitat Offset</u> Effectiveness (Table C6); • <u>Juvenile Crab Nursery Habitat</u> Effects Prediction (Table C7); • <u>Orange Sea Pen Transplantation</u> Effectiveness (Table C8); • <u>Juvenile Salmon Density</u> Effects Prediction (Table C9); • <u>Sandy Gravel Beach Habitat Offset</u> Effectiveness (Table C10); • <u>Subtidal Rock Reefs Habitat Offset</u> Effectiveness (Table C11); • <u>Caisson Refuge Habitat Mitigation</u> Effectiveness (Table C12); • <u>Underwater Noise</u> Evaluation and Associated Effects Prediction (Table C13); • <u>Western Sandpiper</u> Prey Effects Prediction (Table C14); • <u>Salinity Model</u> Evaluation and Associated Effects Prediction (Table C15); • <u>Barn Owl Nest Box</u> Mitigation Effectiveness (Table C16); • <u>Barn Owl Productivity</u> Effects Prediction (Table C17); • <u>Diving Birds Abundance</u> Effects Predictions (Table C18); • <u>Avian Risk</u> from <u>Artificial Light</u> Effects Prediction (Table C19); • <u>Light</u> Trespass and Sky Glow Effects Prediction and Mitigation Effectiveness (Table C20); • <u>Human Health Air Quality</u> Effects Predictions (Table C21); and • <u>Human Health Noise</u> Effects Predictions (Table C22). <p>The VFPA will provide each draft FUP element to parties listed in Tables C1 through C22 (current drafts provided in Appendix C) for review a minimum of 90 days prior to the start of construction.</p>																							
82	✓	✓	✓	<p>The VFPA has committed to developing and supporting a Follow-up Advisory Committee, an independent oversight governance body of the RBT2 FUP, which will evaluate, independently report on, and make recommendations on the VFPA's implementation of the RBT2 FUP.</p>	Follow-up Program	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table B1 Compilation of Proposed Mitigation Measures and Other Commitments – Marine Shipping Associated with the Project

Number	Phase			Updated Applicable Mitigation Measures
	Design	Construction	Operation	
Current Use of Lands and Resources for Traditional Purposes (Current Use)				
1			✓	The VFPA commits to collaboration with the appropriate regulatory authorities and Indigenous groups to support the following: a) The provision of real-time information regarding the movement of Project-associated shipping traffic through the marine shipping area; and b) The identification of measures that may reduce the impact of international shipping lanes to fishing by Indigenous groups.
2			✓	The VFPA commits to actively participate as a key stakeholder in regional federal government initiatives and programs (refer to Table B2), and as appropriate, to coordinate the VFPA’s own consultation with Indigenous groups on Project-associated marine shipping in alignment with those initiatives.
Marine Mammals				
3			✓	Prior to the start of operation, the VFPA will distribute the marine mammal awareness pamphlets "Marine Mammals of the Roberts Bank Area" and "Mariner's Guide to Whales, Dolphins, Porpoises of Western Canada" to marine pilots working within VFPA jurisdiction. The VFPA will continue to explore opportunities to contribute to, support, and/or participate in regional and/or multi-stakeholder initiatives that will inform effective management and recovery of the endangered southern resident killer whale population, including Government of Canada initiatives under the Ocean Protections Plan (OPP), the Whale Initiative, and the VFPA-led Enhancing Cetacean Habitat and Observation (ECHO) Program. This includes ongoing consultation and opportunities with Indigenous groups, regulators, agencies, and stakeholders. The VFPA will continue to engage in regional programs to address the current condition of southern resident killer whale and will support/collaborate with the Government of Canada to meet recovery objectives in its federal Action Plan for southern resident killer whale.

Table C1 RBT2 Follow-up Program (FUP) Element: Current Use of Lands and Resources for Traditional Purposes (including Intangible Cultural Heritage) Effects Prediction and Mitigation Effectiveness

Characteristics	Description
Objective (Why/What?)	<p>Rationale: Verify effects predictions and mitigation effectiveness</p> <p>Program purpose: Collaboratively establish a communications mechanism for VFPA-Indigenous group dialogue regarding issues, concerns, and opportunities related to RBT2 during construction and operation. This mechanism will support dialogue concerning topics of importance to Indigenous groups, including but not limited to other RBT2 FUP elements applicable to the conclusions of the current use of lands and resources for traditional purposes (Current Use) assessment.</p>
Responsibility (Who?)	<p>Consultation / Collaboration: Follow-up Advisory Committee, Indigenous Advisory Committee (IAC) and individual Indigenous groups, and applicable regulatory and permitting agencies (e.g., DFO, Transport Canada)</p> <p>Implementation: The VFPA collaborating with Indigenous groups.</p>
Approach / Methods (How?)	<p>Approach: Building on concepts discussed in ongoing consultation, the VFPA will collaborate with Indigenous groups to determine the approach to continued VFPA-Indigenous group dialogue during construction and operation phases.</p> <p>Methods: Prior to construction start, the VFPA will continue to utilize the Indigenous Advisory Forums (IAF) and one-on-one consultation with individual Indigenous groups to support Project-related dialogue. The VFPA will collaborate with Indigenous groups to determine the structure of the IAC.</p> <p>The IAC will be a multi-group communications mechanism for VFPA-Indigenous group dialogue during construction and operation phases of the Project with a terms of reference that is developed and agreed to by the VFPA and Indigenous groups. The IAC will include representatives of Indigenous groups with interests that overlap with terminal footprint and will be a vehicle for discussions of matters of importance to Indigenous groups, including but not necessarily limited to Project mitigation, the RBT2 FUP, environmental management plans, offsetting, integration of traditional knowledge, and accessing of Project-related benefits. The IAC will meet with the VFPA regularly at agreed to frequency to receive progress updates, review monitoring reports, discuss Project-related issues identified by their represented communities, and otherwise provide advice and feedback to the VFPA. In turn, IAC representatives will facilitate the transfer of information between their communities and the IAC and the VFPA.</p>
Timing (When?)	<p>Both the IAC and the Follow-up Advisory Committee will be established prior to the start of construction and will dissolve when the VFPA, the Follow-up Advisory Committee, and appropriate regulators agree that the RBT2 FUP has met its objectives and monitoring and reporting are no longer warranted.</p>
Connection with Other FUP Elements	<p>The Current Use FUP coordinated through the IAC and Indigenous group consultation will consider all relevant aspects of the RBT2 Project.</p> <p>The Follow-up Advisory Committee will include two Indigenous group nominees that will be expected to communicate with the IAC.</p> <p>All other FUP elements will inform this FUP element (as a communications mechanism with Indigenous groups) and vice versa (refer to Approach/Methods).</p>

Table C2 RBT2 FUP Element: Coastal Geomorphic Process Evaluation and Associated Effects Predictions

Characteristics	Description
Objective (Why/What?)	<p>Rationale: Verify effects predictions</p> <p>Program purpose: Verify effects predictions on Project-related changes to geomorphic features and sediment erosion and deposition</p> <p>Monitoring target: Roberts Bank tideflat geomorphic characteristics and surficial sediment characteristics</p>
Responsibility (Who?)	<p>Consultation: Follow-up Advisory Committee, DFO, Natural Resources Canada, and interested Indigenous groups</p> <p>Implementation: VFPA</p> <p>Collaboration: Not applicable</p>
Approach / Methods (How?)	<p>Approach: A before-after study design will be used to verify effects predictions regarding potential Project-related changes to the seabed (geomorphic and sediment characteristics) using digital elevation models (DEM) (developed from topographic, LiDAR, and bathymetric surveys), sediment sampling, and ortho-rectified aerial photographs. Tideflat geomorphic characteristics that will be compared before, during, and after construction include tideflat elevations and locally altered elevational and visual changes (e.g., dendritic channels, mounding, localized depressions). Surface sediment characteristics assessed will include grain size and organic carbon content (which could provide an indication of sediment eutrophication and changes in sediment-associated biological communities). Approaches will differ between nearfield and far-field study areas owing to differences in predicted effects from the terminal. Any observed changes will be evaluated relative to existing circatidal, seasonal, and inter-annual (non-synoptic) variability. Data will be evaluated through a combination of geospatially enabled quantitative comparisons and interpretation by qualified professionals.</p> <p>Methods: Aerial orthophoto and LiDAR surveys will be conducted using a light aircraft equipped with orthophotography and LiDAR imaging systems. Bathymetric survey will be conducted from a vessel using multibeam sonars or similar bathymetric surveying equipment. LiDAR and bathymetric data will then be used to generate before, during, and after construction DEMs, which can be compared to historical DEMs using geospatial analytical approaches. Surficial sediment mini-cores will be collected for laboratory analysis of sediment grain size and total organic carbon content.</p>
Study Area (Where?)	<p>Surveys in the nearfield study area will be conducted on the subtidal and adjacent intertidal portions of the tideflats (the area expected to undergo the most rapid change due to scour and deposition). Surveys in the far-field study area will be conducted on the Roberts Bank tideflats (from approximately the lower of the low water boundary to the supralittoral) within the coastal geomorphology local study area.</p>
Timing (When?)	<p>In the nearfield zone, topographic and bathymetric surveys will be conducted once pre-Project construction, every 3 to 4 months during the year following completion of the terminal containment dykes, twice annually in the year after that, and annually for the next four years. All surveys targeting the far-field zone will be conducted during summer low tides. Orthophoto surveys will be conducted once pre-Project construction, annually during construction of the terminal containment dykes, and annually for five years following completion of the terminal containment dykes. LiDAR surveys will be conducted once pre-Project construction and in years 1, 3, 5, and 10 following completion of the terminal containment dykes.</p>

Characteristics	Description
Connection with Other FUP Elements	Roberts Bank ecosystem model evaluation and associated effects verification for marine vegetation and the Western sandpiper prey effects prediction.

Table C3 RBT2 FUP Element: Roberts Bank Ecosystem Model Evaluation of Marine Vegetation Forecasts and Associated Effects Verification

Characteristics	Description
Objective (Why/What?)	<p>Rationale: Verify effects predictions</p> <p>Program purpose: Verify effects predictions of Project-related changes in marine vegetation (native eelgrass, Japanese eelgrass, tidal marsh, <i>Ulva</i>, biomat, biofilm, and brown algae) productivity, including evaluating relevant Roberts Bank ecosystem model forecasts.</p> <p>Monitoring target: Biomass (t/m²) (estimated from density (# shoots/m²) or percent cover, and spatial extent (m²))</p>
Responsibility (Who?)	<p>Consultation: Follow-up Advisory Committee, DFO, ECCC, and interested Indigenous groups</p> <p>Implementation: VFPA</p> <p>Collaboration: Interested Indigenous groups</p>
Approach / Methods (How?)	<p>Approach: A Before-After-Control-Impact study design will be used to compare productivity of marine vegetation components (native eelgrass, Japanese eelgrass, tidal marsh, <i>Ulva</i>, biomat, biofilm, and brown algae) at project and reference study areas pre- and post-Project, thereby testing Roberts Bank ecosystem model forecasts. Productivity will be determined annually from the spatial extent of marine vegetation at Roberts Bank, which will be mapped from ortho-imagery, and a field sampling program will be designed to ground truth and characterise biophysical attributes. Field sampling will be conducted within the study area using quadrat surveys, with the number and distribution of sample locations determined following the first aerial mapping and ground-truthing survey. The methodological approach to monitoring biofilm will also be informed by the FUP element dedicated to Western sandpiper prey effects prediction. A power analysis will be conducted with the first year of baseline data to confirm adequate power for statistical comparison.</p> <p>Methods: Methods used will be a combination of aerial imagery (for marine vegetation mapping) and field sampling (to ground truth mapping and collect data on vegetation), consistent with standard best practices in B.C. and previous studies conducted in the local assessment area (LAA) / regional assessment area (RAA) (TDR MF-7 in Appendix AIR10-C of CEAR Document #388). Data recorded within quadrats during field sampling will include substrate characterisation, identification of marine vegetation, and estimates of density of vegetation (percent cover or shoots/m²). Leaf area index (mean shoot length x shoot width x mean shoot density) will also be recorded for native and Japanese eelgrass.</p>
Study Area (Where?)	The impact study area will be located on Roberts Bank, on the north side of the Roberts Bank causeway. A suitable and comparable reference study area outside the LAA will be selected.
Timing (When?)	Monitoring will occur during peak growing season in July/August. Aerial surveys will be conducted pre-Project construction and bi-annually for up to 10 years following the completion of the terminal containment dykes. Field data

Characteristics	Description
	collection and quadrat surveys will be conducted bi-annually for up to 10 years following completion of the terminal containment dykes.
Connection with Other FUP Elements	Roberts Bank ecosystem model evaluation and associated effects verification for biofilm under marine vegetation (informed by the Western sandpiper prey effects prediction), infauna (informed by the Western sandpiper prey effects prediction), rockfish and lingcod (informed by the subtidal rock reefs habitat offset effectiveness), and great blue heron.

Table C4 RBT2 FUP Element: Roberts Bank Ecosystem Model Evaluation of Blue Heron Effects Forecasts and Associated Verification

Characteristics	Description
Objective (Why/What?)	<p>Rationale: Verify effects predictions</p> <p>Program purpose: Verify effects predictions of negligible effects to great blue heron abundance in the LAA, including the Roberts Bank ecosystem model forecast</p> <p>Monitoring target: Abundance (# of individuals) and density (# of individuals/km²) of great blue herons</p>
Responsibility (Who?)	<p>Consultation: Follow-up Advisory Committee, ECCC, and interested Indigenous groups</p> <p>Implementation: VFPA</p> <p>Collaboration: Interested Indigenous groups</p>
Approach / Methods (How?)	<p>Approach: Great blue heron abundance and density will be compared between pre-construction and post-construction periods at impact (within the LAA) and reference (outside of the LAA) study areas to determine whether any potential differences between time periods are within the range of natural variability documented for the LAA and/or are attributable to the Project. The survey approach used will be the same as that used during the Deltaport Third Berth Adaptive Management Strategy, which is a rapid survey of intertidal habitats, from numerous survey sites established within treatment and reference study areas, designed to allow enumeration of herons while minimizing the potential for double-counting (Hemmera et al. 2011). Following the initial year of data collection, the program will be statistically evaluated to determine whether the study design will allow for potential Project-related effects to be separated from natural variability.</p> <p>Methods: Surveys of great blue herons will be used to compare abundance and density among time periods and locations by rapidly counting all herons visible from specific locations (survey sites), regardless of their location relative to that point (i.e., point counts). Survey sites will be positioned to maximize survey efficiency and spatial coverage and, once established, the same survey sites will be used repeatedly for all time periods throughout monitoring. Heron usage of intertidal habitats is greatest during low tides when eelgrass beds and intertidal mudflats are exposed facilitating heron foraging (Hemmera et al. 2008, 2009, 2010); thus, surveys will be conducted within two hours of peak low tide using a spotting scope and binoculars. A survey will be defined as one complete assessment of a study area.</p>
Study Area (Where?)	Impact sites will be located on Roberts Bank within the LAA, including along Brunswick Dyke, the Roberts Bank causeway, Tsawwassen First Nation Marsh, and the BC Ferries causeway. A reference site will be located within the Fraser River estuary.

Characteristics	Description
Timing (When?)	Surveys will be conducted every two weeks from March through October for 2 years pre-Project construction and in years 1, 2, 3, 4, and 5 post-Project construction.
Connection with Other FUP Elements	Roberts Bank ecosystem model evaluation and associated effects verification for marine vegetation (native eelgrass, Japanese eelgrass, tidal marsh, <i>Ulva</i> , biomat, biofilm, and brown algae), for biofilm (informed by the Western sandpiper prey effects prediction), infauna (informed by the Western sandpiper prey effects prediction), and rockfish and lingcod (informed by the subtidal rock reefs habitat offset effectiveness).

Table C5 RBT2 FUP Element: Eelgrass Habitat Offset Effectiveness

Characteristics	Description
Objective (Why/What?)	<p>Rationale: Verify mitigation effectiveness</p> <p>Program purpose: Assess the effectiveness of created eelgrass bed(s) in providing marine productivity benefits, including juvenile salmon and herring, and Dungeness crabs</p> <p>Monitoring target: Eelgrass cover (overall areal bed extent (m²), plant coverage (% cover)) and productive capacity (density of flowering shoots); abundance/diversity of fish and invertebrates</p>
Responsibility (Who?)	<p>Consultation: Follow-up Advisory Committee, DFO, ECCC, and interested Indigenous groups</p> <p>Implementation: VFPA</p> <p>Collaboration: Interested Indigenous groups</p>
Approach / Methods (How?)	<p>Approach: Effectiveness of created eelgrass bed(s) in offsetting potential Project-related marine productivity losses will be determined through annual diver-supported fixed transect and quadrat surveys. Data collected during these surveys will be used to quantify and compare eelgrass cover in created and reference (naturally established) eelgrass beds. Quadrat establishment along systematically placed transects will be based on a stratified random sampling design (stratified by factors known to affect eelgrass productivity, such as water depth and light). The number of transects and quadrats will be contingent on the area of created habitat and results of a power analysis to ensure final study design provides adequate power for statistical comparisons.</p> <p>Methods: Methods to be used will be consistent with standard best practices in B.C. (Precision Identification 2002). Side-scan sonar will be used to define the outer boundaries of created bed(s) and document areal bed extent. Data collected during quadrat surveys will be used to assess eelgrass coverage (density (eelgrass shoots/m²), leaf area index (mean shoot length x shoot width x mean shoot density; for one shoot selected per quadrat in unbiased fashion)), eelgrass reproductive capacity (density of flowering shoots), and biophysical data (e.g., water depth, substrate type). The number of motile invertebrates (e.g., crabs) and fish observed by species will be recorded as incidental observations during transect and quadrat establishment and during quadrat surveys. Invasive species will be identified and recorded. Underwater video will also be taken during establishment of transects.</p>

Characteristics	Description
Study Area (Where?)	Eelgrass bed(s) will be created in areas such as north of the proposed terminal where conditions of lower wave and current action are predicted. The reference sites will be located within existing native eelgrass habitats within the LAA (e.g., north or south of the causeway).
Timing (When?)	Monitoring will occur once annually towards the end of the growing season in August/September and in years 1, 2, 3, 4, and 5 post-Project construction. Side-scan sonar surveys will be completed in years 2 and 5.
Connection with Other FUP Elements	Intertidal marsh, sandy gravel beach, and subtidal rock reefs habitat offset effectiveness FUP elements and Roberts Bank ecosystem model evaluation and associated effects verification for marine vegetation.

Table C6 RBT2 FUP Element: Intertidal Marsh Habitat Offset Effectiveness

Characteristics	Description
Objective (Why/What?)	<p>Rationale: Verify mitigation effectiveness</p> <p>Program purpose: Determine effectiveness of created intertidal marsh habitat in providing marine productivity benefits</p> <p>Monitoring target: Intertidal marsh physical stability; vegetation establishment (e.g., percent cover, stem density and length, species diversity); biophysical characteristics (e.g., substrate, invertebrate abundance); water quality (e.g., salinity, temperature, dissolved oxygen); and fish abundance and diversity</p>
Responsibility (Who?)	<p>Consultation: Follow-up Advisory Committee, DFO, ECCC, and interested Indigenous groups</p> <p>Implementation: VFPA</p> <p>Collaboration: Interested Indigenous groups</p>
Approach / Methods (How?)	<p>Approach: Effectiveness of created intertidal marsh habitat in offsetting potential Project-related losses in marine productivity will be determined through annual topographical and biophysical surveys. These surveys will be used to quantify and compare intertidal marsh characteristics in created and referenced (naturally established) intertidal marsh sites. Surveys will be conducted at the site-level and by sampling within quadrats established randomly along systematically placed transects within each site. The number of established transects and quadrats will be contingent on the area of created habitat and results of a power analysis to ensure final study design provides adequate power for statistical comparisons.</p> <p>Methods: Methods used will be consistent with previous studies conducted in the LAA/RAA (CEAR Document #1186). Surveys will be conducted at low tide through observation, standardised photographs, and drone-recorded video. GPS topographical surveys to be conducted along fixed transects (perpendicular to the shoreline) will be used to document elevations, physical stability, and marsh spatial limits. Data collected during quadrat surveys will be used to assess vegetation establishment (percent cover, stem density and length, species diversity) using a modified Braun-Banquet method (CEAR Document #1186), physical and biophysical characteristics (e.g., substrate type, invertebrate abundance, native plant composition), and other marsh characteristics (e.g., woody debris accumulation). Invasive species will be identified and recorded. Water quality sampling (e.g., salinity, temperature, dissolved oxygen) and fish sampling (e.g., abundance, species diversity) will also be conducted for each site.</p>

Characteristics	Description
Study Area (Where?)	Intertidal marshes will be created in quiescent areas such as along the widened causeway. Reference intertidal marshes will be located outside of the zone of Project influence, preferentially within the LAA (e.g., north of the causeway, west shore of Westham Island), but potentially within the RAA.
Timing (When?)	Monitoring will occur once annually towards the end of the growing season in August/September in years 1, 2, 3, 4, and 5 post-Project construction. GPS topographical surveys and drone video work will be completed in years 1, 2, 3, 4, and 5 post-Project construction.
Connection with Other FUP Elements	Eelgrass, sandy gravel beach, and subtidal rock reef habitat offset effectiveness FUP elements and Roberts Bank ecosystem model evaluation and associated effects verification for marine vegetation.

Table C7 RBT2 FUP Element: Juvenile Crab Nursery Habitat Effects Prediction

Characteristics	Description
Objective (Why/What?)	<p>Rationale: Verify effects predictions</p> <p>Program purpose: Verify effects prediction of continued establishment and use of juvenile nursery habitat</p> <p>Monitoring target: Density of juvenile crabs (#/m²) by macrophyte habitat (e.g., native eelgrass, non-native eelgrass, <i>Ulva</i>)</p>
Responsibility (Who?)	<p>Consultation: Follow-up Advisory Committee, DFO, and interested Indigenous groups</p> <p>Implementation: VFPA</p> <p>Collaboration: N/a</p>
Approach / Methods (How?)	<p>Approach: A Before-After-Control-Impact study design will be used to compare juvenile Dungeness crab densities within two study areas (control, impact) pre-, during, and post-construction, thereby evaluating the effect prediction. Sampling will occur four times annually at multiple sampling sites within each study area during the crab settlement window (June to September) over multiple years. A random stratified design will be employed to ensure that sampling effort is both random and evenly distributed within macrophyte habitat types (e.g., maximum of 10 sites within each native eelgrass, non-native eelgrass, and drift green algae habitat type). A power analysis will be conducted with data from the first year to ensure adequate power for statistical comparisons.</p> <p>Methods: In accordance with information provided in TDR MI-2 in Appendix AIR10-C of CEAR Document #388, Dungeness crabs will be quantified in sediment sampled to 10 cm in depth and sorted through two coupled sieves (mesh sizes 2 and 4 mm). Crabs, including megalopae, will be counted, sexed (where possible), and measured (carapace widths (mm)). Juveniles will be identified based on carapace width (as per Dunham et al. (2011)) and their densities will be compared by habitat type and time period.</p>
Study Area (Where?)	The impact study area will be located on Roberts Bank between the north side of the Roberts Bank causeway and Canoe Passage (i.e., where Project activities have the potential to affect the settlement of juvenile Dungeness crab). The control study area will be located in the inter-causeway area outside of the zone of Project influence.

Characteristics	Description
Timing (When?)	Monitoring will be conducted four times annually during the settlement period of juvenile Dungeness crabs (June through September) for two years pre-Project construction and in years 2, 4, 6, 8, and 10 post-Project construction.
Connection with Other FUP Elements	Roberts Bank ecosystem model marine vegetation effects verification.

Table C8 RBT2 FUP Element: Orange Sea Pen Transplantation Effectiveness

Characteristics	Description
Objective (Why/What?)	<p>Rationale: Verify mitigation effectiveness</p> <p>Program purpose: Verify the effectiveness of sea pen translocation, including monitoring for factors that influence the success of the mitigation including sea pen density, recruitment, as well as presence of predators</p> <p>Monitoring target: Orange sea pen density (#/m²) and recruitment (# juveniles); # of predators (i.e., sea stars, nudibranchs)</p>
Responsibility (Who?)	<p>Consultation: Follow-up Advisory Committee, DFO, and interested Indigenous groups</p> <p>Implementation: VFPA</p> <p>Collaboration: N/a</p>
Approach / Methods (How?)	<p>Approach: The effectiveness of translocation of orange sea pens, a mitigation measure intended to reduce Project footprint effects, will be assessed by conducting SCUBA surveys to estimate orange sea pen densities at transplant sites (i.e., sites into which orange sea pens have been relocated) and control sites (i.e., sites outside the Project footprint within the existing aggregation). Transplant and control sites will be monitored three times during the first year post-transplant to ensure effective salvage. The primary goal of monitoring will be to confirm persistence of transplanted orange sea pens by comparing densities at each transplant site relative to initial planting densities. Additionally, transplant densities will be evaluated relative to densities at control sites. The number and size of transplant sites will be finalised through consultation with DFO and interested Indigenous groups.</p> <p>Methods: A pre-Project construction survey will be conducted to update the mapped distribution of orange sea pens using towed underwater video. Results of this survey will be used to inform transplant targets, in collaboration with DFO and interested Indigenous groups. Transplant sites will be selected using a ground-truthed species distribution model developed specifically for the Project. Orange sea pens will be harvested from the existing aggregation under the proposed terminal footprint and translocated at similar densities to pre-vetted transplant sites. SCUBA surveys, conducted three times in one year, will be used to count orange sea pens and potential predators, and to document evidence of recruitment, within all transplant and control sites. Densities (# orange sea pens per m²) will be compared among sites and monitoring events.</p>
Study Area (Where?)	All transplant and control sites will be located at Roberts Bank, outside of the Project footprint, in suitable habitat identified through modelling and ground truthing.

Characteristics	Description
Timing (When?)	An updated mapped distribution of orange sea pens will be conducted pre-Project construction. Orange sea pens will be transplanted before Project construction commences. Monitoring will occur in the transplant and control sites three times over the course of the first year after transplanting (one, six, and 12 months post-transplant).
Connection with Other FUP Elements	None

Table C9 RBT2 FUP Element: Juvenile Salmon Density Effects Prediction

Characteristics	Description
Objective (Why/What?)	<p>Rationale: Verify effects predictions</p> <p>Program purpose: Verify that Project effects on productivity of juvenile salmon, including chum and Chinook, are negligible as predicted in the EIS</p> <p>Monitoring target: Distribution and densities (#/m³) of juvenile salmon</p>
Responsibility (Who?)	<p>Consultation: Follow-up Advisory Committee, DFO, and interested Indigenous groups</p> <p>Implementation: VFPA</p> <p>Collaboration: Key organizations working in the Fraser River estuary, DFO, interested Indigenous groups</p>
Approach / Methods (How?)	<p>Approach: To evaluate whether a Before-After-Control-Impact (or Control-Impact, depending on available baseline data) study design could be implemented to compare densities of juvenile salmon, including chum and Chinook, within two study areas (control, impact) pre- and post-construction, thereby verifying effects predictions. Power analysis will be conducted to determine whether a monitoring program is feasible¹⁴. If feasible, the power analysis will direct study design details, including number of sampling sites and distribution, and sampling frequency and duration, to ensure adequate statistical power for effective comparison. Environmental data collected during sampling, and DFO smolt survey data from the Strait of Georgia, will be used as blocking factors in analyses.</p> <p>Methods: If feasible, distribution and density of juvenile salmon, including chum and Chinook, will be determined and compared among study areas and time periods using beach seines in the intertidal and purse seines in the subtidal, consistent with methods used previously (TDR MF-3 in Appendix AIR10-C of CEAR Document #388, response to IR12-10 of CEAR Document #934). Captured individuals will be identified to lowest taxonomic level, counted, and measured; data on environmental conditions (e.g., temperature, salinity, water depth) will be recorded. Fin clip or scale samples will be collected and genetically analysed to identify juvenile salmon stocks.</p>
Study Area (Where?)	The impact study area will encompass the area north of the Roberts Bank causeway to Canoe Passage and the inter-causeway area south of the Roberts Bank causeway. The control study area will be sited entirely outside of the zone of Project influence, away from anticipated major development or restoration action (e.g., west side of Westham Island).

¹⁴ The VFPA has committed that, if it is determined that it is not reasonable to attribute detectable change in juvenile salmon density to the Project, alternatives to the FUP element will be considered at that time, including additional offsetting approaches.

Characteristics	Description
Timing (When?)	Baseline monitoring data from 2012 and 2013 will be supplemented with two additional years of pre-Project construction data, as well as additional pre-Project construction data that may be available from other key organizations that are working in the Fraser River estuary. The required number of years of post-Project construction monitoring to detect a potential Project change will be determined by the power analysis, if monitoring is deemed feasible.
Connection with Other FUP Elements	Data acquired for other FUP elements on physical (e.g., temperature, salinity, water depths) and biological (e.g., marine food sources) attributes of the marine habitat may inform data analysis for this FUP element.

Table C10 RBT2 FUP Element: Sandy Gravel Beach Habitat Offset Effectiveness

Characteristics	Description
Objective (Why/What?)	<p>Rationale: Verify mitigation effectiveness</p> <p>Program purpose: Determine effectiveness of created sandy gravel beach(es) in providing habitat for forage fish spawning</p> <p>Monitoring target: Forage fish beach spawning habitat characteristics (tidal elevation and substrate composition) and use by spawning Pacific sand lance and surf smelt (egg presence, abundance, and developmental stage)</p>
Responsibility (Who?)	<p>Consultation: Follow-up Advisory Committee, DFO, and interested Indigenous groups</p> <p>Implementation: VFPA</p> <p>Collaboration: Interested Indigenous groups</p>
Approach / Methods (How?)	<p>Approach: Effectiveness of created sandy gravel beaches in offsetting Project-related marine productivity losses will be assessed through GPS transect topographical surveys to monitor elevation, physical stability, and beach spatial limits. Composite beach spawn sampling of forage fish eggs will also be conducted monthly during two spawning periods to monitor use of the created spawning beaches by sand lance and surf smelt. GPS topographical surveys will be conducted along fixed transects perpendicular to shore. Spawn surveys will be conducted at sample sites distributed systematically along transects established parallel to shore. The number of transects that will be established for topographical surveys and number and distribution of sample sites that will be used for spawn surveys will be contingent on the area of created habitat and results of a power analysis to ensure that final study design provides adequate power for statistical comparisons.</p> <p>Methods: Methods used will be consistent with previous studies conducted in the LAA/RAA (CEAR Document #1186). Surveys will be conducted at low tide through observation, standardised photographs, and drone-recorded video. GPS topographical surveys will be conducted using a GPS to document elevations, physical stability, and beach spatial limits. Composite beach spawn sampling will be conducted at sample sites established along 30-m transects within the upper intertidal zone (i.e., between 3.0 and 4.5 m chart datum elevation). Sampling will involve removing approximately 2 L of sediment from the upper 2-3 cm of substrate within 2.5 m on either side of the transect for follow-up lab analysis; sieving sediment samples through graduated screens (4 mm, 2 mm, and 0.5 mm); air-drying and splitting to a mass appropriate amount for the maximum particular size in accordance with ASTM C-136 and C-117 protocols; oven drying; and sieving for comparison to grain-size preferences for beach spawn forage fish. A sub-sample consisting of particles</p>

Characteristics	Description
	of fraction 0.5 mm and less will be examined by a trained professional for egg presence and developmental stage based on marine shore spawning forage fish embryo survey methodology.
Study Area (Where?)	Sandy gravel beaches will be created in areas of higher wave energy along the widened causeway and proposed terminal.
Timing (When?)	Monitoring will occur once per month in the winter (November, December, and January), coinciding with anticipated peak Pacific sand lance spawning period, and once per month in the summer (June, July, and August), coinciding with surf smelt spawning period. Monitoring will be conducted in years 1, 2, 3, 4, and 5 post-Project construction. GPS topographical surveys and drone video work will be completed in years 2 and 5 post-Project construction.
Connection with Other FUP Elements	Eelgrass, intertidal marsh, and subtidal rock reefs habitat offset effectiveness FUP elements.

Table C11 RBT2 FUP Element: Subtidal Rock Reefs Habitat Offset Effectiveness

Characteristics	Description
Objective (Why/What?)	<p>Rationale: Verify mitigation effectiveness</p> <p>Program purpose: Determine effectiveness of constructed subtidal rock reef habitat in providing marine productivity benefits</p> <p>Monitoring target: Macroalgae cover; sessile invertebrate cover; motile marine biota (fish and invertebrate) usage, abundance, and diversity; and lingcod egg mass presence, egg mass volume, and state of egg development</p>
Responsibility (Who?)	<p>Consultation: Follow-up Advisory Committee, DFO, and interested Indigenous groups</p> <p>Implementation: VFPA</p> <p>Collaboration: N/a</p>
Approach / Methods (How?)	<p>Approach: Effectiveness of constructed subtidal rock reef habitat in offsetting Project-related marine productivity losses will be determined through annual diver-supported belt transect and quadrat surveys. Data collected during surveys will be used to quantify macroalgae cover, sessile invertebrate cover, and motile marine biota (fish and invertebrate) presence, abundance, and diversity on created subtidal rock reef habitat sites, which will then be compared with previously created subtidal rock reef reference sites and native soft substrate reference sites. Quadrat establishment along systematically placed transects will be based on a stratified random sampling design (stratified by factors known to affect rock reef productivity, such as depth). Lingcod egg mass surveys will also be undertaken, using roaming diver searches. The number of transects and quadrats and level of effort for lingcod egg mass surveys will be contingent on the area of habitat created and results of a power analysis to ensure final study design provides adequate power for statistical comparison.</p> <p>Methods: Methods will be consistent with those used previously (TDR MF-5 in Appendix AIR10-C of CEAR Document #388). During surveys within established quadrats, diver observations (supported by underwater video and still photographs) will be used to assess percent cover (using a modified Braun-Banquet method) and species diversity of macroalgae and sessile invertebrate, physical data (e.g., water depth, substrate type), and total number of motile invertebrate (e.g., crabs) and fish observed by species. The number and species of motile invertebrates and fish observed will also be recorded as incidental observations during transect and quadrat establishment. Invasive species will be identified and recorded. Underwater video will also be taken during establishment of transects. Lingcod egg mass surveys will be carried out using roaming diver searches counting egg masses and recording volume and state of development.</p>
Study Area (Where?)	<p>Subtidal rock reefs will likely be created adjacent to existing constructed rock reefs immediately south of the existing terminal and within the LAA, in proximity to reference sites (existing constructed subtidal rock reefs and soft substrate).</p>
Timing (When?)	<p>Monitoring of the created subtidal rock reefs will occur once annually in August/September. Monitoring will be conducted in years 1, 2, 3, 4, and 5 post-Project construction. Lingcod egg mass surveys will occur once in late January to mid-March in years 3 and 5.</p>

Characteristics	Description
Connection with Other FUP Elements	Eelgrass, intertidal marsh, and sandy gravel beach habitat offset effectiveness FUP elements and the Roberts Bank ecosystem model rockfish and lingcod verification.

Table C12 RBT2 FUP Element: Caisson Refuge Habitat Mitigation Effectiveness

Characteristics	Description
Objective (Why/What?)	<p>Rationale: Verify mitigation effectiveness</p> <p>Program purpose: Determine, over the long term, effectiveness of caisson fish refugia as habitat for demersal fish to offset the anticipated loss of productivity</p> <p>Monitoring target: Marine invertebrate and marine fish, including demersal fish, presence, abundance, and diversity</p>
Responsibility (Who?)	<p>Consultation: Follow-up Advisory Committee, DFO, and interested Indigenous groups</p> <p>Implementation: VFPA</p> <p>Collaboration: N/a</p>
Approach / Methods (How?)	<p>Approach: Marine invertebrate and marine fish, including demersal fish, productivity measures (e.g., presence, abundance, diversity) will be assessed through annual diver-supported surveys. Data will be collected within sampling quadrats established in the constructed caisson refuge habitats (treatment quadrats) compared to similar data collected from reference quadrats located outside of the refuge habitats (control quadrats). The number of established sampling quadrats will be contingent on the number of constructed caisson refuge habitats and results of a power analysis to ensure final study design provides adequate power for statistical comparisons.</p> <p>Methods: Methods to be used will be consistent with previous studies conducted in the LAA/RAA, including work completed as part of effectiveness monitoring of caisson refuge habitats created as compensation for the Deltaport Third Berth project (Balanced Environmental 2010). Treatment quadrats will be established at fixed locations on the inside walls of a subsample of constructed caisson fish refugia (including below the refugia opening, above the opening, on one of the side walls, and on the back wall) and reference quadrats will be located on outer caisson surfaces. During surveys, percent cover of sessile invertebrates (determined using a modified Braun-Banquet method) and the total number of motile invertebrates and marine fish, including demersal fish, will be recorded by species within each quadrat, as documented by diver observations and supported by underwater video and still photographs. Underwater video (supported by sufficient lighting) will also be used to document the presence of any motile invertebrates and fish within the constructed refuge habitat and outside of established quadrats on an opportunistic basis.</p>
Study Area (Where?)	All caisson refuge habitat constructed as part of the terminal’s berth face. Within each refugia opening, treatment sampling quadrats will be established on the inside caisson walls and control quadrats will be located on outer caisson surfaces.
Timing (When?)	Monitoring will occur once annually in August/September. Monitoring will be conducted in years 1, 2, 3, 4, and 5 following installation of caisson fish refugia.

Characteristics	Description
Connection with Other FUP Elements	None

Table C13 RBT2 FUP Element: Underwater Noise Evaluation and Associated Effects Predictions

Characteristics	Description
Objective (Why/What?)	<p>Rationale: Verify effects predictions</p> <p>Program purpose: Verify effects predictions on Project-related changes to underwater noise during terminal operation</p> <p>Monitoring target: Underwater noise levels (decibels)</p>
Responsibility (Who?)	<p>Consultation: Follow-up Advisory Committee, DFO, and interested Indigenous groups</p> <p>Implementation: VFPA, through qualified acoustical consultant</p>
Approach / Methods (How?)	<p>Approach: A before-after study design will be used to compare underwater noise within the predicted terminal operations footprint immediately before and after the start of Project terminal operation to verify predicted effects of Project operation on the acoustic environment. Similar to previous underwater noise monitoring studies in 2012 and 2014, monitoring will be conducted simultaneously at two fixed locations within the predicted noise footprint of the proposed terminal for a period of approximately 60 days during both winter and summer. The monitoring locations will be selected to confirm the spatial extent of predicted noise levels from approach/berthing and unberthing/departure of container ships and associated support tugs. Noise level statistics will be compared between before and after periods to verify predictions of terminal operations noise and will control for the effects of adjacent noise sources (i.e., vessel movements and terminal activities from Westshore, Deltaport, BC Ferries), weather conditions, and tidal cycles.</p> <p>Methods: Noise levels will be sampled at each fixed location using a calibrated hydrophone recording system (either cabled or autonomous) that is capable of continuous, uninterrupted sampling for the entire monitoring period. Sound levels will be recorded, at minimum, over the frequency range 10–64,000 Hertz, and reported as one-minute sound pressure levels for broadband, 1/3-octave band, and decade-band frequency ranges, and as power spectral density levels. The hydrophones will be deployed on subsea moorings at a fixed elevation above seabed (e.g., 3 metres) to minimize influence of turbulence and cable strum, due to tidal currents, on the sampled data. Additional metadata will be collected continuously during the monitoring period, including Automatic Identification System (AIS) vessel tracking data (to account for the influence of Project-related and non-Project-related vessel movements) and meteorological data. Data will be analysed to evaluate whether predictions are being met and whether any trends or relationships are apparent.</p>
Study Area (Where?)	Underwater noise monitoring will occur within the predicted terminal operation footprint described in CEAR Document #1363.
Timing (When?)	Monitoring will occur continuously for approximately 60 days during winter (January-February) and summer (July-August) for one year pre-Project construction and for three years post-Project construction, during times when RBT2 ships are present and not present at the terminal.

Characteristics	Description
Connection with Other FUP Elements	None

Table C14 RBT2 FUP Element: Western Sandpiper Prey Effects Prediction

Characteristics	Description
Objective (Why/What?)	<p>Rationale: Verify effects predictions</p> <p>Program purpose: Verify that effects of the Project on the capability of the LAA to support the Western sandpiper population through potential alterations to prey distribution and abundance are negligible</p> <p>Monitoring target: Abundance/density of biofilm (mg chlorophyll <i>a</i>/m², mg fatty acids/m², mg carbohydrates/m²) and macro- and meiofauna invertebrate prey (mg fatty acids/m², mg carbohydrates/m²)</p>
Responsibility (Who?)	<p>Consultation: Follow-up Advisory Committee, ECCC, and interested Indigenous groups</p> <p>Implementation: VFPA</p> <p>Collaboration: Simon Fraser University</p>
Approach / Methods (How?)	<p>Approach: A Before-After-Control-Impact study design will be used to compare density and biomass (measures of productivity) of biofilm and invertebrates (sandpiper prey) within two study areas (control, impact) pre- and post-Project construction, thereby testing predictions made during the assessment that potential Project effects on biofilm and invertebrates will be negligible. Six sampling events will be conducted during the Western sandpiper migratory period (April-May) at seven sites within each study area over multiple years prior to, during, and post-construction. A power analysis will be conducted to ensure adequate power for statistical comparisons following the first year of data collection.</p> <p>Methods: Abundance/density (mg/m²) of biofilm and invertebrates will be measured and compared across study sites and sampling periods. Biofilm will be sampled by scraping the top 2 mm of biofilm-sediment from the surface of mudflats; invertebrates will be sampled using a 9-cm diameter and 4-cm depth core consistent with previous empirical studies (CEAR Documents #1215 and #1385). Two replicate biofilm and invertebrate samples will be collected at each site. Samples will be processed, stored, and analysed following methods used in previous studies to ensure comparability, including analyses to yielding complete fatty profiles of samples.</p>
Study Area (Where?)	The impact study area will be located at Roberts Bank between the north side of the Roberts Bank causeway and Canoe Passage. Impact sampling sites were established during the 2016-2018 biofilm dynamics study (CEAR Documents #1215 and #1385). The control study area will be located within the Fraser River estuary such as west of Westham Island or Sturgeon Bank, in areas where high Western sandpiper use was identified during the 2012-2013 existing condition studies (TDR CB-1 in Appendix AIR10-C of CEAR Document #388).
Timing (When?)	Monitoring will occur in April and May during Western sandpiper northward migration, for two years pre-Project construction, annually during the two year construction of the containment dyke, and for up to 5 years post-Project construction. As the containment dyke will be completed approximately 18 months into construction, monitoring of shorebird prey under Project hydrodynamic conditions will be initiated during the second or third year of Project construction.

Characteristics	Description
Connection with Other FUP Elements	Roberts Bank ecosystem model biofilm and infaunal effects verification and the salinity effect prediction FUP elements.

Table C15 RBT2 FUP Element: Salinity Model Evaluation and Associated Effects Prediction

Characteristics	Description
Objective (Why/What?)	<p>Rationale: Verify effects predictions</p> <p>Program purpose: Evaluate model predictions of salinity changes in the intertidal water column (with a particular focus on biofilm habitat) during and following Project construction and linkages to effects predictions</p> <p>Monitoring target: Water column salinity levels (practical salinity units)</p>
Responsibility (Who?)	<p>Consultation: Follow-up Advisory Committee, DFO, B.C. Ministry of Forests, Lands, Natural Resource Operations and Rural Development, and interested Indigenous groups</p> <p>Implementation: VFPA</p> <p>Collaboration: N/a</p>
Approach / Methods (How?)	<p>Approach: A before-after study design will be used to compare salinity in the Project area before and after the initiation of Project construction to allow verification of predictions of Project-related effects on water column salinity made during the effects assessment. To ensure comparability with the existing baseline dataset, the study approach will follow the same methods implemented for the ongoing salinity monitoring program. Salinity will be monitored at the existing monitoring stations and statistical analyses will be employed to assess the extent of Project-related changes in water column salinity levels during and post-construction, relative to the baseline dataset.</p> <p>Methods: Salinity will be automatically measured at five minute intervals at 10 sampling stations using multi-parameter auto-logging instruments (vanEssen CTD-Diver water quality meters). The monitoring stations will consist of one water quality meter located at the sediment water column interface. Data will be downloaded monthly and sensors will be calibrated as per manufacturers specifications, visually inspected, and maintained as necessary.</p>
Study Area (Where?)	The study area will mirror the ongoing salinity monitoring program. Ten stations across the salinity gradient from Canoe Passage to the Roberts Bank causeway are established in the mid- and upper-intertidal flats. The monitoring locations are established within areas where Project-related changes to salinity levels are anticipated, or in known biofilm habitat.
Timing (When?)	Monitoring will be conducted throughout the year during construction and up to 5 years post-Project construction.
Connection with Other FUP Elements	Western sandpiper prey effects prediction.

Table C16 RBT2 FUP Element: Barn Owl Nest Box Mitigation Effectiveness

Characteristics	Description
Objective (Why/What?)	<p>Rationale: Verify mitigation effectiveness</p> <p>Program purpose: Determine the effectiveness of installed nest boxes in increasing barn owl productivity in the RAA to offset potential Project-related productivity losses in the LAA due to owl-vehicle road and rail mortalities (i.e., motorized traffic)</p> <p>Monitoring target: Barn owl productivity (% occupied nest boxes, % of nest fledging young, # owls fledged/year)</p>
Responsibility (Who?)	<p>Consultation: Follow-up Advisory Committee, ECCC, B.C. Ministry of Environment and Climate Change Strategy, City of Delta, and interested Indigenous groups</p> <p>Implementation: VFPA</p> <p>Collaboration: Non-profit organization(s), Indigenous groups, and (likely) private landowners</p>
Approach / Methods (How?)	<p>Approach: A Before-After-Control-Impact study design will be used to document barn owl productivity within two study areas (control, impact) during three time periods (pre-, during, and post-construction), which will allow evaluation of the effectiveness of nest boxes installed within the RAA as a mitigation measure designed to offset Project-related barn owl losses due to road and rail mortality in the LAA (see barn owl productivity effects prediction FUP element, Table C17). Barn owl road mortalities are greatest within 2.5 km of high traffic roads (Ramsden 2003). Within the RAA, roads fitting this description are Highways 17, 17A, 99, and Deltaport Way, which will inform the placement of nest boxes. Attempts will be made to place all new nest boxes ≥ 2.5 km from major roads and near high quality foraging habitat, a landscape attribute shown to be positively correlated with fledging success (Taylor 1994, Hindmarch 2010, Hindmarch et al. 2017). Pre-Project monitoring will provide data to refine the detailed study design (e.g., verify the number of nest boxes needed to offset potential adverse Project effects).</p> <p>Methods: The VFPA will work with collaborators to erect five barn owl nest boxes within 10 km of the proposed Project, during the first year of construction. The installation of nest boxes is anticipated to more than offset the conservative estimate of six Project-related mortalities per year, based off a mean barn owl fledging success of approximately 2.4 young fledged/nest (Andrusiak 1994, Hindmarch 2010, Hemmera 2017). Barn owl productivity will be determined through annual nest box monitoring using accepted standards (Hindmarch 2010, Hemmera 2017).</p>
Study Area (Where?)	Existing nest boxes located within 2.5 km of the LAA boundary will be considered within the impact study area. Nest boxes installed between 2.5 km and 10 km outside of the LAA will be within the control study area.
Timing (When?)	Monitoring will be conducted six to eight times during the barn owl breeding period, between March and September, after the first year of construction, and for up to five consecutive years post-Project construction.
Connection with Other FUP Elements	Barn owl productivity effects prediction FUP element.

Table C17 RBT2 FUP Element: Barn Owl Productivity Effects Prediction

Characteristics	Description
Objective (Why/What?)	<p>Rationale: Verify effects predictions</p> <p>Program purpose: Verify the predictions of negligible Project effect on barn owl productivity with mitigation applied (speed limit management, driver awareness, education training, nest box installation, and support the establishment/maintenance of barn owl foraging habitat) by determining road and rail mortality and comparing to nest productivity</p> <p>Monitoring target: Barn owl losses (# Project-related road and rail mortalities/year) ≤ productivity (# barn owls fledged from nest boxes/year)</p>
Responsibility (Who?)	<p>Consultation: Follow-up Advisory Committee, ECCC, B.C. Ministry of Environment and Climate Change Strategy, and interested Indigenous groups</p> <p>Implementation: VFPA</p> <p>Collaboration: Indigenous groups</p>
Approach / Methods (How?)	<p>Approach: Barn owl road and rail collision mortalities (pre-Project, during construction, and during operation) will be quantified and compared to Project-related productivity gains (see barn owl nest box mitigation effectiveness FUP element, Table C16) to verify predictions made during the EIS that potential Project residual effects on barn owl productivity are negligible with the suite of mitigation measures implemented. Pre-Project monitoring will provide additional data to refine the detailed study design (e.g., stratifying survey intensity by seasonal collision risk) and verify the number of nest boxes needed to offset potential adverse Project effects. Mortality monitoring data during construction and operation will be compared to annual nest box productivity data to verify that owls affected by Project-associated vehicle and rail collisions are offset.</p> <p>Methods: Walking or driving surveys will be conducted within a 5-10 m buffer along roads and railway tracks within the LAA. Owl carcasses will be recorded and removed during surveys as per accepted scientific collision mortality assessment standards (Ramsden 2003, Boves and Belthoff 2012, Hemmera 2017, TDR TW-4 in Appendix AIR10-C of CEAR Document #388). Scavenger removal and searcher efficiency trials will be conducted to adjust mortality estimates for carcasses removed by scavengers between surveys and imperfect detection of carcasses by surveyors to ensure accurate estimates of annual mortality rates are achieved.</p>
Study Area (Where?)	Road and rail mortality monitoring will be conducted within the terrestrial portion of the LAA and the Roberts Bank causeway extending 500 m into the marine environment from the intersection of the causeway with terrestrial upland habitat.
Timing (When?)	Road and rail owl mortality monitoring surveys will be conducted for two years pre-Project construction, in years 1, 2, 4, and 5 during the construction period, and for up to five consecutive years post-Project construction. Surveys will be conducted weekly over the annual cycle during the pre-construction period and will inform potential study design refinement for the construction and operation periods based on potential differences in seasonal collision risk.
Connection with Other FUP Elements	Barn owl nest box mitigation effectiveness FUP element.

Table C18 RBT2 FUP Element: Diving Birds Abundance Effects Predictions

Characteristics	Description
Objective (Why/What?)	<p>Rationale: Verify effects predictions</p> <p>Program purpose: Verify effects predictions for diving bird populations in the LAA (as measured by abundance, density, and diversity), with the Project in place</p> <p>Monitoring target: Diving bird species presence, abundance, and density</p>
Responsibility (Who?)	<p>Consultation: Follow-up Advisory Committee, ECCC, and interested Indigenous groups</p> <p>Implementation: VFPA</p> <p>Collaboration: N/a</p>
Approach / Methods (How?)	<p>Approach: To evaluate whether a Before-After-Control-Impact study design could be implemented to compare presence, abundance, and density of diving birds (sea ducks, diving ducks, grebes, loons, cormorants, alcids) within two study areas (control, impact) pre- and post-Project, thereby allowing evaluation of potential changes in diving bird presence and abundance with Project development. Surveys will be conducted multiple times each year (during spring and fall migration and the winter residence period) over multiple years during the pre-construction and Project operation periods. A power analysis will be conducted to determine whether a monitoring program is feasible given anticipated natural variability in diving bird abundance in study areas, following the first year of data collection. If feasible, the power analysis will direct study design details, including sampling frequency and duration.</p> <p>Methods: Presence, abundance, and density of diving birds by species will be determined and compared across study areas and survey periods. Diving birds will be surveyed within intertidal and sub-tidal habitats via boat transects during high tide, employing methods aligned with provincial standards and used in published peer-reviewed literature (MOE 1997, Holm and Burger 2002, Burger et al. 2004, 2008). Surveyors will record bird counts by species and location along transects and will also record the perpendicular distance between the transect and bird(s) to allow adjustment of estimates for incomplete detection.</p>
Study Area (Where?)	<p>To maximize comparability and minimize natural variability in count data, both study areas will be located in intertidal and subtidal habitat identified as high use for diving birds during surveys conducted across the Fraser River delta (Butler and Cannings 1989). The impact study area will be located within LAA, and the control study area will be located within the Fraser River estuary likely at Sturgeon Bank, approximately 10 km north of the LAA.</p>
Timing (When?)	<p>Four surveys will be conducted during high tides (when diving ducks are most dependably abundant (Hemmera et al. 2009, 2010)) in each of three seasons (fall migration (September, October), the winter residence period (November, December), and spring migration (March, April) (Butler and Cannings 1989, Hemmera et al. 2009, 2010)). Monitoring will be conducted two years pre-Project construction and for up to 5 years post-Project construction, if monitoring is deemed feasible.</p>
Connection with Other FUP Elements	<p>None</p>

Table C19 RBT2 FUP Element: Avian Risk from Artificial Light Effects Prediction

Characteristics	Description
Objective (Why/What?)	<p>Rationale: Verify effects predictions</p> <p>Program purpose: Verify effects predictions of a negligible effect to coastal bird population viability, including migratory birds and species at risk, within the LAA from artificial light</p> <p>Monitoring target: Number of bird mortalities, by species, associated with artificial lights and lit structures at the terminal</p>
Responsibility (Who?)	<p>Consultation: Follow-up Advisory Committee, ECCC, and interested Indigenous groups</p> <p>Implementation: VFPA</p> <p>Collaboration: N/a</p>
Approach / Methods (How?)	<p>Approach: Avian collision mortalities in the vicinity of artificial lights and lit structures will be monitored with ground-based transect carcass surveys to confirm predictions of negligible Project effects. Potential adverse light effects on birds have been associated with poor weather conditions and migration (Rich and Longcore 2013); thus, surveys will occur during these high risk windows. Study design (the temporal and spatial distribution of surveys) will be developed coincident with finalisation of the detailed Project lighting design. Mortality data will be analysed to determine if results differ from effects predictions, and whether mortalities vary spatially, with abiotic factors, such as weather, or other factor(s).</p> <p>Methods: Avian collision mortality will be assessed by conducting surveys along transects established in the vicinity of light standards and lit infrastructure where avian collisions may occur. Carcass surveys will be conducted on foot in accordance with accepted collision mortality monitoring standards (Environment Canada 2007, Huso et al. 2016). Scavenger removal and surveyor efficiency trials will be conducted to adjust mortality estimates for carcasses removed by scavengers or missed by surveyors. Any carcasses found during surveys will be photographed, bagged, frozen, and species, date, carcass condition, GIS location, signs of obvious trauma, and likely cause of death will be recorded in accordance with the provincial carcass handling guidelines (Seilecki 2009) and with assistance from the UBC Beaty Biodiversity Museum as needed. Stranded birds will be handled following best management practices outlined in ECCC (2016).</p>
Study Area (Where?)	Monitoring will occur on the RBT2 terminal pod within the subtidal portion of the Project.
Timing (When?)	Carcass transects surveys will be conducted weekly from August through May over three consecutive years post-Project construction.
Connection with Other FUP Elements	None

Table C20 RBT2 FUP Element: Light Trespass and Sky Glow Effects Predictions and Mitigation Effectiveness

Characteristics	Description
<p>Objective (Why/What?)</p>	<p>Rationale: Verify light effects predictions and mitigation effectiveness</p> <p>Program purpose: Verify that changes in light trespass and sky glow and the corresponding Environmental Light Classification Zones at select points of reception (PORs) are comparable with those predicted in EIS Section 9.4 and the responses to IR6-01 and IR6-02 (CEAR Document #934) and verify that the light mitigation measures at the terminal achieve light levels less than 100 lux on the adjacent sea bed.</p> <p>Monitoring target: Light trespass levels (lux) and sky glow (%)</p>
<p>Responsibility (Who?)</p>	<p>Consultation: Follow-up Advisory Committee, interested Indigenous groups, DFO, and other interested stakeholders</p> <p>Implementation: VFPA</p> <p>Collaboration: None</p>
<p>Approach / Methods (How?)</p>	<p>Approach: Levels of light trespass and sky glow will be compared before the start of construction, during construction, and during operation at PORs to verify predictions made during the assessment on Project-related changes in light levels. Four PORs have been identified, at which light measurements will be taken before construction (to identify potential changes in baseline conditions since the EIS was conducted) and during construction and operation (to compare to predicted values). Comparison of light trespass and sky glow among time periods and verification of effects predictions based on these comparisons will be interpreted using professional experience. In addition, the effectiveness of light mitigation at the terminal will be verified by confirming whether light levels are less than 100 lux on the adjacent sea bed.</p> <p>Methods: At each POR, light trespass measurements will be made on a vertical plane towards the Project site using a photometer, and sky glow measurements will be taken at the zenith and at 45° from the zenith in the direction of the Project site using a Sky Quality Meter. To account for slight variations in direction and emissions, multiple measurements with the same orientation will be taken at each POR and averaged. Measurements taken prior to construction will be compared to previous existing condition values in the EIS to identify any potential changes from other sources of light since the EIS was conducted, and measurements taken during Project construction and operation will be compared with predicted light levels reported in the EIS to verify predictions of Project-related light effects. As light levels (illuminance) decreases with increasing water depth, illuminance (lux) will be measured at the water surface at select locations around the Project. If surface light levels are above 100 lux, measurements through the water column will be taken at up to four locations to confirm reduced illuminance with increasing water depth and light levels on the sea bed.</p>
<p>Study Area (Where?)</p>	<p>Proposed PORs include those at which a change in sky glow, light trespass zone classification, or Bortle Scale rating was predicted in the EIS, IR6-01 response (CEAR Document #934), or IR6-02 response (CEAR Document #934),</p>

Characteristics	Description
	respectively. These are POR1 (Galiano Island), POR2 (Mayne Island), POR7 (Brunswick Point), and POR11 (Existing Roberts Bank terminals). Final selections of PORs (measurement locations) will be based on stakeholder consultation. Light at the sea bed will be taken at up to four locations.
Timing (When?)	POR monitoring will be conducted four times per year in a variety of weather conditions (categorically defined (clear skies, mainly clear, partly cloudy, mainly cloudy, fog)) for one year pre-Project construction, during construction, and for one year post-Project construction. Sea bed light level monitoring will be conducted within one year post-Project construction under representative Project light operating conditions.
Connection with Other FUP Elements	Avian Risk from Artificial Light Effects Prediction

Table C21 RBT2 FUP Element: Human Health Air Quality Effects Predictions

Characteristics	Description
Objective (Why/What?)	Rationale: Verify effect predictions Program purpose: Verify the human health effect predictions as they relate to air quality; compare ambient air quality to predicted contaminant concentrations and applicable human health thresholds Monitoring target: PM _{2.5} and respiratory irritants, including NO ₂
Responsibility (Who?)	Consultation: Follow-up Advisory Committee, Health Canada, ECCC, Metro Vancouver, B.C. Ministry of Health, City of Delta, Tsawwassen First Nation, Musqueam First Nation, and other interested Indigenous groups Implementation: VFPA, through qualified air quality consultant, and health risk assessors Collaboration: VFPA, terminal operator, infrastructure developer, contractors
Approach / Methods (How?)	Approach: Rely on air quality monitoring data to verify a) health effects predicted for construction phase; and b) predictions of negligible health effects during operation. The air quality monitoring will be conducted as part of the Air Emission Management Plans for both the construction and operation phases and will include details on contaminants of potential concern to be monitored; the equipment to be used to obtain air quality concentrations and meteorological data; quality assurance and control measures; and adaptive management measures for air quality (e.g., dust control) to be implemented if contaminant levels approach pre-determined thresholds. Methods: PM _{2.5} and NO ₂ concentrations will be continuously measured at Station T39 during construction and operation, and measured in real-time with a portable monitor at select locations at or near the Project during the construction phase (determined in consultation with parties listed above). The source of elevated levels will be determined when levels approach pre-determined thresholds. Health risk quotients will be calculated based on ambient concentrations of these parameters for specific averaging periods, and compared to applicable human health thresholds (to be determined in consultation). If health risks are higher than predicted, appropriate adaptive measures will be

Characteristics	Description
	implemented (adaptive measures will be linked to the Air Emission Management Plan). Ambient air quality monitoring will be conducted according to standard practice and Metro Vancouver's ambient air quality network procedures.
Study Area (Where?)	Air quality monitoring will be conducted continuously at Pebble Hill Park in Tsawwassen (Station T39) and periodically within and adjacent to Project construction areas.
Timing (When?)	Air quality monitoring will be conducted pre-Project construction, during construction, and during operation, with duration and frequency of monitoring and reporting (for air quality and health risks) to be established during development of the Air Emission Management Plans.
Connection with Other FUP Elements	Human health noise effects prediction.

Table C22 RBT2 FUP Element: Human Health Noise Effects Prediction

Characteristics	Description
Objective (Why/What?)	<p>Rationale: Verify effects predictions</p> <p>Program purpose: Verify that nighttime sound levels are in accordance with levels predicted in the EIS given mitigation implemented</p> <p>Monitoring target: Nighttime sound level (L_n)</p>
Responsibility (Who?)	<p>Consultation: Follow-up Advisory Committee, Health Canada, City of Delta, Tsawwassen First Nation, Musqueam First Nation, and other interested Indigenous groups</p> <p>Implementation: VFPA, through qualified acoustical consultant</p> <p>Collaboration: VFPA, infrastructure developer, contractors, terminal operators, and rail operators</p>
Approach / Methods (How?)	<p>Approach: Rely on noise monitoring data to verify a) health effects predicted related to nighttime noise; and b) predictions of negligible health effects from other types of noise. The nighttime sound level (L_n) including low frequency noise will be continuously logged by permanent or semi-permanent monitoring stations at key receptor locations prior to, during, and after construction. The L_n, as related to health effect predictions, will be reviewed at specific intervals and compared to health thresholds and EIS predictions to verify that noise levels are consistent with predicted levels. If L_n values are higher than predicted, the source(s) and/or cause(s) will be determined and additional mitigation implemented as needed.</p> <p>Methods: Review the locations of the existing VFPA permanent monitoring stations and identify possible additional permanent (or semi-permanent) monitoring stations, as necessary during both construction and operation. L_n data collected at these stations will be reviewed against thresholds and predictions at least monthly. More frequent reviews may be added for construction activities expected to create maximum sound emissions.</p> <p>If during Project construction or operation noise-related complaints are received, related to any type of noise, additional short-term monitoring would be conducted at residences or other strategic locations to identify noise sources and</p>

Characteristics	Description
	investigate mitigation approaches. All noise monitoring equipment will meet ANSI standards for Type 1 sound level meters.
Study Area (Where?)	The existing VPFA permanent monitoring stations within the local study area are located at the Tsawwassen First Nation administration building, at Fred Gingell Park in Tsawwassen, and at the tug basin at Deltaport. An additional monitoring station may be required (e.g., at RBT2 marine terminal), and additional temporary monitoring may take place at residences in the LAA, as described above.
Timing (When?)	Continuous monitoring already exists, and will continue throughout construction, plus at minimum one year of operation. Monitoring required to inform community responses / support adaptive management would be implemented as needed, with durations defined by the nature of the investigation.
Connection with Other FUP Elements	Human health air quality effects prediction.

Appendix H: List of Panel Conclusions and Recommendations

MARINE SHIPPING ASSOCIATED WITH THE PROJECT

Recommendation 1

The Panel recommends that the Government of Canada review ship inspection and aerial surveillance activities to identify improvements that would reduce the discharge of oil and other pollutants in the marine shipping area.

Recommendation 2

The Panel recommends that the Government of Canada, in collaboration with Bird Studies Canada, develop a monitoring program to assess chronic oiling in the marine shipping area. The program should identify the most vulnerable bird species and locations in the marine shipping area that are at highest risk of oil exposure.

ALTERNATIVE MEANS OF CARRYING OUT THE PROJECT

- The Panel concludes that the Proponent's assessment of alternative means of carrying out the Project was appropriate.

GREENHOUSE GAS EMISSIONS

- The Panel concludes that construction and operations of the Project would contribute to additional greenhouse gas emissions in the Metro Vancouver area, even after the application of mitigation measures. This contribution would result in a significant adverse cumulative effect.

Recommendation 3

The Panel recommends that the Proponent be required to:

- Develop and publicize regular inventories of greenhouse gas emissions from the Project, develop greenhouse gas reduction strategies for all components of the Project, and monitor and publicize the effectiveness of these strategies in reducing greenhouse gas emissions;
- Develop and implement a greenhouse gas emissions reduction plan for the Project in consultation with British Columbia Ministry of Environment and Climate Change Strategy and Metro Vancouver; and
- Require, through its contractual arrangements, the infrastructure developer and project operator to reduce greenhouse gas emissions aligned with British Columbia Ministry of Environment and Climate Change Strategy and Metro Vancouver greenhouse gas reduction strategies.

ATMOSPHERIC ENVIRONMENT

Air Quality

- The Panel concludes that construction and operations of the Project would result in exceedances of applicable air quality standards and guidelines for NO₂ and PM_{2.5}, and contribute to exceedances of ozone.
- The Panel concludes that ambient air pollution conditions in the marine shipping area and adjacent coastal regions, including in transboundary waters, are unlikely to be materially affected by Project-associated marine shipping because it would emit a very small fraction of total pollutants in the marine shipping area.

Recommendation 4

The Panel recommends that the Proponent be required to:

- Conduct emissions inventories during the construction phase of the Project to verify that assumed reductions of emissions of air pollutants from all sources in the Roberts Bank port complex over the time span between existing and expected conditions are correct; and
- Develop a comprehensive air quality monitoring and management strategy to effectively monitor air quality on the landward side of the Roberts Bank port complex during both construction and operations. This strategy must be designed in collaboration with Metro Vancouver and Environment and Climate Change Canada and be operational before construction commences. The monitoring must be designed to detect possible exceedances of pollutants according to applicable existing and future federal air quality standards, guidelines and objectives. The strategy should:
 - utilize data from existing regional air quality monitoring stations operated by Metro Vancouver, and at least two additional air quality monitoring stations;
 - include an adaptive management plan, designed to ensure that ambient air quality during construction does not exceed applicable standards, guidelines, and objectives and criteria. This plan must include measures for construction reduction or cessation when standards are exceeded;
 - transition after construction into a Follow-up Air Quality Monitoring Program;
 - verify the success of the proposed air quality emission reduction measures for the first five years of operations; and
 - include an adaptive management plan, designed to ensure that ambient air quality during operations does not exceed applicable standards and criteria

Light Pollution

- The Panel concludes that without the implementation of effective mitigation measures and management plans, the Project would result in further degradation of the light environment.

Recommendation 5

The Panel recommends that the Proponent be required to develop and implement its Light Management Plan and Follow-up Program, in collaboration with the City of Delta, Environment and Climate Change Canada, Fisheries and Oceans Canada and the Tsawwassen First Nation, to achieve the following objectives:

- Monitor the select points of reception (POR) to ensure light trespass and sky glow predictions from the environmental assessment are correct (POR 1, POR 2, POR 7, POR 11);
- Employ technically and economically feasible light fixtures, shielding, location, scheduling and flashing frequency so as to ensure that the EIS predictions are achieved; and
- Allow collaborating parties to review and approve draft plans for both construction and operations at a minimum of 90 days prior to construction.

Recommendation 6

The Panel recommends that the Proponent be required to implement an adaptive management plan to ensure that the Commission internationale de l'éclairage (CIE) classifications are returned to those predicted, if the follow-up program measurements indicate that light trespass and sky glow exceed predicted classifications.

Noise and Vibration

- The Panel concludes that the Project would increase noise levels in the upland area and over marine surfaces adjacent to the proposed terminal. The Panel concludes that the contribution of the Project would be the greatest at site 4 and surrounding areas.
- The Panel concludes that marine shipping associated with the Project would not measurably affect annual average atmospheric noise levels in the marine Local Assessment Area.

Recommendation 7

The Panel recommends that the Proponent be required to:

- Develop and implement, in collaboration with the Tsawwassen First Nation and Health Canada, additional mitigation measures to reduce noise levels, including those for low-frequency noise, for the construction and operational phases of the Project; and

- Implement a solution-oriented complaint resolution process that is in place for the duration of the Project, and communicate the process, decisions, actions taken and outcomes achieved to potentially-impacted residents and communities.

MARINE ENVIRONMENT

Coastal Geomorphology

- The Panel concludes that the follow-up program proposed by the Proponent is required to address the Proponent's modelling uncertainties and be developed and managed in collaboration with Fisheries and Oceans Canada and Natural Resources Canada.

Recommendation 8

The Panel recommends that the Proponent be required to monitor scour along the northwest corner of the terminal at 5-year intervals immediately following the completion of construction and extending for 20 years after the commencement of operations (i.e. 5 monitoring episodes). In the event that scour is detected, the Proponent should be required to remediate any such changes.

Surficial Geology and Marine Sediment

- The Panel concludes that changes to surficial geology and marine sediments due to the Project would be undetectable, relative to natural variability, in the context of the sediment load from the Fraser River.

Recommendation 9

The Panel recommends that during construction, the Proponent be required to employ specific dredging practices to handle the upper 0.5 m of sediments from the existing tug basin and tug basin expansion area in order to reduce the potential for increasing polychlorinated biphenyl concentrations in the receiving environment.

Marine Water Quality

- The Panel concludes that the Project would result in minor changes in salinity in the Local Assessment Area given that the Project would cause a reduction in salinity variability, especially during freshet periods.
- The Panel concludes that marine shipping associated with the Project would not adversely affect marine water quality if regulatory safeguards to protect marine water quality in the marine shipping area are observed.

Recommendation 10

The Panel recommends that the Proponent, in consultation with Environment and Climate Change Canada and Fisheries and Oceans Canada, be required to:

- Conduct a review of the spatial and temporal design of its existing salinity monitoring program; and
- Implement the new proposed salinity monitoring follow-up program, in order to verify its predictions of changes in salinity, during and following Project construction.

Recommendation 11

The Panel recommends that the Proponent be required to:

- Develop a follow-up program to verify the accuracy of the environmental effects predictions related to eutrophication due to the Project; and
- Implement adaptive management measures if monitoring indicates that there is evidence of eutrophication due to the Project.

Underwater Noise

- The Panel concludes that during construction and operations of the Project, the underwater noise environment in the Local Assessment Area would intermittently become noisier than existing conditions.

Recommendation 12

The Panel recommends that the Proponent be required to design and implement an Underwater Noise Management Plan to achieve the following:

- Ensure that the Underwater Noise Management Plan elements are in place before construction commences, and continue for the duration of the construction phase;
- In collaboration with Fisheries and Oceans Canada, select monitoring parameters and methods to ensure underwater noise levels remain below prescribed thresholds for marine fish and marine mammals, and develop procedures in case of sound exceedances;
- Ensure the use of vibratory pile driving methods as much as possible during construction, in order to reduce underwater noise. When impact pile driving methods are required, vibratory methods are to be used to drive the pile for the majority of its length, and the impact pile driving method is to be used for the final 1 to 2 m; and
- Implement mitigation measures for Project construction that would prevent injury and behavioral disturbance to marine fish and marine mammals during impact pile driving, including but not limited to sound dampening methods or technologies such as bubble curtains.

Recommendation 13

The Panel recommends that Fisheries and Oceans Canada and Transport Canada, in collaboration with the Proponent, identify suitable locations for the placement of

hydrophones to monitor changes in underwater noise due to the Project and marine shipping associated with the Project.

Recommendation 14

The Panel recommends that the Proponent be required to develop and implement an Underwater Noise Monitoring Plan and Follow-up Program, in collaboration with Fisheries and Oceans Canada and Transport Canada, that is built around deployed hydrophones that would be in place for 60 days in winter and 60 days in summer for one-year pre-construction, annually during construction and for three years following the commencement of Project operations.

Recommendation 15

The Panel recommends that the Proponent and the terminal operator be required to investigate the use of electric tugs to reduce underwater noise generated during Project berthing and approach operations, and to adopt electric tugs when it is determined that they are technically and economically feasible. The Proponent should annually update the feasibility for adoption of electrical tugs.

Recommendation 16

The Panel recommends that the Proponent be required to continue efforts undertaken as part of the Enhancing Cetacean Habitat and Observation Program to measure the source level and underwater noise levels generated by existing and future classes of container ships, and report annually on their findings.

Recommendation 17

The Panel recommends that the Government of Canada evaluate, through a one year pilot project, compulsory measures to reduce underwater noise in collaboration with the Proponent and industry stakeholders.

Wave Environment

- The Panel concludes that actual ship wake wave height, where ships pass over shallower parts of the marine shipping area, would be substantially higher than those modelled by the Proponent.
- The Panel concludes that ship wake wave height in shallower parts of the marine shipping area would constitute a safety hazard to small recreational and fishing boats.
- The Panel concludes that ship wake waves from marine shipping associated with the Project would not contribute significantly to shoreline erosion in the marine shipping area beyond erosion caused by existing wind-driven waves.

EFFECTS OF THE ENVIRONMENT ON THE PROJECT

- The Panel concludes that the design of the Project adequately accounts for possible adverse effects of the environment on the Project in the short term and up until the year 2050.

OFFSETTING

- The Panel concludes that the proposed offsetting plan, totaling 29 hectares, is not sufficient to compensate for the reduction in productivity associated with the habitat loss of 177 hectares at Roberts Bank.

Recommendation 18

The Panel recommends that the Proponent, in collaboration with Fisheries and Oceans Canada, Environment and Climate Change Canada, the Tsawwassen First Nation and the Musqueam Indian Band, be required to:

- Develop an offsetting strategy that includes onsite and offsite offsets in adjacent areas of the Fraser River estuary, for example Sturgeon Bank; and
- Monitor the offset habitats until such time that it can be demonstrated that they are fully functional.

MARINE VEGETATION

Biofilm

- The Panel concludes that the Project would not result in an adverse effect on biofilm productivity or composition and diatom assemblages at Roberts Bank.
- The Panel is unable to conclude with certainty that the Project would result in an adverse effect on polyunsaturated fatty acid production by biofilm.

Recommendation 19

The Panel recommends that the Proponent, in collaboration with Fisheries and Oceans Canada and Environment and Climate Change Canada, be required to include identification of sources and dynamics of polyunsaturated fatty acid production in its salinity and biofilm monitoring follow-up program.

Recommendation 20

The Panel recommends that the Proponent be required to, in partnership with Environment and Climate Change Canada, develop a plan to address potential adverse effects on polyunsaturated fatty acid production, which would include:

- A plan to continue biofilm research during the northern migration period of Western sandpiper for the duration of construction and the first 3 year of operations;
- A review of biofilm sampling and statistical methodology used in past studies and integrating best practices in future studies;

- Open data sharing with other researchers in mudflat and biofilm ecology; and
- Continuation of public reporting on biofilm and Western sandpiper research.

Biomat

- The Panel concludes that biomat at Roberts Bank is unlikely to be compromised by the Project, and that any Project effect would be negligible.

Macroalgae

- The Panel concludes that the Project would not result in an adverse effect on macroalgae.

Eelgrass

- The Panel concludes that the Project would not result in an adverse effect on eelgrass.

Wetlands and Biodiversity Protection

- The Panel concludes that the Project would result in a significant adverse effect on wetlands. The Panel further concludes that the expansion of the causeway would result in a significant adverse effect on provincially red-listed marsh communities.
- The Panel concludes that the Project would result in a significant cumulative effect on wetlands and on wetland functions in the lower Fraser River estuary, including provincially red-listed marsh communities.

Recommendation 21

The Panel recommends that the Proponent, in collaboration with Fisheries and Oceans Canada, Environment and Climate Change Canada, BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development, the Tsawwassen First Nation and the Musqueam Indian Band, be required to include in its final Offsetting Plan:

- Design for intertidal marsh offset habitats to promote the growth of native species that would compensate for the loss and degradation of listed marsh communities due to the expanded causeway; and
- An offsite Offsetting Plan that could include areas of the Fraser River estuary such as Sturgeon Bank and the foreshore of Westham Island where bulrush marshes have recently receded.

Recommendation 22

The Panel recommends that the Proponent, in collaboration with Environment and Climate Change Canada, BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development, and in partnership with the Tsawwassen First Nation and the Musqueam Indian Band, be required to include in its follow-up program for intertidal marsh offsets:

- Monitoring of British Columbia red- and blue-listed communities in the Local Assessment Area;
- Monitoring of the tidal marsh communities at Brunswick Point and on Tsawwassen First Nation Lands, in order to better understand Project effects and effects from sea-level rise in comparison with the historical state of the marshes; and
- Measures for detecting and reporting the presence of invasive species in its onsite offsets and ensure their eradication if detected.

MARINE INVERTEBRATES

Infaunal and epifaunal invertebrates

- The Panel concludes that the Project would not result in an adverse effect on infaunal and epifaunal invertebrates.

Bivalve shellfish

- The Panel concludes that due to the adaptability and wide spread distribution of bivalve shellfish in the area, the residual adverse effect of the Project on bivalve shellfish would not be significant.
- The Panel concludes that the Project would result in an adverse cumulative effect on bivalve shellfish. The effect would not be significant.

Dungeness crab

- The Panel concludes that due to the habitat loss associated with the 177 hectare terminal footprint and reductions in productivity, and in the absence of adequate mitigation measures, the Project would result in a significant adverse effect on Dungeness crab.
- The Panel concludes that the Project would result in a significant cumulative effect on Dungeness crab.

Recommendation 23

The Panel recommends that the Proponent, in collaboration with Fisheries and Oceans Canada, the Tsawwassen First Nation, and the Musqueam Indian Band, be required to:

- Refine crab offsetting to ensure that the offsets are located in high suitability habitat for juvenile crab; and
- Develop a follow-up program for Dungeness crab that includes:
 - monitoring of juvenile crab nursery habitat;
 - monitoring of the effectiveness of the proposed eelgrass offsets for increasing Dungeness crab productivity; and
 - increase offsetting to match the productivity losses due to the Project.

Orange sea pen

- The Panel concludes that the residual adverse effect of the Project on the orange sea pen colony in the Local Assessment Area, even after proposed mitigation, would be significant.
- The Panel cannot conclude whether or not the Project would result in a cumulative effect on orange sea pen.

Recommendation 24

The Panel recommends that the Proponent be required to:

- Proceed with its proposed transplant program of orange sea pen; and
- Conduct monitoring annually through the construction phase of the Project to ensure viability of the transplanted individuals as part of the proposed follow-up program.

MARINE FISH AND FISH HABITAT

Pacific Salmon

- The Panel concludes that the Project would result in a residual adverse effect and an adverse cumulative effect on juvenile chum salmon. The effects would not be significant.
- The Panel concludes that the Project would result in a residual adverse effect and an adverse cumulative effect on ocean-type juvenile Chinook salmon populations from the Lower Fraser and South Thompson Rivers. The effects would be significant.

Recommendation 25

The Panel recommends that the Proponent, in collaboration with Fisheries and Oceans Canada, the Tsawwassen First Nation and the Musqueam Indian Band, be required to:

- Develop and implement a statistically defensible sampling program, to evaluate the abundance and distribution of ocean-type salmon in the Local Assessment Area prior to construction;
- Evaluate the extent of existing and future migration disturbance due to terminal placement;
- Develop additional offsets onsite and offsite to fully mitigate a potential loss in ocean-type Chinook salmon productivity; and
- Develop and implement a plan to support hatchery initiatives designed to increase the production of Lower Fraser ocean-type Chinook salmon from existing Fisheries and Oceans Canada facilities.

Forage Fish

- The Panel concludes that, due to the loss of spawning habitat, and in the absence of effective mitigation measures, the Project would result in a significant adverse effect on Pacific sand lance and surf smelt.
- The Panel concludes that the Project would result in an adverse cumulative effect on Pacific sand lance and surf smelt. The cumulative effect would not be significant because it would be spatially limited to the Local Assessment Area.

Recommendation 26

The Panel recommends the Proponent, in partnership with the Tsawwassen First Nation and the Musqueam Indian Band, and in consultation with British Columbia Ministry of Forest, Lands, Natural Resource Operations and Rural Development, be required to design and implement their proposed eulachon and sturgeon studies to include:

- Hydroacoustic monitoring;
- An evaluation of the potential for eulachon migration disruption; and
- Measures for the identification of hydroacoustic targets, such as simultaneous net sampling.

Recommendation 27

The Panel recommends that the Proponent be required to include in the final Dredging and Sediment Discharge Management Plan, measures to reduce direct mortality of Pacific sand lance during dredging of the berth pocket.

Flatfish

- The Panel concludes that the Project would result in a residual adverse effect and an adverse cumulative effect on flatfish. The effects would not be significant.

Reef and Demersal Fish

- The Panel concludes that the Project would not result in a residual adverse effect on demersal fish after the Proponent's mitigation measures are applied.
- The Panel concludes that there would be no effect from marine shipping associated with the Project on marine fish and fish habitat.

Marine Mammals

Southern Resident Killer Whale

- Based on the effects due to the Project and marine shipping associated with the Project on underwater noise, Chinook salmon prey availability and potential ship strikes, and in the absence of effective and mandatory mitigation measures, the Panel concludes that there would be a significant adverse effect on the Southern Resident Killer Whale.

- The Panel concludes that the Project and marine shipping associated with the Project would result in a significant adverse cumulative effect on the Southern Resident Killer Whale.

Recommendation 28

The Panel recommends that the Proponent, in collaboration with Fisheries and Oceans Canada and the Indigenous Advisory Committee, be required to develop and implement a Marine Mammal Management Plan and Follow-up Program during construction that includes the following:

- Establish buffer zones for different species of marine mammals (other than harbour seals and sea lions) where construction activities would need to be reduced or ceased if a marine mammal(s) enters a zone;
- If a marine mammal is sighted within the prescribed buffer zone, specify that work should not restart until the marine mammal(s) has moved out of the buffer zone for at least 30 minutes;
- Establish a decision protocol that describes the circumstances (type of marine mammals sighted, proximity to civil works, type of activities being undertaken) in which underwater noise-producing activities would be reduced or ceased;
- Use marine mammal observers to monitor the prescribed buffer zones;
- Coordinate marine mammal observers with whale sighting networks to receive advance warning of marine mammals approaching the construction area;
- Establish an efficient system of communication between the Environmental Monitor and the marine mammal observers for when underwater noise-generating activities should be reduced or ceased;
- Limit the timing of impact pile driving to daytime only to ensure the detection of all marine mammals within the prescribed buffer zones;
- Limit the seasonal timing of impact pile driving activities to avoid periods of marine mammal occurrence that could result in injury or behavioural disturbance;
- Specify the location and number of hydrophones to be deployed to detect marine mammals, including during times of darkness or low-visibility at the onset of construction; and
- Use additional technologies to detect marine mammals in darkness and during times of poor visibility, if deemed to be technically feasible.

Recommendation 29

The Panel recommends that the Proponent be required to:

- Continue initiatives carried out as part of the Enhancing Cetacean Habitat and Observation Program to reduce the potential effects of commercial vessel traffic on at-risk cetaceans throughout the southern coast of British Columbia, and report annually to summarize the outcome of the initiatives;

- Make arrangements for the renewal of the ‘Species at Risk Act Section 11 Conservation Agreement to Support the Recovery of the Southern Resident Killer Whale’ for an additional five-year term;
- Promote, through annual communication activities addressed to stakeholders of the Conservation Agreement, the adoption of voluntary, practical, and effective mitigation measures that would lead to quantifiable reductions in threats to whales as a result of shipping activities, and to encourage stakeholders to renew their commitment to the Agreement; and
- Generate an annual public report that summarizes compliance with voluntary measures and the reasons for non-compliance.

Recommendation 30

The Panel recommends that Fisheries and Oceans Canada and Transport Canada renew their commitment to the ‘Species at Risk Act Section 11 Conservation Agreement to Support the Recovery of the Southern Resident Killer Whale’ for an additional five-year term.

Recommendation 31

The Panel recommends that the Government of Canada, in collaboration with the Proponent, and other commercial traffic vessel operators:

- Achieve an objective of net overall decrease in underwater noise by commercial vessel traffic, and report annually on their progress; and
- Identify those portions of the Salish Sea where marine shipping overlaps most strongly with Southern Resident Killer Whale both spatially and temporally so as to maximize the benefits of underwater noise reductions.

Recommendation 32

The Panel recommends that Fisheries and Oceans Canada undertake a context-specific analysis of acoustic impacts on Southern Resident Killer Whale from commercial vessel traffic in the Salish Sea, and make the results available to the Proponent and to the public.

Northern Pacific Humpback Whales

- The Panel concludes that the Project and marine shipping associated with the Project would result in a residual adverse effect on Humpback Whales. Since the population of Humpback Whales in the Salish Sea is increasing, the effects would not be significant.
- The Panel concludes that the Project and marine shipping associated with the Project would result in an adverse cumulative effect on Humpback Whales. The effects would not be significant.

Recommendation 33

The Panel recommends that the Proponent, in collaboration with Fisheries and Oceans Canada, Transport Canada, and the Indigenous Advisory Committee, continue efforts under the Enhancing Cetacean Habitat and Observation Program to implement and evaluate the effectiveness of voluntary slowdowns in areas of high Humpback Whale and Southern Resident Killer Whale density, such as Swiftsure Bank, to reduce underwater noise and the risk of fatal vessel strikes to Humpback Whales and Southern Resident Killer Whale.

Recommendation 34

The Panel recommends that Fisheries and Oceans Canada determine the likelihood of lethal and non-lethal vessel strikes based on updated and effort-corrected information on Humpback Whale density in the areas utilized by Project-related vessels, and communicate the results to the Proponent and pilots to reduce the potential for vessel strikes.

Stellar Sea Lion

The Panel concludes that the Project and marine shipping associated with the Project would result in a residual adverse effect and an adverse cumulative effect on Stellar Sea Lion. The effects would not be significant.

Avifauna

Diving Birds

- The Panel concludes that the Project would result in a residual adverse effect and an adverse cumulative effect on diving birds. Since diving birds are not habitat-limited in the Project area the effects would not be significant.

Barn owl

- The Panel concludes that the Project would result in a residual adverse effect on the barn owl. The effect on the barn owl would not be significant if both the Panel's proposed recommendations and the Proponent's mitigation measures are applied.
- The Panel concludes that increases in vehicle traffic due to the Project in combination with existing traffic and projected increases in human population and urbanization would result in a significant adverse cumulative effect on the barn owl population in the regional area.

Shorebirds

- Due to the uncertainty with respect to fatty acid production in biofilm, the Panel is unable to conclude with reasonable confidence that the Project would or would not have an adverse effect on the Western sandpiper.

- The Panel concludes the Project would result in a residual adverse effect on the great blue heron and the barn swallow if the mitigation measures proposed by the Proponent and the Panel are not appropriately applied and fully effective.

Recommendation 35

The Panel recommends that the Proponent be required to, in consultation with Environment and Climate Change Canada, Bird Studies Canada and BC Ministry of Transportation and Infrastructure:

- Design and install physical barriers in the Local Assessment Area to reduce road-associated mortality risk for barn owls. Further, the physical barriers should be designed to:
 - not attract other avian species and therefore increase vehicle collision risk. This includes species with conservation status or protected under the *Conservation Act, 1994*; and
 - conserve suitable barn owl roadside grass verge hunting habitat where the road and the verge habitat are co-located; and
- Develop a barn owl conservation plan that includes:
 - the type(s) of physical barriers to be installed, locations, and maintenance requirements;
 - the number of nest boxes that would be installed and their locations in the Local and Regional Assessment Areas;
 - post-installation of nest box effectiveness monitoring, to assess usage and productivity, for the first five years of operation; and
 - a system for annual reporting to assess mitigation effectiveness and any need for adaptive management measures.

Recommendation 36

The Panel recommends that the Proponent be required to include as part of the offsetting framework objectives, solutions that focus specifically on the Great blue heron that would compensate any loss of productivity of foraging habitat in the intertidal zone of the Local Assessment Area that is used by the species.

Recommendation 37

The Panel recommends that the Proponent be required to include in its Wildlife Management Plan:

- Any SARA-listed or COSEWIC designated bird species found in the Local Assessment Area, to verify the accuracy of the effects assessment and the effectiveness of mitigation measures. This should explicitly include the Great blue heron and the barn swallow; and
- Contingency or adaptive management measures in the event that monitoring results indicate the Project effect on diving birds to be greater than predicted.

CURRENT USE OF LANDS AND RESOURCES FOR TRADITIONAL PURPOSES

- The Panel concludes that the Project would result in a residual adverse effect on the current use of lands and resources for traditional purposes for the Tsawwassen First Nation that cannot be fully mitigated. The effect would be significant.
- The Panel concludes that the Project would result in a residual adverse effect on current use of lands and resources for traditional purposes for the Musqueam Indian Band that cannot be fully mitigated. The effect would be significant.
- The Panel concludes that the Project would result in a residual adverse effect on current use of lands and resources for traditional purposes for Indigenous groups that harvest in the vicinity of the Project. The effect would not be significant.
- The Panel concludes that the Project would result in a cumulative adverse effect on the current use of lands and resources for traditional purpose for the Tsawwassen First Nation and the Musqueam Indian Band. The effects would be significant.

Recommendation 38

The Panel recommends that Transport Canada and Fisheries and Oceans Canada, in collaboration with the Proponent, be required to address safety concerns and the practicality for the Tsawwassen First Nation and the Musqueam Indian Band to harvest crabs for food, social and ceremonial purposes within the existing and expanded navigational closure areas using floats. Utilization of floats during crab fishing could occur during short-term berthing windows or when container ships are absent from Port facilities.

Recommendation 39

The Panel recommends that the Proponent, in collaboration with the Tsawwassen First Nation and the Musqueam Indian Band, be required to develop and implement a cumulative effects monitoring and mitigation plan for the first five years of operation of the Project. The plan should include the:

- Identification of monitoring parameters for incremental adverse effects on the cumulative effects of environmental components, such as crab and juvenile salmon, resulting from the Project;
- Specification of Tsawwassen's and Musqueam's roles and provision of funding for their involvement in monitoring and reporting on cumulative effects of chosen environmental components;
- Identification of mitigation and protocols to reduce cumulative effects, including management plans on required specific environmental components; and

- Identification of thresholds that would trigger the need to implement adaptive management measures.
- The Panel concludes that marine shipping associated with the Project would result in a residual adverse effect on the current use of lands and resources for traditional purposes for the Pacheedaht First Nation. The effect would not be significant.
- The Panel concludes that marine shipping associated with the Project would result in a residual adverse effect on the current use of lands and resources for traditional purposes by the Ditidaht First Nation. The effect would not be significant.
- The Panel concludes that marine shipping associated with the Project would result in a residual adverse effect on the current use of lands and resources for traditional purposes by the Maa-nulth Nations. The effect would not be significant.
- The Panel concludes that marine shipping associated with the Project would result in an adverse cumulative effect on the current use of lands and resources for traditional purposes by the Pacheedaht First Nation, the Ditidaht First Nation and the Maa-nulth Nations. The cumulative effects would be significant for the Pacheedaht First Nation and the Ditidaht First Nation.
- The Panel concludes that the marine shipping associated with the Project would result in a residual adverse effect on the current use of lands and resources for traditional purposes by Indigenous groups that harvest in, or traverse, the marine shipping area. The significance cannot be determined.
- The Panel concludes that the marine shipping associated with the Project would result in an adverse cumulative effect on the current use of lands and resources for traditional purposes by Indigenous groups that harvest in, or traverse, the marine shipping area. The significance cannot be determined.

Recommendation 40

As part of the Ocean Protection Plan initiatives the Panel recommends that Transport Canada, in collaboration with the Proponent, Indigenous groups and other stakeholders, develop and implement a program that facilitates safe harvesting in and around shipping lanes in the Project area and the marine shipping area (Segments A, B, C, and D). The Program should include:

- An evaluation of conditions affecting Indigenous groups' ability to safely access and harvest in fishing areas prior to construction of the Project and for the first five-year period of operations in order to determine the effects from marine shipping activities associated with the Project;

- An identification of measures to prevent further cumulative effects, particularly at Swiftsure Bank, the Gulf Islands and the Salish Sea;
- A proposal to map out different options for the relocation of the shipping lanes and the need for the addition of tug escorts and any resulting effects; and
- An assessment of the needs for maritime technical capacity for the Pacheedaht First Nation, the Ditidaht First Nation, the Pauquachin First Nation, and the Maa-nulth Nations. This should include the capacity to anticipate and monitor vessel traffic and to engage in real-time communication with large commercial ships and the Marine Communication and Traffic Service.

PHYSICAL AND CULTURAL HERITAGE

Physical Heritage Resources

- The Panel concludes that the Project would result in a residual adverse effect on physical heritage, if fish trap stakes are present. With implementation of proposed mitigation this effect would not be significant.

Recommendation 41

The Panel recommends that the Proponent prior to construction be required to:

- Excavate a series of trenches, across the eastern end of the causeway expansion area within the area of moderate archaeological potential, and within the historic channel, located northwest of the terminal, formerly draining Canoe Passage; and
- Provide an inventory of fish trap stakes found and ensure their protection and archaeological investigation.

Recommendation 42

The Panel recommends that the Proponent be required to:

- Monitor annually during construction and for five years of operation, the erosion of the historic tidal channel that lies northwest of the terminal, formerly draining Canoe Passage; and
- Manage chance-find artifacts including undertaking further archaeological sampling and investigation as appropriate.

- The Panel concludes that marine shipping associated with the Project would not result in an adverse effect on archaeological sites due to coastal erosion.

Recommendation 43

The Panel recommends that Parks Canada and the Archaeology Branch of the British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural

Development establish an erosion monitoring and protection program for coastal archaeological sites and areas of archaeological potential in the zones of influence identified in Segment B of the marine shipping area. The archaeological monitoring and management plan should:

- Establish a baseline by documenting the condition of previously known archaeological sites and by assessing areas of archaeological potential concurrently with the construction of the Project;
 - Document any changes from the established baseline;
 - Document and collect, where applicable, the findings of archaeological resources that are exposed during the course of the monitoring program; and
 - Identify and implement site protection measures.
- The Panel concludes that ship-wake waves from marine shipping associated with the Project would not result in a residual adverse effect on archaeological or historical sites in the USA.

Cultural Heritage Resources

- The Panel concludes that the Project would result in a residual adverse effect on cultural heritage for the Tsawwassen First Nation, the Musqueam Indian Band and the Tsleil-Waututh Nation. The effects would be significant for the Tsawwassen First Nation and the Tsleil-Waututh Nation.
- The Panel concludes that the Project would result in a significant adverse cumulative effect on cultural heritage for the Tsawwassen First Nation, the Musqueam Indian Band and the Tsleil-Waututh Nation.

Recommendation 44

Before construction starts, the Panel recommends that the Proponent, in collaboration with the Tsawwassen First Nation, the Musqueam Indian Band, and the Tsleil-Waututh Nation, be required to prepare a cultural and community mitigation plan. The plan should include:

- For all groups: cultural monitoring and thresholds to assess residual effects and their significance for tangible or intangible cultural resources of the Nation or Band;
- For the Tsawwassen First Nation: in collaboration with Transport Canada, implementation of measures that would support Tsawwassen's continued access to the sea and practice of their sea-based culture. These measures should include consideration of additional safe marine access point(s) in the Project area; and
- For the Tsleil-Waututh Nation: implementation of measures provided by the Tsleil-Waututh Nation in confidence to the Panel and the Proponent.

Recommendation 45

The Panel recommends that the Government of Canada, in collaboration with the Proponent and the Tsawwassen First Nation, co-develop a plan to protect cultural heritage, including support for their language protection efforts and sea-based learning activities.

- The Panel concludes that marine shipping associated with the Project would result in a residual adverse effect on cultural heritage for Indigenous groups that use the marine shipping area for cultural practices. The effect would not be significant.
- The Panel concludes that marine shipping associated with the Project would result in a significant adverse cumulative effect on cultural heritage for Indigenous groups that use the marine shipping area for cultural practices.

Recommendation 46

The Panel recommends that Transport Canada, with the collaboration of concerned stakeholders and Indigenous groups, develop and implement a monitoring program to determine the overlap of Indigenous use and vessel traffic within the shipping lanes. Monitoring components should include safety and potential loss of cultural heritage due to the interference with cultural practices and knowledge transmission in the shipping lanes. The results of the monitoring program should be used to develop mitigation measures that would reduce any adverse effects identified through the monitoring program. Consideration of mitigation measures should include the feasibility of speed reductions in areas of high overlap and provision of funds for safety improvements.

SOCIO-ECONOMIC CONDITIONS

- The Panel concludes that the Project would bring beneficial local and regional employment for Metro Vancouver and, in particular, for Delta.
- The Panel concludes that the Project would bring positive economic development to Metro Vancouver and, in particular, for Delta.
- The Panel concludes that with the implementation of the Panel's proposed recommendations, the Project would not result in an adverse effect on the socio-economic conditions, locally or in the region, as a result from changes in services, infrastructure and Project revenues.

Recommendation 47

In order to meet Metro Vancouver Integrated Solid Waste and Resource Management Plan industrial diversion targets the Panel recommends that the Proponent be required to include, in its Hazardous Materials and Waste Management Plan, measures to:

- Limit non-hazardous waste generation for the Project; and
- Minimize the amount of hazardous waste that would be produced by the Project.

Recommendation 48

The Proponent, in consultation with the Delta Police Department, the Royal Canadian Mounted Police and the Canada Border Services Agency be required to:

- Examine the creation and implementation of a multi-jurisdictional port policing authority to prevent and control crime incidence at Roberts Bank terminals. The task force would eventually transition to the Roberts Bank Terminal 2 port operator security entity; and
- Negotiate an agreement with the City of Delta to allocate sufficient funds to implement an integrated police team commensurate with the requirements of the Project.

Recommendation 49

The Panel recommends that the Proponent, in consultation with the City of Delta, be required to develop a monitoring plan prior to the construction of the Project that would annually evaluate the incremental increase in spending for particular services and infrastructure to determine if the Project is adding a financial burden to Delta. The plan would include:

- Monitoring throughout construction and for the first 5 years of operations; and
- Mechanisms for increasing compensation for the city in the event that revenues are insufficient to meet additional expenditures induced by the Project.

- The Panel concludes that the Project would bring beneficial employment and business opportunities for Indigenous groups and individuals.

Recommendation 50

The Panel recommends that the Proponent be required to ensure that all Indigenous groups identified in the Environmental Impact Statement and the Marine Shipping Addendum who express interest in accessing potential employment and business opportunities related to the Project be made fully aware, in a timely fashion, of the opportunities for training, employment, and contracting.

- The Panel is of the view that existing and future commercial ventures would not be affected by the Project or marine shipping associated with the Project, except potentially for the Tsawwassen First Nation and the First Nations of the Maa-nulth Treaty Society. In the case of the Maa-nulth, there would be a residual adverse effect and an adverse cumulative effect on commercial fishing in the marine shipping area associated with the Project. The effects would not be significant.
- The Panel concludes that there would be a residual adverse effect and an adverse cumulative effect on the Maa-nulth Nations commercial fishing within the 12 nautical mile limit of Canada's territorial sea. The residual effect is not significant and the Panel cannot conclude on the significance of the cumulative effect.

Recommendation 51

The Panel recommends that during the construction phase and the first two years of operations, the Proponent be required to develop a reporting mechanism for concerns from the Tsawwassen First Nation and the Maa-nulth Nations on potential effects of the Project and associated marine shipping activities on their commercial ventures and to evaluate and engage with the groups to find mutually appropriate solutions.

COMMUNITY RESOURCES**Land and Marine Water Uses**

- The Panel concludes that there would be a non-significant adverse effect and a significant adverse cumulative effect of the Project on agriculture land use due to the loss of a small portion of land contained within the Agricultural Land Reserve.

Recommendation 52

The Panel recommends that the Proponent be required to:

- Maintain as agricultural the portion of land acquired from the BC Railway Company and not required by the Project; and
- Implement an agricultural management plan to prevent, monitor and compensate for the loss of farmland and employment and, potential effects on Agricultural Land Reserve properties adjacent to the Project lands.

Visual Resources

- The Panel concludes that the Project would result in a significant adverse effect on visual resources at daytime points of reception 3 and 4 and surrounding areas.
- The Panel concludes that the Project would result in a residual adverse effect on visual resources at nighttime points of reception 1, 2, 7, and 11 and surrounding areas. The effect would not be significant.

Recommendation 53

The Panel recommends that the Proponent be required to include in its Light Management Plan a follow-up of:

- Nighttime point of reception 5 for potential effects on Tsawwassen community residents; and
 - Nighttime point of reception 6 for potential effects on Tsawwassen First Nation Lands and members of the community.
- The Panel concludes that the Project would result in a significant adverse cumulative effect on daytime and nighttime visual resources.

Recommendation 54

The Panel recommends that Transport Canada in collaboration with Canadian Port Authorities:

- Work collaboratively with existing associations, such as the Worldwide Association of Port Cities and Canadian urban planners, to develop a charter, with principles and guidelines that could be followed to minimize visual effects of port expansions and promote social acceptance; and
- Develop and implement with Indigenous groups and other stakeholders, ways to promote port areas as an asset for tourism and/or the promotion of existing heritage elements.

Outdoor Recreation

- The Panel concludes that the Project would result in a residual adverse effect on outdoor recreation. The Panel is unable to determine the significance of the effect.
- The Panel concludes that the Project would result in a significant adverse cumulative effect on outdoor recreation.

Recommendation 55

The Panel recommends that Fisheries and Oceans Canada develop a mechanism to engage with recreational seafood harvesters regarding the expansion of the navigational closure areas during construction and operations of the Project and to identify appropriate mitigation measures to facilitate the continuation of recreational seafood harvesting.

- The Panel concludes that marine shipping associated with the Project would result in a residual adverse effect on outdoor recreation in the marine shipping area for small vessel boaters. The effect would not be significant.
- The Panel concludes that marine shipping associated with the Project would result in an adverse cumulative effect on outdoor recreation in the marine shipping area. The effect would be significant in Segment B.

Marine Commercial Use

- The Panel concludes the Project would result in a residual adverse effect and an adverse cumulative effect on marine commercial use due to the expansion of the existing navigational closure area. The effects would be significant.

Recommendation 56

The Panel recommends that the Proponent, in collaboration with the Area I Crab Fisherman Association, the Indigenous commercial crab fishers that operate within the Local Assessment Area, and Fisheries and Oceans Canada, be required to develop alternate

management arrangements that ensure the continued productivity of the commercial crab fishery.

HUMAN HEALTH

Exposure to Atmospheric Pollutants

- The Panel concludes that the construction phase of the Project would result in a residual adverse effect on human health due to chronic exposure of annual-average NO₂. The effect would be significant.
- The Panel concludes that the operational phase of the Project would result in a significant adverse effect on human health based on predicted exposures to 1-hour average NO₂ and respiratory irritants.
- The Panel concludes that the operational phase of the Project would result in a significant adverse cumulative effect on human health based on predicted exposures to 1-hour average NO₂ and respiratory irritants.
- The Panel concludes that there would be no air quality effects on human health arising from marine shipping associated with the Project.

Recommendation 57

The Panel recommends that the Proponent during construction and operations be required to comply with the most stringent applicable air quality standards and exposure limits.

Exposure to Noise and Vibration

- The Panel concludes that noise from the construction and operations of the Project would result in a residual adverse effect on human health. The effect would not be significant.

Recommendation 58

The Panel recommends that the Proponent be required to design and implement a follow-up program to achieve the following:

- Carry out continuous monitoring of nighttime sound levels, including low-frequency noise at the Tsawwassen First Nation administration building throughout construction, plus 2 years of operations;
- If noise levels during monitoring are higher than predicted, the Proponent is to determine the source and cause of the noise and implement additional mitigation measures, at source or at receptor locations, as required; and
- Carry out continuous daytime monitoring at the Tsawwassen First Nation administration building for one year of operations to determine whether receptor-

based mitigation measures are required at the proposed school located on Tsawwassen First Nation Lands.

- The Panel concludes that the Project would result in a significant adverse cumulative effect on human health due to noise.
- The Panel concludes that noise from marine shipping associated with the Project would not result in a residual adverse effect on human health.

Exposure to Shellfish Contamination

- The Panel concludes that the Project would not result in a residual adverse effect on human health related to shellfish contamination.

Food Security

- The Panel concludes that the predicted Project effects on crab would cause a change in the diet and result in an adverse effect on food security for Indigenous groups using the Local Assessment Area. However, the Panel cannot conclude if the change would result in an adverse effect on human health.

Recommendation 59

The Panel recommends that the Government of Canada initiate a well-designed and appropriately funded study on food security, to be implemented in collaboration with Indigenous groups and responsible health authorities. The objective of the study would be to examine the effects of food insecurity on the health of Indigenous groups harvesting in the Project area, such as the Tsawwassen First Nation and the Musqueam Indian Band. The study should target preferred traditional marine resources, consumption rates, and effects on consumption of real or perceived contamination.

Stress and Annoyance

- The Panel cannot conclude on the Project effects on human health due to stress and annoyance given these aspects of human health are perceived differently by individuals.

Health Inequity

- The Panel cannot conclude definitively on the effects of the Project on human health related to health inequity or to what extent health inequity could be improved or aggravated by the Project for specific vulnerable groups.

ACCIDENTS AND MALFUNCTIONS

- The Panel concludes that additional measures are required to adequately address effects that may occur as a result of land-based accidents or malfunctions.

Recommendation 60

The Panel recommends that the Proponent be required, in collaboration with the City of Delta and the BC Ministry of Environment and Climate Change Strategy, to include in its Environmental Management Plans the following:

- Regular, coordinated training and exercises involving the organizations responsible for spill prevention and control of hazardous and noxious substances that may be released during land-based construction and operations;
- A description of the roles and responsibilities of each organization involved in a coordinated accident response, including the identification and solutions to any limitation towards effective and coordinated emergency response; and
- A review of necessary additional expenditures induced for the City of Delta for health and response services and equipment.

Recommendation 61

The Panel recommends that the Proponent be required, in collaboration with the appropriate provincial and federal organizations, the City of Delta, and the Tsawwassen First Nation, to include in its Environmental Management Plans:

- Preventative measures to minimize or avoid accidents or malfunctions that could arise from carrying out land-based construction and operation activities that may pose a risk during sensitive time periods for vulnerable species in the vicinity of the Project, such as juvenile salmon and migratory birds;
 - Detailed response protocols to account for all types of substances that may be spilled at the terminal, and for different environmental conditions at Roberts Bank;
 - Measures for the long-term monitoring of effects due to spills of oils, lubricants and other hazardous and noxious substances;
 - Measures for the remediation of the effects of these spills; and
 - A review of necessary additional expenditures induced for the City of Delta for health and emergency response services and equipment with a mechanism for cost recovery.
- The Panel concludes that if a worst-case oil spill event were to occur, it would result in a residual adverse effect, which could be significant for vulnerable species such as the Southern Resident Killer Whale and marine birds, marine commercial and recreational activities, current use, cultural heritage and health of Indigenous groups.

Recommendation 62

The Panel recommends that the Proponent be required, in collaboration with Transport Canada, the Canadian Coast Guard, the Western Canada Marine Response Corporation, and the City of Delta, to develop an integrated response plan, similar to the Greater Vancouver Integrated Response Plan, to ensure effective and coordinated response to marine shipping accidents that may occur within the Proponent's jurisdiction.

Recommendation 63

The Panel recommends that the Proponent be required, in its Construction and Operations Spill Preparedness and Response Plans, in collaboration with the British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development, Environmental and Climate Change Canada, and Parks Canada, to:

- Identify specific measures to protect archaeological sites and areas of importance, based on information provided by appropriate agencies and Indigenous groups; and
- Incorporate marine and terrestrial wildlife oil spill vulnerability information, on species, populations, and their spatial and temporal distributions, in addition to measures and strategies required to report, respond to, and monitor spill emergencies.

Recommendation 64

The Panel recommends that the Proponent be required to publicly report, on an annual basis, their participation and contribution to the Oceans Protection Plan Working Group and other federal initiatives relevant to marine shipping associated with the Project for the first five years of operations.

Recommendation 65

The Panel recommends that Transport Canada and its federal partners, in partnership with the Western Canada Marine Response Corporation:

- Revise mandatory response times in the marine shipping area to reflect improved capacities since the response times were mandated by the *Canada Shipping Act, 2001*, and further, to improve response times based on the results from consultation with relevant parties as part of Oceans Protection Plan initiatives;
- Renew collaborative activities with the British Columbia Ministry of Environment and Climate Change Strategy to improve coordination and alignment of legislation, policy and programs related to spill response and environmental management of oil spills among different levels of government; and
- Continue to support and invest in oil spill research and modelling initiatives, such as near-shore modelling, to support the advancement of evidence-based Geographic Response Strategies.

Recommendation 66

The Panel recommends that Transport Canada and the Canadian Coast Guard:

- Evaluate measures to improve and broaden the Ship-source Oil Pollution Fund for justifiable costs and damages that are not currently included, especially to compensate for effects on cultural heritage of Indigenous groups; and
- Examine measures to improve oil spill response and to co-develop proposals, such as for an emergency spill response base at Port Renfrew.

Recommendation 67

The Panel recommends that the Government of Canada, in collaboration with the British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development, communicate the locations of known physical and cultural heritage sites to oil spill response authorities in order to enhance the protection of these sites in the event of an oil spill. The locations should be shared under a confidentiality agreement to be signed before Project operations begin.

INDIGENOUS GROUPS OF THE NORTHWEST PACIFIC COAST OF THE USA

- The Panel concludes that the Project and marine shipping associated with the Project would result in a residual adverse transboundary effect and an adverse cumulative transboundary effect on the cultural practices of the USA Indigenous groups related to the Southern Resident Killer Whale. The Panel is unable to determine the significance of these effects.

PURPOSE, COST AND BENEFITS

- The Panel concludes that the Proponent has adequately demonstrated the purpose of the Project.

Recommendation 68

The Panel recommends that the Government of Canada develop and implement intergovernmental management programs for the improvement and long-term environmental management of the Fraser River estuary and the Salish Sea. The programs should include: a governance body made up of public and private sector stakeholders and representatives of Indigenous groups to oversee the programs, funding commitments, monitoring requirements, a decision-making framework around possible future resource development and management, environmental conservation programs, community sustainable and subsistence activities and a public reporting system. The Intergovernmental Management Programs should be developed to align with the result of a regional environmental assessment (See Recommendation 70)

CUMULATIVE EFFECTS**Recommendation 69**

The Panel recommends that the Cumulative Effects of Marine Shipping initiative of the Oceans Protection Plan be pursued with appropriate budgets.

Recommendation 70

The Panel recommends the Government of Canada undertake two regional environmental assessments for the Fraser River estuary and the Salish Sea to establish an environmental baseline, identify environmental and cumulative effects of the areas, and mitigation and follow-up requirements. The regional assessment should be used to develop and implement

Intergovernmental Management Programs of the Fraser River estuary and the Salish Sea (See Recommendation 68).

ENVIRONMENTAL MANAGEMENT PLANS, FOLLOW-UP AND MONITORING

Recommendation 71

In addition to the engagement of the Indigenous Advisory Committee in the Project area, the Panel recommends that the Proponent be required to develop and implement an Indigenous Advisory Committee that consists of those Indigenous groups undertaking activities in the marine shipping area and are potentially affected by marine shipping associated with the Project.

Appendix I: List of Acronyms and Abbreviations

Acronym	Meaning
AICFA	Area I Crab Fisherman Association
ALC	Agricultural Land Commission
ALR	Agricultural Land Reserve
BCIOM	British Columbia Input-Output Model
BCVRM	British Columbia Visual Resources Management
CAAQS	Canadian Ambient Air Quality Standards
CCME	Canadian Council of Ministers of the Environment
CD	chart datum
CEAA 2012	<i>Canadian Environmental Assessment Act, 2012</i>
CIE	Commission internationale de l'éclairage
CO	carbon monoxide
CO _{2e}	carbon dioxide equivalent
COPC	contaminants of potential concern
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
dB re 1 µPa	decibels relative to one microPascal
dB	decibels
dBA	A-weighted decibels
dBC	C-weighted decibels
DFO	Fisheries and Oceans Canada
DHA	docosaheanoic acids
ECCC	Environment and Climate Change Canada
ECHO	Enhancing Cetacean Habitat and Observation
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EPA	eicosapentaenoic acids
FLNRORD	British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development
FREMP	Fraser River Estuary Management Program
FSC	food, social, and ceremonial
GCT	Global Container Terminals Canada
GHG	Greenhouse Gas
HHRA	Human Health Risk Assessment
IC	intermediate component
IMO	International Maritime Organization

LAA	Local Assessment Area
Ld	daytime equivalent level
Ldn	day-night average level
Leq	equivalent sound level
LFN	low-frequency noise
Lmax	maximum sound level
Ln	nighttime equivalent level
MSA	Marine Shipping Addendum
NOx	nitrogen oxide
NO ₂	nitrous dioxide
NRCan	Natural Resources Canada
OPP	Oceans Protection Plan
OSC	Ocean Shipping Consultants
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyls
PCDD/PCDF	polychlorinated dibenzo dioxin/furan
PCoD	Population Consequences of Disturbance
PM	particulate matter
PM ₁₀	particulate matter less than 10 micrometers in diameter
PM _{2.5}	particulate matter less than 2.5 micrometers in diameter
POR	point of reception
PSU	practical salinity units
PUFA	polyunsaturated fatty acids
RAA	Regional Assessment Area
RBEM	Roberts Bank Ecosystem Model
RQ	risk quotient
SARA	<i>Species at Risk Act</i>
SO ₂	sulphur dioxide
SRKW	Southern Resident Killer Whale
TEU	twenty-foot equivalent units
The Agency	Canadian Environmental Assessment Agency
The Minister	The Minister of Environment and Climate Change Canada
The Panel	Federal Review Panel
The Project	Roberts Bank Terminal 2 Project
The Proponent or Port Authority	Vancouver Fraser Port Authority
TMX	Trans Mountain Pipeline Expansion Project

UCLM	upper confidence limit of the mean
UNDRIP	United Nations Declaration on the Rights of Indigenous Peoples
VC	valued component
VdB	vibration level
VQC	Visual Quality Classes
WCMRC	Western Canada Marine Response Corporation
WMA	Wildlife Management Area
WRF-NMM	Weather Research Forecast Mesoscale Model